Final

Environmental Impact Statement (EIS)

for the

Airspace Training Initiative

Shaw Air Force Base, South Carolina

June

2010

ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
$\mu g/m^3$	micrograms per cubic meter
169 FW	169th Fighter Wing
20 FW	20th Fighter Wing
AAM	Annual Arithmetic Mean
AAQS	Ambient Air Quality Standards
ACC	Air Combat Command
ACM	Air Combat Maneuvering
ACT	Air Combat Tactics
AEF	Aerospace Expeditionary Force
AFB	Air Force Base
AFI	Air Force Instruction
AFOSH	Air Force Occupational Safety and Health
AFSC	Air Force Safety Center
AGL	above ground level
AGM	Annual Geometric Mean
Air Force	United States Air Force
ALTRV	altitude reservation
ANG	Air National Guard
ANGS	Air National Guard Station
ANSI	American National Standards Institute
AQCR	Air Quality Control Region
AQRV	air quality related value
AR	Aerial Refueling Track
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATCAA	Air Traffic Control Assigned Airspace
ATI	Airspace Training Initiative
ATP	Advanced Targeting Pod
BAM	Bird Avoidance Model
BASH	Bird/Wildlife-Aircraft Strike Hazard
BFM	Basic Fighter Maneuvering
BGEA	Bald and Golden Eagle Protection Act
BRAC	Base Realignment and Closure
CAA	Clean Air Act
CAS	Close Air Support
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
CRIS	Cultural Resource Information System
CSAR	Combat Search and Rescue
CWA	Clean Water Act
DAFIF	Digital Aeronautical Flight Information Files
dB	decibel
dBA	A-weighted decibel
DEAD	Destruction of Enemy Air Defenses
DNL	Day-Night Average Sound Level
DNLmr	Onset Rate-Adjusted Monthly Day-Night Average Sound Level
DNR	Department of Natural Resources
DoD	Department of Defense
DOT	Department of Transportation
EA	Environmental Assessment
ECR	Electronic Combat Range
EDR	Environmental Data Resources, Inc.
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EO	Executive Order
EOD	explosive ordnance disposal
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAC	Forward Air Controller
FAR	Federal Aviation Regulation
FICON	Federal Interagency Committee on Noise
FICUN	Federal Interagency Committee on Urban Noise
FL	Flight Level
FONSI	Finding of No Significant Impact
FY	Fiscal Year
GPS	global positioning system
HADB	High Altitude Dive Bomb
HAP	High Accident Potential
HARB	High Altitude Release Bomb
HARM	high speed anti-radiation missile
HUD	Department of Housing and Urban Development
Hz	Hertz
IFR	Instrument Flight Rules
IICEP	Interagency and Intergovernmental Coordination for Environmental Planning
ILS	Instrument Landing System
INRMP	Integrated Natural Resources Management Plan
IR	Instrument Route
JDAM	Joint Direct Attack Munition
KIAS	knots indicated airspeed
L_{max}	Maximum Sound Level
LOA	Letter of Agreement
MAILS	Multiple Aircraft Instantaneous Line Source
MARSA	military assumes responsibility for the separation of aircraft
MBTA	Migratory Bird Treaty Act
MCAS	Marine Corps Air Station
Mini-MUTES	Mini-Multiple Threat Emitter System
MJU	Multi Jettison Unit
MLRA	Major Land Resource Area
MOA	Military Operations Area
mph	miles per hour
MSL	mean sea level
MTR	Military Training Route
NAAQS	National Ambient Air Quality Standards
NAS	National Airspace System
NATO	North Atlantic Treaty Organization
NEI	National Emissions Inventory
NEPA	National Environmental Policy Act
NF	Metric Indicating Power Setting
NHPA	National Historic Preservation Act
NM	Nautical Mile
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOA	Notice of Availability
NOTAM	Notice to Airmen
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service

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Cover Sheet

FINAL ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR AIRSPACE TRAINING INITIATIVE (ATI)

a. *Responsible Agency:* United States Air Force (Air Force)

b. *Cooperating Agency:* Federal Aviation Administration (FAA)

c. *Proposals and Actions:* This Final Environmental Impact Statement (EIS) analyzes the potential environmental consequences of a proposal to modify the training airspace overlying parts of South Carolina and Georgia. The proposal would improve airspace training for pilots of the 20th Fighter Wing (20 FW) based at Shaw Air Force Base (AFB) and pilots of the 169th Fighter Wing (169 FW) at McEntire Air National Guard Station (ANGS). The 20 FW and 169 FW need access to local training airspace that provides as realistic a combat environment as feasible to support national military objectives. The Airspace Training Initiative (ATI) Draft EIS Proposed Action was to: 1) create a new Military Operations Area (MOA)/Air Traffic Control Assigned Airspace (ATCAA) (Gamecock E) to join the western boundary of Gamecock D with Restricted Area 6002 over the Poinsett Electronic Combat Range (ECR); 2) expand Gamecock D to become Gamecock F ; 3) combine and use Gamecock C and D concurrently and simultaneously; 4) return Gamecock B to the National Airspace System (NAS); 5) raise the ceiling of Poinsett MOA; 6) expand Bulldog A to the east to underlie and match the boundaries of existing Bulldog B; 7) develop electronic training transmitter sites; 8) continue use of chaff and flares in existing airspace and include the use in new airspace; and 9) implement deconfliction methods (airspace scheduling and exclusionary areas). Alternatives A and B are comparable to the Proposed Action, except they vary the airspace modifications and training transmitter sites. Under the No-Action Alternative pilots would continue to train in the existing airspace, although pilots would potentially be deployed into combat without the benefit of being proficient in maneuvers necessary for combat conditions. The Air Force decision at this time is to mitigate the proposed action by not pursuing items 1 through 5 above. Item 6 has been revised following discussions with FAA and the public by establishing Bulldog C and Bulldog E MOAs beneath the Bulldog B MOA. Bulldog C and Bulldog E occur in a portion of the area proposed for the Bulldog A extension beneath a portion of the existing Bulldog B. The northern boundary of Bulldog C would be approximately 19 nautical miles (NM) to the south of the northern boundary of the existing shelf area to address Air Traffic Control (ATC) concerns at Augusta Regional Airport. This preferred alternative also includes a provision to accommodate Instrument Flight Rules (IFR) traffic at Millen and Emanuel County airports by authorizing the controlling agency (Atlanta ATC Center) to temporarily raise the floor of the Bulldog MOAs to deconflict the MOAs from IFR traffic. At a minimum, all public airports within the lateral confines of the Bulldog MOAs will be avoided by at least 1,500 feet and 3 NM. Under the preferred alternative, items 7 through 9 above would be implemented and new training transmitter sites and use of chaff and flares would be as described under the Mitigated Proposed Action.

d. *Comments and Inquiries:* Written comments on this document should be directed to Ms. Linda DeVine, ATI EIS Project Manager, HQ ACC/A7PS, 129 Andrews Street, Suite 337, Langley AFB, VA 23665-2769. Telephone inquiries may be made to Shaw AFB Public Affairs at 803-895-2019.

e. *Designation:* Final EIS

f. *Abstract:* This Final EIS has been prepared in accordance with the National Environmental Policy Act. The public and agency scoping process focused the analysis on the following environmental resources: airspace management and air traffic control, noise, safety, air quality, physical resources, biological resources, cultural resources, land use, socioeconomics, and environmental justice. This document responds to public and agency comments on the Draft EIS; presents all public and agency input received during the 49 day public comment period; and includes analysis of the Mitigated Proposed Action developed by the Air Force in consultation with the FAA. Gamecock MOA revisions or additions are no longer a part of the Air Force Mitigated Proposed Action (preferred alternative). Air Force training needs are met through Letter of Agreement (LOA)-defined airspace that permit aircraft to transit from Gamecock D to Poinsett Range between 18,000 to 22,000 feet MSL. Bulldog C and E MOA deconfliction measures are included in the Mitigated Proposed Action. Use of chaff and M-206 and MJU-7 flares in the new airspace would not be expected to discernibly impact any environmental resource because these are currently permitted in Bulldog B MOA/ATCAA overlying the proposed airspace. Siting and construction of additional electronic training transmitters for realistic pilot training would have minimal short-term, localized effects. Transmitter operations would not be expected to impact communications or any environmental resources. All analysis conducted during the original analysis of this proposal continues to be valid for the preferred alternative, the Mitigated Proposed Action. The Mitigated Proposed Action enhances the training opportunities of F-16 pilots at Shaw AFB and McEntire ANGS. The Mitigated Proposed Action would have some perceived airspace, noise, safety, physical, and socioeconomic consequences and no noticeable effects on other resources.

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FINAL

ENVIRONMENTAL IMPACT STATEMENT FOR THE AIRSPACE TRAINING INITIATIVE

SHAW AIR FORCE BASE, SOUTH CAROLINA

JUNE 2010

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The following appendices may be found on a CD included at the back of this document. The CD also contains the Draft EIS. Hard copies of the appendices have been provided to the repositories (in South Carolina at the (Harvin) Clarendon County, Georgetown County, Horry County, Sumter County, Richland County, Florence County, Marion County, Berkeley County, Lake City, Chapin Memorial, Williamsburg County and Charleston County public libraries; and, in Georgia at the Oconee Regional, Statesboro Regional, East Central Georgia Regional, Jenkins County Memorial, Jefferson County, East Georgia College, Burke County, and the Rosa M.Tarbutton Memorial public libraries) and are also available to the public upon request.

TABLES

FIGURES

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EXECUTIVE SUMMARY

The 20th Fighter Wing (20 FW), based at Shaw Air Force Base (AFB), South Carolina, currently manages and trains in military training airspace overlying parts of the states of South Carolina and Georgia.

In August 2005, in accordance with the National Environmental Policy Act (NEPA), the United States Air Force (Air Force) released a Draft Environmental Impact Statement (EIS). The Draft EIS presents the potential environmental consequences of the Air Force's proposal to improve training for pilots assigned to Shaw AFB and McEntire Air National Guard Station (ANGS), South Carolina.

As a result of public and agency comments received during the Draft EIS review, the 49-day public comment period, and the Federal Aviation Administration (FAA) aeronautical review process, the Air Force and FAA have been consulting to mitigate air traffic concerns while continuing to meet Shaw AFB training requirements. The comments and meetings culminated in the identification of the Preferred Alternative consisting of mitigations to the Draft EIS Proposed Action. This Final EIS has been prepared in accordance with NEPA and its implementing regulations.

Between the time the Draft EIS was issued in August 2005 and the publication of this Final EIS in May 2010, the Air Force and FAA have been working together to address concerns raised by the public and communities on the Draft EIS Proposed Action and alternatives. This Final EIS presents the Air Force and FAA Mitigated Proposed Action which addresses public and agency concerns in accordance with NEPA and its implementing regulations.

This Final EIS addresses potential environmental consequences of a proposal to improve airspace for training pilots stationed at Shaw AFB and McEntire ANGS, South Carolina. These improvements are proposed by the 20 FW and called the Airspace Training Initiative (ATI). These proposed changes include creating new airspace, establishing additional locations for electronic training transmitters to increase the realism of pilot training, and including the use of defensive countermeasures (chaff and flares) in the new airspace. The ATI training airspace would provide pilots the opportunity to develop conditioned responses to threats and provide adequate space for combat training maneuvers. ATI would increase training opportunities for the Shaw AFB-based 20 FW, the McEntire ANGS-based 169th Fighter Wing (169 FW), and transient users of the 20 FW-managed military airspace in South Carolina and Georgia. ATI would support an expanded range of maneuvers and tactics and would improve aircrew combat success.

The Air Force is the proponent for the ATI proposal and is the lead agency for the preparation of the EIS. The FAA is a cooperating agency. Congress has charged the FAA with administering all navigable airspace in the public interest as necessary to ensure the safety of aircraft and the efficient use of such airspace. Portions of ATI propose to change the configuration of airspace and establish new airspace. FAA participation and coordination with the Air Force were requested so that all NEPA and other assessments required by both agencies could proceed concurrently. As a cooperating agency, FAA has participated in public scoping and preparation of this Final EIS.

PURPOSE AND NEED

The purpose of ATI is to provide effective and realistic military training airspace that is sized and configured to support training for 20 FW and 169 FW F-16CJ+ missions. The F-16CJ+ has new technologies that improve target acquisition and standoff capabilities. The F-16CJ+ squadrons at Shaw AFB and McEntire ANGS have new missions and tactics to follow through with the Suppression of Enemy Air Defenses (SEAD) and Destruction of Enemy Air Defenses (DEAD) missions. Shaw AFB and McEntire ANGS F-16CJ+ aircraft comprise 70 percent of the Air Force's continental United States (U.S.)-based SEAD and DEAD capabilities. The 20 FW managed training airspace does not adequately support training at lower altitudes to visually acquire, identify, and simulate destruction of threats. The Air Force needs to support state-of-the-art aerial combat and surface attack missions of the F-16CJ+ multi-role fighter. Training airspace is needed that is configured to allow Shaw AFB aircrews to practice current tactics, to highly tune offensive and defensive pilot skills, and to train for F-16CJ+ mission assignments.

Pilots from the 20 FW and 169 FW must be trained and prepared to face the world's most sophisticated hostile tactics and anti-aircraft systems when they deploy as part of the Air Force's Aerospace Expeditionary Force (AEF). The proposed ATI airspace changes provide as realistic a combat environment as feasible to enhance combat capabilities and survivability of Shaw AFB and McEntire ANGS aircrews as they execute their mission and support national military and security objectives.

MITIGATED PROPOSED ACTION AND ALTERNATIVES

This Final EIS analyzes the Mitigated Proposed Action, Alternative A, Alternative B, and the No-Action Alternative. Details of each are presented in Table ES-1. Figure ES-1 presents an overview of the airspace potentially affected by ATI.

ENVIRONMENTAL CONSEQUENCES

NEPA requires focused analyses on environmental resources potentially affected by the Mitigated Proposed Action or an alternative. Operational requirements for ATI, environmental considerations, and public and agency inputs were used to identify specific environmental resources for consideration in this Final EIS. The baseline conditions and environmental consequences of the mitigated proposed or alternative airspace changes, the consequences of chaff and flare use, and the consequences of training transmitter construction are analyzed for each environmental resource in Chapter 3.0.

Table ES-1. Description of Mitigated Proposed Action and Alternatives

	Component	*Mitigated Proposed Action*	*Alternative A*	*Alternative B*	*No-Action Alternative*
Gamecock MOA	Create new Gamecock E MOA from 8,000 feet MSL to 22,000 feet MSL	NO	YES	YES Gamecock E Low from 8,000 to 13,999 feet MSL; Gamecock E High from 14,000 to 22,000 feet MSL	NO
	Create new Gamecock F MOA underneath Gamecock D in areas that do not overlap with C, from 10,000 feet MSL[1]	NO	Instead, expand Gamecock D MOA to 5,000 feet MSL	Instead, expand Gamecock D MOA to 8,000 feet MSL	NO
	Combine use of Gamecock C and D	NO	YES	YES	Use independently
	Return Gamecock B to National Airspace System (NAS)	NO	YES	NO	NO
Poinsett MOA	Poinsett: Raise ceiling from 2,500 feet MSL to 5,000 feet MSL	NO	YES	YES	Ceiling remains at 2,500 feet MSL
Bulldog MOA	Bulldog A: Expand Boundary to match up with Bulldog B extending from 500 feet AGL to 10,000 feet MSL.	Instead create new Bulldog C and Bulldog E MOAs under Bulldog B MOA and adjacent to Bulldog A MOA extending from 500 feet AGL to 10,000 feet MSL	YES	Instead, expand Bulldog B to 3,000 feet MSL	Continue with Bulldog B ledge
New Training Transmitters	Place Under Bulldog A, and Gamecock C/D	YES	YES	YES	Continue use of available sites
	Place along Coast	YES	YES	NO	NO
Chaff and Flares	Include use within new and expanded airspace above 5,000 feet MSL	YES	YES	YES	Continue use in existing airspace

Note: 1. 10,000 MSL is 10,000 feet above MSL.
MOA = Military Operations Area; MSL = mean sea level; AGL = above ground level

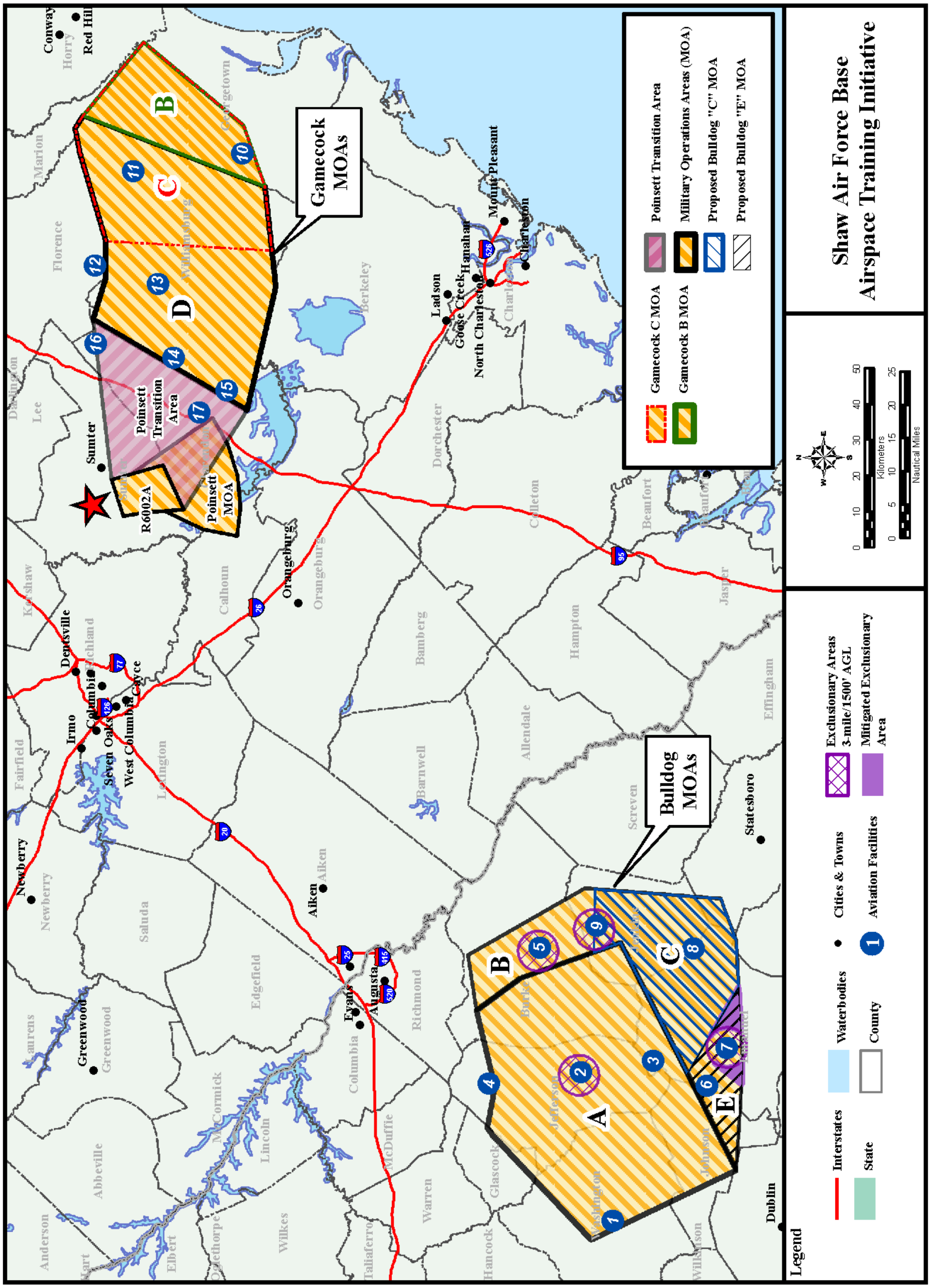

Figure ES-1. Airspace Potentially Affected by ATI

As noted on Table ES-1, the Mitigated Proposed Action excludes all proposed changes to the Special Use Airspace (SUA) associated with the Gamecock or Poinsett Military Operations Areas (MOAs) in South Carolina. The baseline conditions for the areas affected by proposed changes to those areas were generally not updated between the Draft EIS and Final EIS because no environmental consequences would be anticipated. Because the Mitigated Proposed Action still includes additional training transmitter sites beneath the Gamecock C MOA and along the coast of South Carolina, updates to resources and references, such as airspace management including air traffic, and socioeconomics have been updated. The Air Force has validated and/or updated baseline conditions and reference material used for areas affected by the Mitigated Proposed Action or alternatives to ensure the potential environmental consequences identified for those areas are based on the most recent data available.

Cumulative effects and other environmental considerations associated with the Mitigated Proposed Action and alternatives, as well as past, present, and reasonably foreseeable actions, are presented in Chapter 4.0. The potential direct and indirect environmental consequences are summarized below for each environmental resource.

Airspace Management and Air Traffic Control

Airspace management is defined as the direction, control, and handling of flight operations in the navigable airspace that overlies the geopolitical borders of the U.S. and its territories. Specific concerns of airspace management focus on effects of the proposed airspace changes to non-military users of the airspace. The FAA is responsible for approving and publishing any airspace modifications, creating new airspace, or expanding existing airspace.

The creation of new MOA airspace would require non-rule-making action by the FAA (Department of Transportation [DOT] FAA 2008). Responsibilities, procedures for aircraft operations, air traffic control operations, and utilization of Air Traffic Control Assigned Airspace (ATCAAs) are documented in Letters of Agreement (LOAs) between the scheduling military agency (20 FW) and the applicable Air Route Traffic Control Center (ARTCC) (Atlanta and Jacksonville Centers). These LOAs are supplemental to the procedures in FAA Orders 7110.65 (Air Traffic Control) and 7610.4 (Special Military Operations). A Poinsett Transition Area (PTA) has been established in an LOA between the Air Force and FAA. The PTA is designed to allow F-16s from the 20 FW and 169 FW to transit, in a tactical manner, from Gamecock D MOA to R-6002C, and return to Gamecock D MOA. The PTA is for the sole use of Shaw and McEntire-based jets. This is transition airspace only and is not used as a MOA. The PTA is normally assigned an altitude of Flight Level (FL)

Public Question: *How will civil aircraft traffic traverse the proposed airspace?*

Answer: *VFR traffic will use see-and-avoid and IFR traffic will be under ATC. In addition, as a direct result of civilian pilots and others comments during scoping, the Air Force has developed alternatives that change airspace dimensions and/or create MOA segments that could be managed to support civil aviation traversing the proposed airspace modifications.*

180 and below FL 220. When that block is unavailable, Air Traffic Control (ATC) shall assign whatever altitude(s) that is available.

The Mitigated Proposed Action would create Bulldog C and E MOAs. Civilian airports within the proposed Bulldog C and E MOAs would have minimum exclusion areas of 3 nautical miles (NM) and 1,500 feet above ground level (AGL). In addition, the proposed Bulldog E MOA has a larger exclusionary area designated around the Emanuel County Airport in response to concerns about interference with airport operations.

The FAA Atlanta ARTCC would have the authority to manage the airspace and control civilian air traffic into and out of the Swainsboro and Millen airports. The Atlanta ARTCC would also have the authority to temporarily raise the floors of the proposed Bulldog C and E MOAs when they are active to allow civilian aircraft clearance to transit the airspace.

Most conflicts with Military Training Routes (MTRs), federal airways, jet routes, and private airports would be avoided because the altitude at which these routes are established are either above or below the airspace in the Mitigated Proposed Action or alternatives. In cases where these routes intersect with the proposed airspace and alternative airspace, deconfliction would be managed as it is for current conditions.

Deployment of chaff designed to not interfere with FAA ATC radars would be managed through communication between the 20 FW and the ARTCC, resulting in no projected airspace management impacts from expanded chaff use. Use of flares or training transmitter sites would not impact civil air traffic or the ATC system.

Under Alternatives A and B, creating Gamecock E MOA and lowering the floor of Gamecock D MOA were identified as potentially significant impacts to civil aviation by pilots at public hearings. Although there would be airspace above and below the new MOAs, and air traffic controllers have complete coverage of aircraft in this airspace, a greater concentration of civil aircraft could occur in the vicinity of the new airspace. The floor of Gamecock D could especially affect air traffic by requiring civil aviation to fly below 5,000 feet mean sea level (MSL) or use see-and-avoid rules to traverse the MOA. Alternative B creates Gamecock E High and Low MOAs and an 8,000 foot floor for Gamecock D and retains Gamecock B. Alternative B has the potential to generally improve civil aircraft transit of the area when compared with Alternative A.

Noise

Noise is considered to be unwanted sound that interferes with normal activities or otherwise diminishes the quality of the environment. Concerns regarding noise expressed at public hearings included annoyance, effects on rural environment, effects on animals, and effects on recreation areas.

Noise in military airspace is quantified by metrics called the Day-Night Average Sound Level (DNL) and the Onset-Rate Adjusted Monthly Day-Night Average Sound Level (DNLmr).

DNLmr accounts for the annoyance associated with the "surprise" effect of noise from high-speed military aircraft flying at low altitude. Under the Mitigated Proposed Action, mathematical models calculate that noise levels would increase in those areas under proposed Bulldog C and E MOAs, but would decrease slightly beneath Bulldog A MOA. Alternative A would increase noise under newly expanded portions of Bulldog A MOA and Gamecock D and E MOAs, but would slightly decrease noise levels beneath existing portions of Bulldog A and Gamecock B and C MOAs. Alternative B would result in similar increases and decreases in noise levels under each MOA to Alternative A except that the floor of Bulldog B would be lowered and Bulldog A would not be expanded.

Implementation of the Mitigated Proposed Action, Alternative A, or Alternative B does not propose additional training flights while expanding the airspace volume. This results in slightly lower noise exposure under the existing Bulldog A for the Mitigated Proposed Action when compared with baseline conditions. For the same reason, noise levels under Gamecock C and B and existing portions of Bulldog A would be lower under Alternatives A or B as compared to baseline conditions.

DNL generated by military aircraft in this area range from less than 35 decibels (dB) DNLmr (in areas underlying a MOA only) to 54 dB DNLmr (in areas underlying both a MOA and an MTR). Under the Mitigated Proposed Action, the floors of Bulldog C and E MOAs would be established at 500 feet AGL. Areas beneath these two MOAs would be exposed to additional low military altitude overflights. In areas underlying the Bulldog C and E MOA only, noise levels would increase from less than 35 dB DNLmr to approximately 47 dB DNLmr, and in areas underlying both the MOAs and MTRs, noise levels would increase from less than 50 dB DNLmr to no higher than 52 dB DNLmr (Table 3.2-6). Noise levels beneath the existing Bulldog A MOA would decrease slightly from 49 dB DNLmr to 47 dB DNLmr due to low altitude training expanding into the newly created Bulldog C and E MOAs. No changes would occur to noise levels beneath the MTRs, the Restricted Airspace over Poinsett Electronic Combat Range (ECR), or the Gamecock MOAs. Several MTRs associated with the airspace cross or merge with other MTRs or pass through MOAs. As a result, the cumulative noise levels on the ground at the point of these interactions accounts for all the noise produced by aircraft using the airspace.

The calculated noise levels beneath each of the airspace units is below the 55 dB threshold identified by United States Environmental Protection Agency (USEPA) as a level to consider the potential for significant impact, and there would be no anticipated impacts to human health. There would be a noticeable increase in low-level overflights and military aircraft would become a noticeable contributor to noise levels under the proposed Bulldog C and E MOAs. The number of highly annoyed people could increase from approximately 1 percent of the population under the existing conditions to approximately 4 percent of the population under these proposed airspace units (see Appendix H). In some cases, the calculated values are near or below the estimated ambient conditions of 35 to 44 dB. In such cases, military aircraft may be seen or briefly heard, but there is little or no contribution from military aircraft to cumulative noise levels.

Changes in noise levels under Alternative A for the Bulldog MOAs, Poinsett MOA, and Gamecock MOAs reflect the increased volume of airspace and the reduced time spent in any individual MOA during a typical training mission. Where Bulldog A would be extended, the DNLmr noise levels would increase from less than 35 dB DNLmr to a calculated condition of 47 dB DNLmr. There could be a noticeable increase in low-level overflights and military aircraft would become a noticeable contributor to noise levels under the extended Bulldog A airspace. The number of highly annoyed people could increase from approximately 1 percent of the population under the existing conditions to approximately 4 percent of the population under the expanded Bulldog A MOA.

Alternative B calculated noise levels in the same area are less than 35 dB DNLmr. This means that under Alternative B, military aircraft could be noticed but would not be a major contributor to average noise conditions in the area and the number of highly annoyed individuals would continue at approximately 1 percent. Noise levels under Bulldog A would be reduced slightly from 49 dB DNLmr to 47 dB DNLmr due to aircraft operations at greater than 3,000 feet AGL being expanded into the larger Bulldog B MOA. This reduction would be the same as under Alternative A. In all cases, noise levels associated with the use of the proposed airspace would be below any thresholds that would be expected to cause impact to human health.

Noise associated with construction of the training transmitter sites would be localized, intermittent, and of relatively short duration. During operation of the sites, noise due to human presence would be limited and confined to the general area of the site.

Safety

Civil aviation pilots expressed concern that, under the Draft EIS Proposed Action and Alternative A, the modification to the Gamecock MOAs created higher concentrations of civil aircraft that posed a safety risk. Under the Mitigated Proposed Action, no changes would occur to the Gamecock MOAs. The flight safety risk in the proposed Bulldog MOAs would be unchanged from the current conditions. FAA and Shaw AFB air traffic control would work together to avoid risks to civil aircraft flying under or above the proposed new airspace. Scheduling of airspace blocks would be done to assist civil aviation transit. Under the Draft EIS Proposed Action or Alternative A, the public expressed concern that the extension of Bulldog A could create a perception that safety at airports under the military airspace was reduced and could possibly affect local development. The Final EIS Mitigated Proposed Action reduces the extent of additional airspace, includes exclusionary areas around the airports, and incorporates airspace management to address public concerns.

Airspace modifications that involve developing low-altitude airspace could increase bird/wildlife aircraft strikes. Flight safety risks would be minimally increased by the potential for bird/wildlife-aircraft strikes in the Mitigated Proposed Action, Alternative A, or Alternative B. In both the Gamecock and Bulldog MOAs, indicated risk from a bird/wildlife-aircraft strike is not excessive. Pilot briefings about seasonal presence of wildlife hazards reduce safety risks.

Alternative B contains a split Gamecock E and a higher floor for Gamecock D. These elements could improve the space and scheduling for civilian flights and reduce safety concerns. Alternative B would establish a 3,000-foot MSL floor for Bulldog B and does not extend Bulldog A. These elements would reduce public concern for safety around the local airports when compared with Alternative A.

ATI does not propose any changes to operations and maintenance, ordnance use, or number of training flights. No specific explosives safety risks are associated with the Mitigated Proposed Action or alternatives because no elements of the Mitigated Proposed Action have the potential to alter or modify explosives use. An estimated two dud flares a year could fall to the ground under the Bulldog MOAs and two Gamecock MOAs. Although the possibility of a person on the ground being struck and seriously injured by a dud flare cannot be totally discounted, studies have shown that the possibility of such an occurrence is so minute it can be essentially discounted (Air Force 1997a). Dud flares that are not exposed to temperatures in excess of 1,200 degrees should not pose a safety risk. Local agencies would be informed to notify Shaw AFB in the event that a dud flare was located.

Two types of flares are proposed for use in the new and expanded airspace, the M-206 and the Multi Jettison Unit (MJU)-7 A/B. When flares are deployed, plastic parts, aluminum coated wrapping, and felt spacers fall to the ground. Most of the flare residual material could be an annoyance if found but would not constitute a safety risk. The potential exception is the MJU-7 A/B Safe and Initiation (S&I) device which weighs 0.045 pounds and could strike the ground with the force of a large hailstone. The number of MJU-7 A/B flares proposed for annual deployment and the area, population, vehicles, and buildings under the Bulldog and Gamecock MOAs were used to calculate the expected frequency of an S&I device striking something or someone. The expected frequency of a large hailstone-like S&I device is calculated to be 1 vehicle and 15 structures annually, and the expected frequency of striking a person is calculated to be 1 in 200 years under the Gamecock MOA. Under the Bulldog MOAs, the expected frequency is nearly 1 vehicle and 14 structures per year, and the expected frequency of striking a person is calculated to be 1 in 200 years. No damage to structures would be expected, but vehicles could incur a cosmetic ding. A strike to an unprotected person could cause a bruise-like injury. Approximately 20 percent of any strikes to a person could be to the head, and cause a potentially more serious injury. The Air Force has established procedures for any damage claims that begin by contacting Shaw AFB Public Affairs Office.

Questions were raised by the public about potential risk from wake turbulence associated with military aircraft. Calculations of F-16CJ+ wing vortex wind speeds from overflights below 1,000 feet AGL produce surface wind speeds of from 6 to 8 miles per hour (mph), which is comparable to ambient wind conditions. No wind vortex impacts are expected from an F-16CJ+ overflight within the Gamecock, Bulldog, or Poinsett MOAs.

Ground safety risks from operation of existing and proposed new training transmitter sites would be minimal because the Air Force would continue to follow applicable regulations, technical orders, and Air Force Occupational Safety and Health (AFOSH) standards.

Air Quality

Areas under the existing and proposed airspace modifications are in air quality attainment. No overall increase in emissions are anticipated from military aircraft training and nearly all training flights occur above the 3,000 feet AGL mixing height for emissions. The minor increases in emissions in the area of the new Bulldog C and E MOAs under the Mitigated Proposed Action, or the expanded Bulldog A MOA under Alternative A, or cumulatively would not affect local or regional air quality. Under Alternative B, training flights would not be proposed to change below the air quality mixing height so there would be no air quality effect. Construction of electronic training transmitter sites could result in transient local increases in emissions that would not significantly affect local air quality. No conformity determination is required.

Physical Resources

Physical resources include soil and water. Chaff and flares and construction of training transmitter sites are the only ATI elements with the potential to affect physical resources. Flares are released above 5,000 feet MSL and burn out in 400 feet, so there is a low probability of a flare-caused fire affecting physical resources. Extensive previous research has shown little to no negative effects of chaff or flare material on soil or water quality. The distribution of chaff fibers would be approximately 3.85 grams (0.12 ounce) per acre per year in the Bulldog MOAs and 3.89 grams (0.12 ounce) per acre per year in the Gamecock MOAs. At this deposition rate, chaff is not likely to accumulate or affect soil or water resources. Within the Bulldog and Gamecock MOAs, an average of one flare per 84 and 120 acres would be released, respectively.

Materials that fall to the ground after chaff and flare deployment consist of plastic end caps, plastic sliders (or pistons), the S&I device (MJU-7 A/B only), felt spacers, and aluminum coated wrapping material that could be from 1-inch x 1-inch up to 3-inches x 13 inches. The deposition rates under the MOAs are projected to be approximately one piece of chaff or flare residual material per 5 acres per year. The felt spacers and wrapping material are comprised of naturally occurring materials and eventually deteriorate. The plastic parts are inert and should not impact physical resources.

Ground-disturbing activities associated with construction of training transmitter sites (gravel pad, staging area, and gravel access road) would impact approximately 0.6 acre per site. The sites are not expected to contribute to secondary impacts to wind or water resources. Implementation of standard construction practices would reduce the potential for dust and erosion. No significant impacts to physical resources, including soil or water, would be anticipated to result from training transmitter site construction or airspace modifications.

Biological Resources

Biological resources are plants and wildlife, including threatened and endangered species, migratory birds, and domestic animals. Seven federally listed endangered species and six threatened species have the potential to occur under the current and proposed airspace. The Air Force has completed informal consultation with the United States Fish and Wildlife Service (USFWS) to evaluate potential impacts. The USFWS concurred with the Air Force's determination of "may affect, not likely to adversely affect" (USFWS letter, dated December 5, 2007 in Appendix A). For most of the ROI, average noise exposure from aircraft under the Mitigated Proposed Action or alternatives would be comparable to or slightly higher than that experienced in the current airspace. No scientific studies support significant negative impacts to wildlife or domestic animals at noise levels associated with current or proposed military training. In areas where noise levels are predicted to increase (specifically Bulldog C and E MOAs under the Mitigated Proposed Action; the expanded Bulldog A, proposed Gamecock E, and Gamecock D under Alternative A; and Bulldog A and B and Gamecock E and D in Alternative B), some animals, including special-status species, may be temporarily sensitive to new noise levels. For example, animals may startle or temporarily shift habitat use or activities in areas under new low-level flight. Although species may vary in their response, past research has documented that most wildlife and domestic animals would habituate and return to normal activities. A particularly close or loud aircraft overflight could still produce a startle reaction and negative response in habituated animals. Such incidents would likely be random and infrequent and would not negatively affect populations of special-status species. Regarding specific species, nest success of red-cockaded woodpeckers would not be expected to be affected by airspace modifications. The Mitigated Proposed Action or Alternative A could increase the risk of bird-aircraft strikes for wood storks and other large birds in the area of the extended Bulldog A, or C and E. This would not be the case for Alternative B.

Previous studies have documented that wildlife and domestic animals would not be harmed by residual chaff or flare materials. There is a very low likelihood of an individual animal being struck by falling flare residual materials. Chaff fibers, flare ash, and flare end caps and other inert materials would not accumulate in amounts that would affect forage or water quality. Because of the low rate of application and use of chaff fibers during defensive training, wildlife or domestic animals would have little opportunity to ingest, inhale, or otherwise come in contact with chaff fibers. Most animals would avoid chaff fibers and, even if they were ingested, they are unlikely to be available in amounts that could cause injury. An animal would have to consume many chaff bundles or billions of chaff fibers before toxic levels are reached. One controlled study demonstrated that calves would not eat chaff fibers unless the chaff was soaked in molasses. And even then, there was no internal damage from the chaff fibers. There are no recorded cases of domestic or wild animals ingesting chaff or flare residual materials.

Siting criteria for training transmitter sites include the avoidance of wetlands and sensitive areas for wildlife and a preference for areas already cleared of trees (such as agricultural land). Therefore, most wildlife species and native vegetation would not be affected by the training transmitter sites. Preliminary field evaluations were performed at three sites. No threatened or endangered species or their habitats were observed at three potential training transmitter sites under the Bulldog A MOA. Field surveys for threatened and endangered species would be conducted at other potential sites prior to final site approval and a determination would be made as to the potential effect to biological resources.

Consultation with the USFWS regarding species resulted in no effect determination on the American chaffseed, Canby's dropwort, little amphianthus, pondberry, flatwoods salamander, and red-cockaded woodpecker. A determination of may affect, but not likely to adversely affect wood storks due to insignificant effects also resulted from the consultations.

Cultural Resources

Cultural resources that are currently overflown by military training aircraft include prehistoric and historic districts, sites, structures, and artifacts that are eligible for listing or are listed on the National Register of Historic Places (NRHP). Cultural resources important to Native Americans but not considered significant under the National Historic Preservation Act (NHPA), such as those recognized by the Native American Graves Protection and Repatriation Act, could also be located beneath existing and proposed airspace, although none are known. Under Alternatives A and B, 29 NRHP-listed properties directly underneath the existing Gamecock MOAs or the potential Gamecock E MOA include four districts, a battle site, houses and commercial buildings, Fort Watson, and the Santee Indian Mound. Under Alternatives A and B, resources underneath the proposed Gamecock D MOA would be overflown at a minimum of 5,000 feet MSL, which will not affect the characteristics that make these resources eligible for the NRHP. Beneath the existing Bulldog A and Bulldog B MOAs are 35 properties listed on the NRHP. These properties range from homes and plantations to churches and schools, and include six historic districts. NRHP resources under existing airspace Bulldog A are currently subjected to overflights without affecting their NRHP status.

In the Mitigated Proposed Action there are 10 NRHP properties under the proposed Bulldog C and E MOAs. Some of the NRHP properties within the proposed Bulldog C and E MOAs are currently overflown by military aircraft using MTRs. It is not anticipated that the Mitigated Proposed Action or an alternative expanding Bulldog A would detrimentally affect cultural resources under the airspace. The amount of chaff and flare residual material associated with the Mitigated Proposed Action or alternatives would be released over an extended area, minimizing the possibility of an adverse effect to NRHP properties. While the likelihood of chaff, flares, or residual components striking a NRHP property is minimal, at worst the potential damage would be similar to that of a large hailstone.

Under the Mitigated Proposed Action or an alternative, training transmitters would be located in areas selected for their proximity to services. The Air Force conducted NHPA Section 106 consultation (HP-050829-004) with the Georgia SHPO. The Georgia SHPO indicated no historic properties or archaeological resources listed in or eligible for the NRHP would be impacted by the proposed action as defined in the Draft EIS. Once the final training transmitter emitter locations have been selected, additional cultural resources visits will be conducted in coordination with the SHPO to identify and recover any significant archaeological information. In South Carolina, four general areas, one site under Gamecock C MOA and three sites along the coast, were analyzed for the placing of additional emitters in areas along roads and with access to utilities. If specific site locations are identified in the future, the AF would need to complete the EIAP, environmental baseline and cultural surveys, and NHPA Section 106 consultation. In the event that cultural resources are discovered during preliminary surveys of the construction sites or during ground-disturbing activities, all construction activity would cease and the Shaw AFB Natural Resources Manager would be contacted and the SHPO and/or tribe would be notified as outlined in the Shaw AFB Integrated Cultural Resources Management Plan (Air Force 2008). The Air Force requested identification of concerns and initiation of Government-to-Government consultation during the scoping process and provided the Draft EIS to the Eastern Band of Cherokee Indians and the Catawba Indian Nation. No responses were received and no issues or concerns were identified. In accordance with the NHPA, 36 CFR Part 800.5 (c), if the SHPO/THPO fails to respond to an Agency official finding within the 30-day review period, then the agency official can consider them to be in agreement with the finding. Therefore, no impacts are expected to cultural resources from the Mitigated Proposed Action or an alternative.

Land Use

There would be no anticipated change in general land use patterns, land ownership, land management plans, or special use areas due to airspace changes or use of chaff and flares. Individuals finding chaff or flare residual materials on their property or in natural areas could be annoyed, but land use would not be expected to change. Aircraft noise levels would not change appreciably above current levels for any airspace unit except for the Mitigated Proposed Action under the Bulldog C and E MOAs or Alternative A under the expanded Bulldog A MOA. In all airspace areas, aircraft noise would not be expected to significantly impact residential land use, farms, parks, or wildlife refuges. The Mitigated Proposed Action or Alternative A would have a small annual increase in training flights within three miles of Magnolia Springs State Park that could result in annoyance to some people, although park use is not expected to change. The number of highly annoyed people in the area under the new Bulldog C and E MOAs or the expanded Bulldog A MOA could increase from 1 to 4 percent of the population. This increased annoyance would apply primarily to individuals outside designated avoidance areas. Calculated noise levels show that few, if any, additional individuals would be highly annoyed in the same area if Alternative B were selected. Average noise levels in all cases would be below those identified by USEPA as a level for evaluating potential environmental consequences and no significant land use impacts are anticipated.

Training transmitter sites are generally expected to be on agricultural land leased by the U.S. government from private landowners. Land use would change on approximately 0.6 acres for the training transmitter equipment gravel pad and access road. Therefore, for the proposed six transmitter sites under the Mitigated Proposed Action and Alternative A, approximately 3 to 4 acres would be affected by changed land use; approximately 2 acres would be affected for the three sites under Alternative B. This represents a negligible portion of the ROI. Training transmitter site selection would avoid special use areas such as wildlife refuges or other natural areas.

Socioeconomics

Socioeconomic concerns include potential effects on employment, personal income, property values, and other economic pursuits as a result of the new or expanded military training airspace. Detailed population and economic characteristics were evaluated for portions of counties under the existing and proposed airspaces. The proposed airspace modifications under the Mitigated Proposed Action would mitigate potential impacts to general aviation. Altitude structures and FAA and Air Force ATC of the proposed airspace are in place to reduce conflicts between military use and civilian air traffic.

Concern was expressed by civil aviation pilots that the lower level altitude structures of Gamecock E and D under the Draft EIS Proposed Action or Alternative A would interfere with flights, including air taxi operations. These concerns included having to fly at inefficient altitudes and in more turbulent air. Under the Mitigated Proposed Action, no changes are proposed to the Gamecock MOAs. Civil air traffic, including air taxi operations, would operate the same as under the existing conditions.

The public expressed concern that the extension of Bulldog A MOA had the potential to constrain economic development opportunities in communities under or near the expanded airspace. Inadequate communication and potential constraints on IFR traffic were also noted as public concerns. These concerns have been addressed by mitigation measures incorporated into the Mitigated Proposed Action. Exclusionary areas would be established around each public aviation facility affected by the Mitigated Proposed Action. IFR traffic would have access to use an Instrument Landing System (ILS) at an airport with minimum delay. Life-flights to regional hospitals would continue to be given priority by ATC and would be expected to remain unimpeded by the proposed changes in military airspace. Airspace scheduling and coordination with FAA would be implemented to deconflict military and civilian aircraft. Neither the Mitigated Proposed Action nor Alternative A or B is expected to impact regional socioeconomic resources or economic development in the counties underlying the airspace.

Use of chaff and flares and resulting plastic, wrapping, and felt materials that fall to the ground would not be in quantities to affect socioeconomic resources. Any damage, such as a ding to a vehicle, would be handled through established claims procedures at Shaw AFB.

Construction activity associated with the proposed training transmitter sites could take place over several years. Employment and earnings in the localities surrounding the proposed sites would not be discernibly affected. No permanent or long-lasting socioeconomic effects are anticipated as a result of transmitter site development for either the Mitigated Proposed Action or any alternative.

Environmental Justice

Federal agencies are required by law to address potential impacts of their actions on environmental and human health conditions in minority and low-income communities. Furthermore, they must identify and assess environmental health and safety risks that may disproportionately affect children. The low-income communities and the minority and youth population under the current airspace, the proposed airspace or alternatives, and the generally proposed locations of the new training transmitters were evaluated. The rural parts of counties associated with the airspace have generally not kept pace with the economic growth of South Carolina and Georgia. Although some areas of these counties are relatively economically depressed, there would be no disproportionately high or adverse impacts to minority or low-income communities that would result from the Mitigated Proposed Action or an alternative. There would be no disproportionate health and safety risks to children.

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1.0 PURPOSE AND NEED

1.1 INTRODUCTION

The 20th Fighter Wing (20 FW), based at Shaw Air Force Base (AFB), South Carolina, currently manages and trains in military training airspace overlying parts of the states of South Carolina and Georgia. As described in Sections 1.3 and 1.4, this airspace does not meet all 20 FW mission training needs for current combat conditions. The 20 FW is proposing effective and realistic military training airspace to support training for pilots of the 20 FW and South Carolina Air National Guard (ANG) pilots assigned to the 169th Fighter Wing (169 FW) at McEntire Air National Guard Station (ANGS), South Carolina. These proposed changes include creating new airspace, establishing additional locations for training transmitters to improve pilot training realism, and including the use of defensive countermeasures (chaff and flares) in the new airspace. Collectively, these proposals constitute the Shaw AFB Airspace Training Initiative (ATI).

ATI is proposed to improve support for missions and tactics, including simulated weapons delivery and defensive maneuvers. As described in Section 1.4, ATI would enable pilots to more readily "train as they will fight." ATI would create training airspaces to realistically train for existing and expected combat conditions. The ATI training airspace would provide pilots the ability to develop conditioned responses to threats and provide additional space for realistic combat training maneuvers. ATI would increase training opportunities for 20 FW, 169 FW, and transient users of the 20 FW-managed military airspace in South Carolina and Georgia. The 20 FW and 169 FW fly F-16 aircraft and transient users include F-15, F-18, AV-8B, A-10, and EA-6B aircraft from other DoD units. ATI would improve support for maneuvers and tactics and would improve aircrew combat success and survivability as mission capabilities evolve in response to national security objectives, the Overseas Contingency Operation, and other global missions.

This Environmental Impact Statement (EIS) addresses potential environmental consequences that could result from proposed implementation of the Shaw AFB ATI.

1.2 BACKGROUND

The 20 FW at Shaw AFB has identified an operational requirement to configure Shaw AFB-managed training airspace to support the mission assignments of 20 FW and 169 FW F-16 aircraft pilots. This requirement supports the existing training mission of the 55th, 77th, and 79th Fighter Squadrons (20 FW) at Shaw AFB and the 157th Fighter Squadron (169 FW) at McEntire ANGS.

The 20 FW is an integral part of the United States Air Force's (Air Force's) Aerospace Expeditionary Force (AEF), with routine deployment overseas in support of the war on terror worldwide. 20 FW and 169 FW pilots are routinely deployed to the world's hot spots where they are exposed to enemy threats in combat. The constant evolution of technology and sophistication of air defenses available to potential enemies demand that pilots be trained to instantly respond to these increasing threats.

The 20 FW must have access to training airspace that provides as realistic a combat environment as feasible to execute its mission and to support national military and security objectives. Shaw AFB and McEntire ANGS continue to deploy people and aircraft to contingencies throughout the world in response to the Overseas Contingency Operation. Recent deployments include the following:

Deployed 20 FW F-16s supporting Operation Iraqi Freedom.

- Operation Iraqi Freedom and Enduring Freedom (pictured at left).
- Operation Allied Force in support of North Atlantic Treaty Organization's (NATO's) stand to cease Serbian warfare on Albanians.
- Operations Northern Watch and Southern Watch in support of the United Nation's no-fly zone in Iraq.
- Operation Noble Eagle, providing homeland security.

State-of-the-art aerial combat and surface attack missions of the F-16 require highly tuned offensive and defensive pilot skills that are best practiced in airspace that simulates conditions likely to be encountered in actual combat.

1.2.1 Shaw AFB

F-16CJ+ takes off from Shaw AFB, South Carolina for a local training mission. The F-16CJ+ is often referred to as an F-16 throughout this EIS.

Shaw AFB is located in the east central part of South Carolina, approximately 35 miles east of the capital city of Columbia and approximately 20 miles east of McEntire ANGS (Figure 1-1). Shaw AFB is located within the city limits of Sumter and is 10 miles west of the city's center. Shaw AFB manages the Poinsett Electronic Combat Range (ECR) located approximately 10 miles south of the base. The airspace managed and used by Shaw AFB is described in Section 2.1.

Shaw AFB was activated on 30 August 1941 as one of the largest flying fields in the United States (U.S.) to train pilots. Following World War II, the 20th Fighter-Bomber Group arrived at Shaw Field with its P-51 Mustang fighters. The 20th Fighter-Bomber Group later exchanged its Mustangs for Shaw's first jet aircraft, the P-84 Thunderjet. By 1957, RF-101 Voodoo aircraft were operating from Shaw AFB. These reconnaissance aircraft helped identify and track activities in Cuba during the Cuban Missile Crisis in the autumn of 1962. The RF-101 aircraft were replaced by RF-4C Phantoms in 1965. In 1982, the Wing received its first F-16 aircraft. During 1990, when Iraq invaded Kuwait, Shaw AFB F-16 Fighting Falcons were the first United States Air Force (Air Force) jets available to stop the Iraqi ground forces. Following Desert Storm, Shaw AFB aircraft deployed to the Persian Gulf in support of Operation Southern Watch to enforce the Iraqi "No Fly Zone." Shaw AFB units were redesignated as the 20 FW in the reorganization of the Air Force during 1994.

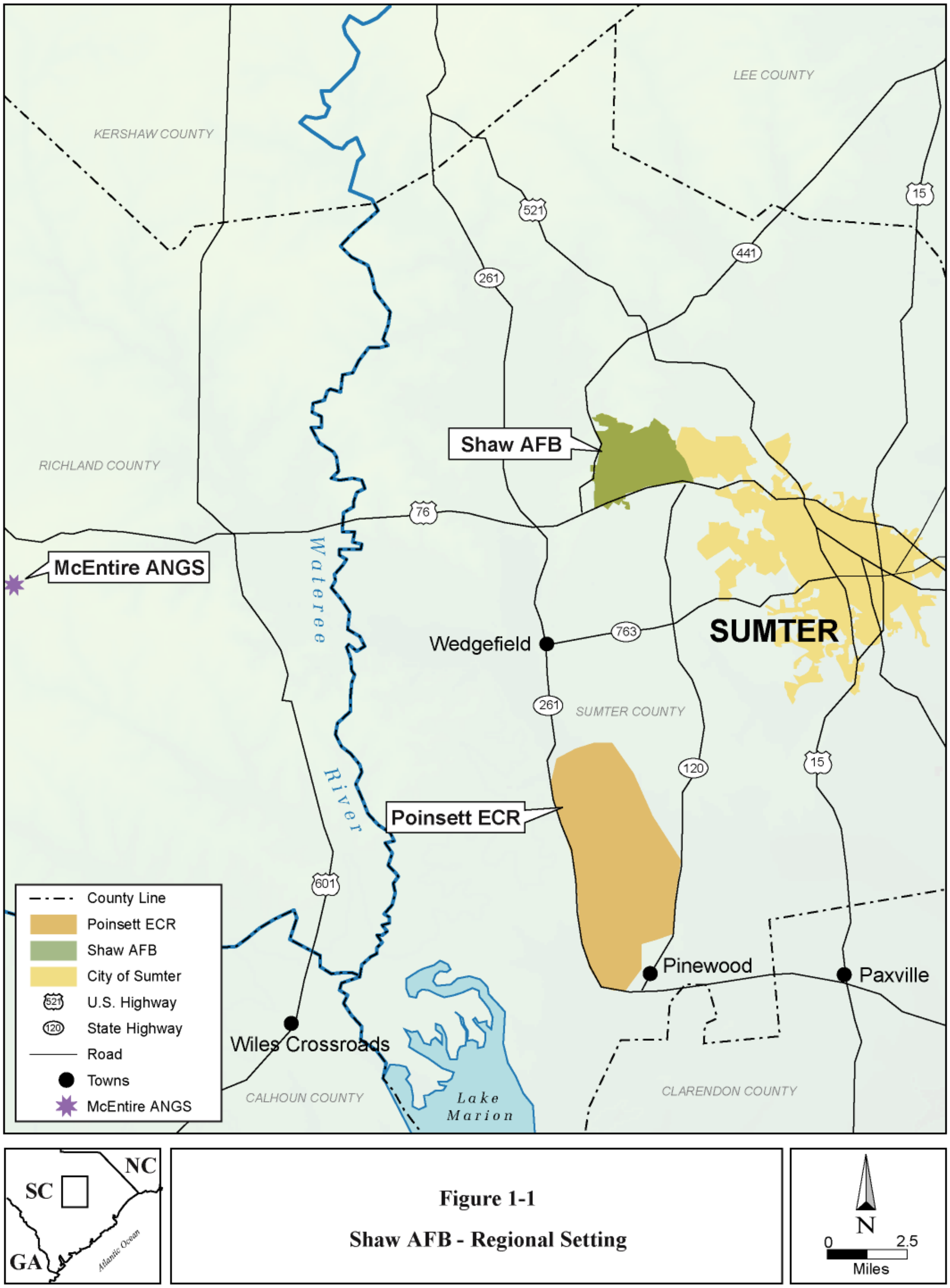


Figure 1-1

Shaw AFB - Regional Setting

Today, the 20 FW at Shaw AFB contains the 55th, 77th, and 79th Fighter Squadrons and has the primary mission to provide, project, and sustain combat-ready air forces. At Shaw AFB, the 20 FW is the host Wing and the U.S. Air Forces Central Command (AFCENT) is the major tenant. The base's general goals are to sustain the resources and relationships deemed appropriate to pursue national interests, and to provide for the command, control, and communications necessary to execute the missions of the Air Force, Air Combat Command (ACC), AFCENT, and the 20 FW.

The primary mission aircraft of the 20 FW and 169 FW is the F-16 Block 50/52 Fighting Falcon (F-16CJ+): a single-seat, single-engine, all-weather, multi-role day and night tactical fighter with air-to-air and air-to-ground missions. Table 1-1 outlines the missions and tactics required for 20 FW pilot training. All active Air Force units and many ANG and Air Force Reserve units have converted to the F-16C/D, which is deployed in a number of block variants. The F-16 is powered by a single turbofan engine with an afterburner and is capable of flying at twice the speed of sound (Mach 2) and at operational altitudes over 50,000 feet.

Shaw AFB and McEntire ANGS-based F-16s are best recognized for their ability to employ the air-to-ground high-speed anti-radiation missile (HARM) and the AN/ASQ-213 HARM Targeting System used in the Suppression of Enemy Air Defenses (SEAD) missions (refer to Table 1-1). This specialized version of the F-16 became the provider for Air Force SEAD missions when the F-4G Wild Weasel was retired from the Air Force Inventory. Recently, 20 FW mission requirements have expanded to include Destruction of Enemy Air Defenses (DEAD).

1.2.2 Current Shaw AFB Training Requirements

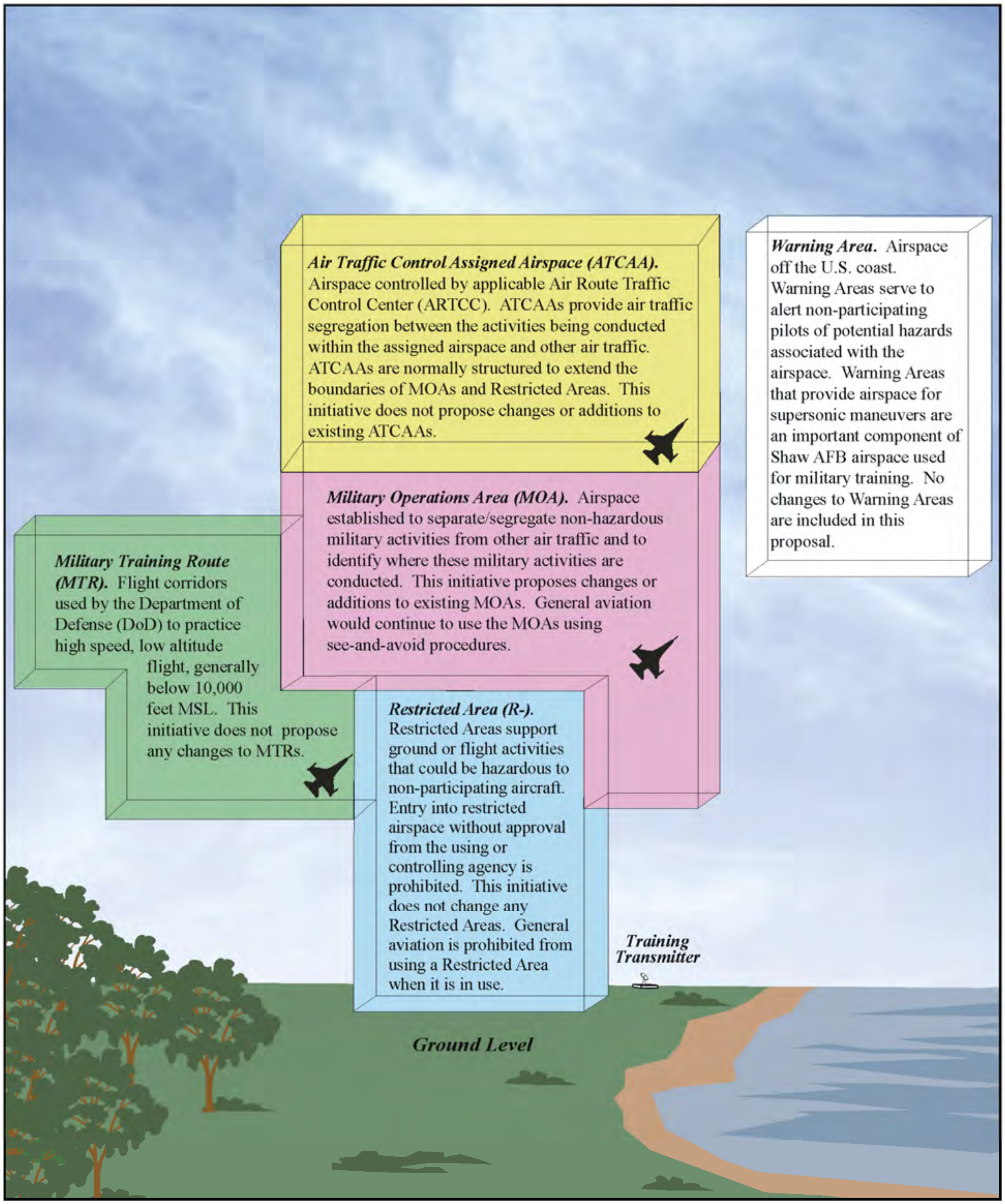
As part of the AEF, 20 FW and 169 FW pilots are routinely deployed for 120 days to overseas airfields where they participate in U.S.-directed peacekeeping missions. During these deployments, Air Force pilots must be trained to meet and counter increasingly sophisticated enemy forces employing upgraded equipment and enhanced tactics. Pilots assigned to Shaw AFB and McEntire ANGS must be trained to support both air-to-air and air-to-ground missions. To meet their mission responsibilities, pilots must be trained to demonstrate proficiency in the tactics listed in Table 1-1. Section 2.1 describes how ATI would improve training in the tactics listed in Table 1-1. Training in each of the current missions and tactics is required of 20 FW pilots. Enhanced capabilities of the F-16 aircraft described in Section 1.4 and increasingly sophisticated tactics and weapons deployed by opponents dictate the need for ATI proposed airspace modifications. Most, if not all, training flights are integrated into a cohesive series of activities reflecting those performed during an actual combat mission.

There are five types of training airspace used by the 20 FW and the 169 FW. Figure 1-2 displays these types of airspace. The ATI proposes changes to Military Operations Areas (MOAs), one of the five types of special use military training airspace in South Carolina and Georgia. No change is proposed for the Air Traffic Control Assigned Airspace (ATCAAs), Military Training Routes (MTRs), Restricted Airspace, or offshore Warning Areas where Shaw AFB F-16 aircraft have the ability to fly and simulate the launch of air-to-air and air-to-ground munitions at supersonic speeds.

Table 1-1. Current Missions and Tactics Required for 20 FW Pilot Training

Mission/Tactic	*Definition*
Basic Weapons Delivery	Air-to-ground delivery of ordnance, such as training ordnance, as permitted on the Poinsett Electronic Combat Range (ECR). Ordnance delivery is accomplished using a conventional box pattern.
Tactical Delivery of Weapons	A tactical delivery uses patterns and techniques that minimize final flight path predictability, yet allows sufficient time for accurate weapons delivery. This delivery affords more challenging multiple attack headings and profiles; the pilot is exposed to varying visual cues, shadow patterns, and the overall configuration and appearance of the target. Finding and identifying the target (target acquisition) is added to the challenge of successfully attacking the target.
Surface Attack Tactics (SAT)	Practiced in a block of airspace such as a Military Operations Area (MOA) or Restricted Area that provides room to maneuver. Precise timing during the flight to, and attack of the target is practiced, as is target acquisition. Ordnance is only used on approved ranges. Training includes egress from the target area and reforming into a tactical formation.
Close Air Support (CAS)	Focuses on missions providing direct support to ground forces in close proximity to enemy forces. A Forward Air Controller (FAC), who may be located in the air or on the ground, uses radio contact to direct CAS. Training includes coordination with the FAC, determining the precise location of friendly troops, and simulated delivery of ordnance on enemy positions.
Basic Fighter Maneuvering (BFM)	Fundamental training of all air-to-air flight maneuvering conducted with two aircraft practicing individual offensive and defensive maneuvering against each other.
Air Combat Maneuvering (ACM)	ACM stresses intra-flight coordination, survival tactics, and two-ship maneuvering against an adversary. The use of on-board radar is emphasized in this training.
Air Combat Tactics (ACT)	Three or four aircraft designated as friendly or enemy forces separate as far as possible in the maneuvering airspace to begin tactics training. Opposing forces approach each other at different designated altitudes to ensure vertical separation.
Tactical Intercept (TI)	Target aircraft and intercept aircraft are separated beyond each aircraft's radar detection capability. The target aircraft attempts to penetrate the area protected by the interceptor. The interceptor must detect the target, maneuver to identify the aircraft, and then position itself to successfully intercept.
Use of Advanced Targeting Pods (ATP)	During the day, the ATP assists in navigation, target identification, and weapons delivery at various altitudes. During the night, use of the ATP supports training at specified altitudes for navigation, target acquisition, and weapons delivery training.
Suppression of Enemy Air Defenses (SEAD)	Highly specialized mission requiring specific ordnance and avionics. The objective of this mission is to neutralize or destroy ground-based anti-aircraft systems.
Destruction of Enemy Air Defense (DEAD)	A specialized mission that combines tactics, ordnance, and avionics for the specific objective of the destruction and confirmation of the destruction of ground-based weapons that could threaten friendly forces.
Combat Search and Rescue (CSAR)	A specialized mission using aircraft, rescue teams, and specialized equipment to search for and rescue personnel in distress. Training is conducted at low airspeeds at 1,000 feet above ground level (AGL) or lower.

Source: Air Force 1998.



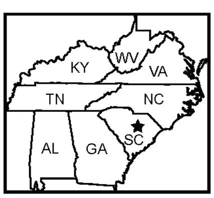
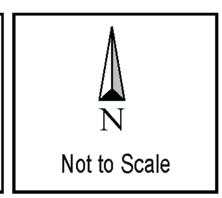


Figure 1-2

Types of Special Use Airspace for Shaw AFB and McEntire ANGS Pilot Training



By reconfiguring airspace and adding training transmitters under the airspace, aircrews can conduct realistic training and improve training value. Airspace managed by Shaw AFB associated with this proposal is presented in a top-down view in Figure 1-3. Section 2.2.1 details the ATI proposed changes to this airspace.

Training transmitters under or near Shaw airspace provide realistic electronic threats.

At any time during combat missions described in Table 1-1, a pilot could be exposed to numerous types of threats, either air-based (opposing aircraft with missiles and guns) or ground-based (various surface-to-air missiles or anti-aircraft artillery). Training transmitters under or adjacent to the training airspace simulate the targeting or guidance systems associated with these threats. Each training transmitter would be placed on a 150-foot by 150-foot gravel pad within an approximately 15-acre fenced area.

Figure 1-2 includes a representative training transmitter under the airspace. The 20 FW currently has several sites for the deployment of ground-based electronic training transmitters in areas under or near existing military training airspace. Training transmitters can be rotated among sites to create realistic varied threat scenarios for pilot training. Additional sites under or near the airspace create varied training situations comparable to those faced in actual combat. These transmitters provide electronic signatures that simulate ground-based "enemy" radar systems, threaten pilots during training, and require pilots to take defensive actions for self-protection. Pilots are currently authorized to use chaff and flares to counter these threats as part of defensive training in Shaw AFB training airspace (Air Force 2003).

1.2.3 ATI EIS Development

In August 2005, in accordance with the National Environmental Policy Act (NEPA) and its implementing regulations, the Air Force released a Draft EIS. The Draft EIS presents the potential environmental consequences of the Air Force's proposal to improve training for pilots assigned to Shaw AFB and McEntire ANGS, South Carolina. The Draft EIS Proposed Action and alternatives, including the No Action alternative, were called the Airspace Training Initiative.

As a result of public and agency comments received during the Draft EIS review, the 49-day public comment period, and the Federal Aviation Administration (FAA) aeronautical review process which included public participation in 2008, the Air Force and FAA have been consulting to mitigate air traffic concerns while continuing to meet Shaw AFB training requirements. Comments and meetings on the Draft EIS and the aeronautical proposal culminated in 2009 with the identification of the Preferred Alternative consisting of the Draft EIS Proposed Action with mitigating measures. The new Mitigated Proposed Action is described in Section 2.2 and the environmental consequences of the Mitigated Proposed Action are analyzed in Chapter 3.0.

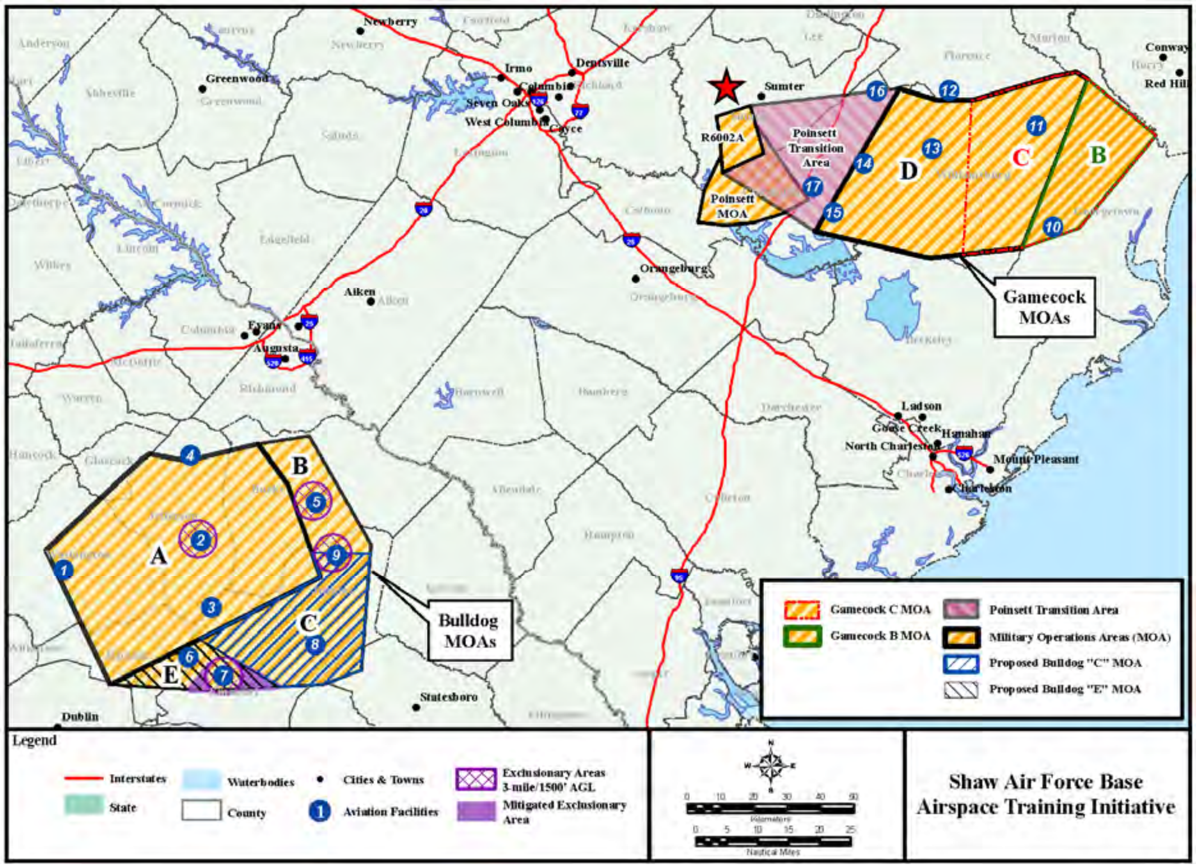


Figure 1-3. Airspace Potentially Affected by ATI

1.3 PURPOSE OF AIRSPACE TRAINING INITIATIVE

The purpose of ATI is to provide more effective and realistic military training airspace that is sized, configured, and able to improve training for the 20 FW and 169 FW F-16 transformational capabilities. Section 2.2 details the ATI Final EIS Mitigated Proposed Action and the Draft EIS Proposed Action. The ATI proposal would enhance training opportunities, thus increasing combat capability and survivability of Shaw AFB and McEntire ANGS F-16 pilots. The F-16 squadrons at Shaw AFB and McEntire ANGS comprise 70 percent of the Air Force's continental U.S.-based SEAD and DEAD assets. Pilots must train as they will fight to be prepared to face the world's most sophisticated hostile tactics and anti-aircraft systems when they deploy as part of the Air Force's AEF.

1.4 NEED FOR SHAW AFB AIRSPACE TRAINING INITIATIVE

The 20 FW is proposing the ATI to meet several specific needs. New technologies and new missions and tactics have resulted in new operational requirements within each airspace unit.

New technologies: Since Operation Desert Storm in 1991, Air Force weapon systems and tactics have advanced considerably. Deployed aircrews need to be trained to succeed against the world's most sophisticated hostile tactics and anti-aircraft systems. New sensors like the

HTS R7 and Advanced Targeting Pod on the F-16 have increased the capability of the aircraft to be distant from, or stand off from, the target as compared to earlier versions of the F-16. In addition, newer munitions like the Joint Direct Attack Munition (JDAM) have further enhanced aircraft capabilities, including improved target-acquisition and standoff capabilities. These improved capabilities require pilots of the F-16 to train at greater distances from the target than has previously been the case.

During scoping for this EIS, several participants asked why Shaw AFB needed the changes and additions to the current training airspace.

New Missions and Tactics: The 20 FW and 169 FW need access to local training airspace that provides as realistic a combat environment as possible to execute their mission and support national military and security objectives. State-of-the-art F-16 aerial combat and surface attack missions require highly-tuned offensive and defensive pilot skills. The new tactics require a full range of flight profiles, from low to high and from slow to fast. These tactics necessitate the use of larger airspace volumes. The proposed airspace modifications would provide aircrews a larger, contiguous training airspace with greater distances between simulated launch and simulated impact points for SEAD and other mission training. ATI would create training airspace to support changes in weapons platforms and changes in fighter tactics that have evolved to meet current and projected threats.

While the current airspace structure supports some aspects of the required training needs, the Bulldog MOA Complex has deficiencies that ATI would address. ATI meets current need and provides additional airspace resource capabilities for the foreseeable future.

Bulldog MOA Complex: Currently F-16 pilots can accomplish SEAD training missions in the Bulldog MOAs as configured because the airspace structure is of sufficient size to allow for the desired stand-off distances. However, as the 20 FW and 169 FW transition from the traditional SEAD mission to DEAD missions, pilots are often required to train at lower altitudes in order to visually acquire, identify, and simulate destruction of the training transmitter "threats." The current Bulldog MOA airspace configuration and training transmitter site locations do not permit this. The addition of two MOAs beneath Bulldog B MOA/ATCAA and adjacent to the Bulldog A MOA and the addition of transmitter sites under Bulldog A would meet this training need and allow pilots to fly at the lower altitudes required over the transmitter sites. While there is no training range associated with the Bulldog MOAs, the airspace modification to the Bulldog MOAs would substantially enhance the realism of DEAD mission training.

1.5 LEAD AND COOPERATING AGENCIES

The Air Force is the proponent for the ATI proposal and is the lead agency for the preparation of the EIS. The Federal Aviation Administration (FAA) is a cooperating agency. Appendix A includes correspondence between the two agencies regarding cooperating agency status.

As defined in 40 Code of Federal Regulations (CFR) §1508.5, a cooperating agency…

> means any Federal agency other than a lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action significantly affecting the quality of the human environment.

Congress has charged the FAA with administering all navigable airspace in the public interest as necessary to ensure the safety of aircraft and the efficient use of such airspace. For the FAA, the portion of the ATI proposal to establish new airspace is the primary action. This leads to the FAA's participation as a cooperating agency. As a cooperating agency, FAA has participated with the Air Force in public scoping, preparation of the Draft EIS, public and agency review, and the creation of the Mitigated Proposed Action analyzed in this Final EIS.

> ***Public Question:*** *During public review, commenters asked when a decision would be made.*
>
> ***Answer:*** *Neither an Air Force nor an FAA decision has been made. Public and agency comments help focus environmental analysis that must be completed prior to any ATI decision.*

The Air Force submitted an airspace proposal to FAA in accordance with FAA Order 7400.2. Based on the airspace proposal, FAA solicited comments from the public. In October 2008, FAA held an informal public meeting on the proposed establishment of Bulldog C and E MOAs at the Augusta Regional Airport. After receipt of public and agency comments on the Draft EIS and aeronautical proposal with further consultation with the FAA, the Air Force incorporated the comments and results from consultations in this Final EIS. Any Air Force decision on the ATI proposal will be documented in an Air Force Record of Decision (ROD). According to FAA environmental policies and procedures (Order 1550.1E) and in accordance with 40 CFR 1506.3, the ATI Final EIS can be adopted in whole or in part, as an official environmental analysis supporting the airspace proposal. Upon acceptance, the FAA would issue its own ROD and provide notification to the United States Environmental Protection Agency (USEPA) of the adoption.

1.6 ORGANIZATION OF THIS EIS

This EIS is organized into the following chapters and appendices. Chapter 1.0 describes the purpose and need of the proposal to provide military training airspace that is adequately sized, properly configured, and capable of supporting the training mission for F-16 aircraft based at Shaw AFB and at McEntire ANGS. A detailed description of the Mitigated Proposed Action, Draft EIS Proposed Action, operational alternatives, and the No-

ATI EIS

Action Alternative is provided in Chapter 2.0. Chapter 2.0 also discusses alternatives considered but not carried forward for further analysis. Finally, Chapter 2.0 provides a comparative summary of the effects of the Mitigated Proposed Action, and alternatives with respect to the various environmental resources.

Chapter 3.0 describes both the existing conditions and the environmental consequences within the area potentially affected by the Mitigated Proposed Action or an alternative. A full range of applicable environmental resources is presented. Cumulative effects of the Mitigated Proposed Action, as well as other recent past, current, and future actions that may be implemented in the region of influence (ROI) for the Mitigated Proposed Action or alternatives are addressed in Chapter 4.0. Chapter 4.0 also presents the relationship between short-term uses and long-term productivity identified for the resources affected, and the irreversible and irretrievable commitment of resources if the Mitigated Proposed Action or an alternative were implemented. Chapter 5.0 contains references cited in the EIS and lists the individuals and organizations contacted during the preparation of the EIS. A list of the document preparers is included in Chapter 6.0. Chapter 7.0 is a glossary of frequently used terms.

In addition to the main text, the following appendices are included in this document: Appendix A, Public Involvement and Agency Correspondence; Appendix B, Characteristics of Chaff; Appendix C, Characteristics and Analysis of Flares; Appendix D, Draft EIS Comments and Responses; Appendix E, Relevant Statutes, Regulations, and Guidelines; Appendix F, Airspace Description and Utilization; Appendix G, Controlled Airspace; Appendix H, Aircraft Noise Analysis and Airspace Operations; Appendix I, Output from Noise Modeling – MR_NMAP; Appendix J, Air Quality Calculations Using the Multiple Aircraft Instantaneous Line Source (MAILS) Model; Appendix K, Public Airports Under ATI Airspace; and Appendix L, Public and Agency Correspondence Relative to the FAA Aeronautical Circularization.

Shaw AFB 20 FW Mission.
Shaw AFB is home to the 20 FW. The 20 FW's primary mission at Shaw AFB is to provide, project and sustain combat ready air forces...any challenge, anytime, anywhere. To accomplish its mission, Shaw AFB employs the F-16 fighter aircraft. The 20 FW is the largest U.S. Air Force combat F-16 Wing.

McEntire ANG 169 FW Mission. McEntire ANGS is home to the 169 FW. The 169 FW's mission is to maintain wartime readiness and the ability to mobilize and deploy expeditiously to carry out tactical air missions or combat support activities. South Carolina ANG pilots train with their F-16 aircraft in Shaw AFB training airspace.

Shaw AFB and McEntire ANGS F-16s are:

- A compact high-performance weapons system
- Highly maneuverable
- Proven in combat
- Multi-role fighters with precision strike, beyond-visual range, and day and night capabilities
- Lead Air Force responsibilities for SEAD/DEAD missions

ATI provides local training to enhance the value of a limited number of training hours.

Existing airspace managed by Shaw AFB does not provide adequate space for pilots to train to meet current or realistic enemy threats. Shaw is proposing to:

- Create new airspace to improve existing training
- Identify sites for training transmitters
- Use chaff and defensive flares in the new and modified airspace

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This section describes the Mitigated Proposed Action, the Draft Environmental Impact Statement (EIS) Proposed Action, two action alternatives, and the No-Action Alternative. The Draft EIS Proposed Action was designed to implement changes to Special Use Airspace (SUA) in South Carolina and Georgia to support current training requirements of the 20th Fighter Wing (20 FW) and 169th Fighter Wing (169 FW). The Mitigated Proposed Action in this Final EIS does not propose charting new airspace in South Carolina and proposes limited airspace changes in Georgia. Section 2.6, Table 2-12, describes the Mitigated Proposed Action and alternatives. Between the time the Draft EIS was issued in August 2005 and the publication of this Final EIS in May 2010, the United States Air Force (Air Force) and Federal Aviation Administration (FAA) have been working together to address concerns raised by the public and communities on the Draft EIS Proposed Action and alternatives. This Final EIS presents the Air Force and FAA Mitigated Proposed Action which addresses public and agency concerns.

The Mitigated Proposed Action excludes all proposed changes to the SUA associated with the Gamecock or Poinsett Military Operations Areas (MOAs) in South Carolina. The baseline conditions for the areas affected by proposed changes to those areas were generally not updated between the Draft EIS and Final EIS because no environmental consequences would be anticipated. Because the Mitigated Proposed Action still includes additional training transmitter sites beneath the Gamecock C MOA and along the coast of South Carolina, updates to resources and references, such as airspace management including air traffic, and socioeconomics have been updated. The Air Force has validated and/or updated baseline conditions and reference material used for areas affected by the Mitigated Proposed Action or alternatives to ensure the potential environmental consequences identified for those areas are based on the most recent data available.

2.1 INTRODUCTION

This section describes the Airspace Training Initiative (ATI) mitigated proposed changes to the Shaw Air Force Base (AFB) training airspace. Refer to Figure 1-2 for an explanation of the five different types of airspace used for training.

ATI would provide airspace improvements to accomplish more realistic training in 20 FW and 169 FW missions. The existing airspace is depicted in Figure 2-1 for the Gamecock and Poinsett MOAs and associated Air Traffic Control Assigned Airspace (ATCAAs) in South Carolina. The Mitigated Proposed Action does not include any changes to the Gamecock or Poinsett MOAs. Figure 2-2 presents the existing Bulldog MOAs and associated ATCAA in Georgia. The Mitigated Proposed Action does include changes to the Bulldog MOA.

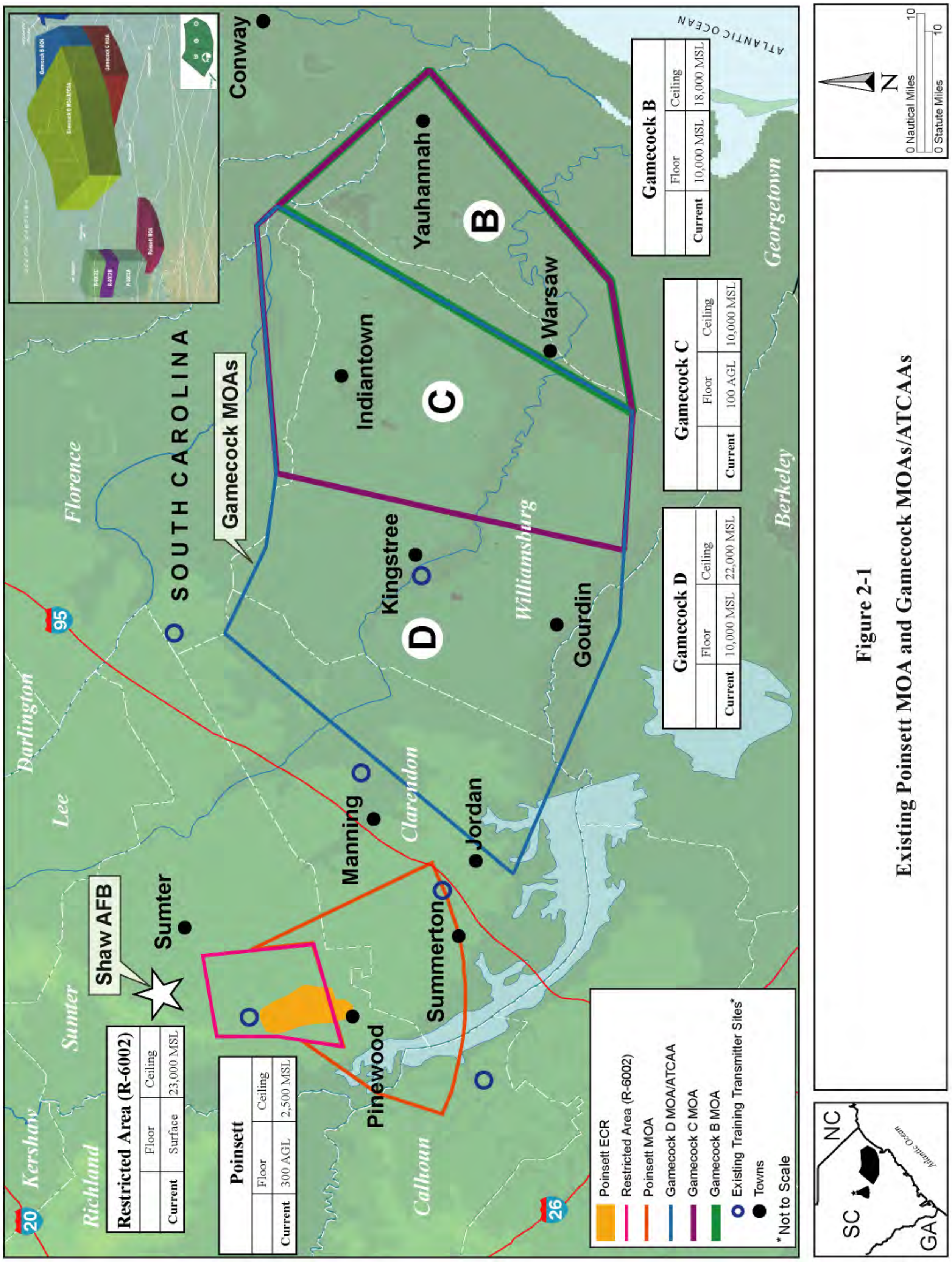


Figure 2-1
Existing Poinsett MOA and Gamecock MOAs/ATCAAs

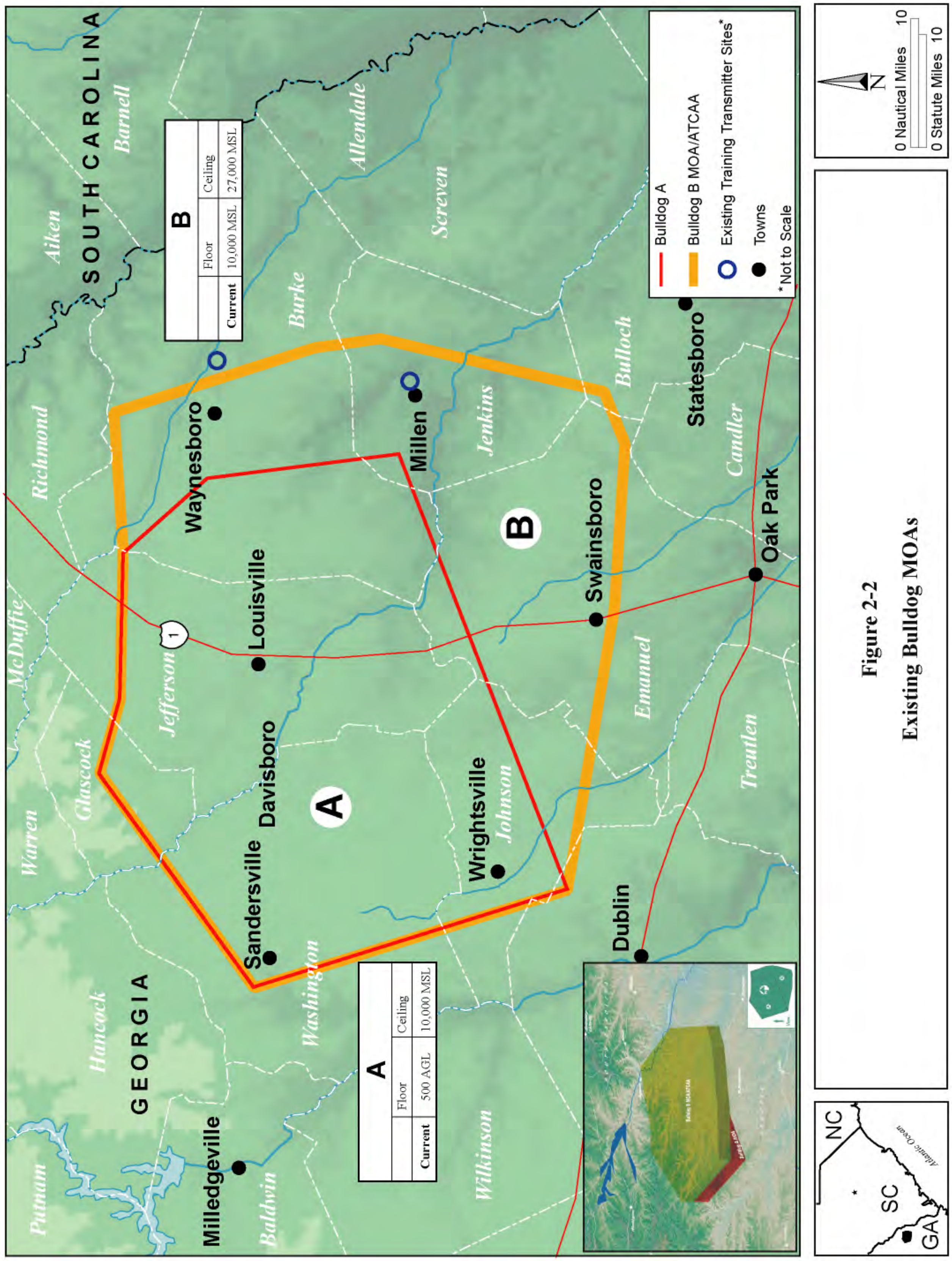


Figure 2-2
Existing Bulldog MOAs

Table 2-1 correlates the mission training requirements established by Air Force Instruction (AFI) 11-2F-16 Volume 1, *F-16 Aircrew Training*, with the existing airspace and Mitigated Proposed Action. The shortcomings of the current airspace for realistic training can be appreciated by considering the mission training requirements from Table 1-1 and reviewing the evaluation of the airspace's ability to support them in Table 2-1. As explained in Table 2-1, certain mission training can be accomplished in the existing airspace, but more advanced training to meet conditions faced in combat is limited by the current airspace configuration.

Implementing modifications to the Bulldog MOAs would configure and size the airspace to improve training of 20 FW and 169 FW pilots to meet the conditions they currently face in combat.

The following section provides specific details of the Mitigated Proposed Action and the Draft EIS Proposed Action (Section 2.2), two action alternatives (Sections 2.3 and 2.4), and the No-Action Alternative (Section 2.5). Section 2.6 provides a summary of the Mitigated Proposed Action and alternatives. Section 2.7 provides information about developing and screening the alternatives. Alternatives considered but not carried forward are found in Section 2.8. Section 2.9 discusses the Environmental Impact Analysis Process (EIAP) as it applies to Shaw AFB's ATI. Section 2.10 provides comparisons of potential environmental consequences of the Mitigated Proposed Action and alternatives, based on detailed analysis presented in Chapter 3.0.

2.2 MITIGATED PROPOSED ACTION AND DRAFT EIS PROPOSED ACTION

Application of the operational criteria and the other consideration to the candidate airspace resulted in the identification of the proposed configurations of Gamecock MOA Complex, Poinsett MOA, and Bulldog MOA Complex as the airspace combination best meeting the ATI purpose and need. Public and agency review and comments on the Draft EIS resulted in the United States Air Force (Air Force) and Federal Aviation Administration (FAA) reviewing the Draft EIS Proposed Action, Alternative A, and Alternative B. Following this review, mitigations were incorporated into a Mitigated Proposed Action in this Final EIS.

The Mitigated Proposed Action and the Draft EIS Proposed Action are described in terms of four fundamental components:

- Creation of new airspace to improve meeting training requirements;
- Identification of new training transmitter sites to provide realistic threats; and
- Extension of defensive chaff and flare use in the new and modified airspace to practice avoidance of air and ground-based threats.

Details of these components are described in the following sections. Each component is described as it was presented under the Draft EIS Proposed Action and as it is presented in the Mitigated Proposed Action. Table 2-2 summarizes the ATI proposal under the Draft EIS Proposed Action and this Final EIS Mitigated Proposed Action.

Table 2-1. Relationship of Airspace to Mission Training Requirements (Page 1 of 3)

Mission/Tactics	*Discussion of Training Airspace*	*Airspace Constraints*	*Mitigated Proposed Action Changes*
Basic Weapons Delivery and Tactical Weapons Delivery	Training occurs in a combination of the Poinsett Military Operations Area (MOA) and the restricted airspace above the Poinsett Electronic Combat Range (ECR). In general, training in Basic Weapons Delivery is supported by the Restricted Area (R-6002) and the Poinsett MOA.	The relatively small size of these airspace elements and the lack of contiguous inter-connected airspace places constraints on the ability of the airspace to support the maneuvering required for tactical weapons delivery.	No charted airspace improvement to the Gamecock MOAs is proposed in the Mitigated Proposed Action.
Surface Attack Tactics (SAT), Suppression of Enemy Air Defenses (SEAD), and Destruction of Enemy Air Defenses (DEAD)	Improved F-16 capabilities make target acquisition possible from a much greater distance than permitted by the Poinsett MOA and associated Restricted Airspace. Training requires developing skills in finding the target, maneuvering to allow attack on the target, accomplishing the attack, departure from the target area, and reforming into a tactical formation.	The lack of connecting airspace between the existing Gamecock MOAs and Restricted Airspace over the Poinsett ECR limits comprehensive training. Training in SEAD and DEAD is especially limited since a mission requires suppression from a distance (such as from the Gamecock MOA) followed by ensuring destruction through maneuvering from Gamecock all the way into the Poinsett ECR Restricted Airspace.	No charted airspace improvement to the Gamecock MOAs is proposed in the Mitigated Proposed Action.

Table 2-1. Relationship of Airspace to Mission Training Requirements (Page 2 of 3)

Mission/Tactics	*Discussion of Training Airspace*	*Airspace Constraints*	*Mitigated Proposed Action Changes*
Basic Fighter Maneuvering (BFM) and Air Combat Maneuvering (ACM)	Training occurs in a MOA/Air Traffic Control Assigned Airspace (ATCAA) complex, such as the Bulldog MOA, where fundamental and intra-flight coordination and two-ship maneuvering can be practiced.	The stratified or layered altitude structure of this airspace places artificial constraints on the flexibility required for effective training in these techniques. These constraints would not exist in an actual combat situation, and such constrained training teaches habits that can be extremely dangerous in combat. Pilots using military training airspace in the U.S. are often concerned about remaining within the horizontal and vertical boundaries of that airspace. Depending on the overall configuration of the airspace, they could be prevented from exercising the full range of tactical maneuvers of which the aircraft is capable. This creates artificial training constraints that would not exist in the combat environment, thereby limiting the overall realism of training.	The Mitigated Proposed Action would extend Bulldog A training airspace by establishing smaller extension Bulldog C and E MOAs to create an airspace supporting realistic BFM and ACM training.

Table 2-1. Relationship of Airspace to Mission Training Requirements (Page 3 of 3)

Mission/Tactics	*Discussion of Training Airspace*	*Airspace Constraints*	*Mitigated Proposed Action Changes*
Air Combat Tactics (ACT) and Tactical Intercepts (TI)	Improved F-16 target acquisition requires friendly and enemy aircraft to be separated by greater distances to begin training. In the Bulldog airspace, pilots need the ability to maneuver from lower to higher altitudes within a large contiguous airspace and to be separated from opposing air and ground threats for realistic training.	The stratified or layered altitude structure of this airspace places artificial constraints on the flexibility required for effective training in these techniques, which would not exist in an actual combat situation.	The Mitigated Proposed Action establishment of Bulldog C and E MOAs under the Bulldog B would create a contiguous block of airspace to permit pilots to practice tactical maneuvers at a range of altitudes, to respond to threats with appropriate maneuvers, to acquire targets at a realistic distance, and to pursue training missions to practice achieving effective control of the airspace.
Close Air Support (CAS), Advance Tactical Pods (ATP), and Combat Search and Rescue (CSAR)	Direct support to ground forces, including targeting and rescue training, requires a continuous airspace that reaches from a low altitude, to identify friendly ground forces or protect downed aircrews during rescue, to a high altitude for avoidance of surface threats and suppression of enemy air- and ground-based threats.	The non-contiguous nature and the stratified, or layered altitude structure of this airspace artificially constrains the flexibility required for effective training in these techniques. These constraints do not exist in an actual combat situation.	The Mitigated Proposed Action establishment of Bulldog C and E MOAs under the Bulldog B MOA would create additional realistic low to high airspace elevations and permit more comprehensive and realistic search and rescue and CAS training. This training can be combined with higher altitude simulated suppression of enemy defenses to create realistic battlefield conditions. Mission-specific ATP training for CAS and CSAR, and the integration of such training with SEAD and TI missions, permits pilots to become experienced in the multiple activities that occur in a real battle space.

Table 2-2. Summary of Draft EIS Proposed Action and Mitigated Proposed Action

ATI Proposal Component	*Draft EIS Proposed Action*	*Mitigated Proposed Action*
Gamecock Military Operations Areas (MOAs)	Draft EIS Section 2.2.1.1; Final EIS Section 2.2.1.1: Create Gamecock E MOA between Gamecock MOAs and Poinsett Electronic Combat Range (ECR) from 8,000 feet mean sea level (MSL) up to 22,000 feet MSL; create Gamecock F MOA from 5,000 feet MSL up to 10,000 feet MSL below the existing Gamecock D MOA; Gamecock B MOA would be deleted and returned to the National Airspace System (NAS); no changes to the existing Gamecock C MOA.	Section 2.2.1.1: No charted airspace changes or expansions
Poinsett MOAs	Draft EIS Section 2.2.1.2; Final EIS Section 2.2.1.2: Raise the ceiling of Poinsett MOA to 5,000 feet MSL.	Section 2.2.1.2: No charted airspace changes or expansions
Bulldog MOAs	Draft EIS Section 2.2.1.3; Final EIS Section 2.2.1.3: Extend Bulldog A MOA beneath the entire Bulldog B MOA. Bulldog A MOA to have an altitude from 500 feet above ground level (AGL) to 10,000 feet MSL.	Section 2.2.1.3: Mitigate public and agency concerns by charting Bulldog C and E MOAs beneath the Bulldog B MOA and adjacent to Bulldog A MOA from 500 feet AGL to 10,000 feet MSL.
Transmitter Sites	Draft EIS Section 2.2.2; Final EIS Section 2.2.2: One additional training transmitter under Gamecock C MOA; two additional transmitters under Bulldog A MOA; three training transmitters on the South Carolina coast near cities of Awendaw, McClellanville, and Georgetown.	Section 2.2.2: One additional training transmitter under Gamecock C MOA; two additional transmitters under Bulldog A MOA. Also three training transmitters on the South Carolina coast near cities of Awendaw, McClellanville, and Georgetown.
Chaff/Flares	Draft EIS Section 2.2.3; Final EIS Section 2.2.3: Allow chaff and flares in existing and proposed airspace at a minimum altitude of 5,000 feet MSL and above.	Section 2.2.3: Allow chaff and flares above 5,000 feet AGL in all modified and expanded airspace

2.2.1 Modifications to Airspace Structure

The Mitigated Proposed Action includes modifications of the airspace structure for Bulldog MOAs. The modifications are limited in scale as compared to the Draft EIS Proposed Action in order to address concerns of airspace access and airport access to civilian air traffic. The following discusses proposed changes in the respective airspace structures under both the Draft EIS Proposed Action and the Mitigated Proposed Action.

2.2.1.1 GAMECOCK MOA DRAFT EIS PROPOSED AIRSPACE MODIFICATIONS

Gamecock MOAs are used by Shaw AFB for training. Table 2-3 describes each MOA's vertical dimensions and provides information on the areas underlying the Gamecock MOAs.

Table 2-3. Existing Gamecock MOA Location and Vertical Dimensions

Training Airspace	*South Carolina Underlying Counties*	*Current Floor*[1]	*Current Ceiling*[2]
Gamecock B	Portions of Georgetown, Marion, and Horry	10,000 feet MSL	18,000 feet MSL
Gamecock C	Portions of Williamsburg, Florence, and Georgetown	100 feet AGL	10,000 feet MSL
Gamecock D	Portions of Williamsburg, Clarendon, and Berkeley	10,000 feet MSL[3]	18,000 feet MSL

Notes: 1. Average ground elevation underlying MOAs is approximately 500 feet MSL.
2. By definition, MOAs extend from a charted altitude up to, but not including 18,000 feet MSL or less. Proposed ceilings reflect the inclusion of ATCAA from 18,000 feet MSL and above to further extend the vertical boundary of the airspace.
3. Operationally, the floor of Gamecock D MOA is restricted to 12,000 feet MSL per Letter of Agreement (LOA) between 20 FW and Jacksonville Air Route Traffic Control Center (ARTCC).

AGL = above ground level; MSL = mean sea level

The Draft EIS proposed airspace modifications to improve training consisted of a new Gamecock E MOA to form a "bridge," allowing maneuvering and training between the Gamecock MOAs and the Poinsett Electronic Combat Range (ECR). Figure 2-3 depicts the Draft EIS Proposed Action additions to the Gamecock MOAs. This airspace would permit more realistic training in SAT, SEAD, and DEAD. Use of chaff and flares above 5,000 feet above mean sea level (MSL) would allow pilots to employ defensive training tactics.

In response to public and agency comments on the Draft EIS, the Mitigated Proposed Action does not include the charting of any modifications or expansions to the Gamecock MOAs. Under the Mitigated Proposed Action, the existing Gamecock MOAs would be operated in accordance with current practices and procedures. Gamecock B MOA would not be returned to the National Airspace System (NAS), but would remain as an operational MOA.

The existing Air Force-FAA Memorandum of Understanding permitting transit from the Gamecock MOAs to Poinsett Electronic Combat Range (ECR) would continue in effect. This Letter of Agreement (LOA) established an airspace corridor between Gamecock MOAs and Poinsett ECR. The LOA-defined corridor extends from 18,000 feet MSL up to, but not including, Flight Level (FL) 220 (22,000 feet MSL). Aircraft maneuvering is limited and the use of chaff and flares are not permitted in this corridor. Aircraft are required to maintain tactical formation while in the corridor and complete the flight within 15 minutes unless otherwise coordinated with Air Traffic Control (ATC). This corridor is only active while military aircraft are transitioning into R-6002. The LOA airspace is shared with military and civilian air traffic with Jacksonville Air Route Traffic Control Center (ARTCC) providing standard ATC separation.

2.2.1.2 Poinsett MOA Draft EIS Proposed Modifications

Under the Draft EIS Proposed Action, the vertical extent of Poinsett would be expanded by raising the ceiling from 2,500 feet MSL to 5,000 feet MSL. This change, noted in Figure 2-3, would have increased the airspace volume available and provided for realistic aircrew maneuvering for surface attack and related missions. Under the Mitigated Proposed Action, the Poinsett MOA would not be expanded or modified.

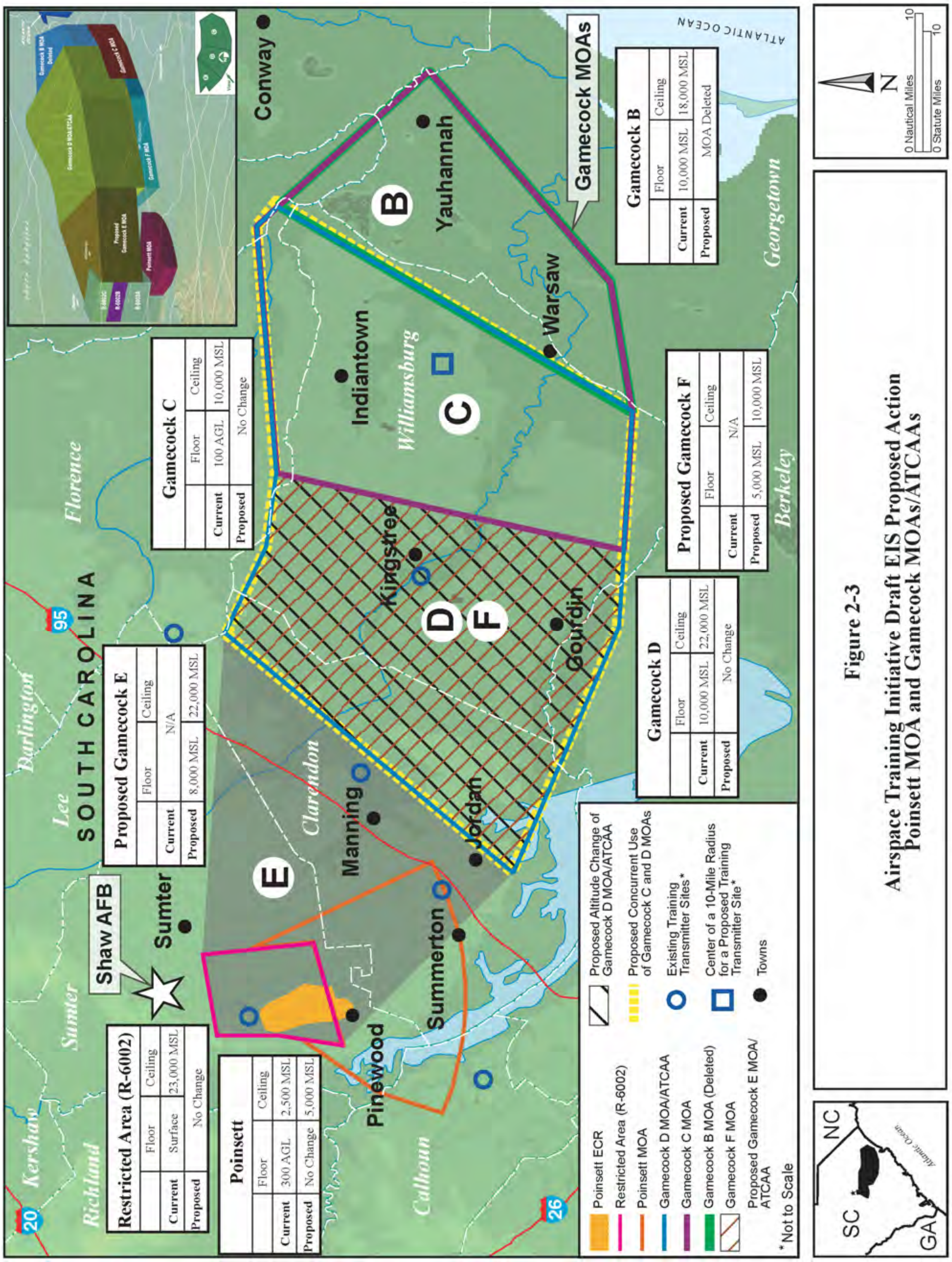


Figure 2-3

Airspace Training Initiative Draft EIS Proposed Action Poinsett MOA and Gamecock MOAs/ATCAAs

The existing Air Force-FAA Memorandum of Understanding permitting transit from the Gamecock MOAs to Poinsett Electronic Combat Range (ECR) would continue in effect. This Letter of Agreement (LOA) established an airspace corridor between Gamecock MOAs and Poinsett ECR. The LOA-defined corridor extends from 18,000 feet MSL up to, but not including, Flight Level (FL) 220 (22,000 feet MSL). Aircraft maneuvering is limited and the use of chaff and flares are not permitted in this corridor. Aircraft are required to maintain tactical formation while in the corridor and complete the flight within 15 minutes unless otherwise coordinated with Air Traffic Control (ATC). This corridor is only active while military aircraft are transitioning into R-6002. The LOA airspace is shared with military and civilian air traffic with Jacksonville Air Route Traffic Control Center (ARTCC) providing standard ATC separation.

2.2.1.3 POINSETT MOA DRAFT EIS PROPOSED MODIFICATIONS

Under the Draft EIS Proposed Action, the vertical extent of Poinsett would be expanded by raising the ceiling from 2,500 feet MSL to 5,000 feet MSL. This change, noted in Figure 2-3, would have increased the airspace volume available and provided for realistic aircrew maneuvering for surface attack and related missions. Under the Mitigated Proposed Action, the Poinsett MOA would not be expanded or modified.

2.2.1.4 BULLDOG MOA DRAFT EIS AND FINAL EIS PROPOSED MODIFICATIONS

Bulldog MOA is comprised of two existing components designated Bulldog A and Bulldog B. Table 2-4 provides information on the areas underlying these components, as well as on their existing vertical dimensions.

Table 2-4. Bulldog MOA Location and Vertical Dimensions

Training Airspace	*Georgia Underlying Counties*	*Current Floor* [1]	*Current Ceiling*[2]
Bulldog A	Portions of Washington, Jefferson, Johnson, Glascock, Burke, Jenkins, and Emanuel	500 feet AGL	10,000 feet MSL
Bulldog B	Portions of Burke, Emanuel, Jefferson, Washington, Glascock, Jenkins, and Johnson	10,000 feet MSL[3]	27,000 feet MSL

Notes: 1. Average ground elevation underlying MOAs is approximately 500 feet MSL.
2. By definition, MOAs extend from a charted altitude (floor) up to, but not including 18,000 feet MSL or less. Proposed ceilings reflect the inclusion of ATCAA to further extend the vertical boundary of the airspace.
3. Operationally, the floor of Bulldog B MOA east and south of Bulldog A MOA is restricted to 11,000 feet MSL per LOA between 20 FW and Atlanta ARTCC.

AGL = above ground level; MSL = mean sea level

Under the Draft EIS Proposed Action, the airspace structure of Bulldog A MOA would have been expanded to the east under the Bulldog B "shelf" to match the boundary of the existing Bulldog B. The Draft EIS Proposed Action would have increased the airspace volume available for aircrew training in the Bulldog MOAs and would have provided for more efficient and effective use of the existing airspace.

Figure 2-4 depicts the Mitigated Proposed Action. Under the Mitigated Proposed Action, the boundaries of Bulldog A MOA would not be expanded as proposed in the Draft EIS. The Mitigated Proposed Action would chart two smaller airspace extensions of the Bulldog A MOA under the existing Bulldog B MOA/ATCAA. These two MOAs would expand the Bulldog Complex's capability for flight training activities while avoiding civil aviation operations to the extent possible. The two mitigated MOAs would be: 1) The new Bulldog E MOA would be created contiguous with Bulldog A MOA's southern boundary and would extend from 500 feet above ground level (AGL) up to, but not including, 10,000 feet MSL. 2) The new Bulldog C MOA would be created contiguous with Bulldog A MOA's southeastern boundary and with the Bulldog E MOA. Bulldog C MOA would also extend from 500 feet AGL up to, but not including, 10,000 feet MSL. The dimensions of the Bulldog B MOA/ATCAA would not change and would overlie the existing Bulldog A MOA as well as the Bulldog C and E MOAs.

The Mitigated Proposed Action is in direct response to the Augusta Regional Airport's concerns for unlimited access to the Augusta airport. The Augusta Regional Airport's Class D airspace would remain as it is charted and Bulldog A would not be expanded under the northeastern portion of the Bulldog B MOA/ATCAA (Figure 2-4). The Mitigated Proposed Action is also in direct response to concerns from the civil and general aviation communities. Public airports within the proposed Bulldog C and E MOAs would have minimum exclusion areas of 3 nautical miles (NM) and 1,500 feet AGL. In addition, the proposed Bulldog E MOA has a larger exclusion area designated around the Emanuel County Airport in response to concerns about interference with airport operations (Figure 2-4).

The FAA Atlanta ARTCC would have the authority to manage the airspace and control civilian air traffic into and out of the Swainsboro and Millen airports. The Atlanta ARTCC would also have the authority to temporarily raise the floors of the proposed Bulldog C and E MOAs when they are active to allow civilian Instrument Flight Rules (IFR) aircraft clearance to transit the airspace.

2.2.1.5 SUMMARY OF AIRSPACE CHANGES

Table 2-5 summarizes the changes in airspace structure that would be implemented under the Mitigated Proposed Action and Draft EIS Proposed Action. The Mitigated Proposed Action distributes training flights within the airspace to better accommodate training requirements.

During a single training mission, pilots may fly their aircraft through several individual elements of military training airspace.

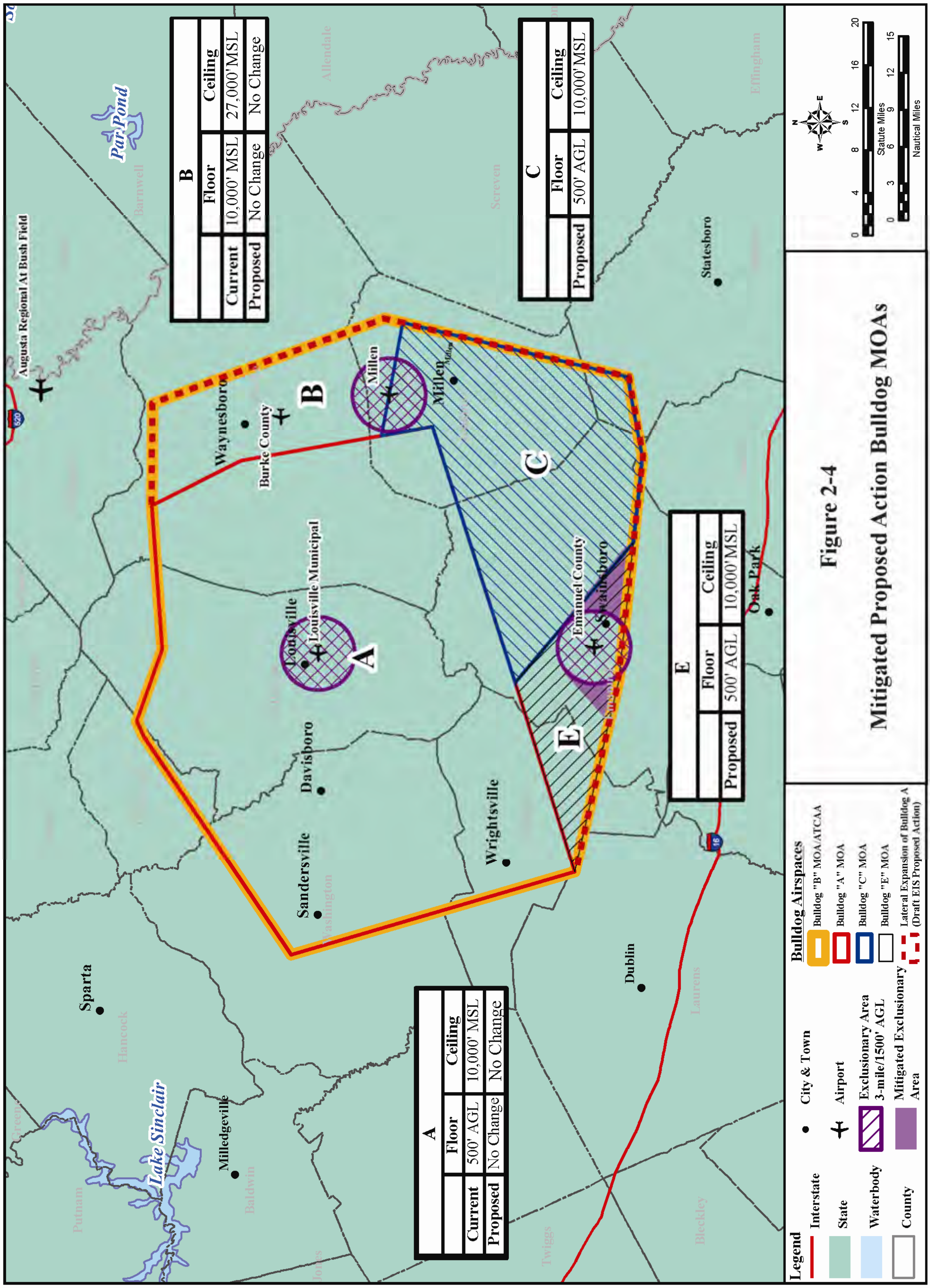


Figure 2-4
Mitigated Proposed Action Bulldog MOAs

Table 2-5. Summary of Changes in Airspace under the Mitigated Proposed Action and the Draft EIS Proposed Action (Page 1 of 2)

Training Airspace	*Underlying Counties*	*Current Floor*[1]	*Current Ceiling*[2]	*Draft EIS Proposed Floor*	*Draft EIS Proposed Ceiling*[3]	*Mitigated Proposed Floor*	*Mitigated Proposed Ceiling*
Gamecock B	Georgetown, Marion, and Horry, South Carolina	10,000 feet MSL	UTBNI 18,000 feet MSL	MOA Deleted	MOA Deleted	No Change from Current	No Change from Current
Gamecock C	Williamsburg, Florence, and Georgetown, South Carolina	100 feet AGL	10,000 feet MSL	100 feet AGL	10,000 feet MSL	No Change from Current	No Change from Current
Gamecock D	Williamsburg, Clarendon, and Berkeley, South Carolina	10,000 feet MSL[3]	UTBNI 18,000 feet MSL	10,000 feet MSL	UTBNI 18,000 feet MSL	No Change from Current	No Change from Current
Gamecock E (new)	Sumter and Clarendon, South Carolina	N/A	N/A	8,000 feet MSL	22,000 feet MSL	N/A	N/A
Gamecock F (new)	Williamsburg, Clarendon, and Berkeley, South Carolina	N/A	N/A	5,000 feet MSL	10,000 feet MSL	N/A	N/A
Poinsett	Sumter, Calhoun, and Clarendon, South Carolina	300 feet AGL	2,500 feet MSL	300 feet AGL	5,000 feet MSL	No Change from Current	No Change from Current
Bulldog A	Washington, Jefferson, Johnson, Glascock, Burke, Jenkins, and Emanuel, Georgia	500 feet AGL	UTBNI 10,000 feet MSL	500 feet AGL in extension	UTBNI 10,000 feet MSL in extension	Extension mitigated by Bulldog C and E	Extension mitigated by Bulldog C and E
Bulldog B MOA	Burke, Emanuel, Jefferson, Washington, Glascock, Jenkins, and Johnson, Georgia	10,000 feet MSL[4]	UTBNI 18,000 feet MSL	No Change	No Change	No Change from Current	No Change from Current

Table 2-5. Summary of Changes in Airspace under the Mitigated Proposed Action and the Draft EIS Proposed Action (Page 2 of 2)

Training Airspace	*Underlying Counties*	*Current Floor*[1]	*Current Ceiling*[2]	*DEIS Proposed Floor*	*DEIS Proposed Ceiling*[3]	*Mitigated Proposed Floor*	*Mitigated Proposed Ceiling*
Bulldog B ATCAA	Burke, Emanuel, Jefferson, Washington, Glascock, Jenkins, and Johnson, Georgia	18,000 feet MSL	27,000 feet MSL	No Change	No Change	No Change from Current	No Change from Current
Bulldog C (Mitigation)	Bulloch, Candler, Emanuel, and Jenkins, Georgia	N/A	N/A	N/A	N/A	500 feet AGL	UTBNI 10,000 feet MSL
Bulldog E (Mitigation)	Emanuel, Johnson, and Lauren, Georgia	N/A	N/A	N/A	N/A	500 feet AGL	UTBNI 10,000 feet MSL

Notes:
1. Average ground elevation underlying MOAs is approximately 500 feet MSL.
2. By definition, MOAs extend from a charted altitude up to, but not including 18,000 feet MSL or less. Proposed ceilings reflect the inclusion of ATCAA to further extend the vertical boundary of the airspace.
3. Operationally, floor of Gamecock D MOA is restricted to 12,000 feet MSL per LOA between 20 FW and Jacksonville ARTCC.
4. Operationally, floor of Bulldog B MOA east and south of Bulldog A MOA is restricted to 11,000 feet MSL per LOA between 20 FW and Atlanta ARTCC.

MSL = mean sea level; UTBNI = up to, but not including; MOA = Military Operations Area; AGL = above ground level; N/A = Not Applicable

2.2.1.6 TRAINING WITHIN THE AIRSPACE

This section describes the current and proposed training activity within the proposed ATI mitigated training airspace. Training activity within the airspace is described in terms of sorties and sortie operations. A *sortie* is defined as a single aircraft taking off, performing one or more training missions, and returning to base. During the training, the aircraft may be flown in several airspace elements. When one aircraft uses one airspace element, that aircraft is said to be conducting one sortie operation. On one training sortie, an aircraft may fly through a number of airspace elements. This would produce a corresponding number of sortie operations. For example, if an F-16 flew from Shaw AFB through Bulldog A and B MOAs, this would count as one sortie and two sortie operations. The number of sortie operations identified for individual airspace elements will normally be greater than the number of sorties flown from Shaw AFB.

The term aircraft hours is used to describe the amount of time an airspace element is used by training aircraft. Aircraft hours quantify the use of the airspace when an airspace element is scheduled. During a scheduled, or reserved time, an airspace element may be used by numerous training aircraft. Technical analysis of environmental resources, such as noise, safety, and air quality, requires details beyond the airspace scheduled time. The term aircraft hours reflects the number of aircraft and the flight time each aircraft spends in an airspace element. For example, if an airspace element were scheduled for an hour and during that hour six aircraft fly in the airspace element for 20 minutes each, this would equate to a total of two aircraft hours (6 x 20 minutes) in the airspace element.

Table 2-6 presents the current distribution of individual aircraft by type within the training airspace. The table provides the annual hours for which the airspace is scheduled and the number of specific aircraft sortie operations conducted in that airspace. The aircraft shown account for all users of the airspace, not just aircraft assigned to the 20 FW and 169 FW.

Table 2-7 compares current and proposed altitude distributions and flight activity under the Mitigated Proposed Action. The altitude distributions are based on estimates of the percent of time an individual aircraft spends in each altitude range for each airspace element. The calculated aircraft hours are based on the percentage of time in the altitude range and the total aircraft hours estimated for each airspace element.

Neither the configuration nor use of Military Training Routes (MTRs), the Poinsett ECR, or the offshore Warning Areas would change under the Mitigated Proposed Action or an alternative.

2.2.2 Placement of New Training Transmitter Sites

Currently, six training transmitter sites are adjacent to or beneath the Gamecock and Poinsett MOAs and three training transmitter sites are adjacent or beneath the Bulldog MOAs (see Figure 1-3). Under the Mitigated Proposed Action, six additional electronic training transmitter sites would be established or identified with one location under the Gamecock C MOA, three locations under the Bulldog A MOA, and three locations would be along the South Carolina coast. Training transmitter sites along the South Carolina coast would allow limited SEAD/DEAD training in offshore Warning Areas described in Figure 1-2 and located on Figure 1-3. The ability to use the higher altitudes and supersonic speeds available in W-161 and W-177 would be enhanced by these electronic transmitters. As depicted in Figure 2-3, the Mitigated Proposed Action includes one additional training transmitter site beneath Gamecock C MOA; two additional training transmitter sites beneath the Bulldog A MOA near Grange and Magruder (Magruder North, Magruder South, and the Grange site were analyzed as part of the proposed action). Three training transmitter sites along the South Carolina coast, one each within a 10-mile radius of the South Carolina coastal cities of Georgetown, McClellanville, and Awendaw, were analyzed to determine the feasibility of coastal locations for training transmitters. Additional environmental analysis will be required for these sites prior to final site selection.

Table 2-6. Aircraft Type Distribution Annually by Airspace Unit Under Existing Conditions[1]

Aircraft	BULLDOG		GAMECOCK B [2]		GAMECOCK C		GAMECOCK D		POINSETT MOA		R-6002	
	Sched. Hours	*Sortie Operations*	*Sched. Hours*	*Sortie Operations*	*Sched Hours*	*Sortie Operations*	*Sched Hours*	*Sortie Operations*	*Sched. Hours*	*Sortie Operations*	*Sched. Hours*	*Sortie Operations*
F-16	1,265	4,427	36	216	892	2,594	1,384	4,143	33	140	1,238	2,590
F-15	20	80	0	0	128	512	102	408	3	14	122	255
F-18	706	1,353	0	0	240	720	140	576	4	19	172	360
F-14	0	0	0	0	0	0	0	0	0	0	0	0
AV-8B	20	60	0	0	30	90	12	36	1	1	11	23
A-10	0	0	0	0	474	1,422	50	150	2	5	45	94
EA-6B	0	0	0	0	0	0	12	36	1	1	11	23
Total	2,011	5,920	36	216	1,764	5,338	1,700	5,349	44	180	1,599	3,345

Notes: 1. Fiscal Year (FY) 2003 Data
2. Operational Readiness Exercises (OREs) and Operational Readiness Inspections (ORIs) only.

MOA = Military Operations Area; Sched. = Scheduled

Table 2-7. Existing and Projected Annual Use of Mitigated Proposed Action Airspace

	Airspace Operations (Percent Time at Indicated Altitudes) Under Current (Cur.) and Proposed (Prop.) Conditions													
Altitude	**500-1,000**		**1,000-2,000**		**2,000-5,000**		**5,000-10,000**		**10,000-FL170**		**FL170-FL230**		**> FL230**	
Airspace	***Cur.***	***Prop.***	***Cur.***	***Prop.***	***Cur.***	***Prop.***	***Cur.***	***Prop***	***Cur.***	***Prop.***	***Cur.***	***Prop.***	***Cur.***	***Prop.***
Bulldog Complex	5	5	5	5	5	5	10	10	60	60	10	10	5	5
Gamecock B	0	0	0	0	0	0	5	5	95	95	0	0	0	0
Gamecock C	10	10	10	10	40	40	40	40	0	0	0	0	0	0
Gamecock D/F[1]	0	0	0	0	0	0	0	0	85	85	15	15	0	0
Gamecock E	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Poinsett	50	50	50	50	0	0	0	0	0	0	0	0	0	0
R-6002	8	8	8	8	8	8	24	24	32	32	20	20	0	0
Aircraft Hours														
Bulldog Complex	148	148	148	148	148	148	296	296	1,776	1,776	296	296	148	148
Gamecock B	0	0	0	0	0	0	5	0	103	0	0	0	0	0
Gamecock C	267	267	267	267	1,068	1,068	1,068	1,068	0	0	0	0	0	0
Gamecock D/F[1]	0	0	0	0	0	0	0	0	2,273	2,273	401	401	0	0
Gamecock E	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Poinsett	8	8	8	8	0	0	0	0	0	0	0	0	0	0
R-6002	134	134	134	134	134	134	401	401	535	535	335	335	0	0

Note: 1. Under current conditions, data pertain to Gamecock D only; Gamecock F is not proposed.
2. Gamecock E not included in Mitigated Proposed Action.

Source: Personal communication, Byers 2004.

DESCRIPTION OF TRAINING TRANSMITTERS

The training transmitter sites under or near the MOAs create realistic threats within the MOA airspace, and the training transmitter sites along the coast project threats into the offshore Warning Areas and into MOAs. The offshore Warning Areas are important elements of Shaw training airspace (see Figure 1-2).

The signals from this threat emitter system simulate an integrated air defense system typical of defenses encountered in combat.

A representative type of threat emitter is the Mini-Multiple Threat Emitter System (Mini-MUTES). Mini-MUTES are sited at the existing training transmitter sites and provide pilots with simulated threats to train in threat avoidance. The Mini-MUTES shown here project the electronic radiation of multiple, realistic threat signals. These signals simulate an integrated air defense system as may be encountered in combat. By reacting to this simulated threat, aircrews can train and be monitored under controlled and measurable conditions. Each Mini-MUTES consists of a tracking antenna, emitter/ receiver antennas, and transmitter enclosures. Mini-MUTES units, such as the one pictured on this page, are located on a rotating base, mounted on a 32-foot long, 8-foot wide flatbed trailer.

LOCATION OF TRAINING TRANSMITTERS

For the safe use, control, and maintenance of the transmitter system, ideal placement is determined by four elements:

- System should be located on a slight rise having an unobstructed view of the airspace;
- The electrically powered system requires good vehicular access and nearby electric and phone service;
- System operation requires a safety buffer of approximately 400 feet, depending on the size and power of the transmitter; and
- Open, agricultural areas are more desirable than urban areas or areas with large population concentrations.

Training transmitter sites for Gamecock C MOA and along the South Carolina coast would be located according to the requirements of placement.

Under the Bulldog A MOA, three potential sites have been identified for the installation of two additional training transmitter locations (refer to Figures 1-3 and 2-4). One site is located in Jefferson County, Georgia, on agricultural land located approximately one-half mile south of State Route (SR) 171. Known as the Grange site, it is connected to SR 171 by a well-maintained graded dirt road and has nearby electric and phone service. Located on a slight rise at an elevation of 367 feet above sea level, it has an extensive view of the surrounding airspace. A preliminary evaluation of potential environmental concerns (Environmental Data Resources, Inc. [EDR] 2005a) as well as a field evaluation (SAIC 2005) did not identify any issues that would preclude the selection of this site.

The second and third sites, known as Magruder north and south, are located in Burke County and are near Magruder, Georgia. Both sites have nearby access to electric and phone service and are adjacent to maintained roads. Magruder north is located next to Magruder-Rosier Road, 0.47 mile from the town of Magruder and sits at an elevation of 292 feet above sea level. The area is currently pasture land. Although the preliminary environmental evaluation (EDR 2005b) did not identify any concerns with the area of Magruder north, a field evaluation located an archaeological site having both prehistoric and historic components (SAIC 2005). Based on selection criteria, the presence of sensitive environmental resources could make Magruder north the less desirable of the two possible Magruder locations. Magruder south is located off Cobb Road, approximately 1.4 miles from the town of Magruder. The area sits at an elevation of 309 feet above sea level and is currently in cultivation. A preliminary evaluation of potential environmental concerns (EDR 2005c) in addition to a field evaluation (SAIC 2005) did not identify any issues that would preclude the selection of this site.

The transmitter sites along the South Carolina coast would be within a 10-mile radius of the cities of Georgetown, McClellanville, and Awendaw (refer to Figures 1-3 and 2-3 for existing sites and proposed locations). The specific coastal sites have not been identified. If the coastal sites are identified in the future, the Air Force would need to complete the EIAP, environmental baseline and cultural surveys, and NHPA Section 106 consultation.

DETAILS OF THE TRAINING TRANSMITTER SITES

Figure 2-5 provides a representative diagram of a typical training transmitter site layout. The approximate design, including area is depicted.

Each Mini-MUTES would be placed on a gravel pad measuring 150 feet by 150 feet, yielding an area of approximately 0.5 acres. The pad area would be enclosed by a 6-foot-high chain link fence topped with three strands of barbed wire. The Mini-MUTES is designed to be self-contained and unmanned. Periodic routine maintenance and servicing would occur.

An outer perimeter measuring 800 feet by 800 feet would be enclosed by a three-strand smooth wire fence, creating an approximate 15 acre safety buffer zone. The size of the buffer zone could vary depending on the size and power of the

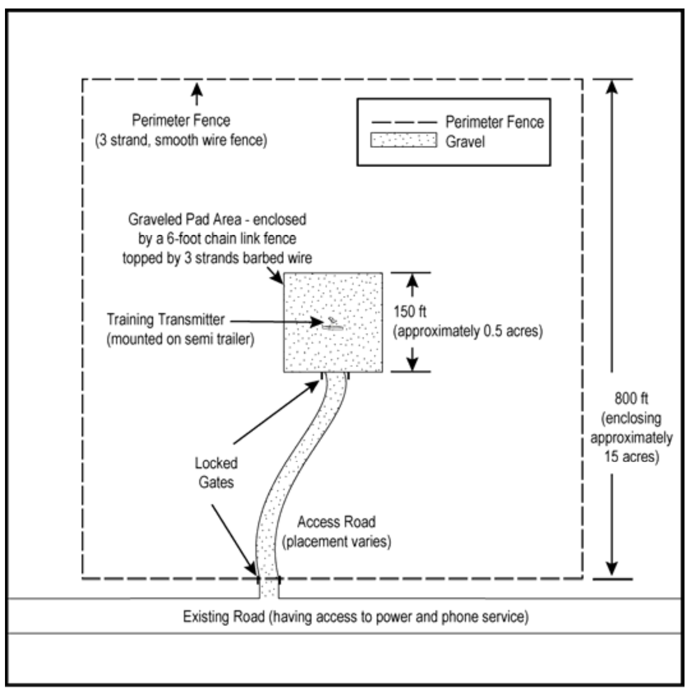


Figure 2-5. Training Transmitter Site Representative Diagram

transmitter. While the perimeter fence would serve to limit general access, coordination between the landowner and the Air Force would permit current land use between the perimeter and the pad enclosure. Only the 0.5-acre pad enclosure would be removed from use. Both fences would have lockable gates. Replicas of threat equipment may be placed within the 15 acres to provide visual cues to pilots. Figure 2-6 presents examples of real threats and replica threats.

Real Threats. During conflicts, enemy forces attempt to protect assets by positioning defensive weapons to prevent U.S. forces from completing their missions. Examples of real threats Shaw AFB pilots will face are pictured at right. A realistic training environment simulates opposing radar, air-to-air missiles, and surface-to-air missiles.

Training Transmitters. Opposing radar is simulated by training transmitters or emitters, such as the one at left. These on-the-ground transmitters are under or near training airspace and simulate real threats "fired" at the aircrews. Pilots must learn to quickly react to these threats.

Replica Threats at Training Transmitter Sites. The proposed training transmitter sites would be located on open areas of approximately 15 acres. Mock threats (pictured right) that look like a radar (top) or missiles (bottom) may be situated within the approximately 15 acres to give pilots visual training realism. Transmitter sites would require an access road, electrical power and telephone connection.

Figure 2-6. Real and Replica Threats

Each training transmitter site would be serviced by local electrical power and telephone service. An improved gravel access road would be constructed to the transmitter site from the hard surface road, the exact placement of which would depend on the surrounding infrastructure. The area disturbed for the transmitter footprint and temporary construction staging area, including the gravel access road, would be approximately 0.6 acre on each site.

2.2.3 Use of Chaff and Flares

Chaff and flares are defensive counter measures used to defend against air or ground-based threats. Chaff, bundles of extremely small strands of aluminum-coated silica fibers, is designed to briefly confuse opposition radar and permit a pilot to maneuver to avoid the threat. Flares are used to attract enemy heat-seeking missiles and lead them away from the targeted aircraft. Flares used in defensive training burn out in approximately 400 feet and would not be deployed below 5,000 feet MSL or approximately 4,500 feet AGL. This means that flares would burn out approximately 4,100 feet AGL.

Effective air combat training requires that pilots instantaneously react to a threat by deploying chaff or flares as defensive counter measures. Figure 2-7 depicts the life cycle of defensive chaff and flares. Under the Mitigated Proposed Action, the use of chaff and flares in the existing Gamecock and Bulldog MOAs presented in Table 2-8 would be included in the new Bulldog C and E MOAs. There would not be an increase in the use of chaff and flares within the overall airspace, although there would be a redistribution of chaff and flares within the new and modified airspace.

Winds at the altitude chaff and flares are deployed and at altitudes between deployment and the ground would affect the drifting and ultimate deposition of residual materials. The eventual location of chaff fibers would depend on the release altitude and winds at different altitudes. Training aircraft have been found to fly randomly within an airspace (United States Air Force [Air Force] 1997a). For the purpose of this Environmental Impact Statement (EIS), all chaff fibers are assumed to fall to the ground under the airspace and are assumed to be evenly distributed throughout the airspace. In actual practice, pilots tend to avoid flying near the boundaries of the airspace to avoid flying outside the SUA. This would reduce the use of flares and chaff within 1 to 2 miles of the airspace edge.

CHAFF

Modern chaff (such as RR-188) consists of bundles of extremely small strands of aluminum-coated silica fibers that are designed to reflect radio waves from a radar set. Modern chaff is made as small and light as possible so that it will remain in the air long enough to confuse enemy radar. Individual chaff fibers (known as "angel hair" chaff) are approximately the thickness of a very fine human hair and range in length from 0.3 inch to 1.0 inch (0.76 centimeters to 2.5 centimeters). The length of the chaff determines the frequency range of the radio wave most effectively reflected by that particular fiber. Chaff fibers are cut to varying lengths to make them effective against the wide range of enemy radar systems that may be encountered. Chaff used in the Shaw airspace is designed to not interfere with radars operated by the FAA for ATC throughout the NAS.

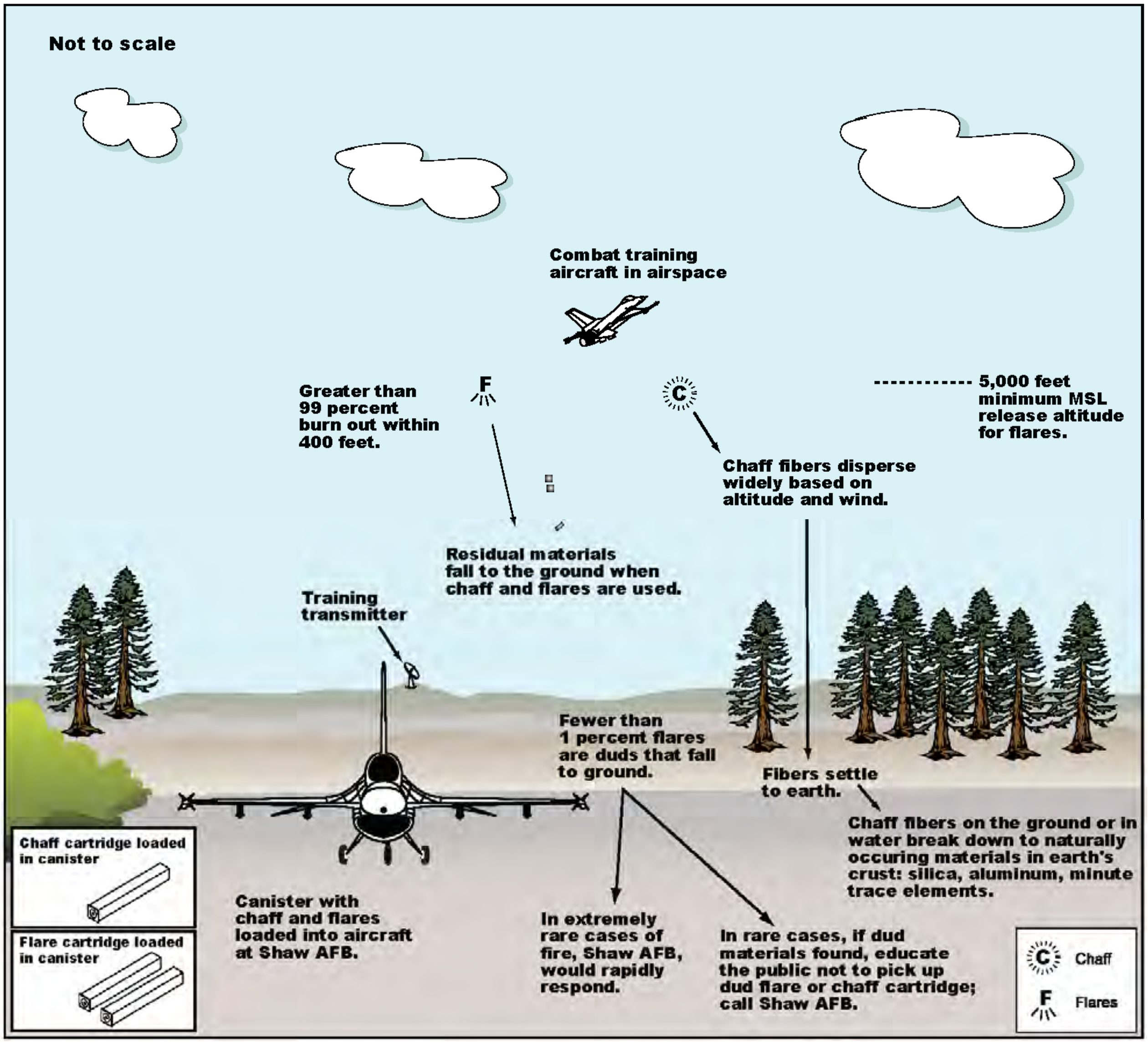


Figure 2-7. Shaw AFB Life Cycle of Training Defensive Chaff and Flares

Table 2-8. Annual Existing and Proposed Distribution of Chaff and Flares in the MOAs

MOA	*Chaff Bundles*[1]	*Chaff/Flare Ash Concentrations Per Acre Per Year*	*Flares M-206/ MJU-7 A/B*[1]	*Approximate Flare Distribution Per Year*
Bulldog	57,600	.13 ounces/3.85 grams	8,338/8,595	1 flare over 84 acres
Gamecock	62,400	.14 ounces/3.97 grams	6,254/6,446	1 flare over 120 acres

MOA = Military Operations Area
Sources: 1. Air Force 2003; personal communication, Byers 2005.

About 5 million chaff strands are dispensed in each bundle of chaff. When released from an aircraft, chaff initially forms an “electronic cloud” that disperses widely in the air. Dispersed chaff effectively reflects radar signals and forms an image on a radar screen. If the pilot quickly maneuvers the aircraft while momentarily obscured or masked from precise radar detection by the electronic cloud, the aircraft can avoid the threat. When multiple chaff bundles are ejected, each forms a similar cloud that further confuses radar-guided weapons. Chaff itself is not explosive; however, it is ejected from the aircraft pyrotechnically using a small explosive charge that is part of the ejection system. The chaff dispenser remains in the aircraft. Two plastic end caps that are ⅛-inch thick x 1-inch x 1-inch, and a felt spacer, are ejected with the chaff. On rare occasions, the chaff may not wholly separate and may fall to earth as a clump. The distribution of chaff and flares reflected in Table 2-8 relates to all bundles used. A concentration of chaff fibers could be higher if a chaff bundle failed to function. For more detailed information on chaff, please refer to Appendix B.

FLARES

Defensive flares are magnesium pellets that, when ignited, burn for a short period (3.5 to 5 seconds) at approximately 2,000 degrees Fahrenheit (°F). Because the burn temperature is hotter than the exhaust of an aircraft engine, the flare attracts and decoys heat-seeking weapons and sensors targeted on the aircraft. Pilots must regularly train with defensive flares under simulated threat conditions to ensure a near-instinctive reaction to deploy flares in extremely high stress conditions. Training with flares in the missions described in Table 2-1 is necessary to ensure survival by deploying defensive flares in actual combat. Two types of flares are proposed to be used for defensive training in the MOAs. They are the M-206 flare and the Multi Jettison Unit (MJU)-7 A/B flare.

The M-206 flare is a parasitic flare that is ignited in the aircraft and consumes nearly all the flare materials during deployment. M-206 residual materials that are not consumed and that fall to the ground consist of two 1-inch x 1-inch x 1/8-inch pieces of plastic, that serve as a retaining end cap and a plunger device, a 1-inch x 1-inch felt spacer, and an unburned aluminum coated wrapping material that could be from 1-inch x 1-inch up to 2-inches x 13-inches. The majority of the wrapping materials is consumed in the deployment process. The MJU-7 A/B flare ignites while being dispensed from the aircraft. After ignition, the MJU-7 A/B flare has several pieces of residual materials that fall to the ground. These materials are: a 1-inch x 2-inch x 1/8-inch end cap, a 1/2-inch x 1-inch x 2-inch hard plastic Safe and Initiation (S&I) device, a 1-inch x 2-inch x 1/2-inch piston, two 1-inch x 2-inch felt spacers, and an aluminum coated wrapping material that could be from 1-inch x 2-inches up to 3-inches x 13-inches. The majority of the used flare materials that fall have surface area to weight ratios that would not produce an impact when the flare material struck the ground. The one item that could fall with enough force to adversely affect an object on the ground is the MJU-7 A/B S&I device with a weight of 0.7 ounces (personal communication, Schirack 2005). The MJU-7 A/B S&I device would strike the earth with approximately the same force as a large hailstone.

During annual training, approximately 51 percent of the flares used in the Bulldog and Gamecock MOAs would be MJU-7 A/B flares and approximately 49 percent would be M-206 flares. On extremely rare occasions (approximately 0.01 percent of the flares dispensed), a flare may not ignite during ejection and would fall to the earth as a dud flare. For more detailed information on flares, refer to Appendix C.

The minimum altitudes for deploying flares during 20 FW and 169 FW training in Shaw AFB airspace exceed the 2,000 feet AGL established by the Air Force over nongovernment-owned or controlled lands (Air Force 2003). For the Gamecock and Bulldog MOAs, the minimum release altitude of 5,000 feet MSL is approximately 4,500 feet AGL (see Table 2-9). Because F-16 pilots from the 20 FW and 169 FW train throughout the airspace, flares may be released within these full range of altitudes above 5,000 feet MSL (Air Force 2003).

Table 2-9. Altitudes for Deploying Chaff and Flares in MOAs and ATCAAs

MOA/ATCAA	Aircraft Operational Altitudes (feet)		Minimum Altitudes for Chaff and Flares (feet)
	Floor	Ceiling	
Bulldog A/B and ATCAA[1]	500 feet AGL	27,000 feet MSL	5,000 feet MSL
Bulldog C/E[2]	500 feet AGL	10,000 feet MSL	5,000 feet MSL
Gamecock B[1]	10,000 feet MSL	18,000 feet MSL	10,000 feet MSL
Gamecock C[1]	100 feet AGL	9,999 feet MSL	5,000 feet MSL
Gamecock D and ATCAA[1]	10,000 feet MSL	22,000 feet MSL	10,000 feet MSL

Notes: 1. Existing airspace.
2. Proposed airspace.
MOA = Military Operations Area; ATCAA = Air Traffic Control Assigned Airspace; AGL = above ground level; MSL = mean sea level
Source: Air Force 2003.

2.2.3.1 Residual Materials

The chaff bundles, M-206 flares, and MJU-7 A/B flares respectively represent three, five, and six pieces of residual components that could fall to the ground under the airspace.

The existing condition is that defensive chaff and flares are used for training within the MOAs. Approximately 57,600 chaff bundles, 8,338 M-206 flares, and 8,595 MJU-7 A/B flares are released throughout the Bulldog A and B MOAs annually, yielding a total of 266,060 residual materials. Given a total acreage of 1,424,031 acres beneath the Bulldog MOA, on average, one residual component falls on every 5.35 acres annually. There would be no proposed change in the amount of chaff or flares deployed in training. Chaff and flares would be used for training within the proposed Bulldog C and E MOAs. Since chaff and flares are currently used in Bulldog B MOA, the ground distribution of chaff and flare residual components under the airspace would not be expected to substantially change from the existing condition.

Approximately 62,400 chaff bundles, 6,254 M-206 flares, and 6,446 MJU-7 A/B flares are released throughout the Gamecock MOAs annually. This total of 257,146 residual materials spread over a total acreage of 1,521,856 acres beneath the Gamecock MOAs, on average, results in one residual component falling on every 5.92 acres annually.

2.2.4 Military Training Route Utilization

No modifications are proposed to the MTRs depicted in Figures 2-8 and 2-9. Table 2-10 includes MTR utilization by representative aircraft type during FY 03. These MTRs continue to be used for conducting military flight training at airspeeds in excess of 250 knots between 100 feet AGL and 10,000 feet MSL depending upon the MTR. These MTRs pass through ATI airspace (current and proposed) as identified in Table 2-10. Although ATI does not involve changes in the use of MTRs, the aircraft using the MTRs are included in the evaluation of noise and cumulative effects in this EIS.

2.2.5 Airspace Mitigations

The Mitigated Proposed Action includes the following methods to support joint military and civilian use of the airspace. In accordance with requirements stipulated in FAA Order 7400.2F, the FAA requires that a 3-nautical mile (NM) circle extending to 1,500 feet AGL be designated for public airports under or adjacent to SUA. This circle would be mapped over each airport in the airspace and designated an exclusionary area to exclude military training aircraft (Figure 2-4).

> ***Public Question:*** *Why can't communities with airports be carved out of airspace proposal?*
>
> ***Answer:*** *Exclusionary areas would be designated by FAA around any public airports under or adjacent to the modified airspace. Specific exclusionary areas are currently designated around airports within or adjacent to the existing airspace. Each exclusionary area is a minimum of 1,500 feet high with a 3-NM radius.*

This exclusionary area is expanded to include access to Emanuel County Airport. The area under Bulldog B, north of Millen, used for Augusta approach would not be part of the Mitigated Proposed Action (Figure 2-4). The Air Force will work with FAA to schedule and use all MOAs in a manner that deconflicts military and civilian aircraft use.

2.2.6 Overall Summary of Mitigated Proposed Action

In summary, the Mitigated Proposed Action would expand the size, operational altitudes, and usefulness of the Shaw AFB-managed SUA through the following elements:

- Expand the Bulldog MOA Complex by creating Bulldog C and E MOAs as mitigations to the Draft EIS proposed expansion of the Bulldog A MOA. Bulldog C and E MOAs would have a floor of 500 feet AGL and a ceiling of 10,000 feet MSL to match the vertical altitudes of the existing Bulldog A MOA.
- Develop electronic training transmitter sites under Bulldog and Gamecock MOAs and along the coast of South Carolina.
- Include the use of M-206 and MJU-7 A/B flares and chaff above 5,000 feet MSL in the new and expanded airspace.
- Implement an array of management actions including scheduling and deconfliction measures to support accommodation of civil aviation.

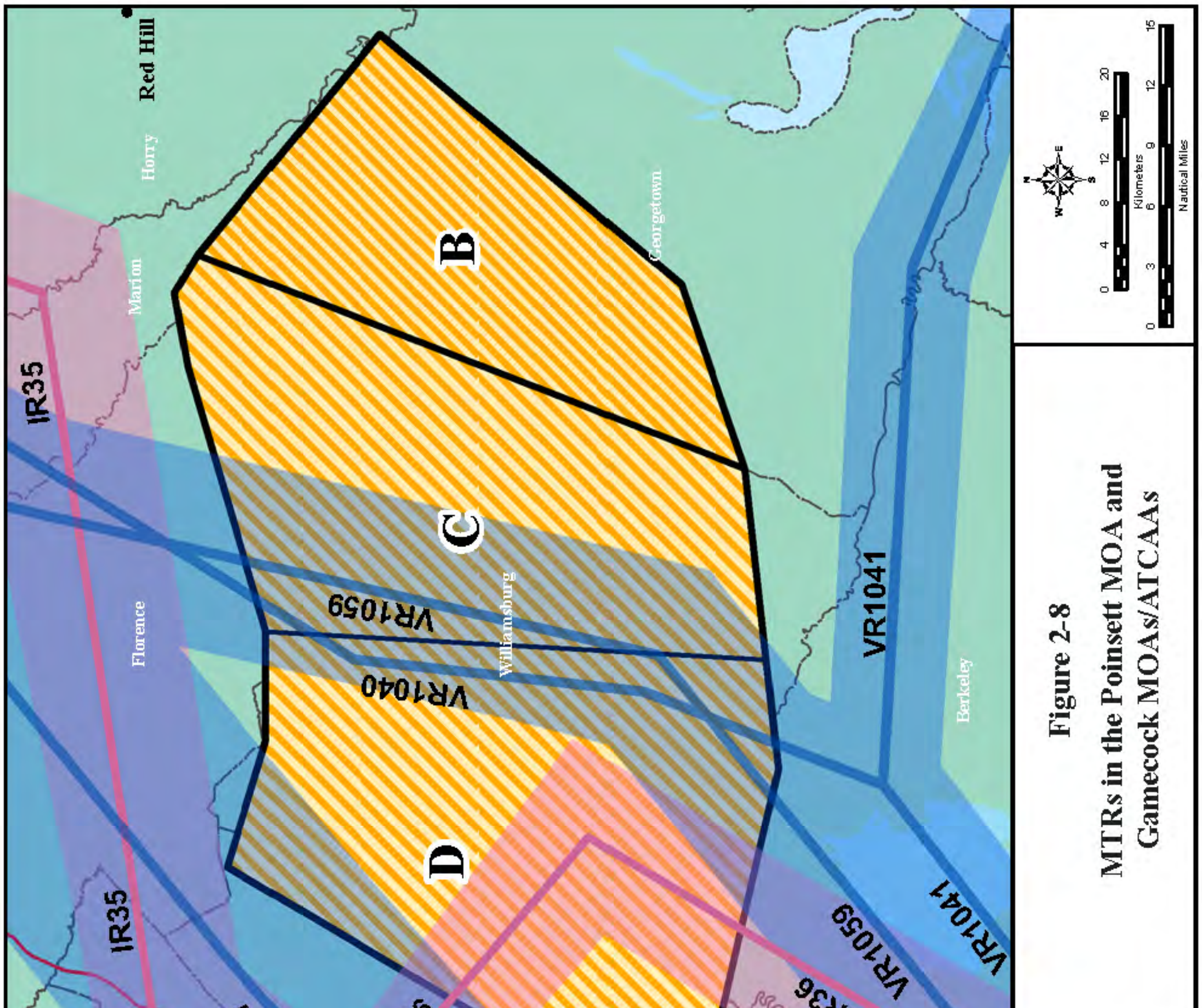


Figure 2-8
MTRs in the Poinsett MOA and Gamecock MOAs/ATCAAs

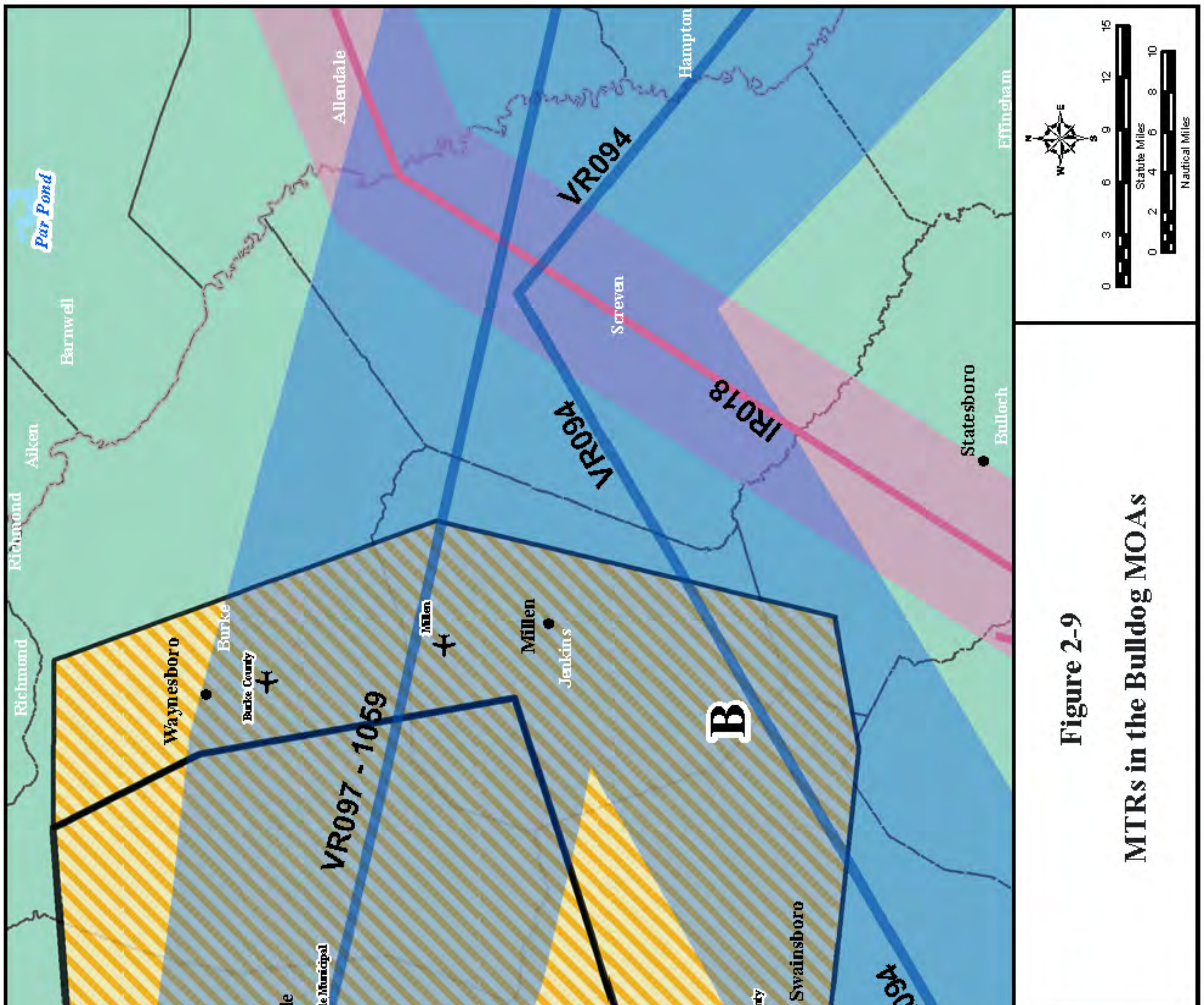


Figure 2-9
MTRs in the Bulldog MOAs

Table 2-10. MTR Utilization by Aircraft

Route	Maximum Feet		MOA[1]	Aircraft														
	Floor	*Ceiling*		*C-17*	*C-130*	*F-15*	*EA-6*	*AV-8*	*F-18*	*T-38*	*T-39*	*F-16*	*A-10*	*T-45*	*T-1*	*S-3*	*T-34*	*Total*
IR-035	300 AGL	4,000 MSL	G	339	1													**340**
IR-036	300 AGL	4,000 MSL	G	15	2										3			**20**
IR-074	100 AGL	7,000 AGL	B	1										1				**2**
VR-087	100 AGL	8,000 MSL	G			271		12	19			20	1	1				**324**
VR-088	100 AGL	8,000 MSL	G	5		128	3	8	90			51						**285**
VR-094	100 AGL	3,000 MSL	B		1	8			19									**28**
VR-097	100 AGL	8,000 MSL	G/B	1		21			26		9	89					1	**147**
VR-1059[2]	100 AGL	8,000 MSL	G/B	1		27		6	28	1	436	165	1	1	12	8		**686**
VR-1040	200 AGL	1,500 AGL	G	11			5	11	65			16						**108**
VR-1004	200 AGL	1,500 AGL	B						267		266							**533**

Notes: 1. G = Gamecock Military Operations Area (MOA), B = Bulldog MOA, G/B = Gamecock and Bulldog MOA.

2. On VR-1059, there are 2 F-18 and 1 C-17 operations at night. These are included in the total operations for the respective routes.

2.3 ALTERNATIVE A

Alternative A was designed to achieve improved training in several mission required areas. Alternative A included new airspace, airspace modifications, and procedures to support military and civilian aircraft use of the airspace. Alternative A consisted of the following elements:

- Create Gamecock E to form a bridge to allow maneuvering and training between the Gamecock MOA Complex and the Poinsett ECR. Gamecock E MOA would have a floor of 8,000 feet MSL and a ceiling of 22,000 feet MSL.
- Lower the floor of Gamecock D in areas that do not overlap with Gamecock C, from 10,000 feet MSL to 5,000 feet MSL.
- Combine Gamecock C and Gamecock D for concurrent use.
- Return Gamecock B to the NAS.
- Raise the ceiling of Poinsett from 2,500 feet MSL to 5,000 feet MSL.
- Expand the boundaries of Bulldog A to match those of Bulldog B.
- Develop electronic training transmitter sites under Bulldog A and Gamecock C/D and along the South Carolina coast.
- Include the use of defensive chaff and flares within new and expanded airspace above 5,000 feet MSL as described under the Mitigated Proposed Action.

In addition, Alternative A included a set of management actions to support joint military and civilian use of the airspace. The FAA requires that a 3-NM circle extending to 1,500 feet AGL be designated for public airports under or adjacent to the airspace. This circle would be mapped over each airport in the airspace and designated an exclusionary area to exclude military training aircraft. Other management actions include the following:

- Unless operational requirement exists, the Poinsett MOA and the Gamecock E MOA will not be scheduled simultaneously.
- Work with FAA to schedule and use all MOAs in a manner that deconflicts military and civilian aircraft use to the maximum extent practical.
- Return Gamecock B MOA to the NAS to expand general aviation airspace access and transect of coastal areas to the east of the Gamecock MOAs.

The elements of Alternative A applicable to the Poinsett and Gamecock MOAs are presented in Figure 2-10. Figure 2-11 depicts the changes to the Bulldog MOAs under Alternative A. Aircraft operations would be as described for Table 2-11. Chaff and flare usage would continue to be as described in Table 2-8.

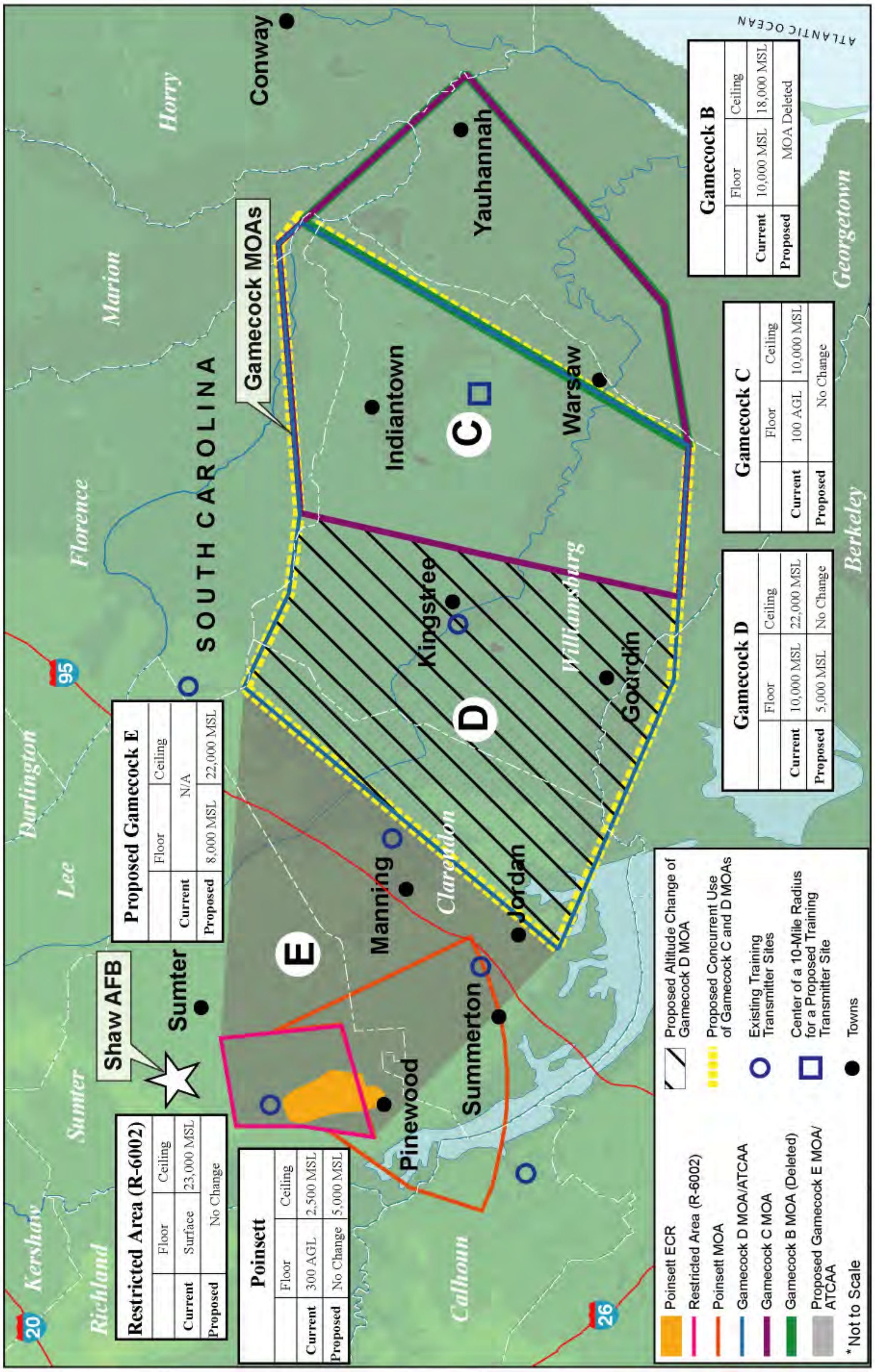
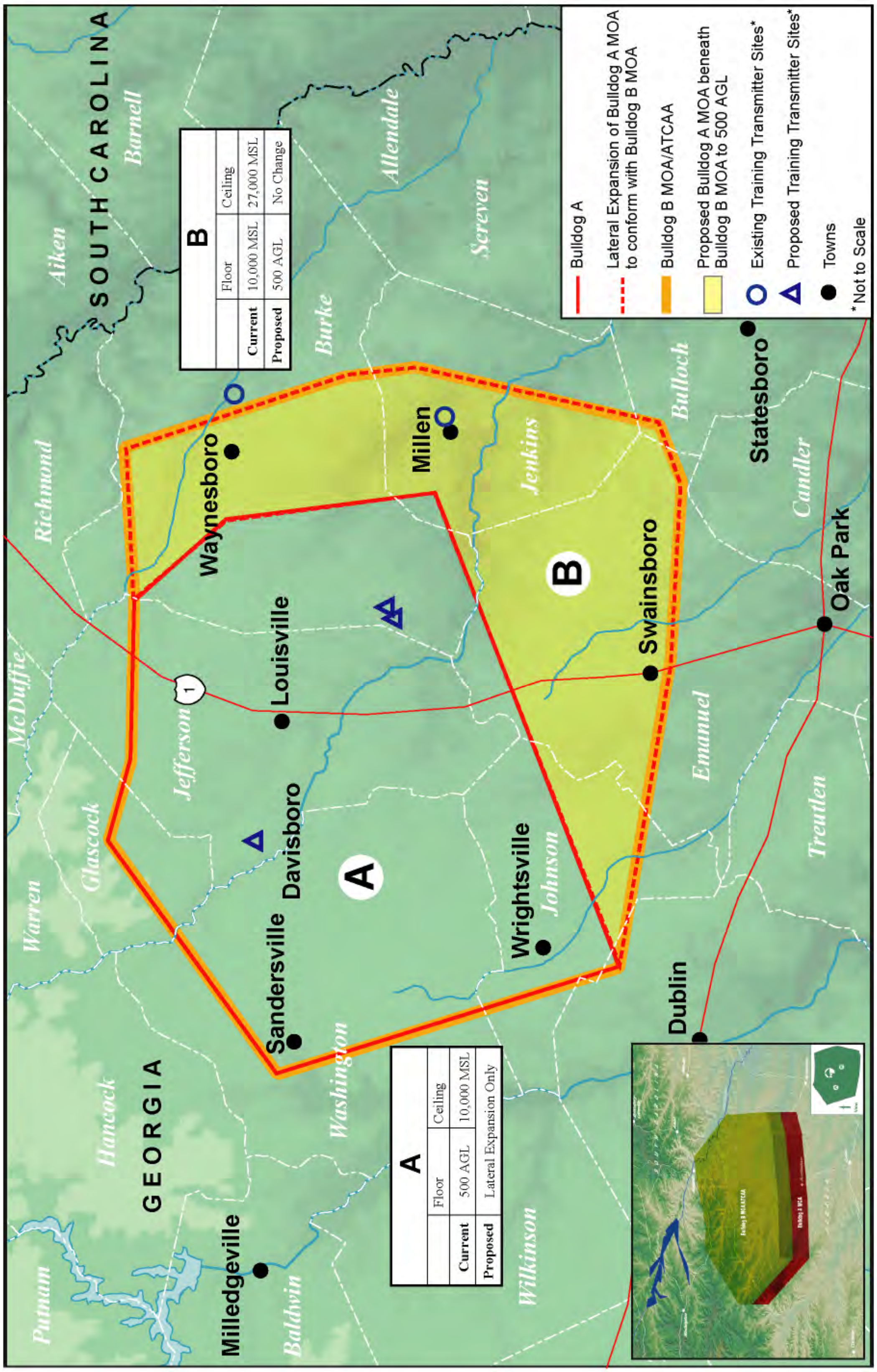


Figure 2-10

Alternative A - Poinsett MOA and Gamecock MOAs/ATCAAs



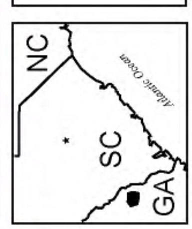


Figure 2-11

Alternative A - Bulldog MOAs

Table 2-11. Existing and Projected Annual Use of Alternative A Airspace

	Airspace Operations (Percent Time at Indicated Altitudes) Under Current (Cur.) and Proposed (Prop.) Conditions													
Altitude	**500-1,000**		**1,000-2,000**		**2,000-5,000**		**5,000-10,000**		**10,000-FL170**		**FL170-FL230**		**> FL230**	
Airspace	*Cur.*	*Prop.*	*Cur.*	*Prop.*	*Cur.*	*Prop.*	*Cur.*	*Prop*	*Cur.*	*Prop.*	*Cur.*	*Prop.*	*Cur.*	*Prop.*
Bulldog	5	5	5	5	5	5	10	10	60	60	10	10	5	5
Gamecock B	0	0	0	0	0	0	5	0	95	0	0	0	0	0
Gamecock C	10	10	10	10	40	40	40	40	0	0	0	0	0	0
Gamecock D/F[1]	0	0	0	0	0	10	0	50	85	25	15	15	0	0
Gamecock E	0	0	0	0	0	0	0	40	0	45	0	15	0	0
Poinsett	50	25	50	25	0	50	0	0	0	0	0	0	0	0
R-6002	8	8	8	8	8	8	24	24	32	32	20	20	0	0
Aircraft Hours														
Bulldog	148	148	148	148	148	148	296	296	1,776	1,776	296	296	148	148
Gamecock B	0	0	0	0	0	0	5	0	103	0	0	0	0	0
Gamecock C	267	178	267	178	1,068	711	1,068	711	0	0	0	0	0	0
Gamecock D/F[1]	0	0	0	0	0	178	0	891	2,273	445	401	267	0	0
Gamecock E	0	0	0	0	0	0	0	712	0	802	0	267	0	0
Poinsett	8	4	8	4	0	7	0	0	0	0	0	0	0	0
R-6002	134	134	134	134	134	134	401	401	535	535	335	335	0	0

Note: 1. Under current conditions, data pertain to Gamecock D only; under proposed conditions, Gamecock D/F are considered collectively.
FL = Flight Level
Source: Personal communication, Byers 2004.

2.4 ALTERNATIVE B

Alternative B addressed the need to expand the size, operational altitudes, and usefulness of Shaw AFB airspace through new and modified airspace, as follows:

- Establish a new "Gamecock E" MOA with two areas, a "Gamecock E Low MOA" (8,000 to 13,999 feet MSL) and a "Gamecock E High MOA/ATCAA" (14,000 to 22,000 feet MSL), linking Gamecock D MOA/ATCAA with R-6002. This would allow the use of one MOA (either high or low), when the other MOA is unavailable.
- Lower the floor of Gamecock D MOA from 10,000 to 8,000 feet MSL in areas where it does not overlap Gamecock C MOA.
- Combine and use Gamecock C and Gamecock D MOAs concurrently and simultaneously.
- Continue use of Gamecock B.
- Raise the ceiling on Poinsett MOA from 2,500 to 5,000 feet MSL.
- Lower the floor of Bulldog B from 10,000 to 3,000 feet MSL. Lower the ceiling of Bulldog A from 10,000 to 2,999 feet MSL. Do not modify the boundary of Bulldog A MOA to match that of Bulldog B.
- Develop electronic training transmitter sites under Bulldog A and Gamecock C MOAs.
- Include the use of chaff and flares within the new and expanded airspace above 5,000 feet MSL.

Figure 2-12 depicts the Alternative B Gamecock MOA changes and Figure 2-13 depicts the Alternative B Bulldog MOA changes.

Aircraft operations data under Alternative B are essentially the same as provided in Table 2-6 and Table 2-7. Alternative B would include the use of chaff and flares in new and modified airspace. Chaff and flare usage under this alternative would be approximately 1 percent less than that provided in Table 2-8 due to the continued use of Gamecock B for OREs and ORIs.

Alternative B deconfliction methods to support joint military and civilian use of the airspace are as follows:

- Designate a 3-NM circle extending to 1,500 feet AGL for airports under or adjacent to the airspace. This "bubble" over each airport would be designated an exclusionary area to exclude military training aircraft.
- Schedule use of the airspace in two-hour blocks to support civilian aircraft flights through the airspace.
- Do not schedule the Poinsett MOA and the Gamecock E MOA simultaneously to provide for civilian traffic in this airspace corridor.

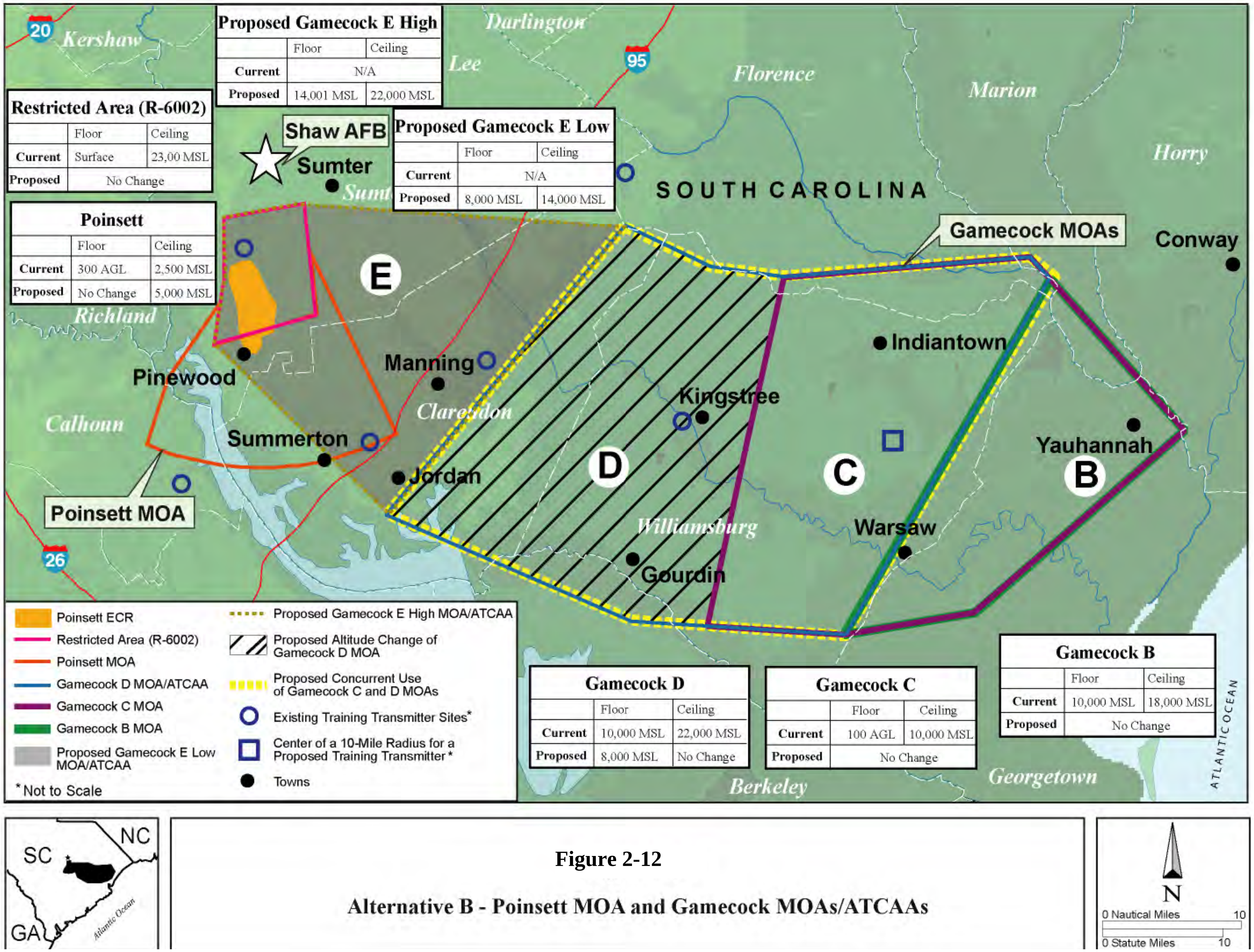


Figure 2-12

Alternative B - Poinsett MOA and Gamecock MOAs/ATCAAs

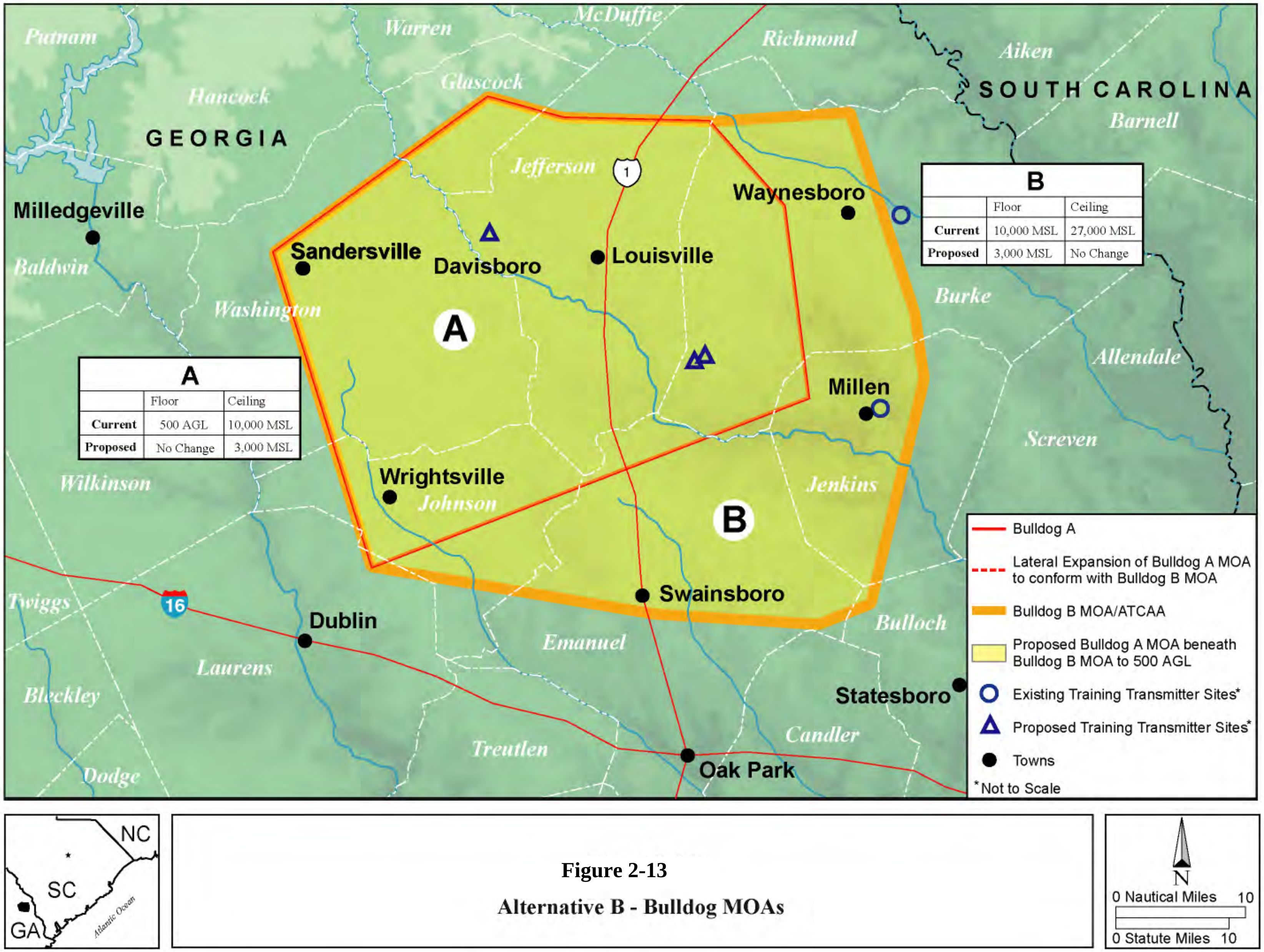


Figure 2-13
Alternative B - Bulldog MOAs

2.5 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, no airspace modifications would be undertaken with respect to Gamecock, Poinsett, or Bulldog MOAs. Likewise, no change in ATCAA airspace associated with these MOAs would be undertaken. No additional training transmitter sites would be identified in the areas underlying the airspace or along the South Carolina coast.

Figure 2-1 presents the existing and No-Action condition for the Gamecock MOAs/ATCAA and Poinsett MOA. Figure 2-2 presents the existing and No-Action conditions for the Bulldog MOAs. Under No-Action, the 20 FW and 169 FW would continue to train to the extent possible within the airspace including the use of defensive chaff and flares (Table 2-8). The 20 FW and 169 FW would continue to be obligated to send F-16 aircraft, pilots, and maintenance personnel off station to bases that have suitable airspace for realistic stand-off distance for simulated munitions delivery and for prosecution of missions, including SEAD, DEAD, from MOA airspace into a range. Under the No-Action Alternative, most 20 FW squadrons would have few opportunities to go off station to realistically train with the full prosecution of SEAD and DEAD missions. Aircrews would potentially be deployed overseas into combat without the benefit of being proficient in maneuvers needed in combat conditions.

2.6 SUMMARY OF PROPOSED ACTION AND ALTERNATIVES

Table 2-12 provides a summary of the airspace, transmitters, and chaff and flare usage associated with the Draft EIS Proposed Action, the Mitigated Proposed Action, and alternatives.

2.7 CRITERIA FOR DEVELOPING AND SCREENING ALTERNATIVES IN COORDINATION WITH THE FAA

The Air Force identified operational criteria and other considerations for use in identifying alternatives that met the purpose and need. Operational criteria and other considerations are presented in Section 2.7.1. Section 2.7.2 discusses the application of these criteria and considerations to formulate action alternatives in response to the ATI purpose and need. Training transmitter operational requirements and siting criteria are presented in Section 2.7.3.

> ***Public Question:*** *Isn't there other airspace that can meet Shaw AFB needs?*
>
> ***Answer:*** *Shaw AFB reviewed all available airspace for resolution of training requirements. Other airspace has distance, availability, or configuration constraints that would not permit Shaw AFB pilots to efficiently train for mission tasking. Shaw AFB currently uses offshore warning areas for supersonic training and Gamecock, Poinsett, and Bulldog airspaces to train for combat missions over land.*

Table 2-12. Summary of Mitigated Proposed Action, Draft EIS Proposed Action, and Alternatives (Page 1 of 2)

	Component	*Draft EIS Proposed Action*	*Mitigated Proposed Action*	*Alternative A*	*Alternative B*	*No-Action Alternative*
Gamecock MOAs	Create new Gamecock E MOA from 8,000 feet MSL to 22,000 feet MSL	YES	NO	YES	YES Gamecock E Low from 8,000 to 13,999 feet MSL; Gamecock E High from 14,000 to 22,000 feet MSL	NO
	Create new Gamecock F MOA underneath Gamecock D in areas that do not overlap with C, from 10,000 feet MSL[1]	Gamecock F to 5,000 feet MSL	NO	Instead, expand Gamecock D MOA to 5,000 feet MSL	Instead, expand Gamecock D MOA to 8,000 feet MSL	NO
	Combine use of Gamecock C and D	YES	Use independently	YES	YES	Use independently
	Return Gamecock B to NAS	YES	NO	YES	NO	NO
Poinsett MOA	Poinsett: Raise ceiling from 2,500 feet MSL to 5,000 feet MSL	YES	Ceiling remains at 2,500 feet MSL	YES	YES	Ceiling remains at 2,500 feet MSL

Table 2-12. Summary of Mitigated Proposed Action, Draft EIS Proposed Action, and Alternatives (Page 2 of 2)

	Component	*Draft EIS Proposed Action*	*Mitigated Proposed Action*	*Alternative A*	*Alternative B*	*No-Action Alternative*
Bulldog MOAs	Bulldog A: Expand Boundary to match up with Bulldog B	YES	NO	YES	Instead, lower floor of Bulldog B to 3,000 feet MSL	Continue with Bulldog B ledge
	Create mitigated Bulldog C MOA underneath Bulldog B and contiguous with Bulldog A from 500 feet AGL to 10,000 feet MSL	NO	YES	NO	NO	NO
	Create mitigated Bulldog E MOA underneath Bulldog B and contiguous with Bulldog A from 500 feet AGL to 10,000 feet MSL	NO	YES	NO	NO	NO
New Training Transmitters	Place Under Bulldog A, and Gamecock C/D	YES	YES	YES	YES	Continue use of available sites
	Place along Coast	YES	YES	YES	NO	NO
Chaff and Flares	Include use within new and expanded airspace above 5,000 feet MSL	YES	YES	YES	YES	Continue use in Bulldog A and B MOAs

Note: 1. MSL - Mean Sea Level; 10,000 MSL is 10,000 feet above MSL
MOA = Military Operations Area; NAS = National Airspace System; AGL = above ground level

2.7.1 Criteria and Considerations

Five airspace characteristics were identified as operational criteria to meet ATI's purpose and need. These operational criteria are listed below and described in Section 2.7.1.1.

- **Existing Airspace:** Make maximum use of existing designated military airspace.
- **Distance:** Be located at a distance such that sufficient time would be provided within the airspace to meet training objectives without refueling.
- **Proximity to Military Training Range:** Be located adjacent to or near an existing military training range for full mission training.
- **Availability:** Provide sufficient availability to meet training requirements in a timely and routine manner.
- **Configurable Airspace:** Provide airspace with a configuration and volume sufficient to meet training needs.

Public Question: *How did the Air Force identify alternatives?*

Answer: *The Air Force used five operational criteria and two other considerations to evaluate candidate alternatives and to define the Proposed Action and alternatives.*

The Air Force also addressed two additional non-operational considerations for the airspace. These considerations are listed below and described in Section 2.7.1.2.

- **Population:** Avoid population centers to the extent possible.
- **Civilian Air Traffic:** Minimize conflict with concentrations of civilian air traffic to the extent possible.

These criteria and considerations are discussed in detail below.

2.7.1.1 OPERATIONAL CRITERIA

Airspace identified for aircrew training must meet certain operational requirements. These requirements are as follows:

EXISTING AIRSPACE

Airspace is a valuable national resource. Whenever possible, the Air Force seeks to meet the ATI purpose and need through maximum use of existing military airspace and minimum change to non-military airspace. The Air Force considered military training airspace addressed in Table 2-12 as a potential basis for developing an action proposal and alternatives.

DISTANCE

The F-16 aircraft has a specific fuel capacity. Training airspace needs to be located such that an F-16 can launch from the base, perform multiple training missions, and return to the base with adequate fuel reserves without refueling. The result is that effective and efficient F-16 training requires airspace within approximately 100 NM of the base. Airspace that is located at a greater distance requires pilots to expend excessive amounts of fuel and flight time in transit rather than in combat training. Training airspace should be located within 100 NM from Shaw AFB to provide sufficient time within the airspace for F-16 pilot training needs.

MILITARY TRAINING RANGE

The training syllabus for F-16 aircrew of the 20 FW and 169 FW includes practice in the tactics of munitions delivery as described in Table 2-1. These tactics include stand-off simulated launch, simulated threat suppression, and delivery of approved munitions. Training in munitions delivery can only be accomplished at an approved range. Such ranges are accompanied by overlying restricted airspace within which pilots maneuver to deliver munitions at selected targets. Modern airspace and ranges make use of electronic threat emitters to simulate ground based radar and anti-aircraft units. Adequate training in threat avoidance and full execution of missions require MOA airspace contiguous with the restricted airspace above a range. This allows pilots to combine the use of MOA and restricted airspace to practice the skills required for success in combat.

AVAILABILITY

Airspace mangers at military installations manage specific training airspace. There is considerable demand for the use of any training airspace, both by users at the controlling base, and by users at other installations. Airspace managers give first priority for access to pilots from the controlling installation on an "as required" basis. Access by other aircrews is allowed on an "as available" basis. Effective training requires that airspace be routinely available on an as required basis. Airspace to be used as a basis of defining an ATI alternative should be available on an as required basis.

CONFIGURABLE AIRSPACE

Combat training airspace needs to be sufficiently sized and configured to allow pilots to practice current tactics and make full use of F-16 capabilities (described in Section 2.1). This requires both a horizontal and vertical extent that allows for representative engagement distances with hostile threats, employment of chaff and flares, and simulated electronic combat. Adequacy of a given airspace volume depends on the configuration of the airspace. Airspace at a distance in excess of the distance criterion was reviewed to see whether any candidate alternatives with adequate volume could be used. Air Force personnel reviewed the volume and configuration of military training airspace within approximately 200 NM of Shaw AFB and McEntire ANGS to determine whether any of the airspace within or even outside the distance criteria could be modified to meet the size and configuration requirements for 20 FW and 169 FW training.

2.7.1.2 OTHER CONSIDERATIONS

Two other considerations were addressed for ATI alternatives. These considerations are not requirements that must be met. Rather, they represent preferences that the Air Force feels are important factors in identifying airspace used as the basis for ATI alternatives.

POPULATION CONCENTRATIONS

It is highly desirable that military training airspace overlie areas of relatively low population density. While it is not always possible to completely avoid inhabited areas, wherever practical the Air Force attempts to configure airspace in such a way as to minimize exposure of underlying populations to military aircraft activity. Areas with lower population densities are preferred over areas with higher population densities. Avoidance areas are established within the underlying area to minimize overflight of sensitive receptors including population concentrations.

CIVILIAN AIR TRAFFIC

Commercial and general aviation, as well as the military, present competing demands on regional airspace. The volume of commercial and general aviation traffic in flight tracks potentially affected by adjusting military training airspace was quantified and the potential for deconfliction was considered in the review of potential alternatives. Wherever possible, the Air Force has sought to develop an action or alternatives to minimize disruption to commercial and general aviation.

2.7.2 Application of Criteria and Considerations

Identification and analysis of alternatives is a core element of the environmental process under the National Environmental Policy Act (NEPA) and 32 Code of Federal Regulations (CFR) 989. For this proposal, the Air Force worked with the FAA, the states of South Carolina and Georgia, and the public to help identify alternatives.

Table 2-13 presents airspace reviewed and compared with operational requirements and other considerations to determine which airspaces could be carried forward as a basis for alternatives to meet the purpose and need of ATI.

A total of 13 airspace blocks were evaluated in terms of the operational criteria and other considerations. All 13 existing airspace blocks were considered in screening to determine whether an existing airspace just outside the distance criterion could meet all other criteria. All of these existing airspace blocks are in areas of relatively low population concentrations. Six blocks were found to lie within the required 100-NM distance of Shaw AFB and McEntire ANGS: Fort Bragg North MOAs, Fort Bragg South MOAs, Beaufort MOAs, Gamecock MOAs, Bulldog A and B MOAs, and Poinsett MOA. Of these airspace blocks, only Gamecock, Bulldog, and Poinsett MOAs could be scheduled on an as required basis.

Table 2-13. Application of Operational Criteria and Considerations

Existing MOAs	*Approximate Distance (NM one way)*	OPERATIONAL CRITERIA: *Distance (Maximize Training Time)*	*Near Existing Military Training Range*	*Available As Required*	*Configurable Airspace*	OTHER CONSIDERATIONS: *Relatively Low Population Density*	*Potential Civilian Air Traffic*
Snowbird	180	NO	YES	NO	NO	YES	YES
Hatteras MOA	180	NO	YES	NO	NO	YES	YES
Quickthrust E, F, G, H, I, J, L, M, N	140	NO	YES	NO	NO	YES	YES
Gator 1, 2	140	NO	YES	NO	NO	YES	YES
Seymour Johnson Echo	140	NO	YES	NO	NO	YES	YES
Fort Stewart B1, B2, C1, C2	130	NO	NO	NO	NO	YES	YES
Bulldog D	120	NO	NO	YES	NO	YES	NO
Fort Bragg North Area A, B	100	YES	NO	NO	NO	YES	YES
Fort Bragg South Area A, B	90	YES	NO	NO	NO	YES	YES
Beaufort 1, 2, 3	70	YES	YES	NO	NO	YES	YES
Gamecock A, B, C, D, I	40	YES	YES	YES	YES	YES	SOME
Bulldog A, B	90	YES	NO	YES	YES	YES	SOME
Poinsett	10	YES	YES	YES	YES	YES	SOME

MOA = Military Operations Area; NM = nautical mile

Civilian air traffic in the Gamecock, Bulldog, and Poinsett areas was evaluated as being relatively low, although modifications to these airspaces could result in some disruption to civilian air traffic.

Of the airspace that met all of the foregoing criteria and considerations, only Poinsett MOA lay immediately adjacent to airspace overlying a combat training range. Gamecock MOA lies relatively close to the same training range (Poinsett Electronic Combat Range). Modifications to the airspace structure of the Poinsett and Gamecock MOAs would have provided the best opportunity for meeting the purpose and need of ATI. Bulldog MOAs meet all selection criteria except for adjacency to a training range. While the absence of a training range limits the use of Bulldog A and B for meeting all aspects of the purpose and need, the fact that the airspace meets the other criteria makes it a location suitable for most training activities. Modification to the Bulldog MOAs, in combination with changes to the Gamecock MOAs, would have substantially improved air combat training under the purpose and need.

2.7.2.1 TRAINING TRANSMITTER OPERATIONAL REQUIREMENTS AND SITING CRITERIA

The identification of new transmitter sites utilizes a set of criteria independent of those used to identify appropriate airspace. These criteria are as follows:

- *Under or near airspace*. The transmitter is designed to realistically simulate a battlefield environment and successfully accomplish mission training, especially for the SEAD and DEAD missions. Locations for transmitter sites should be approximately 15 to 20 miles apart where possible and either under or within approximately 40 NM from the MOAs to create varied training threats that simulate combat conditions.
- *Distance from roads (access/power)*. Siting near existing roads and power lines reduces cost and disturbance to environmental resources.
- *Existing cleared area*. An existing cleared area, of approximately 15 acres, improves the range of the transmitter while reducing the extent of clearing or other disruption to the existing environment.
- *Distance from environmentally sensitive areas*. Avoidance of environmental sensitive areas such as wetlands, wildlife refuges, or other natural areas reduces the potential effects on sensitive resources.
- *Elevated terrain*. An area on a slight rise having an unobstructed view permits the transmitter to have a greater line of sight into the training airspace, thereby improving its effectiveness as a training aid.

These selection criteria have been applied to select existing and potential sites and would be applied to areas within South Carolina and Georgia to identify additional potential locations for developing training transmitter sites.

2.7.2.2 APPLICATION OF SITING CRITERIA TO TRAINING TRANSMITTER SITES

The training transmitter alternative sites are proposed to be located in areas that are on disturbed ground with access and power and that avoid, to the extent possible, low-lying areas, such as wetlands. As potential sites are identified that meet the distance, location, and siting criteria, they will be evaluated for potential environmental consequences in comparison with the environmental aspects identified in this EIS. Should there be a change in the size of a site, the general location identified in this EIS, the topographic requirements, or in regulations governing such sitings, a subsequent Environmental Impact Analysis Process (EIAP) will address those changes.

2.8 ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

Throughout the alternative identification and screening process, as well as during public scoping, other candidate alternatives were considered to support the ATI purpose and need (as described in Sections 1.3 and 1.4). In accordance with AFI 13-201, Shaw AFB sought to modify existing SUA rather than create any separate new SUA to meet training requirements specified in Chapter 1.0. The Air Force and the FAA considered two additional candidate alternatives to meet training requirements for F-16 aircrews at Shaw AFB and McEntire ANGS. These candidate alternatives were not carried forward as operationally viable alternatives in this EIS. These candidate alternatives were as follows:

- **Establish a smaller corridor, or stationary altitude reservation (ALTRV), to link Gamecock D MOA with Poinsett ECR (R-6002).** A corridor would be 10 NM wide with the northern boundary of the ALTRV corridor connecting the northwestern corner of Gamecock D MOA with the northeastern corner of R-6002. A corridor would allow some limited airspace for transitioning in a tactical manner from the Gamecock MOAs to the Poinsett ECR, but would not offer the maneuvering airspace required for realistic SEAD/DEAD or strike package training. This alternative was examined but not carried forward for analysis as part of this EIS because it did not provide airspace that met the specific training requirements.
- **Allow the full use of the Gamecock D MOA as published (i.e., 10,000 feet MSL – Flight Level [FL] 180), while preserving the FL220 ATCAA.** This alternative would improve existing airspace and the training capability for pilots who are currently restricted procedurally to a 12,000 foot MSL floor in Gamecock D. This alternative was not carried forward because the maneuvering airspace would continue to be constrained and no simulated diving deliveries or target acquisition passes could be made. This alternative would preclude effective DEAD tactics training in this area. Because this alternative would not optimize existing training airspace and would not focus on the need for specific training requirements, it was not carried forward for further analysis.

2.9 ENVIRONMENTAL IMPACT ANALYSIS PROCESS

This ATI EIS has been prepared in accordance with NEPA (42 United States Code [USC] 4321-4347), Council on Environmental Quality (CEQ) Regulations (40 CFR § 1500-1508), and 32 CFR 989, *et seq*., *Environmental Impact Analysis Process* (AFI 32-7061). NEPA is the basic national requirement for identifying environmental consequences of federal decisions. NEPA ensures that environmental information is available to the public, agencies, and the decision-maker before decisions are made and before actions are taken.

The environmental analysis process includes public and agency review of all information pertinent to the Proposed Action and alternatives, and provides a full and fair discussion of potential consequences to the natural and human environment. After release of the Draft EIS, a series of public hearings were conducted to involve the public and agencies, to identify possible consequences of an action, and to focus analysis on environmental resources potentially affected by the Proposed Action or alternatives.

Reasonable alternatives to the Proposed Action as well as the No-Action Alternative were evaluated in the Draft EIS. Public and agency input from public hearings, written communications, and agency consultations have been incorporated into this Final EIS. In this Final EIS, the Proposed Action from the Draft EIS has been mitigated in response to public and agency comments and in coordination with the FAA. The Air Force analyzed alternatives to ensure that fully informed decisions are made after review of the comprehensive, multidisciplinary analysis of potential environmental consequences. Compliance with NEPA guidance for preparation of an EIS involves several critical steps summarized below and depicted in Figure 2-14. This EIS process described below is also intended to satisfy the NEPA requirements for the FAA. FAA's federal actions are dependent upon the SUA proposal. Figure 2-15 depicts the FAA non-regulatory SUA standard process.

1. *Announce that an environmental analysis will be conducted.* Announcements were published in local newspapers September 16-22, 2004 and, following community outreach/scoping meetings, a Notice of Intent for this EIS was published in the *Federal Register* on December 3, 2004.

2. *Conduct community outreach/scoping meetings.* This step identifies the relevant issues to be analyzed in depth and eliminates issues that are not relevant. Scoping for this environmental analysis ran from August 26, 2004 through January 5, 2005. Throughout the 4-month period, the Air Force actively solicited comments through press releases, newspaper ads, public service announcements, flyers, letters, and postcards to the public, local governments, federal and state agencies, tribes, airports, and pilot associations. These entities were solicited to ensure that their concerns and comments about the proposal were included in the analyses. In August 2004, the Air Force initiated the Interagency and Intergovernmental Coordination for Environmental Planning (IICEP) and submitted letters to airports, local, state, tribal and federal agencies informing them of the Air Force's intent to prepare this EIS. Sample IICEP letters and a list of IICEP recipients are contained in Appendix A. Community outreach/scoping meetings were held in Manning, Kingstree, and Georgetown, South Carolina, and Millen, Georgia, to present details about the proposal, to explain the NEPA process, and to provide opportunities for public and agency involvement (refer to Section 2.9.2.1). Approximately 35 members of the public and agency representatives attended the meetings. In addition to receiving verbal and written comments at the scoping meetings, the Air Force also received written comments from the public and agencies through the mail. To the extent possible, these scoping comments have been used to shape the alternatives and analysis and focus the potential environmental issues addressed in this Draft EIS (see Section 2.9.2.1). Comments on the Proposed Action and alternatives will continue to be accepted throughout the environmental process.

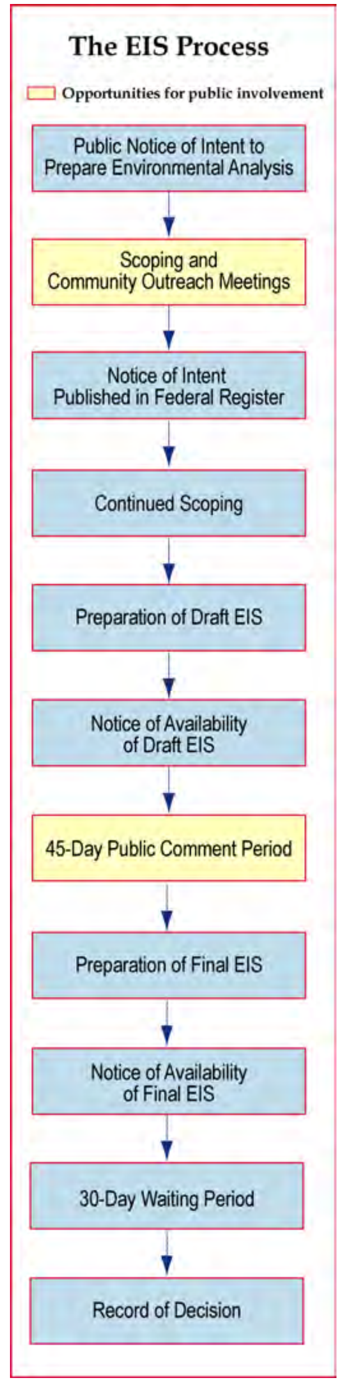


Figure 2-14. EIS Process

3. *Prepare a Draft EIS.* The Draft EIS was a comprehensive document for public and agency review. The Draft EIS described the ATI purpose and need, explained the Proposed Action and alternatives, presented the existing conditions in the region potentially affected, and provided analysis of the potential environmental consequences of the Proposed Action and each alternative, including the No-Action Alternative. The Draft EIS was distributed to agencies and members of the public who requested copies. To ensure the widest dissemination possible, copies were also distributed to regional libraries in the potentially affected area. The 45-day public comment period began when the Notice of Availability (NOA) for the Draft EIS was filed in the *Federal Register*.

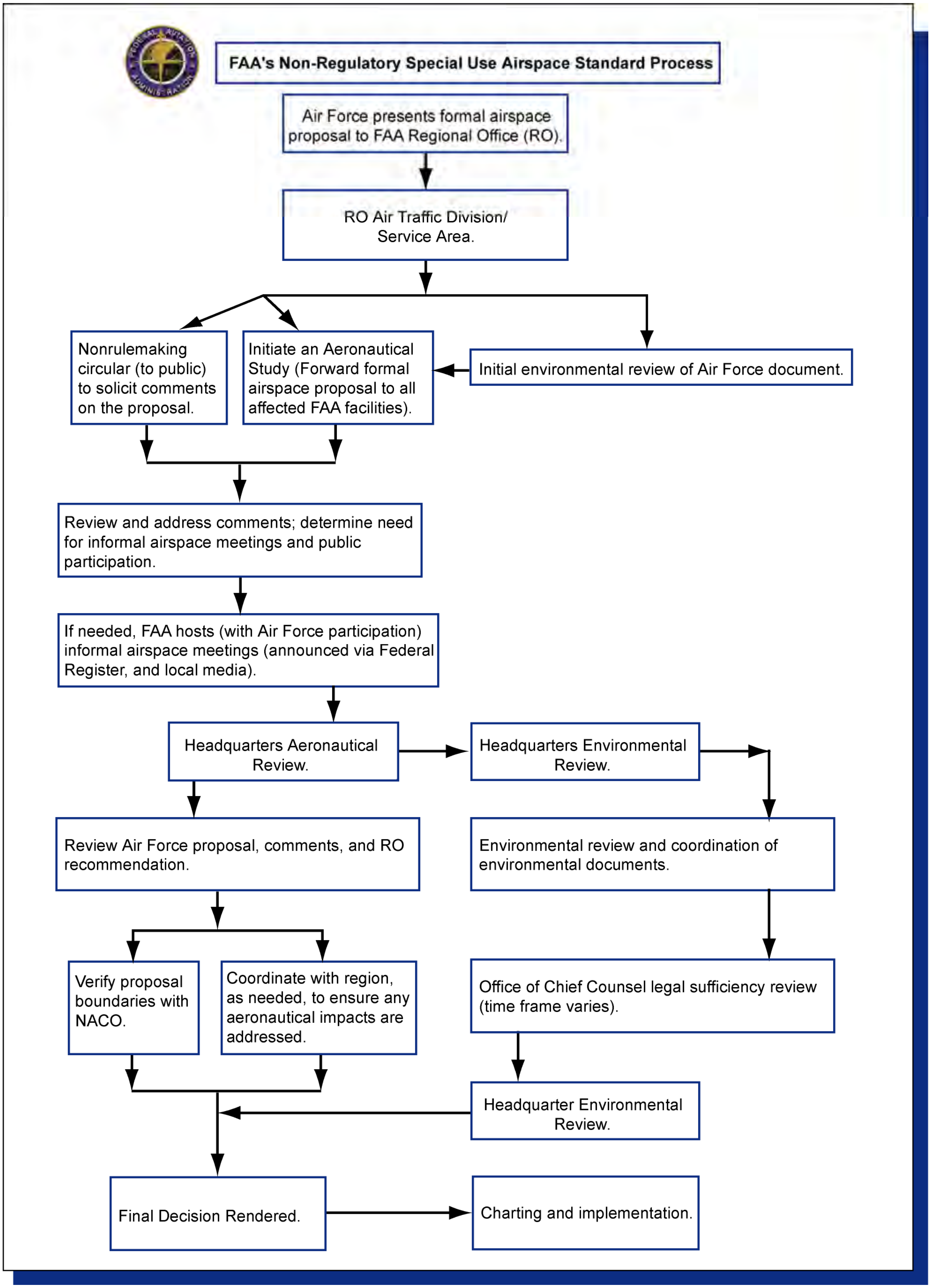


Figure 2-15. FAA's Non-Regulatory Special Use Airspace Standard Process

4. *Public/Agency Review.* The 45-day public comment period provided the public and agencies the opportunity to review the Draft EIS and to provide comments on the analysis. This comment opportunity included a series of public hearings held between October 3 and October 7, 2005. The hearings gave the public and agencies an opportunity to verbally comment on the Draft EIS after their review and evaluation of the document. The hearings provided direct feedback to the Air Force from the public and agencies. Comments received during the public comment period were incorporated into the Final EIS. Written comments submitted at public hearings and those received through the mail by the Air Force were given equal consideration in the preparation of the Final EIS.

> ***Public Question:*** *What was the notification of public hearings to receive public comments on the ATI Draft EIS?*
>
> ***Answer:*** *Publication of the Notice of Availability in the Federal Register, newspaper display ads, posted flyers, press releases, public service announcements, and letters to agencies and state clearinghouses identified public hearing times and locations. These media and mailing lists were also used to notify the public and agencies about the Draft EIS availability.*

5. *Prepare a Final EIS.* This Final EIS has been prepared following the public comment period and addresses comments within the scope of the EIS submitted during the public comment period or presented at public hearings. All public hearing testimony and written comments received are included in the Final EIS. The Final EIS is a revision of the Draft EIS to reflect public and agency comments, the Air Force's responses, and additional information received from reviewers. The Final EIS provides the decisionmaker with a comprehensive review of the potential environmental consequences of selecting the Proposed Action or an alternative. The NOA is published in the Federal Register to announce availability of the Final EIS.

6. *Issue a Record of Decision.* The final step in the NEPA process is approval of the Record of Decision (ROD). The NOA begins a 30-day waiting period before the ROD is signed. The ROD identifies which action has been selected by the Air Force decision-maker and what management actions or other measures would be carried out to reduce, where possible, adverse impacts to the environment.

2.9.1 Scope of Resource Analysis

The Draft EIS Proposed Action, the Final EIS Mitigated Proposed Action, and action alternatives have the potential for effects to certain environmental resources. Specific environmental resources with the potential for environmental consequences include airspace management and air traffic control (including airport traffic), noise, safety, air quality, physical resources (including visual), biological resources, cultural resources, land use, socioeconomics, and environmental justice. Potentially affected environmental resources on lands underlying the Poinsett, Gamecock, and Bulldog MOAs have been analyzed.

As noted on Table 2-12, the Mitigated Proposed Action excludes all proposed changes to the SUA associated with the Gamecock or Poinsett MOAs in South Carolina. The baseline conditions for the areas affected by proposed changes to those areas were generally not updated between the Draft EIS and Final EIS because no environmental consequences would be anticipated. Because the Mitigated Proposed Action still includes additional training transmitter sites beneath the Gamecock C MOA and along the coast of South Carolina, updates to resources and references, such as airspace management including air traffic, and socioeconomics have been included. The Air Force has validated and/or updated baseline conditions and reference material used for areas affected by the Mitigated Proposed Action or alternatives to ensure the potential environmental consequences identified for those areas are based on the most recent data available.

Development of training transmitter sites would include ground-disturbing activities and construction labor requirements. These activities could potentially affect biological, cultural, land use, air quality, safety, or socioeconomic resources. The South Carolina and Georgia State Historic Preservation Offices (SHPOs) were contacted regarding cultural resources as training transmitter siting alternatives.

Chapter 3.0 presents the affected environment followed by an analysis of environmental consequences for environmental resources in potentially affected areas underlying Gamecock, Bulldog, Poinsett MOAs, and the coastal areas where training transmitters could be established. Section 2.10 provides a summary comparison of environmental consequences.

2.9.2 Public and Agency Involvement

CEQ regulations (40 CFR § 1501.7 and 1503.1) and Air Force NEPA regulations (32 CFR 989) require an early and open process for identifying significant issues related to a proposed action and obtaining input from the public prior to making a decision that could significantly affect the environment. These regulations specify public involvement at various junctures in the development of an EIS, including public scoping prior to the preparation of a Draft EIS and public review of the Draft EIS prior to preparing and publishing the Final EIS. Following publication of the Final EIS and a minimum of a 30 day waiting period, the Air Force will sign a Record of Decision (ROD).

The ATI proposal was initially developed by the Air Force, in cooperation with the FAA, and an Environmental Assessment (EA) was begun. Upon further analysis and after interest expressed during the public and agency scoping, the Air Force changed from an EA to an EIS.

2.9.2.1 Public Involvement Meetings and Hearings

The Air Force initiated the public involvement scoping process by publishing newspaper advertisements in sections of local newspapers. Publication dates are listed in Table 2-14. These advertisements announced the Air Force's intent to prepare environmental analysis on the ATI proposal and hold community outreach scoping meetings to obtain public and agency input on the scope of the environmental process. During the weeks of September 6 and 13, 2004, the Air Force notified the public of the meetings through posted flyers, press releases, and public service announcements in towns under the potentially affected airspace.

Table 2-14. Display Ad Schedule for Community Outreach Scoping Meetings and Public Hearings

Publication Date	*Newspaper Name*	*Newspaper Location*
Community Outreach Scoping Meetings		
September 16, 2004	The Manning Times	Manning, South Carolina
September 17, 2004	The Georgetown Times	Georgetown, South Carolina
September 18, 2004	The Item	Sumter, South Carolina
September 20, 2004	The Blade	Swainsboro, Georgia
September 22, 2004	The Millen News	Millen, Georgia
September 22, 2004	The True Citizen	Waynesboro, Georgia
Public Hearings		
September 13, 2005	The Times Extra	Manning, South Carolina
September 15, 2005	The Manning Times	Manning, South Carolina
September 17, 2005	The Item	Sumter, South Carolina
September 18, 2005	The Charleston Post and Courier	Charleston, South Carolina
September 21, 2005	The Forest Blade	Swainsboro, Georgia
September 21, 2005	The Millen News	Millen Georgia
September 21, 2005	The True Citizen	Waynesboro, Georgia
September 23, 2005	The Fort Gordon Signal	Fort Gordon, Georgia
September 23, 2005	The Georgetown Times	Georgetown, South Carolina

After public notification, public and agency community outreach scoping meetings were held the last week of September 2004 in Georgia and South Carolina. The Air Force and FAA representatives of these meetings actively solicited input from the public, local governments, federal and state agencies, Native American organizations, and special interest groups. Table 2-15 identifies locations and dates of the scoping meetings. Due to the public interest expressed at the community outreach scoping meetings, the Air Force published a Notice of Intent to prepare an EIS in the *Federal Register* on November 26, 2004. This notice announced the scoping period was extended to December 3, 2004 based upon interest expressed during community outreach scoping meetings. An additional notice was published on December 3, 2004 further extending the scoping period through January 5, 2005. In December 2004, the Air Force also mailed a postcard to interested citizens providing notice of intent to prepare an EIS and the January 5, 2005 comment extension. Written comments were received during and after the scoping period and the issues raised were summarized in the Draft EIS.

Following the scoping period, and taking the scoping comments into consideration, the Air Force prepared the Draft EIS for ATI, Shaw AFB, South Carolina. The NOA of the Draft EIS appeared in the *Federal Register* on September 2, 2005.

The Air Force provided notification of public hearings and made the Draft EIS available to the public and agencies for review and comment through postcards, newspaper display ads, press releases, public service announcements, flyers, the Shaw AFB and Air Combat Command (ACC) websites, and letters accompanying the direct mailing of the Draft EIS. Table 2-14 presents the newspapers and dates the display ads appeared and Table 2-15 summarizes the public hearings schedule. The Draft EIS was posted on the World Wide Web at http://www.cevp.com, the ACC Environmental Analysis website, as well as on the Shaw AFB website at http://www.shaw.af.mil, both of which were publicly accessible. Copies of the Draft EIS were sent to federal, state, and local agencies, Native American organizations, special interest groups, and citizens. The document was also sent to citizens or entities that requested a copy and was made available at libraries throughout the region of influence (ROI).

Table 2-15. Meeting and Hearings

Date	*Location*
Scoping Meetings	
September 27, 2004 Monday	Manning High School Lecture Hall, Manning, South Carolina
September 28, 2004 Tuesday	Kingstree Senior High School Cafeteria, Kingstree, South Carolina
September 29, 2004 Wednesday	JB Beck Middle School Auditorium, Georgetown, South Carolina
September 30, 2004 Thursday	Millen Community House, Millen, Georgia
Public Hearings	
October 3, 2005, Monday	Manning Senior High School Lecture Hall, Manning, South Carolina
October 4, 2005, Tuesday	Kingstree Senior High School Cafeteria, Kingstree, South Carolina
October 5, 2005, Wednesday	Jenkins County Ag Center, Millen, Georgia
October 6, 2005, Thursday	Wadley Lions Club, Wadley, Georgia
October 7, 2005, Friday	Radison Hotel, Charleston Airport, Room Ashley II, Charleston, South Carolina

The public review and comment period for the Draft EIS took place over 49 days. During this time, the Air Force held five public hearings in Manning, Kingstree, and Charleston, South Carolina and in Millen and Wadley, Georgia during the week of October 3, 2005 to provide an opportunity for the public to comment on the proposal and the analysis contained within the Draft EIS. The Air Force encouraged public and agency representatives to provide oral and written comments on the Draft EIS during the public hearings or to mail written comments on or before October 21, 2005, the close of the public comment period. Letters were received after the close of the comment period through November 21, 2005. Public hearing comments and all written comments received were reviewed and considered and are included in this Final EIS.

There were 77 people who attended the hearings, with 21 people providing oral or written comments during that time. Public displays and sign-in and comment sheets informed attendees that providing personal information along with comments was considered consent to publish that information; however, residential addresses are blocked out from publication in this Final EIS. Overall, the Air Force received comments from 60 individuals or agencies during the public comment period. The closing date of the public comment period was October 21, 2005, although comments are included in this document which were received through November 21, 2005.

FAA also solicited comments from the public on the proposed establishment of the Bulldog C and E MOAs in a notice issued on December 5, 2007. FAA also held an informal public meeting regarding the proposal on October 23, 2008 at the Augusta Regional Airport.

2.9.2.2 Issues Raised During the Draft EIS Review

The comments received at the public hearings and throughout the comment period are included in this Final EIS (Appendix D). Responses to substantive comments are included in Appendix D. These comments received at the public hearings are similar to scoping comments summarized in Appendix A. Public hearing comments are summarized in Table 2-16.

Table 2-16. Public Hearing Comments Summary

Issue Raised	*Draft EIS Section*	*Final EIS Response Number*
Concerns regarding airspace conflicts between private aircraft and military aircraft within the MOAs.	2.2.6, 3.1.2, 3.1.3.1, 3.9.3.1	AM-3, AM-5, AM-7, AM-9
Asked if the airspace changes would have an impact on medical flights.	3.1.2, 3.1.3.1, 3.9.3.1	AM-14
Concerns about the changes in airspace causing airspace restrictions and interfering with airport upgrades, private aviation businesses and flights, and the surrounding economy dependent upon local air service.	3.9.2, 3.9.3.1	NP-8, SE-1, SE-2, SE-4, PN-1
Concern about safety hazards from flare use, inconvenient diversions around airspace, their fear of crashes or near misses with military aircraft, and the possibility of a bird strike causing an Air Force pilot to eject.	2.2.6, 3.1.2, 3.1.2.1, 3.3.3.1, 3.9.3.1	AM-7, SA-1, SA-2, SA-3, SA-4, BI-2
Concerns were expressed about the impacts of low level flight on the cities of Louisville and Wadley, Georgia.	3.1.2	AM-5, NO-1
Concerned about the impacts of noise on wildlife, human health, and quality of life.	3.2.3, 3.8.3.1, 3.9.3.1	SE-4, BI-1
Asked about potential impacts to the endangered wood stork.	3.6.3	BI-2, BI-5
Asked if the transmitters would affect telephone lines.	3.8.3.1	LU-1
Asked how the scoping comments had been addressed in the Draft EIS.	1.5, 2.9	GE-3, NP-10, AM-3

2.9.3 Environmental Resources not Carried Forward as Separate EIS Sections

Some environmental resources were not carried forward for evaluation as separate sections in this EIS because it was determined that implementation of the Draft EIS Proposed Action, the Mitigated Proposed Action, or any of the alternatives would be unlikely to affect these resources. These resources are hazardous materials and waste management, ground transportation, and visual resources. A brief explanation of the reasons why these resources were not expected to be impacted is provided below:

Hazardous Materials and Waste Management: The implementation of the Draft EIS Proposed Action, the Mitigated Proposed Action, or alternatives would not increase the use of any hazardous materials. The training transmitters are electrically powered and require a minimum of petroleum products in maintenance. Construction associated with the transmitter sites would not generate substantial solid or hazardous waste. Construction effects are addressed in physical and biological resource sections.

The use of chaff and flares would continue and most chaff or flare residual materials do not constitute hazardous materials or waste. Except for the extremely rare dud flare, residual materials are not hazardous. The use of chaff and flares for training activities constitutes the normal and intended use of the product rather than waste disposal. The Munitions Rule provides that munitions used for the training of military personnel are not solid waste and not subject to Resource Conservation and Recovery Act regulation. The United States Environmental Protection Agency (USEPA) views such training activities as constituting the normal use of the product rather than waste disposal. Since the chaff or flare unit was used for its intended training purpose, the residual material that falls to the ground would not be considered hazardous waste. The effects of residual material from deployment of chaff and flares are addressed in the discussions of safety, physical resources, and socioeconomics.

Ground Transportation: The implementation of the Draft EIS Proposed Action, the Mitigated Proposed Action, or an alternative would not involve an increase in base personnel or an increase in the use of the road or railroad systems in the study area and would not have the potential to interfere with the movement of vehicles. Training transmitter traffic would be minimal and generally indistinguishable from local truck and auto traffic. Transportation issues regarding aircraft, both commercial and general aviation, are addressed in the environmental discussions of airspace and socioeconomics.

Visual Resources: The implementation of the Draft EIS Proposed Action, the Mitigated Proposed Action, or alternatives would not affect the visual environment. Military training jet aircraft have been common sights in the MOAs for over 50 years. The new and modified airspace locations are within close proximity to or under areas already in use by military aircraft for training, and therefore, the appearance of military aircraft would not be expected to change the existing viewshed. The training transmitter sites would be located in remote areas, on rural private property, and would likely not be visible from a public right-of-way. Chaff and flare residual materials are addressed in airspace, physical resources, and socioeconomics.

2.10 CONSULTATION AND COORDINATION

Both NEPA and CEQ regulations (40 CFR 1502.19) require intergovernmental notifications prior to any detailed statement of environmental impacts. Through the process of IICEP, AFI 32-7060, concerned federal, state, and local agencies must also be notified and allowed sufficient time to evaluate potential environmental impacts of a proposed action. Through the ATI IICEP process, the Air Force notified more than 135 federal, state, and local agencies. The Air Force accomplished this in four ways: (1) contacting agencies early in the environmental process via letters to inform them of the proposal and to solicit their comments on the Proposed Action and alternatives, (2) conducting community outreach scoping meetings, (3) sending copies of the Draft EIS to federal, state, and local agencies, and (4) holding public hearings on the Draft EIS.

2.10.1 Continuing Consultation

In addition to these four methods, the Air Force consulted or coordinated directly with federal and state agencies in the potentially impacted states of Georgia and South Carolina. Key consultation and coordination letters between the Air Force and public agencies are contained in Appendix B of the Draft EIS, while Appendix B of this document includes additional correspondence from the Air Force to the United States Fish and Wildlife Service (USFWS) and a subsequent letter from USFWS concurring with the Air Force's determination that the proposed project may affect, but is not likely to adversely affect, Wood Storks and stating their belief that the requirements of Section 7 of the Endangered Species Act (ESA) have been met. Comments from agencies on the Draft EIS are presented in Appendix D of this Final EIS.

The Air Force closely coordinated and consulted with the FAA, a cooperating agency for this EIS, on the Proposed Action and alternatives. The Air Force met with FAA control towers, regional offices, and ARTCCs on several occasions to discuss potential alternative airspace configurations that would meet the needs required to fulfill the Air Force's and the FAA's purpose while minimizing airspace impacts. This consultation started prior to the beginning of the EIS process in September 2004 and continued through 2009. Based on the airspace proposal submitted by the Air Force, FAA also solicited comments from the public. In October 2008, FAA held an informal public meeting on the proposed establishment of Bulldog C and E MOAs at the Augusta Regional Airport. This ongoing consultation culminated in the Mitigated Proposed Action presented in this Final EIS. Comments received by the FAA during the FAA aeronautical circularization are included in Appendix L of this Final EIS.

> ***Public Question:*** *During public review, commenters asked when a decision would be made.*
>
> ***Answer:*** *Neither an Air Force nor an FAA decision has been made. Public and agency comments help focus environmental analysis that must be completed prior to any ATI decision.*

The Air Force coordinated with the respective wildlife departments, Departments of Environmental Quality, and SHPOs in Georgia and South Carolina. The nature and degree of coordination with these state agencies varied depending upon their request for coordination, the potential for effects on resources under their jurisdictions, and the organization of departments within each state. Copies of the responses are included in Appendix D.

2.10.2 FAA Impact Analysis Categories

When the FAA (participating in the ATI EIS as a cooperating agency) is the lead agency or proponent of an action, it considers analysis of an array of environmental resources similar to the Air Force's. FAA action on the ATI proposal constitutes an FAA non-regulatory SUA process (refer to Figure 2-15). Table 2-17 lists those resource analysis categories, as identified in FAA Order 1050.1E (Change 1, effective date March 20, 2006), and correlates them with the resources discussed in the ATI EIS. FAA Order 1050.1E, Section 6.1c, discusses FAA's requirement to satisfy 49 USC, Subtitle I, Section 303(c), commonly referred to as Section 4(f). This act mandates that special effort be made to preserve the natural beauty of the countryside and Public Park and recreation lands, wildlife and waterfowl refuges, and historic sites in implementing transportation projects. Section 6.1c of the Handbook exempts designation of airspace for military flight operations from Section 4(f). Specifically, the Department of Defense reauthorization in 1997 provided that "No military flight operations (including a military training flight), or designation of airspace for such an operation, may be treated as a transportation program or project for purposes of Section 303(c) of Title 49, USC" (P.L. 105-85, November 18, 1997).

Table 2-17. Impact Analysis Categories Identified in FAA Order 1050.1E (2006)

FAA Impact Analysis Categories	*ATI EIS Environmental Resource*	*Summary*
Air Quality	Air Quality	Essentially no change in air quality in existing airspace. Minor emission increases in new and expanded airspace.
Coastal Resources	Included in Land Use	Training transmitter sites near coastline; no changes to coastal resources anticipated.
Compatible Land Use	Land Use and Recreational Resources	Proposed Action and alternatives occur in areas already overflown by aircraft. Current land uses are not incompatible with existing levels of noise. Training transmitters compatible with agricultural land uses.
Construction Impacts	Included in Physical Resources	Minimal construction activities associated with Proposed Action or alternatives.
Department of Transportation Act: Sec. 4(f)	Not a rule making action (Order 6501.1E, CHGI, Section 311a	No analysis of Sec. 4(f) areas required for FAA non-rule making actions.
Farmlands	Physical Resources and Land Use	Potential to convert agricultural uses to non-agricultural uses; minor impacts associated with transmitter and road construction.
Fish, Wildlife, and Plants	Biological Resources	Training transmitter sites to avoid sensitive species; additional surveys required.
Floodplains	Physical Resources	Training transmitter sites to avoid floodplains.
Hazardous Materials, Pollution Prevention, and Solid Waste	Included in Safety and Physical Resources	No expected increase in use of hazardous materials or generation of solid waste.
Historical, Architectural, Archeological, and Cultural Resources	Cultural Resources	Proposed Action and alternatives do not include demolition or on-the-ground effects; noise impacts are not anticipated.
Light Emissions and Visual Impacts	Not carried forward for further analysis as a separate topic; see also Land Use and Recreational Resources	No new light emissions. Minor increase in visual impacts in new training areas.
Natural Resources, Energy Supply, and Sustainable Design	Included in Land Use and Physical Resources	Aircraft would continue to use fuel under all alternatives. Minor increases in electrical uses for transmitters and minor loss of land resources to transmitter construction.
Noise	Acoustic Environment	Little change under existing airspace. Noticeable but minor increases in noise levels under new airspace and expanded airspace. Transient noise associated with training transmitters.
Secondary (Induced) Impacts	Discussed in Cumulative Impacts section (Chapter 4.0)	Secondary impacts are not anticipated.
Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks	Socioeconomics, Safety, and Environmental Justice	No additional impacts to human, social, or economic resources are anticipated.
Water Quality	Physical Resources	Proposed Action or alternatives not expected to impact water quality
Wetlands	Biological Resources	Training transmitter sites to avoid wetlands
Wild and Scenic Rivers	Land Use and Recreational Resources	The Black River, a designated Scenic River, is already overflown by training aircraft. No additional impacts are anticipated.

2.10.3 Regulatory Compliance and Permit Requirements

This EIS has been prepared to satisfy the requirements of NEPA (Public Law [P.L.] 91-190, 42 USC 4321 *et seq*.) as amended in 1975 by P.L. 94-52 and P.L. 94-83. The intent of NEPA is to protect, restore, and enhance the environment through well-informed federal decisions. In addition, this document was prepared in accordance with Section 102 (2) of NEPA, regulations established by the

CEQ (40 CFR 1500-1508), AFI 32-7061, (i.e., 32 CFR Part 989), and FAA Order 7400.2. Any change to chartered airspace is the responsibility of the FAA. This responsibility is discussed in Section 1.5.

This analysis of environmental resources considered all applicable federal, state, and local regulations in Chapter 3.0 of this document. Certain areas of federal legislation, such as the ESA and National Historic Preservation Act (NHPA), have been given special consideration. Other regulatory or permit requirements are not anticipated for the Proposed Action or alternatives.

Implementation of the Proposed Action or an alternative will involve coordination with several agencies. Compliance with the ESA requires communication with the United States Fish and Wildlife Service (USFWS) in cases where a federal action could affect listed threatened or endangered species, species proposed for listing, or candidates for listing. The primary focus of this consultation is to request a determination of whether any of these species occur in the region of influence of the Proposed Action. If any of these species are present, a determination of the potentially adverse effects on the species is made. Should no species protected by the ESA be affected by the Proposed Action, no additional action is required. No adverse effects are anticipated. Letters were sent to the appropriate USFWS offices as well as state agencies, informing them of the Proposed Action and alternatives and requesting data regarding applicable protected species. Appendix A includes copies of relevant coordination letters sent by the Air Force.

The preservation of cultural resources falls under the purview of SHPO, as mandated by the NHPA and its implementing regulations. A letter was sent to the South Carolina and Georgia SHPOs and the Catawba Indian Nation and the Eastern Band of Cherokee Indians informing them of the Proposed Action and alternatives (Appendix A). Further communication is included as part of the Draft EIS review process.

This EIS has been prepared in compliance with NEPA; other federal statutes, such as the Clean Air Act (CAA) and the Clean Water Act (CWA); Executive Orders (EOs); and applicable state statutes and regulations. Table 2-18 summarizes these applicable federal, state, and local permits and the potential for change to the permits due to the Proposed Action or an alternative. No new permits are expected to be required to implement the Proposed Action or alternatives.

Table 2-18. Environmental-Related Permitting

Permit	*Resource*	*Proposed Action*
Part B, Resource Conservation and Recovery Act Corrective Action Permit (Shaw AFB)	Hazardous Waste	No change in hazardous waste.
Interim Status Part B, Subpart X (Poinsett ECR)	Operations	No on the ground activities on Poinsett ECR.
Title V Air Operating Permit	Air	No change to air emissions.
Public Water System Operating Permit (Shaw AFB)	Water	No construction on Shaw AFB.
Public Water System Operating Permit (Poinsett ECR)	Water	No construction on Poinsett ECR.
General NPDES Permit	Storm Water	Construction associated with training transmitters.
Individual NPDES Permit	Storm Water	

AFB = Air Force Base; ECR = Electronic Combat Range; NPDES = National Pollutant Discharge Elimination System

2.11 SUMMARY COMPARISON OF ENVIRONMENTAL CONSEQUENCES BY ALTERNATIVES

Table 2-19 compares the environmental consequences for the Mitigated Proposed Action and alternatives. This summary table is derived from the detailed consequences sections for each environmental resource presented in Chapter 3.0.

Table 2-19. Summary of Impacts by Resource
(Page 1 of 8)

Mitigated Proposed Action	*Alternative A*	*Alternative B*	*No-Action*
AIRSPACE MANAGEMENT AND AIR TRAFFIC CONTROL			
Modification to existing MOA airspace and creation of new MOA airspace would require non-rule-making action by the FAA. Responsibilities, procedures for aircraft operations, ATC operations, and utilization of ATCAAs are documented in LOAs between the scheduling military agency (20 FW) and the applicable ARTCC (Atlanta and Jacksonville Centers). These LOAs are supplemental to the procedures in FAA Orders 7110.65 (Air Traffic Control) and 7610.4 (Special Military Operations). Public airports within the proposed Bulldog C and E MOAs would have minimum exclusionary areas of 3 NM and 1,500 feet AGL. In addition, the proposed Bulldog E MOA has a larger exclusionary area designated around the Emanuel County Airport in response to concerns about interference with airport operations. Deconfliction of military and civil traffic in Bulldog C and E would be managed as under current conditions in Bulldog A. The FAA Atlanta ARTCC would have the authority to manage the airspace and control civilian air traffic into and out of the Emanuel County and Millen airports. The Atlanta ARTCC would have the authority to temporarily raise the floors of Bulldog C and E MOAs when they are active to allow civilian aircraft clearance to transit the airspace. The likely number of aircraft requiring ATC service from FAA and supporting Air Force controllers is within their ability to deconflict in the changed airspace. Life-flights to regional hospitals would be given precedence by Air Traffic Controllers, and would be expected to remain unimpeded by changes to military training airspace. Chaff used in the Shaw airspace is designed to not interfere with FAA ATC radars and would not create airspace management impacts. Continued use of chaff/flares and training transmitter sites would not impact civil air traffic or the ATC system.	The environmental consequences to commercial and general aviation, local airports, and airspace management would be greater than those described for the Mitigated Proposed Action. Changes to Gamecock MOAs and the Bulldog A MOA were identified by commenters and the FAA as having the potential for significant airspaces impacts. The boundaries of the Bulldog A and B MOAs would be made conformal. Lowering Gamecock D and not designating Gamecock F could reduce scheduling flexibility for civil aircraft transit. Effects of chaff and flare use and electronic training transmitter siting would not impact airspace management.	Alternative B creates Gamecock E high and low MOAs and proposes a higher floor to the lowered Gamecock D. These modifications could improve civil aircraft transit of the area when compared with Alternative A. Alternative B lowers the floor of Bulldog B to 3,000 feet AGL and does not extend Bulldog A under Bulldog B. Alternative B reduces aviation concerns and does not need exclusionary bubbles due to the higher Bulldog B floor altitude. Under Alternative B, the proposed changes to the Bulldog B MOA could still impact Augusta approach. Potential airspace management requirements to deconflict civil aircraft users of the airspace would be less than under Alternative A. Effects of chaff and flare use and electronic training transmitter siting would not impact airspace management.	No airspace modifications or expansion of SUA would occur. Airspace use and management would remain unchanged from current conditions. Chaff and flare use would continue in the existing airspace and existing training transmitter sites would be used for some training realism.

Table 2-19. Summary of Impacts by Resource
(Page 2 of 8)

Mitigated Proposed Action	*Alternative A*	*Alternative B*	*No-Action*
NOISE			
Under the Mitigated Proposed Action, Bulldog C and Bulldog E MOAs would be established beneath Bulldog B MOA adjacent to the existing Bulldog A MOA as depicted in Figure 2-4. Several MTRs (VR-094, VR-1004 and VR-097 – 1059) currently exist in the same area. Taking into consideration the sortie operations in the existing MOA and MTRs, the current DNLmr in the area underlying the proposed airspace, ranges from less than 35 dB (in areas underlying the MOA only) to 54 dB (in areas underlying both the MOA and MTRs). With the establishment of the proposed Bulldog C and E MOAs, noise levels would increase from less than 35 dB DNLmr to approximately 47 dB DNLmr in areas underlying the proposed MOAs, and from less than 35 dB DNLmr to less than 52 dB DNLmr in areas underlying the MOA and MTRs. No changes would occur to noise levels beneath the MTRs that lie outside of the MOA airspace, the Restricted Airspace over Poinsett ECR, or the Gamecock MOAs. The calculated noise levels beneath each of the airspace units is below the 55 dB DNL threshold identified by USEPA as a level to consider the potential for impact, and there would be no anticipated impacts to human health. There would be a noticeable increase in low-level overflights and military aircraft would become a noticeable contributor to noise levels under the proposed Bulldog C and E MOAs. The number of highly annoyed people could increase from approximately 1 percent of the population under the existing conditions to approximately 4 percent of the population under these proposed airspace units. In some cases, the calculated values are near or below the estimated ambient conditions of 35 to 44 dB. In such cases, military aircraft may be seen and briefly heard. Noise associated with construction of the training transmitter sites would be localized, intermittent, and of relatively short duration. During operation of the sites, noise due to human presence would be limited and confined to the general area of the site.	Military aircraft contributions to DNL would noticeably increase under the Bulldog A extension area from less than 35 dB DNLmr to 47 dB DNLmr. Military aircraft contribution to cumulative noise levels where existing MTRs overlap with the expanded Bulldog A MOA would discernibly increase from 36 dB DNLmr to a calculated 49 dB DNLmr. The calculated noise levels under the Bulldog A expanded airspace would be noticeable in the rural environment and are projected to increase the number of highly annoyed individuals from approximately 1 percent of the population to approximately 4 percent of the population. DNL generated by military aircraft are calculated in the 35 to 37 dB DNLmr range under Gamecock E and D. This is within the estimated ambient conditions of 35 to 44 dB and means that military aircraft could be noticed but would not be a major contributor to ambient sound conditions. Noise level increases, although annoying, would all be below the 55 dB level identified by USEPA as the noise level to consider for the potential for impacts. New training transmitter sites could involve activities that would create transient noise. Such noise would be limited and confined and would not be expected to be intrusive to the surrounding community.	DNL generated by military aircraft would be comparable to or lower than Alternative A. Lowering Bulldog B rather than extending Bulldog A would result in a calculated less than 35 dB DNLmr. This would be discernibly lower than under Alternative A and means that, under Alternative B, military aircraft could be noticed but would not be a major contributor to noise conditions in the area. The number of highly annoyed individuals would continue at approximately one percent of the population. Overall, noise levels associated with Alternative B are well below any thresholds to consider the potential for impacts. New training transmitter sites could involve activities that would create transient noise. Such noise would be limited and confined and would not be expected to be intrusive to the surrounding community.	No additions or modification would be made to the military training airspace which currently supports the 20 FW, 169 FW, and other transient users. Noise levels resulting from the use of this military training airspace would remain unchanged from current conditions, and would be somewhat higher under the existing airspace than with the Mitigated Proposed Action or an action alternative..

Table 2-19. Summary of Impacts by Resource (Page 3 of 8)

Mitigated Proposed Action	*Alternative A*	*Alternative B*	*No-Action*
SAFETY			
ATI does not propose any changes to sorties and maintenance, ordnance use, or number of training flights. No specific explosives safety risks are associated with the Mitigated Proposed Action or alternatives, as no elements of the Mitigated Proposed Action have the potential to alter or modify explosives use. FAA and Shaw AFB air traffic control would work together to avoid risks to civil aircraft flying under or above the proposed new airspace. Scheduling of airspace blocks would be done to assist civil aviation transit. The public expressed concern that the extension of Bulldog A could create a perception that safety at airports under the military airspace was reduced. Exclusionary areas around the airports could somewhat allay public concern. The flight safety risk in the Bulldog MOAs would not be substantially different from the current conditions. Most chaff and flare plastic and aluminum coated wrapping materials that fall to the ground following deployment do not, and would not, constitute a safety risk. The MJU-7 A/B S&I device weighs 0.7 ounces and could strike the ground with the force of a large hailstone. Cosmetic damage could occur annually to an estimated 1.0 vehicles under the Gamecock MOAs and 0.9 vehicles under the Bulldog MOAs. There would be a per year calculated risk of 0.005 or 5 in 1,000 years, 1 in 200 years that an unprotected person under either Bulldog MOAs or Gamecock MOAs could be struck by a falling S&I device. As with a large hailstone, this could bruise but would not be likely to cause serious injury. An estimated four dud flares a year could fall to the ground under the airspace. The possibility that a dud flare could strike and seriously injure a person is so minute that it can be essentially discounted. Dud flares that are not heated in excess of 1,200 degrees should not pose a safety risk; local agencies would be informed to notify Shaw AFB in the event that a dud flare was located. No wind vortex impacts are expected from an F-16 overflight within the proposed Bulldog airspace. Ground safety risks from operation of existing and proposed new training transmitter sites would be minimal as the Air Force would continue to follow applicable regulations, technical orders, and AFOSH standards. The use of training transmitters in the proposed new locations would create no specific ground safety concern.	Safety aspects were of concern to the public and FAA for general aviation within the expanded Bulldog A MOA and for civil aviation using Augusta approach. Civil aviation pilots expressed concern that under Alternative A, the proposed Gamecock E MOA and the lowered Gamecock D MOA created higher concentrations of civil aircraft that posed a safety risk. The FAA and Shaw AFB ATC would work together to avoid safety risks to civil aircraft flying under or above the proposed airspace. Scheduling of airspace blocks would be done to assist civil aviation transit. Other safety aspects associated with the airspace use, chaff and flare use, training transmitter siting, and use would be similar to those described for the Mitigated Proposed Action.	Alternative B contains a split Gamecock E and a high floor for Gamecock D. These elements could improve the space and scheduling for civilian flights and reduce safety concerns when compared with Alternative A. Alternative B establishes a 3,000-foot MSL floor for Bulldog B and does not extend Gamecock A. These elements would reduce public concern for safety around the local airports. The higher Bulldog B floor in the extension area would result in no expected additional risk for bird/wildlife-aircraft strikes in the area. Other safety aspects associated with airspace use, chaff and flare use, and training transmitter siting and use would be similar to those described for the Mitigated Proposed Action.	No changes to 20 FW training assets would occur. No changes to the use of chaff and flares in existing airspace and training would occur. Chaff and flares effects are as described under the Mitigated Proposed Action.
AIR QUALITY			
Areas under the existing and proposed airspace modifications are in air quality attainment. No overall increase in emissions are anticipated from military aircraft training and nearly all training flights occur above the 3,000-foot AGL mixing height for emissions. The minor increases in emissions in the area of the proposed Bulldog C and E MOAs under the Mitigated Proposed Action would not affect local or regional air quality. Construction of electronic training transmitter sites could result in transient local increases in emissions that would not significantly affect local air quality.	Air quality effects would be the same as described under the Mitigated Proposed Action. No air quality impacts are anticipated.	Air quality effects would be the same as described in the Mitigated Proposed Action except that under Bulldog B, training flight emissions would be above the air quality mixing height and there would be no air quality effect.	Air quality would not change as a result of the No-Action Alternative.

Table 2-19. Summary of Impacts by Resource
(Page 4 of 8)

Mitigated Proposed Action	*Alternative A*	*Alternative B*	*No-Action*
PHYSICAL RESOURCES			
Physical resources include soil and water. Chaff and flare use and construction of training transmitter sites are the ATI elements with the potential to affect physical resources. Within the proposed Bulldog Complex and the existing Gamecock MOAs, an average of one flare per 84 and 120 acres would be released, respectively. Flares are released above 5,000 feet MSL and burn out in 400 feet, so there is a low probability of a flare-caused fire affecting physical resources. Flare and chaff deployment produces inert plastic parts, aluminum wrapping (ranging from 1-inch by 1-inch up to 3-inches by 13-inches), and felt spacers. One piece of flare or chaff residual material would be expected per 5 acres per year. The wrapping and felt would deteriorate to naturally occurring materials over time. The plastic is inert. Although a possible annoyance if found by a person, the flare residual materials are not expected to accumulate in quantities that could affect soil or water resources. Deployed chaff is thinner than very fine hair. Extensive previous research has shown little to no negative effects of chaff or flare ash on soil or water quality. The distribution of chaff would be approximately 3.85 grams (0.12 ounce) per acre per year in the proposed Bulldog Complex and 3.89 grams (0.12 ounce) in the Gamecock MOAs per acre per year. Chaff is not likely to accumulate or otherwise impact physical resources. No impacts are expected as a result of transmitter site construction. Each site is projected to disturb 0.6 acres, Implementation of standard construction practices would reduce the potential for dust or erosion. No significant impact would be expected on soil, water, or other physical resources.	Consequences under Alternative A would be similar to those described under the Mitigated Proposed Action. No significant impact would be expected on soil, water, or other physical resources.	Consequences under Alternative B would be similar to those described under the Mitigated Proposed Action. No significant impact would be expected on soil, water, or other physical resources.	No changes to physical resources would occur under the No-Action Alternative. Chaff and flares effects are as described under the Mitigated Proposed Action.

Table 2-19. Summary of Impacts by Resource
(Page 5 of 8)

Mitigated Proposed Action	*Alternative A*	*Alternative B*	*No-Action*
BIOLOGICAL RESOURCES			
Average noise exposure to biological resources would be comparable to or slightly higher than that experienced in the current airspace, which has not resulted in significant negative impacts to wildlife or domestic animals. In areas where noise levels are predicted to noticeably increase (proposed Bulldog C and E MOAs) animals may be temporarily sensitive to the new noise levels. For example, animals may startle or temporarily shift habitat use or activities in areas under new low-level flight. Although species may vary in their response, past research has documented that most wildlife and domestic animals would habituate and return to normal activities. A particularly close or loud aircraft overflight could still produce a startle reaction and negative response in habituated animals. Such incidents would likely be random and infrequent. Special-status wildlife species would not be significantly affected by noise levels of the Mitigated Proposed Action. Wood storks or other large birds are at risk of collision with military aircraft and are a safety concern for the pilots and aircraft. This would be the case under the proposed Bulldog C and E MOAs. Nest success of red-cockaded woodpeckers would not be affected by airspace modifications. No threatened or endangered species or their habitats were observed at three potential training transmitter sites under the Bulldog A MOA. Field surveys for threatened and endangered species would be conducted at other potential sites prior to final site approval and a determination would be made as to the potential effect to biological resources. Previous studies have documented that wildlife and domestic animals would not be harmed by residual chaff or flare materials. There is a very low likelihood of an individual animal being struck by falling flare residual material. Chaff fibers, flare ash, and other residual material would not accumulate in amounts that would affect forage or water quality. Most animals would avoid chaff fibers and, even if they were ingested, they are unlikely to be available in amounts that could cause injury. There are no recorded cases of domestic or wild animals ingesting end caps. *No effect* on the following threatened and endangered species: American chaffseed, Canby's dropwort, little amphianthus, pondberry, seabeach amaranth, shortnose sturgeon, flatwoods salamander, and red-cockaded woodpecker. *May affect, but is not likely to adversely affect* wood stork, due to insignificant effects.	Consequences under the Bulldog MOAs would generally be the same as described under the Mitigated Proposed Action. Under the proposed Gamecock E MOA noise levels are expected to range between 36 dB DNLmr and 47 dB DNLmr and in the lowered Gamecock D MOA noise levels would be about 47 dB DNLmr. Special-status wildlife species that could be impacted by increased noise levels or events in the proposed Gamecock E, Gamecock D, and expanded Bulldog A MOAs are bald eagle, wood stork, red-cockaded woodpecker, migratory birds, and flatwoods salamander. A literature review of potential noise impacts to these species is discussed above under the Mitigated Proposed Action. No significant adverse impacts are expected to biological resources or special-status species under Alternative A. No significant adverse impacts are expected from chaff or flare use under Alternative A. Chaff and flare consequences are as described for the Mitigated Proposed Action. No threatened or endangered species or their habitats were observed at three potential training transmitter sites under the Bulldog A MOA. Field surveys for threatened and endangered species would be conducted at other potential sites prior to final site approval and a determination would be made as to the potential effect to biological resources. *No effect* on the following threatened and endangered species: American chaffseed, Canby's dropwort, little amphianthus, pondberry, seabeach amaranth, shortnose sturgeon, flatwoods salamander, and red-cockaded woodpecker. ***May affect, but is not likely to adversely affect*** **wood stork, due to insignificant effects.**	Consequences would generally be the same as described under Alternative A except noise levels in the Gamecock MOAs and Bulldog MOAs would be slightly lower under Alternative B. Under the proposed Gamecock E MOA noise levels are expected to range between 36 and 44 dB DNLmr. Areas beneath the Bulldog A/B MOAs would experience fewer aircraft overflights decreasing noise levels to 47 dB DNLmr. With a higher floor in the Bulldog A expansion area and lower noise levels, Alternative B would not have as much potential to flush resident or migratory species as compared to the Mitigated Proposed Action or Alternative A. The higher airspace floor in the area where Bulldog A would not be extended raises the training altitude above the altitudes commonly used by wood storks and most other large birds. No significant adverse impacts are expected to biological resources or special-status wildlife species under Alternative B. No significant adverse impacts are expected from chaff or flare use under Alternative B. Chaff and flare consequences are as described for the Mitigated Proposed Action. No threatened or endangered species or their habitats were observed at three potential training transmitter sites under the Bulldog A MOA. Field surveys for threatened and endangered species would be conducted at other potential sites prior to final site approval and a determination would be made as to the potential effect to biological resources. *No effect* on the following threatened and endangered species: American chaffseed, Canby's dropwort, shortnose sturgeon, flatwoods salamander, and red-cockaded woodpecker. Little amphianthus, pondberry, and seabeach amaranth do not occur in the ROI for Alternative B. *May affect, but is not likely to adversely affect* wood stork, due to insignificant effects.	No changes to biological resources would be expected under the No-Action Alternative.

Table 2-19. Summary of Impacts by Resource
(Page 6 of 8)

Mitigated Proposed Action	*Alternative A*	*Alternative B*	*No-Action*
CULTURAL RESOURCES			
In South Carolina, 29 NRHP-listed properties are directly underneath the existing Gamecock MOAs. No changes to the Gamecock MOAs are proposed. NRHP resources under existing airspace are currently subjected to overflights without affecting their NRHP status. In Georgia, 35 properties listed on the NRHP are under the Bulldog A existing and proposed extension areas. Properties under the existing Bulldog A airspace with a 500-foot AGL floor are currently subject to low-level overflights without affecting their NRHP status. Some of the NRHP properties within the proposed Bulldog C and E MOAs are currently overflown by military aircraft using MTRs. Although some individuals visiting properties could be annoyed by an overflight, it is not anticipated that the creation of Bulldog C and E MOAs would detrimentally affect cultural resources under the airspace. The amount of chaff and flares associated with the Mitigated Proposed Action or alternatives would not increase reducing the possibility of an adverse effect to NRHP properties. While the likelihood of chaff or flare residual components striking a property is minimal, at worst the potential damage would be similar to that of a large hailstone. Training transmitters would be located in areas selected for their proximity to services. At the Magruder North Site, located near a Carolina bay, an archaeological site having both prehistoric and historic components and several artifacts were observed. One isolated artifact was found at the Magruder South location, a single, distal biface fragment made of a low-grade chert was found near the southeast corner of the area. No cultural resources were found at the Grange location. The Air Force conducted NHPA Section 106 consultation (HP-050829-004) with the Georgia SHPO. The Georgia SHPO indicated no historic properties or archaeological resources listed in or eligible for the NRHP would be impacted by the proposed action as defined in the Draft EIS. Once the final training transmitter emitter locations have been selected, additional cultural resources visits will be conducted in coordination with the SHPO to identify and recover any significant archaeological information. In South Carolina, four general areas, one site under Gamecock C MOA and three sites along the coast, were analyzed for the placing of additional emitters in areas along roads and with access to utilities. If specific site locations are identified in the future, the AF would need to complete the EIAP, environmental baseline and cultural surveys, and NHPA Section 106 consultation. In the event that cultural resources are discovered during preliminary surveys of the construction sites or during ground-disturbing activities, all construction activity would cease and the Shaw AFB Natural Resources Manager would be contacted and the SHPO and/or tribe would be notified as outlined in the Shaw AFB Integrated Cultural Resources Management Plan (Air Force 2008).The Air Force requested identification of concerns and initiation of Government-to-Government consultation during the scoping process and provided the Draft EIS to the Eastern Band of Cherokee Indians and the Catawba Indian Nation. No responses were received and no issues or concerns were identified. In accordance with the NHPA, 36 CFR Part 800.5 (c), if the SHPO/THPO fails to respond to an Agency official finding within the 30-day review period, then the agency official can consider them to be in agreement with the finding. Therefore, no impacts are expected to cultural resources from the Mitigated Proposed Action or an alternative.	As with the Mitigated Proposed Action, it would be unlikely that changes in airspace associated with Alternative A would detrimentally affect any historic or cultural properties. Consequences would be as described for the Mitigated Proposed Action.	Changes in the shape and use of airspace under Alternative B would not affect the NRHP eligibility of these resources, nor would continued use of chaff and flares. Consequences would be essentially the same as under the Mitigated Proposed Action with the exception that training flights in the area under Bulldog C and E MOAs would be at higher altitudes than with the Mitigated Proposed Action or Alternative A.	No changes to cultural resources would occur under the No-Action Alternative.

Table 2-19. Summary of Impacts by Resource
(Page 7 of 8)

Mitigated Proposed Action	*Alternative A*	*Alternative B*	*No-Action*
LAND USE AND RECREATION			
There would be no anticipated change in general land use patterns, land ownership, land management plans, or special use areas due to airspace changes or use of chaff and flares. Deposition of 1 piece of chaff or flare residual material per 5 acres per year could result in annoyance if found by land owners or users of recreational areas, but it would not be expected to change or otherwise affect any land uses. Aircraft noise levels would not change appreciably above current levels under most airspace. Aircraft noise would not be expected to impact residential areas, farms, parks, or wildlife refuges. Although distributed over the year, there would be a small increase in training flights within sight of Magnolia Springs State Park that could result in annoyance to some people. In the proposed Bulldog C and E MOAs, there would be an increase in low level training flights that could result in an increase of highly annoyed people from 1 percent to 4 percent of the affected population. Training transmitter sites are generally expected to be on agricultural land leased from private landowners. Land use would change on the 0.6 acres disturbed for each of the 6 training transmitters. Approximately 3 to 4 acres would be affected by changed land use under the Mitigated Proposed Action. This represents a negligible amount of agricultural land. Training transmitter site selection would avoid special use areas such as wildlife refuges or other natural areas.	Consequences would be essentially the same as those described for the Mitigated Proposed Action except that the entire area under the extended Bulldog A MOA would be affected. There would be no anticipated change in general land use patterns, land ownership, land management plans, or special use areas. Training transmitter sites would not impact recreational uses in the area.	Consequences would be generally the same as those described for the Mitigated Proposed Action. The primary difference is that average noise levels would be less than 35 dB DNLmr under Bulldog B as compared with 47 dB DNLmr under the Bulldog A/B MOAs with Alternative A. Calculated noise levels show that few, if any, additional individuals would be highly annoyed in the same area if Alternative B were selected. Approximately 2 acres would be affected for training transmitter sites under Alternative B. This represents a negligible amount of land.	No changes to land use or recreation would occur under the No-Action Alternative.

Table 2-19. Summary of Impacts by Resource (Page 8 of 8)

Mitigated Proposed Action	*Alternative A*	*Alternative B*	*No-Action*
SOCIOECONOMICS			
The proposed airspace modifications would not prohibit use of affected airways by general aviation. Altitude structures and FAA and Air Force air traffic controllers would reduce conflicts between military use and civilian air traffic. Life-flights to regional hospitals would be given precedence by Air Traffic Controllers, and would be expected to remain unimpeded by proposed changes to improve military training airspace. The public expressed concern that there would be a potential to constrain economic development opportunities in communities under or near the expanded airspace. The Mitigated Proposed Action reduces this concern through designation of a 3-NM by 1,500-foot AGL exclusionary area around public airports under the proposed airspace, an expanded exclusionary area around the Emanuel County Airport, no expanded MOA in the area of Augusta approach, and the FAA Atlanta ARTCC's authority to temporarily raise the floor of the proposed Bulldog C and E MOAs when they are active to allow civil aviation to transit through the area. Airports with Instrument Flight Rules (IFR) capabilities would be under air traffic control and would not be affected by proposed airspace changes. Airspace modifications under the Mitigated Proposed Action could affect some civil aviation and reduce flexibility at some airports. This is not expected to impact regional socioeconomic resources or economic development in the counties underlying the airspace. Use of chaff and flares and resulting plastic, wrapping, and felt materials that fall to the ground would not be in quantities to affect socioeconomic resources. Any cosmetic or other damage, such as to a vehicle, would be handled through established claims procedures at Shaw AFB. Construction of proposed training transmitter sites would not discernibly affect employment and earnings. No long-lasting socioeconomic effects are anticipated as a result of transmitter site development for either the Mitigated Proposed Action or any alternative. Economic pursuits and property values in the region are not expected to experience negative effects.	Alternative A consequences were perceived by commenters on the Draft EIS as greater than the Mitigated Proposed Action. Concern was expressed by civil aviation pilots during public meetings that the lower level altitude structures of Gamecock E and D would interfere with flights, including air taxi operations. These concerns included having to fly at inefficient altitudes and in more turbulent air. Positive ATC within the existing and proposed Gamecock MOAs should reduce the potential for safety risk but the proposed lower Gamecock D would reduce the flexibility that civilian pilots currently have when transiting the area. Overall, Alternative A airspace modifications would not be expected to qualitatively impact to socioeconomic resources or economic development in the region. Chaff and flare use consequences would be similar to those described for the Mitigated Proposed Action. Economic pursuits and property values in the region are not expected to experience negative effects.	Alternative B has similar consequences to those described for Alternative A. The primary differences are that the Alternative B higher floors for Gamecock E and F and the Bulldog B MOA floor of 3,000 feet MSL reduces pilot and public concerns about socioeconomic impacts. Alternative B airspace modifications are not expected to impact socioeconomic resources. Chaff and flare use consequences would be similar to those described for the Mitigated Proposed Action. Economic pursuits and property values in the region are not expected to experience negative effects.	No changes to socioeconomics would occur under the No-Action Alternative.
ENVIRONMENTAL JUSTICE			
The rural areas of North Carolina and Georgia have not yet benefited from the economic growth in the more urban areas. Although some areas of counties under the airspace are relatively economically depressed, no significant impacts or disproportionately high or adverse effects to minorities, disadvantaged communities, or children are anticipated.	No significant impacts or disproportionately high adverse effects to minorities, disadvantaged communities, or children are anticipated.	No significant impacts or disproportionately high adverse effects to minorities, disadvantaged communities, or children are anticipated.	No changes to environmental justice would occur under the No-Action Alternative.

MOA = Military Operations Area; FAA = Federal Aviation Administration; ATC = Air Traffic Control; ATCAA = Air Traffic Control Assigned Airspace; LOA = Letter of Agreement; 20 FW = 20th Fighter Wing; ARTCC = Air Route Traffic Control Center; NM = nautical mile; AGL = above ground level; SUA = Special Use Airspace; MTR = Military Training Route; DNLmr = Onset Rate-Adjusted Day-Night Average Sound Level; dB = decibel; ECR = Electronic Combat Range; USEPA = U.S. Environmental Protection Agency; DNL = Day-Night Average Sound Level; 169 FW = 169th Fighter Wing; ATI = Airspace Training Initiative; AFB = Air Force Base; S&I = safe and initiation; AFOSH = Air Force Occupational Safety and Health; MSL = mean sea level; ROI = region of influence; NRHP = National Register of Historic Places; SHPO = State Historic Preservation Office; NHPA = National Historic Preservation Act

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter presents the baseline conditions and an assessment of the potential environmental consequences of implementing the Mitigated Proposed Action or an alternative described in Chapter 2.0.

The National Environmental Policy Act (NEPA) requires the analysis to address locations and environmental resources with the potential to be affected by the Mitigated Proposed Action. Locations and resources with no potential to be affected need not be analyzed.

The analysis presented in this chapter is based on overlaying the Mitigated Proposed Action or alternatives from Chapter 2.0 on the baseline or existing conditions presented for each environmental resource. Each of the environmental resources is affected to a different degree and has a different method of analysis. Each resource section presented below begins with an introduction that defines the resource, the region of influence (ROI), the methodology, and scoping issues and other concerns that focused the analysis. The baseline or existing conditions for each resource follows the introduction, methodology, issues and concerns. Each resource section concludes with potential direct and indirect consequences of implementing the Mitigated Proposed Action or an alternative.

Public and agency comments were used to focus the analysis on those environmental resources of interest to scoping participants. Some environmental resources were not carried forward for separate evaluation in this Environmental Impact Statement (EIS) because it was determined that implementation of the Mitigated Proposed Action or any of the alternatives would be unlikely to directly affect those resources. Hazardous materials and waste management, ground transportation, and visual resources are not separately addressed but are evaluated under other resources including safety, physical resources, and socioeconomics. An explanation of the reasons why these resources were not expected to be affected was presented in Section 2.9.2.1.

The public and agencies helped determine the resources to be analyzed. The expected geographic scope of potential impacts is known as the region of influence (ROI). The ROI for this project is defined for each environmental resource as the outermost boundary of potential environmental consequences. The ROI generally is focused on the areas under or near to the Gamecock and Bulldog Military Operations Areas (MOAs) and in areas where training transmitters could be located.

Cumulative effects of the Mitigated Proposed Action or alternatives with other past, present, and reasonably foreseeable future actions within the ROI are presented in Chapter 4.0. Irreversible, irretrievable, short-term, and long-term effects are also discussed in Chapter 4.0.

3.1 AIRSPACE MANAGEMENT AND AIR TRAFFIC CONTROL

3.1.1 Introduction

F-16 training aircraft are a common sight in existing SUA over South Carolina and Georgia.

Airspace management and air traffic control is defined as the direction, control, and handling of flight operations in the "navigable airspace" that overlies the geopolitical borders of the United States (U.S.) and its territories. Navigable airspace is airspace above the minimum altitudes of flight prescribed by regulations under United States Code (USC) Title 49, Subtitle VII, Part A, and includes airspace needed to ensure safety in the takeoff and landing of aircraft, as defined in Federal Aviation Administration (FAA) Order 7400.2E (49 USC). This navigable airspace is a limited natural resource that Congress has charged the FAA to administer in the public interest as necessary to ensure the safety of aircraft and its efficient use (FAA Order 7400.2E 2000). Special Use Airspace (SUA) identified for military and other governmental activities is charted and published by the FAA. Management of this resource considers how airspace is designated, used, and administered to best accommodate the individual and common needs of military, commercial, and general aviation. The FAA considers multiple and sometimes competing demands for aviation airspace in relation to airport operations, Federal Airways, Jet Routes, military flight training activities, and other special needs to determine how the National Airspace System (NAS) can best be structured to address all user requirements. Specific rules and regulations concerning airspace designation and management are presented in Appendix E.

The FAA has designated the airspace within the U.S. as Controlled, Special Use, Other, and Uncontrolled airspace. Controlled airspace is airspace of defined dimensions within which air traffic control service is provided to Instrument Flight Rules (IFR) flights and to Visual Flight Rules (VFR) flights in accordance with the airspace classification (Pilot/Controller Glossary [P/CG] 2010). Controlled airspace is categorized into five separate classes: Classes A through E. These classes identify airspace that is controlled, airspace supporting airport operations, and designated airways affording en route transit from place-to-place. The classes also dictate pilot qualification requirements, rules of flight that must be followed, and the type of equipment necessary to operate within that airspace as presented in Appendix G.

SUA is designated airspace within which flight activities are conducted that require confinement of participating aircraft, or place operating limitations on non-participating aircraft. SUA includes Restricted Areas and MOAs (see Figure 1-2).

Other airspace consists of advisory areas, areas that have specific flight limitations or designated prohibitions, areas designated for parachute jump operations, Military Training Routes (MTRs), and Aerial Refueling Tracks (ARs). This category also includes Air Traffic

Control Assigned Airspace (ATCAA). When not required for other needs, ATCAA is airspace authorized for military use by the managing Air Route Traffic Control Center (ARTCC), usually to extend the vertical boundary of SUA.

Uncontrolled airspace is designated Class G airspace and has no specific prohibitions associated with its use.

The United States Air Force (Air Force) manages airspace in accordance with processes and procedures detailed in Air Force Instruction (AFI) 13-201, *Air Force Airspace Management*. AFI 13-201 implements Air Force Planning Document 13-2, *Air Traffic Control, Airspace, Airfield, and Range Management*, and Department of Defense (DoD) Directive 5030.19, *DoD Responsibilities on Federal Aviation and National Airspace System Matters*. It addresses the development and processing of SUA, and covers aeronautical matters governing the efficient planning, acquisition, use, and management of airspace required to support Air Force flight operations (Air Force 2006).

Air Force management of training ranges, such as Poinsett Electronic Combat Range (ECR) involves the development and implementation of those processes and procedures required by AFI 13-212, Volumes 1, 2, and 3, to ensure that Air Force ranges are planned, operated, and managed in a safe manner, that all required equipment and facilities are available to support range use, and that proper security for range assets is present. The overall purpose of range management is to balance the military's need to accomplish realistic testing and training with the need to minimize potential impacts of such activities on the environment and surrounding communities (Air Force 2007a).

The 20th Fighter Wing (20 FW) training airspace associated with the alternatives includes Restricted Areas, MOAs, and ATCAAs (see Figures 2-3 and 2-4). The volume of airspace encompassed by the potentially affected airspace elements constitutes the ROI for airspace management.

3.1.1.1 METHODOLOGY

The potential effects of the alternative actions on the existing and modified airspace environment were assessed by considering the changes in airspace utilization that would result from the creation of new or the modification of existing SUA. The assessments considered include applicable FAA Air Traffic Control (ATC) procedures (FAA Order 7110.65) and compliance with AFI 13-201 (*Air Force Airspace Management)* and supplements thereto. Other measures that could minimize potential impacts on other regional air traffic and the ATC system were also considered.

Air Force ranges are managed in accordance with requirements and procedures prescribed by AFI 13-212. These requirements address a wide range of subjects that include land ownership and control, weapons use, employee safety, range scheduling, range maintenance, explosive ordnance disposal (EOD), range decontamination, debris disposal, and environmental stewardship of the range.

3.1.1.2 ISSUES AND CONCERNS

The type, size, shape, and configuration of individual airspace elements in the region are based upon, and are intended to satisfy, competing aviation requirements. Potential impacts could occur if air traffic in the region and/or the ATC systems were encumbered by changed flight activities associated with the Mitigated Proposed Action or an alternative. When any significant change is planned, such as new or revised defense-related activities within an airspace element or a change in the complexity or density of aircraft movements, the FAA reassesses the airspace configuration. The FAA seeks to determine if such changes could adversely affect (1) ATC systems and/or facilities; (2) movement of other air traffic in the area; or (3) airspace already designated and used for other purposes supporting military, commercial, or general aviation.

During public hearings and the public review period, concerns were expressed regarding the potential effects upon civil aviation, including flights through active MOAs, flights during inclement weather, and public airports under expanded SUA airspace. Concern was also expressed by other users of the airspace including glider flight operations and private pilot flight training conducted from regional airports. Potential impacts to the management of Poinsett ECR could occur if an alternative prevented or significantly limited the ability of the range manager to comply with stipulated requirements.

3.1.2 Existing Conditions – Airspace Management and Air Traffic Control

MILITARY OPERATIONS AREA

> ***Public Question:*** *What happens with general aviation flight options during bad weather?*
>
> ***Answer:*** *Traffic during bad weather would fly IFR and be under direct control of air traffic controllers. ATC would track all aircraft and assign airspace to protect all users.*

The Mitigated Proposed Action and all action alternatives include the creation of new MOA airspace and/or modifications to existing MOA airspace. Each MOA is airspace of defined vertical and lateral limits established outside Class A airspace to separate and segregate certain non-hazardous military activities from IFR traffic and to identify for VFR traffic where these activities are conducted (P/CG 2010). Class A airspace covers the continental U.S. and limited parts of Alaska, including the airspace overlying the water within 12 nautical miles (NM) of the U.S. coast. Class A airspace extends from 18,000 feet above mean sea level (MSL) up to and including 60,000 feet MSL (P/CG 2010). MOAs are considered "joint use" airspace, in that VFR aircraft are not denied access to the airspace, and IFR aircraft may be routed through the airspace by agreement between controlling and using agencies, when approved separation can be provided from the MOA activity (Department of Transportation [DOT] FAA 2008). This means that non-participating aircraft operating under VFR are permitted to enter a MOA, even when the MOA is active for military use. Flight by both participating (military) aircraft and non-participating aircraft operating under VFR is accomplished under the "see-and-avoid" concept, which stipulates that "when weather conditions permit, pilots operating IFR or VFR are required to observe and maneuver to avoid other aircraft. Right-of-way rules are contained in 14 Code of Federal Regulations (CFR) Part 91" (P/CG 2010). IFR aircraft may be routed through the airspace, by agreement between controlling and using agencies, when approved separation can be provided from the MOA activity (FAA Order 7400.2, Paragraph 25-1-6). In this case, separation service for MOA participants is provided by the controlling center. Participants at public hearings on the Draft EIS expressed concern that communication regarding the actual training activities in the Bulldog MOAs is not adequately provided to civilian aircraft.

Figure 1-3 presents the existing airspace associated with the Shaw Airspace Training Initiative (ATI). This airspace includes the Bulldog A and B MOAs, the Gamecock B, C, and D MOAs, associated ATCAAs, and the Poinsett MOA which supports operations on Poinsett ECR.

These MOAs are scheduled and managed by staff at Shaw Air Force Base (AFB). Activation of the MOA airspace is accomplished by the applicable FAA ARTCC. The Gamecock B MOA that overlaps a portion of Gamecock C has limited use during higher headquarters Operational Readiness Evaluations (OREs) and Operational Readiness Inspections (ORIs). Specific details on the use of the MOAs are documented in Letters of Agreement (LOAs) between the using agency (20 FW) and the applicable ARTCC (Atlanta and Jacksonville Center).

When approaching a MOA, the pilot of the lead military aircraft contacts the applicable ARTCC and requests permission to enter into and activate the MOA. Upon clearance, the military aircraft enter the MOA airspace, and the airspace is considered to be active or "hot." At the completion of training, the applicable ARTCC is again contacted to gain authority to depart the MOA, and obtain clearance for the next phase of flight. When clearance from the ARTCC is provided, the military aircraft depart the airspace, and the MOA airspace is no longer hot. Participants at public hearings on the Draft EIS expressed concern that civil aircraft are delayed or re-routed around the Bulldog MOAs after the airspace is no longer active as a result of inadequate communication among military users, the FAA, and civilian pilots.

As described in Section 2.2.1.1, there is an existing LOA effective October 10, 1996 and last revised on December 2, 2007, between the Air Force and FAA, for the Poinsett Transition Area (PTA). The PTA is designed to allow F-16s from the 20 FW and 169th Fighter Wing (169 FW) to transit, in a tactical manner, from Gamecock D MOA to R-6002C, and return to Gamecock D MOA. The PTA is for the sole use of Shaw AFB and McEntire Air National Guard Station (ANGS)-based jets. This is transition airspace only and is not used as a MOA. The PTA is normally assigned an altitude of Flight Level (FL) 180 or above.

AIR TRAFFIC CONTROL ASSIGNED AIRSPACE

The Mitigated Proposed Action and alternatives include an ATCAA to FL220. ATCAAs are airspace of defined vertical and lateral limits, assigned by ATC, for the purpose of providing air traffic segregation between the specified activities being conducted within the assigned airspace and other IFR air traffic (P/CG 2010). This airspace, if not required for other purposes, may be made available for military use. ATCAAs are normally structured and used to extend the horizontal and/or vertical boundaries of SUA such as MOAs and Restricted Areas.

The existing ATCAAs included in the Shaw airspace are developed, coordinated, used, and managed in accordance with LOAs between the using agency (20 FW), and the applicable ARTCCs (Atlanta and Jacksonville Centers). The LOAs define responsibilities and outline procedures for aircraft operations, ATC operations, and utilization of airspace for which the 20 FW is the scheduling authority. Such LOAs are supplementary to the procedures in FAA Orders 7110.65 (Air Traffic Control) and 7610.4 (Special Military Operations).

There are two ATCAAs associated with the Shaw airspace. They overlie the Bulldog B and the Gamecock D MOA, and extend the vertical boundary of the airspace. The MOAs and ATCAAs are described in Table 3.1-1.

Table 3.1-1. Description of ATI Existing MOAs and ATCAAs

MOA/ ATCAA	ALTITUDES		POTENTIALLY AVAILABLE HOURS OF USE		*Controlling ARTCC*
	Minimum	*Maximum*	*From*	*To*	
Bulldog A MOA	500 feet AGL[1]	UTBNI[2] 10,000 feet MSL [3]	7:00 a.m.[4]	Midnight[4]	Atlanta
Bulldog B MOA	10,000 feet MSL[6]	UTBNI FL 180[5]	7:00 a.m. [4]	Midnight[4]	Atlanta
Bulldog B ATCAA	FL 180	FL 270	In accordance with LOA	In accordance with LOA	Atlanta
Gamecock B MOA	10,000 feet MSL	UTBNI FL 180	Intermittent 8:00 a.m.	Intermittent Midnight	Jacksonville
Gamecock C MOA	100 feet AGL	10,000 feet MSL	8:00 a.m.[4]	Midnight[4]	Jacksonville
Gamecock D MOA	10,000 feet MSL[6]	UTBNI FL 180	8:00 a.m.[4]	Midnight[4]	Jacksonville
Gamecock D ATCAA	FL 180	FL 220	8:00 a.m.[7]	Midnight[7]	Jacksonville
Poinsett MOA	300 feet AGL	2,500 feet MSL	6:00 a.m.[8] 8:00 a.m.[9]	Midnight[8] 4:00 p.m.[9]	Shaw Radar Approach Control

Notes:
1. AGL = Above Ground Level
2. UTBNI = Up To, But Not Including
3. MSL = Mean Sea Level. Average ground elevation in ROI is approximately 500 feet MSL.
4. Actual use is intermittent. Additional scheduling is promulgated through Notices to Airmen (NOTAM).
5. FL = Flight Level. Described in terms of hundreds of feet MSL using a standard altimeter setting. Thus, FL180 is approximately 18,000 feet MSL.
6. Reflects published MOA floor. Procedurally, floor for Bulldog B is 11,000 feet MSL, and floor for Gamecock D is 12,000 feet MSL.
7. ATCAAs are scheduled when requested in conjunction with other SUA to support required training, provided the airspace is available.
8. Monday through Friday
9. Saturday

MOA = Military Operations Area; ATCAA = Air Traffic Control Assigned Airspace; ARTCC = Air Route Traffic Control Center

Sources: Department of Transportation (DOT) FAA 2008, LOA 1999, LOA 2000.

RESTRICTED AREAS

ATI does not include any proposed changes to Restricted Areas. Under Alternatives A and B, the proposed Gamecock E MOA/ATCAA connects to a Restricted Area. A Restricted Area is designated airspace that supports ground or flight activities that could be hazardous to non-participating aircraft. A Restricted Area is airspace designated under 14 Code of Federal Regulations (CFR) Part 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated "joint-use" and IFR/VFR operations in the area may be authorized by the controlling ATC facility when it is not being utilized by the using agency (P/CG 2010). The restricted airspaces, R-6002A, R-6002B, and R-6002C support training activities on Poinsett ECR. If R-6002A, R-6002B, and R-6002C are all activated, operations on Poinsett ECR are supported by a block of airspace that extends from the surface to approximately 23,000 feet MSL. Specific elements of this airspace are described in Table 3.1-2.

Table 3.1-2. Restricted Airspace Description

	Altitudes		Potentially Available Hours of Use		
Restricted Area	*Minimum*	*Maximum*	*From*	*To*	*Controlling ARTCC*
R-6002A	Surface	12,999 feet MSL[1]	6:00 a.m.[2] 8:00 a.m.[3]	Midnight[2] 4:00 p.m.[3]	Jacksonville
R-6002B	13,000 feet MSL	17,999 feet MSL	6:00 a.m.[2] 8:00 a.m.[3]	Midnight[2] 4:00 p.m.[3]	Jacksonville
R-6002C	FL 180[4]	FL 230	6:00 a.m.[2] 8:00 a.m.[3]	Midnight[2] 4:00 p.m.[3]	Jacksonville

Notes: 1. MSL = mean sea level. Average ground elevation in vicinity of Poinsett ECR is approximately 450 to 500 feet MSL.
2. Monday through Friday
3. Saturday
4. FL = Flight Level, expressed in hundreds of feet MSL. Thus, FL 180 is approximately 18,000 feet MSL.

Source: DoD 2009.

MILITARY TRAINING ROUTES

ATI does not involve changes to MTRs. Some MTRs underlie portions of airspace proposed to be changed as part of ATI. MTRs are flight corridors developed and used by the DoD to practice high-speed, low-altitude flight, generally below 10,000 feet MSL. Specifically, MTRs are airspace of defined vertical and lateral dimensions established for the conduct of military flight training at airspeeds in excess of 250 knots indicated airspeed (KIAS) (P/CG 2010). MTRs are developed in accordance with criteria specified in FAA Order 7610.4 (DoD 2009). They are described by a centerline, with defined horizontal limits on either side of the centerline, and vertical limits expressed as minimum and maximum altitudes along the flight track. MTRs are identified as Visual Routes (VR) or Instrument Routes (IR).

VRs are used by DoD and associated Reserve and Air Guard units for the purpose of conducting low-altitude navigation and tactical training under VFR below 10,000 feet MSL at airspeeds in excess of 250 KIAS (P/CG 2010). IRs are used by DoD, including associated Reserve and Air Guard units, for the purpose of conducting low-altitude navigation and tactical training in both IFR and VFR weather conditions below 10,000 feet MSL at airspeeds in excess of

250 KIAS (P/CG 2010). Although not directly involved with ATI, segments of ten MTRs pass through the airspace involved in ATI. Table 3.1-3 describes the ten MTRs, and Figures 2-8 and 2-9 show MTRs in the vicinity of the Gamecock MOAs and Bulldog MOAs, respectively.

Table 3.1-3. Description of MTRs Associated With Shaw ATI Airspace Proposals

MOA[1]	*MTR*	*Altitudes*		*Route Width*		*Hours of Operation*	
		Min	*Max*	*Min*	*Max*	*From*	*To*
G	IR-035	300 feet AGL[2]	4,000 feet MSL[3]	8 NM[4]	10 NM	6:00 a.m.	10:00 p.m.
G	IR-036	300 feet AGL	4,000 feet MSL	8 NM	10 NM	6:00 a.m.	10:00 p.m.
G	VR-087	100 feet AGL	8,000 feet MSL	16 NM	20 NM	Continuous	
G	VR-088	100 feet AGL	8,000 feet MSL	16 NM	20 NM	Continuous	
B	VR-094	100 feet AGL	3,000 feet MSL	20 NM	20 NM	Continuous	
G/B	VR-097	100 feet AGL	8,000 feet MSL	10 NM	20 NM	6:00 a.m.	Midnight
B	VR-1004	200 feet AGL	1,500 feet AGL	4 NM	10 NM	Continuous	
G	VR-1040	200 feet AGL	1,500 feet AGL	4 NM	6 NM	Continuous	
G/B	VR-1059	100 feet AGL	1,500 feet AGL	10 NM	20 NM	Continuous	

Notes: 1. G = Gamecock MOA, B = Bulldog MOA, G/B = Gamecock and Bulldog MOAs
2. AGL = Above Ground Level
3. MSL = Above Mean Sea Level
4. NM = Nautical Mile (1 NM is approximately 6,077 feet)

Source: DoD 2009.

There are 12 additional MTRs managed by the 20 FW. Six are IRs, five are VRs, and one is a Slow Route. These routes are all outside of the ROI associated with the Shaw ATI, are not related to ATI, and are not specifically addressed.

OTHER AVIATION AND AIRSPACE USE

Airspace around Shaw AFB has been designated as Class C airspace to support aviation operations at the Shaw airfield. This designation is consistent with the significant amount of IFR traffic associated with Shaw AFB. When not in active military use, civil aircraft can traverse the Poinsett ECR under ATC authorization. There is one private airport, Creech, located at the extreme northwest corner of R-6002.

JET ROUTES AND OTHER FEDERAL AIRWAYS

ATI does not propose changes in Jet Routes or other Federal Airways. There are five Jet Routes overlying the Bulldog B MOA. Jet Routes are established under Federal Aviation Regulation (FAR) Part 71 in Class A airspace to designate frequently-used routings. They extend from FL 180 to FL 450, inclusive. They have no specified width; widths vary depending on many aeronautical factors (FAA Order 7400.2E 2000). The routes are J-40, J-46, J-53, J-81, and J-85. One Federal Airway, V-70, transverses the southeastern portion of the Bulldog B MOA in a northeast–southwest direction.

Five Jet Routes overlie the Gamecock D MOA. These routes are J-55, J-79, J-121, J-165, and J-210. One Federal Airway, V-437, transverses the Gamecock D MOA in a north-northeast to south-southwest direction. Two Federal Airways, V-3 and V-157, traverse the proposed Gamecock F MOA in a northeast–southwest direction. Jet Routes J-207 and J-210 also transit this proposed airspace.

AVIATION FACILITIES UNDER THE MOAS

Table 3.1-4 provides details for the aviation facilities underlying the ATI associated airspace. Figure 3.1-1 locates these aviation facilities. Table 3.1-5 provides annual use of public airports under the airspace. Additional information on these airports can be found in Appendix K. The Bulldog MOAs overlie eastern Georgia. The coincident portions of the Bulldog A and B MOAs overlie four airports. Two are civil and two are private. One public airport, Wrens Memorial, is geographically situated north of Bulldog A/B, but the airspace supporting operations at the airport extends into the northern portion of the MOAs. The portion of the Bulldog B MOA extending to the south and east overlies six airports. Three are private and three are civil.

The Gamecock MOAs overlie eastern South Carolina. The Gamecock B, C, and D MOAs abut each other in an east-to-west direction. The Gamecock B MOA overlies one civil airport. The Gamecock C MOA overlies one civil and one private airport. The Gamecock D MOA overlies three airports. One is private and two are civil. One public airport, Lake City Evans, is geographically situated north of the Gamecock D MOA, but the airspace supporting the airport operations extends into the northern portion of the MOA. There is one private airport located in the proposed area for the new Gamecock E MOA. One private airport, Byrd, is geographically situated along the northern border of the proposed MOA.

Table 3.1-4. Aviation Facilities Associated with ATI Airspace

SUA	*Aviation Facilities[1]*	*Type*	*Location Within SUA*
Bulldog A/B	Kaolin (1)	Public	Western Border
	Louisville (2)	Public	Central
	Paces South (3)	Private	South-Central
	Wrens Memorial (4)	Public	North of Northern Border
Bulldog B	Burke County (5)	Public	Eastern Border
	Darla (6)	Private	Western Portion
	Emanuel County (7)	Public	Southern Border
	Hacienda De Gay (8)	Private	Southeastern Portion
	Millen (9)	Public	Eastern Border
Gamecock B	Robert F. Swinnie (10)	Public	Southwest Border
Gamecock C	Hemingway-Stukey (11)	Public	North Central
Gamecock D	Lake City Evans (12)	Public	North of Northern Border
	Williamsburg County (13)	Public	Central Portion
	Pocotaligo (14)	Private	Western Border
	Santee Cooper Regional (15)	Public	Southwestern Border
Proposed Gamecock E	Byrd (16)	Private	North of Northern Border
	Palmetto (17)	Private	Southeastern Portion

Note: 1. The number corresponds with Figure 3.1-1.
SUA = Special Use Airspace

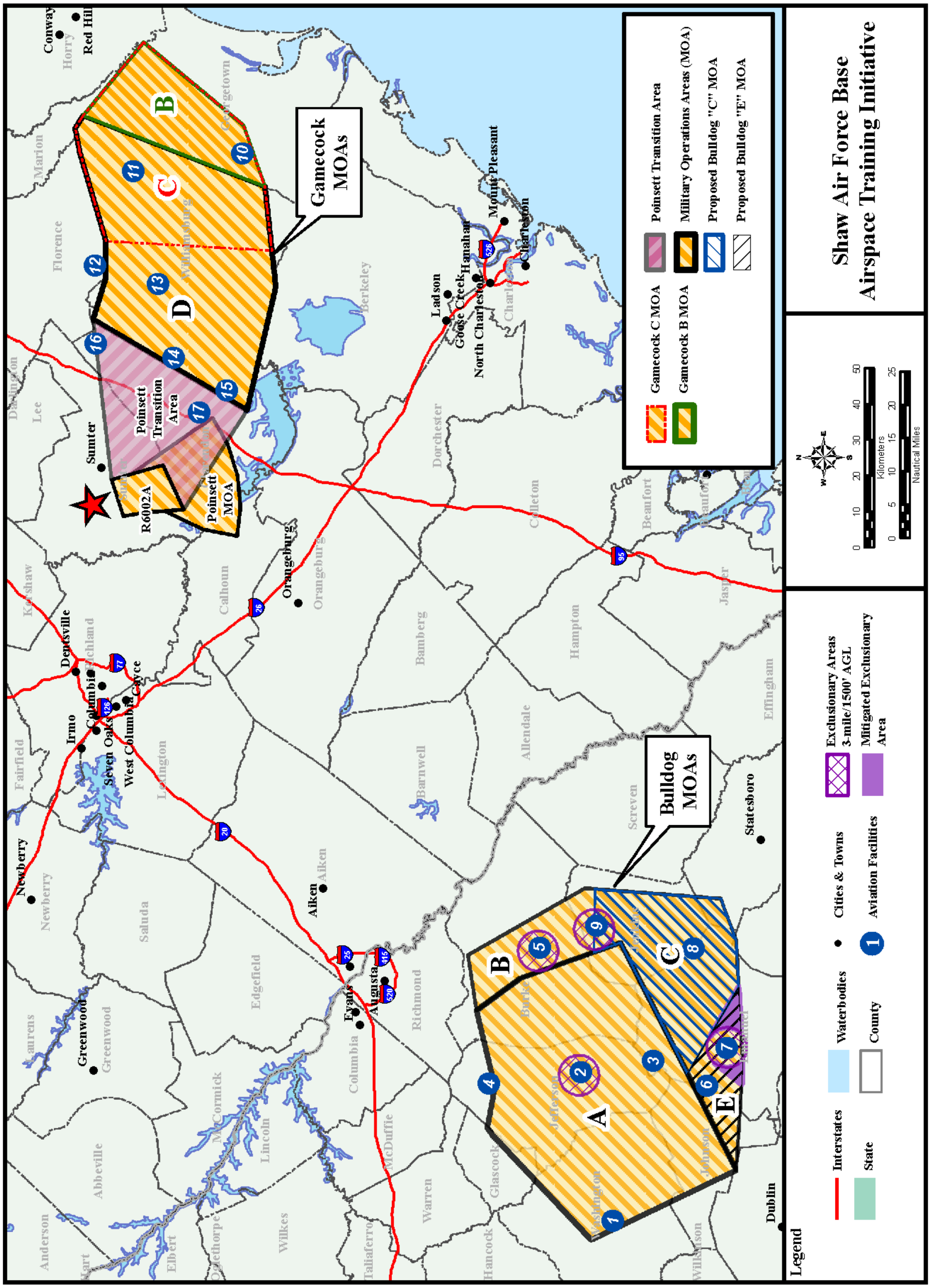


Figure 3.1-1. Aviation Facilities In or Adjacent to ATI Airspace

Table 3.1-5. Annual Use of Public Airports Under the Airspace

Facility Locator[1]	*Aviation Facility*	*Average Operations*[2]
1	Kaolin	28 per day
2	Louisville	134 per week
3	Paces South	Private
4	Wrens Memorial	38 per week
5	Burke County	57 per week
6	Darla	Private
7	Emanuel County	92 per week
8	Hacienda De Gay	Private
9	Millen	48 per week
10	Robert F. Swinnie	83 per month
11	Hemingway-Stukey	25 per month
12	Lake City Evans	59 per week
13	Williamsburg County	115 per week
14	Pocotaligo	Private
15	Santee Cooper Regional	48 per day
16	Byrd	Private
17	Palmetto	Private

Note: 1. This number corresponds with Figure 3.1-1.
2. Use for public airports retrieved from http://www.airnav.com/airports, February 2010; at private airports, use is unknown.

During public hearings, concerns were raised about potential constraints to expansion of activities at regional and county airports, especially potential consequences of the proposed airspace changes to an airport's ability to install an Instrument Landing System (ILS). An ILS is a precision instrument approach system that normally consists of the following electronic components and visual aids:

- A **Localizer**, which provides course guidance to the runway.
- A designated **Glide Slope**, which provides vertical guidance during approach and landing.
- An **Outer Marker**, which is a marker beacon at or near the glide slope intercept altitude of the published ILS approach. This is normally 4 to 7 miles from the runway threshold, along the runway's extended centerline.
- A **Middle Marker**, which is a marker beacon along the glide slope at or near the point of decision height.
- **Approach Lighting** conforming to FAA standards (P/CG 2010).

If additional airports situated in the Bulldog and Gamecock complexes desired to add ILS systems, the airport authority would be required to seek FAA approval for system installation. The airport would be required to meet all of the requirements stipulated in FAA Advisory Circular 150/5300-13 (DOT FAA 2002). After review by the FAA, and if approval were granted, the FAA would coordinate with the airport authority in developing instrument approach procedures. Once ILS procedures were developed and approved by the FAA, if any potential conflict between civil and military operations were indicated, these conflicts would be resolved through LOAs between the military and the applicable ARTCC. Provisions must be made to enable aerial access to private and public use land beneath the area, and for terminal VFR and IFR flight operations. Provisions must also be made to accommodate instrument arrivals/departures at affected airports with minimum delay. The MOA shall exclude the airspace 1,500 feet above ground level (AGL) and below within a 3 NM radius of airports available for public use. This exclusion may be increased, if necessary, based on unique circumstances (DOT FAA 2008). Basically, this means that the military is required to ensure that operations in MOAs do not prohibit access to IFR arrival traffic; therefore, MOA activity may not interfere with an airport's ILS, or IFR traffic using an ILS. Participants at public hearings on the Draft EIS gave specific examples when communication about current military training activity in the Bulldog MOAs interfered with IFR traffic.

Other aviation concerns were aspects expressed during public review regarding emergency medical flights conducted by helicopters to area hospitals (life-flights). There are four hospitals in the ROI equipped with helipads. These are Burke County Hospital, Clarendon Memorial Hospital, Emanuel County Hospital, and Memorial Hospital of Washington County. When notified of the occurrence of a life-flight, Air Traffic Controllers will deconflict other aircraft that may interfere with the helicopter's route and provide priority to the life-flight.

RANGE MANAGEMENT

ATI proposes no change to the Poinsett ECR. Poinsett ECR is a Class A Range. Class A ranges are manned, have a ground-based scoring capability, and a Range Control Officer (RCO) who controls aircraft using the range (Air Force 2007a). Overall responsibility for the operation of Poinsett ECR rests with the Commander of the 20 FW, Shaw AFB, South Carolina. The Operations Group Commander of the 20 FW exercises operational control of the range (Shaw AFB 2000).

Range managers are required to assess risks associated with weapons employment and establish mission parameters that minimize potential safety hazards. Specific weapon safety footprints (which include both ordnance delivery and laser use) must be assessed against each intended target to ensure that they can be safely employed (Air Force 2001d). These assessments have been accomplished by 20 FW staff, and allowable ordnance delivery profiles have been documented in applicable unit supplements to AFI 13-212 (Shaw AFB 2000).

Range operations require that the surface area encompassing the weapon safety footprints (as defined by analysis utilizing Weapons Danger Zone Tool-previously the SAFE-RANGE tool) be protected by purchase, lease, or other restriction to ensure the safety of personnel, structures, and the public from expended rockets, missiles, or target debris (Air Force 2007a). The land associated with the Poinsett Complex meets these requirements.

The Shaw AFB Supplement to AFI 13-212 also assigns responsibilities and provides direction regarding range scheduling, maintenance, explosive ordnance disposal, and range decontamination and debris disposal.

3.1.3 Environmental Consequences – Airspace Management and Air Traffic Control

3.1.3.1 MITIGATED PROPOSED ACTION

GAMECOCK AND POINSETT MOAS

Under the Mitigated Proposed Action, no changes are proposed to the Gamecock or Poinsett MOAs. By LOA between the Air Force and FAA, a PTA is designed to allow F-16s from the 20 FW and 169 FW to transit, in a tactical manner, from Gamecock D MOA to R-6002C, and return to Gamecock D MOA. The PTA is for the sole use of Shaw AFB and McEntire ANGS-based jets. This is transition airspace only and is not used as a MOA. The PTA is normally assigned an altitude of FL180 or above, but below FL220. When that block is unavailable, ATC shall assign whatever altitude(s) are available.

Existing levels of military and civil aviation flight activities within the Gamecock MOAs are not expected to change under the Mitigated Proposed Action. Federal Airways IR-36, VR-1059, and VR-1040 traverse the existing Gamecock MOA. Since there are no changes to the airspace within the Gamecock MOAs and PTA, existing conditions would remain and no additional impacts to air traffic and airspace utilization in the Gamecock and Poinsett MOAs are anticipated under the Mitigated Proposed Action. No impacts to existing Commercial Aircraft Routes (Victor Routes) and MTRs are anticipated since no new airspace is proposed and an existing LOA is in place covering operations within the PTA and addresses concerns regarding impacts to civil aviation raised during public meetings. There are six civilian airports under the existing airspace. Current exclusionary areas would remain around the public airports.

Life-flights to regional hospitals would continue to be given precedence by Air Traffic Controllers, and would be expected to remain unimpeded within the existing airspace.

BULLDOG MOAS

The Mitigated Proposed Action would create new Bulldog C and Bulldog E MOAs under Bulldog B ATCAA and adjacent to Bulldog A MOA extending from 500 feet AGL to 10,000 feet MSL.

Deconfliction of military and civil traffic in Bulldog C and E MOAs would be managed as under current conditions in Bulldog A. The FAA Atlanta ARTCC would have the authority to manage the airspace and control civilian air traffic into and out of the Emanuel County and Millen Airports. The FAA Atlanta ARTCC would also have the authority to temporarily raise the floors of the proposed Bulldog C and E MOAs when they are active to allow civilian aircraft clearance to transit the airspace. The likely number of aircraft requiring ATC from FAA is within their ability to deconflict in the changed airspace.

Most conflicts with Military Training Routes (MTRs), Federal Airways, Jet Routes, and private airports would be avoided because the altitudes at which these routes are established are either above or below the airspace in the Mitigated Proposed Action or alternatives. In cases where these routes intersect with the proposed airspace and alternative airspace, deconfliction would be managed as it is for current conditions.

Public airports within the proposed Bulldog C and E MOAs would have minimum exclusionary areas of 3 NM and 1,500 feet AGL. In addition, the proposed Bulldog E MOA has a larger exclusionary area designated around the Emanuel County and Augusta Regional Airports in response to concerns about interference with airport operations.

Life-flights to regional hospitals would be given precedence by ATC, and would be expected to remain unimpeded by changes to military training airspace.

The creation of Bulldog C and E MOAs are limited in scale as compared to Alternatives A and B and is designed to address concerns of airspace access to civilian air traffic. Therefore, no impacts to air traffic and airspace utilization are anticipated.

> ***Public Question:*** *How will civil aircraft traffic traverse the proposed airspace?*
>
> ***Answer:*** *VFR traffic will use see-and-avoid and IFR traffic will be under ATC. In addition, as a direct result of civilian pilots and others comments during scoping, the Air Force has developed alternatives that change airspace dimensions and/or create MOA segments that could be managed to support civil aviation traversing the proposed airspace modifications.*

CHAFF AND FLARES

The 20 FW proposes to include the use of chaff and flares (which are currently employed in the existing airspace) into the Bulldog C and E training airspace. These defensive countermeasures would continue to be employed in accordance with current Shaw AFB regulations. Flare use has no impact on airspace management issues. The chaff dispensed in response to air or ground-based threats does not interfere with FAA radar. Coordination between the 20 FW and FAA would let the ARTCC know that military aircraft were training in the airspace. Communication and the use of RR-188 chaff would result in no projected airspace management impacts from expanded training chaff use.

3.1.3.2 ALTERNATIVE A

GAMECOCK AND POINSETT MOAS

Under Alternative A, a new MOA/ATCAA would be created to link the existing Gamecock MOA complex with Poinsett ECR (R-6002). This proposed Gamecock E MOA/ATCAA would join the western boundary of the existing Gamecock D MOA/ATCAA with the restricted airspace supporting Poinsett ECR (see Figure 2-3). Gamecock E MOA/ATCAA would extend from 8,000 feet MSL to FL 220 (approximately 22,000 feet MSL).

Five MTRs pass through the area underlying the proposed Gamecock E MOA. However, the ceilings of all are at or below the floor of the MOA. Therefore, no adverse interaction between these elements of military training airspace would be anticipated.

One private airport, Palmetto, underlies the southeastern portion of the proposed MOA. The proposed MOA altitude structure, with a floor of 8,000 feet MSL, is expected to be well above any potential conflicts with the Palmetto Airport.

Two Federal Airways, V-3 and V157, also transverse this region. The floor of the proposed MOA is 8,000 feet MSL and the minimum en route altitude of each of the airways is 2,000 feet MSL. The 6,000-foot difference between each airway floor and the floor of the proposed MOA is expected to be sufficient to avoid conflicting use of the airspace (Digital Aeronautical Flight Information Files [DAFIF] 2008). Civil VFR traffic could fly unimpeded under the floor of the MOA although flights would be at lower altitudes that civil pilots have noted are not as smooth or as efficient as higher altitudes.

Two high-altitude jet routes overlie the proposed Gamecock E MOA airspace. J-207, which has assigned altitudes extending from FL 240 to FL 450, is above the proposed ceiling of FL 220 for the Gamecock E MOA/ATCAA. This would ensure adequate vertical separation between military and civil traffic (DAFIF 2008). Route J-210, with an altitude range of FL 180 to FL 450, does intersect with the proposed Gamecock E MOA/ATCAA airspace (DAFIF 2008). Airspace managers at the 20 FW have discussed these issues with FAA staff at Jacksonville ARTCC. LOAs between the Air Force and the FAA are proposed to coordinate and document processes and procedures to deconflict the airspace, minimize impacts to civil traffic, and manage the military's use of the Gamecock D and E MOA/ATCAAs (personal communication, Byers 2005).

> ***Public Question:*** *How can medical flights transverse the proposed airspace changes?*
>
> ***Answer:*** *The policy is that life-flight and other emergency flights have precedence traversing the airspace. This policy would apply to any proposed airspace changes.*

In addition to creating the Gamecock E MOA, in areas where it does not overlap with Gamecock C MOA, the floor of Gamecock D MOA would be lowered from 10,000 feet MSL to 5,000 feet MSL. One Federal Airway, V-437, transverses the expanded Gamecock D region. The floor of the proposed MOA is 5,000 feet MSL, and the minimum en route altitude of the airway is 4,000 feet. The floor could require civil VFR traffic to fly low in order to fly unimpeded under the floor of the MOA (DAFIF 2008). Although no conflicting use of the airspace would be expected, some civil aircraft pilots would be expected to be concerned that the floor concentrates civil traffic and requires them to fly at too low or at inefficient altitudes.

As previously discussed, life-flights to regional hospitals would be given precedence by Air Traffic Controllers, and would be expected to remain unimpeded by proposed changes to improve military training airspace.

Table 3.1-6 summarizes data used to assess the potential interaction between military and civil traffic in the areas encompassed by the Gamecock D and Gamecock E MOAs. These data on the use of this airspace by IFR traffic were collected from Jacksonville ARTCC and reflect the number of aircraft (sortie-operations) transiting the airspace. Daily data were provided for October 1, 2004 through October 31, 2004. Traffic in the 5,000 feet MSL to 12,000 feet MSL altitude regime was provided for the Gamecock D area. Traffic from 8,000 feet MSL to FL 220 was provided for the Gamecock E area.

Table 3.1-6. Synopsis of Current Traffic in the Area of the Expanded Gamecock D and E (October 2004)

GAMECOCK D					
	Air Carrier	*Air Taxi*	*General Aviation*	*Military*	*Total*
Average Daily Total	7.2	21.5	11.1	2.8	42.6
Percent of Daily Total	16.9%	50.4%	26.1%	6.6%	100%
Maximum Daily Use[1]	17	36	22	7	59
Minimum Daily Use[1]	3	12	2	0	31
GAMECOCK E					
Average Daily Total	29.3	28.0	22.3	4.4	84.0
Percent of Daily Total	34.9%	33.3%	26.6%	5.2%	100%
Maximum Daily Use[1]	44	38	38	11	101
Minimum Daily Use[1]	19	19	9	0	70

Note: 1. Numbers of individual aircraft types and total operations reflect a range of values over a 31 day period. Therefore, the totals are not the sum of individual aircraft types.
Source: Personal communication, Wiseman 2004

As shown in both the proposed areas for Gamecock D and Gamecock E, military operations constitute a relatively small percentage of total operations (6.6 and 5.2 percent respectively). In the Gamecock D region, Air Taxi operations are dominant, whereas in the Gamecock E region, Air Carrier, Air Taxi, and General Aviation operations are relatively equally distributed. Current daily average military operations through the Gamecock E proposed airspace area are approximately twice the average military operations in the Gamecock D region. The funneling effect of the new airspace to civil aviation was a concern expressed during the public meetings. These data suggest that the lowered floor of Gamecock D could especially affect Air Taxi traffic by requiring those aircraft to await ATC clearance, fly below 5,000 feet MSL or, in rare instances if flying VFR, use see-and-avoid procedures to traverse the MOA.

Although Table 3.1-6 is not wholly indicative of ATC workload, if these current activities are averaged over a 24-hour period, ATC services in the Gamecock D area would be required from approximately 2.5 to 1.3 times per hour. In the Gamecock E area, service demands would range from 4.2 to 2.9 times per hour. If it were assumed that all operations occurred during an 8-hour period, demands would range from 7.4 to 3.9 times per hour in the Gamecock D region and from 12.6 to 8.7 times per hour in the Gamecock E region. Planned coordination between the FAA and the 20 FW is expected to deconflict this airspace. The Air Force believes the projected number of aircraft requiring ATC service from FAA controllers and Air Force supporting controllers is within their ability to deconflict in the Gamecock D and Gamecock E regions.
The 20 FW also proposes to combine and use Gamecock C and D MOAs concurrently and simultaneously to develop a cohesive and contiguous block of airspace to better support training requirements. Release of Gamecock B (noted below) and ATC in Gamecock E provide alternative routing and scheduling options. These actions combined with continued close coordination with the FAA should minimize any potential airspace utilization impacts associated with training periods that use the combined Gamecock C and D MOAs.

Based on these comprehensive proposals to modify the Gamecock MOA complex to enhance training capability, the 20 FW has determined that the Gamecock B MOA would no longer be required. Therefore, if Alternative A is approved, the Gamecock B MOA would be relinquished and returned to the NAS to support civil aviation to the east of the reconfigured Gamecock MOA complex.

The 20 FW's agreement to not schedule the Poinsett MOA and the proposed Gamecock E MOA simultaneously would support the transit of civil traffic through this region. This scheduling would permit civil aviation to transit the region at altitudes that avoid military training aircraft.

BULLDOG MOAS

The 20 FW proposes to reconfigure the Bulldog A MOA by expanding it to the east to make it conform with the Bulldog B MOA. The existing and expanded Bulldog A floor would be 500 feet AGL. This would create approximately 830 square miles of new low-altitude airspace in the region.

Military aircraft currently traverse much of the area at low altitudes. Four MTRs (VR-094, VR-097, VR-1004, and VR-1059) pass through the expanded low-altitude airspace. The published floor of these MTRs is 100 feet AGL. VR-097, VR-1004, and VR-1059 pass through the current Bulldog A. One Federal Airway, V-70, passes through the expanded low-altitude airspace. This route is published with an altitude structure from 3,000 to 17,999 feet. Deconfliction of military and civil traffic in the added low-altitude regime would be provided by Atlanta ARTCC, the controlling agency for Bulldog MOA.

As previously discussed for Gamecock, life-flights to regional hospitals within the Bulldog MOAs would be given precedence by Air Traffic Controllers and would be expected to remain unimpeded by any changes to military training airspace.

Two high-altitude Jet Routes overfly the Bulldog MOA/ATCAA complex. These routes extend from FL 180 to FL 450. Existing conditions in the high-altitude regime are not proposed to be changed as part of ATI. Military and civil operations would continue as under existing conditions and there would be no ATI impact expected to these routes.

There are six public airports underlying the Bulldog MOAs. The FAA designates a 3-NM circle extending to 1,500 feet AGL around a potentially affected facility. Three of the existing public airports are within Bulldog A airspace with a training floor of 500 feet AGL. These three airports currently have a 3-NM by 1,500-foot AGL exclusionary area charted within the airspace. These exclusionary areas separate civil aviation from military training aircraft without requiring see-and-avoid procedures. The three public airports under the expanded Bulldog A airspace would be designated as exclusionary areas and the exclusionary areas would be charted on aviation maps. Concerns were expressed at scoping that the 1,500-foot AGL exclusionary area could constrain civil aviation flights and detrimentally affect economic development at specific airports. Sections 3.8 and 3.9 address land use and socioeconomics under the Bulldog MOAs.

Total military training activity within the Bulldog MOAs is not projected to change with the Mitigated Proposed Action or the alternatives. Some redistribution of training operations would occur within the Bulldog MOA airspaces. Table 3.1-7 summarizes data used to assess the potential interaction between military and civil traffic in the areas encompassed by the Bulldog MOAs. Atlanta ARTCC data from June 1 through June 30, 2005 include altitudes ranging from the surface to FL 270 and information on dates of flight and aircraft designations. Aircraft are grouped by daily operations and are identified as commercial traffic (Air Carrier/Air Taxi, general aviation traffic, and military traffic. These data are summarized in Table 3.1-7.

Table 3.1-7. Synopsis of Traffic in Area of Bulldog MOAs (June 2005)

BULLDOG A/B					
	Air Carrier	*Air Taxi*	*General Aviation*	*Military*	*Total*
Average Daily Total	158.8	139.9	121.7	12.3	423.7
Percent of Daily Total	36.7%	32.3%	28.1%	2.9%	100%
Maximum Daily Use[1]	194	169	170	20	553
Minimum Daily Use[1]	114	108	78	2	302

Note: 1. Number of individual aircraft types and total operations reflect a range of values over a 30 day period. Therefore, the totals are not the sum of individual aircraft types.
Source: Personal communication, Byers 2005.

As shown in Table 3.1-7, military operations constitute less than 3 percent of overall traffic. Air Carrier/Air Taxi operations are relatively equally distributed, with Air Carrier operations being somewhat dominant. General aviation traffic operations are generally less than Air Taxi operations.

Existing levels of military and civil aviation flight activities within the Bulldog MOAs are not expected to change under the Mitigated Proposed Action or any alternative. Although not wholly indicative of ATC workload, these current activities, averaged over a 24-hour period, would require ATC services in the Bulldog MOAs from approximately 23.0 to 12.6 times per hour. If these current activities were assumed to occur within an 8-hour period, demands could range from 69.0 to 37.8 times per hour. Coordination between the FAA and the 20 FW would be expected to continue to deconflict this airspace use, and excessive demands on the ATC system would not be expected.

CHAFF AND FLARES

The 20 FW proposes to include the use of chaff and flares in the new and modified training airspace. These defensive countermeasures would continue to be employed in accordance with current Shaw AFB regulations. Flare use has no impact on airspace management issues. The chaff dispensed in the existing Shaw AFB airspace in response to air or ground-based threats does not interfere with FAA radar. Coordination between the 20 FW and FAA would let the ARTCC know that military aircraft were training in the airspace. Communication and the use of RR-188 chaff would result in no projected airspace management impacts from expanded chaff use.

GROUND ACTIVITIES

The use of training transmitter sites would not impact civil air traffic or the ATC system. Training transmitters transmit at a specific frequency to simulate a threat. Civil air traffic would only detect the threat if the aircraft receiver were tuned to the emitter frequency.

There are no aspects of Alternative A involving any changes or modification to Poinsett ECR ground activities. Range management would continue as under current conditions. Flight patterns into the Restricted Area could change with the new airspace, but this would not affect the management of Poinsett ECR. If any special operating procedures would be required as a result of implementing any aspects of Alternative A, detailed guidance would be developed and documented in applicable unit supplements to AFI 13-212.

3.1.3.3 ALTERNATIVE B

GAMECOCK AND POINSETT MOAS

Under Alternative B, a new MOA/ATCAA (Gamecock E) would be created to link the existing Gamecock MOA complex with Poinsett ECR. This MOA would join the western boundary of the existing Gamecock D MOA/ATCAA with R-6002. The proposed Gamecock E MOA would be divided into a low and high component. Gamecock E Low MOA would extend from 8,000 feet MSL to 13,999 feet MSL. Gamecock E High MOA/ATCAA would extend from 14,000 feet MSL to FL 220.

This stratification of the MOA affords SUA access to R-6002 and provides some airspace scheduling flexibility. The total structure of the airspace is essentially the same as Alternative A. Therefore, the previous discussion pertaining to MTRs, airports, Federal Airways, and Jet Routes in the region is also applicable to Alternative B. Airspace management requirements would be slightly reduced from those of Alternative A due to the improved scheduling flexibility for civil and military aircraft deconfliction. Minimal impacts to civil aviation traversing the proposed Gamecock E corridor would result from the implementation of Alternative B.

Alternative B proposes lowering the floor of the Gamecock D MOA from 10,000 feet MSL to 8,000 feet MSL in those areas where Gamecock D does not overlie Gamecock C. Alternative B creates additional low-altitude airspace down to 8,000 feet MSL, as opposed to the 5,000 feet MSL under Alternative A. This would reduce the funneling effect identified as a concern with Alternative A by pilots during scoping. Potential airspace management requirements to deconflict civil aircraft users of the airspace would be less than under Alternative A.

The proposal to combine and use Gamecock C and Gamecock D MOAs concurrently and simultaneously would be expected to require scheduling and coordination with the FAA as would be the case for Alternative A. The extent of scheduling would be reduced because of the additional altitude for civil aviation use when the MOAs were activated. Alternative B would have fewer potential airspace utilization impacts associated with training periods.

Under Alternative B, the Gamecock B MOA would be retained as SUA and its limited use would continue as under current conditions. There would be no impact associated with this continued use.

Alternative B also proposes to raise the ceiling of the Poinsett MOA from 2,500 feet MSL to 5,000 feet MSL. The effects of this change would be the same as discussed under Alternative A. The 20 FW's agreement to not schedule the Poinsett MOA and the proposed Gamecock E MOAs simultaneously, combined with dual scheduling possible for Gamecock E High and Low, would support the transit of civil traffic through this region.

BULLDOG MOAS

Alternative B proposes restructuring the boundaries of the Bulldog MOAs. The Bulldog A and B MOAs would still abut vertically, but the ceiling of Bulldog A and the floor of Bulldog B, respectively, would join at 3,000 feet MSL. This creates additional low-altitude airspace (from 10,000 feet MSL decreasing to 3,000 feet MSL) in the area where the Bulldog B MOA does not overlie the Bulldog A MOA.

The proposed floor of the Bulldog B MOA would be above the ceiling of the four MTRs that pass through the region. Therefore, this aspect of the proposal has no impact on other military training airspace in the area. One Federal Airway, V-70, passes through the Bulldog B MOA where the floor would be lowered to 3,000 feet MSL. Since the minimum en route altitude along this segment of the route is 3,000 feet MSL, deconfliction would be required. Normal ATC procedures could be used to separate military and civil air traffic. The proposed modification to the altitude structure of the Bulldog MOAs is not anticipated to impact other aviation facilities in the region.

Airspace issues and considerations identified for Alternative A also apply to Alternative B. There would be no need to establish 3-NM by 1,500-foot AGL exclusionary areas around airports in the area of airspace expansion because the floor of the airspace at 3,000 feet MSL would be approximately 2,500 feet AGL. Procedures would be established in existing LOA between 20 FW and Atlanta Center to allow IFR aircraft to operate at these airports. Many of the public concerns about potential restrictions on airports associated with Alternative A would be reduced under Alternative B. The same coordination and management actions identified for Alternative A to minimize potentially adverse interactions between military and civil traffic would also be implemented under Alternative B.

CHAFF AND FLARES

The airspace consequences of chaff and flare use under Alternative B would be comparable to those described under the Mitigated Proposed Action and Alternative A.

GROUND ACTIVITIES

There are no aspects of Alternative B that involve any changes or modification to Poinsett ECR. Range management would continue as under current conditions with any required detailed guidance developed and documented in supplements to AFI 13-212. The development and use of new electronic training sites would be the same as under the Mitigated Proposed Action and Alternative A.

3.1.3.4 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, 20 FW, 169 FW, and other transient aircrews would continue to train as under current conditions. No airspace modifications or expansion of SUA would occur. The training inefficiencies resulting from the segmented configuration of the existing airspace would continue. Chaff and flare use, presently authorized in the existing airspace, would continue.

Airspace use and management would remain unchanged from current conditions and scheduling issues associated with the joint military-civil use of the airspace in its current configuration would continue.

3.2 NOISE

3.2.1 Introduction

Noise is considered to be unwanted sound that interferes with normal activities or otherwise diminishes the quality of the environment. It may be intermittent or continuous, steady or impulsive. It may be stationary or transient. Stationary sources are normally related to specific land uses (e.g., housing tracts or industrial plants). Transient noise sources move through the environment, either along established paths (e.g., highways, railroads, and MTRs), or randomly (e.g., an aircraft flying in a block of airspace such as a Restricted Area or a MOA). There is wide diversity in responses to noise that not only vary according to the type of noise and the characteristics of the sound source, but also according to the sensitivity and expectations of the receptor, the time of day, and the distance between the noise source (e.g., an aircraft) and the receptor (e.g., a person or animal).

The physical characteristics of noise, or sound, include its intensity, frequency, and duration. Sound is created by acoustic energy, which produces minute pressure waves that travel through a medium, like air, and are sensed by the ear drum. This may be likened to the ripples in water that would be produced when a stone is dropped into it. As the acoustic energy increases, the intensity or amplitude of these pressure waves increase, and the ear senses louder noise. Sound intensity varies widely (from a soft whisper to a jet engine) and is measured on a logarithmic scale to accommodate this wide range. The logarithm, and its use, is nothing more than a mathematical tool that simplifies dealing with very large and very small numbers. For example, the logarithm of the number 1,000,000 is 6, and the logarithm of the number 0.000001 is -6 (minus 6). As more zeros are added before or after the decimal point, converting these numbers to their logarithms greatly simplifies calculations that use these numbers.

The frequency of sound is measured in cycles per second, or hertz (Hz). This measurement reflects the number of times per second the air vibrates from the acoustic energy. Low frequency sounds are heard as rumbles or roars, and high frequency sounds are heard as screeches. Sound measurement is further refined through the use of "A-weighting." The normal human ear can detect sounds that range in frequency from about 20 Hz to 15,000 Hz. However, all sounds throughout this range are not heard equally well. Therefore, through internal electronic circuitry, some sound meters are calibrated to emphasize frequencies in the 1,000 to 4,000 Hz range. The human ear is most sensitive to frequencies in this range, and sounds measured with these instruments are termed A-weighted, and are shown in terms of A-weighted decibels (dBA).

The duration of a noise event and the number of times noise events occur are also important considerations in explaining noise metrics. The word "metric" is used to describe a standard of measurement. As used in environmental noise analysis, there are many different types of noise metrics. Each metric has a different physical meaning or interpretation and each was developed by researchers attempting to represent the effects of environmental noise.

The three metrics supporting the assessment of noise from aircraft operations associated with ATI are the maximum sound level (L_{max}), the Sound Exposure Level (SEL), and Day-Night Average Sound Levels (DNL). Each metric for quantifying the noise environment is briefly discussed below.

MAXIMUM SOUND LEVEL

The L_{max} metric is used to define peak sound levels. L_{max} is the highest sound level measured during a single noise event (e.g., an aircraft overflight), and is the sound actually heard by a person on the ground. For an observer, the noise level starts at the ambient noise level, rises up to the maximum level as the aircraft flies closest to the observer, and returns to the ambient level as the aircraft recedes into the distance. L_{max} is important in judging the interference caused by a noise event with conversation, sleep, or other common activities.

Table 3.2-1 shows L_{max} values at various distances from the most common aircraft types operating in the Gamecock, Poinsett, and Bulldog MOAs, and the associated MTRs.

Table 3.2-1. Representative Maximum Sound Levels (L_{max})

Aircraft	*Power*	*Airspeed (knots)*	L_{MAX} VALUES (dBA) AT VARYING DISTANCES FROM AIRCRAFT (IN FEET)				
			500	***1,000***	***2,000***	***5,000***	***10,000***
F-16[1]	94% NC	465	99	92	83	70	58
F-16[2]	95.4% NC	500	104	97	89	76	64
F-15[1]	77% NC	450	108	101	93	79	66
F-15[2]	81% NC	520	114	107	98	86	73
F-18[3]	92% NC	500	115	108	99	85	71
AV-8B[3]	95% RPM	300	109	101	93	80	68
A-10[3]	5333 NF	325	94	87	78	65	54

Notes: 1. Reflects average power settings used in MOAs.
2. Reflects average power settings used in MTRs.
3. Reflects average power settings used in MOAs and MTRs.

L_{max} = maximum sound level; dBA = A-weighted decibel; NC = Core Engine Fan Speed; RPM = Revolutions Per Minute; NF = Fan Speed

Source: OMEGA108R 2004.

SOUND EXPOSURE LEVEL

The SEL metric combines the L_{max} with the length of time that the noise persists. SEL does not directly represent the sound level heard at any given time, but rather provides a measure of the total exposure of the entire event. The SEL value represents all of the acoustic energy associated with the event, as though it was present for one second. Therefore, for sound events that last longer than one second, the SEL value will be higher than the L_{max} value. The SEL value is important because it is the value used to calculate other time-averaged noise metrics. Table 3.2-2 shows SEL values corresponding to the aircraft and power settings reflected in Table 3.2-1. As a point of comparison, it may be noted that normal human speech, at a distance of 3 feet, has an SEL noise level of approximately 60 to 63 dBA.

Table 3.2-2. Representative Sound Exposure Levels (SEL) Under the Flight Track for Various Aircraft and Flight Altitudes

Aircraft	*Power*	*Airspeed (knots)*	**SEL VALUES (dBA) AT VARYING DISTANCES FROM AIRCRAFT (IN FEET)**				
			500	***1,000***	***2,000***	***5,000***	***10,000***
F-16[1]	94% NC	465	99	93	87	76	66
F-16[2]	95.4% NC	500	103	98	91	81	70
F-15[1]	77% NC	450	108	102	96	85	74
F-15[2]	81% NC	520	112	107	101	90	80
F-18[3]	92% NC	500	114	108	101	89	77
AV-8B[3]	95% RPM	300	111	105	99	88	78
A-10[3]	5333 NF	325	95	89	82	72	63

Notes: 1. Reflects average power settings used in MOAs.
2. Reflects average power settings used in MTRs.
3. Reflects average power settings used in MOAs and MTRs.

SEL = sound exposure level; dBA = A-weighted decibel; NC = Core Engine Fan Speed; RPM = Revolutions Per Minute; NF = Fan Speed

Source: OMEGA108R 2004.

TIME-AVERAGED CUMULATIVE DAY-NIGHT AVERAGE NOISE METRICS

The number of times aircraft noise events occur during given periods is also an important consideration in assessing noise impacts. Two "cumulative" noise metrics support the analysis of multiple time-varying aircraft events. They are the DNL and the related Onset Rate-Adjusted Monthly Day-Night Average Sound Level (DNLmr).

DAY-NIGHT AVERAGE SOUND LEVEL

The DNL is commonly used to assess aircraft operations around an airport. The DNL provides a basis for the metrics that are used in assessing noise in this EIS. DNL sums the individual noise events and averages the resulting level over a 24-hour period. Thus, it is a composite metric representing the maximum noise levels, the duration of the events, the number of events that occur, and the time of day during which they occur. The DNL metric adds 10 decibels (dB) to those events that occur between 10:00 p.m. and 7:00 a.m. to account for the increased intrusiveness of noise events that occur at night when ambient noise levels are normally lower than during the day time. This cumulative metric provides an excellent measure for comparing environmental noise exposures when there are multiple noise events to be considered.

DNL metrics are the preferred noise metrics of the Department of Housing and Urban Development (HUD), the DOT, the FAA, the United States Environmental Protection Agency (USEPA), and the Veteran's Administration (VA). Ignoring the night and onset-rate penalties for the moment, DNL may be thought of as the continuous or cumulative A-weighted sound level that would be present if all of the variations in sound level that occur over the given period were smoothed out so as to contain the same total sound energy. While DNL does provide a single measure of overall noise impact, it is fully recognized that it does not provide specific information on the number of noise events or the specific individual sound levels that do occur. For example, a DNL of 65 dB could result from a very few noisy events, or a large number of quieter events. Although it does not represent the sound level heard at any one particular time, DNL does represent the total sound exposure. Scientific studies and social surveys have found the DNL to be the best measure to assess levels of community annoyance associated with all types of environmental noise. Therefore, its use is endorsed by the scientific community and governmental agencies (American National Standards Institute [ANSI] 1980, 1988; USEPA 1974; Federal Interagency Committee on Urban Noise [FICUN] 1980; Federal Interagency Committee on Noise [FICON] 1992).

ONSET RATE-ADJUSTED MONTHLY DAY-NIGHT AVERAGE SOUND LEVEL

The DNLmr metric is based upon the DNL metric and accounts for the random and often sporadic nature of military flight training activities in SUA. A specific computer program has been developed to calculate noise levels created by military training activities. Calculations account for the sudden onset of noise created by low altitude, high-speed flight of military aircraft by adding up to 11 dBA to the calculated noise levels. If the onset-rate penalty is not considered, calculations of DNLmr, arithmetically, will yield the same result as calculations of DNL, as long as the numbers of sound events, or aircraft operations considered, are the same.

Measured sound levels were used to develop computer programs such as MR_NMAP, to calculate noise levels resulting from aircraft operations. Sound levels calculated by these programs have been extensively validated against measured data, and have been demonstrated to be highly accurate. Additional technical information on the methodology and concept of noise measurement and modeling, as well as data on noise effects, can be found in Appendix H.

Ambient background noise is not reflected in aircraft noise calculations, for two reasons. First, ambient background noise varies widely, depending on location and other conditions. Since a few loud noise events at any location could result in overstating average noise levels, two additional metrics have been developed by the USEPA. These metrics consider the noise that is monitored and recorded, and the levels and frequency of noise events that exceed a given value. These metrics are useful in estimating "overall average" noise in a particular locale. The two metrics considered are the noise events that exceed a lower level 90 percent of the time (L_{90}) and the noise events that exceed a higher level 10 percent of the time (L_{10}). For example, using these metrics, ambient sound levels for a farm in a valley may range from 35 (L_{90}) to 44 (L_{10}) dB, and a small town cul-de-sac may range from 40 (L_{90}) to 50 (L_{10}) dB (USEPA 1971). Secondly, and probably most important, is that it is reasonable to assume that ambient background noise in the project's ROI would have little or no effect on the calculated DNL. In calculating noise levels, louder sounds dominate the calculations, and aircraft noise would be expected to be one of the louder sounds in the region.

3.2.1.1 METHODOLOGY

Noise levels are calculated using the Air Force's MR_NMAP (refer to Appendix I). MR_NMAP was described in Section 3.2.1 as specifically designed to assess military aircraft noise in MOAs, Restricted Airspace, and MTRs. Calculated noise values will also support analyses in other environmental resources such as biology and socioeconomics.

3.2.1.2 Issues and Concerns

During public hearings and through public comments, concerns were raised including noise generated from low-level military aircraft, noise pollution, and noise disturbances at night. Based on numerous sociological surveys and recommendations of federal interagency councils, the most common benchmark referred to is a DNL of 65 dBA. This value is often used to determine human annoyance and residential land use compatibility around airports, highways, or other transportation corridors. Additionally, a DNL of 55 dBA was identified by the USEPA as a level ". . . requisite to protect the public health and welfare with an adequate margin of safety" (USEPA 1974).

Public annoyance is the most common consequence associated with exposure to elevated noise levels. When subjected to DNL of 65 dBA, approximately 12 percent of persons exposed will be "highly annoyed" by the noise. At a DNL of 55 dBA, the percentage of annoyance is correspondingly lower, at approximately 3 percent. The percentage of people annoyed by noise never drops to zero (some people are always annoyed), but 55 dBA is a level that protects public health and welfare with an adequate margin of safety. Below 55 dB, adverse noise effects are usually not expected to occur (Finegold *et al*. 1994).

3.2.2 Existing Conditions – Noise

Pilots from the 20 FW, the 169 FW, and other DoD units conduct flight activities within the regional military training airspace. Therefore, the ROI for noise includes the land areas underlying the military training airspace associated with the 20 FW's proposals.

The military training airspace associated with ATI includes MOAs, MTRs, and Restricted Areas. In blocks of airspace such as MOAs and Restricted Areas, flight activities are intentionally random and dispersed, reflecting typical combat maneuvers. Over time, these random flight paths produce uniformly distributed sound levels throughout the MOA airspace. Sound levels in MOAs consider the aircraft speeds, altitudes, and engine power settings; overall size of the airspace; and the time spent in each airspace element.

MTR corridors currently exist in areas proposed for ATI. MTRs are described by a centerline with lateral extensions on either side of that centerline. Observed flight tracks in MTRs are dispersed on either side of the centerline in a manner that approximates a standard normal distribution based on the route width. This distributes the existing aircraft noise across the MTR.

MR_NMAP is specifically designed to consider the unique aspects of flight within military training airspace. The calculated uniform distributed sound levels in MOAs and the maximum noise levels along the center line of MTRs are shown in terms of DNLmr in Table 3.2-3. The DNLmr metric is used to recognize the onset-rate penalty of high speed military aircraft. The Bulldog A and B MOAs may be scheduled individually or combined. Sortie operations were distributed to Bulldog A and Bulldog B MOAs based on the percentage of total training time spent in each altitude band (see Table 2-7).

Table 3.2-3 presents the existing sound levels under the respective MOAs in dB DNLmr. Several of the MOAs and MTRs used by the 20 FW overlie, or are close to, land areas identified for avoidance of direct, low-altitude aircraft overflight. These avoidance areas are typically a 3-NM 1,500-foot-high exclusionary area that avoids uses considered sensitive to the intrusive effects of loud and sudden noise or where other aviation activities occur. Table 3.2-3 also reflects the calculated range of noise levels in areas designated for avoidance under each airspace. In all cases, calculated noise levels below 35 dBA are shown as less than 35 (<35).

Table 3.2-3. Calculated Noise Levels in Military Training Airspace Under Existing Conditions

MOA Airspace	*Sound Level (In dB DNLmr)*[1]	*Sound Level in dB DNLmr in Avoidance Areas*[2]
Bulldog B	<35	<35
Bulldog A/B	49	37-45
Gamecock B	<35	N/A[3]
Gamecock C	53	48
Gamecock D	<35	N/A
Poinsett	40	36
R-6002	59	N/A
IR-035	<35	<35
IR-036	<35	<35
IR-074	<35	<35
VR-087	45-46	<35
VR-088	44-45	36-44
VR-094	35	<35
VR-097	<35-40	<35-38
VR-1004	50-52	40-49
VR-1040	47	37-43
VR-1059	41-44	<35-42

Notes: 1. For MOAs, indicates uniformly distributed noise throughout the airspace; for MTRs indicates maximum noise level on route centerline. When applicable, a range of values reflects changes in the configuration of the route. MOAs denoted "A/B" indicate one MOA overlying another MOA; noise levels generated in the MOAs are additive.
2. The noise levels within an avoidance area depend on the location of the receiver and distance by which it is avoided.
3. N/A – Not Applicable. No avoidance areas identified.

MOA = Military Operations Area; dB = decibel; DNLmr = Onset Rate-Adjusted Monthly Day-Night Average Sound Level

Source: Refer to Appendix I.

The values presented in Table 3.2-3 reflect the mathematically calculated output of the MR_NMAP model that measures military aircraft noise. As noted above, background noise in rural areas can range from 35 to 44 dB. Any calculated value equal to, or less than 35 to 44 dBA essentially indicates that although aircraft may be seen or briefly heard, there is little or no observable noise contribution from aircraft in the region. These calculated noise levels represent the size of the airspace, the relatively limited number of operations, and the altitudes at which these operations are conducted.

Several MTRs associated with the airspace interact (cross or merge) with other MTRs or pass through MOAs. The MTRs and the crossing or merging are shown on Figures 2-8 and 2-9. The cumulative noise levels on the ground at the point of these interactions is the sum of all the noise produced by aircraft using the airspace. Table 3.2-4 reflects these combined levels for MTRs with the applicable route segment indicated by the two letter designation provided in the Flight Information Publication AP/1B, Military Training Routes (DoD 2009).

Table 3.2-4. Existing Cumulative Noise Levels

Airspace Involved	*Cumulative Noise (in dB DNLmr)*
IR-035 E-F + IR-036 F-G[1]	<35
IR-035 F-G + IR-036 G-H	<35
IR-035 C-D + VR-087 C-D	45
IR-035 C-D + VR-087 D-E	45
IR-035 D-E + VR-087 E-F	46
IR-036 E-F + VR-087 F-G	46
IR-036 B-C + VR-088 C-D	44
IR-036 C-D + VR-088 C-D	44
IR-036 C-D + VR-088 E-F	44
IR-036 G-H + VR-088 E-F	44
IR-036 F-G + VR-088 F-G	45
IR-074 F-G + VR-097 LL-M	38
VR-097 P-Q + VR-094 D-E	39
IR-074 G-H + Bulldog A/B	49
VR-097 LL-M + Bulldog A/B	50
VR-097 N-O + Bulldog A/B	50
VR-097 O-P + Bulldog A/B	50
IR-036 D-E + Gamecock D	<35
VR-1040 C-D + VR-1059 J-K	49
VR-1059 J-K + Gamecock C	54
VR-1040 D-E + Gamecock C	54
VR-1059 I-J + VR-1040 E-F	49
VR-1059 I-J + VR-1040 F-G	49
VR-1059 H-I + VR-1040 G-H	49
VR-1040 E-F + Gamecock D	47
VR-1059 I-J + Gamecock D	45
VR-1040 I-J + VR-1059 J-K	49
VR-087 E-F + VR-1059 J-K	48
VR-1040 C-D + Gamecock D	47
VR-1059 H-I + IR-036 D-E	44
VR-1059 E-F + Bulldog B	42
VR-1059 C-D + Bulldog A/B	50
VR-1040 G-H + IR-036-D-E	47
VR-1059 G-H + VR-1040 G-H	49

Note: 1. F-G and subsequent letters represent route segments
dB = decibel; DNLmr = Onset Rate-Adjusted Monthly Day-Night Average Sound Level
Source: Refer to Appendix I.

Noise sensitive avoidance areas proximate to the MTRs are identified for each MTR in the Flight Information Publication AP/1B (DoD 2009). Since the centerline of each MTR is often close to others, noise exposure at any given point on the ground may result from several routes. Using the calculations provided by MR_NMAP, the NMPLOT program provides an estimate of the total noise exposure at these points from all sources (Wasmer and Maunsell 2004). Table 3.2-5 identifies the range of existing cumulative noise exposure from each MTR. Noise exposure levels lower than 35 dB DNLmr are indicated as less than 35 (<35).

> ***Public Question:*** *How will increased noise affect quality of life and rural economic activity?*
>
> ***Answer:*** *Military aircraft would be detectable but would not be a major contributor to the ambient noise conditions under Gamecock E and D. Under the proposed Bulldog C or E or Alternative A extension of Bulldog A, average daily noise levels from military training aircraft would increase from 35 DNLmr to 50 DNLmr. This change could increase the number of highly annoyed people from 1 percent to 4 percent of the exposed population. Under Alternative B, average daily noise levels in the extension area would be 39 DNLmr. This change is not expected to increase the number of highly annoyed people. Changes in average daily noise levels are not expected to affect rural economic activity under the Mitigated Proposed Action or an alternative.*

3.2.3 Environmental Consequences – Noise

Noise associated with aircraft operations in the military training airspace under the Mitigated Proposed Action and alternatives will be considered and compared with current conditions to assess impacts. Concerns regarding noise relate to certain potential impacts such as annoyance, speech interference, sleep interference, hearing loss, non-auditory health effects, and effects on domestic animals, wildlife, structures, terrain, and historic and archaeological sites.

Table 3.2-5. Existing Noise Exposure from MTRs (in dB DNLmr)

Route	*Noise Level (in dB DNLmr)*
IR-035	<35-40
IR-036	<35-45
IR-074	<35-40
VR-087	<35-37
VR-088	<35-44
VR-094	40-43
VR-097	<35-44
VR-1004	40-49
VR-1040	39-45
VR-1059	<35-45

dB = decibel; DNLmr = Onset Rate-Adjusted Monthly Day-Night Average Sound Level
Source: Wasmer and Maunsell 2004.

3.2.3.1 Mitigated Proposed Action

No changes would occur to noise levels beneath the MTRs that lie outside of the MOA airspace, the Restricted Airspace over Poinsett ECR, or the Gamecock MOAs. DNLmr noise levels under the airspace units would be the same as they are under Baseline and No Action conditions. Under the Mitigated Proposed Action, Bulldog C and Bulldog E MOA would be established adjacent to the existing Bulldog A MOA, as depicted in Figure 2-4. The area beneath the proposed Bulldog C and E MOAs is beneath the existing Bulldog B MOA as well as several MTRs (VR-94, VR-1004, VR-97, and VR-1059) and is exposed to noise from military aircraft overflights (Table 3.2-6). DNL generated by military aircraft in this area range from less than 35 dB DNLmr (in areas underlying the MOA only) to 50 dB DNLmr (in areas underlying both MOA and MTR). Under the Mitigated Proposed Action, the floors of Bulldog C and E MOAs would be established at 500 feet AGL. Areas beneath these two MOAs would be exposed to additional low altitude military overflights and the DNLmr would increase to between 47 and 52 dB DNLmr (Table 3.2-7). The DNLmr beneath the existing Bulldog A MOA would decrease slightly from 49 dB DNLmr to 47 dB DNLmr due to low and medium altitude training expanding into the newly created Bulldog C and E MOAs.

The calculated DNLmr beneath each of the airspace units is below the 55 dB threshold identified by USEPA as a level to consider the potential for impact. There would be a noticeable increase in low-level overflights and military aircraft would become a noticeable contributor to noise levels under the proposed Bulldog C and E MOAs. There would be no anticipated noise impacts to human health. The number of highly annoyed people could increase from approximately 1 percent of the population under the existing conditions to approximately 4 percent of the population under these proposed airspace units (see Appendix H). In some cases the calculated values are near or below the estimated ambient conditions of 35 to 44 dB. In such cases, military aircraft may be seen or briefly heard but there would be little or no observable noise contribution from military aircraft to the overall ambient noise environment.

Several MTRs associated with the airspace cross or merge with other MTRs or pass through MOAs that would be modified. As a result, the cumulative noise levels on the ground at the point of these interactions accounts for all the noise produced by aircraft using the airspace. Table 3.2-7 reflects these combined noise levels calculated for areas under the airspace. For MTRs, the applicable route segment involved is as defined in the DoD's Flight Information Publication, *Area Planning, Military Training Routes*. In all cases, the noise levels are at or below the 55 dBA identified by USEPA as a level for evaluating potential environmental consequences. Less than 4 percent of the affected population would be expected to become highly annoyed by the proposed noise levels. Consequences would be limited to annoyance.

Table 3.2-6. Calculated DNLmrs Associated With the Mitigated Proposed Action

Airspace	Existing Conditions		Mitigated Proposed Action	
	Sound Level [1]	*Sound Levels in Avoidance Areas* [2]	*Sound Level* [1]	*Sound Levels in Avoidance Areas* [2]
Bulldog B	<35	<35	<35	<35
Bulldog A/B	49	37-45	47	36-43
Bulldog C/B	N/A	N/A	47	34
Bulldog E	N/A	N/A	47	44
Bulldog E/B	N/A	N/A	47	44
Gamecock B	<35	N/A	<35	N/A
Gamecock C	53	48	53	48
Gamecock D	<35	N/A	<35	N/A
Poinsett	40	36-52[4]	40	36-52[4]
R-6002	59	N/A	59	N/A
IR-035	<35	<35	<35	<35
IR-036	<35	<35	<35	<35
IR-074	<35	<35	<35	<35
VR-087	45-46	<35	45-46	<35
VR-088	44-45	36-44	44-45	36-44
VR-094	35	<35	35	<35
VR-097	<35-40	<35-38	<35-40	<35-38
VR-1004	50-52	40-49	50-52	40-49
VR-1040	47	37-43	47	37-43
VR-1059	41-44	<35-42	41-44	<35-42

Notes
1. For MOAs, indicates uniformly distributed noise throughout the airspace; for MTRs indicates maximum noise level on route centerline. When applicable, a range of values reflects changes in the configuration of the route. MOAs denoted A/B, C/B, and E/B indicate one MOA overlying another MOA; noise levels generated in the MOAs are additive.
2. The noise levels within an avoidance area depend on the location of the receiver and distance by which it is avoided.
3. Gamecock D/F modeled as one block of airspace.
4. High value results from proximity to R-6002.

dB = decibel; DNLmr = Onset Rate-Adjusted Monthly Day-Night Average Sound Level
Source: Refer to Appendix I.

Table 3.2-7. Cumulative Noise Levels under the Mitigated Proposed Action

Airspace Involved	Cumulative Noise (in dB DNLmr)	
	Existing Conditions (in dB DNLmr)	*Mitigated Proposed Action (in dB DNLmr)*
IR-074 G-H + Bulldog A/B	49	47
VR-097 LL-M + Bulldog A/B	50	47-48
VR-097 N-O + Bulldog A/B	50	47-48
VR-097 O-P + Bulldog A/B	50	47-48
VR-1059 C-D + Bulldog A/B	50	48-49
VR-1004 J-K + Bulldog E/B	n/a	50-52
VR-94 C-D + Bulldog C/B	n/a	47
VR-94 C-E + Bulldog E/B	n/a	47
VR-97 N-O + Bulldog C/B	n/a	47-48
VR-1059 C-D + Bulldog C/B	n/a	48-49

dB = decibel; DNLmr = Onset Rate-Adjusted Monthly Day-Night Average Sound Level
Source: Refer to Appendix I.

Development and operation of the new training transmitter sites could involve activities that create transient noise. During development and construction, use of heavy equipment would be a noise-producing source. This noise would be localized, intermittent, and of relatively short duration. During operation of the sites, noise could be created as a result of infrequent human presence and activity or as the result of the operation of backup generators. Human presence would be expected to be limited and confined to the general area of the site. The operation of backup generators would occur only when the primary power supply was inoperable. This is not expected to be a common occurrence and noise from the generators would be primarily limited to the site itself. The construction and operation of the transmitter sites would not be expected to create intrusive noise that could impact the surrounding community.

Overall, noise levels associated with the use of the Mitigated Proposed Action airspace and any site development are calculated to be well below any thresholds that would be expected to cause harm to humans or animals, or damage property.

3.2.3.2 ALTERNATIVE A

Under Alternative A, modifications to military SUA would be much more extensive than under the Mitigated Proposed Action. Gamecock E MOA would bridge the western boundary of the existing Gamecock D MOA with the Restricted Airspace R-6002, the floor of Gamecock D MOA would be lowered to 5,000 feet MSL in areas that do not overlap Gamecock C MOA, Gamecock C and D MOAs would be combined, Gamecock B would be returned to the NAS, the ceiling of Poinsett MOA would be raised from 2,500 to 5,000, and the boundaries of Bulldog A MOA would be expanded to match Bulldog B MOA. There are no changes proposed for MTRs or the Restricted Airspace over Poinsett ECR.

Table 3.2-8 compares the noise levels from Alternative A with existing conditions. Table 3.2-8 demonstrates that there would be relatively little change from existing conditions except in those areas where new airspace would be created (Gamecock E) or additional low-altitude airspace would be created (Gamecock D and Bulldog A/B). In some cases the calculated values are near or below the estimated ambient conditions of 35 to 44 dB. In such cases, military aircraft may be seen or briefly heard but there is little or no observable noise contribution from military aircraft.

Changes in noise levels for the Bulldog MOAs, Poinsett MOA, and Gamecock MOAs reflect the increased volume of airspace and the reduced time spent in any individual MOA during a typical training mission. Where Bulldog A would be extended, the DNLmr noise levels would increase from less than 35 dB DNLmr to a calculated 47 dB DNLmr. The calculated noise level is below the 55 dB identified by USEPA as a level to consider the potential for impact, and there would be no anticipated impacts to human health. There could be a noticeable increase in low-level overflights and military aircraft would become a noticeable contributor to noise levels under the extended Bulldog A airspace. The number of highly annoyed people could increase from approximately 1 percent of the population under the existing conditions to approximately 4 percent of the population under the portions of the expanded Bulldog A MOA airspace not within avoidance areas (see Appendix H).

Table 3.2-8. Calculated Noise Levels Associated With Implementation of Alternative A

Airspace	EXISTING CONDITIONS		ALTERNATIVE A	
	Sound Level (in dB DNLmr) [1]	*Sound Levels in Avoidance Areas*[2]	*Sound Level (in dB DNLmr)* [1]	*Sound Levels in Avoidance Areas*[2]
Bulldog B	<35	<35	<35	<35
Bulldog A/B	49	37-45	47	36-43
Gamecock B	<35	N/A	N/A	N/A
Gamecock C	53	48	51	46
Gamecock D	<35	N/A	37	N/A
Gamecock E	N/A	N/A	35	N/A
Poinsett	40	36-52[4]	38	33-52
R-6002	59	N/A	59	N/A
IR-035	<35	<35	<35	<35
IR-036	<35	<35	<35	<35
IR-074	<35	<35	<35	<35
VR-087	45-46	<35	45-46	<35
VR-088	44-45	36-44	44-45	36-44
VR-094	35	<35	35	<35
VR-097	<35-40	<35-38	<35-40	<35-38
VR-1004	50-52	40-49	50-52	40-49
VR-1040	47	37-43	47	37-43
VR-1059	41-44	<35-42	41-44	<35-42

Notes
1. For MOAs, indicates uniformly distributed noise throughout the airspace; for MTRs indicates maximum noise level on route centerline. When applicable, a range of values reflects changes in the configuration of the route.
2. The noise levels within an avoidance area depend on the location of the receiver and distance by which it is avoided.
3. High value results from proximity to R-6002.

dB = decibel; DNLmr = Onset Rate-Adjusted Monthly Day-Night Average Sound Level
Source: Refer to Appendix I.

Several MTRs associated with the airspace cross or merge with other MTRs or pass through MOAs that would be modified. As a result, the cumulative noise levels on the ground at the point of these interactions accounts for all the noise produced by aircraft using the airspace. Table 3.2-9 reflects these combined levels for the modified airspace. For MTRs, the applicable route segment involved is as defined in AP/1B. In all cases, the noise levels are below the 55 dBA identified by USEPA as a level for evaluating potential environmental consequences.

Table 3.2-9. Cumulative Noise Levels under Alternative A

	CUMULATIVE NOISE (IN dB DNLmr)	
Airspace Involved	*Existing Conditions*	*Alternative A*
VR-094 D-E + Bulldog A/B	36	47
IR-074 G-H + Bulldog A/B	49	47
VR-097 LL-M + Bulldog A/B	50	48
VR-097 N-O + Bulldog A/B	50	48
VR-097 O-P + Bulldog A/B	50	48
IR-036 D-F + Gamecock D	<35	37
IR-035 E-F + Gamecock E	N/A	38
VR-087 F-G + Gamecock E	N/A	44
IR-036 E-F + Gamecock E	N/A	36
IR-036 F-G + Gamecock E	N/A	36
VR-1059 J-K + Gamecock C	54	52
VR-1040 D-E + Gamecock C	54	53
VR-1040 E-F + Gamecock D	47	47
VR-1059 I-J + Gamecock D	45	45
VR-1040 C-D + Gamecock D	47	47
VR-1059 C-D + Bulldog A/B	50	49

dB = decibel; DNLmr = Onset Rate-Adjusted Monthly Day-Night Average Sound level
Source: Refer to Appendix I.

Development and operation of the new training transmitter sites could involve activities that create transient noise. During development and construction, use of heavy equipment would be a noise-producing source. This noise would be localized, intermittent, and of relatively short duration. During operation of the sites, noise could be created as a result of infrequent human presence and activity. Such human presence would be expected to be limited and confined to the general area of the site. Therefore, it would not be expected to create intrusive noise that could impact the surrounding community.

Overall, noise levels associated with the use of the proposed reconfigured airspace and any site development are well below any thresholds that would be expected to cause harm to humans or animals, or damage property.

3.2.3.3 ALTERNATIVE B

Under Alternative B, the vertical stratification of the Bulldog A and B MOAs would be modified. Lowering the floor of the overall Bulldog B MOA creates low-altitude airspace within Bulldog B, but not extending Bulldog A reduces the total airspace between 500 feet AGL and 3,000 feet MSL.

Gamecock E would be created and the floor of Gamecock D would be lowered from 10,000 feet MSL to 8,000 feet MSL. Additionally, the Poinsett MOA would be expanded vertically to 5,000 feet MSL.

Table 3.2-10 compares the noise levels that would result from the implementation of Alternative B with current conditions. Lowering the floor of the Bulldog B MOA increases low-altitude airspace and corresponding noise levels under the airspace as compared with the existing conditions. Noise levels under Bulldog A/B would be 47 dB DNLmr for Alternative B (Table 3.2-10). This change would not be discernible as compared with the existing 49 dB DNLmr. In the area where Bulldog A is proposed to be extended for Alternative A, noise levels for Alternative B are calculated to be less than 35 dB DNLmr as compared with 47 dB DNLmr for Alternative A. Aircraft noise in the modified Bulldog B MOA would increase from baseline levels, but would remain below estimated ambient noise levels.

Table 3.2-10. Noise Levels Associated With Alternative B

Airspace	EXISTING CONDITIONS		ALTERNATIVE B	
	Sound Level (in dB DNLmr) [1]	*Sound Levels in Avoidance Areas* [2]	*Sound Level (in dB DNLmr)* [1]	*Sound Levels in Avoidance Areas* [2]
Bulldog B	<35	<35	<35	<35
Bulldog A/B	49	37-45	47	39-44
Gamecock B	<35	N/A	N/A	N/A
Gamecock C	53	48	51	46
Gamecock D	<35	N/A	32	N/A
Gamecock E	N/A	N/A	35	N/A
Poinsett	40	36-52	38	33-52
R-6002	59	N/A	59	N/A
IR-035	<35	<35	<35	<35
IR-036	<35	<35	<35	<35
IR-074	<35	<35	<35	<35
VR-087	45-46	<35	45-46	<35
VR-088	44-45	36-44	44-45	36-44
VR-094	35	<35	35	<35
VR-097	<35-40	<35-38	<35-40	<35-38
VR-1004	50-52	40-49	50-52	40-49
VR-1040	47	37-43	47	37-43
VR-1059	41-44	<35-42	41-44	<35-42

Notes
1. For MOAs, indicates uniformly distributed noise throughout the airspace; for MTRs indicates maximum noise level on route centerline. When applicable, a range of values reflects changes in the configuration of the route.
2. The noise levels within an avoidance area depend on the location of the receiver and distance by which it is avoided.
3. High value results from proximity to R-6002.

dB = decibel; DNLmr = Onset Rate-Adjusted Monthly Day-Night Average Sound Level
Source: Refer to Appendix I.

Table 3.2-11 calculates cumulative noise levels under VR-097 O-P plus Bulldog A/B to decrease from 50 to 48 dB DNLmr, and noise levels under VR-094 D-E plus Bulldog A/B to increase from 36 to 47 dB DNLmr. These noise levels are lower than the 48 dB DNLmr noise levels calculated for the MTRs plus Bulldog A/B under Alternative A. Cumulative noise levels under Alternative B would change from the 36 to 50 current dB DNLmr to 47 to 49 dB DNLmr. The contribution of military aircraft to noise could be noticed on the ground where the estimated ambient rural area sound level is 35 to 44 dB. Average noise levels (dB DNLmr) would be below 55 dB.

Development and operation of the new training transmitter sites could involve activities that would create noise as described for the Mitigated Proposed Action.

3.2.3.4 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, no additions or modifications would be made to the military training airspace that currently supports the 20 FW, 169 FW, and other transient users. Noise levels resulting from the use of this military training airspace would remain unchanged from current conditions, as described in Section 3.2.

Table 3.2-11. Cumulative Noise Levels under Alternative B

	CUMULATIVE NOISE (IN dB DNLmr)	
Airspace Involved	*Current Conditions*	*Alternative B*
VR-094 D-E + Bulldog A/B	36	47
IR-074 G-H + Bulldog A/B	50	47
VR-097 LL-M + Bulldog A/B	50	48
VR-097 N-O + Bulldog A/B	50	48
VR-097 O-P + Bulldog A/B	50	48
IR-036 D-E + Gamecock D	<35	<35
IR-035 E-F +Gamecock E	N/A	38
VR-087 F-G +Gamecock E	N/A	44
IR-036 E-F +Gamecock E	N/A	36
IR-036 F-G +Gamecock E	N/A	36
VR-1059 J-K + Gamecock C	54	54
VR-1040 D-E + Gamecock C	54	54
VR-1040 E-F + Gamecock D	47	47
VR-1059 I-J + Gamecock D	45	45
VR-1040 C-D + Gamecock D	47	47
VR-1059 C-D + Bulldog A/B	50	49

dB = decibel; DNLmr = Onset Rate-Adjusted Monthly Day-Night Average Sound Level
Source: Refer to Appendix I.

3.3 SAFETY

3.3.1 Introduction

This section addresses flight, explosive, and ground safety associated with operations conducted by the 20 FW in regional military training airspace. Flight safety considers aircraft flight risks. Explosive safety discusses the management and use of ordnance or munitions associated with airbase operations and training activities conducted in various elements of training airspace. Ground safety considers issues associated with operations and maintenance activities that support base operations, including fire response.

The safety ROI includes Poinsett ECR and those areas encompassed by regional military training airspace used by aircrews from the 20 FW. This airspace includes the Bulldog, Gamecock, and Poinsett MOAs, the Restricted Areas supporting operations on Poinsett ECR, and several MTRs.

3.3.1.1 METHODOLOGY

Numerous federal, civil, and military laws and regulations govern operations at Shaw AFB. Individually and collectively they prescribe measures, processes, and procedures required to ensure safe operations and to protect the public, military, and property.

The elements of the proposal that have a potential to affect safety are evaluated relative to the degree to which the action increases or decreases safety risks to aircrews, the public, or property. Ground, fire, and crash safety are assessed for the potential to increase risk and the capability to manage that risk by responding to emergencies and suppressing fire. Analysis of flight risks correlates Class A mishap rates and bird/wildlife-aircraft strike hazards (BASH) with projected airspace utilization. Data for current use of the airspace are compared with potential use to assess the magnitude of any safety impacts. Explosive safety considers projected changed uses and handling when compared to current uses and practices.

3.3.1.2 ISSUES AND CONCERNS

Safety concerns associated with ATI as expressed during public hearings and through public comments include increasing the amount of airspace available for low-altitude flight, deconfliction of military and civilian aircraft, and the expanded use of chaff and flares in the new and modified airspace. The assessment includes the ability to manage any new or unique safety issues anticipated to develop as a result of any ATI element.

3.3.2 Existing Conditions – Safety

This section addresses flight safety, explosives safety, and ground safety.

3.3.2.1 FLIGHT SAFETY

The primary public concern with regard to flight safety is the potential for aircraft accidents. Such mishaps may occur as a result of weather-related accidents, mechanical failure, pilot error, mid-air collisions, collisions with manmade structures or terrain, or bird/wildlife-aircraft collisions. Flight risks apply to all aircraft; they are not limited to the military.

The Air Force defines four categories of aircraft mishaps: Classes A, B, C, and High Accident Potential (HAP). Class A mishaps result in a loss of life, permanent total disability, a total cost in excess of $1 million, destruction of an aircraft, or damage to an aircraft beyond economical repair. Class B mishaps result in total costs of more than $200,000, but less than $1 million, result in permanent partial disability or inpatient hospitalization of three or more personnel, but do not result in fatalities. Class C mishaps involve reportable damage of more than $20,000, but less than $200,000, or a lost workday involving 8 hours or more away from work beyond the day or shift on which it occurred; or occupational illness that causes loss of work at any time. HAP represents minor incidents not meeting any of the criteria for Class A, B, or C mishaps. Class C mishaps and HAP, the most common types of accidents, represent relatively unimportant incidents because they generally involve minor damage and injuries, and rarely affect property or the public (Air Force 2001e). Class A mishaps are of primary concern because of their potentially catastrophic results.

AIRCRAFT MISHAPS

It is impossible to predict the precise location of an aircraft accident, should one occur. Major considerations in any accident are loss of life and damage to property. The aircrew's ability to exit from a malfunctioning aircraft is dependent on the type of malfunction encountered. The probability of an aircraft crashing into a populated area is extremely low but it cannot be totally discounted. Several factors are relevant in the ROI: the immediate surrounding areas have relatively low population densities; pilots of aircraft are instructed to avoid direct overflight of population centers at very low altitudes; and, finally, the limited amount of time the aircraft is over any specific geographic area limits the probability that impact of a disabled aircraft in a populated area would occur.

Secondary effects of an aircraft crash include the potential for fire or environmental contamination. Again, because the extent of these secondary effects is situationally dependent, they are difficult to quantify. The terrain overflown in the ROI is diverse. For example, should a mishap occur in highly vegetated areas during a hot, dry summer, such a mishap would have a higher risk of extensive fires than would a mishap in more barren and rocky areas during the winter. When an aircraft crashes, it may release hydrocarbons. Those petroleums, oils, and lubricants not consumed in a fire could contaminate soil and water. The potential for contamination is dependent on several factors. For example, the porosity of the surface soils will determine how rapidly contaminants are absorbed, while the specific geologic structure in the region will determine the extent and direction of the contamination plume. The locations and characteristics of surface and groundwater in the area will also affect the extent of contamination to those resources.

F-16 aircraft carry a small quantity of hydrazine in a sealed canister that is designed to withstand crash impact damage. Hydrazine is a highly volatile propellant that contains toxic elements. It is carried on the F-16 as part of the emergency power unit. When used for this purpose, hydrazine is completely consumed, and poses no safety hazard. In any crash that is severe enough to rupture the canister, it is most likely that fire will also be involved. In this case, the hydrazine will also burn and be completely decomposed. In the unlikely event that the hydrazine should be released but not consumed by fire, impacts on soils and groundwater are likely to be of minor consequence. Hydrazine absorbs water at room temperature. It is incombustible in solution with water at concentrations of 40 percent or less and it evaporates at any given combination of constant meteorological conditions (i.e., temperature, humidity, wind speed, etc.) at a rate slightly slower (approximately 11 percent) than water. For example, at 60 degrees Fahrenheit (°F), 50 percent humidity, and a wind speed of 5 miles per hour, a 4 square-foot pool of hydrazine would evaporate at a rate of approximately 0.0072 pounds per minute (0.12 ounces). In comparison, water would evaporate at a rate of approximately 0.0081 pounds per minute (0.13 ounces) (USEPA 1999). Movement of hydrazine through natural soils has been shown to be slow and limited. Due to its absorption and natural decomposition processes, the probability of released hydrazine significantly contaminating groundwater is considered extremely low. However, if quantities of hydrazine were to reach a surface water body, aquatic life in those areas experiencing high concentrations could be significantly impacted in the immediate area of intense concentration.

Based on historical data on mishaps at all installations, and under all conditions of flight, the military services calculate Class A mishap rates per 100,000 flying hours for each type of aircraft in the inventory. These mishap rates do not consider combat losses due to enemy action. F-16C aircraft have flown more than 4,202,270 hours since the aircraft entered the Air Force inventory during Fiscal Year (FY) 1985. Over that period, 147 Class A mishaps have occurred and 140 aircraft have been destroyed. This results in a Class A mishap rate of 3.50 per 100,000 flight-hours, and an aircraft destroyed rate of 3.33 (Air Force Safety Center [AFSC] 2004a).

Between February 1994 and July 2001 Shaw-based F-16Cs have been involved in six Class A mishaps. The most recent, in July 2001, was the result of the pilot experiencing G-Induced Loss of Consciousness (a phenomenon resulting from some aircraft maneuvers when the effects of the force of gravity results in blood being drained from the brain) (personal communication, Grimes 2004). The six Class A mishaps between 1994 and 2001 can be compared with no Class A mishaps between 2001 and 2005.

In the case of MOAs and Restricted Areas, for each specific aircraft using the airspace an estimated average sortie duration may be used to estimate annual flight hours in the airspace. For MTRs, the length of the route and the average flight speed of the aircraft using the route may be used to determine the amount of flight time each specific type aircraft will spend on the route each year. Then, the Class A mishap rate per 100,000 flying hours can be used to compute a statistical projection of anticipated time between Class A mishaps in each applicable element of airspace. In evaluating this information, it should be emphasized that those data presented are only statistically predictive. The actual causes of mishaps are due to many factors, not simply the amount of flying time of the aircraft.

Aircrews from the 20 FW conduct training activity using MOAs, Restricted Areas, and MTRs. Table 3.3-1 presents statistically projected Class A mishaps based upon the overall F-16 mishap rate per 100,000 flying hours. Table 3.3-1 includes the aircraft operations in each airspace unit, the statistical mishap rate for that aircraft type, and the statistically predicted time between mishaps considering the mishap rates and levels of use.

Table 3.3-1. Projected Class A Mishaps (Current Operations) (Page 1 of 2)

Airspace	*Aircraft*	*Mishap Rate per 100,000 flying hours*	*Annual Operations*	*Annual Hours*	*Years Between Projected Mishaps*
Bulldog	F-16	3.50	4,427	2,213	12.9
	F-15	2.07	80	40	1,207.7
	F-18	3.34	1,353	676	44.3
	AV-8	10.74	60	30	310.4
Gamecock B	F-16	3.50	216	108	264.6
Gamecock C	F-16	3.50	2,594	1,297	22.0
	F-15	2.07	512	256	188.7
	F-18	3.34	720	360	83.2
	AV-8	10.74	90	45	206.9
	A-10	2.35	1,422	711	59.8
Gamecock D	F-16	3.50	4,143	2,071	13.8
	F-15	2.07	408	204	236.8
	F-18	3.34	576	288	104.0
	AV-8	10.74	36	18	517.3
	A-10	2.35	150	75	567.4
	EA-6B	4.83	36	18	1,150.2
Poinsett	F-16	3.50	139	11	2,476.5
	F-15	2.07	14	1	41,574.2
	F-18	3.34	19	2	18,985.5
	AV-8	10.74	1	<1	112,180.6
	A-10	2.35	5	<1	102,537.8
	EA-6B	4.83	1	<1	249,445.0
Poinsett ECR	F-16	3.50	2,590	1,295	22.1
	F-15	2.07	255	127	378.9
	F-18	3.34	360	180	166.3
	AV-8	10.74	23	11	809.7
	A-10	2.35	94	47	905.4
	EA-6B	4.83	23	11	1,800.3
IR-035	C-17	1.04	339	287	334.5
	C-130	0.91	1	1	95,801.6

Table 3.3-1. Projected Class A Mishaps (Current Operations) (Page 2 of 2)

Airspace	*Aircraft*	*Mishap Rate per 100,000 flying hours*	*Annual Operations*	*Annual Hours*	*Years Between Projected Mishaps*
IR-036	C-17	1.04	15	12	8,282.9
	C-130	0.91	2	2	52,475.6
	T-1	0.13	3	3	230,481.1
IR-074	C-17	1.04	1	<1	115,787.4
VR-087	F-15	2.07	271	97	498.4
	AV-8	10.74	12	7	1,251.5
	F-18	3.34	19	7	4,236.0
	F-16	3.50	20	7	3,840.2
	A-10	2.35	1	<1	74,253.7
VR-088	C-17	1.04	5	4	26,645.0
	F-15	2.07	128	41	1,182.3
	EA-6B	4.83	3	2	10,393.5
	AV-8	10.74	8	4	2,103.4
	F-18	3.34	90	30	1,002.0
	F-16	3.50	51	17	1,687.4
VR-094	C-130	0.91	1	<1	124,542.1
	F-15	2.07	8	2	20,934.0
	F-18	3.34	19	6	5,252.7
VR-097	C-17	1.04	1	1	67,220.0
	F-15	2.07	21	13	3,635.9
	F-18	3.34	26	17	1,750.1
	T-39	1.10	9	12	7,675.5
	F-16	3.50	89	59	487.9
VR-1004	F-18	3.34	267	222	135.1
	T-39	1.10	266	442	205.9
VR-1040	C-17	1.04	11	22	4,467.8
	EA-6	4.83	5	9	2,300.4
	AV-8	10.74	11	17	564.3
	F-18	3.34	65	59	511.8
	F-16	3.50	16	14	1,984.1
VR-1059	C-17	1.04	1	2	58,661.5
	F-15	2.07	27	20	2,467.9
	AV-8	10.74	6	8	1,234.9
	F-18	3.34	28	21	1,418.2
	T-38	1.48	1	1	53,946.5
	T-39	1.10	436	657	138.3
	F-16	3.50	165	124	229.7
	A-10	2.35	1	1	36,683.8
	T-1	0.13	12	28	27,205.3

ECR = Electronic Combat Range
Sources: Personal communication, Byers 2004, AFSC 2004a, Marine Corps Safety Center 2005.

The greatest safety risk is associated with F-16 aircraft operating in the Bulldog MOAs. Statistical projections indicate the probability of a Class A mishap occurring once every 12.9

years. To place this into context, based on the number of sorties flown (4,427), the statistically predictive probability of a Class A mishap is 0.0000175, or one chance in 57,100.

The 20 FW maintains detailed emergency and mishap response plans to react to an aircraft accident, should one occur. These plans assign agency responsibilities and prescribe functional activities necessary to react to major mishaps, whether on or off base. Response would normally occur in two phases. The initial response focuses on rescue, evacuation, fire suppression, safety, elimination of explosive devices, ensuring security of the area, and other actions immediately necessary to prevent loss of life or further property damage. Subsequently, the second, or investigation phase is accomplished.

First response to a crash scene is often provided by local emergency services nearest the scene. Currently, the Air Force rapidly mobilizes a response team. The initial response element consists of those personnel and agencies primarily responsible to initiate the initial phase. This element will include the Fire Chief, who will normally be the first On-Scene Commander, fire-fighting and crash rescue personnel, medical personnel, security police, and crash recovery personnel. A subsequent response team will be comprised of an array of organizations whose participation will be governed by the circumstances associated with the mishap and actions required to be performed.

The Air Force has no specific rights or jurisdiction just because a military aircraft is involved. Regardless of the agency initially responding to the accident, efforts are directed at stabilizing the situation and minimizing further damage. If the accident has occurred on non-federal property, a National Defense Area will normally be established around the accident scene and the site will be secured for the investigation phase.

After all required actions on the site are complete, the aircraft will be removed and the site cleaned up. Depending on the extent of damage resulting from a Class A mishap, only the largest damaged parts may be located and removed from a crash site. Anyone incurring damage from Shaw AFB mishaps should contact Shaw AFB directly to inquire about the Air Force damage claims process.

WILDLIFE STRIKE HAZARD

Bird/wildlife-aircraft strikes constitute a safety concern because they can result in damage to aircraft or injury to aircrews or local human populations if an aircraft crashes. Aircraft may encounter birds at altitudes up to 30,000 feet MSL or higher. However, most birds fly closer to the ground. More than 97 percent of reported bird strikes occur below 3,000 feet AGL. Approximately 30 percent of bird strikes happen in the airport environment, and almost 55 percent occur during low-altitude training (AFSC 2002). The remainder (approximately 15 percent) occur at a range of altitudes and varied conditions of flight.

Migratory waterfowl (e.g., ducks, geese, and swans) are the most hazardous birds to low-flying aircraft because of their size and their propensity for migrating in large flocks at a variety of elevations and times of day. Waterfowl vary considerably in size, from 1 to 2 pounds for ducks, 5 to 8 pounds for geese, and up to 20 pounds for most swans. There are two normal migratory seasons, fall and spring. Waterfowl are usually only a hazard during migratory seasons. These birds typically migrate at night and generally fly between 1,500 to 3,000 feet AGL during the fall migration and from 1,000 to 3,000 feet AGL during the spring migration.

In addition to waterfowl, raptors, shorebirds, gulls, herons, songbirds, and other birds also pose a hazard. In considering severity, the results of bird/wildlife-aircraft strikes in restricted areas on ranges show that strikes involving raptors result in the majority of Class A and Class B mishaps related to bird/wildlife-aircraft strikes. Raptors of greatest concern in the ROI are vultures and red-tailed hawks. Peak migration periods for raptors, especially eagles, are from October to mid-December and from mid-January to the beginning of March. In general, flights above 1,500 feet AGL would be above most migrating and wintering raptors.

Wood storks are large wading birds, approximately 4.5 to 5.5 pounds in weight. Wood storks are a concern for bird/wildlife-aircraft strikes in the ROI because of their flight characteristics. Wood storks use thermals, or rising pockets of warm air to move between feeding sites, using the thermals they soar up to 1,000 to 3,000 feet AGL then glide to their destinations.

Songbirds are small birds, usually less than one pound. During nocturnal migration periods, they navigate along major rivers, typically between 500 to 3,000 feet AGL. The potential for bird/wildlife-aircraft strikes is greatest in areas used as migration corridors (flyways) or where birds congregate for foraging or resting (e.g., open water bodies, rivers, and wetlands).

While any bird/wildlife-aircraft strike has the potential to be serious, many result in little or no damage to the aircraft, and only a minute portion result in a Class A mishap. During the years 1985 to 2004, the Air Force BASH Team documented 59,156 bird strikes worldwide. Of these, 25 resulted in Class A mishaps where the aircraft was destroyed. These occurrences constituted approximately 0.04 percent of all reported bird/wildlife-aircraft strikes (AFSC 2004b).

The 20 FW has developed aggressive procedures designed to minimize the occurrence of bird/wildlife-aircraft strikes. The unit has documented detailed procedures to monitor and react to heightened risk of bird-strikes (Shaw AFB 2005), and when risk increases, limits are placed on low altitude flight and some types of training (e.g., multiple approaches, closed pattern work, etc.) in the airport environment. Special briefings are provided to pilots whenever the potential exists for greater bird-strike sightings within the airspace. Historically, aircraft assigned to the 20 FW have been involved in an average of approximately 13 bird strikes per year. Over the last 5 years, the average has been 6.4 per year although in 2003 the unit experienced 19 bird strikes (personal communication, Grimes 2004). Data maintained by the 20 FW Safety Office indicate that the periods of greater risk of bird aircraft strikes occur during March, April, and May, and again during August, September, and October (Air Force 2002).

Some birds that may be encountered in the region are protected under the Migratory Bird Treaty Act (MBTA). Normally, the intentional taking of these avian species requires a depredation permit. However, if a protected species is involved in a bird-aircraft strike, it would be considered an incidental taking, and not an intentional taking. Recognizing this, such incidental taking of migratory birds during military training is exempt from any permitting requirement.

GROUND OBSTRUCTIONS

Tall structures on the ground have the potential to create hazards to flight. Data presented in Section 3.1 for MOAs and MTRs demonstrate where flight at low altitude is authorized. The FAA provides detailed instructions for the marking of obstructions (i.e., paint schemes and lighting) to warn pilots of their presence. Any temporary or permanent structure, including all appurtenances, that exceeds an overall height of 200 feet (61 meters) AGL or exceeds any obstruction standard contained in 14 CFR Part 77, should normally be marked and/or lighted. The FAA may also recommend marking and/or lighting a structure that does not exceed 200 feet AGL or 14 CFR Part 77 standards because of its particular location (DOT FAA 2007). The obstruction standards in 14 CFR Part 77 are primarily focused on structures in the immediate vicinity of airports and approach and departure corridors from airports (14 CFR Part 77 1971).

3.3.2.2 EXPLOSIVES SAFETY

During training, Shaw-based aircraft are not loaded with any ordnance configured with high explosive warheads. Inert training bombs and several different types of rockets are delivered on Poinsett ECR, as well as 20 and 30 millimeter training projectiles fired from the aircrafts' guns.

Munitions expenditure during training are limited to ranges within Restricted Airspace. Air Force safety standards require safeguards on weapons systems and ordnance to ensure against inadvertent releases. All munitions mounted on an aircraft, as well as the guns, are equipped with mechanisms that preclude release or firing without activation of an electronic arming circuit.

Chaff and defensive flares are managed as ordnance. Flares and chaff are authorized for use in the existing MOAs and on Poinsett ECR. Use is governed by detailed operating procedures to ensure safety. Chaff, which is ejected from an aircraft to reflect radar signals, is small fibers of aluminum-coated mica packed into approximately 4-ounce bundles. When ejected, chaff forms a brief "cloud" that temporarily masks the aircraft from radar detection. Although the chaff may be ejected from the aircraft using a small pyrotechnic charge, the chaff itself is not explosive (Air Force 1997a). Chaff used in the existing Shaw AFB airspace is specifically designed to not interfere with FAA radars. Refer to Appendix B for more details on the characteristics of chaff.

Defensive training flares consist of small pellets of highly flammable material that burn rapidly at extremely high temperatures. Their purpose is to provide a heat source other than the aircraft's engine exhaust to mislead heat-sensitive or heat-seeking targeting systems and decoy them away from the aircraft. The flare, essentially a pellet of magnesium, ignites upon ejection from the aircraft and burns completely within approximately 3.5 to 5 seconds, or approximately

400 feet from its release point (Air Force 1997a; Appendix C). Flare use in Shaw AFB-managed airspace is governed by a minimum release altitude restriction of 5,000 feet MSL (approximately 4,500 AGL). Flares are not used in any Shaw AFB managed MOA or MTR with a ceiling below 5,000 feet MSL. Flares may be deployed at lower altitudes above Poinsett ECR and in offshore Warning Areas.

3.3.2.3 GROUND SAFETY

The ATI Mitigated Proposed Action or alternatives do not include modification to any activities at either Shaw AFB or Poinsett ECR. Ongoing operations and maintenance activities conducted by the 20 FW are performed in accordance with applicable Air Force safety regulations, published Air Force Technical Orders, and standards prescribed by Air Force Occupational Safety and Health (AFOSH) requirements.

The 20 FW fire department provides fire and crash response at Shaw AFB and Poinsett ECR. The unit has a sufficient number of trained and qualified personnel, and possesses all equipment necessary to respond to aircraft accidents and structure fires. There are no equipment or facility shortfalls; there are no fire safety waivers in effect. The unit is also party to mutual-aid agreements with the Sumter Fire Department and an Agreement is being negotiated between Shaw AFB and Kershaw County, thus ensuring availability of additional support if required (Air Force 2002; personal communication, Johnson 2010). Strict adherence to all range operating processes and procedures has minimized fire risk on the range. Fire is not considered a significant issue at Poinsett ECR (Air Force 2002).

Aircrews training on Poinsett ECR are authorized to use laser targeting systems. Bioenvironmental Safety and Health Engineers have assessed the range and have found no specific risk associated with laser use. Applicable Shaw AFB supplements to AFI 13-212 identify those targets where use of lasers is authorized and provide detailed procedures that must be followed by both aircrew and range staff when lasing operations are in progress to prevent any human health or safety risk.

No live ordnance is authorized for use on Poinsett ECR. Simulated threats are currently deployed in conjunction with Shaw-managed military training airspace and additional electronic training transmitter sites are proposed for ATI. Training transmitters emit radio frequency (RF) radiation. RF radiation is non-ionizing radiation, which means it is not radioactive radiation. Emissions only occur when the unit is operating and the emitting elements are aimed skyward. Use of these transmitters poses minimal safety risks. Safety buffer zones around the equipment have been developed based on calculations of permissible exposure levels (PEL). The fenced buffer zone perimeter is blocked off and signs indicating the presence of RF radiation are prominently displayed. The restrictions to access, placement of the training transmitters on private property, and warning signs have permitted safe operation on the existing transmitter sites. The same procedures would be applied to the proposed sites. Shaw AFB coordinates with farmers from whom the site is leased to turn transmitters off when the farmer needs to access the area within the fenced buffer zone.

3.3.3 Environmental Consequences – Safety

3.3.3.1 CHAFF AND FLARE USE UNDER THE MITIGATED PROPOSED ACTION AND ALL ALTERNATIVES

Currently, expenditure of chaff and flares is authorized in the existing Gamecock and Bulldog MOA and ATCAA airspace. Under the Mitigated Proposed Action, chaff and flare use would continue in the Gamecock and Bulldog MOAs and is proposed in the Bulldog C and E MOAs. As noted in Section 2.2.4, the total number of chaff bundles (120,000) and flares (29,633) used in the ATI airspace annually will be the same under the Mitigated Proposed Action or an alternative, including the No-Action Alternative. Where chaff and flares would be deployed would be changed within the airspace. As an example, a portion of the chaff and flares used in the original Bulldog A MOA would be used in the Mitigated Proposed Action Bulldog C or E MOAs.

Chaff, although ejected from the aircraft by a pyrotechnic charge, is not explosive. The composition of chaff is similar to those components found in the earth's crust, and do not present health or safety risks to humans or animals.

Use of Multi Jettison Unit (MJU)-7 A/B flares and M-206 flares in the MOA/ATCAA airspace would continue to be conducted in accordance with 20 FW established minimum release altitudes of 5,000 feet MSL (approximately 4,400 to 4,500 feet AGL). Considering the short burn-time of the flare (approximately 3.5 to 5 seconds), all combustible material is consumed approximately 400 feet from the release altitude. This provides a margin of safety of approximately 4,000 feet and ensures that no burning material from a functioning flare contacts the ground. Although a pilot could accidentally release a flare at a lower than authorized altitude, the 4,000 feet of safety margin is more than adequate to prevent a flare-ignited fire under the airspace.

A flare failure can occur if a flare does not ignite and remains in the aircraft, does not burn the prescribed duration or temperature, ignited but is not dispersed, or does not ignite after ejection (a dud flare). A dud flare is one type of flare failure. Historic range clean-ups where flare use is intensive in a relatively constrained geographic area (such as Melrose Range, New Mexico, and Utah Test and Training Range) indicate that of all flares expended, only an estimated 0.01 percent were actually found on the ground as duds (Air Force 2001e). Based on expected use, these overall reliability data indicate that approximately two dud flares per year could impact the ground under the Bulldog MOAs and two under the Gamecock MOAs.

Shaw AFB provides instructions to fire departments and other organizations on how to identify a dud flare and who to contact at Shaw AFB if a suspected dud flare is found. It is extremely unlikely that a dud flare would fall from an aircraft and strike an exposed individual on the ground. Should such an extremely remote accident occur, it could result in injury or death. With a release of approximately one flare per 84 and 120 acres per year in the Bulldog and Gamecock MOAs, respectively, a dud rate on the ground of approximately .01 percent, and a population of approximately 40 to 55 persons per square mile (640 acres) under the airspace, the expected frequency of such an accident is estimated to be between 0.0000011 and 0.0000015 per year. This is extremely unlikely.

Residual components of the M-206 and MJU-7 A/B flares fall to the ground following the ignition/ejection process. The M-206 components consist of two 1-inch x 1-inch x 1/8-inch plastic pieces, a felt spacer, and a piece of aluminum wrapping that could range from 1-inch x 1-inch up to 2-inch x 13-inch depending upon the combustion of the flare. These residual materials which are currently deposited on the ground under the airspace are not expected to be a safety risk.

Residual components of the MJU-7 A/B flare that are normally deposited on the ground after the ignition/ejection process are the hard plastic Safety and Initiation (S&I) device, the plastic piston, the plastic end cap, a piece of aluminum wrap that could range in size from 1-inch x 2-inches up to 3-inches x 13-inches, and one or two felt spacers. The typical weights and geometries of the plastic components are listed in Table 3.3-2.

Table 3.3-2. MJU-7 A/B Flare Major Component Properties

Component	*Geometry*	*Dimensions (inches)*	*Weight (Pounds)*
S&I	Rectangular solid	2 × 0.825× 0.5	0.0453
Piston	Rectangular open	2 × 0.825 × 0.5	0.0072
End Cap	Rectangular plate	1 × 2 × 0.125	0.0072

S&I = safe and initiation

When an object separates from an aircraft in flight, there are numerous physical factors that act on the object that influence where, and with what force, the object impacts the ground. These factors include the size, shape, and weight of the object, as well as other aerodynamic forces that act on the object as it falls through the air.

When an object is dropped, it is subjected to the force of gravity, and enters free-fall toward the ground. The force of gravity creates an acceleration of approximately 32.2 feet/sec^2. The object's shape influences the effect of aerodynamic drag forces exerted on it. These forces reduce the rate of acceleration to varying degrees such that after a period of time, the object is no longer accelerating, and has reached a state referred to as *terminal velocity*. When terminal velocity is reached, the object would continue to fall at that velocity indefinitely. Once terminal velocity is known, the momentum (in pound-seconds) can be calculated. Momentum is the metric used to quantify the relative hazard associated with a falling object striking a person or property on the ground. The terminal velocity and momentum of each MJU-7 A/B flare component in Table 3.3-2 are computed in Table 3.3-3. These velocities are based on maximum (two square inches) and minimum (one square inch) areas. The actual velocity and momentum values would be expected to fall between the maximum and minimum values. The momentum values are the product of mass and velocity.

Table 3.3-3. MJU-7 A/B Flare Component Hazard Assessment

Component	Maximum Surface Area			Minimum Surface Area		
	Area (in²)	*Terminal Velocity (ft/sec)*	*Momentum (lb-sec)*	*Area (in²)*	*Terminal Velocity (ft/sec)*	*Momentu m (lb-sec)*
S&I	1.65	58	0.08	0.413	115	0.16
Piston	1.65	23	0.005	0.413	46	0.01
End Cap	2.0	21	0.005	0.125	84	0.02

in² = square inches; ft/sec = feet per second; lb-sec = pounds per second; S&I = safe and initiation

As a basis of comparison, laboratory experimentation in accident pathology indicates that there is a 90 percent probability that brain concussions would result from an impulse of 0.70 pound-seconds to an unprotected head, and less than a 1 percent probability from impulses less than 0.10 pound-seconds (Air Force 1997). People have been found to spend approximately 10 percent of their time out of doors (Tennessee Valley Authority 2003; Klepeis *et al.* 2001). The MJU-7 A/B S&I device, with a maximum momentum value of 0.16 pound-seconds, could result in a bruise-like injury similar to that of a large hailstone if it struck an unprotected person. Approximately 20 percent of strikes to a person could be to the head and result in a more serious injury. The S&I would not be expected to damage a structure. An S&I impact could cause a cosmetic dent to a vehicle. A strike to the windshield of a moving vehicle could result in an impact comparable to a small stone kicked up by a truck tire. Concern was expressed during public hearings whether flare or chaff residual materials could impact a civilian aircraft during flight or on the ground. The discussion below would be applicable in the extremely unlikely event where a civilian aircraft were to somehow intersect or otherwise be struck by a falling piece of residual material from chaff or flare use. Given the number of civilian aircraft in and flying through the area, the likelihood of any aircraft being struck by a hailstone sized piece of flare residual material would be comparable to the likelihood of an unprotected person being struck by such a piece of residual material as described in Table 3.3-4. Other flare components would not be expected to reach a momentum that could cause cosmetic damage.

This safety assessment focuses on the MJU-7 A/B S&I device. The consequences of a residual component with enough momentum striking particular objects are postulated as follows:

- Striking the body of an unprotected individual: potential injury.
- Striking a private structure: no expected damage.
- Striking a private vehicle: potential cosmetic damage which could include a chip in a windshield.

Based on the factors discussed above, and as detailed in Appendix C, Table 3.3-4 presents the likelihood of an MJU-7 A/B flare S&I device striking an exposed person or property. The rates of usage of the MJU-7 A/B flares are assumed consistent with the estimated use of flares in 2004 (see Section 2.2.4).

Table 3.3-4. Hazard Risk Assessment

Consequence Type	*Expected Value Bulldog MOA (events/year)*	*Expected Value Gamecock MOA (events/year)*
Individual Potential Injury	0.005	0.005
Private Structures Struck	14	15
Private Vehicles Struck	0.9	1.0

MOA = Military Operations Area

The safety risk of deploying the projected number of MJU-7 A/B flares in airspace over the Gamecock MOA or the Bulldog MOA is relatively low for striking structures and substantially lower for striking vehicles. To place this in context, the expected number of structures hit per year would be 14 under the Bulldog MOAs and 15 under the Gamecock MOAs. Approximately one car would be expected to be struck by the equivalent of a large hailstone annually under the Gamecock MOAs and slightly less than one (0.9) car would be expected to be struck under the Bulldog MOAs. The safety risk to persons is substantially less. Based upon the population, the area of flare deployment, the exposure of individuals, and the number of flares proposed, an estimated 0.005 persons could be struck annually. This means that five persons would be expected to be struck in 1,000 years, or one person every 200 years, under either the Bulldog MOAs or the Gamecock MOAs. Approximately 20 percent of those strikes could produce a more serious injury if the head were struck. This means that the potential for a bruise from a falling S&I device is extremely low and the potential for a more serious injury is minute. Please refer to Appendix C for additional details about ground safety risks associated with use of MJU-7 A/B flares.

Anyone incurring damage or injury that result from Shaw AFB training activities should contact Shaw AFB directly to inquire about the Air Force damage claims process.

3.3.3.2 WAKE VORTICES UNDER ANY ALTERNATIVE

Questions were asked at scoping about any risk from wake turbulence or wake vortices. An aircraft is able to fly because the air pressure under the wings is higher than the air pressure above the wings. As a result of the wing's shape, air passing over the top of the wing has a higher velocity than the air passing under the wing. This difference in velocity creates the pressure differential, and results in what is commonly called "lift."

Wake turbulence result when higher pressure air flows around the wing tip toward the relatively low pressure air above the wing. Wake turbulence from an F-16 aircraft is approximately 7 mph for a 300-foot overflight.

The higher pressure air under the wing has a natural tendency to flow around the wing tip toward the relatively lower pressure air above the wing. This flow of air creates what is known as a "wing-tip vortex", or "wake turbulence" behind the aircraft. As the aircraft moves forward, these vortices trail behind the aircraft and sink towards the ground. The maximum velocities occur near the center of the vortex, and decrease further away from the center. As they descend, the maximum velocities near the center decrease, and eventually completely dissipate. The center, or core of the vortex will only descend to a minimum height above the ground. This height is directly related to the aircraft's wing-span (Skujins 2002)

The potential for wake turbulence effects on the ground from an F-16 overflight were calculated for an aircraft flying at 300, 500, and 1,000 feet AGL at a speed of 450 knots. Wind speed in the core of the vortex when it is created would be approximately 111 miles per hour (mph) and would dissipate as the wind vortex reached the ground. Wind speeds on the ground range from 8 to 6 mph from a 300-foot to 1000-foot overflight (Kurylowich 1979).

For purpose of comparison, data from the National Climate Data Center covering a 66-year period reflect that average annual wind velocity is 8 mph and 9 mph in the vicinity of the Bulldog and Gamecock MOAs, respectively (National Oceanic and Atmospheric Administration 1998). No wind vortex impacts are expected from an F-16 overflight within the Gamecock, Bulldog, or Poinsett MOAs.

3.3.3.3 MITIGATED PROPOSED ACTION

Under the Mitigated Proposed Action, the boundaries of Bulldog A MOA would not be expanded as proposed in the original Draft EIS. The Mitigated Proposed Action would chart two smaller airspace extensions of the Bulldog A MOA under the existing Bulldog B MOA/ATCAA. These two smaller MOA extensions to Bulldog A would expand the Bulldog Complex's capability for flight training activities while avoiding civil aviation operations to the extent possible. The two mitigated MOA extensions to Bulldog A would be: 1) The new Bulldog E MOA would be added to Bulldog A MOA's southern boundary and would match Bulldog A from 500 feet AGL up to, but not including, 10,000 feet MSL. 2) The new Bulldog C MOA would be added to Bulldog A MOA's southeastern boundary contiguous with the Bulldog E MOA. Bulldog C MOA would match Bulldog A from 500 feet AGL up to, but not including, 10,000 feet MSL. The dimensions of the Bulldog B MOA/ATCAA would not change and would overlie the existing Bulldog A MOA as well as the Bulldog C and E mitigated MOAs.

The FAA Atlanta ARTCC would have the authority to manage the airspace and control civilian air traffic into and out of the Emanuel County and Millen airports. The Atlanta ARTCC would also have the authority to temporarily raise the floors of the proposed Bulldog C and E MOAs when they are active to allow civilian aircraft clearance to transit the airspace.

FLIGHT SAFETY

The flight safety risk in the Bulldog MOAs would be unchanged from the current conditions presented in Table 3.3-1. The safety risk remains highest for F-16 aircraft operating in the Bulldog MOAs. Statistical projections indicate the probability of a Class A mishap occurring once every 12.9 years. To place this into context, based on the number of sorties flown (4,427), the statistically predictive probability of a Class A mishap is 0.0000175, or one chance in 57,100.

A potential flight safety concern for all alternatives is the presence of ground obstructions in these newly-designated areas. However, as described in Section 3.3.2.1, the FAA provides detailed instructions for marking these possible obstructions. Furthermore, major obstructions are plotted on aeronautical charts, and the heights of these obstructions are shown in feet AGL and MSL. Because obstructions presently exist under the current low-altitude MOA airspace, their presence under the new low-altitude airspace would not be expected to create a major safety concern. As previously discussed, life-flights to regional hospitals would be given priority by ATC and would be expected to remain unimpeded by these changes to military training airspace.

The BASH Team at the AFSC has developed a Bird Avoidance Model (BAM). This model predicts relative risk of wildlife strikes during selected time-frames in specific geographic areas. Within the Bulldog MOAs, the BAM indicates overall moderate risk throughout the year. Risk is somewhat lower in the southern portions of the MOAs than in the northern portions (BAM 2005). In the Bulldog MOA complex, calculated safety risks are not excessive. The modifications to Bulldog A would involve additional low-altitude airspace, where the potential for incidents is greater. Pilots should continue to be briefed and be attentive to the presence of wildlife hazards in this and other low altitude airspace.

EXPLOSIVE SAFETY

Training and inert ordnance would continue to be used as under current conditions at Poinsett Range for all alternatives. No elements of the Mitigated Proposed Action have the potential to alter or modify such use; therefore, implementation of the Mitigated Proposed Action would create no specific explosive safety risks.

GROUND SAFETY

Under the Mitigated Proposed Action, the only new ground facilities would be the training transmitter sites. Operations and maintenance procedures conducted by 20 FW personnel on existing transmitter sites would not change from current conditions. All activities would continue to be conducted in accordance with applicable regulation, technical orders, and AFOSH standards. Operation and use of these sites is not expected to create any ground safety issues.

3.3.3.4 ALTERNATIVE A

FLIGHT SAFETY

Alternative A would add additional low-altitude airspace to the Bulldog and Gamecock MOA/ATCAA complexes. Flight activity in the Poinsett MOA, R-6002, and the MTRs would remain unchanged from current conditions. Therefore, in these airspace elements, safety risks remain as described in Table 3.3-1. Flight safety risks in the Bulldog MOAs would be perceived as somewhat greater than that of the Mitigated Proposed Action. Alternative A extends low-altitude training flights into a larger area, including the Augusta approach. These Alternative A concerns were the basis for establishing the Mitigated Proposed Action.

Modifications in the Gamecock MOA complex would change operational activity. The integration of Gamecock E with the other Gamecock MOAs would mean that slightly less time would be spent by each aircraft training in individual airspace elements (personal communication, Newman 2005). The effects of this change on flight safety risks are compared with current conditions in Table 3.3-5. These data are statistical projections based on historic data, whereas the actual causes of aircraft mishaps are due to many factors, not simply the flying time of the aircraft. As described in Section 2.2.1, the concern that potential new Gamecock MOAs created unsafe transit conditions for civil aviation was the basis for not including the Gamecock MOA improvements in the Mitigated Proposed Action.

Table 3.3-5. Projected Class A Mishaps (Alternative A)

			CURRENT OPERATIONS		ALTERNATIVE A[1]	
Airspace	*Aircraft*	*Mishap Rate*	*Annual Hours*	*Years Between Projected Mishaps*	*Annual Hours*	*Years Between Projected Mishaps*
Bulldog	F-16	3.50	2,213	12.9	2,213	12.9
	F-15	2.07	40	1,207.7	40	1,207.7
	F-18	3.34	676	44.3	676	44.3
	AV-8	10.74	30	310.4	30	310.4
Gamecock B	F-16	3.50	108	264.6	N/A	N/A
Gamecock C	F-16	3.50	1,297	22.0	863.8	33.1
	F-15	2.07	256	188.7	170.5	283.3
	F-18	3.34	360	83.2	239.8	124.9
	AV-8	10.74	45	206.9	30.0	310.7
	A-10	2.35	711	59.8	473.5	89.9
Gamecock D	F-16	3.50	2,071	13.8	1,379.6	20.7
	F-15	2.07	204	236.8	135.9	355.6
	F-18	3.34	288	104.0	191.8	156.1
	AV-8	10.74	18	517.3	12.0	776.7
	A-10	2.35	75	567.4	50.0	851.9
	EA-6B	4.83	18	1,150.2	12.0	1,727.1
Gamecock E	F-16	3.50	N/A	N/A	1,379.6	20.7
	F-15	2.07	N/A	N/A	135.9	355.6
	F-18	3.34	N/A	N/A	191.8	156.1
	AV-8	10.74	N/A	N/A	12.0	776.7
	A-10	2.35	N/A	N/A	50.0	851.9
	EA-6B	4.83	N/A	N/A	12.0	1,727.1

Note: 1. Includes Mitigated Proposed Action.
N/A = Not Applicable
Sources: Personal communication, Byers 2004, AFSC 2004a, Marine Corps Safety Center 2005.

Within the new or modified airspace, the greatest safety risk is associated with F-16 aircraft flying in the Gamecock D and E MOAs. Statistical projections indicate the probability of a Class A mishap once every 20.7 years. Based on the number of sorties flown (4,143), the long-term statistically predictive probability of a Class A mishap is 0.0000117, or one chance in approximately 85,800. Overall, flight safety risks are somewhat reduced in the Gamecock complex, and remain unchanged from current conditions in the Bulldog airspace.

During scoping, pilots of civil aircraft expressed concern that the narrow corridor below the proposed Gamecock D and the floor of the proposed Gamecock E would result in civil aviation being crowded in areas that could affect safe transit of the airspaces. The relative number of aircraft traversing these proposed corridors and the controller support capabilities at Shaw AFB over these areas could be used to support separation of civil aircraft in these corridors.

The Gamecock E MOA would be located adjacent to the western border of the Gamecock D MOA. The Santee National Wildlife Refuge (NWR) is located approximately 4 NM south of the western border of the Gamecock D MOA. Additionally, there are two major water-bodies located in the region. Lake Moultrie is located south of the Gamecock D MOA, and Lake Marion is located south of the Gamecock D and proposed Gamecock E MOAs. All of these features serve as wildlife attractants.

In the Gamecock MOAs, the BAM indicates overall moderate risk throughout the year. However, risk is highest from November to February and lowest during the summer months. Peak risk occurs during December and January (BAM 2005). The BAM safety risks in the Bulldog MOAs would be the same as those discussed under the Mitigated Proposed Action in Section 3.3.3.1.

EXPLOSIVE SAFETY

Training and inert ordnance would continue to be used as under current conditions for Alternative A. No elements of the Alternative A have the potential to alter or modify such use; therefore, implementation of the Alternative A would create no specific explosive safety risks.

GROUND SAFETY

Under Alternative A, potential ground safety impacts are the same as those described under the Mitigated Proposed Action. The only new ground facilities would be the training transmitter sites and operations and maintenance of those sites would not change from current conditions. Operation and use of these sites is not expected to create any ground safety issues. The 20 FW Fire Department has mutual-aid agreements with the Sumter Fire Department, providing additional response capability if required. All of these capabilities would continue in effect.

3.3.3.5 ALTERNATIVE B

Alternative B would lower the floor of the Gamecock D MOA from 10,000 feet MSL to 8,000 feet MSL. Gamecock E MOA would have high and low areas. The floor of Bulldog B would be lowered to 3,000 feet MSL and Bulldog A would not be expanded to make it conformal to the Bulldog B MOA boundaries. These airspace changes would increase the airspace corridors for civil aviation as compared to Alternative A. Fewer airspace areas would require see-and-avoid procedures. This would reduce the extent of safety concern expressed by pilots during public hearings. The Gamecock B MOA would continue to be used on a limited basis and would remain as described in Section 3.3. Other airspace proposals associated with Alternative B would be the same as the Mitigated Proposed Action or Alternative A. Safety issues would basically be as described for the Mitigated Proposed Action or Alternative A with the exception that higher airspace floors would reduce the potential for bird/wildlife-aircraft strikes.

There are no specific proposals associated with the implementation of Alternative B that would create new or unique safety issues different from the Mitigated Proposed Action or Alternative A. Ground, explosive, and flight safety risk assessments generally remain as discussed above. The Bulldog A and B MOAs would not have conformal boundaries. Additional bird/wildlife-aircraft strike risk would be anticipated in the Bulldog B MOA compared to the existing condition. The bird/wildlife aircraft strike risk in the Bulldog MOAs for Alternative B would be less than for the Mitigated Proposed Action or Alternative A. Fewer would be expected in the Bulldog A MOA.

3.3.3.6 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, no changes to 20 FW training assets would occur. Because no specific safety impacts result from the No-Action Alternative, risks associated with ground, explosive, and flight safety would remain unchanged from current conditions.

3.4 AIR QUALITY

3.4.1 Introduction

This section discusses air quality considerations and conditions in the area around Shaw AFB and nearby MOAs in Georgia and South Carolina. It addresses air quality standards and describes current air quality conditions in the region.

FEDERAL AIR QUALITY STANDARDS

Air quality is determined by the type and concentration of pollutants in the atmosphere, the size and topography of the air basin, and local and regional meteorological influences. The significance of a pollutant concentration in a region or geographical area is determined by comparing it to federal and/or state ambient air quality standards (AAQS). Under the authority of the Clean Air Act (CAA), the USEPA has established nationwide air quality standards to protect public health and welfare, with an adequate margin of safety.

These federal standards, known as the National Ambient Air Quality Standards (NAAQS), represent the maximum allowable atmospheric concentrations and were developed for six "criteria" pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable particulate matter less than 10 micrometers in diameter (PM_{10}), ozone (O_3), and lead (Pb) (40 CFR 50). The NAAQS are defined in terms of concentration (e.g., parts per million [ppm] or micrograms per cubic meter [$\mu g/m^3$]) determined over various periods of time (averaging periods). Short-term standards (1-hour, 8-hour, or 24-hour periods) were established for pollutants with acute health effects and may not be exceeded more than once a year. Long-term standards (quarterly or annual periods) were established for pollutants with chronic health effects and may never be exceeded.

Based on measured ambient criteria pollutant data, the USEPA designates areas of the U.S. as having air quality equal to or better than the NAAQS (attainment) or worse than the NAAQS (nonattainment). Upon achieving attainment, areas are considered to be in maintenance status for a period of 10 or more years. Areas are designated as unclassifiable for a pollutant when there is insufficient ambient air quality data for the USEPA to form a basis of attainment status. For the purpose of applying air quality regulations, unclassifiable areas are treated similar to areas that are in attainment of the NAAQS.

On April 15, 2004, the USEPA promulgated attainment designations for the newly established 8-hour O_3 standard effective as of June 15, 2004. The USEPA revoked the 1-hour O_3 standard in June 2005 (USEPA 2004a). On March 27, 2008, the USEPA lowered the 8-hour O_3 standard to 0.075 ppm. The USEPA will make its final designations for areas that attain or do not attain the 2008 standard by March 12, 2010. On December 17, 2004, the USEPA designated areas as attainment for the newly developed standard for particulates less than 2.5 micrometers in diameter ($PM_{2.5}$), which are fine particulates that have not been previously regulated (USEPA 2004b).

STATE AIR QUALITY STANDARDS

Under the CAA, state and local agencies may establish AAQS and regulations of their own, provided that these are at least as stringent as the federal requirements. For all criteria pollutants, Georgia has adopted the NAAQS (Georgia Department of Natural Resources [DNR] 2009). South Carolina has also adopted AAQS for total suspended particulates and gaseous fluorides (South Carolina Department of Health and Environmental Control [SCDHEC] 2009). A summary of the AAQS that apply to the proposed project area is presented in Table 3.4-1.

STATE IMPLEMENTATION PLAN

For non-attainment regions, the states are required to develop a State Implementation Plan (SIP) designed to eliminate or reduce the severity and number of NAAQS violations, with an underlying goal to bring state air quality conditions into (and maintain) compliance with the NAAQS by specific deadlines. The SIP is the primary means for the implementation, maintenance, and enforcement of the measures needed to attain and maintain the NAAQS in each state.

Table 3.4-1. Applicable Ambient Air Quality Standards

Air Pollutant	*Averaging Time*	*Federal NAAQS*		*South Carolina*	*Georgia*
		Primary	*Secondary*		
Carbon Monoxide (CO)	8-Hour 1-Hour	9 ppm 35 ppm	-- --	9 ppm 35 ppm	9 ppm 35 ppm
Nitrogen Dioxide (NO_2)	AAM	0.053 ppm	0.053 ppm	0.53 ppm	0.53 ppm
Sulfur Dioxide (SO_2)	AAM 24-Hour 3-Hour	0.03 ppm 0.14 ppm --	-- -- 0.5 ppm	0.03 ppm 0.14 ppm 0.5 ppm	0.03 ppm 0.14 ppm 0.5 ppm
Particulate Matter (PM_{10})	AAM 24-Hour	-- 150 μg/m³	-- 150 μg/m³	50 μg/m³ 150 μg/m³	-- 150 μg/m³
Particulate Matter ($PM_{2.5}$)[1]	AAM 24-Hour	15 μg/m³ 35 μg/m³	15 μg/m³ 35 μg/m³	15 μg/m³ 35 μg/m³	15 μg/m³ 35 μg/m³
Total Suspended Particulates (TSP)	AGM	--	--	75 μg/m³	--
Ozone (O_3)[2]	8-Hour	0.075 ppm	0.075 ppm	0.075 ppm	0.075 ppm
Lead (Pb) and Lead Compounds	Calendar Quarter Rolling 3-Month Ave.	1.5 μg/m³ 0.15 μg/m³	1.5 μg/m³ 0.15 μg/m³	-- 0.15 μg/m³	-- 0.15 μg/m³
Non-methane Hydrocarbons	3-Hour	-	-	160 μg/m³	-
Gaseous Fluorides	1 Month 1 Week 24-Hour 12-Hour	-- -- -- --	-- -- -- --	0.8 μg/m³ 1.6 μg/m³ 2.9 μg/m³ 3.7 μg/m³	-- -- -- --

Notes: AAM = Annual Arithmetic Mean; AGM = Annual Geometric Mean.
ppm = parts per million; μg/m³ = micrograms per cubic meter.
1. The $PM_{2.5}$ standard (particulate matter with a 2.5 μm diameter or smaller) will be implemented over the next few years. USEPA designated areas as being in attainment or nonattainment of the $PM_{2.5}$ standard in December 2004.
2. The 2008 8-hour O_3 standard of 0.075 ppm replaces the 1997 8-hour standard of 0.08 ppm.

Sources: 40 CFR 50, SCDHEC 2009, Georgia DNR 2009.

Prevention of Significant Deterioration

Section 162 of the CAA further established the goal of prevention of significant deterioration (PSD) of air quality in all international parks; national parks that exceed 6,000 acres; and national wilderness areas and memorial parks that exceed 5,000 acres if these areas were in existence on August 7, 1977. These areas were defined as mandatory Class I areas, while all other attainment or unclassifiable areas were defined as Class II areas. Under CAA Section 164, states or tribal nations, in addition to the federal government, have the authority to redesignate certain areas as (non-mandatory) PSD Class I areas, e.g., a national park or national wilderness area established after August 7, 1977, which exceeds 10,000 acres. PSD Class I areas are areas where any appreciable deterioration of air quality is considered significant. Class II areas are those where moderate, well-controlled growth could be permitted. Class III areas are those designated by the governor of a state as requiring less protection than Class II areas. No Class III areas have yet been so designated. The PSD requirements affect construction of new major stationary sources in the PSD Class I, II, and III areas and are a pre-construction permitting system.

VISIBILITY

CAA Section 169A established the additional goal of prevention of further visibility impairment in PSD Class I areas. Visibility impairment is defined as a reduction in the visual range and atmospheric discoloration. Determination of the significance of an activity on visibility in a PSD Class I area is typically associated with evaluation of stationary source contributions. The USEPA is implementing a Regional Haze rule for PSD Class I areas that will address contributions from mobile sources and pollution transported from other states or regions. Emission levels are used to qualitatively assess potential impairment to visibility in PSD Class I areas. Decreased visibility may potentially result from elevated concentrations of PM_{10} and SO_2 in the lower atmosphere.

GENERAL CONFORMITY

CAA Section 176(c), General Conformity, established certain statutory requirements for federal agencies with proposed federal activities to demonstrate conformity of the proposed activities with each state's SIP for attainment of the NAAQS. Federal activities must not:

(a) cause or contribute to any new violation;

(b) increase the frequency or severity of any existing violation; or

(c) delay timely attainment of any standard, interim emission reductions, or milestones in conformity to a SIP's purpose of eliminating or reducing the severity and number of NAAQS violations or achieving attainment of NAAQS.

General conformity applies only to nonattainment and maintenance areas. If the emissions from a federal action proposed in a nonattainment area exceed annual thresholds identified in the rule, a conformity determination is required of that action. The thresholds become more restrictive as the severity of the nonattainment status of the region increases.

3.4.1.1 METHODOLOGY

Air emissions resulting from the Mitigated Proposed Action were evaluated in accordance with federal, state, and local air pollution standards and regulations. The emissions were estimated and compared with baseline emissions to assess changes in emissions. Air quality impacts from a proposed activity or action would be significant if they:

- increase ambient air pollution concentrations above any NAAQS;
- contribute to an existing violation of any NAAQS;

- interfere with or delay timely attainment of NAAQS; or
- impair visibility within any federally mandated federal Class I area.

The approach to the air quality analysis was twofold. First, an emissions comparison was developed for the Mitigated Proposed Action to determine the magnitude of the change in emissions relative to the baseline.

Second, an air dispersion model was used to predict the change in ambient concentrations resulting from the new aircraft emission levels. The Multiple Aircraft Instantaneous Line Source (MAILS) dispersion model (Leibsch *et al.* 1992) was used to estimate air pollutant concentrations from a reasonable practical scenario for the MOA where the largest increase in low-altitude emissions would occur as a result of the Mitigated Proposed Action. The MAILS model is an air quality screening model that provides conservative estimates of ground-level pollutant concentrations resulting from aircraft engine emissions during flights and is intended for low-altitude flights (within the atmospheric mixing layer). Predicted concentrations from the MAILS modeling runs were compared to the existing NAAQS increments for regulated pollutants.

As described above, Section 169A of the CAA established the PSD regulations to protect the air quality in regions that already meet the NAAQS. Certain national parks, monuments, and wilderness areas have been designated as PSD Class I areas, where appreciable deterioration in air quality is considered significant. Because the Mitigated Proposed Action does not involve creation or modification of any new stationary sources, the PSD requirements do not apply. The level of increased emissions and ground-level impacts were used, however, to qualitatively assess potential impairments to visibility in federal Class I areas.

According to USEPA's General Conformity Rule, in 40 CFR Part 51, Subpart W, any proposed federal action that has the potential to cause violations, as described above, in a nonattainment or maintenance area must undergo a conformity analysis. A conformity analysis is not required in an attainment area. Since all of the counties in the region potentially affected by the Mitigated Proposed Action are designated as attainment for all criteria pollutants, a conformity determination is not required and was not performed.

3.4.1.2 ISSUES AND CONCERNS

No specific air quality issues were identified during public hearings or the public comment review period. The number of sorties associated with the Mitigated Proposed Action and alternatives will not change from current conditions. The potential for any air quality consequences is low. However, as an action that modifies the airspace, the potential ATI air quality effects are considered below.

3.4.2 Existing Conditions – Air Quality

REGIONAL AIR QUALITY

Federal regulations (40 CFR 81) delineate certain air quality control regions (AQCR), which were originally designated based on population and topographic criteria closely approximating each air basin. The potential influence of emissions on regional air quality would typically be confined to the air basin in which the emissions occur. The ROI for the Mitigated Proposed Action and alternatives includes the following seven separate AQCRs, spanning 18 counties in South Carolina and Georgia (40 CFR 81, Subpart B):

- AQCR 53 (Augusta-Aiken Interstate), including Glascock, Jefferson, Emanuel, Jenkins, and Burke Counties in Georgia and Calhoun County in South Carolina (40 CFR 81.114) is beneath the Bulldog A, Bulldog B, and Poinsett MOAs.
- AQCR 54 (Central Georgia Intrastate), including Washington, Johnson, and Laurens Counties in Georgia (40 CFR 81.236) is beneath the Bulldog A and Bulldog B MOAs.
- AQCR 58 (Savannah-Beaufort Interstate), including Bulloch County in Georgia (40 CFR 81.113) is beneath the Bulldog B MOA.
- AQCR 198 (Camden-Sumter Intrastate), including Clarendon and Sumter Counties in South Carolina (40 CFR 81.110) is beneath the Gamecock D and Poinsett MOAs and the Poinsett ECR (R-6002).
- AQCR 199 (Charleston Intrastate), including Berkeley County in South Carolina (40 CFR 81.112) is beneath the Gamecock D MOA.
- AQCR 201 (Florence Intrastate), including Florence and Marion Counties in South Carolina (40 CFR 81.109) is beneath the Gamecock B and Gamecock C MOAs.
- AQCR 204 (Georgetown Intrastate), including Georgetown, Horry, and Williamsburg Counties in South Carolina (40 CFR 81.111) is beneath the Gamecock B, Gamecock C, and Gamecock D MOAs.

ATTAINMENT STATUS

A review of federally published attainment status for Georgia and South Carolina in 40 CFR 81.311 and 40 CFR 81.341, respectively, indicates that this ROI is designated attainment for all criteria pollutants, including CO, NO_2, SO_2, PM_{10}, O_3, Pb, and $PM_{2.5}$. The States of Georgia and South Carolina also have recommended to the USEPA that the ROI attains the 2008 8-hour O_3 (USEPA 2009).

PSD CLASS I AREAS

No mandatory federal PSD Class I areas are located within the ROI. The nearest PSD Class I area is the Cape Romain NWR on the South Carolina coast, which is 24 miles south of the Gamecock MOA. The coastal waters at Cape Romain NWR are sensitive to atmospheric deposition of nitrogen, which contributes to eutrophication and decreases the sensitivity to acidic deposition. Sensitive air quality related values (AQRVs) at Cape Romain NWR include ozone-sensitive vegetation and wildlife, soils, and visibility (National Park Service [NPS] 2004a).

Other nearby Class I areas include the Wolf Island NWR on the Georgia coast (90 miles southeast of the Bulldog MOA); the Okefenokee NWR near the Georgia-Florida border (103 miles south of the Bulldog MOA); and the Shining Rock wilderness areas in western North Carolina (146 miles northwest of the Gamecock MOA). Figure 3.4-1 shows all of the PSD Class I areas within 250 miles of the Gamecock and Bulldog MOAs.

MONITORING DATA

The USEPA has a few monitoring sites located in the region potentially affected by the Mitigated Proposed Action or alternatives. Monitoring data are available for only one of the nine counties in Georgia and six of the nine counties in South Carolina in the area potentially affected by the Mitigated Proposed Action or alternatives. Monitoring data for the past three years is presented in Table 3.4-2 and indicates good air quality.

Table 3.4-2. Air Quality Monitoring Data for Counties in the ROI (Georgia and South Carolina)

Pollutant/Monitoring Station, By County	*Averaging Time*	MAXIMUM CONCENTRATION BY YEAR*		
		2002	*2003*	*2004*
Ozone (ppm)				
Berkeley County, South Carolina	1-Hour	0.100	0.086	0.087
Williamsburg County, South Carolina		0.092	0.082	0.082
Berkeley County, South Carolina	8-Hour	0.083	0.074	0.080
Williamsburg County, South Carolina		0.086	0.078	0.074
Sulfur Dioxide (ppm)				
Georgetown County, South Carolina	1-Hour	0.105	0.062	0.101
	3-Hour	0.082	0.039	0.061
	24-Hour	0.037	0.008	0.012
	AAM	0.002	0.002	0.002
$PM_{2.5}$ ($\mu g/m^3$)				
Washington County, Georgia	24-Hour	36	33	56
Berkeley County, South Carolina		27	25	35
Florence County, South Carolina		32	31	33
Georgetown County, South Carolina		28	29	39
Horry County, South Carolina		28	27	31
Washington County, Georgia	AAM	13.6	13.7	15.9
Berkeley County, South Carolina		10.2	10.3	13.7
Florence County, South Carolina		12.3	12.1	13.9
Georgetown County, South Carolina		12.6	12.3	13.1
Horry County, South Carolina		10.7	10.8	12.7
PM_{10} ($\mu g/m^3$)				
Washington County, Georgia	24-Hour	116	70	64
Georgetown County, South Carolina		93	83	105
Washington County, Georgia	AAM	23	25	26
Georgetown County, South Carolina		30	33	36
Lead ($\mu g/m^3$)				
Georgetown County, South Carolina	24-Hour	0.07	0.11	0.16
Horry County, South Carolina		0.01	0.02	0.01
Sumter County, South Carolina		0.02	0.03	0.02
Georgetown County, South Carolina	AAM	0.01	0.02	0.02
Horry County, South Carolina		< 0.01	< 0.01	< 0.01
Sumter County, South Carolina		0.01	0.01	0.01

Notes: ppm = part per million by volume
$\mu g/m^3$ = micrograms per cubic meter
AAM = Annual Arithmetic Mean
(* - concentrations reported as AAM are annual average, not maximum, concentrations)
Source: USEPA 2005.

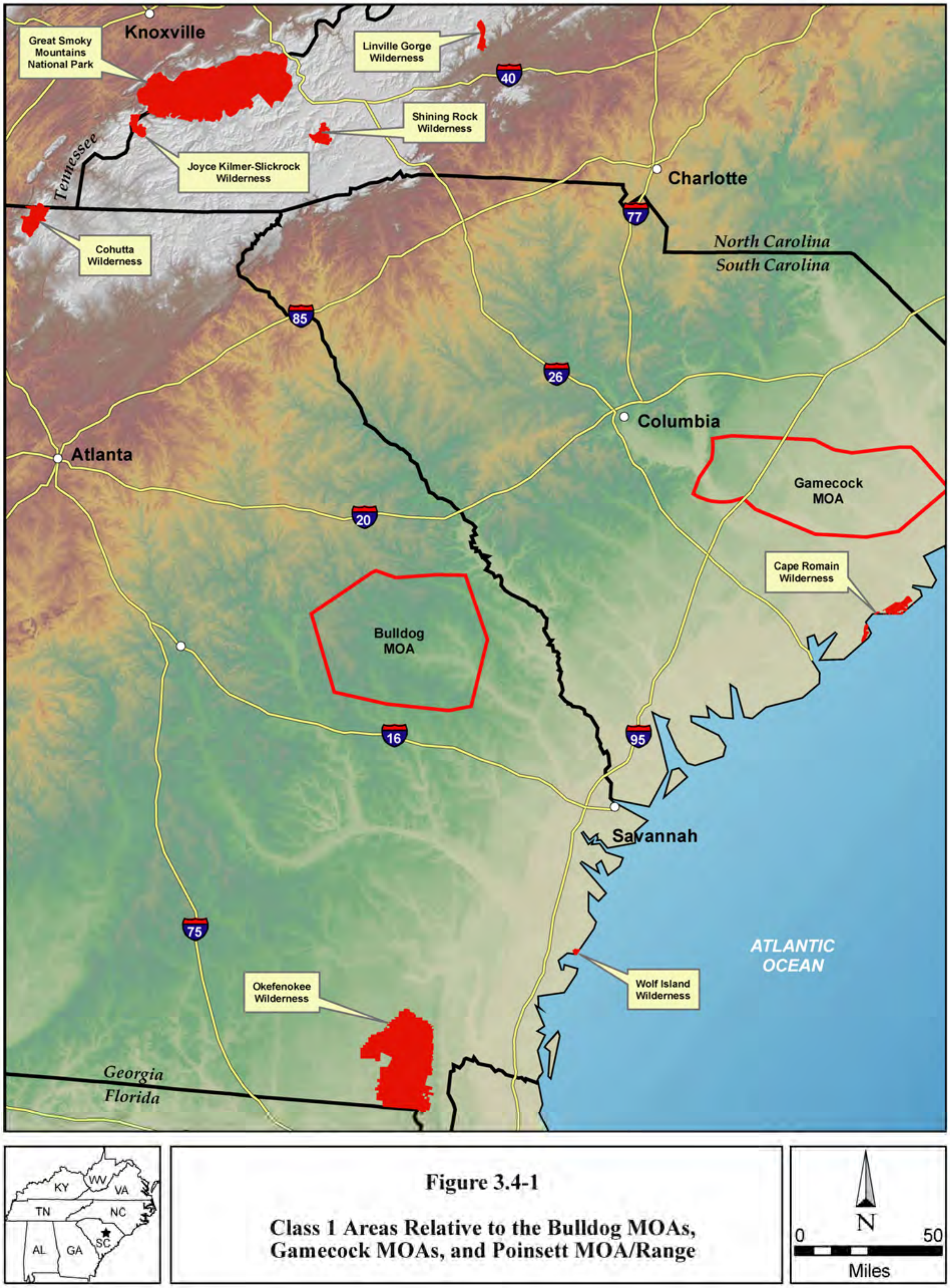


Figure 3.4-1

Class 1 Areas Relative to the Bulldog MOAs, Gamecock MOAs, and Poinsett MOA/Range

CURRENT EMISSIONS

Air emissions in the ROI result solely from aircraft sortie operations in the Gamecock and Bulldog MOAs. Baseline emissions from aircraft sorties through specific airspaces were calculated using emission factors for the A-10, AV-8, EA-6B, F-14, F-15, F-16, and F-18 aircraft published in *Calculation Methods for Criteria Air Pollutant Emission Inventories* (Jagielski and O'Brien 1994), *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources* (USEPA 1992), and *Air Emissions Inventory Guidance Document for Mobile Sources at Air Force Installations* (O'Brien and Wade 2002). Aircraft are assumed to be traveling through the airspace at military power. In the following sections and tables, volatile organic compounds (VOCs) are precursors to the formation of O_3 in the atmosphere; nitrogen oxides (NO_x) include NO_2 and other related compounds; sulfur oxides (SO_x) include SO_2 and other related compounds. Because VOCs and NO_x are precursors to the formation of O_3 in the atmosphere, control of these pollutants is the primary method of reducing O_3 concentrations in the atmosphere. The emissions of particulate matter were calculated based on emission factors for total suspended particulates (i.e., particulates that are less than 30 microns in diameter), which includes PM_{10} and $PM_{2.5}$ components. Since source test data show that virtually all particles emitted by aircraft that burn jet fuel are within the $PM_{2.5}$ range, the PM_{10} and $PM_{2.5}$ emissions data presented is this EIS are of equal values (Aircraft Environmental Support Office 2005). Table 3.4-3 summarizes the current emissions in each airspace.

Emissions from aircraft flying MTR sorties within the boundaries of the Bulldog A MOA where it expands under Bulldog B MOA, calculated using the same methodology as used for the aircraft emissions presented above, are shown in Table 3.4-4.

The current emissions are distributed over 18 counties and seven AQCRs in Georgia and South Carolina, and occur primarily above the mixed layer of the atmosphere. Emissions occurring above the mixed layer do not typically affect ground-level concentrations of these pollutants (USEPA 1992). The Air Force operates no stationary sources of air emissions within the ROI.

Table 3.4-3. Baseline Aircraft Emissions within ROI[1]

	Hours	ANNUAL EMISSIONS (TONS PER YEAR)				
Airspace	*per year*	*CO*	*VOC*	*NO_x*	*SO_x*	*$PM_{10}/PM_{2.5}$*
Bulldog A/B	2,960	17.7	9.5	345.2	8.4	25.2
Gamecock B	108	0.5	0.4	9.5	0.3	0.5
Gamecock C	2,669	21.3	6.7	282.5	7.3	20.7
Gamecock D	2,675	16.3	8.4	303.8	7.5	17.1
Gamecock E	0	–	–	–	–	–
Poinsett	15	0.1	< 0.1	1.7	< 0.1	0.1
Poinsett ECR	1,673	10.2	5.3	189.9	4.7	10.7

Note: 1. The ROI for Air Quality does not include MTRs.
CO = carbon monoxide; VOC = volatile organic compound; NO_x = nitrogen oxides; SO_x = sulfur oxides; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

Table 3.4-4. Baseline Aircraft Emissions from Sorties Flown under the Proposed Bulldog MOA Expansion

Airspace	*Sorties per year*	ANNUAL EMISSIONS (TONS PER YEAR)				
		CO	*VOC*	*NO_x*	*SO_x*	*PM_{10}/$PM_{2.5}$*
IR-074	2	<0.1	<0.1	<0.1	<0.1	<0.1
VR-094	28	<0.1	<0.1	0.2	<0.1	<0.1
VR-097	147	<0.1	<0.1	0.5	<0.1	<0.1
VR-1059	686	0.1	<0.1	0.8	<0.1	<0.1
VR-1004	533	<0.1	<0.1	0.4	<0.1	<0.1
Total	1,396	0.2	<0.1	2.0	0.1	0.1

CO = carbon monoxide; VOC = volatile organic compound; NO_x = nitrogen oxides; SO_x = sulfur oxides; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

REGIONAL AIR EMISSIONS

The NEPA process must also consider impacts from mobile sources and indirect emissions related to the project. For comparison purposes, Table 3.4-5 lists county-wide emissions for the Georgia ROI and the South Carolina ROI, as compiled by the USEPA in its National Emissions Inventory (NEI) (USEPA 2003). The 1999 NEI contains estimates of annual emissions for stationary and mobile sources of air pollutants.

Table 3.4-5. National Air Emissions Inventory for the ROI (1999)

	POLLUTANTS (IN TONS PER YEAR)				
	CO	*SO_2*	*NO_x*	*PM_{10}*	*VOC*
Georgia ROI[1]					
Stationary Sources	40,752	2,886	2,849	44,017	7,865
Mobile Sources	92,321	627	13,813	552	7,499
South Carolina ROI[2]					
Stationary Sources	89,092	126,065	68,456	66,679	37,755
Mobile Sources	292,547	1,790	36,129	1,662	28,692

Notes: 1. Georgia ROI includes the following counties: Bulloch, Burke, Emanuel, Glascock, Jefferson, Jenkins, Johnson, Laurens, and Washington.
2. South Carolina ROI includes the following counties: Berkeley, Calhoun, Clarendon, Florence, Georgetown, Horry, Marion, Sumter, and Williamsburg.

CO = carbon monoxide; SO_2 = sulfur dioxide; NO_x = nitrogen oxides; PM_{10} = particulate matter less than or equal to 10 microns in diameter; VOC = volatile organic compound; ROI = region of influence
Source: USEPA 2003.

GREENHOUSE GASES

Historically, the aviation sector is responsible for about 2.6 percent of the greenhouse gas (GHG) emissions in the Nation, with the U.S. military contributing only a small portion. Military aviation used approximately 0.5 percent of the U.S. aviation fuel in 2000. Non-aviation transportation emits 25 percent, industry 41 percent, and other U.S. sources emit 31 percent of the GHGs (USEPA 2006). Aircraft activities will generate small amounts of GHGs primarily from emission products from internal combustion engines. However, these amounts are negligible and would not significantly contribute to greenhouse gasses. Aircraft activities are not likely to significantly affect the climate on a global or regional scale. Due to this and the fact that there are no current regulations for GHGs under the CAA, GHG emissions will not be discussed or analyzed further.

3.4.3 Environmental Consequences – Air Quality

3.4.3.1 MITIGATED PROPOSED ACTION

Aircraft burn fuel and create air emissions. All counties under the ATI airspace are in air quality attainment. The contribution of Shaw AFB aircraft emissions will not impact regional or local air quality.

The number of aircraft sorties is expected to remain the same under the Mitigated Proposed Action or any alternative, including No Action. Increased air emissions could only be those from the combustion of fuels during aircraft sorties through newly proposed airspace within the mixing layer of the atmosphere. Aircraft use in the airspace potentially affected by the Mitigated Proposed Action could generate localized changes in CO, NO_x, PM_{10}, $PM_{2.5}$, SO_x, and VOC emissions. Additional temporary increases in air emissions would occur due to grading and construction of the transmitter sites. Chaff and flares, used exclusively at altitudes greater than 4,500 feet AGL, with flares burning out at altitudes greater than 4,000 feet AGL, are not expected to affect the air quality at ground level nor within the mixing layer of the atmosphere below 3,000 feet AGL.

CONSTRUCTION EMISSIONS

Temporary construction emissions would occur under the Mitigated Proposed Action during preparation and grading of the 800-foot square transmitter sites. Emissions during the construction period for the additional transmitter sites were quantified to determine the potential impacts on regional air quality. Calculations of VOC, NO_x, CO, SO_x, PM_{10} and $PM_{2.5}$ emissions from construction, grading, and paving activities were performed using USEPA emission factors compiled in the *Calculations Methods for Criteria Air Pollution Emission Inventories* (Jagielski and O'Brien 1994) and *Air Emissions Inventory Guidance Document for Mobile Sources at Air Force Installations* (O'Brien and Wade 2002). Grading emissions include fugitive dust from ground disturbance, plus combustive emissions from heavy equipment and worker travel during the entire construction period. Estimated annual emissions would occur from grading and construction of the six new transmitter sites; each require approximately one acre of land clearing and grading. For analyses purposes, the six sites were each assumed to require 15 acres of clearing. The potential higher end construction emissions are presented in Table 3.4-6.

Table 3.4-6. Construction Emissions – Mitigated Proposed Action

Source	EMISSIONS (IN TONS)				
	CO	*VOC*	*NO_x*	*SO_x*	*PM_{10}/$PM_{2.5}$*
Site Preparation, Grading	3.1	0.6	5.0	0.5	2.7

CO = carbon monoxide; VOC = volatile organic compound; NO_x = nitrogen oxides; SO_x = sulfur oxides; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

Emissions generated by construction projects, such as the preparation of transmitter sites, are temporary in nature and would end when construction is complete. Particulate emissions from fugitive dust would be considerably less than those presented in Table 3.4-6 due to the implementation of control measures in accordance with standard construction practices. For instance, frequent spraying of water on exposed soil during construction, proper soil stockpiling methods, and prompt replacement of ground cover or pavement are standard landscaping procedures that could be used to minimize the amount of dust generated during construction. Using efficient practices and avoiding long periods where engines are running at idle may reduce combustion emissions from construction equipment. Vehicular combustion emissions from construction worker commuting may be reduced by carpooling. Table 3.4-6 presents a worst-case scenario and, therefore, annual emissions would be lower than shown.

In general, combustive and fugitive dust emissions would produce localized, short-term elevated air pollutant concentrations, which would not result in any long-term impacts on the air quality in the ROI.

AIRCRAFT EMISSIONS

Flying operations include aircraft sorties through Gamecock, Bulldog, and Poinsett MOAs and the Poinsett ECR. Transit sorties through MTRs were not quantified because these would not change. Sortie emissions from these operations were calculated using emission factors from *Calculations Methods for Criteria Air Pollution Emission Inventories* (Jagielski and O'Brien 1994), *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources* (USEPA 1992), and *Air Emissions Inventory Guidance Document for Mobile Sources at Air Force Installations* (O'Brien and Wade 2002). The calculations were performed under the assumption that aircraft are flying at military power during the entire sortie. Table 3.4-7 summarizes the aircraft emissions that would occur within each airspace under the Mitigated Proposed Action.

Table 3.4-7. Aircraft Emissions within ROI under the Mitigated Proposed Action

Airspace	*Hours per year*	ANNUAL EMISSIONS (TONS PER YEAR)				
		CO	*VOC*	*NO_x*	*SO_x*	*$PM_{10}/PM_{2.5}$*
Bulldog Complex	2,960	17.7	9.5	345.2	8.4	25.2
Gamecock B	0	–	–	–	–	–
Gamecock C	2,669	21.3	6.7	282.5	7.3	20.7
Gamecock D	2,675	16.3	8.4	303.8	7.5	17.1
Poinsett	15	0.1	< 0.1	1.7	< 0.1	0.1
Poinsett ECR	1,673	10.2	5.3	189.9	4.7	10.7

Note: These emissions are equivalent to those under baseline conditions; the ROI for Air Quality does not include MTRs.

CO = carbon monoxide; VOC = volatile organic compound; NO_x = nitrogen oxides; SO_x = sulfur oxides; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; ROI = region of influence; MTR = Military Training Route

The emissions from aircraft flying MTR sorties within the boundaries of the Bulldog C and E MOAs would not change as a result of the Mitigated Proposed Action and would be equivalent to those shown in Table 3.4-4.

Under the Mitigated Proposed Action, the only location where aircraft activity would increase within the mixing layer (below 3,000 feet, i.e., the only location where aircraft emissions would affect ground level concentrations of air pollutants) would be within the Bulldog C/E MOAs, where the 500-foot floor of these MOAs would expand under the Bulldog B MOA. This area is limited to portions of Burke, Bulloch, Emanuel, Jenkins, and Johnson Counties in Georgia. While the annual number of aircraft sorties and hours of operation in the Bulldog A/B MOAs would be the same as the baseline conditions, the sorties would be redistributed and, the Mitigated Proposed Action would relocate portions of sorties that occur between 500 and 10,000 feet AGL within the existing Bulldog A MOA to the proposed Bulldog C/E MOAs.

MAILS MODELING

Air quality impacts could occur as a result of implementation of the Mitigated Proposed Action since some of the aircraft operations occur at low altitudes (below 3,000 feet AGL). The approach was to use the MAILS dispersion model (Leibsch *et al.* 1992) to analyze these impacts on air quality in the proposed Bulldog C/E MOAs from a reasonable practical scenario. As discussed above, this is the only area where emissions from aircraft flying within the mixed layer would be expected to increase as a result of the Mitigated Proposed Action. The results of the evaluation were used to identify potential exceedances of the NAAQS. The modeling results (i.e., PM_{10} and SO_x concentrations) were also used to qualitatively assess visibility impacts to PSD Class I areas resulting from the increased aircraft activities.

For modeling purposes, it was assumed that not more than 15 percent of sorties in the Bulldog A/B MOAs would occur below 3,000 feet AGL (i.e., within the mixing layer) and therefore having a potential affect on ground-level air pollution concentrations. For comparison purposes, the number of hours of training below 5,000 feet MSL in the Bulldog MOAs is approximately 12.9 percent (see Table 2-7). The proposed Bulldog C/E MOAs increase the area where aircraft would fly at low altitudes from 1,396 to 2,007 square miles, an increase of 611 square miles. The sortie numbers and emission factors used in the modeling runs are shown in the MAILS output printouts presented in Appendix J.

The projected annual sorties for the newly expanded low-altitude portion of the Bulldog A MOA were used to estimate the 1-hour, 3-hour, 8-hour, and 24-hour sortie numbers.

Sorties above 3,000 feet AGL were not included in the MAILS modeling analysis because air quality impacts are not expected from operations at altitudes greater than the atmospheric mixing height. The aircraft emissions database in the MAILS model was modified by adding revised emissions data for the aircraft engines operating in military mode. The MAILS model was used to predict 1-hour, 3-hour, 8-hour, 24-hour, and annual ground-level concentrations for CO, SO_2, PM_{10}, $PM_{2.5}$, and NO_2. The concentrations predicted by the MAILS model for the ROI were compared to the NAAQS, as shown in Table 3.4-8. The results of the modeling analysis show that the Mitigated Proposed Action would produce minimal and less than significant impacts to ambient pollutant levels.

Table 3.4-8. MAILS Modeling Results for the ATI Mitigated Proposed Action

Criteria Pollutant	*Averaging Period*	CONCENTRATION ($\mu g/m^3$) *NAAQS*	*Affected Airspace*	*Percentage of NAAQS*
NO_2	Annual	100	0.0003	0.0003%
PART[1]	24-hour (PM_{10})	150	0.0026	0.0017%
	24-hour ($PM_{2.5}$)	65	0.0026	0.0040%
	Annual (PM_{10})	50	0.00003	<0.0001%
	Annual ($PM_{2.5}$)	15	0.00003	0.0002%
SO_2	3-hour	1300	0.014	0.0011%
	24-hour	365	0.001	0.0002%
	Annual	80	0.00001	<0.0001%
CO	1-hour	40,000	0.17	0.0004%
	8-hour	10,000	0.007	0.0001%

Note: 1. The NAAQS for particulates are for PM_{10} and $PM_{2.5}$. The MAILS model predicts total particulates, which are assumed to consist entirely of PM_{10} and $PM_{2.5}$.

µg/m3 = micrograms per cubic meters; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; SO_2 = sulfur dioxide; CO = carbon monoxide

3.4.3.2 ALTERNATIVE A

The only source of increased air emissions under Alternative A would be those from the combustion of fuels during aircraft sorties through newly proposed airspace within or below the mixing layer of the atmosphere. Any additional aircraft activity in the potentially affected airspace could generate localized changes in CO, NO_x, PM_{10}, SO_x, and VOC emissions. Additional temporary increases in air emissions would occur due to grading and construction of the transmitter sites. Chaff and flares, used exclusively at altitudes greater than 4,500 feet AGL, with flares burning out at altitudes greater than 4,000 feet AGL, are not expected to affect the air quality at ground level nor within the mixing layer of the atmosphere.

CONSTRUCTION EMISSIONS

Temporary construction emissions would occur under the Alternative A during preparation and grading of the 800-square-foot transmitter sites. Because the transmitter sites under Alternative A would be identical to those constructed under the Mitigated Proposed Action, emissions during the construction period for the additional transmitter sites would be equivalent to those shown in Table 3.4-6. In general, combustive and fugitive dust emissions would produce localized, short-term elevated air pollutant concentrations, which would not result in any long-term impacts on the air quality in the ROI.

AIRCRAFT EMISSIONS

Flying operations under Alternative A include aircraft sorties through Gamecock, Bulldog, and Poinsett MOAs and the Poinsett ECR. Transit sorties through MTRs were not quantified, as these would not change as a result of this alternative. Sortie emissions from these operations were calculated using the same emission factors and assumptions that were used to calculate aircraft emissions under the Mitigated Proposed Action. While the annual number of aircraft sorties and hours of operation under Alternative A would be the same as the baseline conditions, they would operate over larger airspaces in association with the proposed Gamecock E MOA and the expanded Bulldog A MOA. Table 3.4-9 summarizes the aircraft emissions that would occur within each airspace under Alternative A.

Table 3.4-9. Aircraft Emissions within ROI for ATI Alternative A

Airspace	*Hours per year*	ANNUAL EMISSIONS (TONS PER YEAR)				
		CO	*VOC*	*NO_x*	*SO_x*	*$PM_{10}/PM_{2.5}$*
Bulldog Complex	2,960	17.7	9.5	345.2	8.4	25.2
Gamecock B	0	–	–	–	–	–
Gamecock C	1,778	14.2	4.5	188.2	4.9	13.8
Gamecock D	1,781	10.9	5.6	202.3	5.0	11.4
Gamecock E	1,781	12.6	5.0	195.8	4.9	12.6
Poinsett	15	0.1	< 0.1	1.7	< 0.1	0.1
Poinsett ECR	1,673	10.2	5.3	189.9	4.7	10.7

Note: The ROI for Air Quality does not include MTRs.
CO = carbon monoxide; VOC = volatile organic compound; NO_x = nitrogen oxides; SO_x = sulfur oxides; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; ROI = region of influence; MTR = Military Training Route

The airspaces potentially affected by Alternative A span a large area over 18 counties and seven AQCRs in Georgia and South Carolina. Under Alternative A, however, the only location where aircraft activity would increase within the mixing layer (below 3,000 feet, i.e., the only location where aircraft emissions would affect ground level concentrations of air pollutants) would be where the 500-foot floor of the Bulldog A MOA would expand under the Bulldog B MOA. This area is limited to portions of Burke, Bulloch, Emanuel, Jenkins, and Johnson Counties in Georgia. While aircraft sorties in the Bulldog A/B MOAs would remain the same as under baseline conditions, Alternative A would relocate portions of sorties that occur between of 500 and 10,000 feet AGL within the existing Bulldog A MOA to the expanded Bulldog A MOA (below the floor of the Bulldog B MOA).

Air quality impacts generated by Alternative A would be similar to those estimated for the Mitigated Proposed Action, as both scenarios would produce similar levels of aircraft operations at low altitudes (below 3,000 feet AGL). Therefore, ground level concentration increases under Alternative A would be the same as those shown in Table 3.4-7 for the Mitigated Proposed Action. The results of the modeling analysis show that Alternative A would produce minimal and less than significant impacts to ambient pollutant levels.

3.4.3.3 ALTERNATIVE B

Any additional aircraft activity in the airspace potentially affected by Alternative B would generate localized changes in CO, NO_x, PM_{10}, SO_x, and VOC emissions. Additional temporary increases in air emissions would occur due to grading and construction of the transmitter sites.

Chaff and flares, used exclusively at altitudes greater than 4,500 feet AGL, with flares burning out at altitudes greater than 4,000 feet AGL, are not expected to affect the air quality at ground level nor within the mixing layer of the atmosphere.

CONSTRUCTION EMISSIONS

Temporary construction emissions would occur under Alternative B during preparation and grading of the 800-foot square transmitter sites. Alternative B would construct three transmitter sites, or half of those proposed for the Mitigated Proposed Action. Therefore, emissions during the construction period for the additional transmitter sites would be approximately one-half those shown in Table 3.4-6 for the Mitigated Proposed Action. Combustive and fugitive dust emissions under Alternative B would produce localized, short-term elevated air pollutant concentrations, but would not result in any long-term impacts on the air quality in the ROI.

AIRCRAFT EMISSIONS

Flying operations under Alternative B include aircraft sorties through Gamecock, Bulldog, and Poinsett MOAs and the Poinsett ECR. Transit sorties through MTRs were not quantified because these would not change as a result of this alternative. Sortie emissions from these operations were calculated using the same emission factors and assumptions that were used to calculate aircraft emissions under the Mitigated Proposed Action. While the annual number of aircraft sorties and hours of operation under Alternative B would be the same as the baseline conditions, they would operate over larger airspaces in association with the proposed Gamecock E MOA. Table 3.4-10 summarizes the aircraft emissions that would occur within each airspace under Alternative B.

Table 3.4-10. Aircraft Emissions within ROI for ATI Alternative B

Airspace	*Hours per year*	**ANNUAL EMISSIONS (TONS PER YEAR)**				
		CO	***VOC***	***NO_x***	***SO_x***	***$PM_{10}/PM_{2.5}$***
Bulldog Complex	2,960	17.7	9.5	345.2	8.4	25.2
Gamecock B	108	0.5	0.4	9.5	0.3	0.5
Gamecock C	1,778	14.2	4.5	188.2	4.9	13.8
Gamecock D	1,673	10.4	5.2	192.8	4.7	10.9
Gamecock E	1,781	12.6	5.0	195.8	4.9	12.6
Poinsett	15	0.1	< 0.1	1.7	< 0.1	0.1
Poinsett ECR	1,673	10.2	5.3	189.9	4.7	10.7

Note: The ROI for Air Quality does not include MTRs.
CO = carbon monoxide; VOC = volatile organic compound; NO_x = nitrogen oxides; SO_x = sulfur oxides; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; ROI = region of influence; MTR = Military Training Route

Alternative B proposes no substantial increases in aircraft activity within the mixing layer over baseline conditions. The floor of Bulldog B MOA, at 3,000 feet MSL, would occur near the top of the mixing layer at 3,000 feet AGL. However, since this airspace extends to 27,000 feet, only a small portion of the proposed aircraft sorties within this airspace would extend into the very top of the mixing layer. Since Alternative B would not substantially increase aircraft sorties within the mixing layer compared to baseline conditions, Alternative B would not substantially increase ground-level ambient pollutant concentrations compared to baseline conditions. Therefore, Alternative B would produce minimal and less than significant impacts to ground-level ambient pollutant levels.

3.4.3.4 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, conditions in the ROI would remain the same as the baseline described in Section 3.4.2. It is expected that air quality would not change as a result of the No-Action Alternative.

3.5 PHYSICAL RESOURCES

3.5.1 Introduction

Physical resources are grouped according to Major Land Resource Areas (MLRAs) and associated subresource areas to facilitate the discussion of baseline or existing conditions. These groupings are based on a national system developed by the United States Department of Agriculture (USDA)-Natural Resources Conservation Service (NRCS) that delineates regions sharing recognizable associations of soils, vegetation, hydrology, and other land features. In addition, surface water features that traverse these MLRAs are also discussed for the lands under the affected airspace.

The ROI for physical resources consists of all lands under the current airspace, the proposed airspace expansion areas, and sites for the training transmitters.

3.5.1.1 METHODOLOGY

Potential impacts to physical resources for the ATI could result from the use of chaff and flares, and the construction of transmitter sites in Georgia and South Carolina. The analysis addresses the effects of chaff and flare residual materials being deposited on resources identified in Section 3.5.1. Physical resources also evaluates the potential for chaff and flare residual materials to accumulate in water bodies and sediments, potential for flare-caused fires, and the potential for materials to leach toxic chemicals or change the chemical composition of surface water bodies. If the chemical breakdown of chaff and flares do not result in toxic concentrations within the environment, then the consequences would be insignificant.

The construction of the training transmitter sites could disturb soils and introduce construction materials into the physical environment.

3.5.1.2 ISSUES AND CONCERNS

Chaff and flares are used in the existing MOAs. Physical resource questions deal mainly with the materials left on the ground after deployment of chaff and flares. Concerns expressed during public hearings and the public comment period included the risk of fire from flare use. Potential impacts could result from the release and breakdown of residual components of flares and chaff. Flares would also have the potential to affect soil or water properties through accumulated deposits of flare ash or introduction of a dud flare to a water body. Other concerns involve the potential for residual materials from deploying chaff and flares to affect the visual aspects of the physical environment. Flares that burn incorrectly or that are dispersed at an unauthorized altitude have the potential to start fires that could affect soil or water properties. The potential to start fires was addressed in Section 3.3.2.1, Safety. Release altitudes and the low failure rates of flares reduce the risk for fires.

Dud flares are flares that fail to ignite after being dispensed from an aircraft. Based on flare reliability, an estimated two dud flares per year fall in the Bulldog MOAs and another two fall in the Gamecock MOAs. A dud flare that falls to the earth is dangerous. Such a dud flare could ignite if it were subjected to temperatures of 1,200 degrees. If it remained unburned in the environment, the dud flare would decompose.

3.5.2 Existing Conditions – Physical Resources

BULLDOG MOAS

The Bulldog MOAs overlie the Vidalia Upland District of the Southern Coastal Plain MLRA. The Vidalia Uplands is a moderately dissected area with a well developed dendritic stream pattern on gravelly, clayey sands. Floodplains are narrow except along the principal rivers, which have a wide expanse of swamp bordering both sides of the channel. Relief varies from 100 to 150 feet. Elevations in the district range from 500 feet in the northwest to 100 feet in the southeast indicating the regional dip (Clark and Zisa 1976). Most of the upland soils are acidic, deep, and well or moderately well drained (West 2000). Depressions occur throughout the uplands. Soils in upland depressions and on floodplains are generally poorly drained, mainly wooded, and suitable for forestry (Air Force 2003).

Rivers and streams dissecting the land under the Bulldog MOAs include the Ogeechee, Ohoopee and Little Ohoopee, and Brier Creek. In addition, numerous pocosins and Carolina Bays exist under the eastern portion of the Bulldog B MOA. Pocosins are evergreen shrub bogs found between coastal freshwater marshes and deepwater swamp forests. Pocosins, like bogs, have lots of sphagnum moss and nutrient-poor acidic soil and water. Carolina Bays are ovate-shaped shallow depressions and represent a type of bog or bog-lake complex unique to the southeastern coastal plain. Other surface water features underlying the Bulldog MOAs include numerous bays, of which, Big Dukes Pond in Jenkins County is the biggest (Air Force 2003).

GAMECOCK MOAS

The Gamecock MOAs, the proposed Gamecock E MOA, and Poinsett Restricted airspace overlie the Middle Atlantic Coastal Plain and the Atlantic Coast Flatwoods Land Resource Area. The predominant landform is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf. Elevations range from 0 to 300 feet (0 to 90 meters) (Bailey 1995). Soils are deep, medium texture, and have adequate to excessive water supplies for use by vegetation. Soils throughout the affected environment range from strongly acidic to moderately acidic with a pH ranging from 4.5 to 6.0 (Bailey 1995).

Surface water resources underlying the Gamecock MOAs and Poinsett restricted airspace include portions of the Santee, Pocotaligo, Black, and Great Pee Dee Rivers. The water table is high in many areas, resulting in poor natural drainage and abundance of wetlands. The southwestern portion of Gamecock D and proposed Gamecock E overlies a portion of Lake Marion, the largest lake in South Carolina that overflows into the Santee River. Pocosins and Carolina Bays occur mostly under the center and eastern portion of the Gamecock MOAs.

TRAINING TRANSMITTER SITES

The training transmitter sites in Georgia would be located near the towns of Grange and Magruder within the Vidalia Upland District (described above for the Bulldog MOAs). Most of the soils in this area are acidic, deep, and well or moderately drained. In South Carolina, one training site would be located beneath the Gamecock C MOA and three training transmitter sites would be located within a 10-mile radius of the South Carolina coastal cities of Georgetown, McClellanville, and Awendaw, respectively. Soils found in this area are generally deep, medium textured and range from strongly acidic to moderately acidic (Bailey 1995). Siting criteria for the transmitter sites would include avoiding areas adjacent to water bodies or wetlands. Section 2.7.2.1 describes the siting criteria used for transmitter site selection.

3.5.3 Environmental Consequences – Physical Resources

3.5.3.1 MITIGATED PROPOSED ACTION

The Mitigated Proposed Action would have negligible effects on soil and water resources due to chaff deposition. Chaff used in the existing Shaw AFB (RR-188) consists of aluminum-coated silica fibers 2 inches or less in length, and approximately the thickness of very fine human hair (Appendix B). The major components of chaff are silica, aluminum, and stearic acid. These components are generally prevalent in the environment. Silica (silicon dioxide) (SiO_2) belongs to the most common mineral group, silicate minerals. Silica is inert in the environment and does not represent an environmental concern with respect to soil chemistry. Aluminum (Al) is the third most abundant element in the earth's crust, forming some of the most common minerals, such as feldspars, micas, and clays (Air Force 1997a). Kaolin ($Al_2Si_2O_5[OH]_4$) is Georgia's most important mineral product used for paper coatings, fiberglass, and aluminum chemicals (Economic Minerals of Georgia 2005). Stearic acid is animal fat that degrades when exposed to light and air.

Pounds of chaff fibers would have to be concentrated to have the potential to generate adverse effects to soil or water resources (Air Force 1997a). Chaff disperses widely when deployed and ultimate disposition depends upon the altitude of release and the prevailing winds at different altitudes at the time of release. Based on the quantity of chaff bundles proposed for deployment in the MOAs, the distribution of chaff would be approximately 3.85 grams per acre per year in the proposed Bulldog Complex and 3.97 grams in the Gamecock MOAs per acre per year. At this deposition rate, chaff would not accumulate to a point where it could create an impact. Even if a clump of chaff were to not disperse, the humid condition and acidic soil properties of soils found in Georgia and South Carolina have been found to break down chaff fibers quickly. This reduces the opportunity for elevated levels of mineral accumulation that could be leached into soils, surface waters, or ground waters (Air Force 1997a).

If chaff does not deploy correctly, the fibers may clump together and fall to the ground. When this occurs, tufts or clumps of chaff can be discernible to the naked eye and could result in a visual annoyance. It is unlikely that chaff clumps would accumulate in soil and water in quantities that would negatively affect their uses or damage these resources. Weathering would cause the light chaff to either break down in place or be distributed by the wind.

FLARES

Two types of flares are proposed for use in the expanded airspace. The M-206 flare and the MJU-7 A/B flare. Both types of flares are designed to completely burn out in about 4 seconds. The flares are designed to be fully consumed before reaching the ground, with a dud rate on the ground estimated to be less than 0.01 percent (Air Force 1997a). In rare cases, if a dud flare or some of the materials from a burned flare reach the ground, the components that have any potential to affect soil and water chemistry are minute quantities of chromium, magnesium, aluminum, boron, and barium.

Magnesium (Mg) and boron (b) showed levels in sufficient concentrations for further evaluation in field and laboratory tests on flares (Air Force 1997a). Magnesium is an essential nutrient often found in nuts, seafood, and cereals and is a principal component of chlorophyll. Only in extremely large quantities can magnesium affect water properties. Given the number, dispersal, and reliability of flares, accumulations of such levels would be impossible. Boron is both an essential and toxic element for plants. While large quantities of boron can be toxic under certain conditions, the quantities from flare combustion (less than 0.5 gram) are too small to have a toxic effect (Air Force 1997a).

Aircraft operations in the MOAs are dispersed throughout the airspace and flares are similarly dispersed. Within the Gamecock MOA complex, an average of one flare would be deployed above 120 acres per year. Under Bulldog MOAs, average flare distribution would remain unchanged at approximately one flare per 84 acres per year.

Flare residual materials could come in contact with a water surface or soils. The M-206 flare residual materials that fall to the ground include a residual end cap, a felt spacer, a plastic piston, and a thin aluminum wrap. The MJU-7 A/B flare discharges plastic end caps, a felt spacer, a piston, an S&I device, and aluminum wrap. The constituents of flares are presented in Appendix C.

Flare residual materials observed during field surveys conducted on two Air Force ranges included plastic end caps, foil wrappers, and plastic parts. No dud flares were found although they are known to occur (Air Force 1997a). The field studies were on Air Force ranges where flares had been used for decades. A check survey at Poinsett ECR identified end caps, foil wrappers, S&I devices, and one dud flare. If chaff and flare expended plastic, felt, and wrapping materials were distributed evenly throughout the airspace, it would result in approximately one piece of residual material per 5 acres under either the Bulldog or Gamecock MOAs. Residual materials do not appear to accumulate in quantities that would result in a significant visual effect, although spent flare materials could be intrusive and unwanted to private landowners in the area. Flare residual materials could be undesirable in areas specifically protected to preserve naturalness and pristine qualities. These areas include Wilderness Areas, Wild and Scenic Rivers, wildlife and habitat project areas, and areas designated to have outstanding visual quality, where any human-made object would be incongruous and unexpected, and where people walking, camping, and hiking would be within viewing distance of flare materials on the ground.

There would be a very low likelihood for fires to occur as a result of flare use due to the low failure rate of flares and the deployment of flares above 5,000 feet MSL. Fire safety is further discussed in Section 3.3.3.

The plastic pistons, end caps, and S&I devices are inert and are not expected to decompose. They would not be expected to impact soil resources, but the visual effect of such manmade objects could affect recreational areas or waters. The felt spacers would decompose as described above for chaff. The aluminum wrapping materials would also decompose. However, this would occur over a much longer period of time.

Flare residual materials would not be expected to discernibly or measurably affect water or soil resources. Given the large size of the existing and proposed Bulldog and Gamecock MOAs and the annual number of flares that are used in the airspace, no substantive impact would occur to soils or water resources.

TRAINING TRANSMITTER SITES

Transmitter sites are proposed under the Bulldog A, Gamecock C, and within three areas along the South Carolina coast. In general, the sites would be about 150-feet square surrounded by an approximate 15-acre buffer area. Ground-disturbing activities for the transmitter footprint construction staging area and expected gravel access road would be approximately 0.6 acres.

Construction would consist of developing a gravel pad on which the transmitter site would be located and a gravel access road. Only surface grading would be required therefore impacts to and from a shallow surface water table would not be expected. Sites that are adjacent to or contain water bodies or wetlands would be avoided as part of the siting criteria described in Section 2.7.2.1.

The construction sites are not expected to disturb more than approximately 0.6 acres. If a construction site were one acre or more, a site-specific erosion and sediment control plan would be required. Surface-disturbing activities that could cause increases in stormwater runoff or offsite sedimentation would need to be minimized. The issuance of the National Pollutant Discharge Elimination System (NPDES) permit for construction activities in excess of 1 acre is tied to plan approval by the SCDHEC. As the construction of the proposed transmitter sites is expected to be less than one acre, an NPDES permit would not be required.

The six transmitter sites are estimated to be approximately 0.6 acre each of disturbed area. This is not expected to contribute to secondary impacts through wind or water erosion. Implementation of standard construction practices would reduce the potential for dust and erosion. No significant impacts to soil or water would be anticipated to result from training transmitter site construction. The transmitters are electrically powered and the amount of oil or solvents used on site would be contained and cleaned up as part of normal maintenance. No hazardous materials are expected to be generated that could migrate off-site and affect soils or water bodies.

3.5.3.2 ALTERNATIVE A

The difference between Alternative A and the Mitigated Proposed Action relates to changes in airspace that would not affect physical resources. The use of chaff, flares, and transmitter sites would be the same. As described above, no impact would be expected from the use of chaff and flares on physical resources. Visual effects of flare residual materials are as described for the Mitigated Proposed Action. In general, chaff and flare residual materials could affect water and soil resources only if they were deposited in extremely large quantities. Given the large size of the Bulldog and Gamecock MOAs and proposed Gamecock E MOA and the annual number of chaff and flares that would be dispersed, there would not be a significant impact to physical resources.

Because the number and location of training transmitter sites would be the same for Alternative A as under the Mitigated Proposed Action, the training transmitter effects would be the same as described for the Mitigated Proposed Action. No significant impacts to soil or water would result from the implementation of Alternative A.

3.5.3.3 ALTERNATIVE B

The difference between Alternative B and the Mitigated Proposed Action relates to changes in airspace and to a reduced number of training transmitter sites. The use of chaff and flares would be essentially the same as described for the Mitigated Proposed Action. No impact would be expected from the use of chaff and flares on physical resources. Visual consequences of deposited chaff and flare residual materials would be as described for the Mitigated Proposed Action.

The number of transmitter sites would be reduced under Alternative B. The construction effects would be the same as described for the Mitigated Proposed Action, although three fewer sites would be developed. No significant impacts to soil or water would result from the implementation of Alternative B.

3.5.3.4 NO-ACTION ALTERNATIVE

The effects to physical resources under the No-Action Alternative would be the same as current conditions. Natural and manmade fires occur throughout the area. Chaff and flares are currently used in the existing Gamecock MOAs, Bulldog MOAs, and Restricted Areas. No changes to physical resources would occur under this alternative.

3.6 BIOLOGICAL RESOURCES

3.6.1 Introduction

Biological resources in this discussion refer to plants and animals and the habitats in which they occur. Assemblages of plant and animal species within a defined area that are linked by ecological processes are referred to as natural communities. The existence and preservation of these resources are intrinsically valuable; they also provide aesthetic, recreational, and socioeconomic values to society. This section focuses on plant and animal species or vegetation types that typify or are important to the function of the ecosystem, are of special societal importance, or are protected under federal or state law or statute. For purposes of the analysis, biological resources will be organized into three major categories: (1) vegetation and habitat, including wetlands; (2) wildlife; and (3) special-status species. Because of their societal and economic importance, domestic animals (e.g., cattle, sheep, hogs, poultry, and horses) are also included in this discussion.

Federal laws and regulations that apply to biological resources include Fish and Wildlife Coordination Act, MBTA, Clean Water Act (CWA), NEPA, Federal Land Policy and Management Act, Endangered Species Act (ESA), applicable Executive Orders (EOs) (e.g., EO 13086, *Responsibilities of Federal Agencies to Protect Migrant Birds*), state hunting regulations, and state laws protecting plants and nongame wildlife (Appendix E).

The ROI for biological resources for the Mitigated Proposed Action consists of lands beneath the Bulldog A and B MOAs, and proposed areas for training transmitter sites. Alternatives A and B add the Gamecock B, C, and D MOAs, Poinsett MOA, R-6002, and the alternative Gamecock E and lowered Gamecock D MOAs. For ease of discussion, the area under the Gamecock B, C, and D MOAs, Poinsett MOA, R-6002, and the proposed Gamecock E and D MOAs, will be referred to as the Gamecock ROI. Lands under Bulldog A and B MOAs will be the Bulldog ROI. Proposed training transmitter sites will be discussed as the training transmitter sites ROI.

Vegetation includes all existing terrestrial plant communities but excludes discussion of special-status plants. The composition of plant species within a given area defines ecological communities and determines the types of wildlife that may be present. Wetlands are a special category of sensitive habitats and are subject to regulatory authority under Section 404 of the CWA, EO 11990 *Protection of Wetlands*, and EO 19988 *Floodplain Management*. The United States Army Corps of Engineers (USACE) administers Section 404 and has jurisdiction over all Waters of the U.S., including wetlands. Waters of the U.S. is a broad term that encompasses most water resources, including navigable and other waters used for commerce or industrial purposes; waters used to irrigate crops; waters that support fish or shellfish used in commerce; waters that provide habitat for migratory birds or endangered species; and wetlands (33 CFR Part 328). Jurisdictional wetlands are those areas that meet all the criteria defined in the USACE's *Wetlands Delineation Manual* (Environmental Laboratory 1987).

Wildlife includes all vertebrate animals with the exception of special-status species. Typical animals include terrestrial vertebrate groups such as snakes, lizards, songbirds, waterfowl, raptorial birds, hoofed animals, carnivores, bats, rodents, and other small mammals. Under particular circumstances, significant invertebrate species such as mollusks (e.g., snails) or insects may also be included. The attributes and quality of available habitats determine the composition, diversity, and abundance patterns of wildlife species assemblages, or communities. Each species has its own set of habitat requirements and interspecific interactions driving its observed distribution and abundance. Community structure is derived from the net effect of the diverse resource and habitat requirements of each species within a geographic setting. For this reason, an assessment of habitat types and area affected by the Mitigated Proposed Action or alternatives can serve as an overriding determinant in the assessment of impacts for wildlife populations.

Special-status species are defined as those plant and animal species listed as threatened, endangered, candidate, or species of concern by the United States Fish and Wildlife Service (USFWS), as well as those species with special-status designations by the states of South Carolina and Georgia. The ESA protects federally listed threatened and endangered plant and animal species. Candidate species are species that USFWS is considering for listing as threatened or endangered but for which a proposed rule has not yet been developed. Candidates do not benefit from legal protection under the ESA. In some instances, candidate species may be emergency listed if USFWS determines that the species population is at risk due to a potential or imminent impact. The USFWS encourages federal agencies to consider candidate species in their planning process because they may be listed in the future and, more importantly, because current conservation actions may prevent future listing. Species of concern are species for which data were inconclusive to support ESA protection at the time of the proposed listing. It is an informal designation, although USFWS recommends tracking of population trends and threats. The South Carolina DNR and Georgia DNR maintain a list of endangered and threatened fish, wildlife, and plants. Typically state and federal lists have considerable overlap, but occasionally a state may provide more protection than is required at the federal level.

3.6.1.1 METHODOLOGY

Four areas of consideration are used to identify the potential environmental consequences to wildlife and habitat. These areas are (1) the importance (i.e., legal, commercial, recreational, ecological, or scientific) of the resource; (2) the proportion of the resource that would be affected relative to its occurrence in the region; (3) the sensitivity of the resource to proposed activities; and (4) the duration of any ecological ramifications. Impacts to resources would be considered significant if special-status species or habitats are adversely affected over relatively large areas or disturbances cause significant reductions in population size or distribution of a special-status species.

To analyze the potential consequences of the Mitigated Proposed Action and alternatives for biological resources, the methodology was to (1) contact the USFWS with respect to threatened, endangered, proposed, and candidate species in the area; (2) determine the potential of special-status species to occur in the ROI; (3) conduct a literature review on the effects of aircraft noise and chaff and flares on biological resources; and (4) evaluate the Mitigated Proposed Action and alternatives relative to current baseline conditions.

Special-status species in the ROI are summarized below in Section 3.6.2. The literature reviews on noise effects and chaff and flares are summarized below in Section 3.6.1.2. Potential impacts of the Mitigated Proposed Action and alternatives are discussed in Section 3.6.3.

3.6.1.2 ISSUES AND CONCERNS

Impacts to biological resources potentially result from (1) increased noise levels in new and expanded airspace; (2) chaff and flare residual materials and dud flares in new and expanded airspace; (3) habitat disturbance and habitat loss at proposed training transmitter sites; and (4) disturbance or displacement of special-status species at proposed training transmitter sites. The potential issues and concerns for wildlife and domestic animals due to aircraft noise and chaff and flares are reviewed in more detail below. In particular, concerns were expressed during public hearings and the public comment period included impacts to livestock, domestic wildlife, and endangered species from noise and low level overflights.

AIRCRAFT NOISE

The review of the noise effects literature shows that the most documented reaction of animals newly or infrequently exposed to low-altitude aircraft is the "startle effect." Although an observer's interpretation of the startle effect is behavioral (e.g., the animal runs in response to the sound or flinches and remains in place), it does have a physiological basis. The startle effect is a reflex; it is an autonomic reaction to loud, sudden noise (Westman and Walters 1981, Harrington and Veitch 1991). Increased heart rate and muscle flexion are the typical physiological responses.

The literature indicates that the type of noise that can stimulate the startle reflex is highly variable among animal species (Manci *et al.* 1988). In general, studies have indicated that close, loud, and sudden noises that are combined with a visual stimulus produce the most intense reactions. Rotary wing aircraft (helicopters) generally induce the startle effect more frequently than fixed wing aircraft (Gladwin *et al.* 1988, Ward *et al.* 1999). External physical variables, such as landscape structure and wind, can also lessen the animal's perception of and response to aircraft noise (Ward *et al.* 1999).

Animals can habituate to fixed wing aircraft noise as demonstrated under controlled conditions (e.g., Conomy *et al.* 1998, Krausman *et al.* 1998) and by observations reported by biologists working in parks and wildlife refuges (Gladwin *et al.* 1988). Brown *et al.* (1999) defined habituation as "… an active learning process that permits individuals to discard a response to a recurring stimulus for which constant response is biologically inappropriate without impairment of their ability to respond to other stimuli." However, species can differ in their ability to habituate to aircraft noise, particularly the sporadic noise associated with military aircraft training (e.g., Conomy *et al.* 1998). Furthermore, there are no studies that have investigated the potential for adverse effects to wildlife due to long-term exposure to aircraft noise.

Wild ungulates, such as deer (*Odocoileus* spp.), appear to vary in sensitivity to aircraft noise. Responses reported in the literature varied from no effect and habituation to panic reactions followed by stampeding (Manci *et al.* 1988, Weisenberger *et al.* 1996). Aircraft noise has the potential to be most detrimental during periods of stress, especially winter, gestation, and calving (DeForge 1981). Krausman *et al.* (1998) studied the response of wild bighorn sheep in a 790-acre enclosure to frequent F-16 overflight at 395 feet AGL. Heart rate increased above preflight level during 7 percent of the overflights but returned to normal within 120 seconds. No behavioral response by the bighorn sheep was observed during the overflights.

A few researchers have studied the potential effects of aircraft noise on small mammals. Chesser *et al.* (1975) found that house mice (*Mus musculus*) trapped near an airport runway had larger adrenal glands than those trapped 2 kilometers from the airport. In the lab, naïve mice subjected to simulated aircraft noise also developed larger adrenal glands than a control group. However, the implications of enlarged adrenals for small mammals with a relatively short life span are undetermined. The burrows of some small mammals may reduce their exposure to aircraft noise. Francine *et al.* (1995) found that kit foxes (*Vulpes macrotis*) with twisting tunnels leading to deeper burrows experienced less noise than kangaroo rats with shallow burrows. McClenaghan and Bowles (1995) studied the effects of aircraft overflights on small mammals and were unable to distinguish potential long-term effects due to aircraft noise compared to other environmental factors.

Most studies have found few negative effects of aircraft noise on raptors. Ellis *et al.* (1991) examined behavioral and reproductive responses of several raptor species to low-level flights. No incidents of reproductive failure were observed and site re-occupancy rates were high (95 percent) the following year. Several researchers found that ground-based activities, such as operating chainsaws or an intruding human, were more disturbing than aircraft (White and Thurow 1985, Grubb and King 1991, Delaney *et al.* 1997). Red-tailed hawks (*Buteo jamaicensis*) and osprey (*Pandion haliaetus*) appeared to readily habituate to regular aircraft overflights (Andersen *et al.* 1989, Trimper *et al.* 1998). Mexican spotted owls (*Strix occidentalis lucida*) did not flush from a nest or perch unless a helicopter was as close as 330 feet (Delaney *et al.* 1997). Nest attendance, time-activity budgets, and provisioning rates of nesting peregrine falcons (*Falco peregrinus*) in Alaska were found not to be significantly affected by jet aircraft overflights (Palmer *et al.* 2003). On the other hand, Andersen *et al.* (1990) observed a shift in home ranges of four raptor species away from new military helicopter activity, which supports other reports that wild species are more sensitive to rotary wing aircraft than fixed-wing aircraft.

In their review, Manci *et al.* (1988) noted that aircraft can be particularly disturbing to waterfowl. Conomy *et al.* (1998) suggested, though, that responses were species-specific. They found that black ducks (*Anas rubripes*) were able to habituate to aircraft noise, while wood ducks (*Aix sponsa*) did not. Black ducks exhibited a significant decrease in startle response to actual and simulated jet aircraft noise over a 17-day period, but wood duck response did not decrease uniformly following initial exposure. Some bird species appear to be more sensitive to aircraft noise at different times of the year. Snow geese (*Chen caerulescens*) were more easily disturbed by aircraft prior to fall migration than at the beginning of the nesting season (Belanger and Bedard 1989). On an autumn staging ground in Alaska (i.e., prior to fall migration), 75 percent of brant (*Branta bernicla*) and only 9 percent of Canada geese (*Branta canadensis*) flew in response to aircraft overflights (Ward *et al.* 1999). There tended to be a greater response to aircraft at 1,000 to 2,500 feet AGL than at lower or higher altitudes. In contrast, Kushlan (1979) did not observe any negative effects to wading bird colonies (i.e., rookeries) when fixed-wing aircraft conducted surveys within 200 feet AGL; 90 percent of the observations indicated no reactions from the birds. Nesting California least terns (*Sterna albifrons browni*) did not respond negatively to a nearby missile launch (Henningson, Durham, and Richardson 1981).

Although the desert tortoise (*Gopherus agassizii*) does not reside anywhere near the ROI, it is one of the few reptiles to be studied regarding its response to aircraft noise. Desert tortoises newly exposed to simulated subsonic aircraft noise initially adopted a defensive response by "freezing" their activity for up to 113 minutes (Bowles *et al.* 1999). During subsequent exposure, the response was a milder defensive state for less than 5 minutes, suggesting habituation.

As with wildlife, the startle reflex is the most commonly documented effect on domestic animals. Results of the startle reflex are typically minor (e.g., increase in heart rate or nervousness) and do not result in injury. Espmark *et al.* (1974) did not observe any adverse effects due to minor behavioral reactions to low-altitude flights with noise levels of 95 to 101 dBA. Exceptions, however, may occur when animals are crowded in small enclosures, where loud, sudden noise may cause a widespread panic reaction (Air Force 1993). Such negative impacts were typically only observed when aircraft were less than 330 feet AGL (United States

Forest Service [USFS] 1992). Several studies have found little direct evidence of decreased milk production, weight loss, or lower reproductive success in response to aircraft noise. For example, Head *et al.* (1993) did not find any reductions in milk yields with aircraft Sound Exposure Levels (SEL) levels of 105 to 112 dBA. Many studies documented that domestic animals habituate to aircraft noise (see reviews in Manci *et al.* 1998; Head *et al.* 1993).

CHAFF AND FLARES

Specific issues and potential impacts of chaff and flares on biological resources are discussed below. These issues have been identified by DoD research (Air Force 1997a, Cook 2001), General Accounting Office review (United States General Accounting Office 1998), independent review (Spargo 1999), resource agency instruction, and public concern and perception. No reports to date have documented negative impacts of chaff and flares to biological resources. These studies are reviewed below.

Concerns for biological resources are also related to the residual materials of chaff and flares that fall to the ground or dud flares. Residual materials are several flare components, including plastic end caps, felt spacers, aluminum-coated wrapping material, plastic retaining devices, and plastic pistons. Specific issues are (1) ingestion of chaff fibers or flare residual materials; (2) inhalation of chaff fibers; (3) physical external effects from chaff fibers, such as skin irritation; (4) effects on water quality and forage quality; (5) increased fire potential; and (6) potential for being struck by large hailstone-sized flare residual material (the plastic S&I device of the MJU-7 A/B flare).

Because of the low rate of application and dispersal of chaff fibers and flare residues during defensive training, wildlife and domestic animals would have little opportunity to ingest, inhale, or otherwise come in contact with these residual materials. An average of one piece of chaff or flare residual material is estimated to be annually deposited on each 5 acres under the airspace. Although some chemical components of chaff are toxic at high levels, such levels could only be reached through the ingestion of many chaff bundles or billions of chaff fibers. Barrett and MacKay (1972) documented that cattle avoided consuming clumps of chaff in their feed. When calves were fed chaff thoroughly mixed with molasses in their feed, no adverse physiological effects were observed pre- or post-mortem.

Chaff fibers are too large for inhalation, although chaff particles can degrade to small pieces. However, the number of degraded or fragmented particles is insufficient to result in disease (Spargo 1999). Chaff is similar in form and softness to very fine human hair, and is unlikely to cause negative reactions if animals were to inadvertently come in contact with it.

Chaff fibers could accumulate on the ground or in water bodies. Studies have shown that chaff breaks down quickly in the humid environment and acidic soil conditions of the Southeast (Air Force 1997a). In water, only under very high or low pH could the aluminum in chaff become soluble and toxic (Air Force 1997a). Few organisms would be present in water bodies with such extreme pH levels. Given the small amount of diffuse or aggregate chaff material that could possibly reach water bodies, water chemistry would not be expected to be affected. Similarly, the magnesium in flares can be toxic at extremely high levels, a situation that could occur only under repeated and concentrated use in localized areas. Flare ash would disperse over wide areas; thus, no impact is expected from the magnesium in flare ash. The probability of an intact dud flare leaving an aircraft during training is 0.01 percent (Air Force 2001e). Since toxic levels would require several dud flares to fall in one confined water body, no effect of flares on water quality would be expected. Furthermore, uptake by plants would not be expected to occur.

As described in Section 3.3, Safety, the expected frequency of an S&I device from an MJU-7 A/B flare striking an exposed person under either the Gamecock ROI or the Bulldog ROI is 0.005 or less than 1 percent. Such a strike to a bird, small mammal, or reptile could produce a mortality. The relatively small likelihood of such a strike, especially when compared with more immediate threats such as highways, would not be expected to have any effect on populations of small species. Strikes to larger species, such as wild ungulates or farm animals could produce a bruise and a startle reaction. Such a strike from an S&I device would not be expected to seriously injure or otherwise significantly affect natural or domestic species under either ROI.

Flare residual materials also include aluminum coated wrapping and lighter plastic parts. The plastic parts, such as end caps, are inert and are not expected to be used by or consumed by any species. The aluminum coated wrapping, as it degrades, could produce fibrous materials similar to naturally occurring nesting materials. There is no known case of such materials being used in nest construction. In a study of pack rats (*Neotoma* spp.), a notorious collector of odd materials, no chaff or flare materials were found in nests on military ranges subject to decades of dispensing chaff and flares (Air Force 1997a). Although lighter flare residual materials could be used by species under the airspace, such use would be expected to be infrequent and incidental.

There is little risk of fire from the use of flares in the ROI. Flares would be released above 5,000 feet MSL and are designed to burn out within approximately 400 feet of the release altitude, leaving an extensive safety margin to prevent any burning materials from reaching the ground (Air Force 2001e). Plastic and aluminum coated wrapping materials from flares that do reach the ground would be inert. The percentage of flares that malfunction is small (<1 percent probability for all categories of malfunction; Air Force 2001e). Dud flares (i.e., those that do not ignite at release and fall intact to the ground) contain magnesium, which is thermally stable and requires a temperature of 1,200 degrees Fahrenheit for ignition. Self-ignition is highly unlikely under natural conditions.

3.6.2 Existing Conditions – Biological Resources

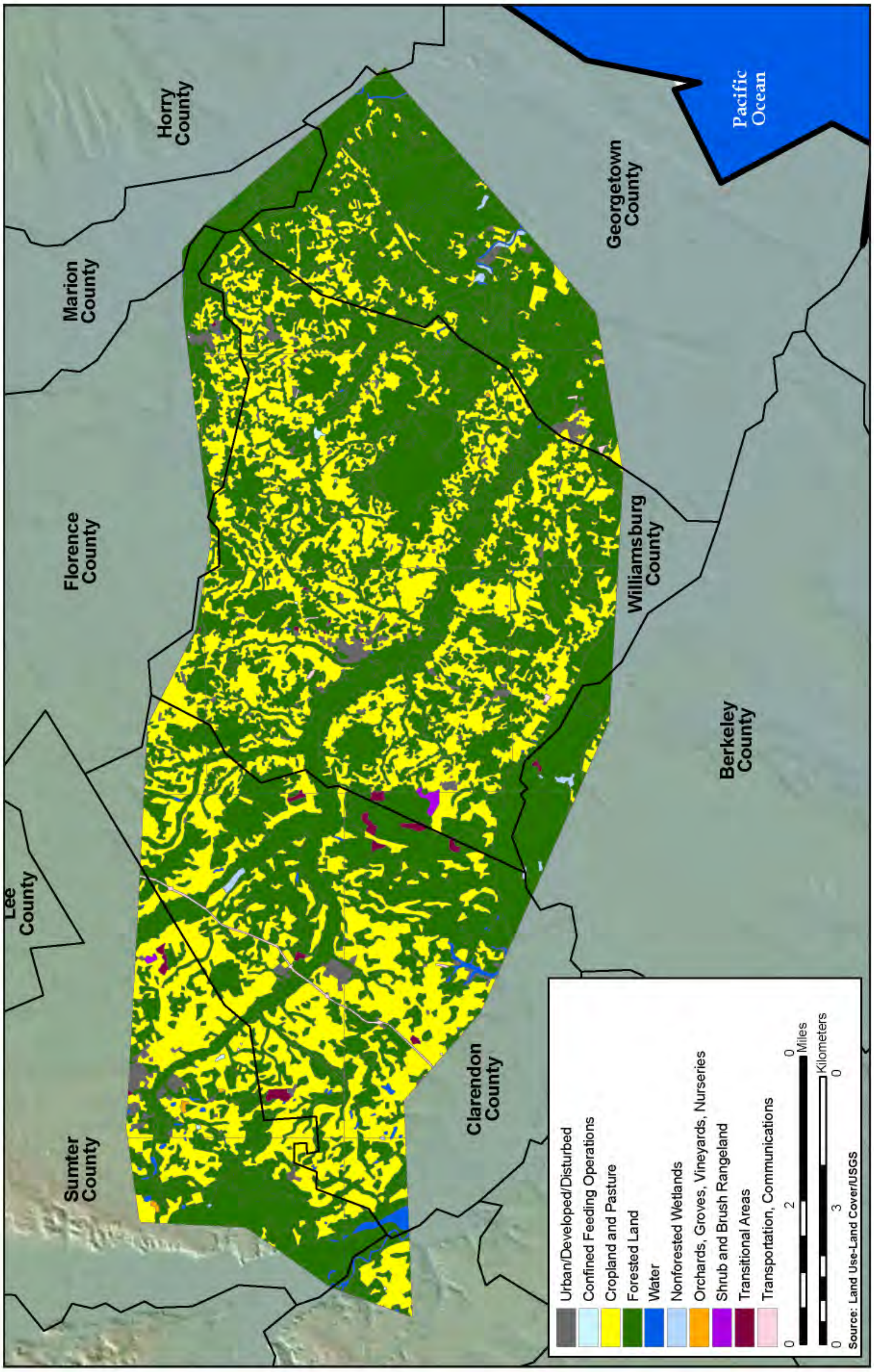
3.6.2.1 GAMECOCK AND BULLDOG ROIS

VEGETATION

Agriculture, forestry, and small towns are the primary land uses in the Gamecock and Bulldog ROIs. In the Gamecock ROI, 64 percent of the land area is classified as forested (25 percent evergreen forest, 19 percent forested wetlands, 16 percent mixed forest, and 4 percent deciduous forest) and 33 percent is cropland and pasture (Figure 3.6-1). In the Bulldog ROI, 56 percent is forest land (36 percent evergreen forest, 9 percent forested wetlands, 9 percent mixed forest, and 2 percent deciduous forest) and 43 percent is cropland and pasture (Figure 3.6-2). In both areas, there are very small amounts of other land cover types such as orchards, nonforested wetlands, and residential areas.

The area largely lies within the Outer Coastal Plain Mixed Forest Province, with western portions grading to the Southeastern Mixed Forest Province (Bailey 1995). Natural vegetation is dominated by the southern evergreen forest. Upland areas and sand ridges are typically forested with longleaf (*Pinus palustris*) and loblolly pines (*Pinus taeda*), oaks (*Quercus* spp.), and hickory (*Carya* spp.) trees. Wax myrtle (*Morella cerifera*), holly (*Ilex* spp.), large gallberry (*Ilex coriacea*), and red bay (*Persea borbonia*) are typical shrubs. Vines are abundant and include greenbriar (*Smilax* spp.), grapes (*Vitus* spp.), and jessamine (*Jasminus* spp.). Bottomland swamps and marshes are common and support trees such as baldcypress (*Taxodium distichum*), sweetgum (*Liquidambar styraciflua*), tupelo gum (*Nyssa* spp.), and tulip tree (*Liriodendron tulipifera*). Unique features called Carolina Bays are found in the region. These shallow, undrained depressions can support different community types, including Atlantic White Cedar (*Chamaecyparis thyoides*) Swamps, Pocosins, Depression Meadow/Gum Ponds, and Cypress/Gum Swamps (Mariah Associates and SAIC 1996).

A high proportion of wetlands are found in the ROIs for South Carolina and Georgia. Of the Gamecock ROI, 24 percent is classified as palustrine forested wetland and 5 percent is palustrine scrub-shrub wetland (Table 3.6-1). In the Bulldog ROI, 12 percent is palustrine forested wetland, with small amounts of other wetland types (Table 3.6-2).



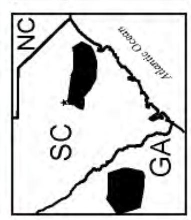
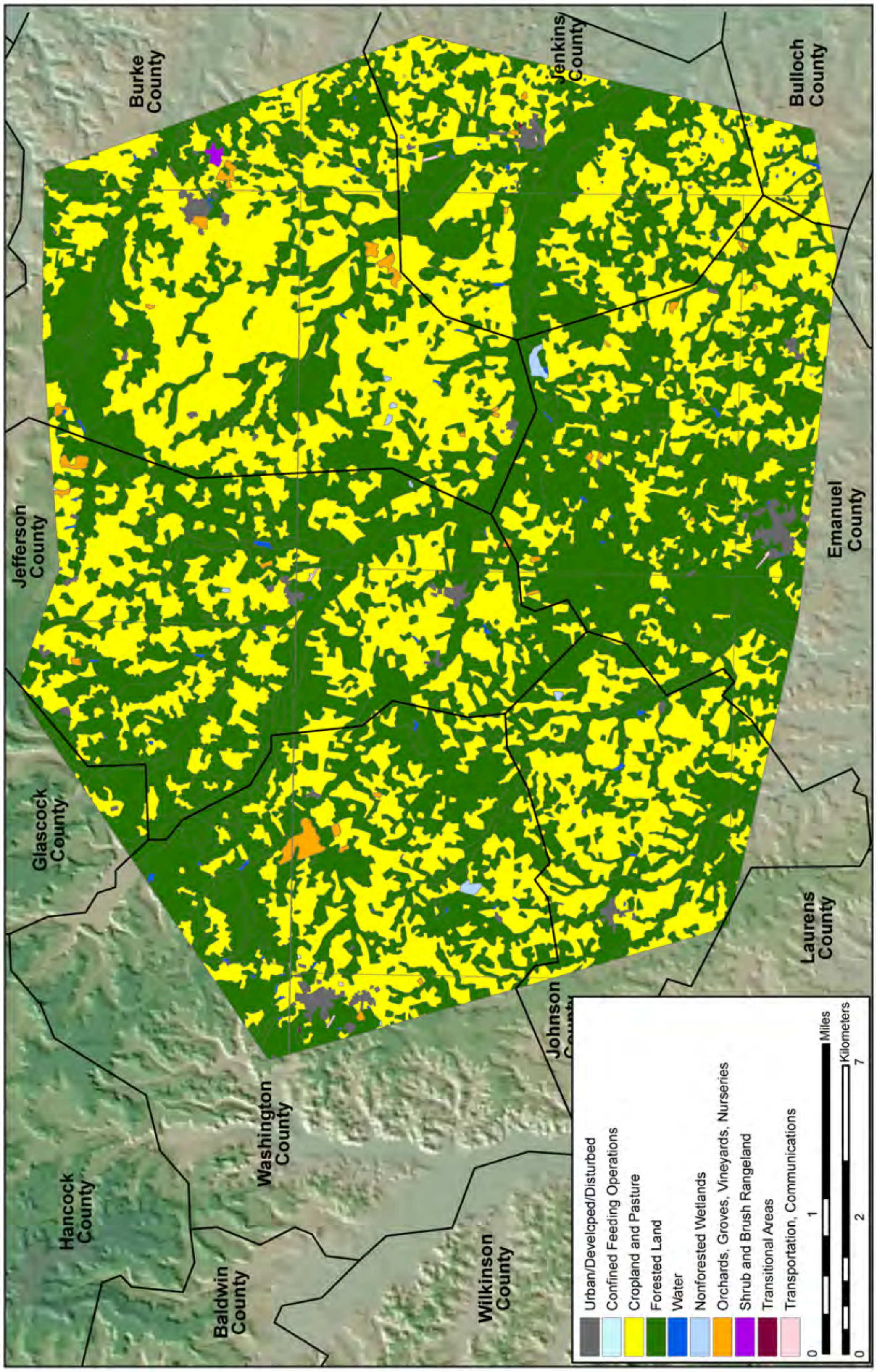


Figure 3.6-1
Land Cover Beneath the Gamecock ROI



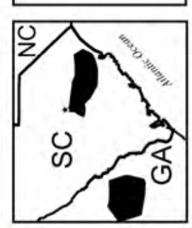


Figure 3.6-2

Land Cover Beneath the Bulldog ROI

Table 3.6-1. Wetlands in the Gamecock ROI

Wetland Type	*Acres*	*Percent*
Lacustrine/Limnetic	8,818	0.67
Lacustrine/Littoral	457	0.03
Palustrine/Aquatic Bed	282	0.02
Palustrine/Emergent	8,480	0.64
Palustrine/Forested	322,587	24.40
Palustrine/Scrub-Shrub	70,060	5.30
Palustrine/Unconsolidated Bottom	3,979	0.30
Palustrine/Unconsolidated Shore	40	0.00
Riverine/Lower Perennial	2,276	0.17
Riverine/Tidal	2,318	0.18
Total Wetlands	1,321,914	100.00
Uplands	902,615	68.28

Source: USFWS 2003a.

Table 3.6-2. Wetlands in the Bulldog ROI

Wetland Type	*Acres*	*Percent*
Lacustrine/Limnetic	1,560	0.11
Lacustrine/Littoral	372	0.03
Palustrine/Aquatic Bed	634	0.04
Palustrine/Emergent	7,132	0.50
Palustrine/Forested	176,518	12.39
Palustrine/Scrub-shrub	6,137	0.43
Palustrine/Unconsolidated Bottom	7,788	0.55
Palustrine/Unconsolidated Shore	65	0.00
Riverine/Lower Perennial	451	0.03
Total Wetlands	1,424,457	100.00
Uplands	1,223,800	85.91

Source: USFWS 2003a.

WILDLIFE

The variety of forest habitats found in the region support a diverse wildlife community. Songbirds are abundant and include ovenbirds (*Seiurus aurocapillus*), wood thrushes (*Hylocichla mustelina*), pine warblers (*Dendroica pinus*), summer tanagers (*Piranga rubra*), Carolina wrens (*Thrythorus ludovicianus*), and northern cardinals (*Cardinalis cardinalis*). Swamps and marshes support a large number of amphibians such as eastern spadefoot toad (*Scaphiopus holbrookii*), southern toad (*Bufo terrestri*), oak toad (*Bufo quercus*), and numerous salamanders. Game birds in the region include eastern wild turkey (*Meleagris gallopavo*), northern bobwhite (*Colinus virginianus*), and mourning dove (*Zenaida macroura*). Common mammals include Virginia opossum (*Didelphis marsupialis*), southern woodrat (*Neotoma floridana*), cotton mouse (*Peromyscus gossypinus*), gray squirrel (*Sciurus carolinensis*), white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), and gray fox (*Urocyon cinereoargenteus*).

The diverse habitats and moderate climate of South Carolina and Georgia also attract an abundance and diversity of migratory bird species, ranging from ducks and geese to shorebirds and small songbirds, such as warblers. The ROI lies within the Atlantic Flyway, a migratory path generally following the eastern coastline; a variety of bird species use this route as they migrate between their northern breeding grounds and southern wintering grounds. Many of these species may spend the winter in South Carolina and Georgia. For example, many species of waterfowl are only found in the ROI during the fall and spring migration or in winter. These include gadwall (*Anas stepera*), green-winged teal (*Anas creca*), canvasback (*Aythya valisneria*), redhead (*Aythya americana*), ring-necked duck (*Aythya collaris*), and common goldeneye (*Bucephala clangula*). Many species of songbirds migrate further south to Central and South America and the Caribbean Islands, but these birds may stopover in South Carolina and Georgia to rest and refuel.

Public Question: *What is done to prevent collisions between aircraft and migratory birds?*

Answer: *The Air Force has developed aggressive procedures to minimize the occurrence of bird/wildlife-aircraft strikes, however, incidents involving aircraft of the 20 FW have occurred at a rate of approximately 13 bird strikes per year. Safety risks in the Gamecock MOAs would remain unchanged, however risk in certain areas of the Bulldog MOAs would increase moderately throughout the year, peaking in December and January.*

SPECIAL-STATUS SPECIES

Nineteen special-status species have the potential to occur in the nine South Carolina counties affected by in the Gamecock ROI (Table 3.6-3). Seven species are federally endangered and four are federally threatened. Endangered species are Canby's dropwort, American chaffseed, Schweinitz's sunflower, pondberry, shortnose sturgeon, wood stork, and red-cockaded woodpecker (see Tables 3.6-3 and 3.6-4 for scientific names). Threatened species are seabeach amaranth, little amphianthus, flatwoods salamander, and loggerhead. There is no designated critical habitat for the federally threatened and endangered species in the ROI. Seven additional species are listed only as state endangered or threatened, but they do not have federal protection under the ESA.

Twenty special-status species may be found in the six Georgia counties of the ROI (Table 3.6-4). Four species are federally endangered and two are federally threatened. Endangered species are Canby's dropwort, shortnose sturgeon, wood stork, and red-cockaded woodpecker. Threatened species are flatwoods salamander and eastern indigo snake. Fourteen additional species are listed only as state endangered or threatened, but they do not have federal protection under the ESA. The bald eagle was previously listed for federal protection under the ESA; however, due to recovery the bald eagle was delisted in 2007. The bald eagle is now protected under the MBTA and the Bald and Golden Eagle Protection Act (BGEA).

Table 3.6-3. Federal and State-Listed Threatened and Endangered Species for the Counties within the Gamecock ROI in South Carolina

Common Name	*Scientific Name*	*Counties of Occurrence*	*Status[1]*
Plants			
American chaffseed	*Schwalbea americana*	Berkeley, Clarendon, Florence, Horry, Sumter, Williamsburg	FE/SE
Canby's dropwort	*Oxypolis canbyi*	Berkeley, Clarendon, Florence, Sumter, Williamsburg	FE/SE
Seabeach amaranth	*Amaranthus pumilus*	Georgetown, Horry	FT/ST
Schweinitz's sunflower	*Helianthus schweinitzii*	Horry	FE/SE
Little amphianthus	*Amphianthus pusillus*	Berkeley	FT/ST
Pondberry	*Lindera melissifolia*	Berkeley	FE/SE
Fish			
Shortnose sturgeon	*Acipenser brevirostrum*	Berkeley, Calhoun, Georgetown	FE/SE
Carolina pygmy sunfish	*Elassoma boehlkei*	Georgetown	ST
Amphibians			
Flatwoods salamander	*Ambystoma cingulatum*	Berkeley	FT/SE
Gopher frog	*Rana capito*	Berkeley	SE
Reptiles			
Loggerhead	*Caretta caretta*	Georgetown, Horry	FT/ST
Spotted turtle	*Clemmys guttata*	Berkeley, Clarendon, Georgetown, Horry	ST
Birds			
Wood stork	*Mycteria americana*	Georgetown, Horry	FE/SE
Least tern	*Sterna antillarum*	Berkeley, Georgetown, Horry, Sumter	ST
Wilson's plover	*Charadrius wilsonia*	Georgetown	ST
Bald eagle	*Haliaeetus leucocephalus*	Berkeley, Calhoun, Clarendon, Florence, Georgetown, Horry, Marion, Sumter	SE/MBTA/BGEA
American swallow-tailed kite	*Elanoides forficatus*	Berkeley, Georgetown	SE
Red-cockaded woodpecker	*Picoides borealis*	Berkeley, Clarendon, Florence, Georgetown, Horry, Marion, Sumter, Williamsburg	FE/SE
Mammals			
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	Berkeley, Georgetown, Horry, Marion, Sumter, Williamsburg	SE

Note: 1. Status: FE = federal endangered, FT = federal threatened, SE = state endangered, ST = state threatened, MBTA = Migratory Bird Treaty Act, BGEA = Bald and Golden Eagle Protection Act.

Source: South Carolina DNR 2009.

Table 3.6-4. Federal and State-Listed Threatened and Endangered Species for the Counties within the Bulldog ROI in Georgia

Common Name	*Scientific Name*	*Counties of Occurrence*	*Status[1]*
Plants			
Canby's dropwort	*Oxypolis canbyi*	Burke, Jefferson	FE/SE
Georgia plume	*Elliottia racemosa*	Burke, Emanuel	ST
Indian olive	*Nestronia umbellula*	Burke, Emanuel, Jefferson	ST
Ocmulgee skullcap	*Scutellaria ocmulgee*	Burke	ST
Rosemary	*Ceratiola ericoides*	Burke, Emanuel	ST
Sweet pitcherplant	*Sarracenia rubra*	Burke, Emanuel, Jefferson	SE
Dwarf witchalder	*Fothergilla gardenia*	Emanuel	ST
Parrot pitcherplant	*Sarracenia psittacina*	Emanuel	ST
Pickering's morningglory	*Stylisma pickeringii*	Emanuel, Jenkins	ST
Bay starvine	*Schisandra glabra*	Washington	ST
Harper's dodder	*Cuscuta harperi*	Washington	ST
Invertebrates			
Atlantic pigtoe mussel	*Fusconaia masoni*	Burke, Jefferson, Jenkins	SE
Fish			
Shortnose sturgeon	*Acipenser brevirostrum*	Burke	FE/SE
Robust redhorse	*Moxostoma robustum*	Johnson, Washington	SE
Amphibians			
Flatwoods salamander	*Ambystoma cingulatum*	Burke, Emanuel, Jefferson	FT/ST
Reptiles			
Gopher tortoise	*Gopherus polyphemus*	Burke, Emanuel, Jefferson, Jenkins, Johnson	ST
Eastern indigo snake	*Drymarchon corais couperi*	Emanuel, Jenkins	FT/ST
Birds			
Wood stork	*Mycteria americana*	Burke, Emanuel, Jefferson, Jenkins, Johnson	FE/SE/
Bald eagle	*Haliaeetus leucocephalus*	Burke, Emanuel, Glascock, Jefferson, Jenkins, Johnson, Washington	SE/ MBTA/ BGEA
Red-cockaded woodpecker	*Picoides borealis*	Burke, Emanuel, Jefferson, Jenkins, Johnson, Washington	FE/SE

Note: 1. Status: FE = federal endangered, FT = federal threatened, SE = state endangered, ST = state threatened; MBTA = Migratory Bird Treaty Act, BGEA = Bald and Golden Eagle Protection Act.

Sources: Georgia DNR Wildlife Resources Division 2009, USFWS 2009.

Four of the federally listed species are known to occur in the Gamecock ROI. These are American chaffseed, Canby's dropwort, shortnose sturgeon, and red-cockaded woodpecker (South Carolina Heritage Trust 2003). Four federally listed species are known to occur in the Bulldog ROI. These are Canby's dropwort, flatwoods salamander, wood stork, and red-cockaded woodpecker (Georgia DNR Wildlife Resources Division 2009). These species are discussed in more detail below.

American chaffseed is a federally listed endangered species and a state endangered species in South Carolina and Georgia. Its range extends through the coastal plain of the Atlantic and Gulf coasts, from New York to Texas (USFWS 1995). It is known to occur in the Gamecock ROI, but not under the Bulldog ROI (Patrick *et al.* 1995, South Carolina Heritage Trust 2003, Georgia DNR Wildlife Resources Division 2009).

American chaffseed is a small herbaceous plant, 12 to 24 inches tall. The plant is covered in minute hairs, including the flowers, which are purplish-yellow. American chaffseed is found in open, moist pine flatwoods, fire-maintained savannas, edges between wetlands and dry sandy soils, and open grassy areas (USFWS 1992, South Carolina Wildlife Federation 2004a, Plants 2004). It is a hemiparisitic plant that draws nutrients from the roots of other plants. It is intolerant of shade and thus requires periodic natural disturbances, such as fire, to maintain its preferred habitat. Its primary cause of endangerment is habitat loss due to development and fire suppression (USFWS 1992).

Canby's dropwort is a federally listed endangered species and a state endangered species in South Carolina and Georgia. It is found in the lowland plains of the mid-Atlantic coast. It is known to occur in both the Gamecock and Bulldog ROIs (Patrick *et al.* 1995, South Carolina Heritage Trust 2003, Georgia DNR Wildlife Resources Division 2009). Canby's dropwort is a tall (2.6 to 3.9 feet) perennial plant of the parsley family. It has slender leaves and small white flowers, which are borne on compound umbels. It reproduces primarily through the spread of underground roots or rhizomes. Canby's dropwort is found in wet meadows, at the edges of cypress-pine ponds, and wet pine savannas (USFWS 1986a, Patrick *et al.* 1995). It is found in wet, open habitats, with soils of sandy loam or acidic peat-mucks underlain by clay layers (USFWS 1990). The primary threats to this species are habitat loss due to ditching and draining of shallow ponds and wetlands; and alteration of groundwater table from development and road construction (USFWS 1986a).

The **shortnose sturgeon** is a federally listed endangered species and a state endangered species in South Carolina and Georgia. It is known to occur in the Gamecock ROI, but not the Bulldog ROI (South Carolina Heritage Trust 2003, Georgia DNR Wildlife Resources Division 2009).

The shortnose sturgeon spends much of its life cycle in the lower reaches of the large river systems along the east coast and in estuarine and tidal habitats (National Marine Fisheries Service [NMFS] 2004). They migrate upriver to spawn in the spring. In the vicinity of the ROI in South Carolina, it is known from the Santee, Congaree, and Wateree rivers and Lake Marion. Although population numbers or movements are not known, it is assumed sturgeon in this system are land-locked (i.e., no longer migrate to the ocean) (NMFS 1998). Overfishing and pollution were the original causes of the species endangerment. Current threats include habitat alteration due to dams, dredging, and development of coastal areas.

Flatwoods salamander is a federally listed threatened species, a state endangered species in South Carolina, and a state threatened species in Georgia. It occurs in the lower southeastern Coastal Plain in South Carolina, Georgia, and Florida (USFWS 1999a). It is known to occur in the Bulldog ROI, but not in the Gamecock ROI (South Carolina Heritage Trust 2003, Georgia DNR Wildlife Resources Division 2009).

The flatwoods salamander is found in longleaf pine and slash pine (*Pinus elliottii*) flatwoods, and savannas (South Carolina Wildlife Federation 2004b). Ideal habitat is moist, open, and maintained by frequent fires (USFWS 1999a). For much of the year, the adult salamanders live underground or beneath leaf litter. The salamanders move to breeding ponds from October to December with the advent of fall rains. Breeding ponds are isolated, temporary wetlands, which may be mostly dry during the fall. Eggs are laid in moist places, such us under leaf litter, logs, or moss. However, the eggs must be completely inundated to hatch, thus relying on the ponds to fill throughout the winter. After a growth period of three to five months, the larvae emerge from the ponds in April. Loss of pine flatwoods and breeding ponds are the primary threats to the flatwoods salamanders (USFWS 1999a).

The **wood stork** is a federally listed endangered species and a state endangered species in Georgia and South Carolina. It breeds in Florida, Georgia, and South Carolina. It is known to occur in the Bulldog ROI in Georgia, but not in the Gamecock ROI in South Carolina (South Carolina Heritage Trust 2003, Georgia DNR Wildlife Resources Division 2009).

The wood stork breeds in large colonies, called rookeries, in cypress and mangrove (*Rhizophora mangle*) swamps. Wood storks can travel up to 80 miles between rookeries and suitable feeding areas (USFWS 1984). Wood storks were noted during scoping comments as a large bird that could pose a safety risk to low-flying aircraft. Wood storks feed on fish in freshwater and brackish wetlands. Although wood storks are sensitive to disturbance during the nesting season, loss of feeding habitat has primarily led to the species endangerment (Coulter *et al.* 1999). Suitable wetlands have been lost to human development and agriculture or their hydrologic regimes have been altered (USFWS 1984). Recommended buffer distances are 65 meters (213 feet) for rookeries and 100 meters (328 feet) for foraging areas (Rodgers and Smith 1995, 1997).

The **red-cockaded woodpecker** is a federally listed endangered species and a state endangered species in Georgia and South Carolina. Its range includes much of the southeastern U. S. It is known to occur in both the Gamecock and Bulldog ROIs (South Carolina Heritage Trust 2003, Georgia DNR Wildlife Resources Division 2009).

The red-cockaded woodpecker inhabits the pine forests of the southeast. It prefers old (at least 80 to 120 years of age) longleaf pine stands, but will also use other species of pine. Suitable stands are relatively open and park-like, which were historically maintained by fire (USFWS

2003b). Red-cockaded woodpeckers excavate nesting cavities in live trees, particularly those with decaying heartwood due to red-heart fungus (Bent 1992, USFWS 2003b). Nest cavities are often surrounded by exuding sap, which the birds maintain by drilling small holes (Bent 1992). The sticky sap deters some predators, such as the black rat snake (*Elaphe obsoleta*), from entering the nest cavity. This species has a highly developed social system with young from the previous year assisting the breeding pair in the rearing of the young (Jackson 1994).

Threats to the red-cockaded woodpecker are mainly habitat loss and fragmentation. Past logging has drastically reduced the range and extent of the longleaf pine forest. Fire suppression has changed the characteristics of remaining forests, which now usually consist of small trees, a closed canopy, and a dense shrubby understory (USFWS 2003b). Habitat fragmentation has resulted in many isolated populations of red-cockaded woodpeckers. The species has been the subject of intensive research and management and as a result, there have been some increases in population size (Jackson 1994).

The **bald eagle** was a federally listed threatened species until 2007. In response to consistent population increases, the bald eagle was down-listed from endangered to threatened in 1994. In 1999, the USFWS proposed de-listing of the species (USFWS 1999b), and on June 28, 2007 the bald eagle was delisted from its Threatened status in the lower 48 states. Bald eagles continue to be protected by the MBTA and the BGEA as well as state endangered species laws. The bald eagle is a state-listed endangered species in South Carolina and Georgia. Small numbers of breeding and wintering eagles can be found in the Gamecock and Bulldog ROIs (South Carolina Heritage Trust 2003, Georgia DNR Wildlife Resources Division 2009). Because of its protection under other federal and state laws mentioned above and because concerns about effects on bald eagles were raised in scoping, the impact analysis concerning bald eagle is retained in this Final EIS.

The bald eagle is a large, primarily fish-eating raptor, although they also consume waterfowl and carrion. It nests near large bodies of water, such as coastal estuaries, lakes, reservoirs, and large rivers. Nest sites are typically in large trees adjacent to water. In the southern U.S., nesting begins in late December to early January. Nests are about 5 feet wide and 3 feet deep, and can be used for several years in a row. On average, two eggs are laid, which hatch in 35 days. The chicks fledge at about 11 to 12 weeks of age, but the parents continue to care for the young birds for another 4 to 11 weeks (Ehrlich *et al.* 1988, Wood *et al.* 1998).

In the southeastern U.S., bald eagle pairs may remain in the general breeding territory throughout the winter or move to other suitable areas (Buehler *et al.* 1991, Buehler 2000). Winter habitat must provide adequate food and roost sites that are protected from severe weather and human disturbance (Buehler 2000). Several to hundreds of bald eagles may gather nightly at communal winter roosts. Roost trees are usually the tallest and largest trees in a stand.

3.6.2.2 TRAINING TRANSMITTER SITES

Three sites have been identified as proposed locations for training transmitters under the Bulldog A MOA in Georgia, near the towns of Grange and Magruder; only two of these will be selected. Environmental site reviews occurred for each of the three proposed transmitter locations, including a check for natural areas, floodplains, and federal wetlands within 2 miles of the proposed sites. Although no natural areas or floodplains were identified, there are federal wetlands within 2 miles of each site (Environmental Data Resources [EDR] 2005a; 2005b; 2005c; SAIC 2005).

The Grange site was planted in winter wheat at the time of the site visit. Identified federal wetlands are 1 to 2 miles away from the proposed site, and do not pose a concern for the 15-acre affected area. There is a small patch of planted pines (<1 acre) to the west and windrows to the northwest (SAIC 2005). The surrounding landscape is primarily agricultural. Wildlife observed in the pine stand were white-eyed vireo (*Vireo griseus*), eastern towhee (*Pipilo erythrophthalmus*), pine warbler, blue jay (*Cyanocitta cristata*), and northern cardinal. Barn swallows (*Hirundo rustica*) were observed foraging for insects over the wheat field.

The Magruder south site is a field that is currently in grass hay. There is a diked, steep-sided stream within 700 feet of the approximate center of the proposed site (SAIC 2005). The stream is bordered on both sides by agricultural land. Natural vegetation occurs in a narrow strip of 16-30 feet; however, there is little or no wetland/emergent vegetation along the stream. There is also a small longleaf pine stand (<1 acre) about 800 feet to the southwest. Wildlife observed along the stream and in the pine stand were eastern towhee, pine warbler, northern cardinal, summer tanager, barn swallow, and American crow (*Corvus brachyrhynchos*).

The Magruder north site is in a cattle pasture, situated between Magruder-Rosier Road and Turkey Pond. Turkey Pond is a large diked pond, which is controlled by an outlet at the southeast end (SAIC 2005). The shoreline of the pond is approximately 700 feet from the center of the proposed transmitter site. A small American alligator (*Alligator mississippiensis*) and several slider turtles (species unidentified) were observed in the water. The pond is bordered by a thin strip of willows (*Salix* spp.) and raspberry bramble (*Rubus* spp.). Birds observed in or around Turkey Pond were double-crested cormorant (*Phalacrocorax auritus*), ring-necked duck, red-winged blackbird (*Agelaius phoeniceus*), common grackle (*Quiscalus quiscula*), northern mockingbird (*Mimus polyglottus*), Carolina wren, loggerhead shrike (*Lanius ludovicianus*), eastern kingbird (*Tyrannus tyrannus*), spotted sandpiper (*Actitis macularia*), killdeer (*Charadrius vociferus*), and barn swallow. Cattle egrets (*Bubulcus ibis*) were foraging in the pasture. There was also a small patch (less than 5 acres) of mixed forest land within ¼ mile south of the site.

The following federally listed threatened and endangered species have the potential to occur in Burke and Jefferson counties: Canby's dropwort, shortnose sturgeon, flatwoods salamander, wood stork, and red-cockaded woodpecker. Species characteristics, habitat associations, and threats to these species were discussed above in Section 3.6.2.2. A search for these species was undertaken, as well as for state-listed species (Table 3.6-4) and their potential habitat at the Grange and Magruder sites; no special-status species or their habitats were observed (SAIC 2005).

Training transmitter sites along the South Carolina coast would be within a 10-mile radius of Georgetown, McClellanville, and Awendaw. Six federally listed endangered species have the potential to occur in the three counties affected by these proposed sites (Table 3.6-5). These are American chaffseed, Canby's dropwort, pondberry, shortnose sturgeon, wood stork, and red-cockaded woodpecker. Four federally threatened species may also occur in the training transmitter site ROI. These are seabeach amaranth, little amphianthus, flatwoods salamander, and loggerhead. There is no designated critical habitat for the federally threatened and endangered species in the training transmitter site ROI. Nine additional species are listed only as state endangered or threatened, but they do not have federal protection under the ESA. Threatened and endangered species potentially affected by a training transmitter site under Gamecock C are described in the previous section and Table 3.6-3.

Excluding lands within the intercoastal waterway, the following federally listed species are known to occur within a 10-mile radius of the coastal training transmitter sites: American chaffseed, Canby's dropwort, seabeach amaranth, little amphianthus, pondberry, shortnose sturgeon, flatwoods salamander, wood stork, and red-cockaded woodpecker (South Carolina Heritage Trust 2003). Refer to Section 3.6.2.1 for a discussion of species characteristics, habitat associations, and threats for seven of these species. Seabeach amaranth, little amphianthus, and pondberry are discussed below.

Seabeach amaranth is a federal threatened species and state threatened species in South Carolina. This small annual plant once existed along beaches of the nine east coast states. Currently, the species exists only in New York, North Carolina, and South Carolina. In the training transmitter site ROI, populations of seabeach amaranth are known in the coastal areas of Georgetown County (South Carolina Wildlife Federation 2005a). The plant is found primarily on barrier island and coastal plain beaches, in areas with little or no vegetation.

Threats to the species includes man-made beach stabilization and extreme weather events, such as hurricanes (USFWS 1993a). Human and vehicle trampling can be a problem in unprotected areas.

Little amphianthus is a federal threatened species and a state threatened species in South Carolina. It is known from one location in the training transmitter site ROI (South Carolina Heritage Trust 2003). Little amphianthus is a small aquatic plant that inhabits temporary pools (called vernal pools) in granite outcrops. Although the pools often dry up throughout the summer season, seeds of little amphianthus can germinate when late winter and spring rains refill the pools (South Carolina Wildlife Federation 2005b). The species is threatened by rock quarries and land management practices that influence the water quality of vernal pools (USFWS 1988).

Pondberry is a federal endangered species and a state endangered species in South Carolina. Small populations exist in the Francis Marion National Forest in Berkeley County (USFWS 1986b). Pondberry is deciduous shrub that grows up to 6 feet tall. Populations are largely clonal, and sexual reproduction appears to be extremely rare (USFWS 1993b). The species is associated with bottomland hardwood forests and wetlands. Habitat loss is the primary cause of endangerment (USFWS 1986b).

Table 3.6-5. Federal and State-Listed Threatened and Endangered Species for the Counties of the Proposed Training Transmitter Sites in Coastal South Carolina

Common Name	*Scientific Name*	*Counties of Occurrence*	*Status*[1]
Plants			
American chaffseed	*Schwalbea americana*	Berkeley, Charleston	FE/SE
Canby's dropwort	*Oxypolis canbyi*	Berkeley, Charleston	FE/SE
Seabeach amaranth	*Amaranthus pumilus*	Charleston, Georgetown	FT/ST
Little amphianthus	*Amphianthus pusillus*	Berkeley	FT/ST
Pondberry	*Lindera melissifolia*	Berkeley	FE/SE
Invertebrates			
Dwarf siren	*Pseudobranchus striatus*	Charleston	ST
Fish			
Shortnose sturgeon	*Acipenser brevirostrum*	Berkeley, Charleston, Georgetown	FE/SE
Carolina pygmy sunfish	*Elassoma boehlkei*	Georgetown	ST
Amphibians			
Flatwoods salamander	*Ambystoma cingulatum*	Berkeley, Charleston	FT/SE
Gopher frog	*Rana capito*	Berkeley, Charleston	SE
Reptiles			
Loggerhead	*Caretta caretta*	Charleston, Georgetown	FT/ST
Spotted turtle	*Clemmys guttata*	Berkeley, Charleston, Georgetown	ST
Birds			
Wood stork	*Mycteria americana*	Charleston, Georgetown	FE/SE
Least tern	*Sterna antillarum*	Berkeley, Charleston, Georgetown	ST
Wilson's plover	*Charadrius wilsonia*	Charleston, Georgetown	ST
Bald eagle	*Haliaeetus leucocephalus*	Berkeley, Charleston, Georgetown	SE/MBTA/ BGEA
American swallow-tailed kite	*Elanoides forficatus*	Berkeley, Charleston, Georgetown	SE
Red-cockaded woodpecker	*Picoides borealis*	Berkeley, Charleston, Georgetown	FE/SE
Mammals			
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	Berkeley, Charleston, Georgetown	SE

Note: 1. Status: FE = federal endangered, FT = federal threatened, SE = state endangered, ST = state threatened; MBTA = Migratory Bird Treaty Act, BGEA = Bald and Golden Eagle Protection Act.
Source: South Carolina DNR 2009.

3.6.3 Environmental Consequences – Biological Resources

The Air Force has completed informal consultation with the USFWS which concluded with a determination of "may affect, not likely to adversely affect" on federally listed species.

3.6.3.1 MITIGATED PROPOSED ACTION

The Mitigated Proposed Action does not include any modifications or expansions to the Gamecock MOAs. Under the Mitigated Proposed Action, the existing Gamecock MOAs would be operated in accordance with current practices and procedures. Gamecock B MOA would not be returned to the NAS, but would remain as an operational MOA.

Although the noise measures provided in Section 3.2 are measures applicable to humans, they are repeated here for a relative comparison to baseline conditions and among alternatives. It is generally unknown at what specific noise levels each species is most sensitive. Therefore, it is assumed that wildlife and domestic animals will be sensitive to relative increases in noise levels. Responses will certainly vary among species and individuals from no response to a stimulation of the startle reflex. Even if an animal is habituated to aircraft noise at an average level, an extreme noise event could still cause an animal to startle. As discussed in the literature review (Section 3.6.1.2), animals would generally not injure themselves or abandon nests or young.

AIRCRAFT NOISE

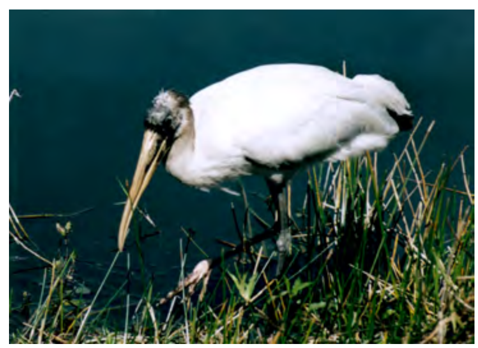
> ***Public Question:*** *How could low-level military flights affect wood storks or bald eagles?*
>
> ***Answer:*** *The potential for bird aircraft strikes is addressed in both Safety and Biological Resources. Special pilot briefings are included to protect aircraft and birds during migration. These briefings include the locations of bald eagle nests and wood stork nesting and foraging areas.*

As discussed in the noise section (Section 3.2), noise levels would change little from current conditions through much of the ROI, except in areas where additional low-altitude airspace is created (Bulldog C and E MOAs). The DNLmr metric is used in relationship to human effects. The DNLmr metric can be extrapolated for use with animals although the average noise effects do not typically affect animal behavior. The DNLmr can be used as an approximate number of SEL events that can have a startle effect upon animals. In the area of the proposed Bulldog C and E MOAs, noise levels would noticeably increase to 47 dB DNLmr. Wildlife under the new MOAs would be exposed to a new combined visual and auditory stimulus from an aircraft at 500 feet AGL. Wildlife under the new MOAs would be exposed to a new combined visual and auditory stimulus from an aircraft at 500 feet AGL. Special-status wildlife species that could be exposed to the slightly increased noise levels or events in the proposed Bulldog C and E MOAs are bald eagle, wood stork, red-cockaded woodpecker, and flatwoods salamander.

The effects of aircraft noise on the bald eagle have been studied relatively well, compared to most wildlife species. Overall, there have been no reports of reduced reproductive success or physiological risks to bald eagles exposed to aircraft overflights or other types of military noise

(Fraser *et al.* 1985, Stalmaster *et al.* 1997, Brown *et al.* 1999; see review in Buehler 2000). Most researchers have documented that pedestrians and helicopters were more disturbing to bald eagles than fixed-wing aircraft, including military jets (Fraser *et al.* 1985, Grubb and King 1991, Grubb and Bowerman 1997). However, bald eagles can be disturbed by fixed-wing aircraft. Recorded reactions to disturbance ranged from an alert posture to flushing from a nest or perch. Grubb and King (1991) reported that 19 percent of breeding eagles were disturbed when an aircraft was within 625 meters (2,050 feet). To protect bald eagles from disturbance, most researchers recommend a minimum buffer of 600 meters (1,968 feet) around bald eagle nests. Winter roosts should be similarly protected. The minimum altitude proposed for the Bulldog C and E MOAs is 500 feet AGL and approximately 148 hours per year (5.3 percent of training hours) would involve training in all the Bulldog MOAs below 1,000 feet AGL (Table 2-7).

According to a letter dated September 17, 2004 from the USFWS in Athens, Georgia (Appendix A) and the "Habitat Management Guidelines for the Bald Eagle in the Southeast Region" (USFWS 1982), fixed-wing aircraft within 500 feet vertical and 1,000 feet horizontal could be detrimental to nesting eagles. Bald eagles are most sensitive to disturbance and could abandon nests during the early breeding period from mid-October to mid-December. Through additional correspondence, dated October 21, 2005, the USFWS revealed there were six bald eagle nests in Jefferson County in 2005. As of January 2010, five of these six nests were still occupied and evidence showed the sixth nest was recently occupied (Harris 2010).



During scoping, commenters expressed concern that low-flying aircraft and wood storks potentially represented a dangerous mix.

In contrast to the bald eagle, little research has been conducted on the effects of aircraft noise on the wood stork. Kushlan (1979) compared the responses of various species of colonial nesting birds (including a small number of wood storks) to three types of census methods for rookeries: ground-based, helicopter, and fixed wing censuses. In general, most species were more disturbed by the human intrusion of the ground-based census than by helicopters or fixed-wing aircraft flying as low as 200 feet AGL. Rodgers and Smith (1995) found that nesting wood storks had the smallest flush distance in response to disturbance compared to other similar species. Wood storks did not flush from their nests until an intruder (human or motorized boat) was within, on average, about 50 feet. In comparison, great blue herons (*Ardea herodias*) had the largest flush distance, and flushed when a person was within 100 feet. In another study, Rodgers and Smith (1997) found that foraging wood storks were disturbed by a motorboat when it approached within about 85 feet.

According to the "Habitat Management Guidelines for the Wood Stork in the Southeast Region" (Ogden 1990), aircraft within 500 feet of a rookery could be detrimental to nesting wood stork. In a letter dated September 17, 2004, the USFWS in Athens, Georgia revealed that there are two wood stork rookeries in Jenkins County. Through additional correspondence, the USFWS stated that on October 21, 2005 there were almost 300 wood stork nests in two wood stork colonies. These wood stork colonies were still active as of January 2010 (Harris 2010). Furthermore, the USFWS expressed concern about wood storks moving between nesting and foraging areas. In particular, wood storks often travel by soaring in "thermals," which are rising currents of warm air. Wood storks can soar up to 1,000 to 3,000 feet AGL in this manner. Therefore, wood storks are at risk of collision with military aircraft and are a safety concern for the pilots and aircraft.

The Air Force BASH program, discussed in detail in Section 3.3.2.1, requires reporting of all bird-aircraft strikes, and the bird species involved are identified if possible. Since 1985, there have been only 3 reports of wood storks involved in aircraft strikes. One of these strikes was in South Carolina. With the relatively large number of wood storks present in areas of the southeastern U.S. that are within military airspace, the historically small number of wood stork-aircraft strikes in these areas, and the safety measures in place to minimize the likelihood of bird-aircraft strikes, the likelihood of an aircraft strike involving wood storks under the Mitigated Proposed Action is very low.

Wood storks and other migratory birds (such as waterfowl and raptors) may have a minimally increased risk of collision with aircraft in the proposed Bulldog C and E MOAs. Although the number of aircraft sorties would not increase, lowering the floor to 500 feet AGL would increase the probability of a collision because these birds are more likely to occur within this lower flight level. Historically, aircraft assigned to the 20 FW have been involved in an average of approximately 13 bird strikes per year. Over the last 5 years, the average has been 6.4 per year.

Some birds that may be encountered in the region are protected under the MBTA. Normally, the intentional taking of these avian species requires a depredation permit. However, if a protected species is involved in a bird-aircraft strike, it would be considered an incidental taking, and not an intentional taking. Recognizing this, such incidental taking of migratory birds during military training is exempt from any permitting requirement. To reduce risks to the pilots and migratory birds, pilots will continue to be briefed about the seasonal presence of bird/wildlife hazards.

Migratory birds require quality stopover habitat to rest and eat. Noise disturbance could cause individual special-status birds and other migratory birds to leave their stopover area prematurely. However, the relatively small change in noise conditions in most areas should not affect migratory species. Under the Mitigated Proposed Action, the proposed Bulldog C and E MOAs would have a potential for noise events to disturb migratory birds using a stopover habitat. However, negative impacts to populations would not be expected.

About one-quarter of the red-cockaded woodpeckers are found on 15 military installations in the Southeast (USFWS 2003b). Due to coordinated planning and conservation efforts, most populations of red-cockaded woodpeckers on military installation are increasing, including at Poinsett ECR. Shaw AFB personnel are active in monitoring and conservation of the red-cockaded woodpecker at Poinsett ECR. Red-cockaded woodpeckers are also found throughout the Bulldog and Gamecock ROIs (South Carolina Heritage Trust 2003, Georgia DNR Wildlife Resources Division 2009).

Red-cockaded woodpeckers on military installations are regularly exposed to noise from military training activities, ranging from weapons fire to helicopters and fighter jets. Delaney *et al.* (2000) evaluated the impact of training noise on the red-cockaded woodpeckers at Fort Stewart, Georgia from 1999–2000. Although they had insufficient data to statistically test fixed-wing aircraft, they observed that red-cockaded woodpeckers never flushed from their nesting cavity when helicopters approached within 100 feet or greater (SEL <102 dB). Therefore, it is expected that red-cockaded woodpeckers would not flush from nest cavities and reproductive success would not be affected by fixed-wing aircraft >500 feet AGL.

The literature review was unable to find any scientific documentation regarding the potential effects of aircraft noise on amphibians. Since the increase in noise levels in proposed airspace is minor, it is expected that flatwoods salamander or other unknown populations of special-status species would not be significantly affected by noise levels of the Mitigated Proposed Action.

In summary, for most of the ROI, average noise exposure from aircraft would be comparable or slightly higher to that experienced in the current airspace, which has not resulted in reports of significant negative impacts to wildlife or domestic animals. In areas where average noise levels are predicted to more substantially increase (Bulldog C and E MOAs), animals, including special-status species, migratory birds, and domestic animals, may startle or temporarily shift habitat use or activities (Harrington and Veitch 1991); however, based on previous studies (reported in 3.6.1.2), wildlife and domestic animals habituate and return to normal activities.

Consultation with the USFWS regarding species resulted in no effect determination on the American chaffseed, Canby's dropwort, little amphianthus, pondberry, flatwoods salamander, and red-cockaded woodpecker. A determination of may affect, but not likely adversely affect, wood storks due to insignificant effects also resulted from the consultations.

CHAFF AND FLARES

No additional chaff or flare usage is proposed within the affected airspace. The same number of chaff and flares as are currently used would be deployed throughout the airspace and areas under the Mitigated Proposed Action are under the Bulldog B MOA where chaff and flare are currently used. The distribution of flares would average 1 flare over 84 acres each year in the Bulldog ROI and 1 flare over 120 acres each year in the Gamecock ROI. As discussed in Section 2.2.4, residual materials of MJU-7 A/B flares have the potential to cause injury to an animal if struck by the falling material. However, given the low distribution and use of the MJU-7 A/B flare (approximately one residual component per 5 acres annually), the probability of an animal being struck is extremely low.

Therefore, as discussed above and in Section 3.6.1.2, chaff and flares at this low level have been documented to have no effect on natural resources, wildlife, special-status species, or domestic animals (e.g., Air Force 1997a, 2003). Therefore, no significant impacts to biological resources are anticipated from chaff and flare use under the Mitigated Proposed Action.

Training Transmitter Sites

According to the Georgia DNR, Canby's dropwort, bald eagle, and red-cockaded woodpecker are known to occur within 10 miles of the Grange site; Canby's dropwort, wood stork, and flatwoods salamander are known to occur within 10 miles of the two Magruder sites (Georgia DNR Wildlife Resources Division 2009). In a letter dated April 15, 2005, the Georgia DNR (formally the Georgia Natural Heritage Program) revealed that there were no records for any rare species within 3 miles of the proposed sites. However, this is a function of a lack of survey data for the area.

No special-status species or their habitats were observed (SAIC 2005) at the Grange and Magruder sites. Habitat for Canby's dropwort and flatwoods salamander is unlikely at Turkey Pond, both of which prefer natural, shallow wetlands and temporary ponds (see Section 3.6.2.2). Wood storks are known to nest approximately 11 to 13 miles southeast of the Magruder sites, so wood storks could move through the area as they fly between nesting and feeding sites. It is not known whether wood storks would use Turkey Pond as a feeding site. Bald eagles and red-cockaded woodpeckers could also move through the training transmitter sites, but ideal nesting habitat is not located nearby. There is a bald eagle nest 4.5 miles east of the Grange site; this distance is beyond the buffer distance recommended by the USFWS (1982). Due to the primarily agricultural land impacted by the training transmitter sites, it is unlikely that any special-status species would be affected by their construction and operation. However, due to the presence of Turkey Pond, the Magruder north site has more potential to attract wildlife.

Proposed training transmitter sites on the South Carolina coast and under the Gamecock C MOA could affect the following federally threatened and endangered species if they were found to be present at the transmitter sites: American chaffseed, Canby's dropwort, little amphianthus, pondberry, seabeach amaranth, shortnose sturgeon, flatwoods salamander, loggerhead, wood stork, and red-cockaded woodpecker (see Tables 3.6-3 and 3.6-5). Several siting criteria identified in Section 2.7.3 would likely exclude the potential for these species. These criteria would avoid wetlands and sensitive areas for wildlife and prefer areas already cleared of trees. Therefore, the following aquatic and wetland-associated species would not likely be found on a potential training transmitter site: Canby's dropwort, little amphianthus, pondberry, shortnose sturgeon, loggerhead, and wood stork. Red-cockaded woodpeckers and bald eagles require trees, and therefore would not be found on a preferred training transmitter site along the South Carolina coast. However, they may occur in the general area or may move through a site. Seabeach amaranth is found primarily on coastal sand dunes, a habitat type that would be avoided for training transmitters. Therefore, two species—American chaffseed and flatwoods salamander—have the potential to occur in the more open habitat of a training transmitter site. Although the flatwoods salamander requires wetlands for breeding, they can be found in relatively open habitats at other times of the year. Field surveys for federally threatened and endangered species would be conducted at the site prior to final site approval and a determination would be made as to the potential to effect biological resources.

3.6.3.2 ALTERNATIVE A

AIRCRAFT NOISE

The Mitigated Proposed Action and Alternative A have similar noise levels and training flight altitudes with similar potential effects on biological resources in the Bulldog ROI. In the newly added portions of Bulldog A, noise levels would noticeably increase from less than 35 dB DNLmr to approximately 47 dB DNLmr. Wildlife under the newly added portions of Bulldog A would be exposed to a new combined visual and auditory stimulus from aircraft at 500 feet AGL. In Gamecock E, the calculated noise level is expected to be about 35 dB DNLmr and the cumulative noise level about 36 to 44 dB DNLmr (see Tables 3.2-8 and 3.2-9). In the lowered Gamecock D, noise levels would increase from <35 dB DNLmr to 37 dB DNLmr; cumulative noise levels would be about 47 dB DNLmr. Special-status wildlife species that could be impacted by increased noise levels or events in the proposed Gamecock E, Gamecock D, and expanded Bulldog A MOAs are bald eagle, wood stork, red-cockaded woodpecker, migratory birds, and flatwoods salamander. A literature review of potential noise impacts to these species is discussed above under the Mitigated Proposed Action. The same small increase in bird-aircraft strike risk would occur as for the Mitigated Proposed Action. In summary, no significant adverse impacts are expected to biological resources, including special-status wildlife species, migratory birds, and domestic animals under Alternative A. The results of consultation with the USFWS would be as described for the Mitigated Proposed Action.

CHAFF AND FLARES

Chaff and flare use would be the same as under the Mitigated Proposed Action. As discussed above, chaff and flares have been documented to have no effect on natural resources, wildlife, special-status species, or domestic animals (e.g., Air Force 1997a, 2003). No significant impacts to biological resources are anticipated from chaff and flare use under Alternative A.

TRAINING TRANSMITTER SITES

Three potential sites in Georgia were visited; no special-status species or their habitats were observed (SAIC 2005). These sites are discussed in more detail under the Mitigated Proposed Action. The Magruder North site is closer to wildlife areas and from a biological perspective is the least preferred of the three Bulldog A sites.

Similar to the Mitigated Proposed Action, the following federally threatened or endangered species have the potential to occur within the training transmitter sites on the South Carolina coast and under Gamecock C: American chaffseed and flatwoods salamander. Field surveys for federally threatened and endangered species would be required prior to site approval.

3.6.3.3 ALTERNATIVE B

AIRCRAFT NOISE

Noise levels would be slightly lower in most of the Gamecock airspaces in Alternative B compared to Alternative A (see Tables 3.2-6 and 3.2-7). In Gamecock E, the calculated noise level is expected to be about 35 dB DNLmr and cumulative about 36-44 dB DNLmr. As noted for the Mitigated Proposed Action and Alternative A, DNLmr can approximate SEL events. Areas beneath Bulldog A/B use would experience slightly fewer aircraft overflights, resulting in a decrease in average noise level from 49 to 47 dB DNLmr. Bulldog A would not be expanded and noise levels in the area under Bulldog B (with lowered floor) would remain below 35 dB DNLmr as compared to 47 dB DNLmr in the same area under Alternative A. Special-status wildlife species that may be affected by an increased noise level in the proposed Gamecock E or Gamecock D MOAs are bald eagle, wood stork, red-cockaded woodpecker, and flatwoods salamander. Red-cockaded woodpeckers may flush from nesting cavities with noise events significantly greater than 65 dBA, but reproductive success is not expected to be affected. Alternative B, with a higher floor in the Bulldog A expansion area and resultant lower noise levels, would not have as much potential to flush resident or migratory species as the Mitigated Proposed Action or Alternative A. No specific information is available on the effects of aircraft noise on flatwoods salamander; however, because the changes in noise levels are relatively small from current conditions, no significant impacts are expected. A literature review of potential noise impacts to these species is discussed above under the Mitigated Proposed Action.

As discussed in a letter dated September 17, 2004, the USFWS in Athens, Georgia expressed concerns about risk of collision with soaring wood storks. The airspace floor under Bulldog B would be above that expected to potentially result in bird-aircraft strikes with soaring wood storks or other large birds. Potential impacts to nesting bald eagles and wood storks would be minimized by Alternative B.

In summary, for most of the ROI, average noise exposure from aircraft would be comparable or slightly higher to that experienced in the current airspace, which has not resulted in reports of significant negative impacts to wildlife or domestic animals. In areas where average noise levels are predicted to slightly increase (Gamecock E, Gamecock D, and Bulldog A/B), animals may be temporarily sensitive to the new noise levels. For example, animals, including special-status species, migratory birds, and domestic animals, may startle or temporarily shift habitat use or activities (Harrington and Veitch 1991); however, based on previous studies (reported in 3.6.1.2), most wildlife and domestic animals are expected to habituate and return to normal activities. The results of consultation with the USFWS would be as described for the Mitigated Proposed Action.

CHAFF AND FLARES

As discussed above, chaff and flares have been documented to have no effect on natural resources, wildlife, special-status species, or domestic animals (e.g., Air Force 1997a, 2003). No significant impacts to biological resources are anticipated from chaff and flare use under Alternative B.

TRAINING TRANSMITTER SITES

Under Alternative B, no training transmitter sites would be developed on the South Carolina Coast; training transmitter sites would still be developed under the Gamecock C MOA and in Jefferson and Burke counties in Georgia. Field surveys for federally threatened and endangered species would be required prior to site approval for a site under Gamecock C.

Three potential sites in Georgia were visited; no special-status species or their habitats were observed (SAIC 2005). These sites are discussed in more detail under the Mitigated Proposed Action. As with the Mitigated Proposed Action, the Magruder North site has more potential to attract wildlife and therefore is the least preferred of the three Bulldog A sites.

3.6.3.4 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, wildlife and domestic animals would continue to experience current noise levels from military aircraft. The proposed airspace changes would not occur; the area underneath the current Gamecock D, the proposed Gamecock E, and the current Bulldog B MOAs would not experience increased noise levels due to a decreased floor. The use of chaff and flares would continue in the current airspace. There would be no new training transmitter sites with the potential to impact wildlife habitat or special-status species. Existing actions have not resulted in significant impacts to biological resources; therefore, no impacts would be expected under the No-Action Alternative.

3.7 CULTURAL RESOURCES

3.7.1 Introduction

Cultural resources are any prehistoric or historic district, site, building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious or other purposes. They include archaeological resources (both prehistoric and historic), historic architectural resources, and traditional resources. Only significant cultural resources (as defined in 36 CFR 60.4) are considered for potential adverse impacts from an action. Significant archaeological and architectural resources are either eligible for listing or listed on the National Register of Historic Places (NRHP). Significant traditional resources are identified by Native American tribes or other groups, and may also be eligible for the NRHP.

On 21 November 1999, the DoD promulgated its American Indian and Alaska Native Policy, which emphasizes the importance of respecting and consulting with tribal governments on a government-to-government basis. The policy requires an assessment, through consultation, of the effect of proposed DoD actions that may have the potential to significantly affect protected tribal resources, tribal rights, and Indian lands before decisions are made by the services.

The ROI for cultural resources is the area within which the Mitigated Proposed Action or alternatives has the potential to affect existing, or potentially existing archaeological, historic architectural, or traditional resources. For the Mitigated Proposed Action and alternatives, the ROI consists of the land beneath existing and proposed airspace, and the proposed new training transmitter locations.

3.7.1.1 METHODOLOGY

Impact analysis for cultural resources focuses on assessing whether the Mitigated Proposed Action or alternatives have the potential to affect cultural resources that are eligible for listing in the NRHP or have traditional significance for American Indian or other traditional groups. Under Section 106 of the National Historic Preservation Act (NHPA), the proponent of the action is responsible for determining whether any historic properties are located in the area; assessing whether the proposed undertaking would adversely affect the resources, and notifying the State Historic Preservation Office (SHPO) of any adverse effects. An adverse effect is any action that may directly or indirectly change the characteristics that make the historic property eligible for listing in the NRHP. If an adverse effect is identified, the federal agency consults with the SHPO, and with federally recognized American Indian tribes or other recognized affected groups as appropriate, to develop measures to avoid, minimize, or mitigate the adverse effects of the undertaking. The Air Force initiated consultation under Section 106 of the NHPA and NEPA with the Georgia and South Carolina SHPOs. Under these acts and the DoD American Indian and Alaska Native Policy of 1999, the Air Force also contacted the Catawba Indian Nation of Rock Hill, South Carolina, and the Eastern Band of the Cherokee Indians of Cherokee, North Carolina.

Direct impacts may occur by physically altering, damaging, or destroying all or part of a resource; altering characteristics of the surrounding environment that contribute to the resource's significance; introducing visual or audible elements that are out of character with the property or alter its setting; or neglecting the resource to the extent that it deteriorates or is destroyed. Direct impacts can be assessed by identifying the types and locations of proposed activity and determining the exact location of cultural resources that could be affected. Indirect impacts generally result from increased use of an area and are harder to quantify.

On-the-ground activities that have the potential to cause direct or indirect adverse effects to archaeological sites eligible for listing on the NRHP are limited to development of new training transmitter sites under the Mitigated Proposed Action and alternatives for the ATI. Preparation of the training transmitter locations may include activities such as grading, graveling, utility installation, and fence construction. Although unlikely, use of the transmitter locations could also lead to indirect on-the-ground effects, such as those that could occur from increased use of areas near or adjacent to archaeological sites, possibly resulting in vandalism, erosion, or other adverse effects. The Mitigated Proposed Action or alternatives do not include demolition or renovation that could directly affect historic buildings and structures eligible for listing in the NRHP. The preferred locations of the new training transmitter sites would be away from buildings, and previously disturbed locations are favored. These locations would be surveyed to state standards for the presence of cultural resources prior to any construction activity.

Effects to cultural resources as a result of the proposed ATI action and alternatives could also stem from changes in the noise or visual environment. The introduction of material to archaeological sites or standing structures from the use of chaff and flares could also be considered an effect. Although extremely unlikely, there could be an effect to a historic building from a falling plastic S&I device similar to that from a large hailstone. Traditional cultural resources have the potential to be affected by any of these actions.

3.7.1.2 ISSUES AND CONCERNS

To date, no issues or concerns specifically related to cultural resources within the project area were identified through public hearings or the public comment period. Over 60 NRHP-listed cultural resources have been identified within the ROI, and many more NRHP-eligible cultural resources are likely to be present. Neither the Catawba Indian Nation of Rock Hill, South Carolina, nor the Eastern Band of the Cherokee Indians of Cherokee, North Carolina, have indicated specific concerns. Neither the Georgia SHPO nor the South Carolina SHPO has identified any specific concerns.

Elements of the Mitigated Proposed Action and alternatives can be divided into three categories: change in the shape of the existing airspace in Georgia and South Carolina; construction of new transmitter locations in Georgia, and deployment of chaff and flares in the new airspace in Georgia.

Actions that result in a change in the use of airspace by aircraft typically have little impact on archaeological resources. In the case of ATI, the airspace portions of the Mitigated Proposed Action and alternatives occur primarily in areas routinely overflown by aircraft. Most archaeological sites, by their very nature of existing below the ground surface, are not affected by vibrations, because they are typically shielded by the surrounding dirt matrix. However, above-ground structures could potentially be affected by vibration and changes in setting related to the introduction of increased noise and visual intrusion from overflights. Traditional cultural resources could also be affected by changes in setting.

Selection criteria for training transmitter locations on cleared areas would avoid potentially valuable cultural resources.

Most of the 65 NRHP properties underlying the existing Mitigated Proposed Action, Alternative A and/or Alternative B airspace in Georgia and South Carolina consist of buildings or other architectural resources. In addition to these, there are numerous resources under the extensive airspace that have not been formally evaluated for eligibility in the NRHP but are considered eligible for the NRHP. Studies have established that subsonic noise-related vibration damage to structures, including historic buildings, requires high sound levels generated at close proximity to the structure in a low frequency range. Even under these conditions, the potential for damage to historic structures is small (Wyle Laboratories 2003). There is an extremely low potential for structural damage to architectural resources or for displacement or breakage of components in archaeological resources under the Mitigated Proposed Action or alternatives.

There is little potential for chaff to have physical or chemical effects on cultural resources (Air Force 1997a). Chaff strands are broken down by natural forces, which render the strands difficult to detect in the surrounding environment (Air Force 1997a). Because of the breakdown of the chaff fibers and the wide dispersion of chaff, it is unlikely that chaff residual components such as end caps would accumulate in sufficient quantities to impair the appreciation or use of cultural resources or Native American traditional areas through visual effects.

Potential concerns regarding flare use include fire risk, impacts from residual material, and aesthetic issues. Existing procedures require deployment of flares above altitudes that are designed to ensure a complete burnout of flares before they contact the ground. Shaw AFB regulations prohibit release of flares below approximately 4,500 feet AGL in the Gamecock MOAs and Bulldog MOAs. Potential inadvertent release of flares or the failure of the flare to function properly has a low likelihood (approximately 0.01 percent), but could result in a fire.

In the extremely remote possibility of fire related to flare use, cultural resources could be damaged by fire, smoke, fire suppression, or fire rehabilitation actions. Potential fire-related damage to cultural resources would be minimized using existing procedures to control fire risk.

One piece of plastic residual material from MJU-7 A/B flares could strike historic structures with an effect similar to that of a large hailstone. Damage would be unlikely due to the number of flares released annually throughout the MOAs and the relatively small number of historic structures under the airspace. An average of one piece of plastic, felt, or wrapping residual material is deposited per approximately 5 acres per year. To date, no impacts to cultural resources from flare residual materials have been reported. In small quantities, flare residual components do not alter landscape conditions and have little effect on the overall aesthetic quality of cultural resources (Air Force 1997a). Section 3.5, Physical Resources and Section 3.8, Land Use, provides additional consideration of landscape issues.

Construction of training transmitter sites entails ground-disturbing activities, including grading, fence installation, road construction, and utility routing. These actions have the potential to disturb cultural resources, particularly archaeological sites.

There is the preference to place the proposed training transmitters away from population centers, yet adjacent to existing roadways and power lines. Additional preferences for training transmitter placement include having a slight elevation compared to surrounding topography and a clear view of the sky. Most locations under consideration have been or are currently in cultivation. Although there is a higher probability of locating archaeological resources in areas of some elevation, they would likely be disturbed given the probable agricultural context. Three possible locations for two training transmitters in Georgia have received a preliminary examination: Magruder North, Magruder South, and Grange. While the Grange location had no apparent cultural resources, Magruder North and Magruder South contained an archaeological site and an isolate, respectively. Neither of these resources has been formally recorded, nor has either been evaluated for NRHP eligibility by the Georgia SHPO. The Air Force conducted timely Section 106 consultation with the Georgia and South Carolina SHPOs for these and additional locations for training transmitters in the course of the EIAP to meet the analysis and public review requirements prescribed by NEPA. Following a review of the Draft EIS, the Air Force received a letter dated September 30, 2005 from the Georgia SHPO (HP-050829-004) stating their finding of "no historic properties or archaeological resources that are listed in or eligible for listing in the NRHP will be affected by this undertaking" (see letter 0006 in Appendix D). The South Carolina SHPO also commented on the Draft EIS in a letter dated September 19, 2005 requesting that once specific construction sites are identified in South Carolina the construction sites be surveyed for cultural resources and those surveys provided to the South Carolina SHPO for review (see letter 0004 in Appendix D). Required steps may include inventory for and identification of cultural resources by qualified professionals, NRHP eligibility evaluation of any resources located, and development of impact mitigation measures, if necessary.

The Air Force requested identification of concerns and initiation of Government-to-Government consultation during the scoping process and provided the Draft EIS to the Eastern Band of Cherokee Indians and the Catawba Indian Nation. No responses were received and no issues or concerns were identified.

In the event that cultural resources are discovered during preliminary surveys of the construction sites or during ground-disturbing activities, all construction activity would cease and the Shaw AFB Natural Resources Manager would be contacted and the SHPO and/or tribe would be notified as outlined in the Shaw AFB Integrated Cultural Resources Management Plan (Air Force 2008).

3.7.2 Existing Conditions – Cultural Resources

HISTORICAL SETTING

Like most of North America, South Carolina and Georgia were probably first inhabited approximately 12,000 years ago (Shaw AFB 2008). In addition to the current fauna, the area was also host to mammoth, musk ox, giant beaver, mastodon, and sloth. Although the continental glaciers never reached the Gulf coast, the local environment was cooler and wetter with sea levels several hundred feet lower than today (Shaw AFB 2008).

The first human inhabitants of the area are believed to have been big game hunters and are termed Paleo Indians (12,000-10,000 years before present). Although they no doubt supplemented their diet by gathering various plant species, such organic items are not often well preserved by the archaeological record. Instead, they are best known through the non-organic artifacts they left behind, principally, projectile points. There are technological distinctions among these projectile points (Clovis, Hardaway, Dalton) that are likely indicative of cultural divisions and possibly the specialization toward hunting particular large game animals (Fagan 1991, Shaw AFB 2008). Due to several factors, including the antiquity of these cultures and rising sea levels, remains of these cultures are sparse, but are found contemporaneously throughout North and South America. These early cultures remain enigmatic, fueling contention about the initial peopling of the New World (Fagan 1991).

Later, as the climate became warmer and drier, the large mammals the Paleo Indians relied upon became extinct. As a result, inhabitants focused on different game species and increased their reliance on plant resources. This was the start of the Archaic Period in southeastern North America, beginning approximately 10,000 years ago. The ROI covers regions where native cultures used both coastal and woodland-based subsistence strategies (Fagan 1991). Archaeological evidence suggests that groups engaged in a highly mobile life way, living in inland winter camps and coastal summer camps, and utilizing major waterways such as the Savannah River as principal routes of travel (Fagan 1991).

At approximately 4,000 years ago, the indigenous populations along South Carolina's coastal plain adopted the use of fired clay vessels, marking what is called the "container revolution" (Fagan 1991). At about the same time, many North American groups were becoming more reliant on an incipient form of agriculture. This time marks the beginning of the Eastern Woodland period. Although the beginning of the period is nearly indistinguishable from the late Archaic, agricultural use gradually intensified, giving rise to towns with public and sacred places and platform mound ceremonialism. By 2,500 years ago, indigenous groups of the greater area developed larger-scale agricultural societies similar to those on the Mississippi and Ohio Rivers (Fagan 1991). However, the vicinity of Shaw AFB, Poinsett ECR, Gamecock, and Bulldog MOAs were located in outlying areas where people lived in settlements consisting of camps and small farmsteads rather than towns (Shaw AFB 2008).

The Spanish were the first Europeans to arrive in the area in the early 1500s, when two ships sent by magistrate Lucas Vasquez de Ayllon explored the South Carolina coast and several islands, returning to Spain with approximately 70 indigenous captives (Encarta 2004). In 1540, Hernando deSoto explored parts of inland Georgia, passing near if not beneath MOAs of the Mitigated Proposed Action, never finding the gold he so eagerly sought (About North Georgia 2009b). Later, the Spanish established a town near present-day Camden, South Carolina as well as a short-lived settlement on Parris Island in 1566 (Encarta 2004, Shaw AFB 2008). In 1562, a group of French Huguenots also established a small settlement on Parris Island, today the home of the Eastern Region Marine Recruiting Depot. The expansion of English settlement displaced the Spanish, finally driving them from the area by 1586 (Encarta 2004). As part of the effort to definitively wrest control from the Spanish and consolidate their own hold on the land, England formed a government for the Carolina colonies in the late 1600s with settlement centering in the Charleston area.

Early settlers and explorers to central South Carolina found a number of Siouan Indian groups that were collectively referred to as the Catawba. Members of the larger Catawba group included the Wateree in today's Sumter County, the Congaree to the west, the Santee to the south, and the Catawba to the north (Shaw AFB 2008). These groups were associated as the Esaw Confederation and fought the English settlers on the coast in the Yamasee War. Following the defeat of the Esaw Confederation, the site of the present day Shaw AFB was vacated except for occasional hunting use (Shaw AFB 2008). Eventually the Catawba were settled on a reservation in northern South Carolina, near Rock Hill.

At the time of contact, the Cherokee were the principal native group in central and eastern Georgia. Regular contact between Euro-Americans and Cherokees in the region began with the founding of the Carolina colonies (Sultzman 1996). With the treaty of 1684, South Carolina initiated trade in deerskins and Indian slaves, and Cherokee warriors became hunters for profit (About North Georgia 2004). European trade and competition aggravated rivalries among native groups, and friction increased between the Cherokee and surrounding native groups, including the Catawba. British interests in the region supported a series of peace efforts culminating in a 1743 treaty between the Cherokee and Catawba (About North Georgia 2004). Conflicts with the British eventually resulted in the Cherokee War of 1760 to 1762. After their defeat, the Cherokee signed a treaty with South Carolina Colony that ceded most of their eastern lands in the Carolinas. Later, in 1782, the Cherokee signed another treaty ceding large parts of eastern Georgia. In 1838, most of the Cherokee were forcibly removed from their remaining lands and placed on a reservation in Oklahoma. The Eastern Cherokee, living in the mountains of western North Carolina, were formally recognized by the U.S. in 1848 and the Qualla Boundary reservation, North Carolina, was chartered in 1889 (Sultzman 1996).

Euro-American settlers moved into central South Carolina, beginning in the mid-1700s, to raise cattle and indigo. The islands off the coast of the Carolinas, Georgia, and northeast Florida (known as the Sea Islands) were the first cotton growing areas on the continent with the first successful crops produced in the early 1790s (All Refer 2010, Beaufort County Public Library 2010).

In turn, Charleston, South Carolina was the jumping off point for a group of British Trustees, led by James Oglethorpe, who first colonized Georgia. The Royal Charter recognizing the colony was certified in 1732 as the group began laying out the town of Savannah (Georgia.Gov 2010). Backed by British investors, early settlers of Georgia had hoped to produce silk, wine and other semi-tropical goods. After the colony failed to turn a profit for the trustees, control was turned over to the first Royal Governor, Captain John Reynolds, in 1754 (Georgia.Gov 2010). An influx of farmers during the Great Overland Migration of the 1750s and 1760s fully settled the colony.

During the Revolutionary War, the Camden, South Carolina area was a British stronghold and skirmishes were fought throughout the countryside. After the war, when the indigo market collapsed, cotton became the crop of choice and African slaves soon outnumbered free men. Large plantations were established throughout the region (Georgia.Gov 2010).

Civil War action took place largely outside the region until near the end of the war when Union forces ("Potter's Raid") attacked local railroads in South Carolina. Also toward the end of the war, Sherman's march passed through parts of north Georgia, including areas under the current Bulldog MOAs, and through Atlanta and Savannah. After the Civil War, large plantations were replaced by smaller farms and logging operations (Georgia.Gov 2010).

After the Battle of Port Royal Sound in 1861, landowners fled from the Beaufort area and the Sea Islands. The land was sold to freed slaves, many of whom lived an isolated existence and engaged in hunting, gathering, and agricultural subsistence economies (Beaufort County Public Library 2010).

Much of southwestern Sumter County, including present-day Poinsett ECR, was set aside as a state park and federal forest land in the 1930s. Shaw Field was established as an Army air base in 1941, in an area that was primarily agricultural fields. Shaw AFB acquired Poinsett ECR in 1951 and Wateree Recreation Area in 1959 (Shaw AFB 2008).

CULTURAL RESOURCES

SHAW AFB

Shaw AFB maintains an active program of cultural resource management. All aspects of the Mitigated Proposed Action and alternatives would be off base, and as such, the Mitigated Proposed Action and alternatives would not impact on-base cultural resources.

AIRSPACE

Airspace considered in the Mitigated Proposed Action or alternatives extends over portions of South Carolina and/or Georgia. The airspace represents all or part of Burke, Emanuel, Glascock, Jefferson, Jenkins, Johnson, and Washington counties in Georgia; and Berkeley, Calhoun, Clarendon, Florence, Georgetown, Horry, Marion, Sumter, and Williamsburg counties in South Carolina. There are numerous cultural resources under the proposed and existing airspace, many of which are eligible for, or listed on, the NRHP. Directly beneath the Bulldog MOAs in Georgia, there are 35 properties listed on the NRHP. These properties range from homes and plantations to churches and schools and include six historic districts. The portions of the South Carolina counties beneath the Alternative A and B airspace have 29 NRHP listed properties. These include four districts, a battle site, houses and commercial buildings, Fort Watson, and the Santee Indian Mound. Table 3.7-1 summarizes NRHP-listed properties by airspace, state, county, and city.

Table 3.7-1. Properties Listed as National Register of Historic Places Beneath Current and/or Proposed Airspace
(Page 1 of 3)

Airspace	*State*	*County*	*Resource Name*	*Location City*
Bulldog A and B MOA	Georgia	Jefferson	Jefferson County Courthouse	Louisville
Bulldog A and B MOA	Georgia	Jefferson	Old Market	Louisville
Bulldog A and B MOA	Georgia	Jefferson	Cunningham-Coleman House	Wadley
Bulldog A, E and B MOA	Georgia	Johnson	Grice Inn	Wrightsville
Bulldog A, E and B MOA	Georgia	Johnson	Johnson County Courthouse	Wrightsville
Bulldog A and B MOA	Georgia	Washington	Francis Plantation	Davisboro
Bulldog A and B MOA	Georgia	Washington	Church-Smith-Harris Street Historic District	Sandersville
Bulldog A and B MOA	Georgia	Washington	City Cemetery	Sandersville
Bulldog A and B MOA	Georgia	Washington	Elder, Thomas Jefferson, High and Industrial School	Sandersville
Bulldog A and B MOA	Georgia	Washington	Holt Brothers Banking Company Building	Sandersville
Bulldog A and B MOA	Georgia	Washington	Johnson, James E., House	Sandersville
Bulldog A and B MOA	Georgia	Washington	North Harris Street Historic District	Sandersville
Bulldog A and B MOA	Georgia	Washington	Sandersville Commercial and Industrial District	Sandersville
Bulldog A and B MOA	Georgia	Washington	Washington County Courthouse	Sandersville
Bulldog A and B MOA	Georgia	Washington	Kelley, James, House	Tennille
Bulldog A and B MOA	Georgia	Washington	Madden, Charles, House	Tennille
Bulldog A and B MOA	Georgia	Washington	Smith, Thomas W., House	Tennille
Bulldog A and B MOA	Georgia	Washington	Tennille Banking Company Building	Tennille
Bulldog A and B MOA	Georgia	Washington	Tennille Baptist Church	Tennille
Bulldog A and B MOA	Georgia	Washington	Tennille Woman's Clubhouse	Tennille
Bulldog A and B MOA	Georgia	Washington	Washington Manufacturing Company	Tennille
Bulldog A and B MOA	Georgia	Washington	Wrightsville and Tennille Railroad Company Building	Tennille
Bulldog B MOA	Georgia	Burke	Burke County Courthouse	Waynesboro
Bulldog B MOA	Georgia	Burke	Haven Memorial Methodist Episcopal Church	Waynesboro
Bulldog B MOA	Georgia	Burke	Jones, John James, House	Waynesboro
Bulldog B MOA	Georgia	Burke	Waynesboro Commercial Historic District	Waynesboro
Bulldog B and E MOAs	Georgia	Emanuel	Coleman, James, House	Swainsboro

Table 3.7-1. Properties Listed as National Register of Historic Places Beneath Current and/or Proposed Airspace (Page 2 of 3)

Airspace	*State*	*County*	*Resource Name*	*Location City*
Bulldog B and E MOAs	Georgia	Emanuel	Emanuel County Courthouse and Sheriff Department	Swainsboro
Bulldog B and E MOAs	Georgia	Emanuel	Rountree, John, Log House	Twin City
Bulldog B and C MOAs	Georgia	Jenkins	Birdsville Plantation	Millen
Bulldog B and C MOAs	Georgia	Jenkins	Camp Lawton	Millen
Bulldog B and C MOAs	Georgia	Jenkins	Downtown Millen Historic District	Millen
Bulldog B and C MOAs	Georgia	Jenkins	Jenkins County Courthouse	Millen
Bulldog B and C MOAs	Georgia	Jenkins	Millen High School	Millen
Bulldog B MOA	Georgia	Jenkins	Carswell Grove Baptist Church and Cemetery	Perkins
Gamecock MOA B	South Carolina	Kershaw	Liberty Hill Historic District	Liberty Hill
Gamecock MOA B	South Carolina	Lancaster	Battle of Hanging Rock Historic Site	Heath Springs
Gamecock MOA B	South Carolina	Lancaster	Heath Springs Depot	Heath Springs
Gamecock MOA B	South Carolina	Lancaster	Cauthen, Dr. William Columbus, House	Kershaw
Gamecock MOA B	South Carolina	Lancaster	Clinton AME Zion Church	Kershaw
Gamecock MOA B	South Carolina	Lancaster	East Richland Street—East Church Street Historic District	Kershaw
Gamecock MOA B	South Carolina	Lancaster	Kershaw Depot	Kershaw
Gamecock MOA B	South Carolina	Lancaster	Matson Street Historic District	Kershaw
Gamecock MOA B	South Carolina	Lancaster	Unity Baptist Church	Kershaw
Gamecock C and D MOA	South Carolina	Florence	Browntown	Johnsonville
Gamecock C and D MOA	South Carolina	Florence	Snow's Island	Johnsonville
Gamecock C and D MOA	South Carolina	Williamsburg	Gamble House	Nesmith
Gamecock D MOA	South Carolina	Williamsburg	Clarkson Farm Complex	Greeleyville
Gamecock D MOA	South Carolina	Williamsburg	New Market	Greeleyville
Gamecock D MOA	South Carolina	Williamsburg	Heller, M. F., House	Kingstree
Gamecock D MOA	South Carolina	Williamsburg	Kingstree Historic District	Kingstree
Gamecock D MOA	South Carolina	Williamsburg	Pressley, Colonel John Gotea, House	Kingstree
Gamecock D MOA	South Carolina	Williamsburg	Scott House	Kingstree
Gamecock D MOA	South Carolina	Williamsburg	Thorntree	Kingstree
Gamecock D MOA	South Carolina	Williamsburg	Salters Plantation House	Salters
Airspace	*State*	*County*	*Resource Name*	*Location City*
Gamecock E MOA	South Carolina	Clarendon	Alderman's 20 Stores in One	Manning
Gamecock E MOA	South Carolina	Clarendon	Davis House	Manning
Gamecock E MOA	South Carolina	Clarendon	Manning Library	Manning
Poinsett MOA	South Carolina	Clarendon	Santee Indian Mound and Fort Watson	Summerton

Table 3.7-1. Properties Listed as National Register of Historic Places Beneath Current and/or Proposed Airspace
(Page 3 of 3)

Airspace	*State*	*County*	*Resource Name*	*Location City*
Poinsett MOA	South Carolina	Clarendon	Senn's Grist Mill--Blacksmith Shop--Orange Crush Bottling Plant	Summerton
Poinsett MOA	South Carolina	Clarendon	Summerton High School	Summerton
Poinsett MOA	South Carolina	Sumter	Millford Plantation	Pinewood
Poinsett MOA	South Carolina	Sumter	Pinewood Depot	Pinewood
Poinsett MOA	South Carolina	Sumter	St. Mark's Church	Pinewood

MOA = Military Operations Area
Source: National Register Information System 2010.

TRAINING TRANSMITTERS

The Mitigated Proposed Action includes six potential training transmitter sites. Two would be located near Grange and Magruder, Georgia under Bulldog A, one would be beneath Gamecock C, and three would be along the South Carolina coast. Each of the sites along the coast would be located within a 10-mile radius of the cities of Georgetown, McClellanville, or Awendaw.

Currently there are 50 NRHP-listed properties in the counties and cities where training transmitter sites could be located. While there are no properties listed in the NRHP for either of the two proposed sites near Grange and Magruder, Georgia, there are 11 sites listed for the two counties they occupy, Jefferson and Burke, respectively. There are three NRHP-listed sites in the vicinity of the proposed training transmitter site beneath Gamecock C and a total of 36 NRHP-listed sites for the three cities near which training transmitters are proposed along the South Carolina coast. Table 3.7-2 summarizes NRHP-listed properties by proposed training transmitter location, state, county, and city (National Register Information System 2010).

Table 3.7-2. Properties Listed as National Register of Historic Places Located Near Proposed Emitter Locations
(Page 1 of 2)

Proposed Emitter Location	*State*	*County*	*Resource Name*	*City*
Georgetown area	South Carolina	Georgetown	St. James Episcopal Church, Santee	Georgetown
Georgetown area	South Carolina	Georgetown	Annandale Plantation	Georgetown
Georgetown area	South Carolina	Georgetown	Arcadia Plantation	Georgetown
Georgetown area	South Carolina	Georgetown	Battery White	Georgetown
Georgetown area	South Carolina	Georgetown	Belle Isle Rice Mill Chimney	Georgetown
Georgetown area	South Carolina	Georgetown	Beneventum Plantation House	Georgetown
Georgetown area	South Carolina	Georgetown	Black River Plantation House	Georgetown
Georgetown area	South Carolina	Georgetown	Brookgreen Gardens	Georgetown
Georgetown area	South Carolina	Georgetown	Chicora Wood Plantation	Georgetown
Georgetown area	South Carolina	Georgetown	Fairfield Rice Mill Chimney	Georgetown
Georgetown area	South Carolina	Georgetown	Friendfield Plantation	Georgetown
Georgetown area	South Carolina	Georgetown	Georgetown Historic District	Georgetown
Georgetown area	South Carolina	Georgetown	Georgetown Lighthouse	Georgetown
Georgetown area	South Carolina	Georgetown	Hobcaw Barony	Georgetown
Georgetown area	South Carolina	Georgetown	Hopsewee	Georgetown

Table 3.7-2. Properties Listed as National Register of Historic Places Located Near Proposed Emitter Locations (Page 2 of 2)

Proposed Emitter Location	*State*	*County*	*Resource Name*	*City*
Georgetown area	South Carolina	Georgetown	Keithfield Plantation	Georgetown
Georgetown area	South Carolina	Georgetown	Mansfield Plantation	Georgetown
Georgetown area	South Carolina	Georgetown	Milldam Rice Mill and Rice Barn	Georgetown
Georgetown area	South Carolina	Georgetown	Minim Island Shell Midden (38GE46)	Georgetown
Georgetown area	South Carolina	Georgetown	Nightingale Hall Rice Mill Chimney	Georgetown
Georgetown area	South Carolina	Georgetown	Old Market Building	Georgetown
Georgetown area	South Carolina	Georgetown	Pee Dee River Rice Planters Historic District	Georgetown
Georgetown area	South Carolina	Georgetown	Prince George Winyah Church and Cemetery	Georgetown
Georgetown area	South Carolina	Georgetown	Rainey, Joseph H., House	Georgetown
Georgetown area	South Carolina	Georgetown	Rural Hall Plantation House	Georgetown
Georgetown area	South Carolina	Georgetown	Weehaw Rice Mill Chimney	Georgetown
Georgetown area	South Carolina	Georgetown	Wicklow Hall Plantation	Georgetown
Georgetown area	South Carolina	Georgetown	Winyah Indigo School	Georgetown
Awendaw area	South Carolina	Charleston	Sewee Mound	Awendaw
McClellanville area	South Carolina	Charleston	Bethel African Methodist Episcopal Church	McClellanville
McClellanville area	South Carolina	Charleston	Cape Romain Lighthouses	McClellanville
McClellanville area	South Carolina	Charleston	Fairfield Plantation	McClellanville
McClellanville area	South Carolina	Charleston	Hampton Plantation	McClellanville
McClellanville area	South Carolina	Charleston	Harrietta Plantation	McClellanville
McClellanville area	South Carolina	Charleston	McClellanville Historic District	McClellanville
McClellanville area	South Carolina	Charleston	Wedge, The	McClellanville
Vidette area	Georgia	Burke	Burke County Courthouse	Waynesboro
Vidette area	Georgia	Burke	Haven Memorial Methodist Episcopal Church	Waynesboro
Vidette area	Georgia	Burke	Hopeful Baptist Church	Keysville
Vidette area	Georgia	Burke	Jones, John James, House	Waynesboro
Vidette area	Georgia	Burke	McCanaan Missionary Baptist Church and Cemetery	Sardis
Vidette area	Georgia	Burke	Sapp Plantation	Sardis
Vidette area	Georgia	Burke	Waynesboro Commercial Historic District	Waynesboro
Grange area	Georgia	Jefferson	Cunningham-Coleman House	Wadley
Grange area	Georgia	Jefferson	Jefferson County Courthouse	Louisville
Grange area	Georgia	Jefferson	Louisville Commercial Historic District	Louisville
Grange area	Georgia	Jefferson	Old Market	Louisville
Gamecock C	South Carolina	Florence	Browntown	Johnsonville
Gamecock C	South Carolina	Florence	Snow's Island	Johnsonville
Gamecock C	South Carolina	Williamsburg	Gamble House	Nesmith

Source: National Register Information System 2010.

Proposed locations for two training transmitters under the Bulldog MOA have been identified at this time. One transmitter would be placed near Grange, where a single location has been chosen. Near Magruder, two possible locations are under consideration, Magruder North and Magruder South.

Preliminary environmental evaluations of the three proposed transmitter locations (Magruder North, Magruder South, and Grange) were performed that included a review of available cultural resource records. These reviews and site visits did not identify concerns related to cultural resources at any of the three proposed locations (Environmental Data Resources, Inc. [EDR] 2005a; 2005b; 2005c; SAIC 2005).

The Grange location is the remnant corner of a field that is missed by a central pivot irrigation system. With a ground visibility of nearly 100 percent, the surface examination failed to locate any cultural resources. Additionally, there is no evidence of historic structures within a half-mile of the proposed transmitter location (SAIC 2005).

The Magruder North location is currently pasture land situated between the west of Magruder-Rosier Road and a large pond. During the field visit, the surface visibility within the pasture ranged from 30 percent on vegetated portions to 100 percent in areas of livestock wallows and trailing, and wave cut banks associated with the pond. An archaeological site having both prehistoric and historic components was observed toward the west side of the parcel. Artifacts observed include more than 100 yellow, white, and reddish chert flakes, two projectile point fragments, glass, ceramic and metal fragments. From the cursory examination, the site occupies at least 300 square meters. This site has not been formally recorded or evaluated for NRHP eligibility.

The Magruder South location is a field that is currently in grass hay and is located east of Cobb Road. Because of the poor ground visibility, the field visit concentrated on examining the uncultivated margins of the field. As the road was constructed by blading only, its surface was also examined. The examination located a single, distal biface fragment made of a low-grade chert, near the southeast corner of the area. Given a lack of topographic features that would make the vicinity attractive to prehistoric habitation (e.g., permanent water, confluence), the biface fragment is likely an isolated artifact. This isolate has also not been formally recorded, nor has it been evaluated for NRHP eligibility.

The South Carolina SHPO reviewed the Air Force's Draft EIS and in a letter dated September 19, 2005 recommended conducting cultural surveys of specific transmitter construction sites once the final sites are selected prior to construction activities (Dobrasko 2005). The South Carolina SHPO had previously responded to the Air Force's Interagency and Intergovernmental Coordination for Environmental Planning (IICEP) letter in the early stages of the EIS process (Sidebottom 2004). At that time, the South Carolina SHPO also recommended that specific emitter locations would need to be surveyed for cultural resources.

There are two databases that will need to be reviewed: the Cultural Resource Information System (CRIS) through the South Carolina Archives & Historic Center (SHPO), and the South Carolina Institute of Archaeology and Anthropology (SCIAA). If archival data does not specifically indicate that the area(s) have been previously surveyed, it is possible that "field research may need to be done to identify historic properties near the site that do not appear in the CRIS or SCIAA databases" (Sidebottom 2004).

The Air Force also provided the Georgia SHPO with the Draft EIS for agency review. In a letter dated September 30, 2005, the Georgia SHPO indicated no historic properties or archaeological resources listed in or eligible for the NRHP were present within the project area. Other historic or archaeological resources may be located within proximity of the project areas; however, the Georgia SHPO determined these resources would not be impacted. Georgia archives would be examined to determine if the training transmitter locations have been inventoried for cultural resources once specific sites for the training transmitters have been identified. If the identified construction sites have not been inventoried for cultural resources then, in compliance with Section 106 of the NHPA, an inventory would determine if significant resources exist at the proposed locations prior to any construction or ground-disturbing activities.

Native American Concerns

Many Native American groups once lived in the ROI in parts of Georgia and South Carolina. However, most of these groups either no longer exist as federally recognized tribes or were forced to move to Oklahoma and other states by the U.S. government in the 19th century. Today, the federally recognized Native American groups in the ROI are the Catawba Indian Nation located near Rock Hill, South Carolina, and the Eastern Band of Cherokee Indians, near Cherokee, North Carolina (NPS 2004b). The Air Force requested the initiation of consultation consultation with these groups, as required by Section 106 of the NHPA, NEPA, and the DoD American Indian and Alaska Native Policy of 1999, to identify concerns under these acts as well as any that could arise through Native American Graves Protection and Repatriation Act or other laws, orders, and regulations pertaining to American Indian issues. The Air Force requested identification of concerns and initiation of Government-to-Government consultation during the scoping process and provided the Draft EIS to the Eastern Band of Cherokee Indians and the Catawba Indian Nation. No responses were received and no issues or concerns were identified.

3.7.3 Environmental Consequences – Cultural Resources

3.7.3.1 Mitigated Proposed Action

Table 3.7-1 lists NRHP properties that underlie the airspace of the Mitigated Proposed Action as well as Alternatives A and B. Current conditions for resources under the Bulldog MOAs include overflights by military and civilian aircraft. Ten NRHP-listed properties are under the proposed Bulldog C and E MOAs. The proposed floor of these two new MOAs would be 500 AGL. Currently, several NRHP-listed resources are being overflown at 500 feet AGL in the

Bulldog A MOA without the NRHP values of these resources being impacted. Neither the noise nor the visual presence of these overflights has affected the NRHP eligibility of the resources. No new NRHP resources would be impacted under the Gamecock MOAs under the Mitigated Proposed Action. The NRHP resources under Gamecock MOAs would continue to be exposed to the current level of flight activity. No traditional cultural resources have been identified in the project area.

Chaff and flares would be unlikely to adversely affect cultural resources beneath the existing and proposed airspace. Under the Mitigated Proposed Action, the amount of chaff and flares would not increase reducing the possibility of an adverse effect to NRHP properties. The residual materials from both chaff and flares falls to the ground in a dispersed fashion, and does not collect in quantities great enough to adversely affect the NRHP status of archaeological or historic resources. No effects from falling MJU-7 A/B flare elements have been recorded. However, there is a remote possibility that if the S&I device struck a historic building in poor repair, the building could be damaged with an effect similar to that from a large hailstone. This scenario is extremely unlikely in view of the distribution of flares and historic structures.

Although construction of the training transmitters could have the potential to adversely affect cultural resources, this outcome would be unlikely. In Georgia, three possible locations for two training transmitter have been identified and received preliminary survey; the locations are agricultural lands that lie adjacent to roads and have access to electrical and phone lines. At the Magruder North Site, located near a Carolina bay, an archaeological site having both prehistoric and historic components and several artifacts were observed. One isolated artifact was found at the Magruder South location, a single, distal biface fragment made of a low-grade chert was found near the southeast corner of the area. No cultural resources were found at the Grange location. The Air Force conducted NHPA Section 106 consultation (HP-050829-004) with the Georgia SHPO. The Georgia SHPO indicated no historic properties or archaeological resources listed in or eligible for the NRHP would be impacted by the proposed action as defined in the Draft EIS. Once the final emitter locations have been selected, additional cultural resources visits will be conducted in coordination with the SHPO to identify and recover any significant archaeological information. In South Carolina, four general areas, one site under Gamecock C MOA and three sites along the coast, were analyzed for the placing of additional emitters in areas along roads and with access to utilities. If specific site locations are identified in the future, the Air Force would need to complete the EIAP, environmental baseline and cultural surveys, and NHPA Section 106 consultation. In the event that cultural resources are discovered during preliminary surveys of the construction sites or during ground-disturbing activities, all construction activity would cease and the Shaw AFB Natural Resources Manager would be contacted and the SHPO and/or tribe would be notified as outlined in the Shaw AFB Integrated Cultural Resources Management Plan (ICRMP) (Air Force 2008).

The Air Force requested identification of concerns and initiation of Government-to-Government consultation during the scoping process and provided the Draft EIS to the Eastern Band of

Cherokee Indians and the Catawba Indian Nation. No responses were received and no issues or concerns were identified.

3.7.3.2 ALTERNATIVE A

Effects to cultural resources under Alternative A would be similar to those under the Mitigated Proposed Action for the Bulldog MOAs. Although over 60 NRHP-listed properties underlie the airspace, it would be unlikely that changes in airspace use would be discernable at any historic or cultural properties. Three NRHP-listed resources are under the proposed Gamecock E airspace. However, with the proposed floor at 8,000 feet MSL, it would be unlikely to adversely affect the NRHP values of these resources. Airspace changes, including alterations in the MOA floors, expansion of boundaries, and establishment of new airspace would not have an adverse effect on archaeological or architectural cultural resources. Chaff and flares would not accumulate in quantities great enough to affect the NRHP eligibility of this resource type nor are impacts from MJU-7 A/B flare components likely. No traditional cultural resources have been identified within the project area. Effects to cultural resources from the construction of training transmitter sites would be the same as described under the Mitigated Proposed Action.

3.7.3.3 ALTERNATIVE B

Under Alternative B, the effects to cultural resources would be similar to Alternative A. Three NRHP-listed resources not currently under existing military airspace would be underneath Gamecock E, but the remaining NRHP-listed resources are currently under existing airspace. Changes in the shape and use of this airspace would not affect the NRHP-eligibility of these resources, nor would continued use of chaff and flares. Effects to cultural resources from the construction of training transmitter sites would be the same as described under the Mitigated Proposed Action.

3.7.3.4 NO-ACTION ALTERNATIVE

Conditions for cultural resources would remain as described in the affected environment section if the No-Action Alternative were selected. Most of the NRHP-listed and eligible resources would continue to be overflown by military and civilian aircraft. Flares and chaff would still be deployed in the Gamecock and Bulldog MOAs. While existing training transmitters would continue operations, new training transmitter locations would not be identified and developed.

3.8 LAND USE

3.8.1 Introduction

The attributes of land use addressed in this analysis include general land use patterns, land ownership, land management plans, and special use areas. General land use patterns characterize the types of uses within a particular area, including agricultural, residential, military, and recreational. Land ownership is a categorization of land according to type of owner; the major land ownership categories include private, federal, and state. Federal lands are described by the managing agency, which may include the USFWS, USFS, or DoD. Land management plans include those documents prepared by agencies to establish appropriate goals for future use and development. As part of this process, sensitive land use areas (e.g., Wilderness or Wild and Scenic Rivers) are often identified by agencies as being worthy of more rigorous management.

Recreation resources consider outdoor recreational activities that take place away from the residences of participants. This includes natural resource areas and man-made facilities (such as county parks and facilities) that are designated or available for public recreational use.

The ROI for land use resources for the Mitigated Proposed Action and alternatives consists of lands beneath the current Gamecock B, C, and D MOAs, Poinsett MOA, R-6002, Bulldog A and B MOAs, the proposed Bulldog C and E MOAs, the proposed Gamecock E MOA, and proposed areas for training transmitter sites. For ease of discussion, the area under the Gamecock B, C, and D MOAs, Poinsett MOA, R-6002, and the proposed Gamecock E, will be referred to as the Gamecock ROI. Likewise, lands under Bulldog A and B and the proposed Bulldog C and E MOAs will be the Bulldog ROI. Training transmitter sites will be discussed separately.

3.8.1.1 METHODOLOGY

Land use and recreational resources are evaluated to determine if any proposed project activity is incompatible with existing land use or adopted land use plans or policies. In general, land use impacts would be considered significant if they would (1) be inconsistent or noncompliant with applicable land use plans and policies, (2) prevent continued use or occupation of an area, or (3) be incompatible with adjacent or nearby land use to the extent that public health or safety is threatened. Recreation resources would be affected if there were a change in access, availability to a recreation site or activity, or a change in recreational opportunities.

3.8.1.2 ISSUES AND CONCERNS

Several issues and concerns about land use and recreational resources were identified during the public involvement process. These can be summarized as follows:

- Would changes in military airspace impact land development at airport-based industrial parks or farms?
- Would aircraft noise impact farms or parks (particularly Magnolia Springs State Park)?
- Would chaff and flares impact residential areas, farmland, timber areas, recreational areas, or wildlife refuges?
- Can training transmitters interfere with cell phones?

3.8.2 Existing Conditions – Land Use

3.8.2.1 GAMECOCK ROI

Agriculture, forestry, and rural communities are the primary land uses in the Gamecock ROI in South Carolina (Table 3.8-1). About 96 percent of the ROI is privately owned land (Figure 3.8-1). Numerous, sparsely populated communities are scattered throughout the counties of the affected MOAs in South Carolina. The City of Columbia lies approximately 50 miles outside the western edge of Gamecock D MOA.

Gamecock ROI lies within Georgetown, Marion, Horry, Williamsburg, Florence, Clarendon, Berkley, Sumter, and Calhoun counties in South Carolina. County and city comprehensive plans establish requirements and guidelines applicable to the private lands in the respective jurisdictions.

Special use areas have been identified within the ROI. Table 3.8-2 lists the special use areas and managing agency in the Gamecock ROI. Special use areas provide recreational opportunities and/or provide solitude or wilderness experiences. These areas may include public land area such as national forests or state and local parks.

Table 3.8-1. Land Uses under the Gamecock ROI

Land Use	*Acres*	*Percent*
Commercial and services	3,275	0.248
Confined feeding operations	665	0.050
Cropland and pasture	437,950	33.130
Deciduous forest land	57,627	4.359
Evergreen forest land	326,792	24.721
Forested wetland	253,586	19.183
Industrial	629	0.048
Industrial and commercial complexes	99	0.008
Lakes	1,650	0.125
Mixed forest land	202,632	15.329
Mixed urban or built-up land	86	0.006
Nonforested wetland	2,314	0.175
Orchards, groves, vineyards, and nurseries	515	0.039
Other urban or built-up land	857	0.065
Reservoirs	8,955	0.677
Residential	14,547	1.100
Shrub and brush rangeland	1,133	0.086
Streams and canals	1,478	0.112
Strip mines, quarries, gravel pits	23	0.002
Transitional areas	4,508	0.341
Transportation, communication, utilities	2,567	0.194
Unknown	24	0.002
Total	1,321,912	100

Source: United States Geological Survey (USGS) 1990.

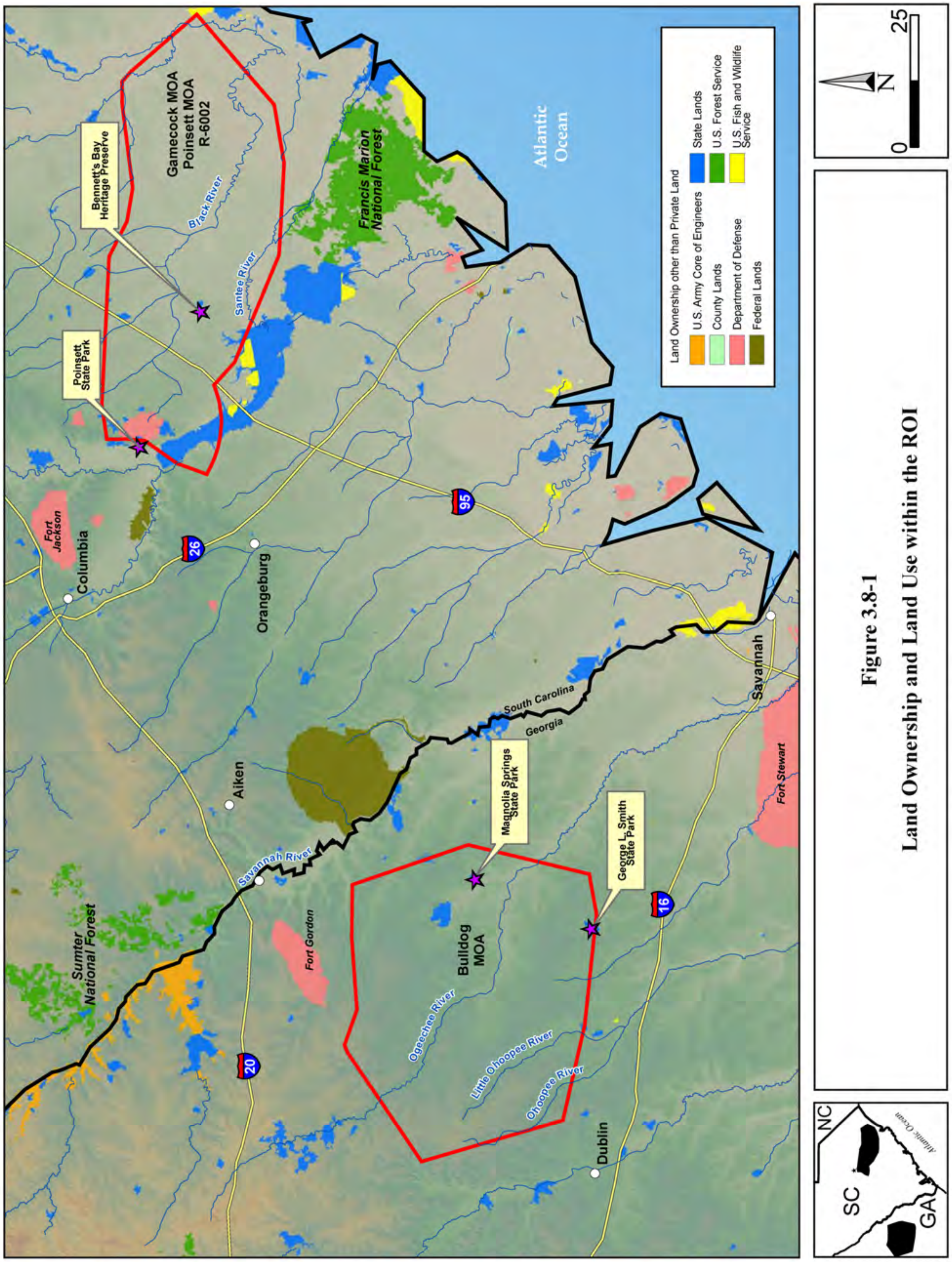


Figure 3.8-1
Land Ownership and Land Use within the ROI

Table 3.8-2. Special Use Areas under Gamecock MOAs

Name	*Managing Agency*
Manchester State Forest Wildlife Management Area Program	South Carolina DNR and the South Carolina Forestry Commission
Waccamaw NWR	USFWS
Black River	South Carolina DNR
Black River Swamp Preserve	The Nature Conservancy
Bennett's Bay Heritage Preserve	South Carolina Heritage Trust Program
Poinsett State Park	South Carolina State Parks

DNR = Department of Natural Resources; NWR = National Wildlife Refuge; USFWS = United States Fish and Wildlife Service

Approximately 1,958 acres of the Waccamaw NWR are beneath the eastern corner of the Gamecock B MOA. The Waccamaw NWR was designated in 1997 to protect and manage important bottomland hardwood forest and associated fish and wildlife along the Waccamaw, Great Pee Dee, and Little Pee Dee rivers (National Wildlife Refuges 2010). The refuge provides recreational opportunities such as hunting, fishing, and wildlife observation.

Notably, the Black River runs through much of the Gamecock ROI. The Black River is a designated Scenic River in South Carolina. The purpose of the Scenic Rivers program is to protect "unique or outstanding scenic, recreational, geologic, botanical, fish, wildlife, historic or cultural values" (South Carolina DNR 2010). The Black River Swamp Preserve is a Nature Conservancy preserve on 1,276 acres near the City of Andrews (The Nature Conservancy 2005).

Portions of Lake Marion and the Santee River occur under the southern extreme of Gamecock D MOA. The northern end of Lake Marion also falls under the Poinsett MOA. Lake Marion, the largest lake in South Carolina, and the Santee River provide many recreational opportunities for tourists and local residents. Fishing is the most popular sport on these water bodies.

Approximately 17,178 acres of state-owned land occur in the Gamecock ROI. This includes a Heritage Preserve, a state park, and a state forest. Bennett's Bay Heritage Preserve in Clarendon County is part of the South Carolina Heritage Trust Program. Bennett's Bay is a large wetland, called a Carolina bay. The 620-acre preserve is accessible to the public for nature study, but collecting of plants and hunting are not allowed (South Carolina Heritage Trust Program 2010).

Poinsett State Park is under the Poinsett MOA and R-6002. The park is in an outlying area of the Sandhills, within the coastal plain. The park's terrain allows for a diversity of plant and animal life. Facilities and activities include a campground, picnic shelters, nature center, hiking, equestrian and biking trails, fishing, swimming, and boating (South Carolina State Parks 2010).

Manchester State Forest, in Sumter and Clarendon Counties, consists of approximately 25,000 acres of mixed pine and hardwood trees native to the midlands of South Carolina. The forest is managed for multiple uses including timber production, fish and wildlife habitat, air and water quality, soil conservation, scenic beauty, scientific research, and recreational opportunities. The

Palmetto Trail, a statewide hiking trail, can be accessed nearby. Manchester State Forest is included in the Wildlife Management Area Program through a cooperative agreement between the South Carolina DNR and the South Carolina Forestry Commission (South Carolina Forestry Commission 2005). Hunting and fishing with a license are permitted.

In addition, the area around Poinsett ECR is in a Conservation Preservation Zoning District. The intent of this district is to recognize, preserve, and protect environmentally sensitive areas of Sumter County for future generations (Air Force 1994). Permitted uses in this district include most agricultural activities, parks and playgrounds, cemeteries, and single-family, detached dwellings and mobile homes (Air Force 1994).

3.8.2.2 BULLDOG ROI

The primary land uses in the Bulldog ROI in Georgia are agriculture, forestry, and small rural communities (Table 3.8-3). Nearly all of the land in the ROI (99 percent) is privately owned (Figure 3.8-1). The City of Augusta, located approximately 25 miles outside the northeastern border of Bulldog B MOA, is the largest city adjacent to the ROI.

Table 3.8-3. Land Uses under the Bulldog ROI

Land Use	*Acres*	*Percent*
Commercial and services	2,558	0.180
Confined feeding operations	110	0.008
Cropland and pasture	607,837	42.684
Deciduous forest land	22,493	1.580
Evergreen forest land	517,842	36.364
Forested wetland	121,477	8.530
Industrial	815	0.057
Lakes	276	0.019
Mixed forest land	127,227	8.934
Mixed urban or built-up land	71	0.005
Nonforested wetland	1,761	0.124
Orchards, groves, vineyards, and nurseries	7,314	0.514
Other agricultural land	138	0.010
Other urban or built-up land	732	0.051
Reservoirs	2,602	0.183
Residential	9,704	0.681
Shrub and brush rangeland	539	0.038
Transitional areas	81	0.006
Transportation, communication, utilities	450	0.032
Unknown	5	0.000
Total	1,424,031	100

Source: USGS 1990.

Bulldog ROI lies within Washington, Jefferson, Johnson, Glascock, Burke, Jenkins, and Emanuel counties in Georgia. City and county comprehensive plans establish requirements and guidelines applicable to private lands in each respective jurisdiction.

Special use areas have been identified within the ROI. Table 3.8-4 lists the special use areas and managing agency in the Bulldog ROI. Special use areas provide recreational opportunities and/or provide solitude or wilderness experiences. These areas may include public land area such as national forests or state and local parks.

Table 3.8-4. Special Use Areas under Bulldog MOAs

Name	*Managing Agency*
Big Dukes Pond Preserve	The Nature Conservancy of Georgia
Di-Lane Wildlife Management Area	Georgia DNR
George L. Smith State Park	Georgia DNR
Magnolia Springs State Park	Georgia DNR
Ohoopee Dunes Natural Area	Georgia DNR
Piedmont NWR	USFWS
Savannah Coastal NWR	USFWS
Yuchi Wildlife Management Area	Georgia DNR

DNR = Department of Natural Resources; NWR = National Wildlife Refuge; USFWS = United States Fish and Wildlife Service

Notably, Magnolia Springs State Park in Millen County and George L. Smith State Park in Emanuel County are under the Bulldog B MOA (Georgia State Parks 2010). The parks offer camping, hiking, fishing, swimming, picnicking, and boating opportunities. Di-Lane Wildlife Management Area near Waynesboro is managed by the Georgia DNR for public hunting opportunities.

The Ogeechee River flows southeast through the ROI. The Ohoopee River and Little Ohoopee River flow under the southwestern portion of the ROI. These rivers provide numerous recreational opportunities (Georgia Water Resources 2003).

There are two Nature Conservancy preserves in the Bulldog ROI (The Nature Conservancy 2005). Big Dukes Pond, near the City of Millen, is a Carolina bay that is recognized by the National Audubon Society as an Important Bird Area (National Audubon Society 2010). The Ohoopee Dunes Preserve is in Emanuel County, near the City of Swainsboro.

3.8.2.3 TRAINING TRANSMITTER SITES

The predominant land types within the 10-mile buffers for the three training transmitter sites along the South Carolina coast are mixed forest lands, forested wetlands, and nonforested wetlands. In the coastal areas, only a small proportion (<7 percent) is croplands and pasture. Conversely, the majority of lands around the sites in Jefferson and Burke counties in Georgia are croplands and pasture (34 percent for the Jefferson County site and 48 percent for the Burke

County site). South Carolina and Georgia have programs and laws in place to protect sensitive coastal resources and prime farmlands.

Twenty seven percent of the Gamecock MOA is prime farmland (NRCS 2004/2005). Under Bulldog MOA, 31 percent of the land is considered prime farmland (NRCS 2004/2005). South Carolina's Department of Agriculture in conjunction with USDA, has a program in place to protect prime agricultural, unique, and important soil from conversion to non agricultural uses (South Carolina Department of Agriculture 2002). Georgia recognizes prime farmland and additional farmland of statewide importance (NRCS 2005).

Lands around these sites include evergreen forest lands, mixed forest lands, and forested wetlands. The proposed training transmitter locations under the Bulldog MOAs are located on prime farmland. Because the approximate location of the new training transmitter site under the Gamecock C MOA is unknown, it is assumed that land uses would be similar to that described above for the Gamecock ROI.

3.8.3 Environmental Consequences – Land Use

3.8.3.1 Mitigated Proposed Action

> ***Public Question:*** *How will low flying military aircraft and associated noise affect recreation sites, including Magnolia Springs State Park, Georgia?*
>
> ***Answer:*** *An MTR for low-level training flights currently traverses the airspace on the north side of the park. Currently, military training aircraft fly a total of approximately 16 to 17 hours per year within 3 miles of the park at an altitude of 3,000 feet or less. The proposed airspace change is calculated to result in an additional 6.5 flying hours per year at that altitude or below.*

Land use impacts are not anticipated since there would be no change in general land use patterns, land ownership, land management plans, or special use areas for the lands underlying the ROI. Changes in airspace would not involve land acquisitions or ground disturbance. An element of the Mitigated Proposed Action includes new airspace that may cause indirect impacts from aircraft overflights in those areas. As discussed in Section 3.2.3.1, Noise, and depicted in Table 3.2-6, noise levels would not change appreciably above current levels for any airspace unit. In some cases, average noise levels would decrease due to the reconfiguration and expansion of the training airspace. Noise levels under the Gamecock MOAs would not change. Under the proposed Bulldog C and E MOAs, noise levels would increase from less than 35 dB DNLmr to approximately 47 dB DNLmr. As described in Section 3.2.2 and Appendix H, land use recommendations begin at a DNL of 65 dBA. Since no DNL would exceed that level, no land use changes are expected. Aircraft noise would not be expected to significantly impact residential areas, farms, parks, or wildlife refuges. This would include special use areas such as Magnolia State Park, the Di-Lane Wildlife Management Area, and other recreation areas.

Public concern was also expressed about increased low level flights over such special use areas as the Magnolia State Park or the George L. Smith State Park. The George L. Smith State Park is located on the extreme southern edge of the airspace (see Figure 3.8-1) and would not be likely to experience an increase in low level flights because pilots try to avoid flying along the edge of a training airspace.

The Magnolia State Park is approximately 2 to 3 miles south of the existing MTR VR-097-VR-1059 centerline, which is coincident in this area. These routes currently support approximately 833 annual low level training flights which are not projected to change.

The Bulldog MOAs are projected to have 296 hours of flights below 2,000 feet MSL (Table 2-2). A 3-mile radius circle centered on Magnolia State Park (28.3 square miles) would represent approximately 5.8 percent of approximately 1,600 square miles overflown by the existing Bulldog A and the proposed Bulldog C and E MOAs. This would produce an estimate of an additional 5.4 hours in a year that training aircraft could be observed below 2,000 feet MSL within the 28.3-square-mile area around the park. This calculated, but not absolute number, can be used for comparison with the calculated current 16 hours per year that current low level training aircraft are within the same 28.3 square mile area. Although distributed over the year, there would be an increase in training flights near or over the park from an estimated 16 to 21.4 hours per year. Such a change, if observed and deemed objectionable, could result in annoyance to some people. The increase in training flights would not be expected to change park use.

Military aircraft are authorized to use chaff and defensive flares in the current Bulldog, Gamecock, and Poinsett airspaces. Under the Mitigated Proposed Action, the use of chaff and flares would be included in the new Bulldog C and E airspace. There would be no anticipated change in general land use patterns, land ownership, land management plans, or special use areas due to use of chaff and flares. This proposal does not increase the hours of training flights occurring within the airspace. The release of chaff end caps and flares with plastic parts and foil wrapping result in an average of one piece of chaff or flare residual material calculated at 5.4 acres per year in the Bulldog MOAs and 5.9 acres per year in the existing Gamecock MOAs. The majority of flare materials that fall to the ground would not produce impacts when the flare material struck the ground. For more detail on the flares, refer to Appendix C. Although the likelihood of encountering any chaff or flare residual material is low, if such were found on private or public recreational land, and recognized, could result in annoyance to the observer.

Chaff fibers are extremely difficult to discern from naturally occurring materials found in the area (Air Force 1997a). Chaff fibers break down to the consistency of background materials. Animals do not typically consume chaff (see Section 3.6.3.2) and it is unlikely that modern chaff or its residual components would accumulate in sufficient quantities to impact land uses, affect recreational resources, or even be found. If chaff does not deploy correctly and disperse in a large cloud, chaff fibers may clump together and fall to the ground. When this occurs, tufts or clumps of chaff can be discernible to the naked eye. These tufts may catch on vegetation or blow across the landscape with the wind. Tufts may stay together or separate into individual fibers as a result of environmental action. Depending upon the context, the chaff may appear to resemble naturally occurring tufted seed pods or be viewed as foreign material until the chaff breaks down to common soil materials of silica and aluminum.

Public concerns have been expressed regarding potential detrimental effects to property values due to the presence of chaff and flare residual components or the fire hazard of flares. Residual deposition of chaff or flare plastic or wrapping materials would be the result of altitude of training, wind directions, and wind speeds. Due to the dispersal nature of deployed chaff and flares, the average wind in the area, wind at altitudes, and the altitude at which chaff and flares are deployed, chaff or flare materials could be carried on wind currents outside and possibly, back inside the airspace. This analysis assumes that all chaff and flare end caps fall on lands under the airspace. This conservative assumption could provide a higher annual concentration of chaff or flare materials than is actually experienced.

With regard to both chaff and flares, the likelihood of adverse impacts associated with these elements is far less than that of impacts from other sources. For example, in the proposed and existing airspace, chaff concentrations would be estimated to be approximately 0.14 gram (0.005 ounce) per acre per year. An estimated one flare per 102 acres would be dispensed in the proposed and existing airspace. The risk of fire associated with flare use is extremely low and virtually indistinguishable compared to other potential sources of fire (e.g., lightning, campfire). In the unlikely incidence of a flare-caused fire, the Air Force has established procedures for damage claims reimbursement. Section 2.2.4 further discusses the use of chaff and flares; Section 3.9, Socioeconomics, further discusses property values; and Section 3.3, Safety, further discusses fire risk.

Chaff and flare use is widely dispersed within the MOAs (Air Force 1997a), reducing the potential for encountering residual components on private residences or within sensitive land use areas. Magnolia Springs State Park, Waccamaw NWR, and many other recreation areas underlie the existing airspace used for training with chaff and flares. Chaff or flare residual components have not been identified in these areas of public visitation at a level that would disturb scenic quality or diminish the recreation experience. If an individual were to identify chaff or flare residual materials, it could result in annoyance. The potential for chaff or flare residual materials changing land use, land ownership, or land management practices would be negligible.

Land ownership is not expected to change with the placement of training transmitter sites; these sites are located on prime farmland leased from private landowners. About 15 acres would be fenced for each training transmitter site (refer to Figure 2-5). It is likely that all of the sites could remain in agricultural production; however, approximately 0.6 acres per site would be removed from production. Therefore, the six sites could affect approximately 3 to 4 acres by changing

Public Question: *Will training transmitters interfere with cell phones?*

Answer: *Training transmitters operate on different frequencies than cell phones and are directed upward toward aircraft rather than toward the ground. These training transmitters do not interfere with cell phone, television, or other communication systems.*

land use under the Mitigated Proposed Action. This represents a small portion of the ROI and a negligible effect to agricultural or prime farmlands. Transmitter site traffic for maintenance and service will be periodic in nature and is not expected to affect other traffic or associated land use. Training transmitters would not be located adjacent to special use areas such as wildlife refuges or other natural areas. Therefore, training transmitters would not be expected to impact recreational uses in the area.

3.8.3.2 ALTERNATIVE A

There would be no change in general land use patterns, land ownership, land management plans, or special use areas for the lands underlying the ROI. Changes in airspace would not involve land acquisitions. An element of Alternative A would include new or expanded airspace for the Gamecock MOA Complex and the Bulldog MOA Complex that may cause indirect impacts from aircraft overflights in these areas. Furthermore, as discussed in Section 3.2.3.1, Noise, and depicted in Table 3.2-6, noise levels under Alternative A would not change appreciably above current levels for any airspace unit. In some cases, average noise levels would decrease due to the reconfiguration and expansion of the training airspace. Therefore, aircraft noise is not expected to impact residential areas, farms, parks, or wildlife refuges. This includes Magnolia State Park, the Waccamaw NWR, and other recreation areas.

As discussed above, no impacts would be expected to land use patterns, land ownership, land management plans, or special use areas due to use of chaff and flares.

Training transmitter sites for Alternative A would not affect agricultural land uses in the ROI. Training transmitter sites would not be located near special use areas and would not impact recreational uses in the area.

3.8.3.3 ALTERNATIVE B

Under Alternative B, Bulldog A/B would be decrease imperceptibly from a DNLmr of 49 dB to a DNLmr of 47 dB and noise levels beneath Bulldog B MOA (with lowered floor) would remain below 35 dB DNLmr. This would be a noticeably lower noise level than the 47 dB DNLmr under Alternative A. Noise would not be expected to impact human communities or influence land use or recreational resources in the ROI, including special use areas.

As discussed above, no impacts would be expected to land use patterns, land ownership, land management plans, or special use areas due to use of chaff and flares.

Under Alternative B, there would be no training transmitter sites on the South Carolina coast. Three training transmitter sites would be developed—two under the Bulldog MOAs and one under Gamecock C. The resulting approximately 2 acres would be a negligible portion of the ROI. Training transmitter sites for Alternative B would not affect agricultural land uses in the ROI and would not be located near special use areas.

3.8.3.4 No-Action Alternative

Under the No-Action Alternative, airspace use, noise levels, and use of chaff and flares would remain as under current conditions. No training transmitter sites would be developed and there would be no change in land use in the ROI.

3.9 SOCIOECONOMICS

3.9.1 Introduction

Socioeconomic resources are typically characterized in terms of population and housing, economic activity, and community services. The Mitigated Proposed Action or alternatives do not include any direct changes in personnel levels, nor is there any proposed change in the number or frequency of aircraft operations within the affected airspace. The socioeconomic analysis addresses all counties with land area underlying the affected airspace, and those counties where new transmitter sites are proposed.

3.9.1.1 Methodology

The socioeconomic impact analysis examines the potential effects of the proposed airspace modifications on the social and economic resources of the Poinsett, Gamecock, and Bulldog MOAs. Throughout this section, the socioeconomic ROI refers to the specific land area within each of the 19 counties that underlies the affected airspace boundaries. Social and economic resources are defined in terms of population and economic activity. Under the Mitigated Proposed Action or alternatives, Air Force personnel levels and operations and maintenance procedures would not change from current conditions; therefore, no direct impacts to employment or income would occur. Potential effects of the Mitigated Proposed Action and alternatives have been evaluated for civil aviation and airports under the airspace, noise conditions and their relationship to properties under the airspace, and safety implications to people and property. Additional discussion of airport effects is presented in Section 3.1.3, Airspace Management and Air Traffic Control.

3.9.1.2 Issues and Concerns

Issues and concerns involving socioeconomic resources were identified during public hearings and the public comment period. Issues related to potential negative effects on economic development, community investments under the airspace, particularly for community investments in public airports, and questions about property values. Civilian pilots and community airport managers expressed concern that safety issues associated with joint airspace use could have detrimental effects on their businesses and development opportunities.

3.9.2 Existing Conditions – Socioeconomics

Military airspace is typically configured to avoid densely populated and metropolitan or urban areas, so such airspace by design, tends to be located over rural and less developed areas.

The ROI for socioeconomics includes portions of 19 counties that contain land area under the airspace associated with the ATI proposal. The affected airspace overlies primarily rural areas in eastern South Carolina and northeastern Georgia. Much of the airspace associated with ATI has been used for military training for many years. The proposal would expand the total affected airspace to include additional underlying areas in Clarendon and Sumter counties in South Carolina, as summarized in Section 2.6 and as depicted in Figure 1-3.

Communities that occur within the boundaries of the ATI affected airspace are typically fewer and relatively low in density compared to urbanized areas outside the airspace. Communities within the airspace have designated avoidance areas to reduce potential overflights to the maximum extent possible.

Land uses under the affected airspace are primarily agriculture, forestry, and rural community services. Several private and civil airports underlie the MOA airspace. The proposed Gamecock MOA complex overlies four civil and three private airports. The Bulldog MOA complex overlies five civil and five private airports (refer to Figure 3.1-1 and Table 3.1-4).

Between the development of the Draft EIS and the development of this Final EIS, the national and regional socioeconomic climate changed. Therefore, in order to capture a more accurate representation of the existing conditions in the ROI under the airspace, the socioeconomic indicators were updated to the most recent data available in the Final EIS. However, due to the rural nature of the ROI, there are some indicators that do not have recent data available.

POPULATION CHARACTERISTICS

Portions of ten counties in Georgia and nine counties in South Carolina are located below the designated military airspace associated with the Poinsett, Gamecock and Bulldog MOAs. Table 3.9-1 identifies these counties and provides the county population and population under each MOA. Population estimates for the specific affected area or ROI within each county were derived using Census Tract and Block Group data from the 2000 Census.

While there are several counties that underlie each MOA airspace segment, many of these have only a small portion of county land in the affected area. The focus of the socioeconomic analysis will be on those counties with the largest proportion of their population included in the affected area. For example, referring to the Alternative A or B Poinsett MOA in Table 3.9-1, Calhoun County has a total population of 15,185 persons, of whom only 421 reside on land under the affected airspace. These 421 persons account for just 2.8 percent of the county population, and 0.7 percent of the Poinsett MOA affected population of 57,606 persons. By comparison, Clarendon County has an affected population of 27,047 persons, accounting for 83.2 percent of the county population and 47.0 percent of the Poinsett MOA affected population. For the purpose of this analysis, the general socioeconomic characteristics within the dominant counties are used as representative of the population under each airspace ROI.

Table 3.9-1. Population and Density Data by Airspace (2000)

	Total County Population	*ROI*[1]	*Percent of County Population*[2]	*Percent of ROI*[3]	*Population Density*[4]
Poinsett ROI	**152,333**	**57,606**	**37.8%**	**100.0%**	**42.3**
Calhoun, South Carolina	15,185	421	2.8%	0.7%	39.9
Clarendon, South Carolina	32,502	27,047	83.2%	47.0%	53.5
Sumter, South Carolina	104,646	30,139	28.8%	52.3%	157.3
Gamecock ROI	**730,669**	**113,901**	**12.8%**	**100.0%**	**55.3**
Berkeley, South Carolina	142,651	1,867	1.3%	1.6%	130.0
Clarendon, South Carolina	32,502	27,047	83.2%	23.7%	53.5
Florence, South Carolina	125,761	5,061	4.0%	4.4%	157.2
Georgetown, South Carolina	55,797	13,423	24.1%	11.8%	68.5
Horry, South Carolina	196,629	11	0.0%	0.0%	173.4
Marion, South Carolina	35,466	300	0.2%	0.3%	72.5
Sumter, South Carolina	104,646	30,139	28.8%	26.5%	157.3
Williamsburg, South Carolina	37,217	36,053	96.9%	31.7%	39.9
Bulldog ROI	**212,647**	**74,549**	**35.1%**	**100.0%**	**39.8**
Bulloch, Georgia	55,983	777	1.4%	1.0%	82.1
Burke, Georgia	22,243	14,190	63.8%	19.0%	26.8
Candler, Georgia	9,577	24	0.3%	0.0%	38.8
Emanuel, Georgia	21,837	15,052	68.9%	20.2%	31.8
Glascock, Georgia	2,556	261	10.2%	0.4%	17.7
Jefferson, Georgia	17,266	13,923	80.6%	18.7%	32.7
Jenkins, Georgia	8,575	7,561	88.2%	10.1%	24.5
Johnson, Georgia	8,560	6,431	75.1%	8.6%	28.1
Laurens, Georgia	44,874	13	0.0%	0.0%	55.2
Washington, Georgia	21,176	16,317	77.1%	21.9%	31.1

Note: 1. The estimated population in the portions of each county actually under the affected airspace.
2. The percentage of the total county population residing on land under the affected airspace.
3. The percentage of the total affected area represented by each county.
4. Population density is calculated as average persons per square mile.

Source: U.S. Bureau of the Census 2000a.

Poinsett ROI (Alternative A or B). Poinsett ECR and Poinsett MOA overlie portions of Calhoun, Clarendon and Sumter counties in South Carolina, just south of Shaw AFB. The Poinsett ROI consists of those portions of the preceding three counties that are actually situated under the Poinsett airspace. The total 2000 population for Poinsett ROI was 57,606 persons, representing 37.8 percent of the total three-county population of 152,333 persons, and 1.4 percent of the South Carolina state population. Fifty-two percent of the ROI population resides in Sumter County, 47 percent in Clarendon County, and less than 1 percent in Calhoun County. Population density in the Poinsett MOA counties ranges from 39.9 persons per square mile in Calhoun County to 157.3 persons per square mile in Sumter County, home to the City of Sumter. The State of South Carolina has an overall population density of 133.2 persons per square mile. The estimated population density for the Poinsett ROI is 42.3 persons per square mile.

In 2008, the population of the three counties totaled 151,880 persons representing a decrease of approximately 453 persons from 2000 estimates of 152,333, or an average annual change of -0.04 percent (Table 3.9-2) (U.S. Bureau of the Census 2008). Clarendon was the only county in the three-county ROI to experience an increase in population from 32,502 persons to 33,149 over the 8-year period. Calhoun County, the smallest in terms of population, experienced a larger decline in population than Sumter County during the same period.

Table 3.9-2. Total Population Estimates Per County, 2000 to 2008

	Total County Population (2000)	*Total County Population (2008)*	*Average Annual Change*
Poinsett ROI	**152,333**	**151,880**	**-0.04%**
Calhoun, South Carolina	15,185	14,583	-0.50%
Clarendon, South Carolina	32,502	33,149	0.25%
Sumter, South Carolina	104,646	104,148	-0.06%
Gamecock ROI	**730,669**	**826,468**	**1.55%**
Berkeley, South Carolina	142,651	169,327	2.17%
Clarendon, South Carolina	32,502	33,149	0.25%
Florence, South Carolina	125,761	132,800	0.68%
Georgetown, South Carolina	55,797	60,731	1.06%
Horry, South Carolina	196,629	257,380	3.42%
Marion, South Carolina	35,466	33,843	-0.58%
Sumter, South Carolina	104,646	104,148	-0.06%
Williamsburg, South Carolina	37,217	35,090	-0.73%
Bulldog ROI	**212,647**	**230,088**	**0.99%**
Bulloch, Georgia	55,983	67,761	2.42%
Burke, Georgia	22,243	22,732	0.27%
Candler, Georgia	9,577	10,580	1.25%
Emanuel, Georgia	21,837	22,825	0.55%
Glascock, Georgia	2,556	2,796	1.13%
Jefferson, Georgia	17,266	16,443	-0.61%
Jenkins, Georgia	8,575	8,547	-0.04%
Johnson, Georgia	8,560	9,550	1.38%
Laurens, Georgia	44,874	47,848	0.81%
Washington, Georgia	21,176	21,006	-0.10%

Note: 1. County figures presented for ROI in this table are for the entire county.
Source: U.S. Bureau of the Census 2008.

Gamecock ROI (Alternative A or B). The proposed Gamecock MOA complex overlies all or portions of the following eight counties in South Carolina: Berkeley, Clarendon, Florence, Georgetown, Horry, Marion, Sumter and Williamsburg. The Gamecock ROI consists of those portions of the preceding eight counties that are actually situated under the Gamecock MOAs airspace. The total 2000 population for the Gamecock ROI was 113,901 persons, representing 15.6 percent of the total eight-county population of 730,669 persons, and 2.8 percent of the 4,012,012 South Carolina population. Over 80 percent of the ROI population resides in Clarendon, Sumter, and Williamsburg counties. Population density in the Gamecock ROI ranged from 39.9 persons per square mile in Williamsburg County to 173.4 persons per square mile in Horry County, home to Myrtle Beach, which is located outside the Gamecock MOA boundary. By comparison, the State of South Carolina has an overall population density of 133.2 persons per square mile. The average population density for the Gamecock ROI is 55.3 persons per square mile.

In 2008, the population of the eight counties totaled 826,468 persons representing an increase of approximately 95,800 persons from 2000 estimates of 730,669, or an average annual change of approximately 1.55 percent (Table 3.9-2). Horry County experienced the largest increase in population with a total of 257,380 persons in 2008, representing a 3.42 average annual change since 2000 estimates. In contrast, Williamsburg County experienced the greatest decline in population during the same period.

Bulldog ROI (Mitigated Proposed Action and Alternative A or B). The Bulldog MOA complex overlies portions of the following ten counties in Georgia: Bulloch, Burke, Candler, Emanuel, Glascock, Jefferson, Jenkins, Johnson, Laurens, and Washington. The Bulldog ROI, as indicated in Table 3.9-1, consists of those portions of the preceding ten counties that are actually situated under the Bulldog MOAs airspace. The total 2000 population for the Bulldog ROI was 74,549 persons, representing 35.1 percent of the total ten-county population of 212,641 persons, and 0.9 percent of the 8,186,453 Georgia population. Burke, Emanuel, Jefferson, and Washington counties each account for about 20 percent of the affected population. Bulloch, Candler, and Laurens counties each account for 1 percent or less of the affected population. Density in affected counties under the Bulldog MOAs ranged from 17.7 persons per square mile in Glascock County to 82.1 persons per square mile in Bulloch County, home to the City of Statesboro, which is located outside the airspace boundary. By comparison, the State of Georgia has an overall population density of 141.4 persons per square mile. The population density for the land area under the Bulldog MOA airspace is 39.8 persons per square mile.

In 2008, the population of the ten counties totaled 230,088 persons representing an increase of approximately 17,441 persons from 2000 estimates of 212,647 or an average annual change of approximately 1.55 percent (Table 3.9-2) (U.S. Bureau of the Census 2008). Bulloch County experienced the largest increase in population with a total of 67,761 persons in 2008, representing a 2.42 average annual change since 2000 estimates. In contrast, Jefferson County experienced the greatest decline in population during the same period.

HOUSING CHARACTERISTICS

Poinsett ROI (Alternative A or B). Housing supply in the Poinsett ROI, presented in Table 3.9-3, totaled 25,498 units in 2000. Occupied housing units amounted to 20,859 units, resulting in a housing occupancy rate of about 82 percent. Owner-occupied units account for 74 percent of occupied units, with the remaining 26 percent occupied by renters. The median value of owner-occupied units in the ROI ranged from a low of $72,500 in Calhoun County to a high of $78,700 in Sumter County, with an overall median home value in the Poinsett ROI of $78,185, compared to the median South Carolina home value of $94,900. Housing characteristics would suggest that the Poinsett ROI is over a rural area that has a high housing ownership rate but is economically depressed when compared with the state as a whole.

In 2008, the total number of housing units in the entire three counties totaled 69,431 units, representing an average annual change of 1.04 percent from 2000 estimates (Table 3.9-4) (U.S. Bureau of the Census 2008). Sumter County experienced the largest increase in the number of housing units followed by Calhoun County and Clarendon County.

Gamecock ROI (Alternative A or B). Housing supply in the Gamecock ROI, presented in Table 3.9-3, totaled 50,650 units in 2000. Occupied housing units amounted to 41,766 units, resulting in a housing occupancy rate of about 82 percent. Owner-occupied units account for 77 percent of occupied units, with the remaining 23 percent occupied by renters. The median value of owner-occupied units in the ROI ranged from a low of $63,300 in Williamsburg County to a high of $119,700 in Horry County, with an overall median home value in the Gamecock ROI of $78,290, compared to the median South Carolina home value of $94,900. Housing values would suggest that the Gamecock ROI, although rural, reflects the overall socioeconomic characteristics of the state.

In 2008, the total number of housing units in the entire eight counties totaled 421,910 units, representing an average annual change of 2.56 percent from 2000 estimates (Table 3.9-4). Horry County experienced the largest increase in the number of housing units followed by Berkeley County and Georgetown County.

Bulldog ROI (Mitigated Proposed Action and Alternative A or B). Housing supply in the Bulldog ROI, presented in Table 3.9-3, totaled 31,455 units in 2000. Occupied housing units amounted to 27,038 units, resulting in a housing occupancy rate of about 86 percent. Owner-occupied units account for 74 percent of occupied units, with the remaining 26 percent occupied by renters. The median value of owner-occupied units in the ROI ranged from a low of $50,800 in Emanuel County to a high of $94,300 in Bulloch County, with an overall median home value in the Bulldog ROI of $57,246, compared to the median Georgia home value of $111,200. Housing values under the Bulldog MOAs suggest a more rural and somewhat economically depressed area when compared with the state as a whole.

In 2008, the total number of housing units in the entire ten counties totaled 95,590 units, representing an average annual change of 0.92 percent from 2000 estimates (Table 3.9-4).

Bulloch County experienced the largest increase in the number of housing units. The other nine counties all experienced less than a 1 percent average annual growth in the number of housing units during the same period.

Table 3.9-3. Housing Characteristics by ROI (2000) [1]

	Household Size	*Housing Units*	*Occupied Units*	*Ownership Rate (Percent)*	*Median Value*
Poinsett ROI	**2.65**	**25,498**	**20,859**	**74.1**	**$78,185**
Calhoun, South Carolina	2.54	196	164	84.4	$72,500
Clarendon, South Carolina	2.62	13,018	9,829	79.1	$77,700
Sumter, South Carolina	2.68	12,283	10,866	69.5	$78,700
Gamecock ROI	**2.65**	**50,650**	**41,766**	**76.9**	**$78,290**
Berkeley, South Carolina	2.75	745	653	74.2	$91,300
Clarendon, South Carolina	2.62	13,018	9,829	79.1	$77,700
Florence, South Carolina	2.59	2,127	1,897	73.0	$85,200
Georgetown, South Carolina	2.55	7,125	5,210	81.4	$114,700
Horry, South Carolina	2.37	8	5	73.0	$119,700
Marion, South Carolina	2.64	24	20	73.5	$63,500
Sumter, South Carolina	2.68	12,283	10,866	69.5	$78,700
Williamsburg, South Carolina	2.69	15,320	13,285	80.5	$63,300
Bulldog ROI	**2.65**	**31,455**	**27,038**	**73.7**	**$57,246**
Bulloch, Georgia	2.53	335	288	58.1	$94,300
Burke, Georgia	2.77	5,751	5,062	76.0	$59,800
Candler, Georgia	2.72	10	8	73.1	$62,700
Emanuel, Georgia	2.61	6,586	5,547	71.1	$50,800
Glascock, Georgia	2.44	124	103	80.0	$48,600
Jefferson, Georgia	2.65	5,887	5,111	72.2	$56,900
Jenkins, Georgia	2.63	3,470	2,834	73.3	$49,400
Johnson, Georgia	2.53	2,766	2,352	79.8	$48,000
Laurens, Georgia	2.55	6	5	71.3	$73,900
Washington, Georgia	2.65	6,520	5,729	74.0	$66,900

Note: 1. County figures presented in this table are for the portion of each county underlying MOA airspace.
ROI = region of influence; MOA = Military Operations Area
Source: U.S. Bureau of the Census 2004.

Table 3.9-4. Housing for County Totals[1]

	Housing Units (2000)	*Housing Units (2008)*	*Average Annual Change*
Poinsett ROI	**63,918**	**69,431**	**1.04%**
Calhoun, South Carolina	6,864	7,352	0.86%
Clarendon, South Carolina	15,303	16,284	0.78%
Sumter, South Carolina	41,751	45,795	1.16%
Gamecock ROI	**344,669**	**421,910**	**2.56%**
Berkeley, South Carolina	54,717	67,256	2.61%
Clarendon, South Carolina	15,303	16,284	0.78%
Florence, South Carolina	51,836	55,051	0.76%
Georgetown, South Carolina	28,282	33,484	2.13%
Horry, South Carolina	122,085	172,841	4.44%
Marion, South Carolina	15,143	15,400	0.21%
Sumter, South Carolina	41,751	45,795	1.16%
Williamsburg, South Carolina	15,552	15,799	0.20%
Bulldog ROI	**88,864**	**95,590**	**0.92%**
Bulloch, Georgia	22,742	27,598	2.45%
Burke, Georgia	8,842	9,372	0.73%
Candler, Georgia	3,893	4,001	0.34%
Emanuel, Georgia	9,419	9,682	0.34%
Glascock, Georgia	1,192	1,215	0.24%
Jefferson, Georgia	7,221	7,402	0.31%
Jenkins, Georgia	3,907	3,940	0.11%
Johnson, Georgia	3,634	3,650	0.05%
Laurens, Georgia	19,687	20,177	0.31%
Washington, Georgia	8,327	8,553	0.34%

Note: 1. County figures presented in this table for the ROI are for the entire county.
ROI = region of influence
Source: U.S. Bureau of the Census 2008.

EMPLOYMENT AND JOB COMPOSITION

As shown in Table 3.9-5, between 2000 and 2008, total employment for the counties combined in the Gamecock and Bulldog regions experienced an increase while total employment in the three-county region of Poinsett declined during the same period. Total employment in Gamecock and Bulldog increased 7.5 percent and 4.9 percent, respectively, however Poinsett employment decreased 8.8 percent from 2000 to 2008. In 2008, the Poinsett, Gamecock, and Bulldog regions all experienced higher unemployment rates than the state unemployment rates of 6.2 and 6.9 for Georgia and South Carolina, respectively.

Table 3.9-5. Employment Characteristics

	Poinsett ROI	*Gamecock ROI*	*Bulldog ROI*
2008			
Labor Force	62,619	388,778	103,491
Total Employment	57,118	359,167	95,816
Unemployment Rate	8.8	7.6	7.4
2000			
Labor Force	65,431	348,698	95,853
Total Employment	62,601	333,950	91,352
Unemployment Rate	4.33	4.2	4.7

ROI = region of influence
Sources: Bureau of Labor Statistics 2009a and 2009b

The distribution of jobs by industry sector for the Poinsett, Gamecock, and Bulldog regions is displayed in Table 3.9-6. In 2007, the largest employment sector in Poinsett was manufacturing (14.2 percent) followed by state and local government (12.0 percent), and retail trade (10.4 percent). The largest employment sector in the Gamecock region was retail trade (12.9 percent) followed by state and local government (10.5 percent) and the accommodation and food services sectors (10.5 percent). In 2007, the state and local government sector comprised the largest employment sector (17.3 percent) in the Bulldog region followed by retail trade (11.3 percent) and manufacturing (10.1 percent). The major employment sectors in the state of Georgia are state and local government, retail trade, and health care and social assistance sectors. In South Carolina, the largest employment sectors are state and local government, retail trade, and manufacturing.

INCOME AND EARNINGS

Median family income in the Poinsett, Gamecock, and Bulldog ROIs were all somewhat less than the state median family income in 2000, the most recent data available. South Carolina median family income was $37,082, compared with $30,388 in the Poinsett ROI and $29,363 in the Gamecock ROI (U.S. Bureau of Economic Analysis 2004b). Bulldog ROI median family income of $26,573 was notably less than the Georgia median family income of $42,433. Median family income under the Poinsett ROI presents a different picture from housing valuation. In general, families under the Poinsett MOA have earnings comparable to any rural area of the state and benefit from lower cost housing. The Gamecock and Bulldog ROIs have proportionately higher housing costs and lower income and earnings.

In 2000, data for per capita personal income (PCPI) showed similar trends to median family income trends. In 2000, the PCPI in Georgia and South Carolina were $21,154 and $18,795, respectively, compared to $14,891 in the Poinsett ROI, $14,960 in the Gamecock ROI, and $13,830 in the Bulldog ROI.

Table 3.9-6. Distribution of Employment by Industry[1] (2007)

	Poinsett ROI	*Gamecock ROI*	*Bulldog ROI*	*Georgia*	*South Carolina*
Total Employment	75,981	437,880	112,094	5,559,982	2,507,978
Farm	2.3	1.4	4.6	1.1	1.3
Forestry, Fishing, related activities	0.4	0.1	1.2	0.5	0.5
Mining	*	*	0.7	0.2	0.1
Utilities	0.1	0.1	*	0.4	0.5
Construction	8.7	9.2	7.4	6.9	7.5
Manufacturing	14.2	8.0	10.1	8.1	10.3
Wholesale Trade	1.8	1.9	1.7	4.3	3.2
Retail Trade	10.4	12.9	11.3	10.6	11.6
Transportation and Warehousing	2.3	2.3	2.4	3.9	2.8
Finance and Insurance	2.2	3.8	2.6	4.1	3.7
Accommodation and Food Services	5.9	10.5	4.9	6.9	8.1
Federal, civilian	1.7	0.9	1.3	1.7	1.2
Military	7.1	1.9	0.6	1.7	2.1
State and Local	12.0	10.5	17.3	10.7	12.4
Information	0.7	1.2	0.9	2.3	1.3
Real Estate	3.3	6.0	2.6	4.9	4.8
Professional, scientific services	2.0	3.2	1.9	6.2	4.6
Management	0.3	0.3	*	1.0	0.7
Administrative	5.0	5.3	2.8	7.5	7.2
Educational services	1.1	0.7	0.5	1.8	1.4
Health Care, Social Assistance	6.4	6.5	3.6	8.2	7.4
Arts, Entertainment, and recreation	1.1	2.5	0.6	1.6	1.8
Other Services	6.6	6.1	5.8	5.6	5.7

Notes: 1. An * denotes figures not published to avoid disclosure of confidential information.
ROI = region of influence
Source: U.S. Bureau of Economic Analysis 2007a.

In 2007, the PCPI in Georgia and South Carolina increased to $33,499 and $31,103, respectively. The Poinsett region experienced the largest increase in PCPI (35.27 percent) between 2000 and 2007 followed by Gamecock (32.51 percent) and Bulldog regions (17.93 percent) as shown in Table 3.9-7.

Table 3.9-7. Per Capita Personal Income

	Average PCPI (2000)	*Average PCPI (2007)*
Poinsett ROI	**20,232**	**27,368**
Calhoun, South Carolina	22,240	31,156
Clarendon, South Carolina	17,911	23,372
Sumter, South Carolina	20,545	27,576
Gamecock ROI	**20,600**	**27,299**
Berkeley, South Carolina	20,136	28,848
Clarendon, South Carolina	17,911	23,372
Florence, South Carolina	23,972	31,802
Georgetown, South Carolina	24,283	34,694
Horry, South Carolina	23,925	28,307
Marion, South Carolina	17,947	22,145
Sumter, South Carolina	20,545	27,576
Williamsburg, South Carolina	16,084	21,644
Bulldog ROI	**19,013**	**22,422**
Bulloch, Georgia	19,572	22,110
Burke, Georgia	17,422	21,609
Candler, Georgia	18,964	21,673
Emanuel, Georgia	18,765	22,323
Glascock, Georgia	19,667	21,024
Jefferson, Georgia	18,042	22,140
Jenkins, Georgia	17,793	20,758
Johnson, Georgia	18,178	19,430
Laurens, Georgia	21,577	26,487
Washington, Georgia	20,154	26,669
State of Georgia	27,990	33,499
State of South Carolina	24,425	31,103

PCPI = per capita personal income; ROI = region of influence
Source: U.S. Bureau of Economic Analysis 2007b.

TRANSMITTER SITES

Potential transmitter sites outside the proposed airspace boundaries are located in the general vicinity of the communities of Awendaw, Georgetown, and McClellanville, South Carolina (see Table 3.9-8). Total population in the town of Awendaw is 1,195 persons in 2000, the most recent data available. There are 443 housing units in Awendaw, with a median home value of $78,000 and a vacancy rate of 9.7 percent. There are 438 employed persons in Awendaw, with an unemployment rate of 5.4 percent. Primary employment sectors are manufacturing, services, and retail trade. Total population in the town of Georgetown is 8,950 persons. There are 3,856 housing units in Georgetown, with a median home value of $83,900 and a vacancy rate of 11.5 percent. There are 3,472 employed persons in Georgetown, with an unemployment rate of 4.4 percent. Primary employment sectors are manufacturing, services, and retail trade. Total population in the town of McClellanville is 459 persons. There are 254 housing units in McClellanville, with a median home value of $147,200 and a vacancy rate of 18.9 percent. There are 215 employed persons in McClellanville, with an unemployment rate of 0.5 percent. Primary employment sectors are services, construction, and agriculture.

3.9.3 Environmental Consequences - Socioeconomics

Based on the issues and concerns presented in Section 3.9.1.2, potential socioeconomic impacts were evaluated related to modifications in airspace use and noise disturbances from overflights. The other resource analyses (e.g., airspace management and air traffic control, noise, safety, physical and biological resources) were reviewed to determine the potential consequences to these resources, which may further result in social or economic impacts within the region. The potential for effects on airports under or near the modified airspace is also discussed in Section 3.1, Airspace Management and Air Traffic Control.

3.9.3.1 MITIGATED PROPOSED ACTION

AIRSPACE MODIFICATIONS

Under the Mitigated Proposed Action, two MOAs would be created under Bulldog B MOA and adjacent to Bulldog A MOA. No changes would be made to the Gamecock Complex. Chaff and flare use would be authorized in the new airspace and would be permitted at altitudes above 5,000 feet AGL.

Table 3.9-8. Socioeconomic Data for Transmitter Sites (2000)

	Awendaw, South Carolina	*Georgetown, South Carolina*	*McClellanville, South Carolina*
Population	1,195	8,950	459
Housing Units	443	3,856	254
Median Home Value	$78,000	$83,900	$147,200
Vacancy Rate	9.7	11.5	18.9
Employment	438	3,472	215
Unemployment Rate	5.4%	4.4%	0.5%

Sources: U.S. Bureau of the Census 2000b, 2000d.

As described in Section 3.9.2, the rural areas in the ROIs have generally not kept pace with the economic growth of the more urban and coastal areas of South Carolina and Georgia. During review of the Draft EIS Proposed Action to expand low level airspace under the entire Bulldog B MOA, some regional airport representatives, pilots, and business persons expressed concern that military airspace use could have detrimental effects on potential economic development related to aviation facilities (e.g., industrial parks and pilot training schools). The Mitigated Proposed Action has been designed to address those concerns. The proposed airspace modifications would not prohibit use of affected airways by general aviation, exclusionary areas would provide for continued local airport access, and airspace management would provide for IFR traffic to and from the airports. In response to public and agency concern on the Draft EIS Proposed Action, the exclusionary area centered on the Emanuel County Airport would be expanded beyond the minimum 3 NM required by FAA. The expanded exclusionary area would provide for continued local airport access by VFR traffic as well as IFR traffic utilizing the proposed ILS.

CIVIL AIRCRAFT

MOAs are considered joint use airspace and both military and civil pilots are required to operate under see-and-avoid rules of flight. During public meetings, agricultural and charter aircraft pilots expressed concern that they did not feel safe within the MOAs under see-and-avoid rules and requested improved communications when military training aircraft were in the vicinity. No changes would be made to the Gamecock Complex. The Gamecock MOAs would continue to be used by the military and deconfliction would rely on see-and-avoid procedures to the extent possible with additional deconfliction provided by positive ATC. The new MOAs proposed for the Bulldog Complex are not anticipated to impact civilian aircraft. As with the current Bulldog A MOA and the existing Gamecock MOAs, civil VFR aircraft would be permitted to traverse the new Bulldog C and E MOAs under see-and-avoid procedures. During inclement weather, civil air traffic would use IFR and all aircraft would be maintained under positive ATC. The proposed additions of Bulldog C and Bulldog E MOAs would be expected to reduce the flexibility of IFR civil air traffic using or traversing the area. However, all public airports would have established exclusionary areas of 3 NM and 1,500 feet AGL to permit civil traffic to enter and leave the airport environment. Additionally, the Atlanta ARTCC would manage the Bulldog airspace and control the traffic into and out of the Emanuel County Airport and the Millen Airport. The Atlanta ARTCC would have the authority to temporarily raise the floors of the Bulldog C and E MOAs in order to let civil traffic traverse the MOAs. In this situation, the military aircraft would be directed to a higher altitude until receiving clearance to return to the lower altitudes once the civil air traffic has cleared the MOAs. Life-flights to regional hospitals would be given precedence by Air Traffic Controllers, and would remain unimpeded by the proposed changes in military airspace. Augusta approach would not be impacted because there would not be a MOA below Bulldog B in the Augusta Airport's Terminal Airspace.

Public Question: *How will agricultural aviation operate safely under the airspace?*

Answer: *Airport and airfield usage by agricultural aviation has been identified under the MOAs. Safety of all pilots and aircraft is a primary concern of the Air Force, and the procedures that have supported agricultural aviation under the existing Bulldog A will apply to any extended low-level airspace.*

AVIATION FACILITIES

Aviation facilities under the Gamecock MOAs would not be expected to be affected by the Mitigated Proposed Action as the MOAs would not be modified and would be utilized the same as under the existing conditions.

A number of public and private aviation facilities exist on lands under or adjacent to the proposed Bulldog C and E MOAs. In response to concerns from commenters under the Bulldog MOAs that the proposed exclusionary areas were not adequate to support efforts by small communities to increase economic activities through airport growth, an exclusionary area would be identified around each public airport as currently exists under the Bulldog A MOA. The minimum exclusionary area is a 3-NM circle extending to 1,500 feet AGL designated over each public airport to deconflict military training aircraft from the immediate vicinity. An expanded exclusionary area would be placed around the Emanuel County Airport in Swainsboro in order to provide additional airspace for air traffic into and out of the airport to easily vector into the airfield. These exclusionary areas are combined with the ARTCC authority to temporarily raise the floors of the Bulldog C and E MOAs to support civil aircraft access and reduce the potential for socioeconomic effects.

A civil aircraft using an ILS is under positive ATC. An ILS is a precision instrument that provides expanded capability to an airport. Military training aircraft do not train where an ILS is in use so there is no anticipated conflict between military training aircraft and aircraft flying IFR or airports with ILS under the airspace. In summary, airports flying ILS approaches under IFR flight plans would be under positive ATC and would be separated from military aircraft operating in special use airspace such as a MOA, and would not be adversely affected by the modified airspace.

NOISE DISTURBANCES

Under the Mitigated Proposed Action, flight activity would be similar to that conducted under existing conditions. Average noise levels are expected to be about the same or reduced as compared to existing conditions. Receptors in the expanded airspace areas (Bulldog MOAs) would experience higher average noise levels as described in Section 3.2.3.

Property values reflect a variety of factors including employment opportunities, regional growth, and both the natural and social environments. Property subject to airport noise in the DNL 65 dB range has been evaluated to determine whether noise levels affect property values, but the valuation results have been dominated by the multiple variables affecting housing valuation. None of the existing or proposed airspace modifications would produce DNLmr noise levels even approaching the DNL 65 dB level. As explained in Section 3.2.3, Noise, DNLmr average noise levels under any of the airspace units are not expected to exceed 55 dB. A number of studies indicate that noise sensitivity depreciation to property values generally does not occur at noise levels under a threshold level of 55 dB (Frankel 1991). For a more detailed discussion of noise levels, see Section 3.2.3, Noise.

Anticipated changes in the noise environment in the affected area, whether decreases or increases in noise levels, would not be sufficient to affect the rural economy or property values on lands underlying the airspace.

CHAFF AND FLARE USE

Defensive training using chaff and flares would be included in the Bulldog C and E MOAs. The deployment of chaff results in two plastic end caps falling to the earth for each chaff bundle deployed. The deployment of a flare results in four or five plastic, felt, or foil wrapping pieces falling to the earth. The average number of flare and chaff materials that would be deposited annually is estimated to be one piece of residual material for approximately 5 acres under the proposed and existing MOAs. Chaff and flare materials would not be expected to accumulate or, in most cases, to be noticed on a property. The up to 3-inch x 13-inch foil wrapper deposited as a result of MJU-7 A/B deployment or the smaller foil wrapper from the M-206 flare could be more easily noticed and be viewed as undesirable material. This could cause annoyance to individuals finding the materials. Such materials would not be expected to accumulate in large enough quantities to affect socioeconomic activities or property values.

The MJU-7 A/B S&I device which falls with approximately the force of a large hailstone could result in cosmetic damage if it struck a vehicle. This is estimated to occur to not more than one vehicle per year under the Bulldog MOAs and one per year under the Gamecock MOAs. In any such case of damage, the Air Force has established procedures for damage claims and the claimant should contact Shaw AFB Public Affairs.

Given the number of flares deployed, the geographic area, and the population under the Bulldog MOAs and Gamecock MOAs, an MJU-7 A/B S&I device has a 0.005 expected number of strikes to a person annually. This means the S&I device has the potential to strike 5 exposed persons in 1,000 years with similar force with that of a large hailstone. The likelihood of this occurring is sufficiently low, that no social or economic effects would be anticipated. In the unlikely event that an individual or vehicle were struck or injured by an S&I device, the procedures for a damage claim would begin by contacting Shaw AFB Public Affairs.

TRANSMITTER SITES

Under the Mitigated Proposed Action, additional electronic training transmitter sites would be established at various locations under Bulldog B and Gamecock C and D MOAs, and at several locations along the South Carolina coast. Each transmitter site would be approximately 0.6 acre in size, with a surrounding buffer of approximately 15 acres. Transmitter sites require an access road, electrical power, and telephone connection.

Construction activities associated with development of the new transmitter sites could take place over an estimated range of 5 to 10 years. Potential socioeconomic impacts generated by the proposed construction activity would include increased employment and earnings in the localities surrounding the proposed sites. These impacts would be temporary and occur only during the construction period. No permanent or long-lasting socioeconomic impacts are anticipated as a result of transmitter site development.

3.9.3.2 ALTERNATIVE A

AIRSPACE MODIFICATIONS

Under Alternative A, existing MOA airspace would be expanded, new MOA airspace would be created, expanded ATCAA would be developed, and one existing MOA would be deleted. Within the existing airspace, chaff and flare use is currently authorized. Chaff and flare use would also be authorized in the new and modified airspace.

The proposed airspace modifications would not prohibit use of affected airways by general aviation and exclusionary areas would provide for continued local airport access.

CIVIL AIRCRAFT

Potential airspace constraints associated with transiting the proposed Gamecock E MOA and the lowered Gamecock D MOA were identified as a concern by pilots during scoping meeting and public hearings. The airspace usage demonstrates that Air Taxis could especially be affected by the proposed new airspace.

The low floor of the modified Gamecock D and the requirement to fly at a less efficient altitude were identified as potential impacts by civilian pilots at public meetings. Positive ATC within the existing and proposed Gamecock MOAs should reduce the potential for safety risk, but the proposed lower Gamecock D MOA would reduce the flexibility that civilian pilots currently have when transiting the area. Deconfliction methods to support joint military and civilian use of the airspace are discussed in Section 2.2.6. These methods are designed to reduce potential impacts to an acceptable level and include airspace scheduling and positive control of transiting aircraft within the Gamecock MOAs.

Altitude structures of the proposed airspace are such that conflicts between military use and civilian air traffic, other than those noted for Gamecock E and D above, are unlikely (see Section 3.1.3, Airspace Management and Air Traffic Control). When airspace was scheduled for military use, the transition corridors would affect civilian air traffic in Gamecock E and D. Life-flights to regional hospitals would be given precedence by Air Traffic Controllers, and would remain unimpeded by the proposed changes in military airspace. Within the Bulldog MOA, where Alternative A extends Bulldog A under Bulldog B, public concerns regarding constraint to civilian aircraft activity are similar to those expressed under the Gamecock MOAs. Specific concerns included potential impacts to a civilian pilot school, to agricultural flights, and to local traffic in the area where the airspace floor would be lowered to 500 feet AGL. The proposed expansion of Bulldog A would be expected to reduce the flexibility of IFR civil air traffic using or traversing the area.

Aviation Facilities

Aviation facilities under the Gamecock MOAs would not be expected to be affected by Alternative A except to the extent that fixed-base operators could face less flexibility as described above.

A number of public and private aviation facilities exist on lands under or adjacent to the proposed Bulldog A airspace expansion. Commenters under the expanded Bulldog A MOA airspace expressed the opinion that proposed exclusionary areas were not adequate to support efforts by small communities to increase economic activities through airport growth. An exclusionary area would be identified around each public airport as currently exists under the Bulldog A MOA with a 3-NM circle extending to 1,500 feet AGL designated over each public airport to deconflict military training aircraft from the immediate vicinity. This exclusionary area has been demonstrated to successfully deconflict traffic under existing Bulldog A airspace.

Noise Disturbances

Under Alternative A, flight activity would occur over an expanded area resulting in average noise levels that are slightly reduced from current conditions under most of the existing airspace. Receptors in the expanded airspace areas (Gamecock D and Bulldog A) would experience higher average noise levels as described in Section 3.2.3.

> ***Public Question:*** *How will community investments, such as hospitals and airports be affected by ATI?*
>
> ***Answer:*** *Shaw AFB airspace currently has avoidance areas around communities, hospitals, and airports. Comparable avoidance areas would be identified around community locations under proposed new or expanded airspace.*

Property values reflect a variety of factors including employment opportunities, regional growth, and both the natural and social environments. Property subject to airport noise in the DNL 65 dB range has been evaluated to determine whether noise levels affect property values, but the valuation results have been dominated by the multiple variables affecting housing valuation. None of the existing or proposed airspace modifications would produce noise levels even approaching the DNL 65 dB level. As explained in Section 3.2.3, Noise, DNLmr average noise levels under any of the airspace units are not expected to exceed 55 dB. A number of studies indicate that noise sensitivity depreciation to property values generally does not occur at noise levels under a threshold level of 55 dB (Frankel 1991). For a more detailed discussion of noise levels, see Section 3.2.3, Noise.

Anticipated changes in the noise environment in the affected area, whether decreases or increases in noise levels, would not be sufficient to affect the rural economy or property values on lands underlying the airspace.

CHAFF AND FLARE USE

Under Alternative A, the use of chaff and flares would be included in the new and modified airspace. As described under the Mitigated Proposed Action, the use of chaff and flares would result in some remnant materials falling to the ground. However, given the wide area of dispersion and the average number of flare and chaff materials that would be deposited annually is estimated to be one piece of residual material for approximately 5 acres under the new, modified, and existing MOAs. While these remnant materials could cause annoyance to individuals finding the materials, such materials would not be expected to accumulate in large enough quantities to affect socioeconomic activities or property values.

The exception could be the MJU-7 A/B S&I device which falls with approximately the force of a large hailstone and could result in cosmetic damage if it struck a vehicle. This is estimated to occur to not more than two vehicles per year under both the Bulldog or Gamecock MOAs. In any such case of damage, the Air Force has established procedures for damage claims and the claimant should contact Shaw AFB Public Affairs.

As discussed under the Mitigated Proposed Action, given the number of flares deployed, the geographic area, and the population under the Bulldog MOAs and Gamecock MOAs, an MJU-7 A/B S&I device has the potential to strike 5 exposed persons in 1,000 years with similar force with that of a large hailstone. The likelihood of this occurring is sufficiently low, that no social or economic effects would be anticipated. In the unlikely event that an individual were struck or injured by an S&I device, the procedures for a damage claim would begin by contacting Shaw AFB Public Affairs.

TRANSMITTER SITES

The potential socioeconomic impacts of the construction of new transmitter sites would be the same as those described in Section 3.9.2.1 under the Mitigated Proposed Action. Construction activities could take place over an extended period of time. Increased employment and earnings in the localities surrounding the proposed sites would be generated as a result of the proposed construction activity. These impacts would be temporary and occur only during the construction period. No permanent or long-lasting socioeconomic impacts are anticipated as a result of transmitter site development.

3.9.3.3 ALTERNATIVE B

Alternative B provides additional airspace for civil aviation under both the Gamecock and Bulldog MOAs when compared with Alternative A. This additional airspace would be in Gamecock E through the additional scheduling flexibility of the high and low MOAs and the higher floor of Gamecock F. The result would be reduced concern by private pilots traversing the airspace. There would be additional civil airspace under Bulldog B in the area where Bulldog A is proposed to expand under Alternative A. The higher floor of the airspace provides access to airports that otherwise would be under exclusionary areas. The higher floor also reduces noise effects on the ground as compared with the Mitigated Proposed Action and Alternative A. Consequences of chaff and flare use would be the same as described for the Mitigated Proposed Action. The minor economic effects of transmitter site construction anticipated under the Mitigated Proposed Action would be even smaller under Alternative B as fewer sites would be developed. No adverse effects on the socioeconomic resources of the region would be expected. Implementation of Alternative B is not expected to create any limitations or consequences that would negatively affect civil aviation, economic activity, or property values in the affected area.

3.9.3.4 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, airspace use and related activity would remain the same as under existing conditions. Flight activity, noise levels, and chaff and flare use would not change. No effects to socioeconomic resources described under the Mitigated Proposed Action or alternatives would occur.

3.10 ENVIRONMENTAL JUSTICE

3.10.1 Introduction

Environmental justice is defined by EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, enacted in 1994, which directs federal agencies to address disproportionate environmental and human health effects in minority and low-income communities. Also included with environmental justice issues are concerns pursuant to EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, enacted in 1997. EO 13045 directs federal agencies to identify and assess environmental health and safety risks that may disproportionately affect children.

EO 12898 applies to federal agencies that conduct activities that could substantially affect human health or the environment. The concept of environmental justice ensures that studies such as EISs address whether actions of federal agencies disproportionately impact human health and environmental conditions in minority communities or low-income communities. The evaluation of environmental justice is designed as follows:

- To focus attention of federal agencies on the human health and environmental conditions in minority communities and low-income communities with the goal of achieving environmental justice.
- To foster non-discrimination in federal programs that substantially affect human health or the environment.
- To give minority communities and low-income communities greater opportunities for public participation in, and access to, public information on matters relating to human health and the environment.

The approach applied in this section is in accordance with the *Interim Guide for Environmental Justice with the Environmental Impact Analysis Process* (Air Force 1997b). For purposes of this analysis, minority, low-income and youth populations are defined as follows:

- *Minority Population*: Blacks, American Indians, Eskimos, Aleuts, Asians, Pacific Islanders, and persons of Hispanic or Latino origin of any race.
- *Low-Income Population*: Persons living below the poverty level, based on a 2000 equivalent annual income of $17,603 for a family of four persons.
- *Youth Population*: Children under the age of 18 years.

In this EIS, the anticipated environmental effects of the Mitigated Proposed Action and alternatives are evaluated for their potential impact to environmental justice. Analysis determined whether there would be a disproportionately high and/or adverse effect to minority or low-income communities, or adverse safety or health risks to children. Estimates of these three population categories were developed based on data from the 2000 Census of Population and Housing. The analysis of environmental justice populations includes all counties with land area underlying the affected airspace.

3.10.1.1 Issues and Concerns

No issues or concerns were specifically identified for Environmental Justice resources during public hearings and public comment review periods. However, several commenters questioned the ethnic or race status of individuals under the airspace. Other commenters also expressed their belief that the areas under the airspace were comprised of impoverished individuals.

3.10.2 Existing Conditions – Environmental Justice

The Poinsett ROI, Gamecock ROI, and Bulldog ROI for environmental justice consist of portions of 19 counties that contain land area under the airspace associated with the ATI proposal. This affected airspace overlies primarily rural areas in eastern South Carolina and northeastern Georgia. Most areas under existing and proposed airspace have experienced military training aircraft (in MOAs and MTRs) for many years. The Mitigated Proposed Action would alter the current airspace in the Bulldog MOA as described in Section 2.6 and as depicted in Figure 1-3.

Military airspace typically is configured to avoid population centers; therefore, such airspace by design tends to be located over rural and less developed areas. More populated communities within the boundaries of the airspace addressed in this analysis are typically scattered, relatively low in density compared to urbanized areas, and are avoided to the maximum extent possible.

Portions of ten counties in Georgia and nine counties in South Carolina are located below the designated military airspace associated with Poinsett, Gamecock, and Bulldog MOAs. Table 3.10-1 identifies total population in each county, the population under the airspace in each county, and data for disadvantaged persons in these counties, the states of Georgia and South Carolina, and for the U.S.

Poinsett ROI (Alternatives A or B). Poinsett ECR and Poinsett MOA overly portions of Calhoun, Clarendon, and Sumter counties in South Carolina, just south of Shaw AFB. The Poinsett ROI consists of those portions of the preceding three counties that are actually situated under the Poinsett airspace. The total 2000 population for Poinsett ROI was 57,606 persons.

Table 3.10-1. Population and Environmental Justice Data by County (2000)

	County Population	*Affected Population*[1]	*Percent Minority*	*Percent Low-Income*	*Percent Youth*
Poinsett ROI		57,606	52.3	19.4	27.8
Calhoun, South Carolina	15,185	421	53.3	16.2	22.7
Clarendon, South Carolina	32,502	27,047	59.3	23.1	27.0
Sumter, South Carolina	104,646	30,139	46.0	16.2	28.6
Gamecock ROI		113,901	57.3	21.6	28.5
Berkeley, South Carolina	142,651	1,867	80.6	11.8	28.4
Clarendon, South Carolina	32,502	27,047	59.3	23.1	27.0
Florence, South Carolina	125,761	5,061	31.0	16.4	30.6
Georgetown, South Carolina	55,797	13,423	56.5	17.1	30.1
Horry, South Carolina	196,629	11	78.1	12.0	31.2
Marion, South Carolina	35,466	300	62.7	23.2	21.6
Sumter, South Carolina	104,646	30,139	46.0	16.2	28.6
Williamsburg, South Carolina	37,217	36,053	67.9	27.9	28.7
Bulldog ROI		74,549	52.2	25.5	29.1
Bulloch, Georgia	55,983	777	39.5	24.5	28.2
Burke, Georgia	22,243	14,190	56.3	28.7	31.4
Candler, Georgia	9,577	24	11.5	26.1	28.3
Emanuel, Georgia	21,837	15,052	41.8	27.4	29.2
Glascock, Georgia	2,556	261	11.2	17.2	23.8
Jefferson, Georgia	17,266	13,923	62.4	23.0	28.6
Jenkins, Georgia	8,575	7,561	46.4	28.4	28.5
Johnson, Georgia	8,560	6,431	41.4	22.6	31.7
Laurens, Georgia	44,874	13	29.2	18.4	27.6
Washington, Georgia	21,176	16,317	57.8	22.9	27.0
Transmitter Sites					
Awendaw town, South Carolina	1,195	1,195	65.6	12.4	29.5
Georgetown city, South Carolina	8,950	8,950	59.0	24.1	28.6
McClellanville town, South Carolina	459	459	7.4	11.8	16.3
State of Georgia	8,186,453	NA	37.4	13.0	26.5
State of South Carolina	4,012,012	NA	33.9	14.1	25.2
United States	281,421,906	NA	30.9	12.4	25.7

Note: 1. The estimated population in the portions of each county actually under the affected airspace.
ROI = region of influence
Sources: U.S. Bureau of the Census 2000a, 2000b.

Minority persons account for 52.3 percent of Poinsett ROI population and 33.9 percent of the South Carolina population. The Poinsett ROI population is 19.4 percent low-income, compared with 14.1 percent for the state. The youth population, comprised of children under the age of 18 years, constitutes 27.8 percent of the Poinsett ROI population, compared to 25.2 percent for South Carolina overall.

Gamecock ROI (Alternatives A or B). The proposed Gamecock MOA complex overlies all or portions of the following eight counties in South Carolina: Berkley, Clarendon, Florence, Georgetown, Horry, Marion, Sumter, and Williamsburg. The Gamecock ROI consists of those portions of the preceding eight counties that are actually situated under the Gamecock MOAs airspace. The total 2000 population for the Gamecock ROI was 113,901 persons, representing 2.8 percent of the 4,012,012 South Carolina population.

Minority persons account for 57.3 percent of the Gamecock ROI population and 33.9 percent of the South Carolina population. The smallest percentage of minority residents in a single county is 31.0 percent (Florence County) and the largest percentage is 80.6 percent (Berkley County).

The population of the Gamecock ROI is 21.6 percent low income, compared with 14.1 percent for the State of South Carolina. The affected areas in all of the ROI counties have low-income populations exceeding the overall state average. Affected low-income populations in the individual counties range from 12.0 percent (Horry County) to 27.9 percent (Williamsburg County).

The youth population, comprised of children under the age of 18 years, constitutes 28.5 percent of the Gamecock ROI population, compared to 25.2 percent for South Carolina overall. There is relatively little variation in the youth population in the affected areas of the ROI counties, ranging from a low of 21.6 percent in Marion County to a high of 31.2 percent in Horry County.

Bulldog ROI (Mitigated Proposed Action and Alternatives A or B). The Bulldog MOA complex overlies all or portions of the following nine counties in Georgia: Bulloch, Burke, Candler, Emanuel, Glascock, Jefferson, Jenkins, Johnson, Laurens, and Washington. The Bulldog ROI consists of those portions of the preceding nine counties that are actually situated under the Bulldog MOAs airspace. The total 2000 population for the Bulldog ROI was 74,549 persons, representing 0.9 percent of the 8,186,453 Georgia population.

Minority persons account for 52.2 percent of the Bulldog ROI population and 37.4 percent of the Georgia population. The smallest percentage of minority residents in a single county is 11.2 percent (Glascock County) and the largest percentage is 62.4 percent (Jefferson County). Incidentally, Glascock County is also the least populated county with a total population of only 2,556 persons.

The population under the Bulldog MOAs is 25.5 percent low-income, compared with 13.0 percent for the State of Georgia. All of the counties in the Bulldog ROI have low-income populations exceeding the overall state average. Low-income populations in the individual counties range from 17.2 percent (Glascock County) to 28.7 percent (Burke County).

The youth population, comprised of children under the age of 18 years, constitutes 29.1 percent of the Bulldog ROI population, compared to 26.5 percent for Georgia overall. There is relatively little variation in the youth population among the counties, ranging from a low of 23.8 percent in Glascock County to a high of 31.7 percent in Johnson County.

Transmitter Sites. Potential transmitter sites outside the proposed airspace boundaries are located in the general vicinity of the communities of Awendaw, Georgetown, and McClellanville, South Carolina. Total population in the town of Awendaw is 1,195 persons. Minority persons account for 65.6 percent of Awendaw's population, 12.4 percent of individuals are low-income, and youths under age 18 represent 29.5 percent of the total population. Total population in the town of Georgetown is 8,950 persons. Minority persons account for 59.0 percent of Georgetown's population, 24.1 percent of individuals are low-income, and youths under age 18 represent 28.6 percent of the total population. Total population in the town of McClellanville is 459 persons. Minority persons account for 7.4 percent of McClellanville's population, 11.8 percent of individuals are low-income, and youths under age 18 represent 16.3 percent of the total population.

3.10.3 Environmental Consequences – Environmental Justice

The environmental justice analysis examines the potential for disproportionate effects of the proposed airspace modifications and noise disturbances on minority or low-income communities or youth populations in the ROI.

3.10.3.1 MITIGATED PROPOSED ACTION

Income and employment factors described in Socioeconomics (Section 3.9.2) suggest that the rural areas of South Carolina have kept reasonable pace with the state economic growth within the urban areas and along the coasts. Median family income in the Bulldog ROI at $26,573 per year is lower than that in rural South Carolina and is approximately 63 percent of the Georgia median family income. This would suggest that the Bulldog ROI is approximately comparable to the rural areas of South Carolina, but it is a relatively low income area when compared with the State of Georgia. Specific counties within the Bulldog ROI have been identified by the State of Georgia as areas for economic assistance to improve the region's economy. The region is somewhat disadvantaged compared to the State of Georgia and this is reflected in the concern about any action which could affect jobs in the rural region. This higher concentration of low-income persons is comparable to nearly all the rural counties in both states. There are no disproportionate impacts to any socioeconomic resource under the Mitigated Proposed Action.

Low-income communities in the ROI represent a proportionately larger segment of the ROI populations than for the states of Georgia and South Carolina as a whole. Based on the noise effects identified in Section 3.2.3 and the socioeconomic effects described in Section 3.9.3, low-income populations are not expected to experience disproportionate environmental or socioeconomic effects.

The minority population under the proposed Bulldog C and E MOAs are comparable to Georgia state levels.

The youth population under the proposed Bulldog C and E MOAs in Emanuel, Jenkins, and Laurens counties is similar, in proportion, to the Georgia state levels. Youth populations are concentrated in the ROI counties' urban areas, which lie outside the affected area. There would be no anticipated disproportionately high or adverse impacts to the human health or environmental conditions in minority communities, in low-income communities, or effects on children under the Mitigated Proposed Action.

3.10.3.2 ALTERNATIVE A

As with the Mitigated Proposed Action, there are no significant impacts to any resource under Alternative A. No disproportionate effects to disadvantaged communities under the airspace are anticipated.

In addition to the income characteristics of the Bulldog ROI discussed under the Mitigated Proposed Action, at around $30,000 per year, the median family income in the Poinsett and Gamecock ROIs is approximately 80 percent of the median family income in South Carolina as a whole. This would suggest that the area under the Poinsett and Gamecock MOAs would not be characterized as disproportionately low income compared to other rural areas in South Carolina.

The minority population in the Poinsett and Gamecock ROIs account for a larger proportion of the total population than for the state of South Carolina as a whole, but there are no environmental or socioeconomic effects anticipated as a result of the Alternative A that would disproportionately affect minority groups. The minority population in the Bulldog ROI is similar in proportion to the Georgia state levels; therefore, no environmental or socioeconomic effects are anticipated to disproportionately affect minority populations.

The youth population in the Poinsett, Gamecock, and Bulldog ROIs is similar, in proportion, to the Georgia and South Carolina state levels. Youth populations are concentrated in the ROI counties' urban areas, which lie outside the affected area. There would be no anticipated disproportionately high or adverse impacts to the human health or environmental conditions in minority communities, in low-income communities, or effects on children under the Mitigated Proposed Action.

There would be no anticipated disproportionately high or adverse impacts to the human health or environmental conditions in minority communities, in low-income communities, or effects on children under Alternative A.

3.10.3.3 ALTERNATIVE B

There are no significant impacts to any resource under Alternative B; therefore, no disproportionate effects to disadvantaged communities under the airspace are anticipated.

There would be no anticipated disproportionately high or adverse impacts to the human health or environmental conditions in minority communities, in low-income communities, or effects on children under Alternative B.

3.10.3.4 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, airspace use and related activity would remain the same as under existing conditions. Flight activity, noise levels, and chaff and flare use would not change. There would be no environmental justice effects or health and safety risks to children.

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4.0 CUMULATIVE EFFECTS AND OTHER ENVIRONMENTAL CONSIDERATIONS

4.1 CUMULATIVE EFFECTS ANALYSIS

Council on Environmental Quality (CEQ) regulations stipulate that the cumulative effects analysis in an Environmental Impact Statement (EIS) should consider the potential environmental impacts resulting from "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 Code of Federal Regulations [CFR] 1508.7). Chapter 3.0 discussed the baseline conditions and potential effects of the Mitigated Proposed Action and alternatives on environmental resources. This chapter identifies and evaluates projects that are reasonably foreseeable that could cumulatively affect environmental resources in conjunction with the Airspace Training Initiative (ATI).

Assessing cumulative effects begins with defining the scope of other actions and their interrelationship with the Mitigated Proposed Action or alternatives (CEQ 1997). The scope must consider other projects that coincide with the location and timetable of the Mitigated Proposed Action or alternatives and other actions. Cumulative effects analyses evaluate the interactions of multiple actions. The first steps of the environmental impact analysis process helped identify other potential and planned actions. During scoping, the public and agencies were asked to provide information about ongoing regional projects and the potential interaction of the Shaw Air Force Base (AFB) ATI with such projects. These initial discussions defined the region of influence (ROI) for ATI, which in turn defined what actions should be considered cumulatively. The ROI for cumulative effects would have both spatial and temporal dimensions.

The CEQ (1997:9) identified and defined eight ways in which effects can accumulate: time crowding; time lag; space crowding; cross boundary; fragmentation; compounding effects; indirect effects; and triggers and thresholds. Furthermore, cumulative effects can arise from single or multiple actions, and through additive or interactive processes (CEQ 1997:9).

Actions not identified in ATI as the Mitigated Proposed Action or an alternative but that could be considered as actions connected in time or space (40 CFR 1508.25) (CEQ 1997:4) may include projects that affect the airspace. This would include the shape or use (such as commercial use) of airspace in and near the proposed ATI airspace or actions that affect environmental resources under the airspace. Cumulative actions could also include projects in the vicinity of the proposed training transmitter sites.

This EIS analysis addresses three questions to identify cumulative effects:

1. Does a relationship exist such that elements of the Mitigated Proposed Action or an alternative might interact with elements of past, present, or reasonably foreseeable actions?
2. If one or more of the elements of the Mitigated Proposed Action or an alternative and another action could be expected to interact, would the Mitigated Proposed Action or an alternative affect or be affected by impacts of the other action?
3. If such a relationship exists, does an assessment reveal any potentially significant impacts from the proposal not identified when the Mitigated Proposed Action or an alternative is considered alone?

An effort has been made to identify all actions that are being considered and that are in the planning phase at this time. To the extent that details regarding such actions exist and the actions have a potential to interact with the ATI Mitigated Proposed Action or an alternative, these actions are included in this cumulative analysis. This approach enables decisionmakers to have the most current information available so that they can evaluate the environmental consequences of the Mitigated Proposed Action.

4.1.1 Past, Present, and Reasonably Foreseeable Actions

This EIS applies a stepped approach to provide decisionmakers with not only the cumulative effects of the Mitigated Proposed Action but also the incremental contribution of past, present, and reasonably foreseeable actions.

4.1.1.1 SHAW AFB AND OTHER MILITARY ACTIONS

PAST AND ONGOING MILITARY ACTIONS

Recent past and ongoing military action in the region were considered as part of the baseline or existing condition in the ROI. As presented in Table 4.1-1, these actions were considered for their relevance to ATI. Each project (summarized in this section) was reviewed to consider the implication of each action and its synergy with the Mitigated Proposed Action and alternatives. Of particular concern were potential overlap in affected area and project timing. Shared aircraft operations were also a consideration.

1994 to 2004 Poinsett Electronic Combat Range (ECR) System Capability and Environmental Management Enhancements

In 1994, a land exchange with the State of South Carolina was negotiated increasing range property from approximately 7,500 acres to 12,521 acres. In 2000, construction of a new tactical target complex (South Target Array) was completed. The Weapons Impact Scoring System, a television ordnance scoring system, was installed in 2003 for the North Target Array. The following year, two towers were constructed and Weapons Impact Scoring System cameras were installed for the South Target Array. Management of the range's natural resources has been defined in the Integrated Natural Resources Management Plan (INRMP) Fiscal Year (FY)

2007-2011, including threatened and endangered species management, forest management, and wildland fire management (United States Air Force [Air Force] 2007b).

Table 4.1-1. Past, Ongoing, and Reasonably Foreseeable Military Actions

Action	*Reference[1]*	*Potentially Relevant to ATI*
Poinsett Electronic Combat Range (ECR) system capability and environmental management enhancement	Air Force 1994 Air Force 2007b	NO
Force Structure Change at Shaw Air Force Base, Sumter, South Carolina	Air Force 1996	YES
Changes in airspace utilization for specific Military Training Routes (MTRs) and Military Operations Areas (MOAs) managed by the 20th Fighter Wing (20 FW)	Air Force 2002	YES
Force Structure Change at Shaw Air Force Base, South Carolina	Air Force 2002	YES
Construction of an assault landing strip at Dobbins Air Reserve Base, Georgia	Air Force Reserve 2003	NO
Decision to base Super Hornets (F/A-18E/F) at Oceana	Navy 2003	YES
Chaff and flares in existing airspace at Shaw AFB	Air Force 2003	YES
Employment of a Mobile Laser Evaluator System (LES-M) for the 20th Fighter Wing at Shaw Air Force Base, South Carolina	Air Force 2004	NO
Modification to the Coastal MOA	ANG 1995 ANG 2002	NO
Wing Infrastructure Development Plan (WINDO) covering infrastructure projects at Shaw AFB and Poinsett ECR	Air Force 2005	NO
Base Realignment and Closure Action at Shaw AFB	Air Force 2007c	YES
Beddown of different aircraft at Shaw Air Force Base (AFB) and/or McEntire Air National Guard Station (ANGS)	Under Consideration	YES

Note: 1. Full citations are provided in Chapter 5.0, References.

1996 Force Structure Change

Shaw AFB is an active military installation that undergoes continuous change in mission and in training requirements. This process of change is consistent with the United States (U.S.) Defense policy that forces must be ready to respond to threats to American interests throughout the world. In the past eight years, two force structure changes have occurred at Shaw AFB. In 1996, the number of A/OA-10s was reduced from 39 to 18 Primary Aircraft Inventory (PAI) aircraft (Air Force 1996). The Air Force also increased the number of F-16s at Shaw AFB from 54 to 78 Primary Assigned Inventory (PAI) Block 50 aircraft by the end of August 1996. Sortie-operations in the Poinsett ECR, two Military Operations Areas (MOAs), and one Military Training Route (MTR) did not noticeably change as a result of the 1996 actions. Sortie-operations in two Warning Areas, three MOAs, and 24 MTRs increased slightly. Base personnel increased by 97 from 5,892 to 5,989 persons as a result of these 1996 actions.

2002 Changes in Airspace Utilization

Also in 2002, Shaw AFB received approval from the Federal Aviation Administration (FAA) for changes to utilization of several existing airspace units under the management of the 20th Fighter Wing (20 FW). The action, environmentally assessed in 2001, included adjustments in the altitude of three MTRs and extension of the operating hours for six MOAs. The three MTRs were Visual Routes (VRs) -087, -088, and -1060, which overlie counties in South Carolina, North Carolina, and Virginia. The proposal also increased the ceilings of each MTR to 6,500 feet above ground level (AGL). The six MOAs receiving the extension of operating hours were Gamecock B, C, D, and E MOAs and the Bulldog A and B MOAs. The proposal extended the operating hours from 10:30 p.m. to midnight in Gamecock B, C, and D MOAs and both Bulldog MOAs.

2002 Force Structure Change

By 2002, Shaw AFB was home to four squadrons of F-16 Block 50 aircraft – three 18 Primary Mission Aircraft Inventory (PMAI) squadrons and one 24 PMAI squadron (Air Force 2002). In FY 03, the Air Force deactivated the 78th Fighter Squadron and added 12 newer F-16 Block 50 aircraft to be distributed among other squadrons within the 20 FW. The 20 FW has the 55th, 77th, and 79th Fighter Squadrons and each squadron now has 24 PMAI Block 50 F-16 aircraft. Base personnel totals 5,663 after this force structure change.

2003 Construction of an Assault Landing Strip

Dobbins Air Reserve Base completed construction of an assault landing strip to train crews of medium-sized aircraft such as C-130s. The assault landing strip has a 3,500 x 60-foot landing zone that will allow C-130H aircraft to practice take-offs and landings in conditions found in forward operating locations (Air Force Reserve 2003).

2003 Training Chaff and Flare Use

In 2003, Shaw AFB concluded an Environmental Assessment (EA) for the use of chaff and flares as defensive countermeasures for training in Bulldog A and B MOAs and Bulldog B Air Traffic Control Assigned Airspace (ATCAA), and Gamecock B, C and D MOAs and Gamecock D ATCAA (Air Force 2003). Three F-16 squadrons from Shaw AFB's 20 FW and one squadron from McEntire Air National Guard's (ANG's) 169th Fighter Wing (169 FW) use these airspace units for training with defensive chaff and flares.

2004 Employment of Mobile Laser Evaluation System at Poinsett ECR

In 2004, the Air Force further enhanced the Poinsett ECR by introducing a mobile laser evaluation system to score the accuracy of laser targeting and related training by 20 FW pilots. This targeting system provides rapid feedback to pilots and observers regarding the speed of targeting and the accuracy of targeting for new F-16 laser targeting systems.

2006 Modifications to the Coastal MOA

The Georgia ANG and FAA completed an EIS evaluating modifications to the Coastal MOA surrounding the Townsend Range near Jesup, Georgia. The airspace was first activated in 2006 and is approximately 100 miles south of the Bulldog MOA and is outside the unrefueled range of Shaw AFB aircraft. It is not regularly used for Shaw AFB or McEntire Air National Guard Station (ANGS) pilot training and would not interact with proposed ATI airspace changes.

2008 United States Army Central Command (USARCENT) EA

Shaw AFB was chosen as the site for the establishment of a permanent air sovereignty alert mission. The alert mission is made up of 20 FW aircraft, and is located on the South Ramp Area. The action was categorically excluded from further environmental analysis or documentation.

REASONABLY FORESEEABLE MILITARY ACTIONS

Shaw AFB, like any other major institution, requires occasional new construction, facility improvements, and infrastructure upgrades. Because ATI does not involve actions at Shaw AFB, construction or other activities at Shaw AFB would not be considered in the cumulative effects analysis.

This category of reasonably foreseeable actions includes military actions that have a potential to coincide, either partially in time or geographic extent, with the Mitigated Proposed Action or alternatives. The airspace modifications for the Bulldog MOA under consideration are needed for the current F-16 mission (see Section 1.3) and, accordingly, are independently justified separate from any potential Shaw AFB mission changes.

In December 2009, the Air Force announced its intent to prepare an EIS to evaluate the potential environmental consequences of basing operational F-35A aircraft at one or more Air Force and/or ANG installations across the U.S. (See Air Force Notice of Intent, 74 Fed. Reg. 69080 Dec 30, 2009, which is incorporated by reference.) Shaw AFB and McEntire ANGS were included in that announcement as one of the alternatives to be considered. At this time, the Air Force is not aware of any aspect of that proposal that could potentially alter the environmental effects predicted for F-16 use of the proposed training airspace. The F-35A is currently anticipated to replace the F-16 aircraft, and so the impacts of it will likely replace those of the F-16 and not be additive to them. Additionally, the ATI proposal was not developed to facilitate F-35A training, nor will adoption of the ATI proposal authorize any F-35A training in the proposed airspace. Any potential F-35A impacts from the use of the Shaw AFB airspace will be analyzed in the F-35A Operational Wing Beddown EIS before any decisions are made either to beddown the F-35A or use the nearby airspace. Accordingly, the F-35A proposal does not have potentially cumulative effects or actions that warrant consideration in this EIS.

4.1.1.2 OTHER FEDERAL ACTIONS

Other past, current, and future federal actions in the area could also contribute to cumulative effects of the Mitigated Proposed Action or alternatives. Federal agencies with jurisdiction within the ROI include the Bureau of Reclamation, United States Army Corps of Engineers (USACE), United States Fish and Wildlife Service (USFWS), United States Department of Agriculture (USDA), FAA, Federal Highway Administration, and Federal Energy Regulatory Commission. Potential actions within the area and occurring in the same time frame as ATI were identified and considered in preparation of this cumulative effects analysis.

FEDERAL AVIATION ADMINISTRATION

The FAA published its *National Aviation Research Plan 2009.* The plan includes goals to increase the safety and efficiency of the National Airspace System (NAS). Various Letters of Agreements (LOAs) between the military and the FAA have been signed to address air traffic operational procedural matters that require the cooperation and concurrence of the military or other airspace users. An example of this is the agreement between Jacksonville Center and 20 FW establishing responsibilities and special procedures for 20 FW operations in the air traffic control (ATC) system.

The existing Air Force-FAA Letter of Agreement (LOA), effective October 10, 1996 and last revised on December 2, 2007, permitting transit from the Gamecock MOAs to Poinsett ECR would continue in effect. This LOA established an airspace corridor between Gamecock MOAs and Poinsett ECR. The LOA-defined corridor extends from 18,000 feet MSL up to, but not including, Flight Level (FL) 220 (22,000 feet MSL). Aircraft maneuvering and the use of chaff and flares are not permitted in this corridor. Aircraft are required to maintain tactical formation while in the corridor and complete the flight within 15 minutes unless otherwise coordinated with Air Traffic Control (ATC). This corridor is only active while military aircraft are transitioning into the Poinsett ECR. When not in use, the LOA corridor is open to civil and general aviation.

4.1.1.3 NON-FEDERAL ACTIONS

Non-federal actions include projects of the State of South Carolina, State of Georgia, various counties within the ROI, cities within the ROI, and private projects. Several counties have published county land use and development plans and projects. Private actions are numerous and often difficult to identify; several identified private and commercial projects are summarized below.

Several local private airports have implemented or are in the process of implementing major improvements. These airport projects are summarized in Table 4.1-2. Other regional aviation facility ongoing and proposed activities are addressed in Section 3.1, Airspace Management and Air Traffic Control.

Table 4.1-2. Private Airport Projects

Airport	*Project Description*	*Time Frame*
Myrtle Beach International Airport	Private heliport developed.	2002
Myrtle Beach International Airport	Northwest Airlines added a route between Detroit and Myrtle Beach.	2004
Myrtle Beach International Airport	Spirit Airlines added daily flights between Washington D.C. and Myrtle Beach.	2004
Swainsboro/Emanuel County Airport	Potential improvements may include an Instrument Landing System (ILS).	2004–2005
Manning Airport	Proposed airport expansion.	2005
Louisville Airport	Recent improvements; a Localizer is scheduled for installation in 2005.	2004–2005

4.1.2 Cumulative Effects Analysis

The following analysis examines (1) how the impacts of the actions presented in the previous sections might be affected by any resulting from the Mitigated Proposed Action or an alternative, (2) whether such a relationship could result in potentially significant impacts not yet identified when the Mitigated Proposed Action or alternatives are considered together with the cumulative actions, and (3) what any cumulative impacts might be.

AIRSPACE MANAGEMENT AND AIR TRAFFIC CONTROL

Over the last decade, several military training airspace modifications have occurred to airspace overlying Georgia. These have included modifications to the Quick Thrust MOAs supporting operations on Townsend Range (R-3007), development of an assault landing strip at Dobbins Air Reserve Base, and development of airspace to support search and rescue training conducted with HH-60 and HC-130 aircraft located at Moody AFB. All of these areas are located between 180 and 250 miles from Shaw AFB. None is in the immediate vicinity of any of the Special Use Airspace (SUA) considered in the ATI proposal. As noted in Section 2.7.1.3 of this EIS, training airspace at those distances does not support the operational criterion to optimize training time and minimize transit.

The military training airspace modifications listed above have been implemented so as to not significantly impact the management or use of airspace by civil aviation. Implementation of ATI airspace changes, with management processes currently in place for the Bulldog MOAs, Gamecock MOAs, Poinsett MOAs, and the Poinsett Restricted Airspace, would not be expected to result in cumulative impacts to regional civil aviation.

In 2003, a Record of Decision (ROD) was published for the EIS assessing the deployment of F/A-18 E/F Super Hornet naval aircraft to the East Coast. In addition to other elements, this decision based 24 aircraft at MCAS Beaufort in South Carolina. These units occasionally use Shaw-managed training airspace as transients. Scheduling of this airspace with the F/A-18 E/F Super Hornets occurs as under current procedures.

Class C airspace has been designated around Myrtle Beach International Airport to manage traffic using the airport. This controlled airspace encompasses a 10-nautical-mile (NM) radius around the airport. Myrtle Beach is located east of Shaw AFB, and the controlled airspace abuts the eastern border of the current Gamecock C MOA. Since 2002, several initiatives have increased operations at this airport. A private heliport has been developed at the airport, and two additional commercial carriers (Northwest Airlines and Sprint Airlines) have begun providing scheduled service from the facility. Currently, all arrival and departure operations occur in the controlled airspace around the airport, and the additional commercial flights operate under Instrument Flight Rules (IFR) conditions, which means they are under positive control by Air Traffic Control (ATC) controllers at the airport. Considering these factors, no added impacts to airspace management would be anticipated. If Alternative A were selected, the airspace comprising the current Gamecock B MOA would be deleted, and the airspace would be returned to the NAS. This would produce a minor additional routing opportunity for aircraft arriving and departing from Myrtle Beach.

Under the Mitigated Proposed Action, there are two airports under the existing Bulldog B MOA and the proposed Bulldog C and E MOAs (Millen and Swainsboro/Emanuel County). Under Alternative A and B, the same Bulldog B MOA airports would be overflown as under the Mitigated Proposed Action with the addition of the Waynesboro/Burke County airport. In addition, there is one privately owned airport under the proposed Gamecock E MOA (Palmetto Airport in Manning) and two public airports under the proposed lowered floor of Gamecock D (Kingstree/Williamsburg County and Santee Cooper Regional). Hemmingway Stuckey Airport is beneath Gamecock C, and Robert F. Swinnie Airport underlies Gamecock C and D. Several of these airports are undergoing improvements and upgrading. Lake City Airport's Class E airspace penetrates Gamecock D. Existing exclusionary areas have been established and charted around the airports to avoid airspace encroachment in their operational areas. The current exclusionary areas (see Section 3.1.3.1) consist of a 3-NM circle centered on the airport and extending up to 1,500 feet AGL. These exclusionary areas, the mitigated exclusionary area around the Emanuel County Airport, and active airspace management to support civilian IFR traffic ensure that military training aircraft would not significantly affect airspace management. Adherence to these exclusionary areas and communication about military use of the airspace are projected to avoid cumulative airspace management impacts under the ATI Mitigated Proposed Action.

NOISE

Since 1996, several changes in the number and type of aircraft stationed at Shaw AFB have occurred. In 1996, the movement of 18 Block 50 F-16 C/D aircraft from Cannon AFB, New Mexico, to Shaw AFB, South Carolina, and the movement of 18 A/OA-10 aircraft from Shaw AFB, South Carolina to Pope AFB, North Carolina was environmentally assessed. In 2002, overall force structure changes at Shaw AFB were also environmentally assessed. The result of both assessments concluded that there were no significant noise impacts in the vicinity of Shaw AFB or under the training airspace. The result of these changes forms the baseline for operations at Shaw AFB. These operations are not projected to substantially change as a result of either the Mitigated Proposed Action or an alternative.

The cumulative effects of transient use of the Shaw AFB managed airspace is not expected to be different from the conditions projected in Section 3.2.3. Transient usage of the airspace from the current Navy and Marine aircraft is not expected to be discernibly different from the current transient usage. None of the cumulative government or other projects is expected to result in a different noise effect than that described in Section 3.2.3. There are no projected cumulative noise effects.

In 2003, a ROD was published for the EIS assessing the deployment of F/A-18 E/F Super Hornet naval aircraft to the east coast. In addition to other elements, this decision based 24 aircraft at MCAS Beaufort in South Carolina. Some of these units occasionally use Shaw-managed training airspace as transient aircraft. F/A-18 aircraft in Shaw-managed airspace are included in the noise analysis on MTRs and in MOAs. Below MTRs, cumulative noise levels range from less than 35 dB DNLmr to 45 dB DNLmr. In MOAs, cumulative noise levels range from less than 35 dB DNLmr to 53 dB DNLmr (see Table 3.2-4). Although not major contributors to overall noise levels, low level aircraft could be noticed, and some people who noticed them could be annoyed (see Section 3.2.1). As presented in Table 3.2-7, noise levels beneath the proposed Bulldog C and E MOAs would increase from less than 35 dB DNLmr to 47 dB DNLmr. Noise generated in Bulldog B MOA, which overlies Bulldog A, C, and E MOAs, and on MTRs which traverse the MOAs, would be expected to remain the same as under baseline conditions. The change in noise level associated with aircraft operations in Bulldog C and E MOAs would be noticeable to residents under the airspace. This noise level is below the threshold level of 55 dB identified as a level to consider potential impacts by USEPA. Some individuals may be annoyed by the increased presence of military training aircraft and/or by the changed noise levels under the proposed Bulldog C or E MOAs. Based on annoyance surveys, the level of highly annoyed people could be expected to increase from approximately one percent to approximately four percent highly annoyed under portions of proposed Bulldog C and E MOAs.

Under Alternative A, where Bulldog A would be extended, the dB DNLmr noise levels would increase from less than 35 dB DNLmr to approximately 47 dB DNLmr. Under Alternative B, noise levels in the same areas would remain below 35 dB DNLmr. Noise levels under the Gamecock MOAs would generally decrease as a result of the expanded airspace volume and the re-distribution of training aircraft within that airspace volume. The two areas of increased noise would be under the new Gamecock E, where calculated aircraft noise levels (see Table 3.2-6) would increase from less than 35 dB DNLmr to 35 dB DNLmr (remaining at or below ambient noise levels). This means that military training aircraft could be noticed but would not be discernible contributors to noise conditions.

Under Gamecock D, the calculated contribution of military aircraft to noise conditions would change from less than 35 to 37 dB DNLmr. This means that the cumulative effect of military training would move from an indiscernible part of the ambient noise environment to a possible discernible part of the noise environment. Under most conditions, the aircraft noise would not be noticed, but it could be discerned in areas where average noise conditions were near the estimated lower 35 dB ambient level 90 percent of the time.

The contribution and operation of training transmitter sites would not have a long-term cumulative effect upon noise.

SAFETY

Public concern with safety to pilots traversing airspace included in the Draft EIS Proposed Action resulted in the identification of the Final EIS Mitigated Proposed Action. The Mitigated Proposed Action or alternatives do not have the potential to create cumulative ground, explosive, or flight safety impacts. Training activities conducted by the 20 FW will not significantly change under the Mitigated Proposed Action.

In 2003, the expanded use of chaff and flares in the Shaw-managed military training airspace was assessed with a finding of no significant impact. Chaff used (RR-188) is chaff designed to not interfere with FAA ATC or other radars. The flare minimum release altitude of 5,000 feet above mean sea level (MSL) that burn out in approximately 400 feet provides an estimated 4,000-foot safety margin to ensure that no burning material reaches the ground.

Flare plastic parts, felt spacers, and aluminum wrapping materials fall to the ground whenever a flare is deployed. An estimated one chaff or flare part falls on the ground for approximately each 5 acres per year. Observation of most flare or chaff residual materials would be an annoyance, with the exception of the S&I device from the Multi Jettison Unit (MJU)-7 A/B flare. This device would fall with the force of a large hailstone and could cosmetically dent a vehicle or injure an unprotected human. No cumulative effects are anticipated beyond those described in Section 3.3.3, Safety.

In terms of flight safety, when the additional F-16s were stationed at Shaw AFB, the recorded Class A mishap rate for F-16 aircraft was 3.59 per 100,000 hours of flight. Between 1994 and 2001, Shaw AFB experienced six Class A mishaps. There have been no Class A mishaps between 2001 and 2005. As the F-16 aircraft type has matured, the Class A mishap rate for this aircraft type has been reduced to the current statistic of 3.50 per 100,000 flying hours. The other major aircraft that may begin to use the Shaw-managed airspace is the Navy's F/A-18. This two-engined aircraft has demonstrated a safety rate of 3.34 Class A mishaps per 100,000 flying hours.

Class C airspace has been designated around Myrtle Beach International Airport to manage traffic using the airport. This controlled airspace encompasses a 10-NM radius around the airport. Myrtle Beach is located east of Shaw AFB and the controlled airspace abuts the eastern border of the current Gamecock B MOA. Since 2002, several initiatives have increased operations at this airport. A private heliport has been developed at the airport, and two additional commercial carriers (Northwest Airlines and Sprint Airlines) have begun providing scheduled service from the facility. All arrival and departure operations occur in the controlled airspace around the airport, and the additional commercial flights operate under IFR conditions, which means they are under positive control by ATC controllers at the airport. Considering these factors, no added impacts to flight safety would be anticipated. The Mitigated Proposed Action does not include the charting of any modifications or expansions to the Gamecock MOAs. Under the Mitigated Proposed Action, the existing Gamecock MOAs would be operated in accordance with current practices and procedures. Gamecock B MOA would not be returned to the NAS, but would remain as an operational MOA.

Airspace management, discussed above, describes the airports and exclusionary areas applied to the airports within the airspace. These exclusionary areas benefit airspace management and also benefit safety by creating a separation between military aircraft and civil aircraft within the vicinity of an airport.

Aircraft controllers have control over civilian and military aircraft within the MOAs. Within the Gamecock MOAs, aircraft traffic is actively routed at altitudes and separate MOA airspaces that avoid conflict. This may be accomplished by routing civil aviation through inactive airspace or closing down a specific MOA for a period to allow the transit of civil aircraft.

Expansion of Bulldog A in Alternative A and/or B would require that procedures be established in letters of agreement to allow IFR civil air traffic to operate at airports under Bulldog MOA when it was active, while providing for positive separation by ATC between military and civil aircraft.

Public comments expressed concern about general aviation pilots using the MOA under "see-and-avoid" conditions. Pilots who commented expressed concern that a MOA in active use for training was considered unsafe even under see-and-avoid conditions. Improved communication and situational awareness were identified by commenters as desired to improve the safety of general aviation within an active MOA. A case of a military training aircraft collision with a crop duster was cited as an example of the unsafe conditions that could exist in an active MOA. On January 18, 2005, an Air Tractor crop duster and an Air Force T-37B training jet collided mid-air over southwestern Oklahoma. The pilot of the crop duster was killed; the two Air Force pilots successfully ejected, with one of them sustaining minor injuries. An investigation was completed and the report finalized by the National Transportation Safety Board on July 31, 2006. The report determined the probable cause of the accident was the failure of the Air Tractor pilot and the T-37B pilot to maintain adequate visual lookout and did not maintain clearance from the other aircraft. Contributing factors to the accident were the lack of a transponder and radio in the Air Tractor and reduced visibility due to haze (National Transportation Safety Board 2006).

AIR QUALITY

Analyses of the potential impacts from other actions affecting the ROI have been or are currently being analyzed in separate NEPA documents. These actions are not directly related to the Mitigated Proposed Action evaluated in this EIS, but are additional actions identified by the installation.

Implementation of the Mitigated Proposed Action or an alternative would not have any long-term impacts to regional air quality. Private and public construction actions could result in emissions associated with construction activities and aircraft operations within the ROI. Air quality impacts from construction activities would be temporary and short-term in nature. As a result, cumulative impacts from the interaction of the proposed and alternative action with other actions are unlikely to contribute to degradation of air quality in the region. The Mitigated Proposed Action or an alternative action would result in insignificant increases in ground-level air pollutant concentrations within the ROI, and there would be no incremental effects from the Mitigated Proposed Action or an alternative when combined with other public or private action in the ROI.

PHYSICAL RESOURCES

No cumulative impacts to physical resources are expected from the Mitigated Proposed Action or an alternative. There would be no cumulative effects from the use of chaff or flares beyond the effects described in Section 3.5.3.

The only potential cumulative impact to physical resources could be from public or private construction occurring in the same areas as the proposed transmitter sites. The other components of ATI such as modifying airspace would not affect physical resources.

Construction upgrades to local airports would not be expected to occur in the same location or time frame as the transmitter site grading. Chaff and flare residual materials would not have cumulative effects upon physical resources. Such chaff and flare materials could result in a visible annoyance to an observer, but would not accumulate on the ground or in water bodies in quantities that could significantly affect soil or water quality.

The transmitter sites in Georgia do not conflict with any of the proposed projects listed in the cumulative resources Table 4.1-1. As part of the siting criteria described in Section 2.2.3, proposed locations for the transmitter sites will avoid areas adjacent to water bodies or wetlands.

BIOLOGICAL RESOURCES

No cumulative impacts to biological resources are expected from the Mitigated Proposed Action or alternatives. Changes in noise levels in the ATI proposal are very small and would not impact wildlife. No other military proposals in the ROI are expected to result in increased noise levels or have cumulative effects beyond those described in Section 3.2.3. Improvements to private or public airports in the vicinity of the ROI could result in increased air traffic through the ROI; however, the potential changes in noise levels are not expected to cumulatively be greater than described for the Mitigated Proposed Action or alternatives.

Construction of a new training transmitter site is expected to disturb 0.6 acre. Biological resources within the approximately 15 acre fenced area for each site could be affected by the fencing. Because training transmitter sites would likely be located on agricultural land, these sites would not be expected to contribute cumulatively to habitat loss or species endangerment in the region.

CULTURAL RESOURCES

The Mitigated Proposed Action and alternatives of the ATI encompass changes to airspace, chaff and flare use, and the installation of new training transmitters, three along the South Carolina coast and three inland in Georgia and South Carolina. There are no projected adverse effects to cultural resources as a result of the airspace or chaff use components of the Mitigated Proposed Action or Alternatives A or B. Although unlikely, the possible adverse impact to a historic structure resulting from falling MJU-7 A/B residual material could add to any adverse effects to cultural resources resulting from other projects, either recently completed, ongoing, or proposed within the ROI.

The installation of new training transmitters involves ground disturbing activities, which have the potential to adversely affect cultural resources. Preliminary examination of three potential locations for two training transmitters in Georgia identified an archaeological site at Magruder North, and an isolated artifact at Magruder South. Once the final training transmitter emitter locations have been selected, additional cultural resources visits will be conducted in coordination with the SHPO to identify and recover any significant archaeological information. In South Carolina, four general areas, one site under Gamecock C MOA and three sites along the coast, were analyzed for the placing of additional emitters in areas along roads and with access to utilities. If specific site locations are identified in the future, the AF would need to complete the EIAP, environmental baseline and cultural surveys, and NHPA Section 106 consultation. If avoidance of a cultural resource is not possible, this could result in an effect that could add to potential effects to cultural resources resulting from other projects, whether recently completed, ongoing, or proposed within the project area.

LAND USE

During public comment, the primary area of public concern for ATI conflict with land use plans was with airport plans under the area proposed for the expansion of Bulldog A. Commenters desired improved communication, exclusionary areas, and scheduling to avoid perceived potential conflicts between military training aircraft and planned airport upgrades designed to enhance community economies.

The Mitigated Proposed Action reduces the low-level training area when compared with the Draft EIS Proposed Action. The Final EIS Mitigated Proposed Action includes improved communication and airspace management and exclusionary areas to reduce the potential for land use and socioeconomic impacts. No specific aspects of ATI have been identified that would produce incremental land use impacts when added to other past, present, or reasonably feasible future actions. Land use, resource, and management plans for federal, state, and local lands under the ROI continue to be updated and revised. ATI is not inconsistent with the general mission and goals of these plans. Plans for airport improvements and expansion in specific locations, as described in Section 4.1.1.3, would not be affected by ATI elements. Actions on private lands affect very specific areas within each county and for the most part, the scope of the actions is focused. The cumulative effects of the Mitigated Proposed Action and alternatives would remain below the threshold of significance for land use and recreation resources.

SOCIOECONOMICS

The airspace modifications and related activities associated with the Mitigated Proposed Action are not expected to have any significant adverse impacts to regional populations or economic activity in the ROI. The overall effects on local airports have been presented in Section 3.1.3. Economic pursuits in the region, including those related to aviation activity, will have less Visual Flight Rules (VFR) flexibility but are planned to have IFR access. Airports with ILS systems would be under ATC and would not be affected. Regional economic activity is not expected to experience any major limitations or negative effects if the Mitigated Proposed Action were implemented separately or concurrently with cumulative actions. The public expressed concerns that Alternative A could have cumulative socioeconomic impacts as a result of constraints to airports under or near an expanded Bulldog A. The incremental effects of the ATI Mitigated Proposed Action, in combination with reasonably foreseeable future actions described in the previous sections, would not be expected to create any significant or adverse cumulative effects to socioeconomic resources in the region.

ENVIRONMENTAL JUSTICE

Airspace use and related activities associated with the ATI proposal are not expected to have any significant adverse impacts separately or cumulatively on minority or low-income communities. The incremental effects of this proposal, in combination with potential impacts associated with the reasonably foreseeable future actions described in the previous sections, would also not be expected to have any cumulative effects on children.

4.2 OTHER ENVIRONMENTAL CONSIDERATIONS

4.2.1 Relationship Between Short-Term Uses and Long-Term Productivity

CEQ regulations (Section 1502.16) specify that environmental analysis must address "…the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity." Special attention should be given to impacts that narrow the range of beneficial uses of the environment in the long-term or pose a long-term risk to human health or safety. This section evaluates the short-term benefits of the proposed alternatives compared to the long-term productivity derived from not pursuing the proposed alternatives.

A short-term use of the environment is generally defined as a direct consequence of a project in its immediate vicinity. Short-term effects could include localized disruptions and higher noise levels in some areas. Under the ATI Mitigated Proposed Action or an alternative, short-term uses of the environment would be negligible. There are no changes to the overall number of sorties flown by the 20 FW or the South Carolina ANG. Noise levels would increase in specific areas under the Bulldog C and E MOAs. Dispersion of the 20 FW and South Carolina ANG training flights into a larger volume of airspace is not expected to result in significant cumulative noise effects. The military training that occurs in the ATI airspace results in noise effects that are transitory in nature. Noise effects would be short term and would not be expected to result in permanent damage or long-term changes in wildlife and livestock productivity or habitat use.

The ATI proposal largely involves changes in airspace and would not significantly impact the long-term productivity of the land. Use of chaff and flares would not negatively affect the long-term quality of the land, air, or water. Airspace changes are procedural and do not affect long-term productive use of natural resources. Under the Mitigated Proposed Action and Alternative A, 96 acres could be fenced although fewer than 4 graded acres are projected to have a change in land use at the proposed training transmitter sites. Alternative B could affect land use on 48 acres. However, actual construction impacts would be restricted to about 0.9 acres at each site. Therefore, long-term productivity of the land would be affected on only 5.4 acres for the Mitigated Proposed Action and Alternative A and 2.7 acres for Alternative B. These acreages represent a negligible portion of the ROI.

4.2.2 Irreversible and Irretrievable Commitment of Resources

NEPA CEQ regulations require environmental analyses to identify "...any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented" (40 CFR Section 1502.16). Primary irreversible effects result from permanent use of a nonrenewable resource (e.g., minerals or energy). Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., disturbance of a cultural site) or consumption of renewable resources that are not permanently lost (e.g., old growth forests). Secondary impacts could result from environmental accidents, such as explosive fires. Natural resources include minerals, energy, land, water, forestry and biota. Nonrenewable resources are those resources that cannot be replenished by natural means, including oil, natural gas and iron ore. Renewable natural resources are those resources that can be replenished by natural means, including water, lumber and soil.

For the ATI Mitigated Proposed Action or an alternative, most impacts are short term and temporary, or longer lasting but negligible. Wildlife may be temporarily disturbed by construction activities at the training transmitter sites and some native vegetation may be lost; however, these sites are expected to primarily be located on agricultural land, thereby minimizing impacts to wildlife and native vegetation. Military training necessarily involves consumption of nonrenewable resources, such as fuel for vehicles and aircraft. However, training operations are not projected to change from current levels under ATI, so no net increase in energy consumption is expected. No irreversible or irretrievable effects are expected for cultural resources or other natural resources, including land and water.

Secondary impacts to natural resources could occur in the unlikely event of an accidental fire caused by an aircraft mishap or flare. However, while any fire can affect agricultural resources, wildlife, and habitat, the increased risk of fire hazard due to operations under the Mitigated Proposed Action or an alternative is very low.

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5.2 AIRPORTS CONTACTED

Refer to Appendix A for a list of airports contacted.

Some of the photos used in this document were provided by the William Hearn family, Sumter, South Carolina.

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7.0 GLOSSARY

Above Ground Level (AGL): Altitude expressed in feet measured above the ground surface.

Aerial Refueling Tracks (ARs): Aerial refueling operations are performed in designated aerial refueling tracks or FAA approved airspace.

Aerospace Expeditionary Force (AEF): An AEF is a group of different types of aircraft with a mix of capabilities suited to the tasking deployed overseas. There are ten AEFs in the Air Force, and consist of wings or squadrons from multiple United States bases, and may operate as a unit or be integrated with existing forces overseas.

Air Force Instruction (AFI): Air Force Instructions enforcing United States laws and regulations.

Air Combat Command (ACC): The Air Force Command that operates combat aircraft assigned to bases within the contiguous 48 states, except those assigned to Air National Guard and the Air Force Reserve Command.

Air Quality Control Region (AQCR): An administrative unit for monitoring and controlling air quality in a specific geographic area.

Air Traffic Control (ATC): The system used to safely direct aircraft in flight, using radar and controllers from both the Federal Aviation Administration and the military.

Air Traffic Control Assigned Airspace (***ATCAA):*** ATCAA is airspace, often overlying a Military Operations Area, extending from 18,000 feet MSL to an altitude assigned by the FAA. ATCAAs are released to military users by the Federal Aviation Administration only for time they are to be used, allowing maximum access o the airspace by civilian aviation.

Candidate Species: A species for which the United States Fish and Wildlife Service has sufficient information regarding the biological vulnerability of and threat(s) to that species to warrant a proposal to reclassify it as threatened or endangered (Formerly Category 1 Candidate species).

Chaff: Chaff is the term for small fibers of aluminum-coated mica packed into approximately 150 gram bundles and ejected by aircraft as a self-defense measure to reflect hostile radar signals.

Council on Environmental Quality (CEQ): The Council is an Executive Office of the President composed of three members appointed by the President, subject to approval by the Senate. Members are to be conscious of and responsive to the scientific, economic, social, aesthetic, and cultural needs of the nation; and to formulate and recommend national policies to promote the improvement of quality of the environment.

Day-Night Average Sound Level (DNL): Day-Night Average Sound Level is a noise metric combining the levels and durations of noise events and the number of events over an extended time period. It is a cumulative average computed over a 24-hour period to represent total noise exposure. DNL also accounts for more intrusive nighttime noise, adding a 10 dB penalty for sounds after 10:00 pm and before 7:00 am. Noise levels are calculated the same way for both DNL and DNLmr.

Decibel (dB): A sound measurement unit.

Defensive Countermeasures: Coordination of maneuvers and use of aircraft defensive systems designed to negate enemy threats. Those maneuvers (which include climbing, descending, and turning) requiring sufficient airspace to avoid being targeted by threat systems. Aircraft use sophisticated electronic equipment to jam air and ground radar-tracking systems and dispense chaff and flares to confuse hostile radar and infrared sensors.

Endangered Species: The Endangered Species Act of 1973, defined the term "endangered species" to mean any species (including any subspecies of fish or wildlife or plants, and any distinct population segment of any species or vertebrate fish or wildlife which interbreeds when mature) that is in danger of extinction throughout all or a significant portion of its range

Environmental Justice: As defined by Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, review must be made as to whether an action disproportionately impacts minority and/or low-income populations.

Flight Level (FL): The Flight Level refers to the altitude above MSL. FL230, for example, is approximately 23,000 feet MSL.

Inert Ordnance: Ordnance without explosive or incendiary material. This inert (non-explosive) ordnance is used by training aircrews authorized to verify that aircraft systems are functioning properly, without the use of live ordnance. Inert ordnance is only used at authorized air-to-ground training ranges.

Instrument Flight Rules (IFR): A standard set of rules that all pilots, civilian and military, must follow when operating under flight conditions that are more stringent than visual flight rules. These conditions include operating an aircraft in clouds, operating above certain altitudes prescribed by Federal Aviation Administration regulations, and operating in some locations like major civilian airports. Air traffic control agencies ensure separation of all aircraft operating under IFR.

Instrument Landing Systems (ILS): An ILS is a precision instrument approach system which normally consists of the following electronic components and visual aids: a Localizer, which provides course guidance to the runway; a designated glide slope, which provides vertical guidance during approach and landing; an Outer Marker which is a marker beacon at or near the glide slope intercept altitude of the published ILS approach. This is normally four to seven miles from the runway threshold, along the runway's extended centerline; a Middle Marker, which is a marker beacon along the glide slope at or near the point of decision height; and Approach Lighting conforming to FAA standards.

Onset-Rate Adjusted Monthly Day-Night Average Sound Level (DNLmr): Onset Rate-Adjusted Monthly Day-Night Average Sound Level is the measure used for subsonic aircraft noise in military airspace (MOAs or Warnings Areas). This metric accounts for the fact that when military aircraft fly low and fast, the sound can rise from ambient to its maximum very quickly. Known as an onset-rate, this effect can make noise seem louder due to the added "startle" effect. Penalties of up to 11 dB are added to account for this onset-rate. (See DNL above).

Maximum Sound Level (L_{max}): Maximum Sound Level is used to define peak noise levels. L_{max} is the highest sound level measured during a single aircraft overflight. For an observer, the noise level starts at the ambient noise level, rises up to the maximum level as the aircraft flies closest to the observer, and returns to the ambient level as the aircraft recedes into the distance.

Mean Sea Level (MSL): Altitude expressed in feet measured above average sea level.

Military Operations Area (MOA): Airspace below 18,000 feet MSL established to separate military activities from instrument flight rule traffic and to identify where these activities are conducted for the benefit of pilots using visual flight rules.

Military Training Route (MTR): A Military Training Route is a corridor of airspace with defined vertical and lateral dimensions established for conducting military flight training at airspeeds in excess of 250 nautical miles per hour.

Nautical Mile (nm): Equal to 1.14 statute miles.

National Environmental Policy Act (NEPA): The National Environmental Policy Act of 1969 directs federal agencies to take environmental factors into consideration in their decisions.

National Historic Preservation Act (NHPA): The NHPA of 1966, as amended, established a program for the preservation of historic properties throughout the United States.

Non-Parasitic Flare: This type of flare incorporates a mechanism to prevent ignition of the pellet in the case. It includes a push button and spring, a firing pin, and a primer assembly. When ignited by the firing pin, the primer assembly fires the ignition charge, which fires the output charge, which ignites the flare pellet. This type of flare is likely to produce the largest number of duds, albeit infrequently, and the most residual materials due to the complexity of the ignition process.

Ordnance: Any item carried by an aircraft for dropping or firing, including but not limited to, live or inert bombs, ammunition, air-to-air missiles, chaff, and flares.

Parasitic Flare: This type of flare is ignited in the aluminum case before it leaves the aircraft by holes in the piston that permit the ignitor gases to contact the first fire mixture on top of the flare pellet. Should ignition of the flare not occur, the flare would not be ejected from the aircraft. This type of flare is less likely than the Non-Parasitic flare to produce duds.

Restricted Areas: A restricted area is designated airspace that supports ground or flight activities that could be hazardous to non-participating aircraft.

Semi-Parasitic Flare: This type of flare has a two-stage ignition sequence where, typically, the first stage ignition occurs in the aluminum case before it leaves the aircraft, which ejects the flare pellet. Once the pellet is ejected, the first stage burn then ignites the Infrared (IR) decoy compound (second stage). This system is safer for combat aircrews than the Parasitic system. Should ignition of the flare not occur, the flare would not eject. This type of flare is also less likely than the Non-Parasitic flare to produce duds.

Sonic Boom: A sonic boom is the noise created when an object breaks the sound barrier.

Sortie: A sortie is a single flight, by one aircraft, from takeoff to landing.

Sortie-Operation: The use of one airspace unit (e.g., Military Operations Area or Warning Area) by one aircraft. The number of sortie-operations is used to quantify the number of uses by aircraft and to accurately measure potential impacts; e.g. noise, air quality, and safety impacts. A sortie-operation is not a measure of how long an aircraft uses an airspace unit, nor does it indicate the number of aircraft in an airspace unit during a given period; it is a measurement for the number of times a single aircraft uses a particular airspace unit. In this EIS, it is also a measurement of the number of different missions or tactics conducted by an aircraft within an airspace block.

Sound Exposure Level (SEL): Sound Exposure Level (SEL) accounts for both the maximum sound level and the length of time a sound lasts. SEL does not directly represent the sound level heard at any given time. Rather, it provides a measure of the total sound exposure for an entire event averaged over 1 second.

State Historic Preservation Office (SHPO): State department responsible for assigning protected status for cultural and historic resources.

Threatened Species: A species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Traditional/Cultural Resource: Cultural and traditional resources are any prehistoric or historic district, site or building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious or other purposes.

Training Transmitter: Provides electronic signatures that simulate ground-based "enemy" radar systems, threaten pilots during training, and require pilots to take defensive actions for self-protection.

Visual Flight Rules (VFR): A standard set of rules that all pilots, both civilian and military, must follow when not operating under instrument flight rules. These rules require that pilots remain clear of clouds and avoid other aircraft. See instrument flight rules.

Visual Routes (VR): Routes used by military aircraft for conducting low-altitude, high speed navigation, and tactical training. These routes are flown under Visual Flight Rules.

Wetland, Jurisdictional: A jurisdictional wetland is a wetland that meets all three United States Army Corps of Engineers criteria for jurisdictional status: Appropriate hydrologic regime, hydric soils, and facultative to obligate wetland plant communities under normal growing conditions provided the wetland is connected to navigable waters of the United States.

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NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
O_3	ozone
OLF	Outlying Landing Field
ORE	Operational Readiness Exercise
ORI	Operational Readiness Inspection
P.L.	Public Law
P/CG	Pilot/Controller Glossary
PAI	Primary Assigned Inventory
Pb	lead
PCPI	per capital personal income
PEL	permissible exposure level
PM_{10}	particulate matter less than 10 micrometers in diameter
$PM_{2.5}$	particulate matter less than 2.5 micrometers in diameter
PMAI	Primary Mission Aircraft Inventory
ppm	parts per million
PSD	prevention of significant deterioration
PTA	Poinsett Transition Area
Q-D	Quantity-Distance
RCO	Range Control Officer
RF	radio frequency
ROD	Record of Decision
ROI	region of influence
S&I	Safe and Initiation
SAT	Surface Attack Tactics
SCDHEC	South Carolina Department of Health and Environmental Control
SCIAA	South Carolina Institute of Archaeology and Anthropology
SEAD	Suppression of Enemy Air Defenses
SEL	Sound Exposure Level
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	sulfur dioxide
SO_x	sulfur oxides
SR	State Route
SUA	Special Use Airspace
TI	Tactical Intercept
TSP	Total Suspended Particulates
U.S.	United States
USACE	United States Army Corps of Engineers
AFCENT	United States Air Forces Central Command
ARCENT	United States Army Central Command
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTBNI	Up To But Not Including
VA	Veteran's Administration
VFR	Visual Flight Rules
VOC	volatile organic compound
VR	Visual Route
WINDO	Wing Infrastructure Development Outlook