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Federal Aviation Administration
Cooperating Agency

Environmental Assessment

for

Proposed Military Operations Areas in Eastern North Carolina

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Abstract

This Environmental Assessment (EA) identifies and evaluates the potential effects of enhancing existing and future training opportunities for the Second Marine Aircraft Wing (2d MAW) and other aircraft operating out of Marine Corps Air Station Cherry Point. The proposed action is to create two functionally independent Military Operations Areas (MOAs), one of which would meet the need for high-speed entry and exit of aircraft along the coastline and the other would meet the need for additional training space. While each of these MOAs would have beneficial stand-alone training value, implementing both would provide the greatest improvement to the quality of aviation training for aircraft operating out of Marine Corps Station Cherry Point. The EA evaluates five alternatives, in addition to the No Action Alternative. These alternatives include: Core and Mattamuskeet MOAs, Core and Cherry MOAs, Core MOA, Mattamuskeet MOA, and Cherry MOA. The Marine Corps is not proposing to create all of these MOAs; rather, at most the Marine Corps desires to create two (Core plus one other).

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EXECUTIVE SUMMARY

This environmental assessment (EA) has been prepared by the Department of the Navy pursuant to the National Environmental Policy Act (NEPA) of 1969 and its regulations implementing NEPA as contained in 32 Code of Federal Regulations (CFR) 775. The Department of the Navy is the lead agency for the proposed action with the Federal Aviation Administration (FAA) serving as a cooperating agency. The intent of this EA is to assess the potential environmental effects of establishing new special use airspace (SUA) in eastern North Carolina in the form of Military Operations Areas (MOAs).

S.1 Description of Proposed Action and Alternatives

The purpose of the proposed action is to create two functionally independent MOAs that would enhance existing and future training opportunities for the Second Marine Aircraft Wing (2d MAW) and other aircraft operating out of MCAS Cherry Point. While each of these MOAs would meet the training needs of the Marine Corps as well as have beneficial stand-alone training value, implementing both MOAs would provide the greatest improvement to the quality of aviation training for aircraft operating out of MCAS Cherry Point.

The first of the proposed MOAs would provide a capability to conduct tactically realistic high-speed ingress (sea-to-land) and egress (land-to-sea) operations at altitudes above 3,000 ft (914 m) mean sea level (MSL). This MOA would eliminate the "speed bump" that is currently imposed when a pilot flying at an altitude greater than 3,000 ft (914 m) MSL but less than 10,000 ft (3,048 m) MSL and greater than 250 knots (kt) in W-122, for example, must pass through non-SUA along the North Carolina coastline in order to reach R-5306A. Only one alternative, referred to herein as the proposed Core MOA, is available to meet this particular Marine Corps training need.

The second proposed MOA would provide a capability to conduct essential aviation training activities that do not require restricted airspace but for safety reasons need to occur in a MOA. Principal requirements for this MOA are that it provide sufficient space for air combat training maneuvers and that it connect to other SUA in eastern North Carolina. The alternatives evaluated in this EA, that meet this particular training need, are the proposed Mattamuskeet and Cherry MOAs.

In addition to evaluating the alternatives individually, combinations of the alternatives are also analyzed in this EA. The combinations considered are the Core and Mattamuskeet MOAs and the Core and Cherry MOAs. Of the alternatives evaluated, the Core and Mattamuskeet MOAs alternative is preferred by the Marine Corps.

S.1.1 Core and Mattamuskeet MOAs Alternative

This alternative would result in the establishment of both the Core and Mattamuskeet MOAs. The proposed Core MOA would overlie a portion of North Carolina's Core Banks (Carteret County),

extending 35 nautical miles (NM) (65 kilometers [km]) along the Core Banks from about 8 miles (13 km) northeast of the Cape Lookout lighthouse to about 1.25 miles (2 km) from the eastern end of Portsmouth Island. The MOA would also extend about 3 NM (6 km) to the southeast over the Atlantic Ocean. The floor of the proposed SUA would be at 3,000 ft (914 m) and the ceiling would be at 17,999 ft (5,486 m). When in use, Navy aircraft would only transit the proposed Core MOA to access other over water and over land training areas.

The proposed Mattamuskeet MOA would overlie portions of North Carolina's Beaufort, Hyde, Pamlico, Tyrell, and Washington Counties, with approximate dimensions of 25 by 30 miles (46 by 56 km). The floor and ceiling of the Mattamuskeet MOA would be the same as identified for the proposed Core MOA. Air operations within the proposed Mattamuskeet MOA would involve high-speed air combat maneuvers and training activities.

S.1.2 Core and Cherry MOAs Alternative

This alternative would implement the Core MOA (as described in S.1.1 above) and the Cherry MOA. The Cherry MOA would include airspace with the approximate dimensions of 25 by 30 miles (46 by 56 km) situated over portions of Beaufort, Craven, Hyde, Pamlico and Washington Counties of North Carolina. The floor and ceiling of the Cherry MOA would be the same as identified for the proposed Mattamuskeet MOA.

S.1.3 Core MOA Alternative

This alternative would implement the Core MOA as described in S.1.1.

S.1.4 Mattamuskeet MOA Alternative

This alternative would implement the Mattamuskeet MOA as described in S.1.1.

S.1.5 Cherry MOA Alternative

This alternative would implement the Cherry MOA as described in S.1.2.

S.2 No Action Alternative

The No Action Alternative is defined as not establishing new SUA in eastern North Carolina. As a result, the training limitations associated with existing SUA would continue. Marine Corps aircraft would continue existing training flight activities over the Core Banks and in the Cherry and

Mattamuskeet areas at airspeeds below 250 kt when at altitudes less than 10,000 ft (3,048 m) MSL, in accordance with FAA regulations (14 CFR 91). Furthermore, overflights of wilderness areas and noise sensitive areas (including national parks and national recreational areas) would continue to occur. As required by Chief of Naval Operations Instruction 3710.7, aircraft would operate over these areas at an altitude no lower than 3,000 ft (914 m) MSL, except when training activities are conducted on a military training route or within existing SUA.

S.3 Environmental Impacts of Proposed Action

This EA provides a generalized overview of the affected environment within the MOAs project footprint, as well as extended discussions on those environmental factors that could be potentially affected by aircraft overflights. Implementation of any of the alternatives or selection of the No Action Alternative would result in no significant environmental impacts with respect to:

- **Safety and Hazardous Materials Management -** Existing management practices regarding these impact categories would continue into the future and adherence to existing environmental and safety procedures and policies would avoid potential adverse impacts.

- **Cultural Resources -** Aircraft noise generated in the MOAs would not be sufficient to damage a historic structure; furthermore, the brief and transitory nature of aircraft noise and overflights would not adversely impact qualities of integrity or affect a property's eligibility for listing in the National Register of Historic Places.

- **Socioeconomics and Community Facilities -** Impacts to socioeconomic resources would not be significant as there would be no new permanent or temporary personnel, no realignment or construction of military facilities, and related shifts in spending, housing, or populations distribution would not occur.

- **Land Use and Coastal Zone Management** - The proposed action would not result in the displacement, alteration, or otherwise physically affect residential, commercial, industrial, or government facilities. Additionally, the proposed action would be undertaken in a manner fully consistent with applicable enforceable coastal zone management policies of the state of North Carolina. Thus, there would be no direct impacts on land use resources and management.

- **Air Quality** - The likelihood for air quality impacts associated with the proposed MOAs was evaluated based on their floor altitude (3,000 ft [914 m] MSL). This floor is the same as the mixing height for pollutants (USEPA, 1992). Thus, all flight activities would occur consistently (100 percent) above the mixing height of 3,000 ft (914 m) MSL for all proposed MOAs. As a result, pollutants from aircraft operations in the MOAs would be dispersed and there would be no significant impact on ground-level air quality conditions.

The potential for environmental impacts in other areas is discussed below.

S.3.1 Core and Mattamuskeet MOAs Alternative

Airspace and Military and Civilian Aircraft Operations

The only changes to existing controlled or uncontrolled airspace in eastern North Carolina would be the establishment of the Core and Mattamuskeet MOAs. The use of the proposed MOAs would be scheduled by MCAS Cherry Point, which would continue to provide radar air traffic control services for both military and civilian aircraft for all SUA under its jurisdiction, including the proposed MOAs, and would control entry and exit (i.e., radar containment services) from the MOAs and for other SUA.

Military aircraft operations would increase under this alternative when compared to the No Action Alternative. Sorties would be flown over the Core Banks as well in the area overlying Lake Mattamuskeet that is within the boundaries of the proposed Mattamuskeet MOA. The annual number of sorties that would be flown within the Core and Mattamuskeet MOAs would be 1,460 and 2,423, respectively. Flight operations in each MOA would be unstructured (i.e., random and widely dispersed), as no specific flight tracks would exist. However, the Marine Corps would be imposing restrictions on flight operations within the Core MOA: (1) flights will be perpendicular to (i.e., across) the Core Banks, not parallel to the island; and (2) there would be no lingering of aircraft within the proposed Core MOA.

For the Core MOA, about 35 percent of the sorties would be conducted between 3,000 ft (914 m) and 5,000 (1,524 m) ft MSL; 45 percent would occur between 5,000 ft (1,524 m) and 10,000 ft (3,048 m) MSL; and the remaining 20 percent would be conducted between 10,000 ft (3,048 m) and 18,000 ft (5,486 m) MSL. The altitude distribution projected for the Mattamuskeet MOA shows 25 percent of sorties would occur between 3,000 ft (914 m) and 10,000 ft (3,048 m) MSL and 75 percent would occur above 10,000 ft (3,048 m) MSL.

When scheduled for use, the proposed MOAs would affect “boxes” of airspace between 3,000 ft (914 m) and 18,000 ft (5,486 m) MSL. These altitude restrictions would allow for minimal potential conflicts between nonparticipatory civil aircraft operations and military operations within the MOAs because civil aircraft operations would be able to continue to occur at all times below the floor of the MOA and above the ceiling without restriction. This would be compatible with existing commercial jet routes, which are above the 18,000 ft (5,486 m) MSL ceiling proposed for the Core and Mattamuskeet MOAs.

General aviation aircraft would continue to be able to fly at all times at altitudes up to 3,000 ft (914 m) MSL. Fixed-wing aircraft, helicopters, ultralight vehicles, balloons, and gliders that would fly over the national wildlife refuges that lie beneath the proposed Mattamuskeet MOA are subject to voluntary minimum altitudes of 2,000 ft (610 m) MSL. Several factors, however, are in place that would reduce the potential for significant impact:

- The proposed Core and Mattamuskeet MOAs would be considered in use (i.e., "active") only when scheduled by military aircraft. When not active, the use of the airspace would be available to all non-military aviation users.

- Even if a MOA was active, a nonparticipatory aircraft would still be allowed to enter and fly through the airspace when the pilot was (1) flying Instrument Flight Rules (IFR) and IFR separation could be provided by MCAS Cherry Point Radar and Air Traffic Control Facility (otherwise, the pilot would be rerouted around the MOA); or (2) flying Visual Flight Rules and the pilot was using "see and avoid" techniques.

MCAS Cherry Point RATCF would insure that military aircraft engaged in training exercises would cause no "spillouts" from the MOA.

No public airports are located within the land areas underlying either the proposed Core or Mattamuskeet MOAs. Activities that may occur at private air strips (Riverside in Leachville and Hodges in Sladesville) situated beneath the proposed MOA airspace would not be affected as the floor of the proposed MOA would be at 3,000 ft (914 m) MSL.

Noise

Noise impacts from aircraft flight operations were considered from both physiological and behavioral perspectives, including: annoyance (measured by consideration of the Day-Night Average Sound Level [L_{dn}] of 65 decibels [dB]); speech interference; sleep disturbance; and effects on domestic animals and wildlife. The 65 dB L_{dn} guideline is the best available measure for determining noise impacts on airport communities. Noise generated by subsonic flight operations within the proposed MOAs was studied through the use of computerized noise models. Results of the modeling showed that there were no significant noise impacts among the alternatives. The average L_{dnmr} (a variation of the L_{dn} noise metric) noise levels for all the alternatives were below 50 dB.

Natural Resources

Natural resources impacts are summarized as follows:

- **Water Resources** - Implementation of the Core and Mattamuskeet MOAs Alternative would not affect water resources in eastern North Carolina as overflights would cause no direct disturbances to surface water resources to the Pamlico Sound and its tributaries.

- **Wildlife** - Issues examined as a result of aircraft overflights within the proposed MOAs include: noise disturbance to wildlife; visual disturbance (startle response) to wildlife; and bird/aircraft strike hazards (BASH). As part of the assessment of the impacts of the proposed action on wildlife and fisheries in this EA, the Department of the Navy has coordinated with federal and state agencies under the Endangered Species Act (ESA) of 1973. The only potential impact would be the flushing of swans and geese that winter in the National Wildlife Refuges that underlie the Mattamuskeet

and Cherry MOAs. Although the avian wildlife in the region may be somewhat habituated to overflights of many kinds, and not negatively affected by them, the number of overflights would increase, which may result in more frequent flushing.

- **Threatened and Endangered Species** - The potential impacts that implementation of the proposed Core and Mattamuskeet MOAs may have on each of the threatened or endangered species within them has been examined in detail in this EA. In summary, the results of this analysis indicate that the implementation of this proposed alternative would not have any significant impact on any federally-listed threatened or endangered species.

- **Vegetation and Wetlands** - No earth disturbance or construction would occur as a result of implementation of the proposed airspace. Therefore, there would be no impacts to vegetation or wetlands.

S.3.2 Core and Cherry MOAs Alternative

Airspace and Military and Civilian Aircraft Operations

The level of military aircraft operations, including the estimated altitude distributions that would occur under this alternative would be the same as previously described for the Core and Mattamuskeet MOAs Alternative. The potential for effects on nonparticipating civil aircraft operations from the military aviation training operations would also be the same as previously described for the Core and Mattamuskeet MOAs Alternative, except for the potential for conflicts between operations of the proposed Cherry MOA and civilian aviation activities on V 139 (outbound to the north from Craven County Regional Airport). This airway provides for northerly navigation to Norfolk, Virginia. Aircraft traveling along this route would be rerouted by Cherry Point RATCF when operations were being conducted in the proposed MOA with minimal impacts in terms of fuel costs and time. As a result, there would be minimal impact on nonparticipating civilian aircraft operations.

No public airports are located within the land areas underlying either the proposed Core or Cherry MOAs. However, three private air strips (Lee Creek in Aurora, Hodges in Sladesville, and Welbourn-Woolard in Vanceboro) are situated beneath the proposed MOA airspace. The 3,000-ft (914-m) MSL floor of the proposed MOA would provide sufficient separation between aviation activities conducted on or in proximity of these private airstrips such that there would be no impact to non-military civilian aviation operations.

Noise and Natural Resources

As with the Core and Mattamuskeet MOAs, implementation of the Core and Cherry MOAs is not expected to have a significant impact.

S.3.3 Core MOA Alternative

Airspace and Military and Civilian Aircraft Operations

Implementation of the Core MOA Alternative would result in 1,404 day sorties and 56 night sorties conducted over the Core Banks (Table 4.1-3). This would equate to about 6 sorties of one minute duration per 24-hour period (assuming 260 training days per year). Cumulatively, the Core MOA would be used for a total of about 24 hours per year (5.6 minutes per training day). There would be no potential to adversely affect nonparticipating civil aircraft operations as a result of establishing the proposed Core MOA for military aviation training operations because the level of projected operations is low and there are no public or private airports located in the land areas underlying the proposed MOA; neither would this alternative conflict with any established federal airways.

Noise and Natural Resources

As with the Core and Mattamuskeet MOAs, implementation of the Core MOA is not expected to have a significant impact.

S.3.4 Mattamuskeet MOA Alternative

Airspace and Military and Civilian Aircraft Operations

The establishment of the proposed Mattamuskeet MOA Alternative would result in a projected 2,423 sorties per year (2,347 day sorties, and 76 night sorties). This would equate to 9.3 sorties per day where the average duration of each sortie would be about 45 minutes. Total average flight time per training day would thus be about 7 hours. The potential for effects on nonparticipating civil aircraft operations and airports from the military aviation training operations that would be conducted in the proposed MOA would be the similar to those previously described for the Core and Mattamuskeet MOAs Alternative.

Noise and Natural Resources

As with the Core and Mattamuskeet MOAs, implementation of the Mattamuskeet MOA is not expected to have a significant impact.

S.3.5 Cherry MOA Alternative

Airspace and Military and Civilian Aircraft Operations

The establishment of the proposed Cherry MOA Alternative would be the same as described for the proposed Mattamuskeet MOA Alternative -- a projected 2,423 sorties per year (2,347 day sorties, and 76 night sorties). The potential for effects on nonparticipating civil aircraft operations and airports

from the military aviation training operations that would be conducted in the proposed MOA would be the similar to those previously described for the Core and Cherry MOAs Alternative.

Noise and Natural Resources

As with the Core and Mattamuskeet MOAs, implementation of the Cherry MOA is not expected to have a significant impact.

S.4 Conclusions

In conclusion, the proposed action would not result in significant impacts with regard to any of the issues investigated in this EA. The proposed action would comply with existing federal regulations and with state, regional, and local policies and programs. The proposed action would be in compliance with all applicable federal acts, executive orders, and policies.

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
ACHP	Advisory Council on Historic Preservation
ACM	Air Combat Maneuver
AFB	Air Force Base
AGL	Above Ground Level
AICUZ	Air Installation Compatible Use Zone
APE	Area of Potential Effect
AQCR	Air Quality Control Region
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATCAA	Air Traffic Control Assigned Airspace
BASH	Bird/Aircraft Strike Hazard
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CAMA	Coastal Area Management Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Carbon Monoxide
COMCABEAST	Commander Marine Corps Bases East
CONUS	Continental United States
CWA	Clean Water Act
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Plan
dB	Decibel
dB(A)	A-weighted decibel scale
DNL	Day-Night Average Sound Levels
DoD	US Department of Defense
DOI	US Department of the Interior
DoN	US Department of Navy
DOT	US Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	US Environmental Protection Agency
ESA	Endangered Species Act
EW	Electronic Warfare
FAA	Federal Aviation Administration
FACSFAC	Fleet Area Control and Surveillance Facility
FAR	Federal Aviation Regulation
FICAN	Federal Interagency Committee on Aviation Noise

ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
FL	Flight Level
FLIP	Flight Information Publication
FR	Federal Register
FRS	Fleet Replacement Squadron
ft	Feet
FY	Fiscal Year
GIS	Geographic Information System
IFR	Instrument Flight Rules
JTFEX	Joint Task Force Exercise
KIAS	Knots Indicated Air Speed
Laser	Light Amplification through Stimulation of Emitted Radiation
L_{dnmr}	Onset-rate adjusted Day-Night Sound Level
MACG	Marine Air Control Group
MAEWR	Mid-Atlantic Electronic Warfare Range
MAG	Marine Air Group
MAGTF	Marine Air-Ground Training Force
MAW	Marine Air Wing
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MEU	Marine Expeditionary Unit
mm	millimeter
MMPA	Marine Mammals Protection Act
MOA	Military Operations Area
MSL	Mean Sea Level
MWSG	Marine Wing Support Group
MTR	Military Training Route
NAAQS	National Ambient Air Quality Standards
NAS	Naval Air Station
NASMOD	Navy Aviation Simulation Model
NAVAID	Navigational Aid
NAVFACENGCOM	Naval Facilities Engineering Command
NC	North Carolina
NEPA	National Environmental Policy Act
NFS	National Forest Service
NHPA	National Historic Preservation Act
NM	Nautical Mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent

ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
NOTAM	Notice to Airmen
NPS	National Park Service
NWI	National Wetland Inventory
NWR	National Wildlife Refuge
OLF	Outlying Landing Field
OPNAVINST	Navy Operational Instruction
Pb	Lead
PL	Public Law
PM10	Particulate matter 10 microns or less in diameter
ppm	parts per million
R-XXXX	Restricted Area
RATCF	Radar Air Traffic Control Facility
RF	Radio Frequency
ROI	Region of Influence
SAR	Search and Rescue
SEL	Sound Exposure Level
SIMMOD	FAA's Airfield and Airspace Capacity Model
SIP	State Implementation Plan
SHPO	State Historic Preservation Officer
SOP	Standard Operating Procedure
sq ft	Square Feet
SUA	Special Use Airspace
TACTS	Tactical Aircrew Combat Training System
TSP	Total Suspended Particulates
T&R	Training and Readiness
TYCOM	Type Commander
UAV	Unmanned Aerial Vehicle
USAF	United States Air Force
USC	United States Code
USEPA	United States Environmental Protection Agency
USFS	United States Forestry Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USMC	United States Marine Corps
USN	United States Navy
VACAPES	Virginia Capes
VFR	Visual Flight Rules
V-XX	Victor Route
W-XXX	Warning Areas

1 PURPOSE AND NEED

The US Marine Corps proposes to enhance existing and future training opportunities for the Second Marine Aircraft Wing (2d MAW) and other aircraft operating out of Marine Corps Air Station (MCAS) Cherry Point. This would be achieved by establishing new special use airspace (SUA) in eastern North Carolina. The SUA would provide the following training enhancements: (1) high speed ingress/egress from a Warning Area over the Atlantic Ocean into existing restricted airspace at a minimum altitude of 3,000 feet (ft) (914 meters [m]) mean sea level (MSL) and at speeds less than supersonic; and (2) additional room for military aircraft to perform required training activities and maneuvers (adjacent to but outside of existing restricted airspace and associated target areas). With these training enhancements, limitations in existing aviation training airspace would be reduced, thereby meeting the need of 2d MAW aviators and pilots from other military services to effectively acquire and maintain the critical skills essential to air combat, now and in the future.

This environmental assessment (EA) has been prepared by the Department of the Navy pursuant to the National Environmental Policy Act (NEPA) of 1969 and its regulations implementing NEPA as contained in 32 Code of Federal Regulations (CFR) 775. The Department of the Navy is the lead agency for the proposed action, with the Federal Aviation Administration (FAA) serving as a cooperating agency in accordance with a January 26, 1998 Memorandum of Understanding.

1.1 Background

The Marine Corps is proposing to establish new SUA in eastern North Carolina. This subchapter provides background on the nature of SUA, its importance in military aviation training, and the limitations of the existing SUA in eastern North Carolina, and includes a discussion of MCAS Cherry Point and its mission.

1.1.1 Defining Special Use Airspace

Simply put, airspace is the three-dimensional space above the earth's surface where buildings protrude and aircraft are operated. Airspace is a finite resource and is managed by the FAA for the use of all aviation sectors needing access -- commercial, general, and military. The National Airspace System is designed to accommodate these users without imposing unreasonable restrictions on any one sector of aviation. The FAA achieves this by:

- Establishing rules that specify how aircraft must be operated.

- Establishing classes of airspace and airways that identify where aircraft may or may not fly.

- Providing air traffic control (ATC) services that help aircraft operate in a safe and orderly manner.

In its design, the National Airspace System bears some similarities to the nation's highway system. For example, just as a road atlas depicts the road network, cities, and large institutional land uses for use in vehicular travel direction, the location and dimensions of airways and different types of airspace are shown in Flight Information Publications (FLIPs) and aeronautical charts for use in aviation routing. Likewise, just as traffic rules and laws specific to a road or interstate must be obeyed by individuals operating automobiles, flight rules and air traffic control procedures dictate how pilots fly in each designated airspace.

Allowable airspeeds and altitudes are subject to FAA rules found in 14 CFR 91 (Subchapter F, General Operating and Flight Rules). These regulations state that an aircraft may not be operated below 10,000 ft MSL (3,048 m) at airspeeds exceeding 250 knots (kt) (288 miles per hour) (14 CFR 91.117). Furthermore, as identified in 14 CFR 91.119, except when necessary for takeoff or landing, an aircraft must be operated such that:

- If a power unit fails, the altitude at which the aircraft is being operated allows for an emergency landing without undue hazard to persons or property on the surface.

- An aircraft operated over any congested area of a city, town, or settlement, or over any open air assembly of persons, maintains an altitude of 1,000 ft (305 m) above the highest obstacle within a horizontal radius of 2,000 ft (610 m) of the aircraft.

- An aircraft operated over other than congested areas must maintain an altitude of 500 ft (152 m) above the surface, except over open water or sparsely populated areas. In those cases, the aircraft may not be operated closer than 500 ft (152 m) to any person, vessel, vehicle, or structure.

- Helicopters may be operated at less than the minimums previously prescribed if the operation is conducted without hazard to persons or property on the surface.

Special Use Airspace is the exception to the operating and flight rules listed above. When operating within SUA, military aircraft can fly at greater speeds and lower altitudes than specified by FAA rules. Special use airspace was developed to identify areas where military activity or unusual flight conditions may occur and serves to alert a nonparticipating aircraft (civilian or military) to the possible presence of these activities. Thus, the safety of all users is assured. There are five types of SUA: prohibited areas, restricted areas, warning areas, military operations areas, and controlled firing areas. Additionally, military training routes (MTRs) are

classified by the FAA as airspace for special use. General descriptions of these types of airspace are shown in Table 1-1.

Procedures for establishing SUA and other areas for special use are contained in the current editions of FAA Order 7400.2 (*Procedures for Handling Airspace Matters*) and FAA Handbook 7610.4 (*Special Military Operations*). The latter handbook was developed jointly by the Department of Defense (DoD) and the FAA.

1.1.2 The Importance of SUA in Military Aviation Training

Maintaining the readiness and sustainability of US Armed Forces is the "number one priority" of DoD, a commitment that has been and continues to be reflected in DoD's budgets and plans for future years. The ability to fly, train, and operate in SUA is vital to maintaining and achieving a high state of operational readiness among Marine Corps aviators. These airspaces provide military aviators with an opportunity to learn and practice the skills needed during combat by safely separating them from other air traffic. Two principal skills that must be attained during these training missions are:

- Expertise with the high technology operating and weapons systems associated with modern tactical aircraft.
- Mastery of real-world tactics.

Not only do today's weapons platforms and weapons systems go farther and faster, they are increasingly more accurate and capable than those of the past. In addition, the advent of new technology development in microelectronics, computers, communications, and sensors has greatly increased the complexity and sophistication of on-board aircraft operating systems. Furthermore, as perceived threats and national defense strategies change and new weapons systems become available to meet these threats, existing tactics must be updated and new innovative tactics developed and regularly and routinely tested.

Developing proficiency in using existing and improved weapons systems, as with nearly any skill, requires frequent and repetitive practice. Mastering complicated tactical equipment, particularly current high technology operating and weapons systems, is more than mere repetition of a series of exercises. Training with these systems (aircraft and weapons) must be intensive and realistic, replicating the realities and stresses imposed under actual combat conditions. A general description of the in-flight military training activities for which the Marine Corps is proposing to establish SUAs is shown in Table 1-2.

Table 1-1

Airspace Definitions Referenced in this EA

Airspace Designation	Definition
Controlled Firing Area	Airspace established to contain activities which, if not conducted in a controlled environment, would be hazardous to nonparticipating aircraft (e.g., airspace overlying an artillery range).
Military Operations Area (MOA)	MOAs consist of airspace of defined vertical and lateral limits established for the purpose of separating certain military training activities (such as air combat maneuvers, intercepts, acrobatics, etc.) from instrument flight rules (IFR) air traffic. Whenever a MOA is being used, nonparticipating IFR traffic may be cleared through the MOA if IFR separation can be provided by air traffic control. Otherwise, air traffic control will reroute or restrict nonparticipating IFR air traffic. Pilots operating under visual flight rules (VFR) should exercise extreme caution while flying within a MOA when military activity is being conducted. The activity status (active/inactive) of MOAs may change frequently. Therefore, pilots should contact any flight service station within 100 miles (161 kilometers) of the area to obtain accurate real-time information concerning the MOAs' hours of operation. Prior to entering an active MOA, pilots should contact the controlling agency for traffic advisories.
Prohibited Area	Airspace within which no person may operate an aircraft without authorization from the using agency. Prohibited areas have been established over sensitive ground facilities such as the White House, Presidential homes, Camp David, etc.
Restricted Area	Restricted areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants.
Warning Area	Airspace generally beginning three nautical miles (5.6 kilometers) off the US coast and extending over international waters. Warning areas contain the same kind of hazardous flight activity to nonparticipating aircraft as restricted areas. A warning area may be located over domestic or international waters or both.
Military Training Routes (MTR)	Routes established generally below 10,000 ft MSL for use by military aircraft to conduct low-altitude, high-speed navigation, and tactical training at airspeeds in excess of 250 knots. A MTR is made up of several route segments with each individual segment having a designated route width and vertical altitude block within which the aircraft using the route must remain. There are two types of MTRs -- IR Routes (Instrument Flight Rules) and VR Routes (Visual Flight Rules). MTRs designated as VR Routes require that all flights be conducted in accordance with visual flight rules except that flight visibility shall be five miles or more, and no flights will be conducted below a ceiling of less than 3,000 ft AGL.
Sources: 14 CFR Subchapter 1, Part 1 (Definitions and Abbreviations), January 1, 2000.	

Table 1-2

Description of Types of Training Activities

Action	Description
Close Air Support	A ground attack mission against enemy targets in proximity to friendly troops, closely coordinated with and controlled by an airborne or ground forward air controller.
Short- and Long-Range Interdiction	A mission to attack a ground target that has been identified in enemy territory. Short-range interdictions might involve breaking up a supply line or reinforcements to enemy lines, whereas long-range interdictions might involve bombing a target that requires much deeper penetration into the enemy area.
Fighter Escort	Aircraft armed with air-to-air weapons for the purpose of engaging and destroying enemy aircraft. The fighter escort provides protection for strike aircraft in order that the strike aircraft may successfully attack enemy ground targets. This combination is known as a “strike package.”
Strike Package	A combination of strike aircraft, fighter escorts, and suppression aircraft combined for a mission of attacking enemy targets.
Combat Air Patrol	Aircraft armed with air-to-air weapons patrolling a section of airspace with the ability to quickly intercept hostile aircraft that enter that airspace.
Air Combat Maneuvers	Two or more opposing pilots, flying in aircraft without weapons, attempting to gain a tactical advantage by position.
Aircraft Acrobatics	The execution of precise flight operations that demonstrate the agility of the aircraft.
Formation Flying	Two or more aircraft flying close together (in a pattern, similar to a flock of geese flying in a “V”) for the purpose of visual mutual support, ease of navigation during a flight, flight integrity or tactical advantage. Formation flying is used enroute to and from SUA and while flying tactically in SUA.

The argument has been made that advances in computer technology -- specifically computer simulation and virtual reality -- could substitute for actual time-on-range training. Computer technologies do provide excellent tools and are, in fact, essential to a successful, integrated training program, reducing the risk and expense typically associated with military training. The Marine Corps at MCAS Cherry Point currently relies upon and will continue to maximize the use of simulators to teach and perfect aviation skills and ordnance delivery. However, training with simulators is only one component of an aviator's training. There is no substitute for an aviator experiencing the stresses of practicing air combat maneuvers in an actual aircraft maneuvering through real flight operations.

Combat conditions can only be replicated within the confines of SUA, where military aircraft can safely operate at tactical speeds and altitudes. Outside of SUA, military aircraft must comply with FAA regulations on airspeed and altitude.

Another restriction imposed on aircraft is the 2,000-ft (610-m) above-ground-level (AGL) voluntary minimum altitude for overflights of national parks, national wildlife refuges, and similar lands administered by the National Park Service, Fish and Wildlife Service, and Bureau of Land Management. These agencies signed a Memorandum of Understanding with the FAA (1993) on the minimum altitude for park and refuge overflights.

For Marine Corps and Navy aircraft, however, the requirements of the 1993 Interagency Memorandum of Understanding are superseded by Chief of Naval Operations Instruction (OPNAVINST) 3710.7 (*Naval Aviation Training and Operating Procedure Standardization* or *NATOPS*). This instruction requires that overflights of noise sensitive areas and wilderness areas be avoided at altitudes less than 3,000 ft (914 m) (AGL), except when in compliance with an approved traffic or approach pattern, military training route (MTR), or when operating in SUA. In addition to wilderness areas, examples of noise-sensitive areas are provided in Section 5.5 of OPNAVINST 3710.7 include:

> *Breeding farms, resorts, beaches, and those areas designated by the US Department of the Interior as National Parks, National Monuments, and National Recreational Areas.*

In summary, access to adequate SUA for training is crucial for military aviators to gain the expertise needed to operate complex systems built into modern tactical aircraft and learn tactics that maximize the combat effectiveness of that aircraft. Overall, effective training increases the probability of aircrew survival. The availability of SUA not only enhances the quality of training, it allows training to be conducted in a safe environment, "as free from other aircraft as practicable" (FAA Order 7610.2).

1.1.3 Training Limitations of Existing SUA

As currently configured, existing SUA in eastern North Carolina presents some limitations to conducting the most effective aviation training activities, particularly high-speed, overland air combat maneuvers, and ingress/egress (sea-to-land/land-to-sea) target interception. Specifically, the lack of SUA connecting Warning Area 122 (hereinafter W-122) with Restricted Area 5306A (hereinafter R-5306A) imposes a "speed bump" where aviators transiting from SUA through adjoining non-SUA at altitudes less than 10,000 ft (3,048 m) MSL must reduce their airspeed to 250 kt or less (Figure 1-1, Speed Bump Requirements at Core Banks). This mandated airspeed reduction causes the training aircraft to depart its tactical flight (combat) profile and, as a result, the training loses realism and intensity, thereby greatly diminishing the training benefit.

In addition to the lack of connectivity between existing SUA, the extent of R-5306A is not sufficient to accommodate training activities beyond those involving use of the two target areas, BT-9/BT-11, nor to accommodate the simulated deployment of new weapons systems that have the capability to precisely deliver the warhead to target at extended ranges of about 15 NM (28 km) or greater. Also known as stand-off weapons, these extended-range weapons can be precisely aimed and fired by an aircraft from many miles away, reducing the risk to the pilot and aircraft of being seen by enemy radar and/or being targeted themselves. Training missions with simulated stand-off weapons must be conducted where there is sufficient associated airspace to contain the entire flight path of the weapon, from simulated launch/release to target. If the extended release point causes the aircraft to be positioned outside designated SUA, new SUA is needed (Chief of Naval Operations [N44] Range Planning Office, September 2000). The extent of R-5306A is not sufficient to accommodate the simulated deployment of stand-off weapons.

As previously stated, the purpose of the proposed action would be to enhance existing and future training opportunities by reducing and/or eliminating limitations to training associated with existing SUA in eastern North Carolina. As a result, 2d MAW aviators and pilots from other military services would be able to conduct training with seamless transitions between SUA and maintain tactical control of their aircraft. Also, additional airspace would be available for aviators' training purposes. Thus, critical skills needed to sustain operational readiness would be acquired and maintained.

1.2 Aircraft Operating Out of MCAS Cherry Point

MCAS Cherry Point, established in 1942, is located midway along the Atlantic Coast of North Carolina on the south bank of the Neuse River. The air station is about 20 miles (32 km) north of Atlantic Beach, North Carolina, and about 90 miles (144 km) west-southwest of Cape Hatteras, North Carolina. The air station currently serves as the Marine Corps' major East Coast tactical aviation training facility. Its mission is to provide aviation/training support to the 2d MAW, its largest tenant command. Major tenants at MCAS Cherry Point are the Naval Air Depot and the 2d MAW and its elements, namely Marine Aircraft Group (MAG) 14, Marine Air Control Group

(MACG) 28, and Marine Wing Support Group (MWSG) 27 (MCAS Cherry Point Website, Accessed July 3, 2000).

The air station uses two pairs of offset runways for arrival and departure traffic and several pads for AV-8 and helicopter operations (ATAC Corporation, February 18, 1998). The airfield operates 24 hours per day during the week with operations starting on Monday at 7:00 AM and ceasing by 11:00 PM on Friday. Weekend operations are from 10:00 AM to 6:00 PM on Saturdays and from 2:00 PM to 10:00 PM on Sundays. These facilities are also available to provide necessary training support to other service organizations including Navy, Air Force, Army, and foreign military components as well as state and federal agencies.

Aircraft stationed at MCAS Cherry Point are primarily fixed-wing. The flying squadrons comprising MAG 14 include three AV-8 Harrier squadrons, four EA-6 Prowler squadrons, and one KC-130 Hercules refueling squadron. The Marine Corps' only AV-8 Harrier and KC-130 Hercules training squadrons are also located at the air station. In addition, two C-9 and two C-12 transport aircraft, along with three HH-46 helicopters that are used to meet the search and rescue (SAR) mission, are based at the air station. Transient aircraft also make use of the airfield.

1.3 Environmental Assessment Process

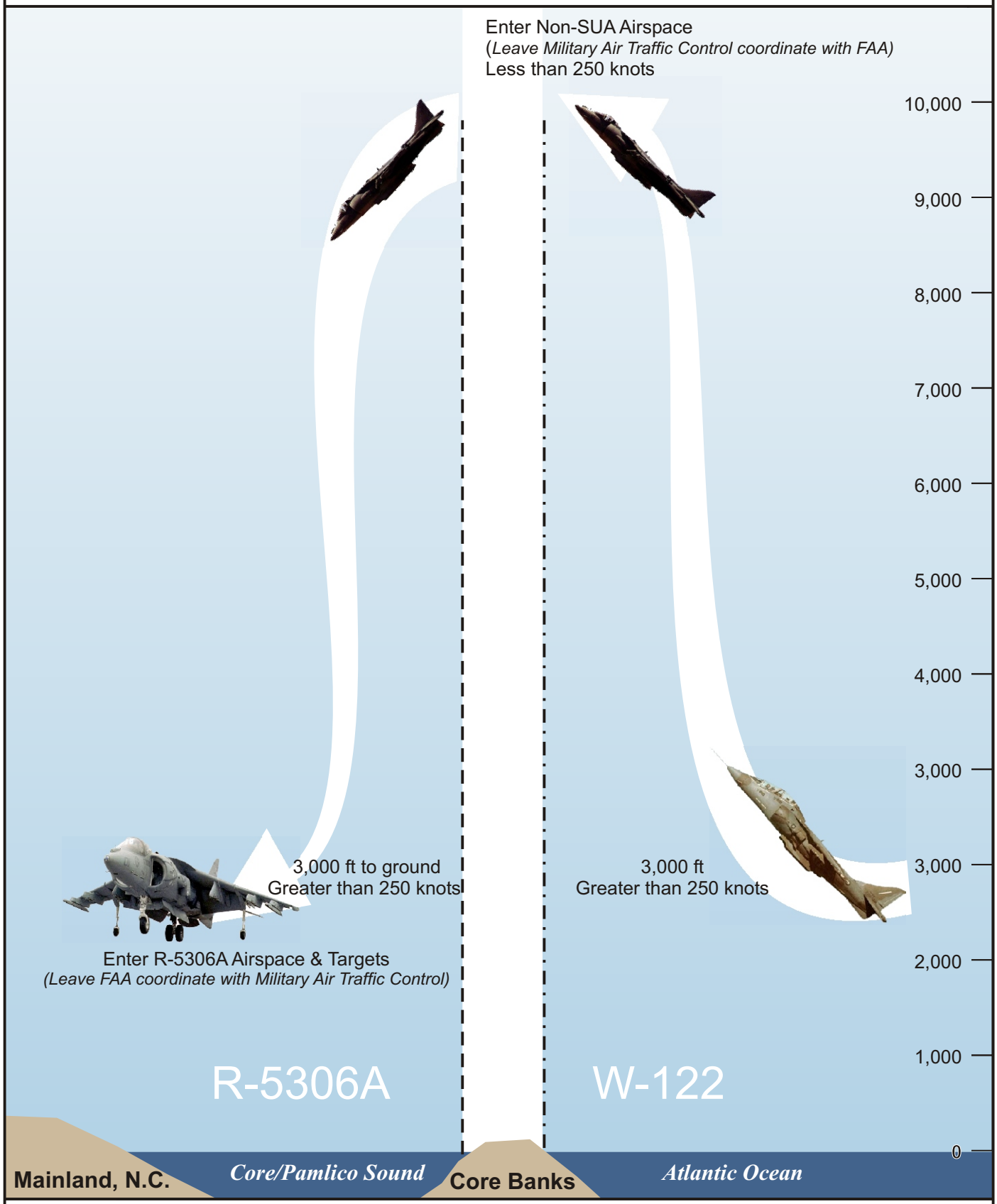
The Department of the Navy is preparing this EA pursuant to NEPA and its implementing regulations as contained in 32 CFR 775. The Department of the Navy is the lead agency for the proposed action, with the FAA serving as a cooperating agency in accordance with a January 26, 1998 Memorandum of Understanding.

For the FAA, Order 1050.1, Appendix 3 (*Policies and Procedures for Considering Environmental Impact*) implements NEPA for the agency. These regulations stipulate that an action proponent must prepare an environmental assessment (EA) for SUA actions where altitudes are below 3000 ft (914 m) AGL (due to the topography of eastern North Carolina AGL and MSL are approximately equivalent and, therefore, MSL will be used throughout the document unless AGL is specifically required) or if supersonic flight is anticipated at any altitude. Based on FAA NEPA regulations, this Marine Corps proposal does not trigger the preparation of an EA (or EIS) because it does not include flight at altitudes less than 3,000 ft MSL, nor does it include supersonic flight at any altitude.

1.3.1 NEPA Review of Previous Proposed SUA

A proposal for establishing new SUA in eastern North Carolina has been the subject of public review under NEPA in the past. Although this EA reflects a proposed action that differs substantially from previous proposals, a review of the history of NEPA documentation undertaken for previous proposals is appropriate for completeness of this document.

Speed Bump Requirements at Core Banks



R-5306A Border
W-122 Border

Figure 1-1

In the mid-1980s, the Marine Corps first identified a need for new SUA that could be used by 2d MAW to conduct its required aviation training operations. Assessments of 2d MAW training needs found that new SUA was needed to provide connectivity between onshore SUA and the offshore Warning Areas as well as to accommodate low-altitude training activities. The proposed SUA included what was known as the Core and Cherry 1 MOAs. The original proposed altitude for these MOAs was between 500 ft (152 m) MSL and 17,999 ft (5,486 m) MSL. Draft and final environmental impact statements (EISs) were published for the proposed MOAs in 1987.

The proposal was subsequently referred by the Department of the Interior to the President's Council on Environmental Quality (CEQ) for resolution under the provisions of 40 CFR 1504. (CEQ is authorized to review and attempt to resolve disputes between federal agencies regarding the environmental effects of proposed major federal actions.) The Department of the Interior asserted that since the Core Banks is part of the designated Cape Lookout National Seashore, overflights would "cause substantial interference with the enjoyment of recreation."

CEQ held public hearings on the issue in January 1988, at which time the Marine Corps and the National Park Service made presentations. Concerned citizens and Congressional and state representatives submitted and/or presented comments during these meetings. Subsequent to these meetings, the CEQ determined there was no reasonable alternative (with regard to the "speed bump" issue and sea-to-land, low-level, high-speed combat training missions) to establishing the Core MOA and made recommendations for coordination between the Marine Corps and the Department of the Interior. The CEQ further found cumulative impacts of airspace use by military agencies over North Carolina needed to be further assessed. Accordingly, in 1992, a supplemental EIS (draft and final) was completed that addressed the recommendations made by CEQ. Further action has never been taken on this proposal.

1.3.2 The NEPA Process

The National Environmental Policy Act (NEPA) of 1969 requires consideration of the environmental impacts of major federal actions. Detailed environmental impact statements (EISs) must be prepared for those major federal actions with the potential to significantly affect the quality of the human environment. Environmental Assessments (EAs) are concise public documents that provide evidence and analysis for determining whether to prepare an EIS or a finding of no significant impact (FONSI), and to aid in an agency's compliance with NEPA when an EIS is not required. The EA should include brief discussions of the purpose and need for the proposal, the alternatives, the affected environment, the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted.

The Marine Corps had initially considered preparing an EIS for this proposed action. However, during the course of preparing its environmental documentation, the Marine Corps determined that impacts of designating new SUA in eastern North Carolina would not be significant and, consequently, that an EA would be the appropriate level of documentation. This approach is

further supported by the fact that FAA regulations do not require preparation of an EA where the proposed SUA are above 3000 ft (914 m) MSL as is the case for the training airspace being proposed by the Marine Corps.

In October 2000, the public was notified that the Marine Corps was in the initial stages of preparing an EIS for this proposed action. The Marine Corps published a Notice of Intent (NOI) in the *Federal Register* on October 6, 2000 to begin the public scoping process. A series of public scoping meetings were held to receive public comment on the proposed action. Comments received during that scoping process have been considered in the preparation of this EA. In addition, this EA has been prepared in accordance with the following regulations and instructions:

- The Council on Environmental Quality (CEQ) regulations as contained in 40 CFR Parts 1500 to 1508, which direct federal agencies on how to implement the provisions of NEPA.

- Marine Corps Order (MCO) P5090.2A, which documents the USMC's internal operating instructions on how it implements the provisions of NEPA.

For this proposed action, analysis of the environmental impacts thus far has shown that no significant effects would occur. Therefore, unless new information shows otherwise, a Finding of No Significant Impact (FONSI) would be appropriate. Marine Corps signature of the FONSI would complete the Department of the Navy's NEPA responsibilities for this proposed action. Then in accordance with FAA regulations (and the MOU between the DoD and the FAA), the FAA as cooperating agency would independently review the EA prepared by the Marine Corps and assess whether the EA conforms with FAA regulations. After completing the assessment, the FAA would then adopt the EA or prepare its own environmental documentation. Upon approval of the proposed action and completion of any environmental documentation, the FAA would publish/chart the new SUA.

1.3.3 Public Participation Program

1.3.3.1 Scoping Meetings

As stated in Subchapter 1.3.2, a NOI to prepare an EIS was published in the *Federal Register* on October 6, 2000. Public scoping meetings were held in late October 2000 between 5:30 PM and 8:30 PM at the following locations in Dare, Beaufort, Carteret, and Craven Counties, all of which are communities underlying or adjacent to the footprint of the proposed MOAs:

- Buxton, North Carolina - October 23, 2000 at Cape Hatteras High School.

- Pinetown, North Carolina - October 24, 2000 at Northside High School.

- Beaufort, North Carolina - October 25, 2000 at East Carteret High School.
- New Bern, North Carolina - October 26, 2000 at the New Bern Convention Center.

Copies of fact sheets developed in support of the planned EIS were made available for public review during the scoping period at 11 libraries located in North Carolina communities that underlie the proposed SUA. Copies of this EA may also be found at the same community libraries. The complete list of these libraries is shown in Table 1-3.

The public scoping period ended on November 20, 2000. Comments were received from several elected officials (including one member of Congress, one state representative, and four local government officials), two federal agencies (National Park Service and Fish and Wildlife Service), three state agencies, eight organizations, and more than 245 private citizens. The comments can generally be categorized into 20 issues as shown in Table 1-4. Overall the issues identified during scoping include economic effects, noise impacts, and safety concerns.

1.3.3.2 Public Meetings

Public meetings were held following the release of the initial version of this EA. Copies of the EA were sent to any member of the public who requested one prior to the public meetings, and were also made available for review at 11 libraries located in North Carolina communities that underlie the proposed SUA; the libraries are listed in Table 1-3. Public meetings were held in July 2002 between 5:30 PM and 8:30 PM at the following locations in Dare, Beaufort, Carteret, and Craven Counties, all of which are communities underlying or adjacent to the footprint of the proposed MOAs:

- Beaufort, North Carolina - July 9, 2000 at East Carteret High School.
- New Bern, North Carolina - July 10, 2002 at the New Bern Convention Center.
- Buxton, North Carolina – July 16, 2002 at Cape Hatteras High School.
- Pinetown, North Carolina – July 17, 2002 at Mattamuskeet High School.
- Pinetown, North Carolina - July 18, 2002 at Northside High School.

The meetings were held to permit public comments on and questions about the EA. Written comments, submitted at the meetings or by mail, by August 8, 2002 became part of the official project record. A total of 111 individuals attended the public meetings, and written comments were received from 54 individuals, groups or agencies. All public comments were considered during preparation of this final EA.

1.3.3.3 Agency Comments

Three federal and state government agencies submitted comments on the EA, as follows:

- North Carolina Department of Environment and Natural Resources (including NCDENR Divisions of Marine Fisheries, Coastal Management, and Parks and Recreation)
- United States Department of the Interior, Fish and Wildlife Service
- United States Department of the Interior, National Park Service

Agency comments can be generally categorized into 8 major issues, as shown in Table 1-5. The issues include concerns about noise levels and the effects of noise on wildlife. These concerns have been addressed during preparation of this final EA.

Table 1-3

Libraries Where Copies of EA and Related Materials May Be Viewed

County	Library	Address
Beaufort	George H. and Laura E. Brown Library	122 Van Norden Street Washington, NC 27889
Beaufort, Hyde, and Martin	Beaufort-Hyde-Martin Regional Library	158 N. Market Street Washington, NC 27889
Carteret	Carteret County Public Library	210 Turner Street Beaufort, NC 28516-2141
Craven and Pamlico	Craven-Pamlico-Carteret Regional Library	400 Johnson Street New Bern, NC 28560-4048
Craven	Godwin Memorial Library	Craven Community College 800 College Court New Bern, NC 28562
Dare	Manteo Library	Virginia Dare Highway Manteo, NC 27954
Dare	Hatteras Library	Highway 12 Hatteras Commercial Center Hatteras, NC 27943
Hyde	Mattamuskeet Library	20418 US 264 Swanquarter, NC 27885
Pamlico	Pamlico County Library	603 Main Street Bayboro, NC 28515
Washington	Washington County Library	201 East Third Street Plymouth, NC 27962
Tyrrell	Tyrrell County Library	414 Main St Columbia, NC 27925

Table 1-4

Summary of Scoping Comments

Issue Category	Issue Characterization
Alternatives	Other alternatives should be considered, including locations in the western US and over the ocean.
Purpose and Need Justification	The Marine Corps has not made a strong enough case for establishing new special use airspace.
Air Pollution	Jet overflights will cause ground level air pollution impacts.
Water Pollution	Overflights will cause water pollution - cause not identified.
Land Use	MOAs are proposed for populous areas; retirement communities are important to local municipalities.
Economy (Regional/Local)	MOAs will adversely affect local and regional economy including recreation, tourism, population growth, and business development.
Property Values	Property values will decrease.
Tourism	Overflights will adversely affect tourist and recreational experiences.
National Wildlife Refuges	• Wildlife and the experience of recreational users will be adversely affected. • Impacts to the Swanquarter Wilderness Area should be addressed.
National Seashores	Quality of visits will be reduced.
Noise - Effects on Humans (Health)	Aircraft noise will be annoying and disturbing to residents, school children, etc.
Noise - Effects on Wildlife	• Wildlife, particularly migratory waterfowl and endangered species may be adversely affected by aircraft noise. • Feral horses on the Outer Banks may be affected. • The potential for bird strikes should be addressed.
Noise - Effects on Livestock	Livestock will be harmed by aircraft noise caused by overflights.
Noise - Effects on Structures	Structures will be vibrated and damage caused to structural integrity and contents (glasses/china).
General Environmental Issues	The term “environmental effects” was used to generally identify the potential for adverse impacts to the area underlying the proposed MOAs.
Civil Aviation (Flight)	IFR/VFR traffic will be hindered; General Aviation (GA) aircraft will be constricted into a 1000-ft (305-m) corridor over refuges and seashores.
Low Level Flights	There are too many existing low level flights that are disturbing to residents.
Local Airport Use	Use and growth of local airports will be hindered.
Safety	• Mixing GA aircraft and military jets will cause a safety hazard. • There is a lack of positive radio and radar control over Pamlico Sound and Beaufort, Hyde, and Dare counties. • Impacts to East Carolina Health Systems helicopters needs to be considered. • Aviation accident rates should be addressed.
Cumulative Impacts	The document should include a cumulative impact analysis of airspace by military agencies and other organizations and operators.

Table 1-5

Summary of Agency Comments on EA

Issue Category	Issue Characterization
Water Pollution	Aircraft crashes will cause water pollution, possibly affecting fisheries.
Tourism	Overflights will adversely affect tourist and recreational experiences.
National Wildlife Refuges	• Wildlife and the experience of recreational users will be adversely affected. • Impacts to the Swanquarter Wilderness Area should be addressed.
National Seashores	Quality of visits will be reduced.
Noise - Effects on Humans (Health)	The noise analysis should consider the use of other metrics, and not rely solely on L_{dnmr}.
Noise - Effects on Wildlife	• Wildlife, particularly migratory waterfowl and endangered species may be adversely affected by aircraft noise. • EA did not adequately address effects on avifauna. • The discussion of potential for bird strikes should be expanded.
Civil Aviation (Flight)	IFR/VFR traffic will be hindered; General Aviation (GA) aircraft will be constricted into a 1000-ft (305-m) corridor over refuges and seashores.
Safety	• Mixing GA aircraft and military jets will cause a safety hazard. • There is a lack of positive radio and radar control over Pamlico Sound and Beaufort, Hyde, and Dare counties. • Discussion of aviation accident rates should be expanded.

2 PROPOSED ACTION AND ALTERNATIVES

The US Marine Corps proposes to enhance existing and future training opportunities for the Second Marine Aircraft Wing (2d MAW) and other aircraft operating out of Marine Corps Air Station (MCAS) Cherry Point. The proposed action is to create new SUA.

2.1 Analysis of Alternatives

The Council on Environmental Quality (CEQ) places significant importance on the discussion of alternatives in an EA. The alternatives analysis provides decision makers and the public with a clear picture of the issues and the rationale used to select the preferred alternative.

2.1.1 Training Considerations in Siting New SUA

In 1983, MCAS Cherry Point began a process of reviewing the adequacy of its SUA to meet the existing and future training needs of Marine Corps aviators. The review process involved two major efforts: an evaluation of Marine Corps aviation training needs (coordinated with 2d MAW pilots and DoD personnel responsible for conducting training operations), and an assessment of the potential for establishing new SUA in eastern North Carolina. Existing SUA and non-SUA in eastern North Carolina are depicted in Figure 2-1 (Airspace in Eastern North Carolina) and a listing of existing SUA is shown in Table 2-1.

As a result of this review, the Marine Corps recognized that SUA over eastern North Carolina was limited in its capability to meet its training needs. The review further found that these limitations could be reduced by creating new SUA to provide: (1) high speed (subsonic) ingress/egress from Warning Area 122 (W-122) over the Atlantic Ocean into existing restricted airspace (R-5306A); and (2) additional room for military aircraft to perform required training activities and maneuvers (adjacent to but outside of existing restricted airspace and associated target areas). Moreover, the Marine Corps determined that if the floor (i.e., lowest altitude) of the proposed new airspace was set at 500 ft (152 m) MSL, Marine Corps aviators would be able to meet all identified training needs.

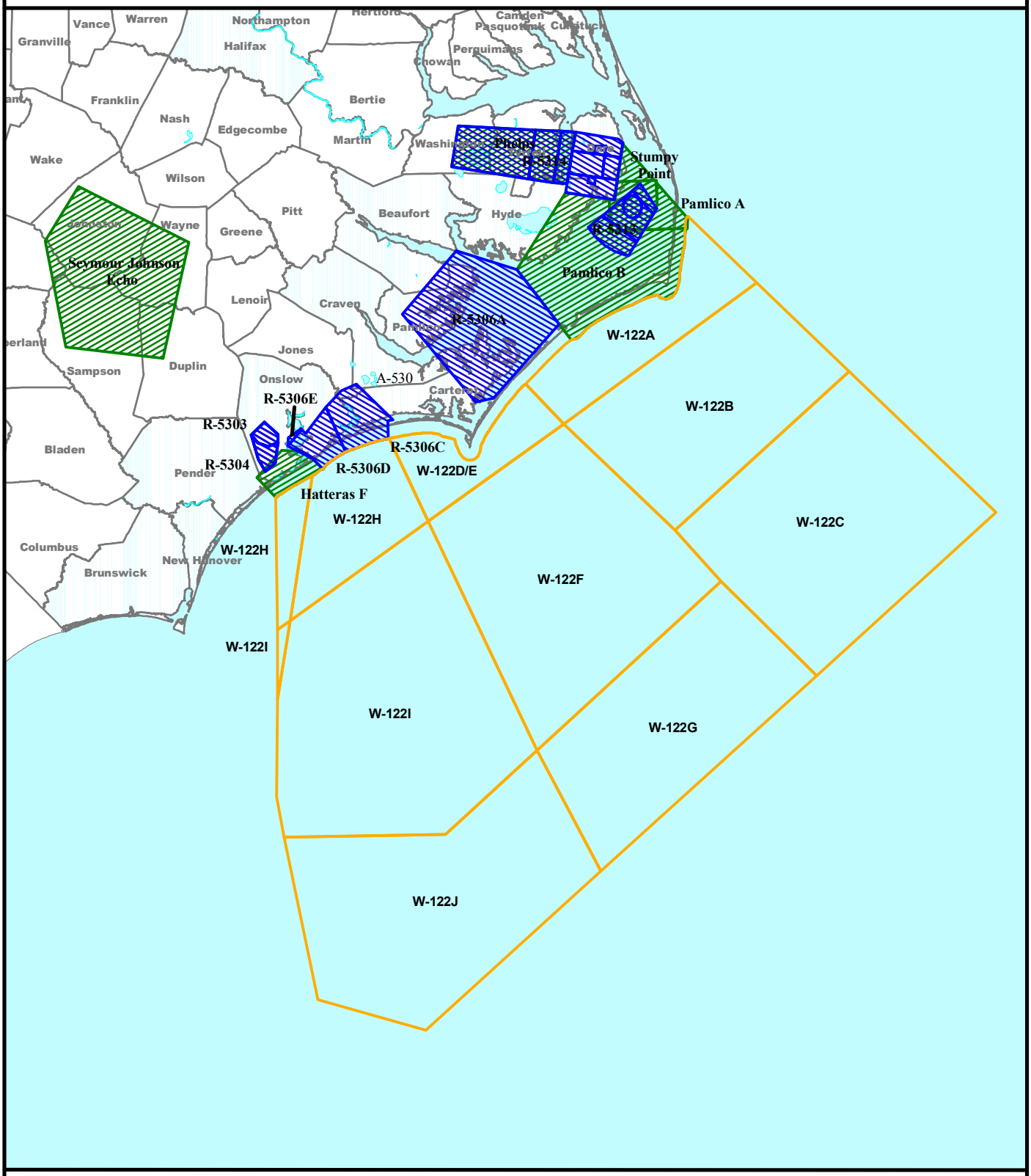
Other specific benefits of creating new SUA were increases in training realism, the availability of additional space for training, and a capability to accommodate new weapons systems. Accordingly, in 1987 and 1991, the Marine Corps proposed creating new airspace in eastern North Carolina in the form of MOAs (see Subchapter 1.3.1). However, these SUA proposals were never implemented.

Table 2-1

Airspace Designations in Eastern North Carolina for Military Use

Type of Airspace	Airspace	Minimum Altitude	Maximum Altitude	Using Agency	Hours of Operation
Restricted Area	R-5303A	Surface	Up to 6,999 ft (2,133 m)	MCB Camp Lejeune	1100-2300Z M-F, OT by NOTAM 24 hrs in advance[4]
	R-5303B	7,000 ft (2,133 ft)	Up to 9,999 ft (3,048 m)	MCB Camp Lejeune	By NOTAM 24 hrs in advance
	R-5303C	10,000 ft (3,048 m)	Up to 17,999 ft (5,486 m)	MCB Camp Lejeune	By NOTAM 24 hrs in advance
	R-5304A	Surface	Up to 6,999 ft (2,133 m)	MCAS Cherry Point	1100-2300Z M-F, OT by NOTAM 24 hrs in advance
	R-5304B	7,000 ft (2,133 ft)	Up to 9,999 ft (3,048 m)	MCAS Cherry Point	By NOTAM 24 hrs in advance
	R-5304C	10,000 ft (3,048 m)	Up to 17,999 ft (5,486 m)	MCAS Cherry Point	By NOTAM 24 hrs in advance
	R-5306A	Surface	Up to 17,999 ft (5,486 m)	MCAS Cherry Point	Continuous
	R-5306C	1,200 ft (366 m)	Up to 17,999 ft (5,486 m)	MCAS Cherry Point	Continuous
	R-5306D	Surface	Up to 17,999 ft (5,486 m)	MCAS Cherry Point	Continuous
	R-5306E	Surface	Up to 6,999 ft (2,133 m)	MCAS Cherry Point	Continuous
	R-5313A	Surface	Up to 13,000 ft (3,962 m)	FACSFAC VACAPES	1300-0400Z M-F, OT by NOTAM 24 hrs in advance
	R-5313B, C	100 ft AGL (30 m)	Up to 13,000 ft (3,962 m)	FACSFAC VACAPES	By NOTAM 24 hrs in advance, not to exceed 20 hrs/mo
	R-5313D	500 ft AGL (152 m)	Up to 13,000 ft (3,962 m)	FACSFAC VACAPES	By NOTAM 24 hrs in advance, not to exceed 20 hrs/mo
	R-5314A, D, E	Surface	Up to 20,500 ft (6,248 m)	Seymour Johnson AFB	1100-0500Z M-F, 1200-2300 S-S, OT by NOTAM 6 hrs in advance
	R-5314B, C, F	500 ft AGL (152 m)	Up to 20,500 ft (6,248 m)	Seymour Johnson AFB	1100-0500Z M-F, 1200-2300 S-S, OT by NOTAM 6 hrs in advance
	R-5314G	200 ft AGL (61 m)	Up to 15,000 ft (4,572 m)	Seymour Johnson AFB	1100-0500Z M-F, 1200-2300 S-S, OT by NOTAM 6 hrs in advance
	R-5314H	500 ft AGL (152 m)	Up to 10,000 ft (3,048 m)	Seymour Johnson AFB	1100-0500Z M-F, 1200-2300 S-S, OT by NOTAM 6 hrs in advance
	R-5314J	1,000 ft AGL (305 m)	Up to 10,000 ft (3,048 m)	Seymour Johnson AFB	1100-0500Z M-F, 1200-2300 S-S, OT by NOTAM 6 hrs in advance

Airspace in Eastern North Carolina



Restricted Airspace

Warning Area

Military Operations Area (MOA)

County Boundary

30 0 30 60 Miles

40 0 40 80 Kilometers

N

Figure 2-1

Table 2-1

Airspace Designations in Eastern North Carolina for Military Use

Type of Airspace	Airspace	Minimum Altitude	Maximum Altitude	Using Agency	Hours of Operation
Warning Areas	W-122A, B, C, F, G, J	Surface	Unlimited	FACSFAC VACAPES	Intermittent
	W-122D	Surface	Up to 17,999 ft (5,486 m)	FACSFAC VACAPES	Intermittent
	W-122E	17,999 ft (5,486 m)	Unlimited	FACSFAC VACAPES	Intermittent
	W-122H, I	Surface	Unlimited except airspace above 24,000 ft (7,315 m) in designated areas	FACSFAC VACAPES	Intermittent
Military Operations Areas (MOAs)	Gamecock A MOA	7,000 ft (2,134 m) MSL	Up to 17999 ft (5,486 m)	Pope AFB, 23rd Fighter Wing	0630-2230 M-F, OT by NOTAM
	Hatteras "F" MOA	3,000 ft MSL (914 m)	13,000 ft MSL (3,962 m)	MCAS Cherry Point	0700-2200 M-F. OT by NOTAM
	Pamlico "A" MOA	8,000 ft MSL (2,438 m)	Up to 17,999 ft (5,486 m)	FACSFAC VACAPES	Sunrise-2300 M-F, OT by NOTAM
	Pamlico "B" MOA	8,000 ft MSL (2,438 m)	Up to 17,999 ft (5,486 m)	FACSFAC VACAPES	0700-2200 M-F. OT by NOTAM
	Phelps "A" MOA	6,000 ft MSL (1,829 m)	Up to 17,999 ft (5,486 m)	Seymour Johnson AFB	0600-2400 M-F, 0700-1800 S-S, OT by NOTAM 6 hrs in advance
	Phelps "B" MOA	10,000 ft (3,048 m)	Up to 17,999 ft (5,486 m)	Seymour Johnson AFB	0600-2400 M-F, 0700-1800 S-S, OT by NOTAM 6 hrs in advance
	Phelps "C" MOA	15,000 ft 4,572 m)	Up to 17,999 ft (5,486 m)	Seymour Johnson AFB	0600-2400 M-F, 0700-1800 S-S, OT by NOTAM 6 hrs in advance
	Seymour Johnson Echo MOA	7,000 ft MSL (2,133 ft)	Up to 17,999 ft (5,486 m)	Seymour Johnson AFB	0600-2000 M-F, OT by NOTAM
	Stumpy Point MOA	Surface	8,000 ft MSL (2,438 m)	FACSFAC VACAPES	Sunrise-2300 M-F, OT by NOTAM

Notes:

1. Controlling Agency for SUA is the FAA, Washington Air Route Traffic Control Center (ARTCC) except controlling agency for A-530, R-5303A and B, 5304A and B, and R-5306A, C, D, and E is MCAS Cherry Point.
2, FACSFAC VACAPES = Fleet Area Control and Surveillance Facility, Virginia Capes.
3. NOTAM = Notice to Airmen.
4. Z = Greenwich Mean Time; OT = Other Times.

Source: FAA, Special Use Airspace, North and South America (AP-1A), April 20, 2000 and FAA Order 7400.E, November 7, 1997.

In 1999, the Marine Corps re-evaluated its previous airspace proposal in light of increasing training needs. This evaluation reconfirmed the need for creating new SUA in eastern North Carolina. Among the factors considered in structuring the proposed airspace was the presence of established communities, Cape Lookout National Seashore, and several National Wildlife Refuges in eastern North Carolina. As a result, the floor for any proposed SUA to be evaluated in this EA has been set at 3,000 ft (914 m) MSL. This floor would allow the Marine Corps to meet the majority of its aviation training needs in North Carolina, with only a small percentage of training needing to be accomplished via deployments to other training areas, such as MCAS Yuma, Arizona. Although not meeting all of its aviation training needs, the Marine Corps has determined that the training and cost benefits associated with this proposed action would be substantial when compared to existing conditions. Additionally, any new or modified airspace would be developed in a way to meet training mission requirements and avoid or minimize impacts to any non-participating aircraft operating in the area.

2.1.2 Objectives and Selection Criteria Used in Identifying SUA Alternatives

Like the EISs for the previous Marine Corps airspace proposal, there are two separate and distinct training enhancements sought by 2d MAW: (1) the need for high speed ingress/egress of aircraft along the coastline and (2) the need for additional training space. The needs for these enhancements are functionally independent and, consequently, the identification of alternative methods to satisfy each need is separately evaluated below.

2.1.2.1 High Speed Ingress/Egress Training Need

For any SUA to satisfy this need, it would have to provide the capability to conduct tactically-realistic high speed ingress (sea to land) and egress (land to sea) operations at altitudes above 3,000 ft (914 m) MSL. High speed is defined as speeds greater than 250 kt, but remaining subsonic. The establishment of this SUA would eliminate the “speed bump” that is currently imposed when a pilot flying at an altitude greater than 3,000 ft (914 m) but less than 10,000 ft (3,048 m) transitions from W-122, across the Core Banks (non-SUA) into R-5306A. Within non-SUA, the pilot may not exceed an airspeed of 250 kt. Only when the aircraft reaches the border of R-5306A can the airspeed be increased. If the “speed bump” non-SUA did not exist, a pilot flying at altitudes between 3,000 and 10,000 ft (914 and 3,048 m) would be able to maintain realistic tactical airspeeds greater than 250 kt (though subsonic) along the entire flight path from W-122 to R-5306A.

Given the configuration of existing SUA in eastern North Carolina, any alternative airspace considered feasible for evaluation in meeting this need must allow for high speed sea to land and land to sea operations between R-5306A and W-122. Specifically, the ingress/egress training space must meet the following criteria:

- **Provide connectivity between R-5306A and W-122** - The airspace must provide direct connective access between R-5306A and W-122.

- **Have sufficient vertical and horizontal dimensions** - The airspace must allow aircraft multiple ingress and egress points along a significant portion of the coastline for at least 20 NM (37 km) and at all altitudes between 3,000 ft (914 m) MSL and 17,999 ft (5,486 m) MSL. An airspace with these horizontal and vertical dimensions would provide Marine Corps aviators with multiple realistic evasion routes from potential adversaries during training exercises.

- **Provide minimal disruption of nonparticipating air traffic while still accomplishing the military training objective** - Given the configuration of SUA in eastern North Carolina, the Marine Corps considers it essential for airspace meeting the ingress/egress training need to cause minimal disruption of civilian air traffic.

Using these criteria for evaluation, the Marine Corps considered the following categories of SUA in developing alternatives to satisfy the need for entry/exit training airspace:

- **Military Training Routes** - A military training route (MTR), by definition, is essentially a one-way road in the sky used by the military for conducting high-speed training at low-altitude (less than 10,000 ft [3,048 m] MSL). A pilot must schedule the MTR before using it and must strictly adhere to its routing, only exiting at published entry/exit points. Clearance from the applicable air traffic control facility must be obtain prior to entering or exiting the route. The width of an MTR is generally about 10 NM (18.6 km), although specific route segments may be wider. Establishing a new MTR to meet the ingress/egress training need would meet the connectivity criterion, but it would not allow for tactically-realistic, multiple entry/exit points into R-5306A, nor would it provide an airspace of sufficient horizontal dimensions. Therefore, establishing an MTR was not considered further in satisfying the ingress/egress training need.

- **Warning Areas** - Warning Areas are located over ocean waters and may be established no closer than 3 NM (5.6 km) of the US coast. Such restrictions would not meet the criterion for connectivity to R-5306A. Therefore, establishing this type of airspace for meeting the entry/exit training need was not considered further.

- **MOAs** - Although MOAs are generally over land areas, such airspace can extend up to the 12 NM (22 km) territorial sea limit. The vertical extent of this type of airspace may range from altitudes below 1,200 ft (365 m) MSL (if a mission requirement exists) up to 17,999 ft (5,486 m) MSL. The horizontal dimensions of the MOA can be identified based on mission requirements. Moreover, this type of

airspace allows transit of nonparticipating aircraft (flying visual flight rules or instrument flight rules [if air traffic control can provide separation]) even when active. The MOA category of SUA meets all of the airspace evaluation criteria established by the Marine Corps.

- **Restricted Areas** - Like a MOA, a new Restricted Area would allow the Marine Corps to meet its entry/exit training need by providing connectivity between R-5306A and W-122 and can be sized to the appropriate horizontal and vertical dimensions. However, when a restricted area is active, nonparticipating aircraft are not allowed to transit the airspace. Since there is an alternative category of designated airspace available that meets the Marine Corps entry/exit training need and is less restrictive to non-participating aircraft (*i.e.*, MOAs), establishing a Restricted Area will not be considered further in this analysis.

Based on the analysis provided above, the only category of airspace that meets all the evaluation criteria relevant to the Marine Corps' high speed ingress/egress training need is a MOA. However, no MOAs currently exist in eastern North Carolina that could meet the identified entry/exit training need. Therefore, the Marine Corps considered establishing a new MOA.

A new potential MOA that could meet the entry/exit training need would be located over the Core Banks and Core Sound. This proposed MOA is approximately 3 NM by 35 NM (5.6 km by 65 km) and overlies a portion of the Cape Lookout National Seashore as illustrated on Figure 2-2 (General Location of Alternatives). It would span the existing area of non-SUA between W-122 and R-5306A and would allow realistic tactical ingress to and egress from R-5306A and associated target areas. The width of the proposed airspace (35 NM [65 km]) would be sufficient to avoid predictable training situations such as when pilots, performing as the adversary force in an exercise, loiter at known fixed points to intercept incoming aircraft.

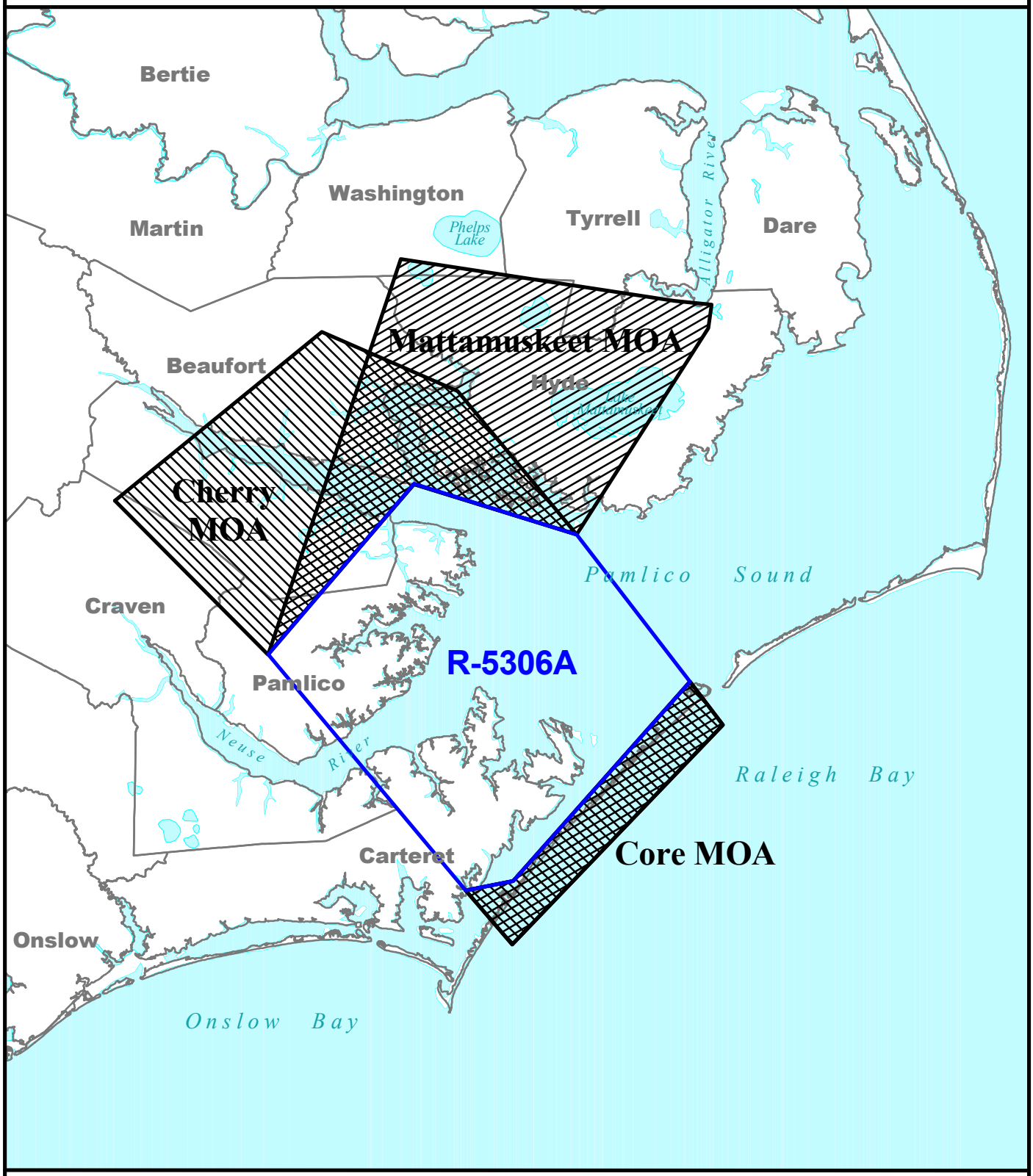
In summary, the Core Banks Area MOA (hereinafter referred to as Core MOA) is considered to be the only reasonable alternative to provide realistic connectivity between R-5306A and W-122 in this EA. This is consistent with CEQ's 1988 finding, which was made after public hearings had been held, that there is no reasonable alternative to the establishment of the Core MOA (see Subchapter 1.3.1).

2.1.2.2 Additional Training Airspace Need

The second training enhancement sought concerns providing additional training airspace for Marine Corps pilots. For any SUA to satisfy this need it would have to provide the capability to conduct essential aviation training activities (e.g., familiarization flights, formation flying, etc.). Specifically, the additional training airspace (new or modified) must meet the following criteria:

- **Have minimum dimensions of 20 NM by 30 NM (37 km by 56 km)** - The types of training identified in Table 2-2 must be conducted in airspace sufficient to

General Location of Alternative Military Operations Areas



Core and Cherry Alternative

Core and Mattamuskeet Alternative

R-5306 (Existing SUA)

County Boundary

10 0 10 20 Miles

10 0 10 20 Kilometers

N

Figure 2-2

accommodate the high speeds and large turning radii required by high performance jet aircraft as well as the simulated delivery of stand-off weapons systems. For example, prior to beginning air-to-air intercept training, aircraft are typically separated by 30 NM (56 km). Additionally, simulated stand-off weapons training typically requires a minimum 15 NM (28 km) standoff distance from the target (Chief of Naval Operations [N44] Range Planning Office, September 2000).

- **Lie predominantly over land (in other words, greater than 50 percent of the surface area underlying the proposed training airspace must be land)-** Military aviators are trained to fly over varying terrains (land, water, and the land/water interface) and to use the contrast of ground-to-sky to orient themselves during more complex maneuvers. The training syllabus for the AV-8 harrier (depicted in Table 2-2) shows that proportionally more types of training flights must be completed over land than over water. So, while some flights do need to be performed over water, SUA that contains a greater underlying surface area of land than water is required.

Table 2-2

Breakdown of Training Flights Requirements in AV-8 Syllabus[1]

Type of Training Flight	% of Training Flights Identified in Syllabus	Conducted Over Land or Water
Familiarization flights, night flights, and night formation flights	45	Over land for visual reference
Instrument flights	10	Over land or water
Air-to-ground delivery of ordnance (always conducted in a restricted area such as R-5306A, with possible transit through a MOA).	30	Over land
Air-to-air combat maneuvers	10	Water
Navigation	5	Over approved low level Terrain Following Routes (land)

Notes:
1. Note that some training flights may meet a combination of missions (e.g., a single flight may satisfy aspects of the night flight and instrument flight training requirements) so that estimated total over land flights may be no more than 45 percent of all training flights actually conducted.

- **Must connect with R-5306A -** Connectivity with R-5306A would readily allow training activities to be shifted from R-5306A thereby enabling the Marine Corps to better utilize its restricted airspace. Additionally, connectivity to R-5306A would allow Marine Corps aviators to more realistically simulate delivery of

stand off weapons in that there would be actual targets (BT-9 and BT-11) to acquire.

- **Provide minimal disruption of nonparticipating air traffic while still accomplishing the military training mission** - Given the configuration of SUA in eastern North Carolina, the Marine Corps considers it important for airspace meeting this training need to cause minimal disruption of civilian air traffic.

All of these evaluation criteria were used by the Marine Corps to identify existing SUA in eastern North Carolina with the potential to meet its identified aviation training needs. No existing SUA in eastern North Carolina meet these evaluation criteria. The only existing SUA that could potentially satisfy the Marine Corps's additional training airspace need is the Pamlico B MOA (satisfies both the dimensions and connectivity requirements). However, upon further analysis, the Marine Corps determined that the surface underlying the Pamlico B MOA is almost entirely over water (greater than 80 percent) and, therefore, this alternative is not considered further.

Accordingly, the Marine Corps began the process of identifying new SUA to meet its need for additional training airspace. The evaluation of the various SUA airspace categories resulted in the following conclusions:

- **MTRs** - Establishing this type of airspace for special use to meet the need for additional training airspace would not allow for the desired lateral dimensions, and would provide for only one-way traffic on each MTR. Therefore, this type of airspace category could not support the required training activities and is not considered further in this analysis.

- **Warning Areas** - As previously mentioned, the boundaries of Warning Areas can begin no closer than 3 NM (5.6 km) of the US coastline. As such, a Warning Area would not allow for connectivity to R-5306A. Furthermore, the entire surface area underlying the Warning Area would be water and not meet the requirement for minimum underlying land area. For these reasons, establishing a new Warning Area is not considered a viable airspace alternative.

- **MOAs** - A new MOA could be created that abuts the north and northwest boundaries of R-5306A. There is sufficient open airspace in these directions that would allow development of a MOA with dimensions of at least 20 NM by 30 NM (37 km by 56 km). Furthermore, this airspace would primarily overlay land and not water. Finally, establishing a MOA would cause minimal disruption to nonparticipating air traffic while still allowing for safe separation of participating and nonparticipating aircraft.

- **Restricted Airspace -** New Restricted airspace could also be created abutting the north and northwest boundaries of R-5306A. This airspace could be sized at the desired dimensions (at least 20 NM [37 km] by 30 NM [56 km]), and would primarily overlay land. Establishing a Restricted Area would be the more restrictive category of airspace for nonparticipating aircraft. The proposed training activities do not require such exclusivity. Because there is a less restrictive category of SUA that would meet the Marine Corps's need for additional training airspace, the creation of a new Restricted Area is not considered further in this analysis.

The analysis of airspace alternatives discussed above demonstrates that the most appropriate type of SUA that would meet the Marine Corps' need for additional training airspace is a MOA. Furthermore, a review of the current airspace configuration in eastern North Carolina shows that such a MOA could adjoin R-5306A by being located to the north and northwest of that airspace. Accordingly, the Marine Corps is proposing establishing either of the following two MOAs, depicted on Figure 2-2 (General Location of Alternatives), in developing alternatives for further evaluation in this report:

- **Cherry MOA** - The proposed airspace in this area would overlie a land area approximately 40 NM (74 km) north of MCAS Cherry Point and 5 miles (9.2 km) southeast of Washington, North Carolina. The proposed airspace would be adjacent to the northwestern boundary of R-5306A. Communities that would underlie the MOA would include Aurora, Bath, and Belhaven. A small portion of this airspace would overlie the Swanquarter National Wildlife Refuge.

- **Lake Mattamuskeet MOA** - Located approximately 45 NM (83 km) northeast of MCAS Cherry Point, the proposed airspace would be adjacent to the northern boundaries of R-5306A and the southern boundaries of R-5314 and the Phelps MOAs. It would overlie portions of the Alligator River, Lake Mattamuskeet and Pocosin Lakes, and Swanquarter National Wildlife Refuges.

2.2 Description of Alternatives Considered in this EA

The Core MOA and either the Cherry or Mattamuskeet MOAs are independent of each other and have stand-alone value for improving the quality of training available to Marine Corps aviators in eastern North Carolina. However, a combination of the Core MOA (Core Banks Area) with any of the other proposed MOAs would result in the greatest training benefit. Also, it should be made clear that the Marine Corps is not proposing to create all of these MOAs, rather, at most the Marine Corps desires to create two (Core MOA plus one other). Consequently, this EA examines the impacts of no action, establishing a combination of two MOAs (Core plus 1), and a single MOA:

- Core and Mattamuskeet MOAs.
- Core and Cherry MOAs.
- Core MOA.
- Mattamuskeet MOA.
- Cherry MOA.

Note that for clarity, the individual MOA alternatives are described below before the combined MOA alternatives.

2.2.1 No Action Alternative

A "no action" alternative provides a useful basis for comparing the impacts of those "action" alternatives that meet the Marine Corps' training needs. CEQ provides several ways of defining "no action." For purposes of this EA, "no action" means that the proposal for establishing new SUA in eastern North Carolina would not take place and, as a result, the training limitations associated with existing SUA would continue.

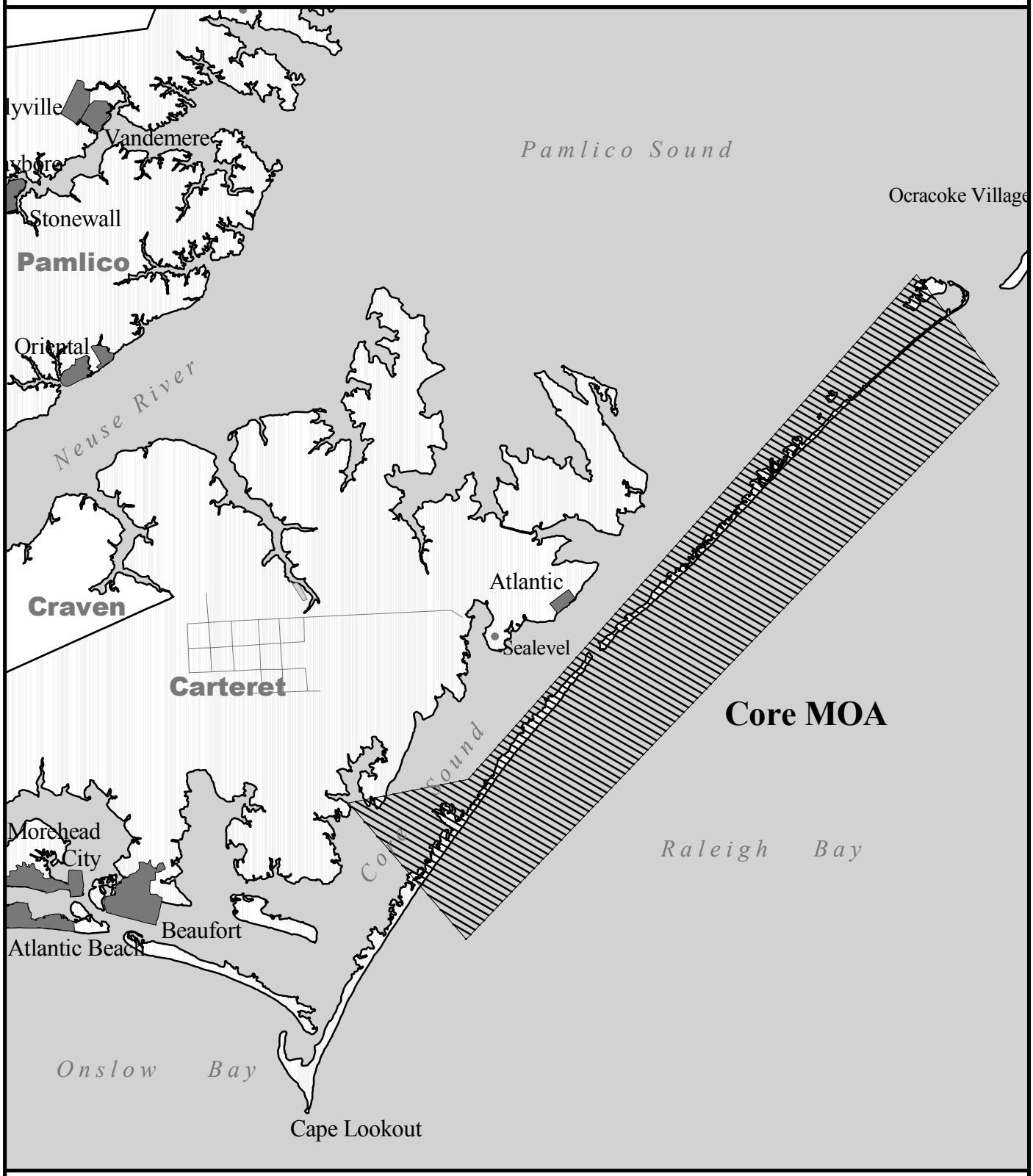
Under "no action" Marine Corps aircraft would continue existing training flight activities over the Core Banks and in the Cherry and Mattamuskeet areas at airspeeds below 250 kt when at altitudes less than 10,000 ft (3,048 m) in accordance with FAA regulations published in 14 CFR 91. Overflights of Wilderness Areas and noise sensitive areas (including National Parks and National Recreational Areas and others as described in Subchapter 1.1.2) would continue to occur. In accordance with Chief of Naval Operations in OPNAVINST 3710.7, aircraft would operate at an altitude no lower than 3,000 ft (914 m) MSL, except when training activities are conducted on a military training route (MTR) or within existing SUA.

2.2.2 Core MOA Alternative

The proposed Core MOA (Figure 2-3, Core MOA Alternative), which satisfies the high speed ingress/egress training need, would overlie a portion of North Carolina's Core Banks (Carteret County), extending 35 NM (65 km) along the Core Banks from about 8 miles (13 km) northeast of the Cape Lookout lighthouse to about 1.25 miles (2.1 km) from the eastern end of Portsmouth Island. The MOA would also extend about 3 NM (5.6 km) to the southeast over the Atlantic Ocean. The floor of the proposed SUA would be at 3,000 ft (914 m) MSL and the ceiling would be at 17,999 ft (5,486 m) MSL.

The MOA would adjoin the existing Pamlico B MOA and overlie portions of the Cape Lookout National Seashore. The primary aircraft training activities associated with this proposed MOA would be subsonic ingress (sea-to-land) and egress (land-to sea) missions intercepting existing

Core MOA Alternative



Core MOA
Municipality
Village
County Boundary
Open Water

5 0 5 10 Miles
6 0 6 12 Kilometers

N

Figure 2-3

targets located at R-5306A. It would serve to eliminate the "speed bump" limitation of the existing airspace configuration.

2.2.3 Mattamuskeet MOA Alternative

The proposed Mattamuskeet MOA (shortened from Lake Mattamuskeet), which satisfies the additional training airspace need, would overlie portions of North Carolina's Beaufort, Hyde, Pamlico, Tyrell, and Washington counties with approximate dimensions of 25 miles by 30 miles (46 km by 56 km). The floor and ceiling of the Mattamuskeet MOA would be the same as identified for the proposed Core MOA, from 3,000 ft (914 m) MSL to 17,999 ft (5,486 m) MSL. The location of this MOA is shown in Figure 2-4 (Mattamuskeet MOA Alternative). The new airspace would span the area between the SUA associated with the existing Navy Dare Bombing Range (R-5314), R-5306A, and the Pamlico B MOA. It would also overlie portions of several National Wildlife Refuges (Alligator River, Lake Mattamuskeet, Swanquarter, and Pocosin Lakes) as well as the Swanquarter Wilderness Area. Air operations within the proposed Mattamuskeet MOA would involve high-speed air combat maneuvers and training activities, including but not limited to the training activities identified in Table 1-2.

2.2.4 Cherry MOA Alternative

The Cherry MOA alternative, which also satisfies the additional training airspace need, would include an airspace with the approximate dimensions of 25 by 30 miles (46 by 56 km). It is situated over portions of Beaufort, Craven, Hyde, Pamlico and Washington counties of North Carolina and the Pamlico and Pungo Rivers (Figure 2-5, Cherry MOA Alternative). It would also overlie a portion of the Swanquarter National Wildlife Refuge. The floor and ceiling of the Cherry MOA would be the same as identified for the proposed Mattamuskeet MOA, from 3,000 ft (914 m) MSL to 17,999 ft (5,486 m) MSL. Proposed air operations would be the same as described for the proposed Mattamuskeet MOA.

2.2.5 Core and Mattamuskeet MOAs Alternative

This alternative would involve the implementation of both the Core and Mattamuskeet MOAs (as previously described individually) and would completely satisfy both of the Marine Corps training needs: high speed ingress/egress and additional training airspace. This is the Marine Corps preferred alternative for the following reasons:

- The Core MOA is the only available option that provides the direct connectivity and flexibility for random ingress and egress to R-5306A required for realistic tactical operations.

- The Mattamuskeet MOA connectivity to other SUA within the area provides for the best possible realism for simulating actual real world combat scenarios. This connectivity also provides for ease of scheduling and seamless transitions between Warning Areas and SUA along the coast of eastern North Carolina which significantly enhances the realism of major joint exercises such as JTFEXs.

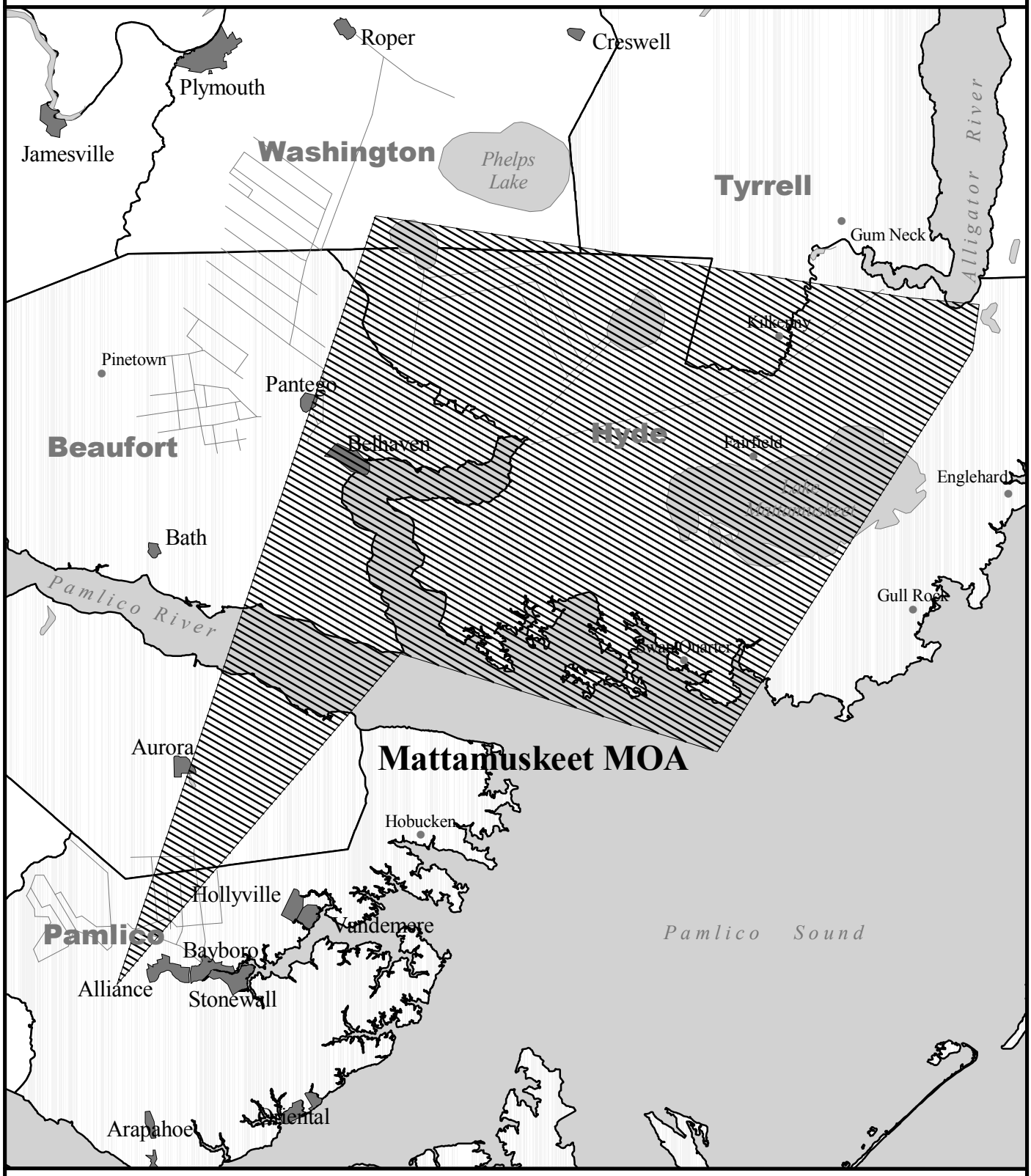
2.2.6 Core and Cherry MOAs Alternative

This alternative would involve the implementation of both the Core and Cherry MOAs (as previously described individually). Although this alternative would satisfy both of the Marine training needs of high speed ingress/egress and additional training space, it was not selected as the preferred alternative for the following reasons:

- Does not provide the same connectivity to other SUA that is realized with the implementation of the Core Mattamuskeet MOAs proposal.

- Creates some impacts on general aviation, air carrier and military aircraft in terms of time and fuel when airspace is active and ATC is required to route them around the air space.

Mattamuskeet MOA Alternative



Mattamuskeet MOA
Municipality
Village
County Boundary
Open Water

5 0 5 10 Miles
8 0 8 16 Kilometers

N

Figure 2-4

Cherry MOA Alternative

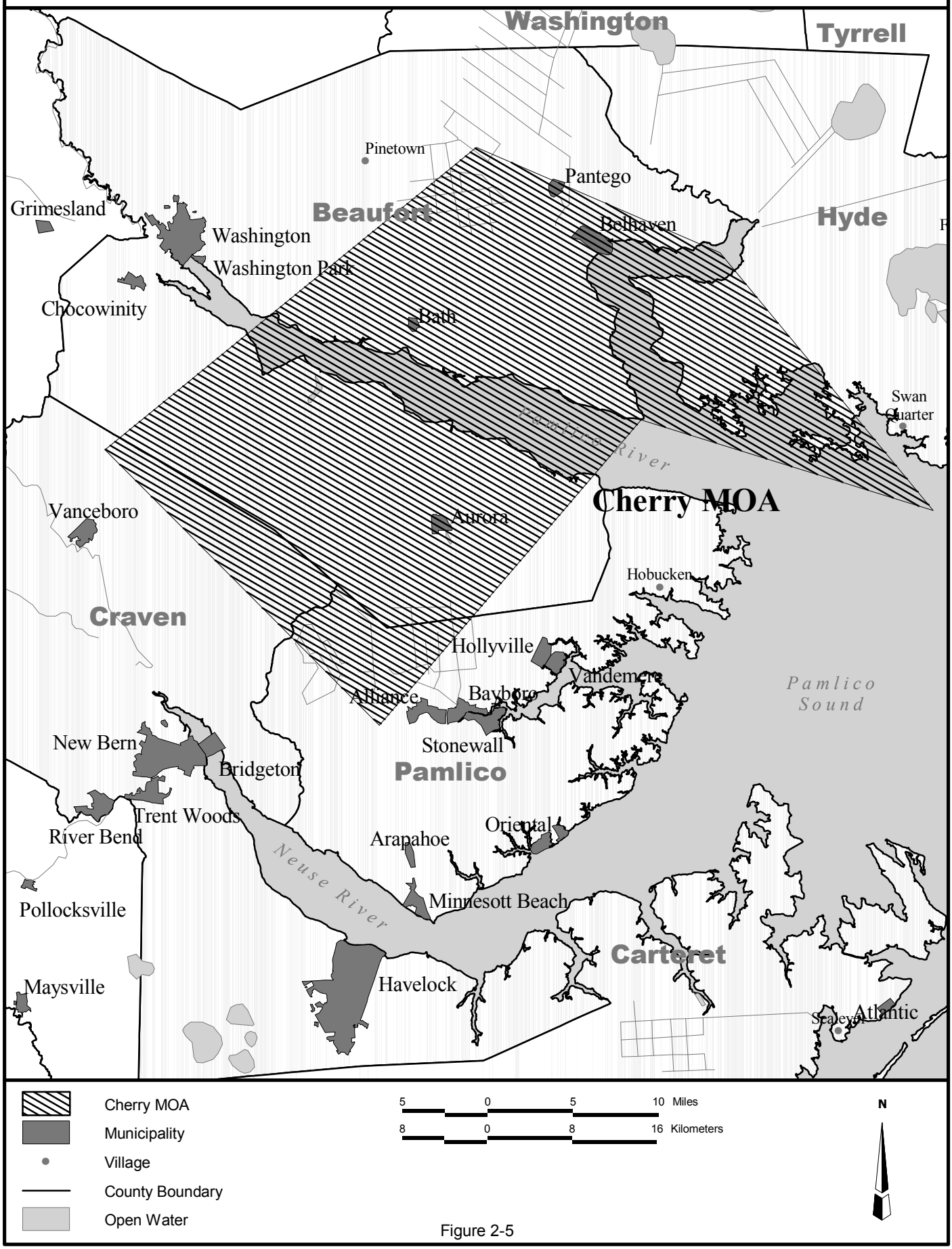


Figure 2-5

3 AFFECTED ENVIRONMENT

This chapter characterizes current or baseline environmental conditions prevalent in the land and water areas that would underlie and be affected by aircraft training operations conducted in the proposed MOAs. The geographic boundaries of this "study area" are broad, roughly defined by the following seven counties: Beaufort, Carteret, Craven, Hyde, Pamlico, Tyrrell, and Washington.

The discussion of the existing environment is maintained on the county level unless a specific topic warrants a more detailed discussion on the city or town level. As well, the depth of description and analysis of each of the pertinent environmental factors (airspace, noise, aircraft operations and safety, natural resources, cultural resources, socioeconomics and community facilities, land use and coastal zone management, and air quality) varies according to the anticipated potential for impact. For example, the description of airspace is more detailed because the proposal has more potential to affect airspace, whereas the description of community facilities is more general in nature because there is little potential for impact. Several traditional environmental factors (geology, soils, water quality, wetlands) are not addressed in this EA as no environmental impacts are expected in these areas should the proposed action be implemented.

This focused approach is consistent with Department of the Navy and CEQ published guidelines for implementing NEPA (32 CFR 775 and 40 CFR 1500). These guidelines instruct that environmental documents succinctly describe the existing environment of an area to be affected by the alternatives under consideration. This means that the analysis should concentrate on important issues at a level of detail sufficient to gain an understanding of the potential effects of a proposed action. Less important material is to be summarized, consolidated, or simply referenced.

3.1 Airspace and Aircraft Operations

This subchapter provides a discussion of airspace resources designated in the vicinity of MCAS Cherry Point and the proposed study area that are used by general aviation and commercial aircraft and for aviation training operations by the Marine Corps and the other military services. The discussion is limited to airspace that lies within 75 NM (139 km) of MCAS Cherry Point.

3.1.1 Airspace

General aviation aircraft (private and governmental), commercial air carriers, charter aircraft, and high-performance military aircraft are the primary users of the airspace overlying eastern North Carolina. Within the study area, these different types of aviation users fly in controlled and

uncontrolled airspace, SUA (e.g., restricted areas, MOAs, and warning areas) and military training routes (MTRs). Shown in Table 2-1 is a listing of designated airspace used by the military in eastern North Carolina. These same designations are graphically depicted in Figure 2-1 (Airspace in Eastern North Carolina).

3.1.1.1 Alert Areas

An alert area denotes where a high volume of pilot training or an unusual type aeronautical activity is conducted that could present a hazard to other aircraft and heightened vigilance is required. The airspace overlying the MCAS Cherry Point and vicinity is designated as A-530.

3.1.1.2 Restricted Areas

Restricted areas in eastern North Carolina operated by the Air Force, Navy, and Marine Corps are as follows:

- **R-5314A-H, J (Dare County Bombing Range)** - Nine restricted airspaces overlie the Dare County Bombing Range: R-5314A, B, C, D, E, F, G, H, and J with aerial extents ranging from surface to 20,500 ft (6,248 m) AGL. The range, used by both the Air Force and Navy, lies to the northeast of MCAS Cherry Point and overlies portions of Dare, Hyde, Tyrrell, and Washington Counties.

- **R-5306D/E, R-5303 A/B/C, and R-5304A/B/C (Marine Corps Base Camp Lejeune)** - These restricted areas are located approximately 25 NM (46 km) southwest of MCAS Cherry Point. Two restricted areas (R-5306D/E) lie within the boundaries of the Marine Corps Base (MCB) Camp Lejeune Complex and are used by fixed-wing squadrons for close-air support and other troop support missions. The other restricted areas (R-5303 A/B/C and R-5304A/B/C) are used in conjunction with training activities occurring in the Greater Sandy Run Area.

- **R-5306A (MCAS Cherry Point)** - This restricted area is about 12 NM (22 km) northeast of MCAS Cherry Point, and overlies the Pamlico Sound and the Neuse and Pamlico Rivers. Associated with the airspace are two bombing targets, BT-9 (Brant Shoals target) and BT-11 (Piney Island range). Both the restricted area and targets are used for air-to-ground weapons delivery, and tactical and electronic warfare training.

- **R-5306C (MCAS Cherry Point)** - This restricted area is approximately 8 NM (15 km) southwest of MCAS Cherry Point and is used for air combat maneuvers and formation training. This restricted area has no associated bombing ranges.

- **R-5313A/B (Stumpy Point Range)** - The Stumpy Point Range is located in Pamlico Sound approximately 65 NM (120 km) north of MCAS Cherry Point. Airspace at this range area includes R-5313A/B together with the overlying Stumpy Point MOA.

3.1.1.3 Warning Areas

There are two warning areas used for training by aircrews from MCAS Cherry Point: W-122A-H and W-72. The Oceana Tactical Aircrew Combat Training System is located within W-72.

3.1.1.4 Military Operations Areas

There are six existing MOAs in eastern North Carolina, some of which are integral components of airspace over existing air-to-ground training ranges. These six MOAs are:

- **Pamlico A** - Pamlico A MOA lies to the northeast of MCAS Cherry Point, where it abuts the Stumpy Point MOA and overlies portions of Cape Hatteras National Seashore and Stumpy Point on the Dare County mainland. However, the majority of its area is over the waters of Pamlico Sound.

- **Pamlico B** - Pamlico B MOA lies to the northeast of MCAS Cherry Point, where it abuts R-5306A and the Stumpy Point, Phelps C, and Pamlico A MOAs. It overlies portions of Cape Hatteras National Seashore (Dare County) and the eastern side of Hyde County (communities of Engelhard and New Holland), but the majority of its area is over the waters of Pamlico Sound.

- **Stumpy Point** - The Stumpy Point MOA is located to the northeast of MCAS Cherry Point over the Pamlico Sound and Stumpy Point on mainland Dare County, and is used to support training operations at the underlying Stumpy Point range.

- **Phelps A, B, and C** - The Phelps MOAs (A/B/C) override the aerial boundaries of R-5314A-H and J of the Dare County Bombing Range. These airspaces are used in conjunction with high-altitude air-to-ground missions at the Dare County Bombing Range, a use that has been confirmed in a Memorandum of Agreement with the FAA.

- **Hatteras F** - This MOA is located approximately 37 NM (69 km) to the southwest of MCAS Cherry Point and south of Camp LeJeune in Onslow and Pender counties.

- **Seymour Johnson Echo** - The Seymour Johnson Echo MOA (Echo MOA) is approximately 72 NM (133 km) to the northwest of MCAS Cherry Point near Goldsboro, North Carolina. It overlies portions of Wayne, Johnston, Sampson, and Duplin Counties.

3.1.1.5 Military Training Routes

Military Training Routes (MTRs) are aerial routes used by the military for conducting low-altitude, high-speed training. There are two types of MTRs:

- **Visual Flight Rules (VR) MTRs** - for low-altitude navigation and tactical training below 10,000 ft (3,048 m) at airspeeds in excess of 250 knots under visual flight rules.

- **Instrument Flight Rules (IR) MTRs** - for low-altitude navigation and tactical training below 10,000 ft (3,048 m) at airspeeds in excess of 250 knots at night and in foul weather.

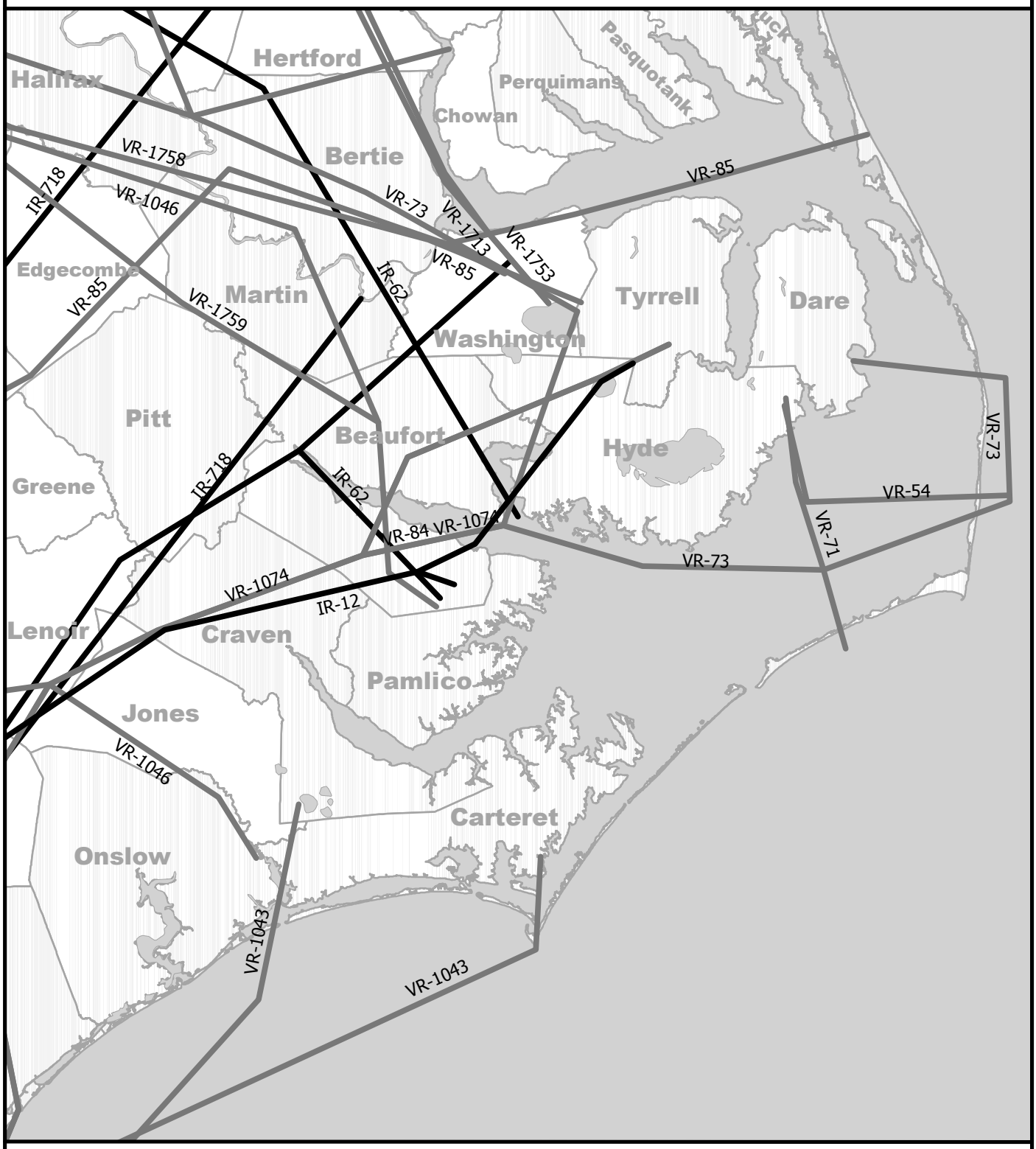
As shown in Table 3.1-1 and graphically depicted on Figure 3.1-1 (Military Training Routes), there are 15 MTRs (both VRs and IRs) that have been established in the airspace within 75 NM (139 km) of MCAS Cherry Point. Four VRs are scheduled by MCAS Cherry Point, all of which lie to the south and east of the air station. VR-1043 and VR-1046 terminate at R-5306A.

Table 3.1-1

Military Training Routes in Eastern North Carolina

MTR Designation	Originating Installation	Hours of Operation
IR 12	Seymour Johnson AFB	Continuous
IR 62	NAS Oceana	Continuous
IR 718	NAS Oceana	Continuous
VR 54	Seymour Johnson AFB	7:00 am-9:00 PM M-F; Other times by NOTAM
VR 71	Seymour Johnson AFB	7:00 am-9:00 PM M-F; Other times by NOTAM
VR 73	Seymour Johnson AFB	Continuous
VR 84	Seymour Johnson AFB	7:00 am-9:00 PM M-F; Other times by NOTAM
VR 85/VR1074	Shaw AFB	Continuous
VR 1043	MCAS Cherry Point	7:00 am-11:00 pm daily
VR 1046	MCAS Cherry Point	6:00 am-6:00 pm M-F
VR 1713	Andrews AFB	7:30 am-sunset daily
VR 1752	FACSFAC VACAPES	Continuous
VR 1753	NAS Oceana	Continuous
VR 1758	NAS Oceana	Continuous
VR 1759	NAS Oceana	9:00 am-sunrise
Source: FAA, 2002.		

Military Training Routes



IR Military Training Route

VR Military Training Route

County Boundary

20 0 20 40 Miles

30 0 30 60 Kilometers

N

Figure 3.1-1

3.1.1.6 Civilian Airports and Military Airfields

The air traffic in the study area below 18,000 ft (5,486 m) MSL, in addition to military aircraft, is comprised of civilian aircraft on Victor Airways (see Subchapter 3.1.1.7) and civilian aircraft operating under VFR. Operations at the airline hubs of Raleigh-Durham, Charlotte, and Atlanta determine the commercial air traffic routing throughout the mid-Atlantic and routes south (Naval Command, Control and Ocean Surveillance Center, July 1994). Flow of commercial air traffic is predominately north/south and along the coastline.

The larger civilian airports in the study area include Craven County Regional Airport (New Bern), Pitt-Greenville Airport (Greenville), the Dare County Regional Airport (Manteo), and Warren Field (Washington County). A complete list of commercial/general aviation airports is shown in Table 3.1-2 and locations of these airports are depicted in Figure 3.1-2 (Civilian Airports and Military Airfields Within the MOA Boundaries). Most of the airports in this region are for commercial use and are privately owned, with only 13 open to the public and owned by county or local governments. The public airports provide commuter service to the major commercial airports in North Carolina and southeastern Virginia.

Craven County Regional Airport handles an average of 163 operations per day (Table 3.1-3), followed by an average of 136 operations per day at the Pitt-Greenville Airport. Three airports, Ocracoke and Engelhard (both in Hyde County) and the Plymouth Municipal Airport, have the fewest daily operations (11 to 17).

Also, as shown in Table 3.1-3, local general aviation makes up more than half of the operations at First Flight (Dare), Craven County (Craven), Michael J. Smith (Carteret), and Kinston/Stallings Field (Lenoir) airports. Ocracoke Airport and Pitt-Greenville Airport are split evenly between local general aviation and transient general aviation operations. Transient general aviation operations make up more than half of the operations of Billy Mitchell, Hyde County (Hyde), Dare County (Dare), Northeastern Regional (Chowan), Plymouth Municipal (Washington), Warren Field (Beaufort), and Martin County (Martin) airports. Air taxi operations make up 12 percent of Hyde County airport operations, which is the highest of all the airports in the vicinity of the proposed project. Military operations account for 6 percent of Michael J. Smith and Kinston/Stallings Field's operations, followed by 5 and 4 percent at Martin County and Warren Field, respectively. Five of the 14 public airports in the project vicinity are unattended.

There are three major military airfields in eastern North Carolina -- MCAS Cherry Point (Havelock), MCAS New River (Jacksonville), and Seymour Johnson Air Force Base (Goldsboro). MCAS Cherry Point was discussed in Chapter 1 of this EA. MCAS New River is part of the MCB Camp Lejeune complex and hosts two primary tenant groups, MAG 26 and 29. Seymour Johnson is the home of the Air Force's 4th Fighter Wing, which is comprised of four F-15E squadrons. In addition, there are one auxiliary and three outlying airfields:

Table 3.1-2

Public and Private Airports in Eastern North Carolina

Airport	Nearest City (County)	Ownership
Albert J. Ellis	Jacksonville (Onslow)	Public
Billy Mitchell	Buxton (Dare)	Public
Ocracoke Island	Ocracoke (Hyde)	Public
Hyde County	Engelhard (Hyde)	Public
Dare County Regional	Manteo (Dare)	Public
Northeastern Regional	Edenton (Chowan)	Public
Plymouth Municipal	Plymouth (Washington)	Public
Washington (Warren Field)	Washington (Beaufort)	Public
Boyd	Chocowinity (Beaufort)	Private
Martin County	Williamston (Martin)	Public
Pitt-Greenville	Greenville (Pitt)	Public
Kinston Regional (Stallings Field)	Kinston (Lenoir)	Public
Star Hill	Cape Carteret (Carteret)	Private
Triple M	Bogue (Carteret)	Private
Circle P	Between Bogue and Newport (Carteret)	Private
Michael J. Smith Field	Beaufort (Carteret)	Public
Dogwood	South of Havelock (Craven)	Private
Bell	Pollocksville (Jones)	Private
Canaan	River Bend (Craven)	Private
Craven County Regional	New Bern (Craven)	Public
Pamlico	Bayboro (Pamlico)	Private
Bay Creek	Mesic (Pamlico)	Private
Wolf	Atlantic (Carteret)	Private
Jackson	Sea Level (Carteret)	Private
Lee Creek	Aurora (Beaufort)	Private
First Flight	Kill Devil Hills	Public
Boyd	Chocowinity (Beaufort)	Private
Hodges	Sladesville (Hyde)	Private
Riverside	Leachville (Hyde)	Private
NC Forest Service Landing Strip	Fairfield (Hyde)	Public
Tom Whitfield Landing Strip	Fairfield (Hyde)	Private
Donald	Plymouth (Columbia)	Private
Keech	Pantego (Beaufort)	Private
Riverside	Plymouth (Washington)	Private
Hickory Hill	Havelock (Craven)	Private
Crystal Beach	North of Coxs Corners (Beaufort)	Private
Welbourn-Woolard (Weyehauser)	South of Rover (Beaufort)	Private
Anderson Landing Strip	East of Vanceboro (Craven)	Private
Gum Neck Landing Strip	Gum Neck (Tyrrell)	Private

Sources:
1. FAA, January 15, 2001.
2. DeLorme, 1997.

Civilian Airports and Military Airfields in Northeastern North Carolina

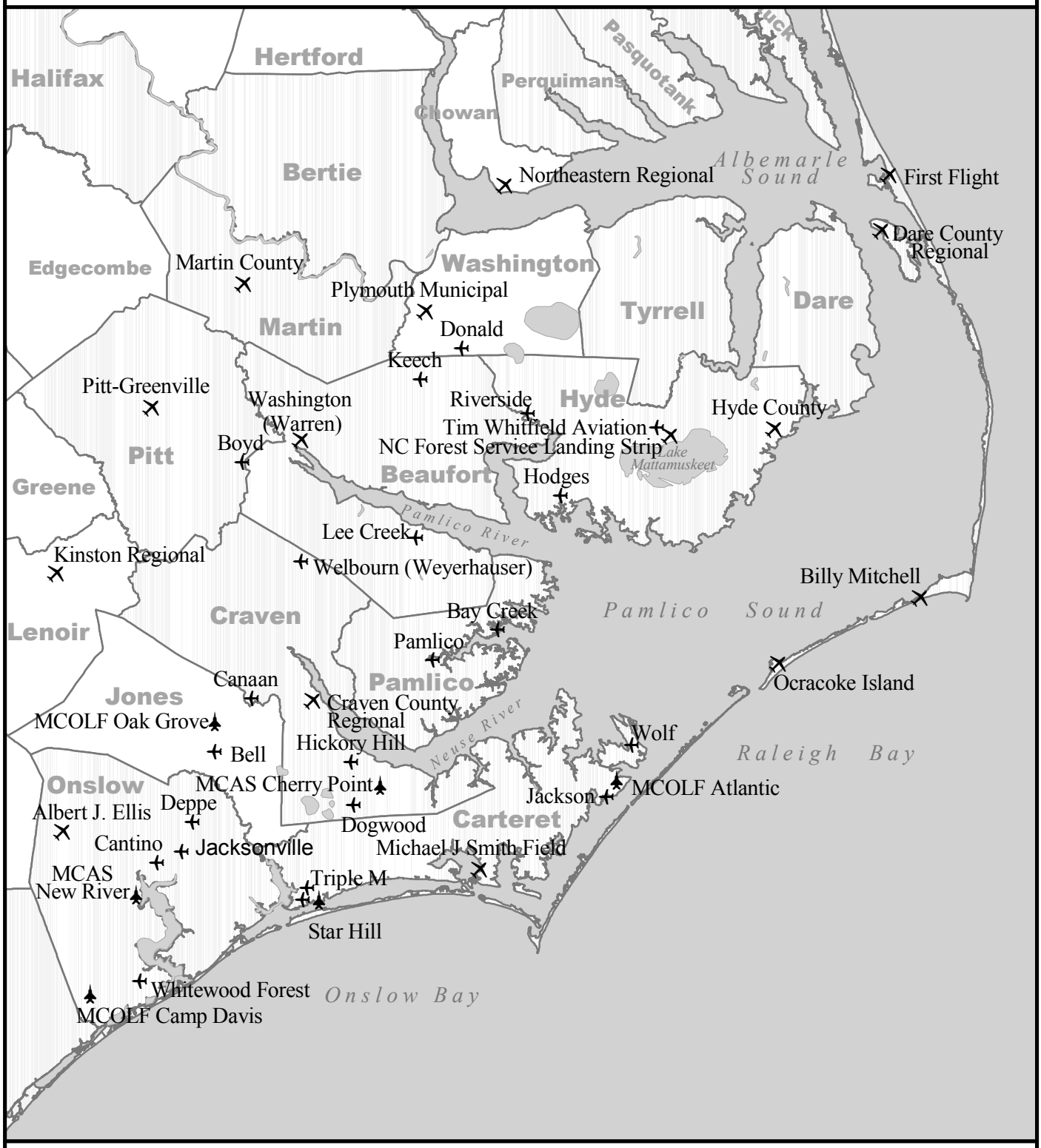


Figure 3.1-2

Table 3.1-3

Public Airports in Project Vicinity

Airport Name (Nearest City)	Runway Condition	Attended	No. Aircraft Based on Field	Average Aircraft Operations Per Day	Operations Details (%)			
					TGA[1]	LGA[2]	AT[3]	MI[4]
Billy Mitchell (Hatteras)	Good	Not Attended	1	25	54	43	1	1
Ocracoke Island (Ocracoke)	Good	Not Attended	1	17	49	49	2	< 1
Hyde County (Engelhard)	Fair	Not Attended	N/A	11	62	25	12	1
Dare County (Manteo)	Fair to Good	8:00 am-7:00 pm	49	128	60	34	4	1
Northeastern Regional (Edenton)	Poor to Good	8:00 am-7:00 pm	13	38	51	44	4	1
Plymouth Municipal (Plymouth)	Fair	Mon-Fri 8:00 am-7:00 pm	10	16	51	43	5	1
Warren Field (Washington)	Poor to Fair	8:00 am-6:00 pm	45	77	60	28	7	4
Martin County (Williamston)	Fair	Nov-Mar 9:00 am-8:00 pm; Apr-Oct 8:00 am-8:00 pm	8	22	63	25	6	5
Pitt-Greenville (Greenville)[5]	Poor to Good	5:30 am-11:30 pm	64	136	32	33	9	1
Kinston/ Stallings Field (Kinston)	Good	5:30 am-0000	43	93	12	82	0	6
Michael J. Smith (Beaufort)	Fair to Good	8:00am-Dusk	87	120	9	77	9	6
Craven County (New Bern)[6]	Fair to Good, Fair	5:00 am-11:30 pm	73	163	11	61	9	2
First Flight (Kill Devil Hills)	Good	Not Attended	N/A	104	37	60	3	<1

Notes:
LGA = Local general aviation
TGA = Transient general aviation
AT = Air Taxi
MI = Military
Source: AirNav: Airport Information [web page], May 7, 2001.

- **Marine Corps Auxiliary Landing Field (MCALF) Bogue** - A controlled, lighted, expeditionary landing field about 20 NM (32 km) east of MCAS New River and about 20 NM (32 km) south of MCAS Cherry Point.

- **Outlying Landing Fields (OLF) Atlantic, Camp Davis, and Oak Grove** - These OLFs are unlit practice fields without control towers. OLF Atlantic is 35 NM (55 km) east of MCAS Cherry Point. OLFs Camp Davis lies within the southern portion of the Greater Sandy Run Area surface training range of MCB Camp Lejeune and Oak Grove lies west southwest of the Craven County airport.

3.1.1.7 Victor Airways

The primary highways in the sky that are used by both IFR and VFR commercial air carriers, general aviation and military air traffic are the low altitude airways (1200 ft [366 m] to 18,000 ft [5486 m]) known as Victor Airways. In the vicinity of MCAS Cherry Point and within the footprint of the proposed MOAs there are three Victor Airways: V56, V139, V290. These routes are shown in Figure 3.1-3 (Victor Airways). The V139 route runs north and south from the Craven County Regional Airport. The V290 route, located north of MCAS Cherry Point, overlies parts of Beaufort, Washington, Tyrrell, and Hyde Counties. This route splits into two legs north of Leachville (Beaufort County), with the southern route extending to Ocracoke Island on the Outer Banks, and the northern route (now V56) extending to Hatteras. At Hatteras, V56 turns northward and is renamed G13, which ends at the Dare County Regional Airport (Manteo).

3.1.2 Aircraft Operations in Eastern North Carolina

Both military and civilian aircraft operations occur in the study area in the airspace described in Subchapter 3.1. Military air traffic includes aircraft from MCAS Cherry Point, MCAS New River, NAS Oceana, and Seymour Johnson Air Force Base (AFB). Other sources of military operations include Pope AFB, various Air National Guard units, Shaw AFB, MCAS Beaufort, and Naval aircraft carriers operating offshore. These aircraft are typically transiting between home airfields, existing on-shore air-to-ground ranges, and going to and from offshore Naval air carriers. Existing sorties occurring in the airspaces in the study area and along MTRs are shown in Tables 3.1-4 and 3.1-5. Baseline sorties by aircraft type and airspace are shown in Table 3.1-6. For reference, a sortie in the context of training operations is defined as “one aircraft or a flight of aircraft entering a region of airspace, operating there for a period of time and leaving.”

The airspace comprising R-5306A and the targets (BT-9/BT-11) is available nearly 24 hours per day and heavily used. A total of approximately 5,704 sorties per year occurs exclusively within R-5306A (i.e., training operations occurring exclusively within R-5306A without also using the BT-9/BT-11). Based on an average of 260 training days per year, the highest concentration of sorties (an average of 22 per day) occurs in R-5306A. The AV-8 aircraft flies over 88 percent

Victor Airways

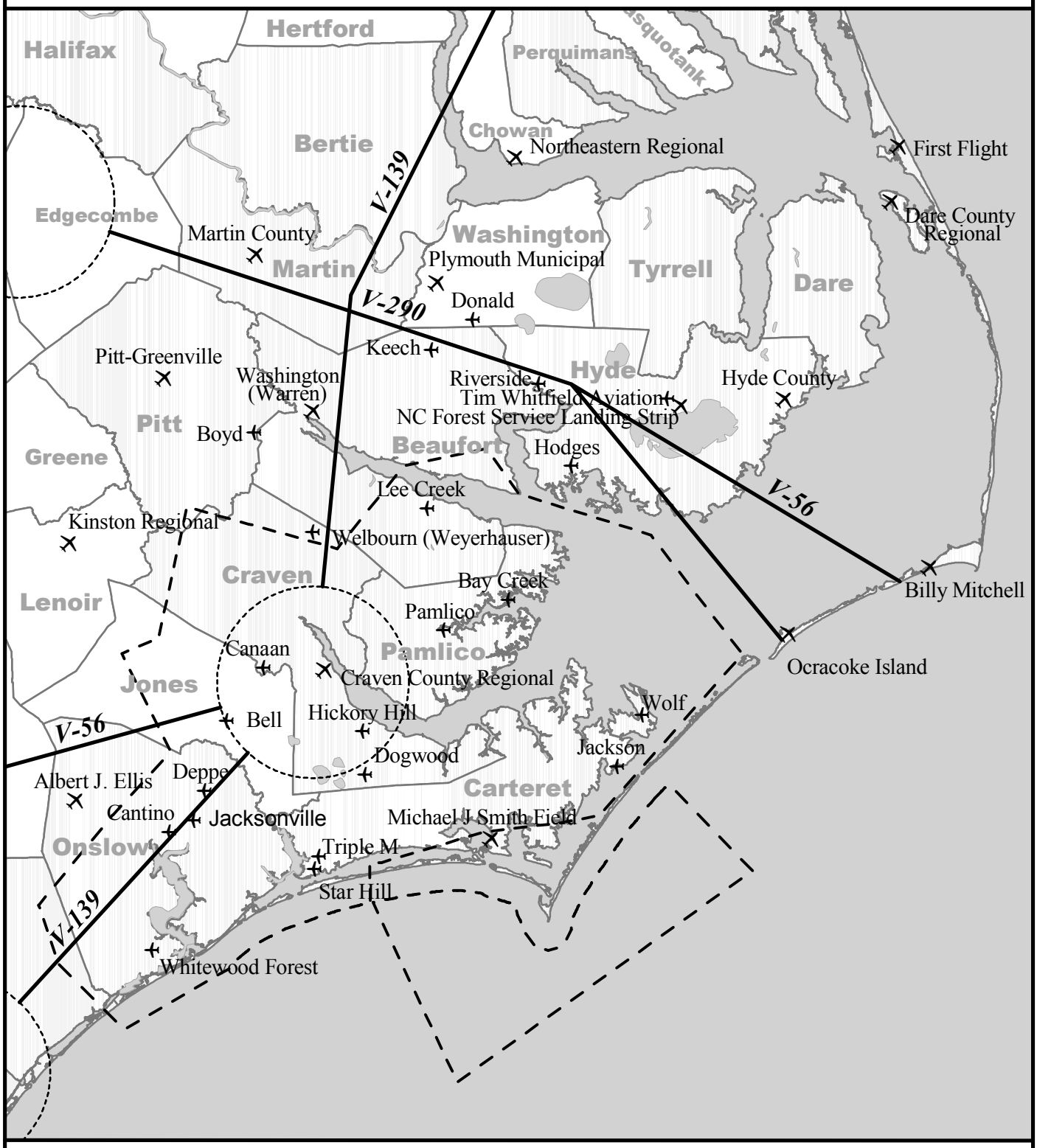


Figure 3.1-3

Table 3.1-4

Annual Baseline Military Aircraft Operations in Eastern North Carolina Airspace

Airspace	Annual Sorties		
	Day (7:00-10:00 pm)	Night (10:00-7:00 am)	Total
R-5306A (Exclusive of BT-9/BT-11)	5,638	66	5,704
W-72	23,371	1,819	25,190
W-122	13,025	1,506	14,531
Targets[1]			
BT-9	1,904	41	1,945
BT-11	4,349	138	4,487

Notes:
1. Area within a 5 NM (9.3 km) radius of target.
Source: ATAC Corporation, 2001.

Table 3.1-5

Navy/Marine Corps Military Training Route Baseline Use

MTR Designation	Annual Sorties		
	Day (7:00 am-10:00 pm)	Night (10:00 pm-7:00 am)	Total
VR 73	267	10	277
VR 1043	0	0	0
VR 1046	174	0	174
VR 1074	299	0	299
VR 1753	214	0	214
Other Visual Routes	1,457	5	1,462
Other Instrument Routes	81	4	85

Source: ATAC Corporation, 2001.

Table 3.1-6

Baseline Annual Sorties by Airspace and Aircraft Type

Aircraft Type	Annual Sorties by Airspace									
	Day (7:00-10:00 pm)				Night (10:00-7:00 am)				Total Day/Night	%
	R-5306A[1]	BT-9[2]	BT-11[2]	Total Day	R-5306A[1]	BT-9[2]	BT-11[2]	Total Night		
Air Force										
A-10 (Air Force)	29	0	0	29	0	0	0	0	29	0.2
F-15C/D (Air Forces)	54	59	379	492	0	0	10	10	502	4.1
F-16 (Air Force)	202	432	368	1,002	4	9	0	13	1,015	8.4
Total Air Force	285	491	747	1,523	4	9	10	23	1,546	12.7
Marine Corps										
AV-8 (Fleet)	2,638	178	1,144	3,960	51	4	38	93	4,053	33.4
AV-8 (FRS)[3]	2,330	424	406	3,160	11	6	7	24	3,184	26.2
F/A-18C/D (Marine Corps)	100	204	376	680	0	12	16	28	708	5.8
Helicopters (Marine Corps)	134	196	286	616	0	0	0	0	616	5.1
KC-130 (MCAS Cherry Point Fleet)	0	0	3	3	0	0	1	1	4	0.0
Total Marine Corps	5,202	1,002	2,215	8,419	62	22	62	146	8,565	70.6
Navy										
F-14C/D (NAS Oceana Fleet)	0	39	397	436	0	0	0	0	436	3.6
F-14C/D (NAS Oceana FRS)[3]	0	53	43	96	0	0	0	0	96	0.8
F/A-18C/D (NAS Oceana Fleet)	0	200	624	824	0	10	50	60	884	7.3
Total Navy	0	292	1,064	1,356	0	10	50	60	1,416	11.7
Other Military										
Other Military Jets	61	20	229	310	0	0	0	0	310	2.6
Other Military Props	90	23	18	131	0	0	0	0	131	1.1
Other Military Helicopter	0	76	76	152	0	0	16	16	168	1.4
Total Other	151	119	323	593	0	0	16	16	609	5.0
Total	5,638	1,904	4,349	11,891	66	41	138	245	12,136	100

Notes:
1. Exclusive of BT-9/BT-11 use.
2. Area within a 5 NM (9.3 km) radius of target.
3. FRS = Fleet Replacement Squadron.

Source: ATAC Corporation, 2001.

of the sorties occurring exclusively within R-5306A. The utilization rate for the BT-11 airspace approximates that of R-5306A (exclusive), with an average of 17 sorties occurring per day based on an average of 260 training days per year. The mix of aircraft using the BT-11 target is broader, although the AV-8 still dominates the number of sorties flown. There are fewer daily sorties to the BT-9 target, averaging between seven and eight per day.

Air traffic transiting eastern North Carolina is composed primarily of general aviation aircraft operating under VFR with the majority flying below 5,000 ft (1,524 m) MSL. Aircraft operations in the study area include:

- Commercial air carriers.
- Menhaden fish spotters.
- Crop dusters.
- Aircraft operated by North Carolina state agencies:
  - Marine Fisheries.
  - Forest Service.
  - Bureau of Investigation.
  - Wildlife Resources Commission.
- Aircraft operated by the US Fish and Wildlife Service.
- National Park Service
- Government and private aircraft conducting photogrammetry.
- Industrial operations (*e.g.*, wood products companies).
- Tourist and business charter.
- Pilot training.
- Recreational flying (including ultralights).
- Emergency aircraft.
- Banner flying

Additional detail on US Fish and Wildlife Service and National Park Service flight operations is summarized in Table 3.1-7. These agencies use aircraft to perform a number of operations over the national wildlife refuges and the national seashores, including wildlife tracking flights, aerial survey flights, and fire spotting (for fire suppression as well as controlled burns). Routine red wolf surveys do follow a flight path (Figure 3.1-4, Wildlife Tracking Flights, Aerial Survey Routes, and Fire Spotting). However, deviations from this flight path may occur if needed. For example, if US Fish and Wildlife Service personnel have noticed that a particular animal's signal has ceased to move from an area for a time, they may leave the routine flight path and fly to that signal in an attempt to locate that animal and determine if it is injured or dead. Figure 3.1-4 also illustrates the general flight paths flown over Mattamuskeet, Swanquarter, and Pocosin Lakes National Wildlife Refuges for waterfowl surveys.

Aircraft also use the Victor Airways in the study area (described in Subchapter 3.1.3) under VFR and IFR at all altitudes below 18,000 ft (5,486 m) MSL as appropriate to the terrain and air

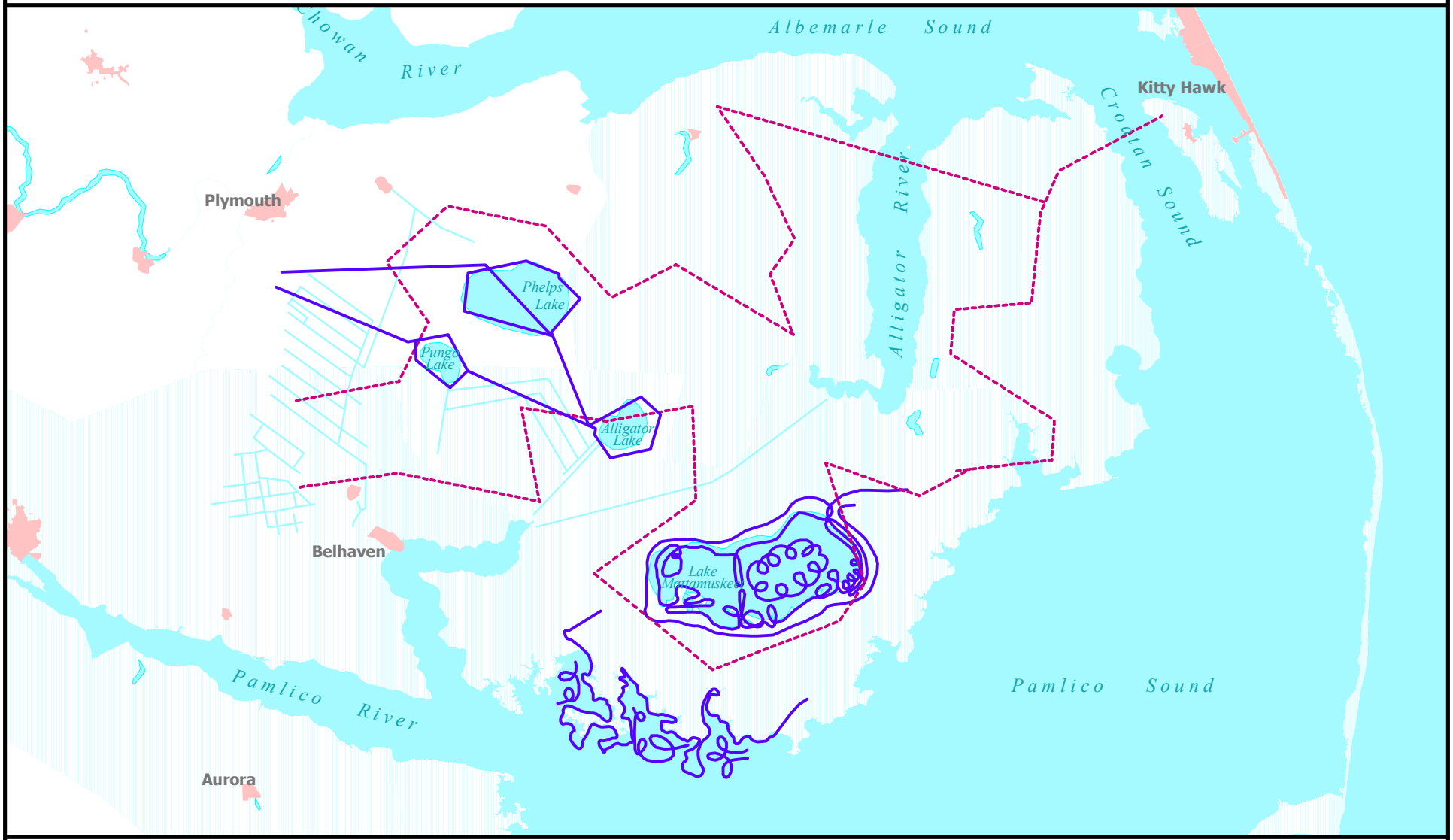
navigation aids. In addition, civilian air traffic must maintain a 3-NM (5.6-km) lateral separation from restricted airspace boundaries (ATAC Corporation, 2001).

Table 3.1-7

US Fish and Wildlife Service and National Park Service Flight Operations in Eastern North Carolina

Type of Flight	Aircraft Used	Location	Frequency	Time of Day/Night	Altitude
Wildlife Tracking (Red Wolf)	fixed-wing float or fixed-wheel	5-county area including Alligator River National Wildlife Refuge	2-3 times per week in February-March (breeding season); once per week for the remainder of the year	7:30 am-4:00 pm	100-500 ft (30 to 152 m) AGL; may fly as high as 2,500 ft (762 m) to get a better signal
Aerial Survey Flights (waterfowl)	fixed-wing float or fixed-wheel	Mattamuskeet, Pocosin Lakes, Swanquarter National Wildlife Refuge	Waterfowl surveys flown 2 times per month from October to March;	Not identified	100-500 ft (30 to 152 m) AGL
Aerial Survey Flights (red-cockaded woodpecker)	helicopter	Alligator River, Pocosin Lakes National Wildlife Refuge	Surveys conducted 2-3 times per year in early spring at Pocosin Lakes NWR and one flight every few years at Alligator River National Wildlife Refuge	7:30 am-4:00 pm	60-500 ft (18-152 m) AGL
Fire Detection Services	fixed-wing	Eastern North Carolina	Daily flights March 1-May 31; 2-3 flights flown February 28 to June 1	Not identified	500 ft (152 m) AGL
Prescribed Burn Fire Management	helicopter	Alligator River, Pocosin Lakes National Wildlife Refuges	Up to 30 flights March 1-May 31	Not identified	500 ft (152 m) AGL
Southern Pine Beetle Monitoring	fixed-wing	Alligator River National Wildlife Refuge	10 flights per year	Not identified	500 ft (152 m) AGL
Sources: Stewart, 2001.					

Wildlife Tracking Flights, Aerial Survey Routes, and Fire Spotting



Waterfowl Aerial Survey Route

Red Wolf Aerial Survey Route

5 0 5 10 Miles

10 0 10 Kilometers

N

Figure 3.1-4

3.1.3 Air Traffic Control

During the hours that the Marine Corps is likely to use the proposed MOA(s) (normally from 7:00 am to 11:00 pm), MCAS Cherry Point's Radar Air Traffic Control Facility (RATCF) provides radar air traffic control services for both military and civilian aircraft within the area depicted in Figure 3.1-3. Cherry Point radar coverage can observe primary targets 45 nautical miles (NM) from the radar antenna at and above 3,000 feet Mean Sea Level (MSL) and primary targets at 55 NM from the radar antenna at and above 4,000 feet MSL. The extent of primary radar coverage in relation to the proposed MOAs is depicted in Figure 3.1-5. Furthermore, transponder equipped aircraft beyond 55 NM from Cherry Point and within the lateral limits of the proposed MOA airspace can normally be observed by secondary radar at and above 4,000 feet MSL. The RATCF also provides approach control services to local civil airports located within this area. In addition to providing air traffic control service, the RATCF at MCAS Cherry Point provides radar containment services for all SUA under its jurisdiction as depicted in Figure 3.1-3. These services include, but are not limited to:

- Separating aircraft and issuing safety alerts.
- Providing for the safe, orderly, and expeditious flow of air traffic within designated airspace.
- Providing radar services including traffic advisories and radar flight following.
- Segregating participating aircraft and letter of agreement holding, non-participating aircraft operations within active Special Use Airspace (SUA).
- Managing SUA real-time use.
- Monitoring and containing participating aircraft operations.
- Protecting against non-participating aircraft entry into active Special Use Airspace through radar surveillance.
- Providing and coordinating assistance to aircraft experiencing emergency conditions.

Other entities with air traffic control responsibility close to the footprint of the proposed MOAs include the FAA's Washington Air Route Traffic Control Center, the Navy's Fleet Area Control Surveillance Facility, Virginia Capes (FACSFAC VACAPES), and the Seymour Johnson Air Force Base.

MCAS Cherry Point Radar Coverage

Figure 3.1-5

3.2 Noise

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Whether that sound is interpreted as pleasant (music, for example) or unpleasant (pile driving, for example) depends largely on the listener's current activity, experience, and attitude toward the source of that sound. Noise is often defined as unwanted sound and is one of the most common environmental issues of concern to the public. Sources of noise that intrude on the everyday quality of life in an urban or suburban area include interstate and local roadway traffic, aircraft, rail, as well as industrial and other neighborhood sources, such as refuse collection trucks.

The loudest sounds the human ear can hear comfortably have one trillion (1,000,000,000,000) times the acoustic energy of sounds the ear can barely detect. Because of this vast range, any attempt to represent the intensity of sound using a linear scale becomes unwieldy. As a result, a logarithmic unit called the decibel (dB) is used to represent the intensity of sound. This representation is called a sound pressure level (SPL).

An SPL of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal conversational speech has an SPL of approximately 60 dB. SPLs above 120 dB begin to be felt inside the human ear as discomfort and eventually pain at still higher levels. The minimum change in SPL that an average human ear can detect is about 3 dB. A change in SPL of 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness, and this relationship holds true for loud sounds and for quieter sounds (Table 3.2-1).

Table 3.2-1

Decibel Changes and Loudness

Change (dBA)	Relative Loudness
0	Reference
3	Barely perceptible change
5	Readily perceptible change
10	Half or twice as loud
20	1/4 or four times as loud
30	1/8 or eight times as loud
Source: Based on Federal Highway Administration, June 1995.	

Because of the logarithmic nature of the decibel unit, sound levels cannot be directly added or subtracted and are somewhat cumbersome to handle mathematically. Decibel addition is often referred to as "energy addition," a term that is illustrative of the fact that when decibel values are added, each decibel value is first converted to its corresponding acoustic energy, then energies

are added using the normal rules of addition, and finally the total energy is converted back to its decibel equivalent. An example of decibel addition is shown in the following box.

Decibel Addition

Some simple rules of thumb are useful in dealing with sound levels. First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. For example:

60 dB + 60 dB = 63 dB, and
80 dB + 80 dB = 83 dB.

On the other hand, the total sound level produced by two sounds of different levels is usually only slightly more than the higher of the two. For example:

60.0 dB + 70.0 dB = 70.4 dB.

The physical characteristics of noise, or sound, include its intensity, frequency, and duration. Because noise events have a range of characteristics, and the human ear does not respond to sounds of varying frequency and intensity in a linear fashion, various “weighting” factors are applied to noise measurements to produce values that correspond to human response. The weighting scale commonly used in measurements of environmental noise is the “A” scale.

The “A” Scale

The normal human ear can usually detect sounds that range in frequency from about 20 hertz to about 15,000 hertz. However, all sounds throughout this range are not heard equally well. Therefore, some sound meters are adjusted to emphasize frequencies in the 1,000 to 4,000 hertz range. The human ear is most sensitive to frequencies in this range and sounds measured with instruments adjusted in this manner are termed “A-weighted.” Thus, in measuring community noise, human frequency dependence is taken into account. In this document all sound levels are A-weighted sound levels (unless otherwise noted) and the adjective "A-weighted" has been omitted.

3.2.1 Noise Descriptors

When an aircraft flies overhead, the sound level changes continuously, starting at the ambient (background) level, increasing to a maximum as the aircraft passes closest to an observer, and then decreasing to ambient as the aircraft flies into the distance. To measure the effect (intensity and frequency) of such a sound event on the environment, mathematical representations, or “metrics” have been developed. The Department of Defense and the FAA have specified metrics

that are appropriate for use in federal aviation noise assessments to address the impacts of aircraft-related single event noise as well as the impacts of total sound exposure over a period of time (e.g., 24 hours):

- **Maximum Sound Level (L_{Amax})** - This metric is used to define maximum noise levels and represents the highest A-weighted sound level measured during a sound event such as a single aircraft overflight. For an observer, the noise level starts at the ambient noise level, rises up to the maximum level as the sound generator comes closest to the observer, and returns to the ambient level as the sound generator recedes into the distance. The maximum sound level is important in judging the interference caused by a noise event with conversation, TV or radio listening, sleep, or other activities. Maximum sound levels of common sound events are shown in Figure 3.2-1 (Typical A-Weighted Sound Levels).

- **Sound Exposure Level (SEL) -** The SEL metric accounts for both the maximum sound level (described above) and the length of time a sound lasts. However, this metric 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 one second. SELs decrease as altitude increases and varies according to the type of aircraft, its altitude or distance from the observer, and its speed. Since aircraft overflights are usually longer than one second in duration, the SEL of an overflight is usually greater than L_{max}. Because the SEL is a composite metric which represents both the intensity and duration of a sound, it is well established within the scientific community that it measures the impacts of sound more reliably than L_{max}.

- **Day-Night Average Sound Level (L_{dn}, also denoted as DNL)** - For the evaluation of community noise effects, and particularly aircraft noise effects, the Day-Night Average Sound Level (L_{dn}) metric is used. This metric combines the levels and durations of noise events and the number of noise events over an extended time period. It is a cumulative average computed over a 24-hour period to represent total noise exposure. A 10 dB adjustment is added to those noise events that occur between 10:00 pm and 7:00 am. This 10 dB "penalty" represents the increased intrusiveness of sounds that occur during normal sleeping hours, both because of the increased sensitivity to noise during those hours and because ambient sound levels during nighttime are typically 10 dB lower than during daytime hours. Because L_{dn} is reported in terms of decibels, and thus logarithmic in nature, the 24-hour average is not a conventional average, but rather is weighted toward high-decibel events, as a consequence of the decibel addition rule described above.

- **On-Set Rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr})** - This metric is the measure used for subsonic aircraft noise in military airspace

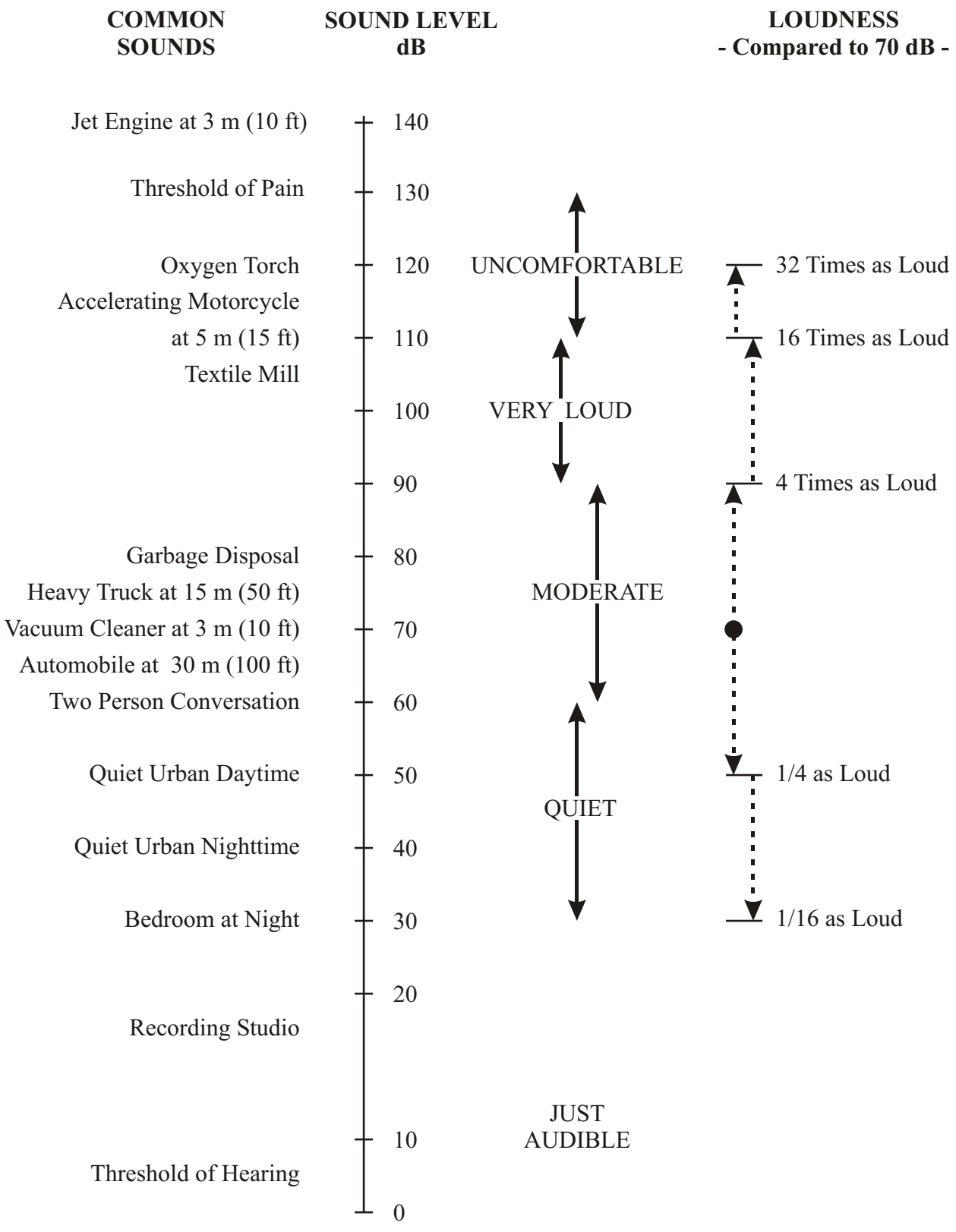
along low-altitude MTRs and in MOAs and restricted and warning areas. This metric accounts for the fact that when military aircraft fly low and fast, the sound can rise from the ambient to its maximum very quickly. Known as an on-set rate, this effect can make noise seem louder due to the added "startle effect." Penalties ranging from 0 to 11 dB, depending on predicted noise increase rates, are added to account for this on-set rate. As with L_{dn}, because L_{dnmr} is reported in decibels, the metric is skewed toward the loudest events. In order to ensure that the most reasonable worst-case scenario is analyzed, the L_{dnmr} metric is based on the number of average daily operations in the month with the highest number of operations so that predictions are not diluted by seasonal periods of low activity.

The principal metric used in this report is the on-set-rate adjusted day-night sound level (L_{dnmr}). The L_{dn} noise metric (and by extension the L_{dnmr}) used in this report is based on extensive research on the effects of noise on communities. In 1992, this metric was endorsed for aviation-related noise analysis by the Federal Interagency Committee on Noise (FICON), a committee composed of representatives from the US Departments of Defense, Transportation, and Housing and Urban Development; CEQ; the US Environmental Protection Agency (USEPA); and the Veterans Administration. It has been found to correlate well with community response to noise and is consistent with controlled laboratory studies of people's perception of noise. While originally developed for major noise sources such as highways and airports in populated areas, L_{dn} has been shown to be applicable to infrequent events (Fields and Powell, 1995) and to rural populations exposed to sporadic military aircraft noise (Stusnick et al., 1992; Stusnick et al., 1993).

Since L_{dn} is a cumulative metric that represents the total (cumulative) sound exposure over a period of time, it does not account for the sound level and duration of individual events, nor does it represent the sound level perceived at any specific time. As a result, some of the public has criticized the use of L_{dn} as not accurately representing community annoyance and land use compatibility with aircraft noise. Much of that criticism stems from a lack of understanding of the measurement or calculation of L_{dn}. One frequent criticism is based on the feeling that people react more to single noise events than to "meaningless" time-average sound levels. In fact, DNL takes into account both the noise levels of all individual events occurring during a 24-hour period and the number of times those events occur. As described above, the logarithmic nature of the decibel unit causes noise levels of the loudest events to control the 24-hour average (see box).

Interpretation of L_{dn} or L_{dmnr} is usually based on the results of attitude surveys that have been conducted to determine the percentages of people who express various degrees of annoyance when exposed to different levels of L_{dn}. Annoyance is definable as any negative subjective reaction to noise on the part of an individual or group (see box). The concept of "percent highly annoyed" has provided the most consistent response of a community to a particular noise environment. In fact, several studies have indicated an 85 to 95 percent correlation between L_{dn} levels and groups reporting that they are highly annoyed by noise sources (USEPA, 1978; Schultz, 1978; and Fidell, et al., 1991 as cited in Appendix C). The correlation is lower for the

Typical A-Weighted Sound Levels



Source: Based on Harris, 1979 and Pierce, 1989.

Figure 3.2-1

annoyance of individuals, not surprising given the various factors that affect how an individual will react to noise. Despite this, the correlation between community annoyance and aircraft noise is considered to be substantially reliable for reference in this EA.

DNL Illustration

The averaging of noise over a 24-hour period does not ignore the louder single events and, in fact, tends to emphasize both the higher sound levels and the number of those events. This is the basic concept of a time-average sound metric, and specifically the L_{dn}. Consider these two examples:

Example A: A single aircraft overflight occurs during the daytime of a 24-hour period and creates a sound level of 100 dB for 30 seconds. During the remaining 23 hours, 59 minutes, and 30 seconds of the day, the ambient sound level is 50 dB. The L_{dn} for this 24-hour period is 65.5 dB.

Example B: Ten 30-second overflights (100 dB) occur during the daytime of the next 24-hour period with the same ambient sound level of 50 dB during the remaining 23 hours and 55 minutes of the day. The L_{dn} for this 24-hour period is 75.4 dB.

Factors Affecting Annoyance Response of an Individual

A number of acoustic factors have been identified that may influence the annoyance response of an individual. Newman and Beattie (1985) divided these factors into emotional and physical variables:

Emotional	Physical
• Feelings about the necessity or preventability of noise • Judgment of the importance and value of the activity that is producing the noise • Activity at the time an individual hears the noise • Attitude about the environment • General sensitivity to noise • Belief about the effect of noise on health • Feeling of fear associated with noise	• Type of neighborhood • Time of day • Season • Predictability of noise • Control over the noise source • Length of time individual is exposed to noise

The results of community noise attitude surveys have been plotted and are represented on the "Updated Schultz Curve" (Figure 3.2-2, L_{dn} and Annoyance). This curve was originally developed in the 1970s and has been subsequently updated and validated several times (e.g., Fidell et al., 1991 as cited in the Noise Analysis Report, attached as Appendix C). As can be seen from the figure, annoyance never equals zero even when there is no noise, because some people are always annoyed. Conversely, annoyance never equals 100 percent, no matter how noisy, because some people are never annoyed or never complain. Response to L_{dnmr} is obtained by applying L_{dnmr} to the L_{dn} axis of the Schultz Curve. Since L_{dnmr} is always greater than or at least

equal to L_{dn}, this automatically yields the increased level of annoyance associated with the added penalties used in L_{dmnr}. The most common point referred to on the Schultz Curve is 65 dB. This benchmark is often used as a threshold for determining residential land use compatibility around airports or highways. It is used in this EA as a criterion for identifying the potential for noise impacts.

3.2.2 Noise Modeling of Existing Aircraft Operations

3.2.2.1 Ambient Noise Levels in Areas Outside Existing SUA

No direct measurements have been made of existing ambient noise conditions in the areas of eastern North Carolina that would underlie the proposed MOAs but are currently outside the boundaries of existing SUA. In general, existing sources of environmental noise in these areas include roadway traffic on highways, commercial airline and private aircraft traffic, recreational activity, and agricultural and industrial operations, in addition to noise from occasional military aircraft operations and the natural noise generated by the numerous waterfowl that seasonally occupy the national wildlife refuges that would underlie the proposed MOAs.

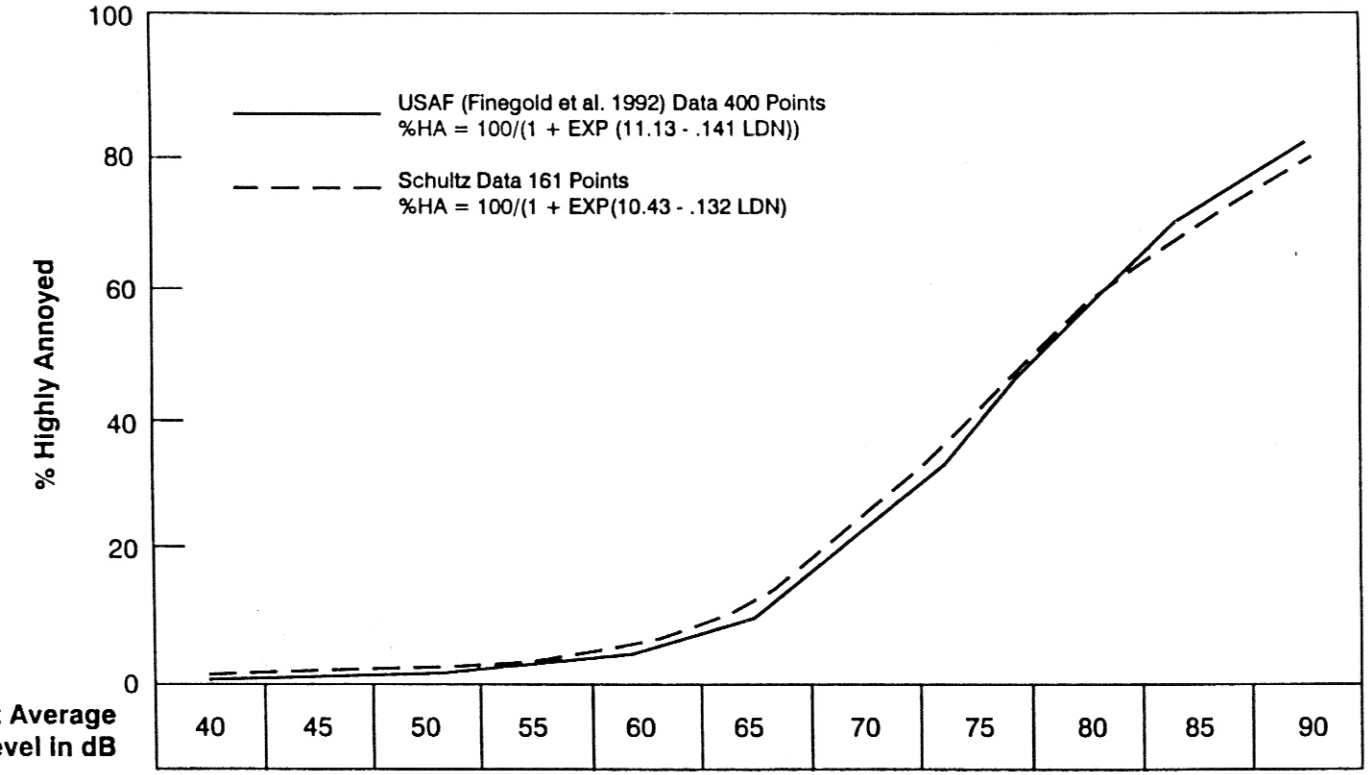
There are limited documented sources on general ambient noise levels occurring in locations similar to those found in eastern North Carolina. The ambient values shown in Table 3.2-2 are provided for general reference only. It is important to recognize that ambient background noise, even in wilderness areas, varies widely depending on location, season, and weather. For example, studies conducted in an open pine forest in the Sierra National Forest in California have measured up to a 10 dB variance in sound levels simply due to an increase in wind velocity (Harrison, 1973 in: US Army Corps of Engineers, May 1999). Studies conducted at Everglades National Park and Key Biscayne National Park (Wyle Labs, 2000) found day-long average ambient noise levels, characterized by the L_{90} metric, to range between 29 and 39 dBA. Diurnal variations in ambient noise levels associated with time of day (i.e., sunrise, sunset, nighttime, daytime) ranged between 28 and 44 dBA.

Table 3.2-2

Ambient Noise Values (Without Aircraft Noise) for Representative Environments

Noise Environment	dBA
Rural and small town environment	40-50
Suburban environment	55-65
Wilderness area	32-54
Ocean surf	61-64
Offshore ocean environment	46
Sources: USEPA, 1974, US Air Force, 1988; and Richardson et al., 1995.	

DNL and Annoyance



Day - Night Average Sound Level in dB	40	45	50	55	60	65	70	75	80	85	90
Calculated %HA Points: USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
Calculated %HA Points: SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81

Source: FICON, 1992.

Figure 3.2-2

3.2.2.2 Ambient Noise Levels in Areas Underlying Existing SUA

To determine the effect of existing aircraft operations in designated SUA, a detailed noise analysis was conducted for the study area using the MR_NMAP noise model (pertinent components of the model are described in Table 3.2-3). This computer-based simulation model is used to predict aircraft noise from aircraft operating in SUA, including MOAs, restricted areas, and along MTRs. It mathematically calculates the noise levels for all aircraft operations over an average 24-hour period, taking into consideration the number and types of aircraft, their flight paths and engine thrust settings, the time of day (daytime or nighttime) that each operation occurs, and other parameters, as appropriate. These resulting noise levels are represented in cumulative L_{dnmr} levels that account for all flight activity occurring within the airspace boundaries. The noise modeling analysis is documented in the noise analysis report, *Noise Analysis of Proposed Core, Mattamuskeet and Cherry Military Operations Areas Near Marine Corps Air Station Cherry Point, North Carolina* (Wyle Laboratories, April 2003), attached as Appendix C. The material presented here and in Subchapter 4.2 draws heavily from that report.

Baseline noise conditions in SUA overlying eastern North Carolina, specifically within R-5306A (and the BT-9/BT-11 targets areas), were analyzed. As described in Subchapter 3.1, a wide array of Department of Defense aircraft (Navy, Marine Corps, Air Force, Army, and Air National Guard) uses the airspace for training operations. These training operations are situationally dependent on aircraft type and training mission and can involve, but are not limited to, delivery of ordnance to the targets, formation flying, and air combat maneuvering. Given the broad use of existing airspace, several assumptions were incorporated into the computerized noise analysis to simulate the variability of military aviation operations:

- Use of the airspace was based on the number of flying days in the busiest month of the year, as provided by MCAS Cherry Point personnel. The modeling periods were 16, 23, and 23 days for BT-9, BT-11, and R-5306A, respectively.

- A random distribution method was used for modeling altitudes, power settings, and airspeeds of existing sorties.

As can be seen in Table 3.2-4, the existing baseline noise level in SUA over eastern North Carolina ranges from an L_{dnmr} level of 57 to 68 dB. Due to the more concentrated occurrence of flight activity that occurs at the target areas (BT-9 and BT-11) within R-5306A, the L_{dnmr} values in those areas are higher (62 and 68 dB, respectively).

Table 3.2-3
Computerized Noise Models

Focus of Analysis	Model Name	Model Description
Airfield Noise	NOISEMAP	NOISEMAP is most accurate for comparing "before-and-after" noise effects that would result from proposed airfield changes or alternative noise control actions, when the calculations are made in a consistent manner. It allows prediction of noise impacts in the absence of the actual implementation and noise monitoring of any such actions. Of course, L_{dn} may be measured directly around an airfield rather than calculated. Calculated sound levels are often supplemented by on-site measurements, where useful. NOISEMAP also has the flexibility of calculating sound levels at any specified point so that noise impacts at representative locations around an airfield can be obtained. The suite of programs included in NOISEMAP are: • NOISEFILE - noise database for many models of aircraft that represents actual noise measurements regularly updated by the Department of Defense for all aircraft. • BASEOPS - allows for entry of runway coordinates, airfield information, flight tracks, flight profiles (powers, altitudes, and speeds), numbers of flight operations, etc. • The core NOISEMAP program incorporates the number of daytime (0700-2200) and nighttime (2200-0700) operations, flight paths, and profiles of the aircraft to calculate L_{dn} at many points on the ground around the facility. • The NMPLOT program draws contours of equal L_{dn} (60, 65, 70, 75, and 80 dB) for overlay onto land-use maps.
Airspace Noise (MOAs, Restricted Areas, and MTRs)	MR_NMAP	MR_NMAP can model the way aircraft fly in a military airspace via three general representations: (1) broadly distributed operations that generally occur in MOAs and restricted areas; (2) distributed parallel tracks that occur along MTRs; and (3) specific tracks that occur in range target areas. The MR_NMAP suite of programs is similar to that described above for NOISEMAP. The aircraft noise levels from the OMEGA10R and NOISEFILE programs are summed and the resultant L_{dnmr} values developed into contours via the NMPLOT program or tabulated for each airspace. The MR_OPS program allows for entry of airspace information, the horizontal distribution of operations, flight profiles (powers, altitude distribution, and speeds), and numbers of sorties.
Source: Appendix C		

Table 3.2-4

Baseline Average L_{dnmr} (dB) Within Existing Special Use Airspace

Airspace Component	Average L_{dnmr} (dB)
R-5306A	57
Targets: BT-9 BT-11	62 68
Source: Appendix C	

The results of the noise modeling show that based on the Schulz curve (Figure 3.2-2), about 10 percent of individuals living in the vicinity of the targets could be expected to be highly annoyed by existing aircraft operations and between 1 and 7 percent of the individuals residing beneath R-5306A outside of the target areas. It is important to note, however, that eastern North Carolina study area is largely rural, with an estimated density of about 62 persons per sq mi (24 persons per sq km) (Table 3.6-1). This density can be considered sparse when compared with densities that occur in urban areas, for example, Wilmington in New Hanover County (2,088 persons per sq mile [806 persons per sq km]). In addition, the combined R-5306A/target airspace does not overlie any established population center and about 38 percent of R-5306A overlies Pamlico Sound.

3.3 Safety and Hazardous Materials Management

This subchapter discusses safety issues and hazardous materials management (focusing on aircraft components in case an emergency situation occurs).

3.3.1 Aircraft Safety

Flight safety is a top priority for all types of aircraft operations in the Department of the Navy and at MCAS Cherry Point. Efforts to minimize risk to operations participants, the public, and property are part of daily operations and procedures. The Department of the Navy has standard safety procedures and precautions such as the *Naval Aviation Training and Operating Procedure Standardization* (NATOPS) program to make safe operations standard for all personnel. Cherry Point Air Traffic Control Containment maintains strict control of all aircraft, military and civil, that operate within or transit through restricted airspace. In addition, aircraft operations in MCAS Cherry Point-controlled airspace must strictly adhere to procedures identified in Air Station Order P3570 (*Target Facilities and Operations Areas, Marine Corps Station Cherry Point, North Carolina*). The combination of air traffic control and adherence to established procedures has resulted in an excellent safety record for the SUA in eastern North Carolina.

The FAA compiles several databases on incidents involving aircraft. One of its databases includes reports of near midair collisions (NMAC) in the US. A near midair collision is defined by the FAA as an:

> *incident associated with the operations of aircraft in which a possibility of a collision occurs as a result of proximity of less than 500 ft to another aircraft, or a report is received from a pilot or a flight crew member stating that a collision hazard existing between two or more aircraft.*

A summary of FAA NMAC data for the ten calendar years 1992 through 2001 (the last full year for which data is available) is presented in Table 3.3-1, below. Over the ten years reviewed, there were a total of 2,428 near midair collisions reported in the US. Military aircraft were involved in 642 of these incidents (26 percent). During this period, 40 of the reported incidents occurred in North Carolina, and military aircraft were involved in 9 cases (23 percent), of which only 1 involved Department of the Navy aircraft.

Table 3.3-1
Reported Near Mid-Air Collisions

Year	United States		North Carolina	
	Total Incidents	Military Incidents	Total Incidents	Military Incidents
2001	211	36	3	1
2000	239	53	5	2
1999	257	69	2	0
1998	211	55	6	1
1997	238	55	7	0
1996	194	45	2	0
1995	238	65	3	2
1994	275	62	4	0
1993	254	98	5	3
1992	311	104	3	0
Total, 1992-2001	2428	642	40	9

Source: FAA NMAC database (available through http://nasdac.faa.gov/), accessed January 22, 2003

3.3.2 Bird/Aircraft Strike Hazards

Bird/aircraft strike hazards (BASH) are a serious concern for military aircraft operations. Military aircraft are prone to strikes because they fly at high speeds and sometimes at lower altitudes where birds are most active. Aircraft collisions with birds in flight have the potential to cause damage to equipment or even the potential destruction of an aircraft resulting in injury or death to aircrews. According to the US Air Force's Aviation Safety Division, for those wildlife mishaps in both the airfield and low-level environments, where altitude is known, 98.42% occur at or below an altitude of 3,000 ft (914 m) above ground level. However, in rare circumstances, aircraft may encounter birds at much higher altitudes (e.g., altitudes above 15,000 ft [4,570 m]) according to statistics available on the US Air Force Aviation Safety Division website. Approximately 50 percent of bird strikes happened at airfields, with 25 percent occurring during low-altitude flight. Migratory corridors and other areas where birds congregate, such as water bodies or marshy coastal areas (common in the eastern North Carolina study area), represent the locations with the greatest hazard. This is especially true during the spring and fall migrations when birds are present in large numbers.

The 2d MAW has implemented procedures to minimize the potential for BASH in flight operations. The BASH plan addresses the airfield at MCAS Cherry Point, outlying fields, SUA (including restricted areas and MOAs), and MTRs. The plan also addresses hazards based on existing bird populations and seasonal migration patterns. Certain portions of the plan must be continuously adhered to, while others require implementation based upon the level of existing bird activity (low, moderate, or severe).

3.3.3 Hazardous Materials Management

There are no hazardous wastes or materials specifically associated with aircraft utilization of existing SUA. However, military aircraft (as well as civilian aircraft) carry hazardous materials that may be released in the event of an aircraft mishap. Hazardous materials that are carried by military aircraft include jet fuel (usually JP-5) and various hydraulic oils.

Aviation fuels (JP-5 and JP-8) are complex mixtures of aliphatic and aromatic hydrocarbons composed of approximately 80 to 90 percent alkanes and cycloalkanes; 10 to 20 percent aromatics (benzene and alkylbenzenes); 1 percent olefins; less than 5 percent polycyclic aromatic hydrocarbons (PAHs); and small amounts of additives (antioxidants, dispersants, corrosion inhibitors, etc.). Most fuel components, which are quite volatile, readily vaporize to the atmosphere where they degrade. Even when released to surface water or soil, the most volatile components of the jet fuels (low molecular weight alkanes and aromatics) would be expected to evaporate quickly. Less volatile components, which tend to adsorb to soil particles or to sediments in surface water, could persist but would eventually degrade.

The amount of jet fuel and hydraulic fluid onboard varies by both aircraft type and the training mission being undertaken. The AV-8, for example, has a maximum internal fuel capacity of 1,100 gallons (4,164 liters). However, the AV-8 can be outfitted with auxiliary fuel tanks to a maximum capacity of 2,300 gallons (8,705 liters) for long-range missions.

Should aircraft mishaps occur, fuel or hydraulic fluids could be released. The magnitude and duration of the spill is controlled through rescue and spill response procedures. The primary respondents to any mishap are installation/range personnel. The second-tier response is provided by a local oil spill removal organization capable of responding within one hour. This planned response allows for quick containment of any spill and minimize any potential land or water contamination. The response time will depend on the location of the aircraft crash, the terrain (woods, open water, sound area or airfield) and weather conditions at the time of the incident. Generally, the Open Water Spill Team (OWST) for Cherry Point is able to have team members and response gear (spill boats, boom trailer) ready within an hour of the call. The OWST provides the initial response to accident-related spills. Depending on the location of the spill, it could take two or more hours drive-time to reach the site.

The OWST will respond to spills in the Neuse River and it's tributaries from the mouth upstream to New Bern and in all waters immediately adjacent to the Outlying Fields. The OWST will also provide the initial response to spills or crashes in the general vicinity of the Air Station and Outlying Fields, unless the Air Station Fire Division Chief (FDC) or EAD determine that initial response by a spill response contractor is in the Air Station best interest, due to factors such as spill location, type of material spilled, and weather conditions.

3.4 Natural Resources

The natural resources found in the study area are strongly influenced by its coastal location on the eastern seaboard. The proposed MOAs would overlie North Carolina's lower coastal plain and the barrier islands of the Outer Banks and Core Banks. The topography of the study area is generally flat and marshy, with the lowest elevations found in Hyde and Tyrrell Counties. The highest elevation, 67 ft (20 m) above mean sea level (National Resources Conservation Service, 1995b), is found in Beaufort County near the Craven County line on US 17.

3.4.1 Water Resources

The predominant natural resource feature in eastern North Carolina is the Pamlico-Albemarle Sound. This resource is the second largest estuary in the eastern US, covering about 2,900 sq mi (7,540 sq km) of surface water with watershed of about 30,880 sq mi (80,288 sq km). The chief components of the estuary system are the Pamlico and Albemarle Sounds, which are linked by the relatively smaller Croatan and Roanoke Sounds. Freshwater is supplied to the estuary by ten major rivers (Alligator, Chowan, Little, Neuse, North, Pamlico, Pasquotank, Perquimans, Pungo, and Roanoke). Numerous freshwater creeks also feed it. The estuary's sources of salt water are the barrier island inlets, including the Ocracoke, Hatteras, and Oregon Inlets that connect the Pamlico Sound to the Atlantic Ocean. Albemarle, Croatan, and Roanoke Sounds have no direct connection with the coastal ocean, but interact via the north end of Pamlico Sound.

Other major surface water resources in the study area are Lake Mattamuskeet, Alligator Lake, and Pungo Lake. Lake Mattamuskeet is North Carolina's largest natural freshwater lake. It is 40,000 acres (16,200 hectares) in size, and shallow (average depth 2.0 ft [0.7 m]) with no natural inlets or outlets; therefore, recharge is by precipitation and water intrusion from a manmade canal system.

The North Carolina Division of Water Quality, consistent with the Clean Water Act, has adopted statewide water quality standards and surface water classifications. "Outstanding Resource Waters" are those waters that are: (1) unique and special; (2) have not been affected by pollution; and (3) have some outstanding resource values. Surface waters that have been designated by the state of North Carolina as "Outstanding Resource Waters" within the project area include the Alligator River; the basin in the Swanquarter and Juniper Bay area adjacent to Pamlico Sound; and portions of the Core and Pamlico Sounds.

Domestic water supplies in the study area are derived from surface and ground water sources, but the vast majority comes from ground water sources (Natural Resources Conservation Service, 1995b). The most important aquifer in eastern North Carolina is the Castle-Hayne aquifer.

3.4.2 Wildlife

3.4.2.1 Marine Mammals

Several species of whales, dolphins, and porpoises, as well as pinnipeds and manatees, can be found in North Carolina waters, as shown in Table 3.4-1. Whales, typically found in ocean waters off the coast of North Carolina, are most frequently encountered during their seasonal migrations. Due to the shallowness of the Pamlico-Albemarle Sound, whales do not usually enter the sound and are not usually found there. Consequently, whales and seals are generally ocean dwellers that are occasional or accidental visitors to the waters of the sounds. Observations of bottlenose dolphins in sound waters are common.

A few species of marine mammals have been sighted, stranded, or have been caught as incidental fisheries bycatch in the Pamlico-Albemarle Sound. These species include humpbacks (*Megaptera novaeangliae*), sei whales (*Balaenoptera borealis)*, fin whales (*Balaenoptera physalis)*, Gervais's beaked whale (*Mesoplodon europaeu*s), harbor porpoise (*Phocoena phocoena)*, bottlenose dolphin (*Tursiops truncatus)*, Risso's dolphin (*Grampus griseu*s), and gray seal (*Halichoerus grypus)*. (Commander in Chief Atlantic Fleet, 2001).

Of the species listed in Table 3.4-1, the fin whale, humpback, northern right whale, sei whale, sperm whale, and West Indian manatee are all federally listed as endangered under the Endangered Species Act (ESA). Pertinent information on each of these species includes:

- **Fin whales** are common in Atlantic waters off the US, from Cape Hatteras northward (Waring et al., 2000). A fin whale ship strike was reported on March 21, 1998 off Salvo, North Carolina, in Dare County (Waring et al., 2000).

- **Humpback whales** primarily pass through North Carolina waters from the northern Atlantic on their way to or from mating and calving waters in the West Indies (Waring et al., 2000). Off the coast of North Carolina between 1995 and 1998, five humpbacks died from either ship strikes (two) or entanglement in fishery equipment/nets (three) (Waring et al., 2000).

- **Northern right whales** winter and calve in coastal waters off the southeastern US and migrate north to summer feeding and nursery grounds in the waters off New England, the Bay of Fundy, and the Scotian Shelf (Waring et al., 2000). No recent ship strikes, strandings, or fishery-related mortalities of the northern right whale have been reported in North Carolina in recent years.

Table 3.4-1

Marine Mammals Whose Range Includes North Carolina[1]

Common Name	Latin Name
Minke Whale	*Balaenoptera acutorostrata*
Sei Whale	*Balaenoptera borealis*
Bryde's Whale	*Balaenoptera edeni*
Fin Whale	*Balaenoptera physalis*
Blue Whale	*Balaenoptera musculus*
Humpback Whale	*Megaptera novaeangliae*
Northern Right Whale	*Balaena glacialis*
Sperm Whale	*Physeter macrocephalus*
Dwarf Sperm Whale	*Kogia simus*
Pygmy Sperm Whale	*Kogia breviceps*
Pygmy Killer Whale	*Feresa attenuata*
Beaked Whales (Cuvier's, Gervais's, Blainsville's, True's; Sowerby's)	*Ziphius cavirostris*; *Mesoplodon europaeus*; *M. densirostris*; *M. mirus*; and *M. bidens*
Pilot Whale	*Globicephala spp.*
Risso's Dolphin	*Grampus griseus*
White-sided Dolphin	*Lagenorhynchus acutus*
Common Dolphin	*Delphinus delphis*
Atlantic Spotted Dolphin	*Stenella frontalis*
Pantropical Spotted Dolphin	*Stenella attenuata*
Striped Dolphin	*Stenella coeruleoalba*
Spinner Dolphin	*Stenella longirostris*
Bottlenose Dolphin	*Tursiops truncatus*
White-beaked Dolphin	*Lagenorhynchus albirostris*
Harbor Porpoise	*Phocoena phocoena*
West Indian Manatee[1]	*Trichechus manatus*
Harbor Seal	*Phoca vitulina*
Hooded Seal	*Cystophora cristata*
Harp Seal[2]	*Phoca groenlandica*
Grey Seal	*Halichoerus grypus*

Notes:
1. Depending on habitat preference, may be found either off the coast of North Carolina in Atlantic Ocean, or in Pamlico or Albemarle sounds.
2. Rarely spotted in North Carolina, or known only from strandings.

Sources: Waring et al., 2000 and Southeast Fisheries Science Center (Draft), 2001.

- **Sperm whales** are typically distributed on the continental shelf edge, over the continental slope, and into mid-ocean regions, and it appears that the North Atlantic population has no clear geographic structure (stock differentiation) (Waring et al., 2000). In winter, sperm whales are concentrated east and northeast of Cape Hatteras. In spring the center of their distribution shifts northward to east of Delaware and Virginia, and parts further north. No published data is available on sperm whale strandings or injuries in North Carolina waters (Waring et al., 2000), but 13 strandings have been documented along the US Atlantic coast between 1994 and 1998.

- **West Indian Manatees** (Florida manatee subspecies) are typically found in the temperate and equatorial waters of the southeastern US. The winter range of the manatee is generally south Florida; however, this range has expanded significantly with the advent of artificial warm water refuges, the spread of exotic submerged aquatic vegetation, and increased protective measures. The extreme range of the manatee on the eastern seaboard is Virginia (Waring et al., 2000), and although it is a rare visitor to North Carolina waters, the number of sighting reports outside of Florida has increased in recent years.

In addition, several species of dolphins have been listed as "depleted" under the Marine Mammal Protection Act. A stock of marine mammals is considered to be depleted if its numbers fall below an optimum sustainable population number under the Marine Mammal Protection Act. The following species/stocks are considered depleted under the Marine Mammal Protection Act: spotted dolphin (coastal and northeastern offshore stocks); bottlenose dolphin (coastal North Atlantic stock); and spinner dolphin (eastern stock) (National Marine Fisheries Service, Office of Protected Resources [web page], April 16, 2001].

3.4.2.2 Sea Turtles

Sea turtles are found in the inshore waters of North Carolina's Pamlico-Albemarle estuary. Surveys conducted by the National Oceanic and Atmospheric Administration's Beaufort Laboratory since 1988 have found that juvenile loggerhead (*Caretta caretta),* green *(Chelonia mydas),* and Kemp's ridley *(Lepidochelys kempii)* sea turtles may be present in the estuary from April to December (Dodd, September 1, 2001 [web page]). Leatherback (*Dermochelys coriacea*) and hawksbill (*Eretmochelys imbricata)* sea turtles may also occur in North Carolina waters. Pertinent information on each of these sea turtle species includes:

- **Loggerhead sea turtle** - Listed as federally endangered, loggerheads are the most common species of sea turtle encountered in North Carolina. Nesting season occurs from May to November (US Fish and Wildlife Service [web page], May 18, 2001). Since 1989 Cape Lookout National Seashore has documented an average of 90 to 100 nests laid each year. The shallow waters of Core and Back Sounds are important feeding areas for turtles migrating up and down the coast

(National Park Service, 2000b [web page]). Sightings of sea turtles in the Cape Lookout bight are most frequent in early summer.

- **Green sea turtle** - These federally listed endangered sea turtles nest infrequently on the Cape Lookout and Cape Hatteras National Seashores (National Park Service [web page], 2000b). The nesting season varies with locality, but is roughly June through September.

- **Kemp's ridley sea turtle** - The federally listed endangered Kemps Ridley sea turtle may be sighted in the Pamlico-Albemarle estuary. These turtles do not nest in North Carolina, preferring to nest in Mexico and sometimes Texas (US Fish and Wildlife Service, [web page], May 18, 2001).

- **Leatherback sea turtle** - These federally listed endangered sea turtles were recently recorded as nesting at the Cape Lookout National Seashore (National Park Service [web page], 2000).

- **Hawksbill sea turtle** - The federally listed endangered hawksbills are found along the continental US coastline from Massachusetts southward; however, sightings north of Florida are rare (Schwartz 1989; National Marine Fisheries Service, and US Fish and Wildlife Service, 1993).

3.4.2.3 Fisheries

The information provided in this subchapter is drawn from *Nature Guide to the Carolina Coast - Common Birds, Crabs, Shells, Fish, and Other Entities of the Coastal Environment* (Meyer, 2000) and from the websites of the Pamlico-Albemarle National Estuary Program and North Carolina Department of Marine Fisheries, unless otherwise noted.

The Pamlico-Albemarle estuary is very shallow, generally less than 30 ft (9 m) deep. It provides a diverse ecological community that supports a great number of fish. The estuary, in fact, provides vital nursery areas, spawning areas, shellfish beds, and submerged aquatic vegetation beds, supports extensive commercial and recreational fisheries in North Carolina, and is valuable to tourism (Albemarle-Pamlico National Estuary Program, September 1, 2001 [web page]). Common fish species found in the estuary are shown in Table 3.4-2.

The Pamlico-Albemarle Sound also contains a diversity of shrimp, clams, oysters, and crabs. The best known of these are the blue crab (*Callinectes sapidus*) and the American oyster (*Crassostrea virginica*). Also occurring in sound are the hard-shelled clam (*Mercenaria mercenaria*) and bay scallop (*Argopectin irradians*). All four of these species are commercially harvested in North Carolina. In addition, three species of shrimp are harvested in the sound and Atlantic Ocean waters off North Carolina: brown shrimp (*Penaeus aztecus*), pink shrimp (*Penaeus duorarum*), and white shrimp (*Penaeus setiferus*).

Table 3.4-2

Fish Species Found in the Pamlico-Albermarle Sound Estuary

Common Name	Latin Name	Common Name	Latin Name
Atlantic menhaden	*Brevoortia tyrannus*	Yellow perch	*Perca flavescens*
spot	*Leiostomus xanthurus*	yellow bullhead	*Ameiurus natalis*
Atlantic croaker	*Micropogonias undulatus*	white catfish	*Ameiurus catus*
silver perch	*Bairdiella chrysoura*	channel catfish	*Ictalurus punctatus*
bluefish	*Pomatomous saltatrix*	white sucker	*Catostomus commersoni*
rainwater killifish	*Lucania parva*	carp	*Cyprinus carpio*
striped killifish	*Fundulus majalis*	golden shiner	*Notemigonus chrysoleucas*
mummichogs	*Fundulus heteroclitus*	silvery minnow	*Hybognathus regius*
banded killifish	*Fundulus diaphanous*	spottail shiner	*Notropis hudsonius*
sheepshead minnow	*Cyprinodon variegatus*	satinfin shiner	*Cyprinella analostana*
needlefish	*Strongylura marina*	pumpkinseed	*Lepomis gibbosus*
bay anchovies	*Anchoa mitchilli*	bluegill	*Lepomis macrochirus*
silversides	*Menidia spp.*	black crappie	*Pomoxis nigromaculatus*
southern flounder	*Paralichthys lethostigma*	smallmouth bass	*Micropterus dolomieu*
winter flounder	*Pleuronectes americanus*	largemouth bass	*Micropterus salmoides*
summer flounder	*Paralichthys dentatus*	longnose gar	*Lepisosteous osseus*
American (white) shad	*Alosa sapidissima*	chain pickerel	*Esox niger*
hickory shad	*Alosa mediocris*	redfin pickerel	*Esox americanus*
alewife	*Alosa psuedoharengus*	eastern mudminnow	*Umbra pygmaea*
blueback	*Alosa aestivalis*	cownose rays	*Rhinoptera bonasus*
striped bass	*Morone saxatilis*	sandbar sharks	*Carcharhinus plumbeus*
white perch	*Morone americana*	bull sharks	*Carcharinus leucas*
American eels	*Anguilla rostrata*		
Source: North Carolina Department of Marine Fisheries, 2001; Meyer, 2000.			

The short-nosed sturgeon (*Acipenser brevirostrum*) is a federally endangered fish whose range may include the surface water bodies in Hyde, Pamlico, and Carteret Counties. The short-nosed sturgeon inhabits the lower sections of larger rivers and coastal waters along the Atlantic coast (US Fish and Wildlife Service [web page], 2001d). Shortnose sturgeon inhabit the main stems of their natal rivers, migrating between freshwater and mesohaline river reaches. Spawning occurs in upper, freshwater areas, while feeding and overwintering activities may occur in both fresh and saline habitats (National Marine Fisheries Service, 1998).

3.4.2.4 Birds

The proposed MOAs would be located within the Atlantic Flyway, a major migration route along the East Coast of the US. During the fall and spring migratory seasons, large numbers of birds are found in this general corridor. The presence of the many national wildlife refuges in eastern North Carolina indicates the importance of this area as a stopover during migration and as an overwintering area, particularly for waterfowl. These national wildlife refuges are noted for their large flocks of overwintering waterfowl, including swans, geese, and ducks.

Ducks and Geese

Aerial surveys conducted by the US Fish and Wildlife Service and North Carolina Wildlife Resources Commission have identified approximately 30 species of waterfowl using the portion of the Atlantic Flyway that overlaps the boundaries of the proposed MOAs. Dabbling ducks such as black duck (*Anas rubripes*) and pintail (*Anas acuta*) are attracted to supplies of widgeon grass. Diving ducks such as redhead (*Aythya americana*) and canvasbacks (*Aythya valisineria*) overwinter on a diet of eelgrass and widgeon grass. Some species, such as oldsquaw (*Clangula hyemalis*), scoter (*Melanitta ssp*.) and bufflehead (*Bucephala albeola*), feed on the shellfish and other benthic invertebrates that populate the marshes and nearshore waters (Hines, Undated). The US Fish and Wildlife Service estimates that roughly 25 percent of the Atlantic Flyway pintail population, roughly 15,000 birds, overwinter near Lake Mattamuskeet and its environs (US Fish and Wildlife Service, 2002).

Large flocks of overwintering waterfowl, including tundra swans (*Cygnus columbianus*) and Canada and snow geese (*Branta canadensis* and *Chen caerulescens*), can be found seasonally in the wildlife refuges and coastal areas of eastern North Carolina. US Fish and Wildlife Service estimates indicate that 70 to 80 percent of the Atlantic Flyway population of tundra swans, and large numbers of Canada goose, overwinter in eastern North Carolina (US Fish and Wildlife Service, 2002). Recent survey data for winter months as shown in Table 3.4-3 provides a snapshot of the wintering population.

Table 3.4-3

Swan, Goose and Duck Historical Wintering Numbers at Eastern North Carolina's Refuges

Refuge and Species[1]	1997	1998	1999	2000
Mattamuskeet National Wildlife Refuge[2]				
Canada Geese	4,450	2,725	2,051	1,748
Snow/Blue Geese	8,400	6,975	1,100	4,270
Tundra Swans	16,886	17,300	6,474	4,616
Ducks	50,009	41,372	42,440	49,930
Swanquarter National Wildlife Refuge[2]				
Canada Geese	22	0	0	0
Snow/Blue Geese	0	0	0	0
Tundra Swans	86	8	0	170
Ducks	1786	5216	307	1260
Pocosin Lakes National Wildlife Refuge[2]				
Canada Geese	N/A	N/A	100	50
Snow/Blue Geese			3,900	29,000
Tundra Swans			9,264	8,325
Alligator River National Wildlife Refuge[3,4]				
Canada Geese	0	0	0	0
Snow/Blue Geese	0	0	0	0
Tundra Swans	1,500	2,100	3,500	1,800

Notes:
1. Species totals include all areas of the refuges surveyed, not just the areas under the proposed project footprint.
2. The last survey date in December (reflecting wintering population) for each year is used.
3. Alligator River aerial waterfowl surveys are only performed for the farm fields at the north end of the refuge, and do not reflect numbers of birds using the southern end of the refuge (under project footprint). The southern end of the refuge is difficult to survey due to current military restrictions at Dare County Range (R-5314).
4. The numbers provided for Alligator River are peak wintering numbers, not December survey numbers.

Sources: US Fish and Wildlife Service, 2001c; US Fish and Wildlife Service, 2001e; Stewart, August 29, 2001.

Wading Birds

Eleven species of wading birds nest in the area underlying the proposed MOAs, including great blue herons (*Ardea herodias*), yellow-crowned night herons (*Nyctanassa violacea*), black-crowned night herons (*Nycticorax nycticorax*), little blue herons (*Egretta caerulea*), tri-colored herons (*Egretta tricolor*), green heron (*Butorides striatus*), great egrets (*Casmerodius albus*), snowy egret (*Egretta thula*), cattle egret (*Bubulcus ibis*), white ibis (*Eudocimus albus*), and glossy ibis (*Plagadis falcinellus*) (North Carolina Wildlife Resources Commission, 2001). These species are sustained by a variety of foods, including various fishes and crabs associated with a variety of habitats from marsh to offshore waters. A known colony of great blue herons (10-20 nests annually) exists at the Mattamuskeet National Wildlife Refuge, and both green and black-crowned night herons are known to have periodically nested at Mattamuskeet/Swanquarter (US Fish and Wildlife Service, 2001c). Great blue herons and green herons also nest at the Alligator River and Pocosin Lakes National Wildlife Refuges.

Shorebirds, Loons, and Pelicans

Shorebirds also use many areas that would underlie the proposed MOAs, most extensively during the migratory season. Table 3.4-4 indicates the large number of shorebirds present at eastern North Carolina's wildlife refuges and national seashores. The piping plover (*Charadrius melodius*) is listed as threatened under the ESA, and the US Fish and Wildlife Service has designated critical habitat for the winter population of the piping plover along the coastlines in Hyde and Carteret Counties within the Cape Hatteras and Cape Lookout National Seashores (*Federal Register*, 66 FR 36038). The roseate tern (*Sterna dougallii*), listed as endangered, does not breed in North Carolina but is an occasional visitor to the Outer Banks during the months of July and August.

Both the American white pelican (*Pelecanus erythrorhynchos*) and brown pelican (*Pelecanus occidentalis carolinensis*) can be found along the coast in North Carolina in the area underlying the proposed MOAs, but only the latter has been known to breed there (North Carolina Wildlife Resources Commission, January 23, 2001). Other fishing birds in the project area include the red-throated loon (*Gavia stellata*), common loon (*Gavia immer*), pied-billed grebe (*Podilymbus podiceps*), horned grebe (*Podiceps auritus*), eared grebe (*P. nigricollis*), and double-crested cormorant (*Phalacrocorax auritus*). Other wading birds include the rails, gallinules, and coots (family Rallidae). The black rail (*Laterallus jamaicensis*) which can be found in Carteret, Craven, Hyde, and Pamlico Counties is rare and is listed as a federal species of concern.

Songbirds

Many species of songbirds nest in or migrate through the area underlying the proposed MOAs. The variety of habitats found in the coastal plain provide opportunities for diversity reflected in the number and types of passerines (perching birds). Finches, wrens, swallows, nightingales, crows, warblers, vireos, tanagers, and flycatchers are only a few of the many birds in the

Table 3.4-4

Shorebirds Occurring within the MOAs Study Area

Common Name	Scientific Name	Common Name	Scientific Name
Black-bellied Plover	*Pluvialis squatarola*	Red Knot	*Caladris canutus*
Upland Plover	*Bartramia longicauda*	Sanderling	*Calidris alba*
Wilson's Plover	*Charadrius wilsonia*	Common Snipe	*Capella gallinago*
Semipalmated Plover	*Charadrius semipalmatus*	American Woodcock	*Philohela minor*
Killdeer	*Charadrius vociferous*	Northern Phalarope	*Lobipes lobatus*
Piping Plover[1]	*Charadrius melodius*		
American Oystercatcher	*Haematopus palliates*	Laughing Gull	*Larus atricilla*
Black-necked Stilt	*Himantopus mexicanus*	Bonaparte's Gull	*Larus philadelphia*
Greater Yellowlegs	*Tringa melanoleuca*	Ring-billed Gull	*Larus delawarensis*
Lesser Yellowlegs	*Tringa flavipes*	Herring Gull	*Larus argentatus*
Solitary Sandpiper	*Tringa solitaria*	Greater Black-backed Gull	*Larus marinus*
Willet	*Catoptrophorus semipalmatus*	Gull-billed Tern	*Gelochelidon nilotica*
Spotted Sandpiper	*Actitis macularia*	Caspian Tern	*Sterna caspia*
Whimbrel	*Numenius phaeopus*	Royal Tern	*Sterna maxima*
Ruddy Turnstone	*Arenaria interpres*	Sandwich Tern	*Sterna sandvicensis*
Semipalmated Sandpiper	*Calidris pusilla*	Common Tern	*Sterna hirundo*
Western Sandpiper	*Calidris mauri*	Forster's Tern	*Sterna forsteri*
Baird's Sandpiper	*Calidris bairdii*	Least Tern	*Sterna antillarum*
Least Sandpiper	*Calidris minutilla*	Black Tern	*Chlidonias niger*
Pectoral Sandpiper	*Calidris melanotos*	Roseate Tern[2]	*Sterna dougallii*
Dunlin	*Calidris alpina*	Northern Gannet	*Morus bassanus*
Short-billed Dowitcher	*Limnodromus griseus*	Black Skimmer	*Rynchops niger*
Long-billed Dowitcher	*Limnodromus scolopaceus*	Sooty Tern	*Sterna fuscata*

Notes:
1. Listed by US Fish and Wildlife Service as threatened under ESA.
2. Listed by US Fish and Wildlife Service as endangered under ESA.

Sources: US Fish and Wildlife Service, March 22, 2001d; National Park Service, December 2000; Species list brochures for Mattamuskeet National Wildlife Refuge Complex and Pocosin Lakes National Wildlife Refuge, Undated; Peterson, R.T., 1980; North Carolina Wildlife Resources Commission, January 23, 2001.

passerine order. Over 125 species of passerines are at least migratory visitors to the Mattamuskeet National Wildlife Refuge, and at least 50 of those species nest there (US Fish and Wildlife Service, 2001c). Pocosin Lakes and Alligator River National Wildlife Refuges shares similar numbers of passerines on their lands as well (US Fish and Wildlife Service, 2001e). In the areas outside of the national wildlife refuges, the number of species present varies depending on habitat.

The red-cockaded woodpecker (*Picoides borealis*) is listed as an endangered species under the ESA, and can be found in suitable habitat in every county in the study area except Washington (US Fish and Wildlife Service [web page], 2001d). This bird's range is closely tied to the distribution of southern pines such as long-leaf pines (*Pinus palustris*). Although not present at the Mattamuskeet National Wildlife Refuge, the red-cockaded woodpecker is found at Alligator River National Wildlife Refuge and the results of aerial surveys performed by the US Fish and Wildlife Service indicate that a population of these birds may be present on Pocosin Lakes National Wildlife Refuge (US Fish and Wildlife Service, 2001e).

Three other passerines, the Bachman's sparrow (*Aimophila aestivalis*), Henslow's sparrow (*Ammodramus henslowii*), and eastern painted bunting (*Passerina ciris ciris*), are listed as federal "species of concern" in North Carolina. The Bachman's sparrow is listed in Carteret and Craven Counties, Henslow's sparrow is listed in Beaufort and Carteret Counties, and the eastern painted bunting is listed in Carteret County.

Raptors

Bald eagles (*Haliaeetus leucocephalus*) are found in Hyde, Craven, Pamlico, Tyrrell, Washington, and Beaufort Counties. Bald eagles are protected as a threatened species under the ESA, the Eagle Protection Act, and the Migratory Bird Treaty Act, although the US Fish and Wildlife Service has proposed delisting the bald eagle (*Federal Register*, 64 FR 36454) in the lower 48 states because of successful recovery efforts. The bald eagle's habitat is usually associated with aquatic ecosystems such as estuaries, lakes, large rivers and some coastlines. Fish are a major component of its diet. Wintering and migratory bald eagles forage extensively at Mattamuskeet National Wildlife Refuge and occasionally on Cedar Island. It is also likely that spring and summer foraging occurs at both Mattamuskeet and Swanquarter National Wildlife Refuges. Immature and adult bald eagles have been observed at the Pocosin Lakes National Wildlife Refuge.

In the year 2000 there were four bald eagle nests within the area underlying the proposed MOAs, and one additional nest located less than 2 miles (3 km) to the east of the of the border of Mattamuskeet MOA near Gull Rock. Two of the four nests within the Cherry MOA footprint are located in Beaufort County near the south bank of the Pamlico River. The other two nests are in Hyde County under the proposed Mattamuskeet MOA footprint. One nest is located along the east bank of the Pungo River near US 264, and the other between Kilkenny and Gum Neck.

Several other species of raptors nest in the proposed project area: ospreys (*Pandion haliaetus*), turkey vultures (*Cathartes aura*), black vultures (*Coragyps atratus*), sharp-shinned hawks (*Accipiter striatus*), and red-tailed hawks (*Buteo jamaicensis*). Other raptor species seen in the area include golden eagles (*Aquila chrysaetos*), Cooper's hawks (*Accipiter cooperii*), rough-legged hawks (*Buteo lagopus*), northern harriers (*Circus cyaneus*) broad-winged hawks (*Buteo brachyurus*), merlins (*Falco columbarius*), American kestrels (*Falco sparverius*), and peregrine falcons (*Falco peregrinus anatum*). The latter was removed from the Endangered Species List on August 25, 1999. Several species of owls, including the eastern screech owl (*Otus asio*), great-horned owl (*Bubo virginianus*), barred owl (*Strix varia*) and barn owl (*Tyto alba*), nest within the project area as well. The saw whet owl (*Aegolis acadicus*) and long-eared owl (*Asio oyus*) are also known to use the area underlying the proposed MOAs.

3.4.2.5 Terrestrial Mammals

Much of the area underlying the boundaries of the proposed MOAs supports an intermediate diversity of mammals, including many species that require large tracts of land distant from human influence. Small mammals present throughout the area include marsh rabbit (*Sylvilagus palustris*), short-tailed shrew (*Sciurus carolinensis*), long-tailed weasel (*Mustela frenata*) and opossum (*Didelphis virginiana)*. Species such as the river otter (*Lutra canadensis*), muskrat (*Ondatra zibethyicus*), and mink (*Mustela vison*) make use of the streams and canals present in the area. White-tailed deer (*Odocoileus virginiana*) and raccoons (*Procyon lotor)* are common, as are several species of bats, shrews, voles, mice, and rats. The red fox (*Vulpes vulpes*)*,* gray fox (*Urocyon cinereoargenteus*), and bobcat (*Felis rufus*) are some of the carnivores that are common to northeastern North Carolina. Black bears (*Ursus americanus*) are found within much of the undeveloped forested area.

Three species of terrestrial mammal are listed as federally threatened, endangered, or of concern under the ESA within the study area:

- The eastern cougar (*Felis concolor couguar*) is listed as endangered in Carteret County.

- An experimental population of the red wolf (*Canis rufus*) was introduced into parts of eastern North Carolina in 1987. Currently, the red wolf population in northeastern North Carolina is estimated at 96, 66 of which are radio-collared (US Fish and Wildlife Service, 2000f). The red wolf is listed as an experimental nonessential endangered species under the ESA, which provides the wolf the status of threatened (for consultation purposes) on public lands, and the status of "species proposed for listing" on private land. The red wolf is listed in Beaufort, Dare, Hyde, Tyrrell, and Washington Counties.

- The Rafinesque's big-eared bat (*Plecotus rafinesquii*) is listed as a federal species of concern in Beaufort and Washington Counties.

3.4.2.6 Reptiles and Amphibians

Many terrestrial species of reptiles and amphibians can be found in the study area, including reptiles such as turtles, lizards, snakes, and the American alligator (*Alligator mississippiensis*), and amphibians such as frogs, toads, salamanders, and newts. Other than the American alligator, which is listed as "threatened due to similarity of appearance" with other rare species and not due to diminished numbers (the population is stable), there are no reptiles or amphibians in the study area that are listed as threatened or endangered under the ESA. However, there are four reptiles listed as federal species of concern in four counties:

- The Carolina gopher frog (*Rana capito capito*) is a species of concern in Beaufort and Carteret Counties.
- The mimic glass lizard (*Ophisaurus mimicus*) is a species of concern in Carteret County.
- The northern diamondback terrapin (*Malaclemys terrapin terrapin*) is a turtle listed as a species of concern in Carteret and Pamlico Counties.
- The only snake listed is the southern hognose snake (*Heterodon simus*), a federal species of concern in Carteret and Craven Counties.

3.4.2.7 Other Species of Importance

There are no federally listed threatened or endangered species of invertebrates within the study area. However, there are six invertebrate species listed as federal species of concern: Arogos skipper (*Atrytone arogos arogos*), Bogue Banks endemic skipper (*Atrytonopsis sp*), Carter's noctuid moth (*Spartiniphaga carterae*), the Venus flytrap cutworm moth (*Hemipachnobia subporphyrea subporphyrea*), the Croatan crayfish (*Procambarus plumimanus*), and the Anointed sallow moth (*Pyreferra ceromatica).*

3.4.3 Vegetation and Wetlands

This subchapter provides a generalized description of the vegetation and wetlands of the land and water areas that would underlie the proposed MOAs.

3.4.3.1 Barrier Islands

Terrestrial Vegetation and Threatened and Endangered Species

Terrestrial plant communities on North Carolina's barrier islands include berms, dunes, open grasslands, closed grasslands, and woodlands. Berms consist of sea oats (*Uniola paniculata*) and other plants that trap sand and form small dunes. Dunes are also populated with sea oats (*U. paniculata*), but the backsides of dunes may be heavily vegetated with vines such as Virginia creeper (*Parthenocissus quinquefolia*). Open and closed grasslands generally provide habitat for salt meadow cordgrass (*Spartina patens),* pennywort (*Hydrocotyle spp.)*, broomsedge (*Andropogon virginicus*), and hairgrass (*Deschampsia)*. Woodlands occur on the higher and more protected portions of the barrier islands, and common species include live oak (*Quercus virginiana)*, southern red cedar (*Juniperus virginiana)*, and American holly (*Ilex opaca*).

While plant communities within the barrier island ecosystem of North Carolina contain a number of plant species considered rare, threatened, or endangered, only one federally threatened species, the seabeach amaranth (*Amaranthus pumilus*) occurs within the study area. The seabeach amaranth occurs on the island portions of Carteret and Hyde Counties.

Wetlands

Much of the barrier islands are wetland, according to the National Wetland Inventory maps. Wetland vegetation types most found on the Outer/Core Banks include tidal flats, high and low salt marshes, and submerged aquatic vegetation. Submerged aquatic vegetation is usually dominated by eelgrass (*Zostera marina*) and widgeon grass (*Ruppia maritima).*

3.4.3.2 Upper Coastal Plain

Terrestrial Vegetation and Threatened and Endangered Species

Terrestrial plant communities that underlie the proposed MOAs include forests, agricultural fields, old fields, marshes, pocosins, and scrub/shrub habitats. An average of 42 percent of this area is forest land, dominated by needle-leafed evergreen with smaller areas of evergreen broad-leaved forest, southern floodplain forest and pocosin (US Forest Service [web page], July 1994). Forest cover type is mainly longleaf pine (*Pinus palustris*), loblolly pine (*Pinus taeda*), and slash pine (*Pinus elliottii)*. Pond pine (*Pinus serotina)* is also prevalent in coastal North Carolina. Oak-gum-cypress forest type is common along major rivers and flood plains and includes laurel oak (*Quercus laurifolia*), water oak (*Q. nigra*), swamp tupelo (*Nyssa sylvatica)*, sweetbay (*Magnolia virginiana)*, bald cypress (*Taxodium distichum)*, and pond cypress (*T. ascendens)*.

The predominant pocosin vegetation type is southeastern shrub bog, which is characterized by a very dense growth of mostly broadleaf evergreen shrubs with scattered pond pine. This habitat is a fire tolerant shrub/scrub complex with a pond pine (*Pinus serotina*) overstory growing on

organic soils with depths up to 12 ft (4 m). Scrub/shrub areas are characterized by young trees, shrubs, and herbaceous vegetation which, left untouched, will also succeed to a young woodland cover type.

While plant communities within the coastal plain ecosystem of North Carolina contain a number of plant species considered rare, threatened, or endangered, only two federally protected species, the rough-leaved loosestrife (*Lysimachia asperulaefolia* - endangered) and sensitive jointvetch (*Aeschynomene virginica* - threatened) occur within the study area. The rough-leaved loosestrife occurs in portions of Beaufort, Carteret, and Pamlico Counties. The sensitive jointvetch is found in portions of Beaufort, Craven, and Hyde Counties.

Wetlands

Wetlands in the proposed MOAs footprint range from brackish marshes and tidal forests along the rivers and sounds, to mesic mixed hardwood forests, wet pine flatwoods, scrub-shrub wetlands, saline marshes (estuarine), freshwater tidal marshes (palustrine), and open water/emergent wetlands. Submerged aquatic vegetation is also found near the shoreline or in shallower areas of Pamlico and Albemarle Sounds.

3.5 Cultural Resources

The intent of the National Historic Preservation Act of 1966, as amended, is to integrate consideration of historic preservation issues into the early stages of project planning by a federal agency. Accordingly, under Section 106 of the National Historic Preservation Act, the head of any federal agency having direct or indirect jurisdiction over a proposed federal or federally financed undertaking is required, before the expenditure of any federal funds on that undertaking, to account for its effects on any district, site, building, structure, or object that is included or eligible for inclusion in the National Register of Historic Places.

As defined in 36 CFR Part 800.16, the area of potential effects is "the geographic area or areas within which an undertaking may cause changes in the character or use of historic properties, if any such properties exist." The area of potential effects thus provides the basis for identifying which resources could potentially be affected by a proposed action. Determination of the extent of the area of potential effects requires some knowledge of how the resource could potentially be impacted by the proposed action. In the case of this proposed action, areas of potential effect (which will be discussed in detail in Subchapter 4.5) might include the effects of aircraft noise on "setting" and vibration impacts on above-ground structures.

There are over 2,100 National Register listings for North Carolina (North Carolina State Historic Preservation Officer [website], January 19, 2001). Approximately 300 of those listings are historic districts. The National Register listings for North Carolina reflect the state's human experience from prehistoric Indian sites; shipwreck sites; modest log houses of settlers and slaves; mansions of wealthy planters and merchants; courthouses; churches; schools and other public buildings; and commercial, industrial, and transportation buildings and sites (North Carolina State Historic Preservation Officer [website], January 19, 2001). In addition to those areas possessing national significance, the land area underlying the proposed new airspace abounds with cultural resources considered historic at the state and local levels. A list of these resources is available through the North Carolina Department of Cultural Resources and summarized below for the study area counties. Tables 3.5-1 and 3.5-2 reflect historic architectural resources for Beaufort and Hyde Counties, some of which lie within the footprint of the proposed MOAs:

- **Beaufort County** - Beaufort County has 13 resources listed in the National Register of Historic Places (National Register Information System [website], January 19, 2001). Of those, 7 are found under the project footprint of the proposed MOAs. The town of Bath has a historic district and a local historic district commission. The North Carolina State Historic Preservation Officer has performed archaeological surveys of the Belhaven waterfront, Bath harbor, and along the Pungo and Pamlico Rivers (North Carolina State Historic Preservation Officer [website], January 19, 2001). The survey of the Belhaven waterfront identified 18 shipwrecks. The survey of Bath harbor identified two shipwrecks,

Table 3.5-1

Listings in the National Register of Historic Places for the Beaufort County Area of Potential Effects

Resource Name	Location	Date Listed
St. Thomas Episcopal Church	Bath	11-20-1970
Bath Historic District	Bath	02-26-1970
Belhaven City Hall	Belhaven	01-27-1981
Bonner House	Bath	02-26-1970
Palmer-Marsh House*	Bath	02-26-1970
Pantego Academy	Pantego	10-25-1984
Ware Creek School	Blounts Creek	12-06-1996
Notes: * National Historic Landmark. Source: National Register Information System [web site], January 19, 2001.		

Table 3.5-2

Listings in the National Register of Historic Places for the Hyde County Area of Potential Effects

Resource Name	Location	Date Listed
George V. Credle House and Cemetery	Rose Bay	07-29-1985
Fairfield Historic District	Fairfield	07-05-1985
Hyde County Courthouse	Swan Quarter*	05-10-1979
Inkwell	Lake Landing	09-01-1978
Lake Landing Historic District	Lake Landing	03-10-1986
Lake Mattamuskeet Pump Station	Swan Quarter	05-28-1980
Ocracoke Historic District	Ocracoke	09-28-1990
Ocracoke Light Station	Ocracoke	11-25-1977
Albin B. Swindell House and Store	Swindell Fork	08-14-1986
Wynne's Folly	Engelhard	12-06-1977
Notes: *The National Register Information System website lists "Swansboro" as the city. This is an error on the website. Source: National Register Information System [web site], January 19, 2001.		

two landings, and a warehouse foundation. The Palmer-Marsh House in Bath is listed on the National Register and is also a National Historic Landmark (North Carolina State Historic Preservation Officer [website], January 19, 2001).

- **Carteret County** - Carteret County has 10 resources listed in the National Register of Historic Places (National Register Information System [website], January 19, 2001) with one of those resources lying within the area of potential effects, Portsmouth Village. However, other historic resources on the Core Banks, the Cape Lookout Lighthouse and Keeper's Quarters, would not lie under the proposed Core MOA. The North Carolina State Historic Preservation Officer has reviewed 15 archaeological studies in Carteret County since 1987 and has over 300 sites recorded in the Historic Preservation Office's statewide inventory (North Carolina State Historic Preservation Officer [website], January 19, 2001).

- **Hyde County** - All 10 of the properties listed on the National Register of Historic Places for Hyde County lie under the area of potential effects for the proposed new airspace (Table 3.5-2). A county architectural survey was completed in 1982, and a comprehensive survey of Ocracoke was completed in 1990. The Lake Landing Historic District is an unspoiled rural expanse of connected plantations that is the state's largest historic district in land area (North Carolina State Historic Preservation Officer [website], January 19, 2001). The North Carolina State Historic Preservation Officer is working with the US Fish and Wildlife Service to renovate Lake Mattamuskeet Lodge to become a tourist attraction and multi-use center (North Carolina State Historic Preservation Officer [website], January 19, 2001). In 1985-87 an archaeological excavation was conducted at the ancient prehistoric Pomeiooc Indian village. Off the coasts of Ocracoke Island, underwater archeologists have examined 20 shipwrecks and fragments. The North Carolina State Historic Preservation Officer's statewide inventory contains information on 50 prehistoric and historic archaeological sites in Hyde County.

- **Craven, Pamlico, Tyrrell, and Washington Counties** - Coordination with the North Carolina State Historic Preservation Office and an Internet search indicated that historic architectural and archaeological resources are present in each of these counties. However, the resources listed in the National Register of Historic Places are found outside the project area of potential effects in these counties.

3.6 Socioeconomics and Community Facilities

3.6.1 Demographics

US Census data for 2000 were used to characterize the population currently residing within the boundaries of the footprint of the proposed MOAs (or study area). The 2000 Census provides population statistics on a census tract basis. As shown in Table 3.6-1, the estimated 2000 combined total population of the study area counties was 232,409. The largest communities that lie within the boundaries of the proposed MOAs are Belhaven (1,968), Aurora (583), Bath (275), and Pantego (170). By contrast, the 2000 populations for some nearby large communities that are outside the proposed MOA boundaries are in New Bern (23,128), Washington (9,583), Morehead City (7,691), and Plymouth (4,107).

Overall, between 1990 and 2000, the population of the study area counties increased by more than 8 percent. With the exception of Washington County (which experienced a 2 percent population decline), all of the counties in the study area increased in population by at least 5 percent during the decade. Hyde and Beaufort Counties, with substantial land area within the proposed project footprint, experienced increases in population between 1990 and 2000, growing at rates of more than 7 and 6 percent, respectively. Craven County, which surrounds MCAS Cherry Point, grew by nearly 9,624 residents or nearly 12 percent during the same period.

The majority of persons in the study area are adults aged 20 to 64 (58.9 percent). Less than 6 percent of the persons residing within the proposed project footprint consist of children less than five years of age, and about 20 percent of the population is comprised of school-age children (ages 5 to 19). Senior citizens (persons 65 years and older) account for about 16 percent of the population. In 1989, the US Department of Agriculture characterized four of the study area counties (Beaufort, Carteret, Craven, and Pamlico) as “retirement destinations” (US Department of Agriculture, 1989).

Table 3.6-1 also provides the 2000 ethnicity statistics for persons residing in the counties underlying the proposed project footprint. Ethnicity is as defined by the US Department of Commerce, Bureau of the Census. In October 1997, the Office of Management and Budget issued revised federal standards for collecting and presenting data on race and ethnicity. Among other changes, the standards allow respondents when answering the race question option to “mark or select one or more races.” As a result, ethnic data from the 1990 Census and 2000 Census cannot be directly compared due to this change in the definition.

As can be seen, the population of the study area is predominantly white (an average of about 66 percent overall) -- approximately 67 percent in Beaufort, 89 percent in Carteret, 68 percent in Craven, 62 percent in Hyde, 73 percent in Pamlico, 56 percent in Tyrrell, and 48 percent in Washington County. Blacks (persons having origins in any of the black racial groups of Africa)

Table 3.6-1

2000 Population and Ethnic Composition of Counties Underlying MOAs

County	Total Population		Ethnic Composition (%)[1,2]							
	Persons	%	White	Black or African Americans	American Indian/Alaskan Native	Asian	Native Hawaiian/ Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino[3]
Beaufort	44,958	19.3	66.8	29	0.2	0.2	0	0.1	0.5	3.2
Carteret	59,383	25.6	89.3	6.9	0.4	0.5	0.1	0.1	0.9	1.7
Craven	91,436	39.3	68.3	24.9	0.4	1	0.1	0.1	1.3	4
Hyde	5,826	2.5	61.6	35	0.3	0.3	0	0	0.6	2.2
Pamlico	12,934	5.6	72.6	24.5	0.5	0.4	0	0.1	0.7	1.3
Tyrrell	4,149	1.8	55.5	39.4	0.2	0.7	0	0	0.6	3.6
Washington	13,723	5.9	47.8	48.8	0.1	0.3	0	0.1	0.6	2.3
Total	232,409	100	65.9	29.7	0.3	0.5	0	0.1	0.8	2.6

Notes:

1. Totals may not add to 100 due to rounding.
2. A zero percentage does not mean that zero persons of an ethnicity are present in that county, rather, so few are present that statistically their numbers represent < 0.1 percent of the county total.
3. Respondents of Hispanic or Latino descent may describe themselves as any racial category - white, black, etc.

Source: US Department of Commerce, Bureau of the Census, State and County QuickFacts. Data derived from 2000 Census SF2.

comprise the second largest grouping, with a total of 29.7 percent of the population in the study area; Washington and Tyrrell Counties have the first and second highest percentages of blacks respectively. Asian and American Indian ethnic groups accounted for 1 percent or less of the population of any of the seven counties. Persons of Hispanic or Latino origin accounted for nearly 3 percent of the population of the study area. Craven and Tyrrell Counties each show about 4 percent of their population as persons of Hispanic ethnicity.

In general, Beaufort, Carteret, Craven, and Washington Counties are more densely populated than the counties of Hyde, Pamlico, and Tyrrell (Table 3.6-2). The difference in population density is most likely due to such factors as their proximity to popular coastal resort areas and the existence of the larger, established communities of Beaufort/Morehead City, New Bern, Washington, and Plymouth.

Table 3.6-2

Population Density in the Study Area (2000)

County	Population Density	
	Per Sq Mi	Per Sq Km
Beaufort	54.3	20.9
Carteret	114.2	43.9
Craven	129.1	49.7
Hyde	9.5	3.7
Pamlico	38.4	14.8
Tyrrell	10.6	4.1
Washington	39.4	15.2
Study Area	62.1	23.8
source: North Carolina Department of Commerce (website)		

3.6.2 Income and Employment

3.6.2.1 Overall Trends

Overall, the economies of the study area counties were dominated by the private sector in 2000. Within this sector more than 60 percent of the jobs were in retail and wholesale trade, service occupations, and manufacturing. Several counties have rather high percentages of jobs in the government sector. For example, government jobs account for about 52 percent of the workforce by industry in Tyrrell County, 47 percent in Hyde, 37 percent in Washington, and 35 percent in Craven County (North Carolina Dept of Commerce [website], May 24, 2001). Craven County's large number of government jobs is attributed to the presence of MCAS Cherry Point and the Croatan National Forest, as well as state and local government positions. The other three

counties have fewer manufacturing, trade, and service jobs; therefore, more of their respectively smaller populations are employed in local, state, or federal government positions. The largest single employer in the study area is the Naval Aviation Depot (NADEP) in Craven County at MCAS Cherry Point, with 3,620 employees (MCAS Cherry Point, 2000).

The total labor force of the seven-county area for 1999 was about 101,080 persons (North Carolina Department of Commerce [website], August 29, 2001). The region's 1999 overall unemployment rate was about 5.7 percent. In 1999, North Carolina's unemployment rate was 3.2 percent, while the US experienced an unemployment rate of 4.2 percent (US Department Labor [website], August 29, 2001).

In 2001, study area median family income ranged from $25,800 (Tyrell County) to $47,000 (Carteret County) as shown in Table 3.6-3. These data compare to $50,200 for North Carolina as a whole (North Carolina Department of Commerce website, April 2002).

Table 3.6-3

Median Family Income in Study Area Counties in 2001

County	Median Income
Beaufort	$39,300
Carteret	$47,000
Craven	$43,900
Hyde	$32,100
Pamlico	$45,500
Tyrrell	$25,800
Washington	$40,600
North Carolina	$50,200
Source: North Carolina Department of Commerce (website, April 2002)	

An average of 19.4 percent of families residing within the footprint of the proposed MOAs were considered to have incomes below the poverty level in 1995 (North Carolina Department of Commerce [website], August 29, 2001). Hyde County had the highest number of families below the poverty level (26 percent). Carteret County had the lowest number of families and persons below the poverty level, about 13 percent. As an average, the seven-county affected area compares somewhat unfavorably to the 1995 North Carolina state average of 13 percent of families living below the poverty level.

3.6.2.2 Commercial Fishing

All of the proposed MOAs overlie portions of Pamlico or Core Sounds, or the Pamlico and Pungo Rivers and their tributaries. Commercial fisheries provide an important source of income

for local residents. Statistics on the commercial harvest of fish and shellfish are compiled by the National Marine Fisheries Service, Division of Fisheries Statistics and Economics. However, these National Marine Fisheries Service statistics are for the commercial harvest from all marine/estuarine waters in the state of North Carolina, including the sounds and rivers (a breakdown of the commercial harvest of fish and shellfish caught in specific North Carolina waters is not yet available from National Marine Fisheries Service). The National Marine Fisheries Service statistics show that in 1999, the commercial harvest of fish and shellfish from North Carolina waters totaled more than 68,444 tons (69,542 metric tons) for a reported retail value of more than $97 million.

Species-specific data for North Carolina's 1999 commercial fisheries harvests have also been compiled by the National Marine Fisheries Service, although these data are not specific to the portion of the catch attributable to any one sound or estuary. However, when they are viewed with a knowledge of the fish species that inhabit the waters underlying the proposed MOAs (fish species are discussed in Subchapter 3.4), some generalizations can be made regarding the potential nature of the harvest of fish and shellfish from Pamlico and Core Sounds, and the Pamlico and Pungo Rivers:

- The single most valuable species harvested is blue crab. In 1999 the value of the catch was almost $38 million.
- The second most valuable species harvested in North Carolina is shrimp at a value of $21.6 million.
- Of the fish species, the most valuable is flounder (flukes and summer) with a value of about $10 million.
- Of the four North Carolina ports that made the "top 100" list for commercial fishery landings ranked by dollar value in the US, only Engelhard-Swanquarter lies in the study area. These combined communities ranked 53rd in 1999, with a catch valued at $11.9 million.

Other important commercial species of fish and shellfish (by dollar value) likely to be harvested in the Pamlico/Core Sounds or the Pamlico or Pungo Rivers would include Menhaden, quahog clams, king and cero mackerel, weakfish, black sea bass, and spot.

3.6.2.3 Agriculture

Agriculture, in particular corn, potato, and wheat production, plays an important role in the economy of the seven study counties. Although in the year 2000, North Carolina's two highest production crops (not highest value crops) were tobacco and sweet potatoes, those two crops are not grown as much in the affected area as are other crops. Beaufort County contains 385 farms, the most in the seven-county study area, and was ranked first in the state in the production of

corn and oats and second in wheat in 1999 (North Carolina Dept of Agriculture [website], September 2000). Irish potatoes are another important crop in the study area; 5 of the 7 counties in the area, Pamlico, Washington, Tyrrell, Carteret, and Hyde, ranked within the top 10 in the state for Irish potato production in 1999.

Livestock production is also important in the affected area. Hogs and pigs had the second highest cash receipts out of all the North Carolina farm commodities in 1999 ($1,160 million). Five of the seven counties in the study area ranked within the top 50 of 100 total counties in production of hogs and pigs in 1999. Only Washington County was listed as having poultry production (broilers) in 1999. It was ranked 31st in the state with 4,300,000 chickens produced in 1999. Overall, Beaufort County has the highest ranking (18th in state) for value of crops in the seven-county study area; the total worth of crops in that area was more than $55 million dollars in 1998.

3.6.3 Tourism and Recreation

3.6.3.1 Tourism

Tourism is vital to the health of the North Carolina economy. In the year 2000, an estimated 43 million people visited the state, spending nearly $12 billion on tourism-related activities. This makes tourism the second largest industry in North Carolina (North Carolina Department of Commerce [website], May 8, 2001). Other facts about North Carolina tourism include:

- North Carolina is ranked 7th in the US in direct domestic travel volume.
- Travel-generated jobs earned approximately $4 billion in payroll income.
- More than $2 billion in tax revenue is generated for federal, state, and local governments each year from travel spending.
- The top attractions in 2000 for North Carolina tourists were shopping, beaches, historical places/museums, outdoor activities, and national and state parks.
- About 44 percent of person-trips were spent in a hotel/motel or bed and breakfast, and 39 percent were spent in a private home.

Based on 2000 attendance figures, Blue Ridge Parkway (20,986,944) and Concord Mills (unlisted for competitive reasons) were ranked first and second as the top attractions for tourists in North Carolina. Cape Hatteras National Seashore ranked sixth with 2,784,126 people visiting in 2000. Fort Macon State Park, the Wright Brothers' National Memorial, and Fort Raleigh National Park ranked 10th, 19th, and 24th in the state for attendance, respectively.

Over 198,000 jobs (including full-time and seasonal/part-time positions) were generated in 1999 through domestic and international traveler spending (North Carolina Department of Commerce [website], May 8, 2001). These jobs comprised more than 5 percent of total non-agricultural employment in North Carolina in 1999. Without these jobs, North Carolina's 1999 unemployment rate of 3.2 percent would have been more than 5 percentage points higher, or nearly 9 percent of the labor force. The employment statistics for the food service, public transportation, and lodging sectors for 1999 are shown in Table 3.6-4. The food service sector, which includes restaurants and other eating and drinking places, provided more jobs than any other industry sector, accounting for slightly more than 40 percent of the state total.

Of the study area counties, Carteret County is ranked the highest in travel impact (12th out North Carolina's counties). In 1999, domestic tourism in Carteret County generated revenue of about $203 million. The 1999 ranking of other counties in the study area are as follows: Craven (34th, $69 million), Beaufort (50th, $45 million), Hyde (67th, $23 million), Pamlico (87th, $12 million), Washington (89th, $10 million), and Tyrrell (98th, $3 million). With the exception of Carteret County (which saw a greater than 2 percent decrease over 1998), each of the study area counties saw tourism revenues increase yearly from 1995 to 1999.

Table 3.6-4

Travel Generated Employment by Industry Sector in North Carolina

1999 Employment	Total (thousands)[1]	Percent of Total
Public Transportation	36.3	18.3
Auto Transportation	4.4	2.2
Lodging	33.6	16.9
Food Service	79.5	40.1
Entertainment and Recreation	24.8	12.5
General Retail Trade	16.3	8.2
Travel Planning[2]	3.4	1.7
Total	198.2	100.0

Notes:
1. Includes both domestic and international employment.
2. Jobs created in travel agencies, wholesale and retail tour companies, and other travel-related service businesses.

Source: North Carolina Department of Commerce, [website], May 8, 2001.

3.6.3.2 Open Space and Recreation

Beaufort County

Goose Creek State Park is Beaufort County's major public recreation area, offering a boat launching facility, hiking, swimming, and picnicking. Camping and bird-watching are also

popular, as is the more than 2,000-ft (610-m) boardwalk across a hardwood swamp and an environmental education and visitor's center. The park is on the north side of the Pamlico River between Washington and Bath and encompasses approximately 1,598 acres (647 hectares). The county is also home to the Goose Creek Game Land, operated by the North Carolina Wildlife Resources Commission. There are also several private recreational camps in the county including: Camp Bonner (Blounts Bay on the south side of the Pamlico River and near Broad Creek) and Camp Hardee (Pamlico River south of Chocowinity) (Beaufort County, 1997). The North Carolina Estuarium is located in Washington.

Carteret County

Carteret County offers a wide variety of recreational opportunities due to its ocean access and mild climate. There are no county or state parks in the portion of Carteret County within the footprint of the proposed MOAs. There is, however, a state-owned research area for scientists and students known as the Rachel Carson Coastal Reserve near Beaufort. This reserve is made up of 26,000 acres (10,522 hectares) on four islands, where numerous bird and fish species, as well as several wild horses are found. The Rachel Carson Coastal Reserve also offers swimming, bird-watching, and picnic areas (North Carolina Estuarine Research Reserve [website], September 5, 2001). Pamlico Sound, as well as both estuarine and ocean beaches with guaranteed public access, also provide a recreational resource in the county.

Cape Lookout National Seashore is located beneath the footprint of the proposed Core MOA. This national seashore was established in March 1966 and is comprised of Shackleford Banks (which run east-west) and Core Banks (which run basically north-south). The visitor's center on Harker's Island is open daily and ferry service to Cape Lookout is available from Harker's Island, Cedar Island, and Ocracoke. The park is largely undeveloped and has no maintained roads. Although it is not possible to accurately measure the number of visitors to Cape Lookout who use private boats to access the park, the National Park Service estimates park visitation has substantially increased from approximately 90,000 in 1990 to 500,000 visitors in 2000 (Rikard, February 21, 2001). Activities at Cape Lookout include camping, hiking, fishing, off-road vehicle use, sightseeing, kayaking/canoeing, wildlife observation, and horse watching. On the Core Banks, visitors can walk around the grounds of the Cape Lookout Light. The Visitor Center is located in the former Keeper's Quarters at the base of the lighthouse.

The Carteret County portion of the study area also encompasses the Cedar Island National Wildlife Refuge, which totals 14,480 acres (5,860 hectares) located on the south shores of the Pamlico Sound to the west of the proposed Core MOA. This national wildlife refuge consists of approximately 11,000 acres (4,451 hectares) of irregularly flooded brackish marsh and 3,480 acres (1,408 hectares) of pocosin and woodland habitat. Recreational opportunities include wildlife observation, fishing, hunting, hiking, biking, and horseback riding. There are two public access boat ramps at the Cedar Island National Wildlife Refuge as well.

Craven County

The Croatan National Forest, which surrounds MCAS Cherry Point in the southern half of the county, is partly managed as state game lands and includes bear sanctuaries and waterfowl impoundments (North Carolina Division of Wildlife Management [website], March 28, 2001). Additionally, the Neuse River Game Land area is owned by the Coastal Land Trust and is divided into two portions, the larger near Jasper, and the smaller not far from New Bern. While there are no state parks in Craven County, there is one county park between New Bern and Havelock off US 70 known as Creekside Park and several municipal parks operated by the city of Havelock and the town of New Bern.

Hyde County

Four national wildlife refuges are located at least partly in Hyde County:

- **Swanquarter National Wildlife Refuge** - South of the village of Swan Quarter along the Pamlico Sound, this refuge is comprised of 16,411 acres (6,642 hectares) of salt marsh islands and forested wetland interspersed with potholes, creeks, and drains (US Fish and Wildlife Service Refuge Visitor Information [website], March 6, 2001). A Presidential Proclamation has set aside an additional 27,082 acres (10,960 hectares) of adjacent non-refuge open water area that is closed to the taking of migratory birds. Approximately 8,800 acres (3,561 hectares) of the Swanquarter National Wildlife Refuge are part of a distinct National Wilderness Preservation System. The public may use Swanquarter National Wildlife Refuge for fishing, crabbing, wildlife observation, and photography, and waterfowl hunting is allowed in designated parts of the refuge.

- **Mattamuskeet National Wildlife Refuge** - This national wildlife refuge is located on the Albemarle-Pamlico peninsula and encompasses over 50,000 acres (20,235 hectares) of marsh, water, timber, and crop lands, including Lake Mattamuskeet, the largest natural lake in North Carolina (US Fish and Wildlife Service Refuges Visitor Information [website], March 6, 2001). The lake is up to 6 miles (10 km) wide and 18 miles (29 km) long, but averages only 2 ft (0.6 m) in depth. The refuge provides valuable migration and wintering habitat for migratory birds and waterfowl on the Atlantic Flyway. Mattamuskeet National Wildlife Refuge offers various recreation opportunities including auto touring, boating, fishing, hunting, hiking, education programs and wildlife viewing.

- **Alligator River National Wildlife Refuge** - The refuge is comprised of 152,195 acres (61,593 hectares) lying on the mainland portions of Hyde and Dare Counties. It is bordered by the Alligator River and Intracoastal Waterway on the west, by the Albemarle Sound on the north, by the Croatan and Pamlico Sounds

on the east, and by Long Shoal River and corporate farmland on the south (US Fish and Wildlife Service Alligator River National Wildlife Refuge [website], March 7, 2001). The refuge serves to protect and preserve unique wetland habitat types and provides protection to endangered species such as red wolves, red-cockaded woodpeckers, and American alligators. Recreational opportunities for the public include auto touring, boating, education programs, fishing, hiking, hunting, and wildlife viewing.

- **Pocosin Lakes National Wildlife Refuge** - Located in Hyde, Tyrrell, and Washington Counties, the refuge is 113,674 acres (46,004 hectares) of what was once the southern extremity of the Dismal Swamp. The predominant vegetation type is southeastern shrub bog, which is also known as a pocosin. Pocosin is a Native American word that means "swamp on a hill." The Pungo National Wildlife Refuge was established in 1963, and became the Pungo Unit of the Pocosin National Wildlife Refuge in 1990, when that Refuge was established (US Fish and Wildlife Service Pocosin Lakes National Wildlife Refuge [website], November 22, 2000). The federally listed red-cockaded woodpecker and bald eagle are found in the area, and the Waccamaw killifish occurs only in nearby Lake Phelps and one other lake in North Carolina. Pocosin Lakes has one of the highest wildfire hazards on the east coast and when dry, the pocosin vegetation and peat soils will burn readily. For that reason, a full-time fire crew is available on station. Recreational opportunities available at Pocosin Lakes are auto touring, fishing, hunting, hiking, and wildlife viewing.

While there are no state parks in Hyde County, the North Carolina Division of Wildlife Management manages three game land areas on the mainland (North Carolina Division of Wildlife Management, [website], March 28, 2001). The Gull Rock Game Land (Gull Rock, North Carolina) features a bear sanctuary, waterfowl impoundment, and a camping area. The New Lake Game Land, along NC 94 close to the Tyrrell County border, is a Nature Conservancy Bear Sanctuary. The Pungo River Game Land lies partially in Beaufort County. It is also owned by the Nature Conservancy and managed as a bear sanctuary.

Mainland Hyde County has one park, Ponzer Community Park, which is heavily utilized by the county for community functions. The park features a large metal building and a playground (Keeney, March 9, 2001). Camping in the county is available only at private campsites. Water access is available at the public boat access in Engelhard or at privately-owned marinas in the area. Other recreational resources in the county are Pamlico Sound, and a number of estuarine and ocean beaches with guaranteed public access.

Pamlico County

There are no federally owned recreation or open space areas in Pamlico County. Goose Creek Wildlife Management Area (also known as Goose Creek Game Land Area) is located near

Hobucken on the south side of the Pamlico River. It is managed by the North Carolina Division of Wildlife Management. Several impoundments comprise the game land area, where one can find ducks, as well as deer, bear, turkey, quail, and squirrels (Olmstead, March 28, 2001).

Pamlico County recreational facilities, including tennis and basketball courts, are found in Arapahoe, Hobucken, Lowland, Mesic, Oriental, Olympia, Reelsboro, and Vandemere. Public access to the waters surrounding Pamlico County is very limited (Pamlico County, 1992). There are three wildlife boating ramps in use and one public ramp at Vandemere. Dawson's Creek is another beach access with facilities that include parking, benches, deck, gazebo, and a beach access ramp, but no boat ramp (Cooper, March 28, 2001). Other recreational resources include Pamlico Sound, and a number of estuarine beaches with guaranteed public access.

Five recreational camps are located in the County. Their operating schedules and approximate summer populations are as follows:

- Camp Sea Gull – operates March to November, with a peak population of 700 campers and 300 counselors.
- Camp Seafarer – operates June through August, with about 600 campers and 350 counselors.
- Camp Caroline – operates full time June through August, weekends February through November, peak population of about 700 people during summer.
- Camp Vandermere – operates year round, during summer lodging for about 150 persons, special events reaching 300 persons.
- Camp Don Lee – information not available.

Tyrrell County

There are no state-owned parks/recreational areas in Tyrrell County, although a portion of the New Lake Game Land does occur here (see the foregoing section on Hyde County). The Scuppernong River Greenway is a 27-mile (46-km)-long greenway owned by the county that includes interpretive trails, pedestrian and bicycle paths, nature observation points, and canoe trails (Conservation Fund North Carolina Projects, [website], March 29, 2001). The greenway includes a 0.5-mile (0.8-km) interpretive boardwalk at the visitor's center along the Scuppernong River at the town of Columbia. Other recreational facilities at the county/town level include Albemare Sound and various estuarine beaches and recreational areas in Columbia, Gum Neck, Sound Side, and Travis (Tyrrell County, 1996). The county does have 3 North Carolina wildlife access ramps, 10 public/informal sites, and 7 private water access sites along Alligator Creek and the Alligator and Scuppernong Rivers (Tyrrell County, 1996).

Washington County

Pocosin Lakes National Wildlife Refuge, as previously discussed, is partially located in Washington County. Pungo Lake is located in the southern portion of the county. The major state

land holding in the county is Pettigrew State Park, south of Creswell off US 64 on NC 1168. This park includes Lake Phelps and offers fishing, shallow-draft sail boating, canoeing, and windsurfing, picnicking, hiking, camping, and cultural history programs. In 1997, 83,184 people visited the park. Other recreational areas in the county include Albemare Sound and several estuarine beaches. Finally, Washington County contains a total of 16 county, town, or privately owned parks/recreation areas and an additional five school recreation areas.

3.6.3.3 Sport Fishing, Boating, and Sailing

Also important to the North Carolina economy are sport fishing, boating, and sailing. In fact, the National Marine Fisheries Service has reported that close to 1.3 million anglers took almost two million fishing trips in 1999 (National Marine Fisheries Service Marine Recreational Fisheries Statistics Survey [website], April 26, 2001). Boat-building is an important manufacturing vocation in four of the seven study area counties: Beaufort, Carteret, Craven, and Pamlico.

3.6.4 Housing

In 2000, the total number of housing units in the seven-county area was 119,525 units, including areas both inside and outside the project footprint (US Census, 2000). The number of occupied housing units, renter-occupied units, vacant units, and number of units for seasonal, recreational or occasional use in each county under the project footprint are shown in Table 3.6-5. As can be seen, 85 percent of the total housing units in the seven-county study area are located in only three of the counties: Beaufort, Carteret, and Craven. Carteret and Craven counties each experienced an 18 percent increase in the number of housing units between 1990 and 2000. Hyde County had a noteworthy increase of 14 percent in the number of housing units between 1990 and 2000.

Craven County has a large military population that often prefers to rent homes rather than buy them due to frequent relocations. That preference is reflected by the high number of renter-occupied units in Craven County (30 percent). Washington County has the second highest number of renters with 23 percent, and Beaufort County comes in third with 21 percent of its total housing units being renter-occupied. Carteret County has high numbers of vacant units, but as Table 3.6-6 shows, most of these vacant units (96 percent) are held for seasonal, recreational, or occasional use reflecting the strong tourism industry in that county.

The most recent data available for median home values, years in which structures were built, and gross rents are from the 1990 US Census (North Carolina State Demographics Librarian, August 29, 2001) as 2000 Census data will not be published until 2002. The table below lists the median home value, the years most homes were built, and median gross rents in each of the seven counties of the study area as shown in the 1990 US Census. Hyde and Tyrrell Counties have the lowest median home values, as well as the largest percentage of aging housing that was built prior to 1940. A surge in home-building took place in all of these seven counties between the years of 1970 and 1979.

Table 3.6-5
Housing Unit Information

County	Total Housing Units	% Change in Housing Units (1990-2000)	Occupied Housing Units	No. Renter-Occupied Housing Units	Vacant Housing Units	No. Vacant Units held for Seasonal/ Recreational/ Occasional Use
Beaufort	22,139	+13	18,319	4,574	3,820	1,891
Carteret	40,947	+18	25,204	5,888	15,743	13,334
Craven	38,150	+18	34,582	11,499	3,568	431
Hyde	3,302	+14	2,185	472	1,117	666
Pamlico	6,781	+12	5,178	922	1,603	902
Tyrrell	2,032	+7	1,537	386	495	246
Washington	6,174	+9	5,367	1,417	807	208
Source: US Department of Commerce, Bureau of the Census, 2000.						

Table 3.6-6
Median Home Values, Build Date, and Gross Rents 1990

County	Median Home Value ($1990)	Dates Largest Percentage of Home Built	Median Gross Rent for Rental Properties ($1990)
Beaufort	$52,600	1960-1984	$289
Carteret	$73,100	1970-1988	$385
Craven	$65,900	1970-1979	$374
Hyde	$43,700	before 1940, and 1970-1979	$263
Pamlico	$54,300	1970-1984	$328
Tyrrell	$37,400	before 1940, and 1970-1979	$270
Washington	$45,500	1960-1979	$266
Source: US Department of Commerce, Bureau of the Census, 1990.			

3.6.5 Taxes and Revenues

Property taxes are the primary source of self-generated local government revenues in the region, in addition to sales taxes, intergovernmental transfers, licenses and fees, among other smaller revenue sources. Property taxes account for 40 percent of Tyrrell County's total revenue, 34 percent of Carteret County's total revenue, and 33 percent of Pamlico County's total revenue, with the remaining four counties all with 28 percent or less. Table 3.6-7 shows the 1999-2000 taxes and revenues of affected counties in the study area.

3.6.6 Community Facilities and Services

This subchapter describes the range of community facilities (education, fire and emergency services, health services), and recreational resources available within the study area.

3.6.6.1 Education

Five Beaufort County schools and three Hyde County schools are located within the study area. However, since this project does not involve addition of more personnel, there is little potential for it to directly affect local schools through increased enrollment. For that reason, there will be no detailed discussion of local schools in this document. The names and locations of these schools are shown in Table 3.6-8.

3.6.6.2 Emergency Services

Emergency services provided in the study area counties include fire, police, and ambulance. These services are summarized by county in Table 3.6-9.

3.6.6.3 Healthcare Services

Major health services in the area that would underlie the proposed new airspace are summarized in Table 3.6-9.

3.6.7 Infrastructure and Utilities

Implementation of the proposed airspace would not involve construction of new facilities or addition of more personnel; therefore, there would be little potential to affect water supply and treatment facilities, wastewater treatment and disposal facilities, electrical supply facilities, solid waste management facilities, or heating and stormwater control and treatment facilities. In addition, no construction would be associated with the proposed action. Therefore, there will be no discussion of these facilities in this EA.

Table 3.6-7

Taxes and Revenues of Affected Counties 1999-2000

County	Property Taxes Collected		Federal Intergovernmental Transfers		Permits and Fees		Total Revenues/ Other Financing Sources (100%)
	$	% of Total	$	% of Total	$	% of Total	
Beaufort	14,952,378	28	0	0	319,991	<1	52,675,085
Carteret	26,538,778	34	112,271	<1	729,380	<1	78,010,875
Craven	23,888,241	27	47,246	<1	709,664	<1	88,078,555
Hyde	3,265,496	25	58,472	<1	43,502	<1	13,172,112
Pamlico	5,288,168	33	0	0	188,628	<1	16,095,412
Tyrrell	1,873,534	40	27,066	<1	14,444	<1	4,693,415
Washington	4,135,015	27	11,002	<1	90,490	<1	15,041,947

Table 3.6-8

Schools within the Study Area

County	Town/City	Name of School	Enrollment	MOA
Beaufort	Bath	Bath Elementary	690	Cherry
	Pantego	Beaufort County Elementary[1]	277	Cherry/Mattamuskeet
	Belhaven	Belhaven Elementary*	397	Cherry/Mattamuskeet
	Pinetown	Northside High	494	Cherry
	Aurora	S.W. Snowden Elementary	405	Cherry
Hyde	Swan Quarter	Mattamuskeet High	167	Mattamuskeet
	Swan Quarter	Mattamuskeet Middle	142	Mattamuskeet
	Swan Quarter	O.A. Peay Elementary	318	Mattamuskeet

Notes:

1. Beaufort County Elementary and Belhaven Elementary were closed and consolidated into one new elementary school, Northeast Elementary (Pinetown) in August of 2001 (Shaw, April 25, 2001).

Sources: Beaufort County Schools [website], April 5, 2001; North Carolina Department of Public Instruction [website], April 5, 2001; and Coley, April 11, 2001.

Table 3.6-9

Emergency Services in the Study Area Counties

County	Emergency Service		
	Fire	Police	Health/Ambulance Service
Beaufort	15 Volunteer Fire Depts: 1 Paid Fire Dept (City of Washington)	Beaufort County Sheriff's Dept 4 Municipal Police Depts	Beaufort Hospital Pungo District Hospital 7 EMS Providers
Carteret	23 Volunteer Fire Depts	Carteret County Sheriff's Dept 7 Municipal Police Depts: (Beaufort, Morehead City, Newport, Pine Knoll Shores, Indian Beach, Emerald Isle, and Cape Carteret)	Carteret General Hospital Sea Level Hospital
Craven	16 Volunteer Fire Districts	Craven County Sheriff's Dept 6 Municipal Police Depts: (Bridgeton, Havelock, New Bern, River Bend, Trent Woods, and Vanceboro)	Craven Regional Medical Ctr MCAS Cherry Point Naval Hospital 7 County Rescue Squads
Hyde	6 Volunteer Fire Depts: Swan Quarter Engelhard Fairfield Ocracoke Scranton Pungo River (shared with Beaufort County)	Hyde County Sheriff's Dept	Ambulances: Swan Quarter Engelhard Fairfield Ocracoke Belhaven Rescue Squad
Pamlico	9 Volunteer Fire Depts: Arapahoe Whortonsville Goose Creek Grantsboro Olympia Reelsboro Oriental Bayboro Vandemere Hazmat Team	Pamlico Sheriff's Dept 1 Municipal Police Dept (Oriental)	3-4 Rescue Squads
Tyrrell	3 Volunteer Fire Depts: Columbia Gum Neck Kilkenny	Tyrrell County Sheriff's Dept	Ambulances: Columbia Gum Neck Air-Vac
Washington	6 Volunteer Fire Depts: Cresswell Mid-County Lake Phelps Long Acre Plymouth Roper	Washington County Sheriff's Dept 3 Municipal Police Depts: (Plymouth, Roper, and Creswell)	EMTs from Washington County Hospital (Plymouth) Air-Vac

3.7 Land Use and Coastal Zone Management

This subchapter discusses land use patterns in the counties and population centers underlying the proposed MOAs. It also provides a review of the land use policies that have been adopted by local government in compliance with the North Carolina Coastal Area Management Act (CAMA) of 1974 for relevant jurisdictions.

3.7.1 Land Use

The proposed MOAs would overlie an area roughly encompassing all or portions of the following counties: Beaufort, Carteret, Craven, Hyde, Pamlico, Tyrrell, and Washington. The counties affected by each proposed airspace are identified in Table 3.7-1.

Table 3.7-1

Counties Potentially Affected by Proposed Airspace

Proposed MOA	Counties Potentially Affected
Core	Carteret Hyde
Cherry	Beaufort Hyde Craven Pamlico
Mattamuskeet	Beaufort Hyde Pamlico Washington Tyrrell

3.7.1.1 Beaufort County

Beaufort County would underlie both the proposed Cherry and Mattamuskeet MOAs. Although generally rural in nature (about 71 percent of land in the county is undeveloped), the county has experienced modest land development and population growth over the last decade (Beaufort County, 1997). Commercial strip development has occurred and is occurring near the county's municipalities and along major transportation routes such as US 264 and US 17 (Beaufort County, 1997). The Washington-Beaufort County industrial park has continued to develop under county sponsorship, and other industrial development has concentrated in and near municipalities where water and sewer facilities are available (Beaufort County, 1997). Major institutional uses (e.g., schools, churches, health services) are located mostly within the incorporated areas in

proximity to the residential population. The county airport, Warren Field Airport, is north of the city of Washington (Beaufort County, 1997b). Table 3.7-2 summarizes acreages by type of land use in Beaufort County as of 1996.

3.7.1.2 Carteret County

In Carteret County, the proposed Core MOA would overlie the Cape Lookout National Seashore, which is comprised of Shackleford Banks, Cape Lookout, Core Banks, and Portsmouth Island. The seashore is under the jurisdiction of the National Park Service, not Carteret County. There are no permanent residents or major institutional uses (schools, churches, health services) on Cape Lookout National Seashore. However, the Core Banks is very popular as a surf fishing destination and two independent concessionaires operate cabins for the National Park Service at two locations on Core Banks:

- **North Core Banks at Long Point** - This area has 6 duplexes (12 units) and 4 octagonal buildings for overnight stays. Additional support facilities include: (1) ferryboat dock, shelters, and orientation areas; (2) enclosed camping shelters; (3) comfort stations (National Park Service, 1999); and (4) a 60-vehicle parking area. Fishermen often leave their vehicles or campers on the island from April to December (National Park Service, 1999).

- **South Core Banks at Great Island** - There are 25 cabins at this area. Additional support facilities include: (1) ferryboat dock, shelters, and orientation areas; (2) enclosed camping shelters; and (3) comfort stations. There is also one parking area at Great Island accommodating approximately 60 vehicles (National Park Service, 1999).

The National Park Service is in the process of amending its *General Management Plan for the Cape Lookout National Seashore* and is considering demolishing the 25 cabins at Great Island and replacing them with 30 new cabins. Another 10 new cabins would be added at Long Point. Generalized land use for all of Carteret County is presented in Table 3.7-3.

3.7.1.3 Craven County

The dominant land use in Craven County is forestland (56 percent) (Table 3.7-4). However, in recent years the county has experienced a steady conversion of forestland to agricultural cropland and urban/suburban development (Craven County, 1998). Craven County's primary urban areas, comprising only about 7 percent of total land area, include the municipalities of New Bern, Trent Woods, and River Bend and, to the southeast, the city of Havelock and MCAS Cherry Point. The US 70 corridor between New Bern and Havelock is the county's third most urbanized area. Commercial and industrial uses are generally concentrated along US 70. Manufacturing is becoming increasingly important to Craven County's economy, and strong

Table 3.7-2

Beaufort County Generalized Land Use

Use	Acres (Hectares)	Sq Miles (Sq Km)	Percent of Total*
Forestland	202,400(80,960)	316.3 (822.4)	33.0
Crop/Pastureland	110,400 (44,160)	172.5 (448.5)	18.0
Incorporated Communities	60,000 (24,000)	93.8 (243.9)	9.8
Industrial Areas	10,000 (4,000)	15.6 (40.6)	1.6
Rural Developed Land	55,200 (22,080)	86.3 (224.4)	9.0
Water	175,334 (70,134)	274 (712.4)	28.6
Total	613,334 (245,334)	958.3 (2491.6)	100.0

Note: *Of Total Land Acreage.
Source: Beaufort County, 1997.

Table 3.7-3

Carteret County Generalized Land Use

Use	Acres (Hectares)	Sq Miles (Sq Km)	Percent of Total
Federal and Non-Wetland Areas	91,637 (36,655)	143.2 (372.3)	13.6
Urban and Built-Up[1]	26,672 (10,669)	41.7 (108.4)	3.9
Agricultural Land	59,500 (23,800)	92.9 (241.5)	8.7
Forest and Fresh Water Wetlands	159,969 (63,988)	249.9 (649.7)	23.5
Salt Water Wetlands	55,000 (22,000)	85.9 (223.3)	8.1
Small and Large Water Bodies	287,310 (114,924)	448.9 (1167.1)	42.2
Total	681,088 (272,524)	1064.2 (2766.9)	100.0

Notes:
1. Includes incorporated areas.
Source: Carteret County, 1996.

Table 3.7-4

Craven County Generalized Land Use

Use	Acres (Hectares)	Sq Miles (Sq Km)	Percent of Total
Farms	72,181 (28,872)	112.8 (293.3)	14.4
Urban and Built-up [1]	37,760 (15,104)	59 (153.4)	7.4
Forestland	278,500 (111,400)	435.2 (1131.5)	55.5
Parks (state, federal, local) [2]	63,694 (25,478)	99.5 (258.7)	12.7
Right-of-way	7,765 (3,106)	12.1 (31.5)	1.5
Water	42,400 (16,960)	66.3 (172.4)	8.4
Total County Area	502,300 (200,920)	784.8 (2040.5)	100.0

Notes:
1. Includes MCAS Cherry Point (13.164 acres [5,266 hectares]).
2. Includes Croatan National Forest.
Source: Craven County Land Use Plan Addendum, 1998.

industrial recruitment efforts have resulted in the growth of industrial job opportunities (Craven County, 1998). Craven County Regional Airport is located just off US 70E in New Bern and features a commercial airline as well as air shipping and general aviation services (Craven Regional Airport, undated).

3.7.1.4 Hyde County

About 40 percent of the county's land area is classified as farmland or timberland. Publicly held property makes up about 15 percent of the county's acreage as well, including Swanquarter and Mattamuskeet National Wildlife Refuges, portions of the Alligator River and Pocosin Lakes National Wildlife Refuges, and three state game land areas. The county's major residential and commercial areas include the communities of Engelhard, Fairfield, and Swan Quarter. Other residential development is dispersed along properties fronting on primary and secondary roads, with concentrations of development in the towns of Nebraska, Middletown, Scranton, Sladesville, and Slocum. Table 3.7-5 lists the approximate acreage of the various land use classifications for Hyde County.

Ocracoke Island, one of the islands of North Carolina's Outer Banks, is also a part of Hyde County. The island, with the exception of Ocracoke Village, where most people are concentrated, is a part of the Cape Hatteras National Seashore. Like many of the populated barrier islands, it experiences a large seasonal population fluctuation.

3.7.1.5 Pamlico County

Pamlico County has seen accelerated development since 1985 as a result of residential subdivision construction along estuarine shoreline areas (Pamlico County, 1992), although urban and developed land still comprise less than 2 percent of total 1991 land uses. Commercial, service, public/semi-public, and limited industrial land uses are concentrated in the county's incorporated areas and the unincorporated communities of Grantsboro, Reelsboro, Hobucken, and Olympia (Pamlico County, 1992). The majority of manufacturing (seafood processing, boat building, and garment manufacturing) is located in Oriental (Pamlico County, 1992). Major institutional uses (schools, churches, health services, etc.) are located mostly in incorporated areas in proximity to the residential population. In spite of this development, the principal land use classification in the county remains forested land (41 percent of total county acreage), a classification that also includes wooded swamps and consolidated pocosin areas. The only significant public holding is the state-owned Goose Creek Wildlife Management area. Acreages associated with principal land uses in Pamlico County are shown in Table 3.7-6.

Table 3.7-5
Hyde County Generalized Land Use

Use	Acres (Hectares)	Sq Miles (Sq Km)	Percent of Total*
Farmland	110,000 (44,000)	171.9 (446.9)	12
Timberland	235,000 (94,000)	367.2 (954.7)	27
Urban - Built up	3,000 (1,200)	4.7 (12.2)	<1
Roadways, Public Facilities, Drainage Ditches and Banks	40,000 (16,000)	62.5 (162.5)	5
Pastureland/small water bodies	5,000 (2,000)	7.8 (20.3)	<1
State owned	17,598 (7,039)	27.5 (71.5)	2
Federally owned	117,923 (47,169)	184.3 (479.2)	13
Total County Land Area	391,808 (156,723)	612.2 (1591.7)	44
Total County Area	881,984 (352,794)	1,378.1 (3583.1)	100
Note: *Numbers may not equal 100 percent. Source: Hyde County, 1997.			

Table 3.7-6
Pamlico County Generalized Land Use

Use	Acres (Hectares)	Sq Miles (Sq Km)	Percent of Total
Forested	150,000 (60,000)	234.4 (609.4)	41.1
Crops and Pasture	39,000 (15,600)	60.9 (158.3)	10.6
Urbanized/Developed	3,000 (1,200)	4.7 (12.2)	1.4
Coastal Wetlands (Marshland)	19,000 (7,600)	29.7 (77.2)	5.3
Water	151,000 (60,400)	235.9 (613.3)	41.6
Total County Area	364,000 (145,600)	568.8 (1478.9)	100.0
Source: Pamlico County, 1992			

3.7.1.6 Tyrrell County

Tyrrell County is sparsely populated, ranking 99 out of North Carolina's 100 counties in terms of population density in 1992 (Tyrrell County, 1996). The highest residential population density is found in the town of Columbia. The majority of the new residential construction and placement of mobile homes has occurred in the Scuppernong and Columbia townships along the waterfronts of Bull Bay and the Albemarle Sound (Tyrrell County, 1996). The federal government owns 56,303 acres (22,785 hectares) or 15 percent of the land in Tyrrell County in the form of Pocosin Lakes National Wildlife Refuge. Acreages associated with principal land uses for Tyrrell County are shown in Table 3.7-7.

3.7.1.7 Washington County

In Washington County, residential development is clustered around the US 64 transportation route as it passes through the three towns of Plymouth, Roper, and Creswell, all of which are to the north and outside the project area. Acreages associated with the principal land uses in Washington County are listed in Table 3.7-8.

Commercial and industrial development within the county is also concentrated along the US 64 "strip" (Washington County, 1994). Major institutional uses (schools, churches, health services) are located mostly in proximity to the residential populations in the county. There are significant private holdings of timberland located throughout the county (Washington County, 1994). Weyerhaeuser and Georgia Pacific have large holdings of forested land. The Pocosin Lakes National Wildlife Refuge lies in portions of Washington, Tyrrell, and Hyde Counties. The 12,000-acre (4,856-hectare) Pungo Unit of the Pocosin Lakes National Wildlife Refuge lies within the study area and is managed principally for waterfowl (US Fish and Wildlife Service [Pocosin Lakes National Wildlife Refuge website], November 22, 2000).

3.7.2 Coastal Zone Management and Land Use Zoning and Policy

North Carolina's Coastal Area Management Act (CAMA) was passed in accordance with the federal Coastal Zone Management Act (CZMA) of 1972. CAMA required local governments in each of the 20 coastal counties in the state to prepare and implement a land use plan and ordinances for its enforcement. Upon approval by the North Carolina Coastal Resources Commission, the plan becomes part of the North Carolina Coastal Management Plan. Coastal zone management policies adopted in each plan must be consistent with established state and federal policies.

Table 3.7-7
Tyrrell County Generalized Land Use

Use	Acres (Hectares)	Sq Miles (Sq Km)	Percent of Total
Federal	57,341 (22,936)	89.6 (233.0)	15.0
State	2,900 (1,160)	4.5 (11.7)	0.8
Urban and Built Up	2,150 (860)	3.4 (8.8)	0.6
Water	109,224 (43,690)	170.7 (443.8)	28.5
Cropland	61,550 (24,620)	96.2 (250.1)	16.0
Forestland	134,459 (53,784)	210.1 (546.3)	35.0
Other (Ditch banks, roadways, etc.)	15,519 (6,208)	24.2 (62.9)	4.1
Total Land Area	273,919 (109,568)	428.0 (1112.8)	71.5
Total County Area	383,143 (153,257)	598.7 (1556.6)	100.0
Source: Tyrrell County, 1996.			

Table 3.7-8
Washington County Generalized Land Use

Use	Acres (Hectares)	Sq Miles (Sq Km)	Percent of Total
Cropland and Pasture	108,306 (43,322)	169.3 (440.2)	49.4
Woodland	101,858 (40,743)	159.2 (414.9)	46.5
Residential	6,500 (2,600)	10.2 (26.5)	3.0
Industrial	2,500 (1,000)	4.0 (10.4)	1.1
Total County Area	219,164 (87,666)	342.4 (890.2)	100.0
Source: Washington County, 1994.			

Coastal zone management policies include: manmade hazards (coastal airspace); economic development; emergency airspace use; cultural and historic resources; and continued public participation policies. In order for a county or city land use policy to be relevant to a federal action, the individual policy must be enforceable. Enforcement is usually accomplished through the issuance of a permit, license, or other similar process. If there is no means for enforcing a policy (i.e., no permit or other means of regulating that policy), then the policy may be considered as guidance. The protection of cultural resources is the only enforceable policy of the four listed above; the other policies are more in the nature of recommendations. Specific coastal zone management policies for each of the counties likely to be affected by the proposed action are summarized in Appendix B.

3.8 Air Quality

3.8.1 National Ambient Air Quality Standards and Attainment Status

The USEPA, under the requirements of the 1970 Clean Air Act as amended in 1977 and 1990, has established National Ambient Air Quality Standards (NAAQS) for six contaminants, referred to as criteria pollutants (40 CFR 50): carbon monoxide, nitrogen dioxide, ozone, particulate matter, lead, and sulfur dioxide. The ambient air quality standards include primary and secondary standards. The primary standards are established at levels to protect public health, with an adequate margin of safety. The secondary standards are established at more stringent levels in order to protect the public welfare.

The North Carolina Department of Environment and Natural Resources has adopted USEPA's NAAQS plus a standard for total suspended particulate matter (TSP) and particulate matter with a diameter of ten microns or less (PM10). These rules, codified as 15A NCAC 2D (Air Pollution Control Requirements for North Carolina), are presented in Table 3.8-1.

Areas that meet the NAAQS standard for a criteria pollutant are designated as "attainment." Areas where the criteria pollutant level exceeds the NAAQS are designated as being in "nonattainment." Nonattainment areas are subcategorized based on the severity of their pollution problem (marginal, moderate, serious, severe, and extreme). When insufficient data exists to determine an area's attainment status, it is designated unclassifiable (or attainment). The proposed MOAs are located in either the Southern Coastal Plain Intrastate Air Quality Control Region, (Carteret, Craven, and Pamlico Counties, 40 CFR Part 81.152), or the Northern Coastal Plain Intrastate Air Quality Control Region (Beaufort, Hyde, Tyrrell, and Washington Counties, 40 CFR 81.149). Pursuant to 40 CFR 81.334, each of the counties that make up these regions has been designated as being in attainment for all criteria pollutants. In addition, the region surrounding the Swanquarter National Wilderness Area has been designated a Class I air quality area. This classification is intended to avoid impacts to visibility in areas, such as wildlife refuges, that have significant visual value.

3.8.2 General Conformity

The Clean Air Act Amendments of 1990 expands the scope and content of the Clean Air Act's conformity provisions by providing a more specific definition of conformity. As stipulated in Section 176(c) of the Clean Air Act Amendments, conformity is defined as "conformity to the State Implementation Program's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards." The USEPA published final rules on general conformity that apply to federal actions in areas designated nonattainment for any of the criteria pollutants under the Clean Air Act (40 CFR Parts 51 and 93) in the November 30, 1993 *Federal Register*. Since the proposed action and alternatives would occur within attainment areas, this rule is not applicable.

Table 3.8-1

National and North Carolina Air Quality Standards

Pollutant and Averaging Time	Primary Standard[1]	Secondary[1]
Carbon Monoxide		
8-hour Maximum	9 ppm	--
1-hour Maximum	35 ppm	--
Nitrogen Dioxide		
Annual Arithmetic Mean	100[7]	100
Ozone		
1-hour Maximum	0.12 ppm[3,9]	0.12 ppm[9,10]
8-hour Maximum	0.08 ppm[4,9]	0.08 ppm[9]
Particulate Matter		
PM 10:		
Annual Arithmetic Mean[2]	50[7]	50
24-hour Maximum	150[5]	150
PM 2.5:		
Annual Arithmetic Mean[2]	15[7]	15
24-hour Maximum	65[6]	65
TSP:		
Annual Arithmetic Mean	75	
24-hour Maximum	150	
Lead		
Quarterly Arithmetic Mean	1.5[8]	1.5
Sulfur Dioxide		
Annual Arithmetic Mean	80[7]	
24-hour Maximum	365[2]	
3-hour Maximum		1300[2]

Notes:
1. All concentrations are in micrograms per cubic meter of air unless designated as parts per million (ppm).
2. Arithmetic mean over the 3 most current years.
3. Expected number of exceedance days shall not be more than one per year (three-year average).
4. An area will attain the standard when three-year average of the annual 4th-highest daily maximum 8-hour concentrations is below 0.08 ppm.
5. An area will attain the standard when the annual highest 99th percentile of 24-hour concentrations over three years is below 150 ug/m^3.
6. An area will attain the standard when the annual highest 98th percentile of 24-hour concentrations over three years is below 65 ug/m^3.
7. Not to be exceeded during any calendar year.
8. Not to be exceeded in any quarter.
9 On April 1, 1999 North Carolina adopted the EPA PM 2.5 and Ozone standards. On May 1999 the US Court of appeals ruled the new EPA PM-2.5 standard as unenforceable and vacated the new 8-hour Ozone standard. The US Supreme Court has agreed to consider an appeal of that decision.
10. On May 27, 1999, the one-hour standard was rescinded by the EMC based on EPA guidance. The one-hour standard will likely be reinstated.

Sources: 40 CFR 50; USEPA, 1997; North Carolina Department of Environment and Natural Resources, 2000.

4 IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

This chapter presents a discussion of the potential environmental impacts that would occur as a result of the Marine Corps establishing new SUA in the form of MOAs in eastern North Carolina. A useful synonym for the term "impact" is "effect." In other words, an analysis of the environmental impacts of an action identifies the "effects" that the action would have upon various components of the environment.

Once impacts are identified, a determination is made regarding their significance. "Significance," as used in NEPA, requires the dual considerations of context and intensity. With respect to context, "the significance of an action must be analyzed in several contexts such as society as a whole (human and national), the affected region, the affected interests, and the locality" (40 CFR 1508.27). Significance varies with the setting of the proposed action and the processes affected. For example, the more resources affected, either individually or cumulatively, the more significant the impact is likely to be considered. Furthermore, the more widespread the effect of an impact, proceeding from local to global, the more likely the impact could be considered to be significant.

The intensity of an impact refers to the severity of an impact. In evaluating the intensity of an impact, the following questions should be considered:

- How large or noticeable is the change or disparity?
- What is the probability of the impact occurring and the duration and rate of occurrence?
- What is the potential for controversy?
- What is the potential for establishing a precedent or violating laws imposed to protect the environment or health and safety?

The more intense the identified impact, the more significant it could be considered. For example, an industrial facility that would generate air pollutants over the life of the facility (say, a 20 year period) that would violate the Clean Air Act NAAQS would be considered to have a significant impact on air quality.

As further stated by the CEQ, the discussion of the environmental consequences associated with a proposed project and its alternatives should be in comparative form. This technique allows issues to become sharply defined and provides "a clear basis for choice among options by the decision maker and the public" (40 CFR 1502.16). Accordingly, the impact analysis provides a

comparative discussion of the No Action Alternative and the proposed MOA alternatives. The implications of the No Action Alternative are examined at the beginning of each subchapter and an analysis of each of the MOA alternatives, as identified in Chapter 2, follows. It should be noted that the Marine Corps has selected the Core and Mattamuskeet combination as its preferred alternative based on the greater training flexibility that can be achieved with this combination in comparison to the other viable alternatives.

The basic organization of Chapter 4 parallels that of Chapter 3. Subchapters 4.1 through 4.8 address the environmental impacts of each proposed project component. Where the potential impacts of the alternative MOAs are similar, these alternatives are discussed together. Subchapter 4.9 discusses cumulative impacts.

4.1 Airspace and Aircraft Operations

The potential for impacts related to the use of airspace overlying eastern North Carolina and on aircraft operations that occur within this airspace are addressed in this subchapter. Issues of concern with respect to use of airspace and aircraft operations would include the following:

- The effect of establishing the military training airspace components upon adjacent controlled, uncontrolled special use or other designated airspace.
- Number of military flight operations with the proposed MOA and their effect upon nonparticipating civil aircraft operations.
- Effect of the proposed airspace actions and flight operations upon civil airports that underlie or are adjacent to the military airspace being assessed in this EA.

4.1.1 Airspace

4.1.1.1 No Action Alternative

Under the No Action Alternative, there would be no change to existing controlled or uncontrolled airspace in eastern North Carolina. Marine Corps aircraft would continue to conduct existing training flight activities over the Core Banks and in the Cherry and Mattamuskeet areas at airspeeds below 250 kt when at altitudes less than 10,000 ft (3,048 m) MSL pursuant to FAA regulations published in 14 CFR 91. Also, in accordance with OPNAVINST 3710.7, aircraft involved in training exercises over Cape Lookout National Seashore and the wildlife refuges in eastern North Carolina would continue to be operated at altitudes of no lower than 3,000 ft (914 m) MSL, except when such training activities were

conducted on an established military training route (MTR) or within existing SUA such as that established in association with R-5306A or the Dare County Bombing Range (e.g., R-5314).

In addition, MCAS Cherry Point's Radar Air Traffic Control Facility (RATCF) would continue to provide radar air traffic control services for both military and civilian aircraft for all SUA under its jurisdiction as described in detail in Subchapter 3.1.

4.1.1.2 Core and Mattamuskeet MOAs Alternative

Implementation of this alternative would result in the establishment of two new MOAs that would provide significant training benefits to military aviators. The Core MOA would allow entry to and exit from W-122 (the Atlantic Ocean) into existing R-5306A airspace at a minimum altitude of 3,000 ft (914 m) MSL and at speeds less than supersonic but greater than 250 kt. The Mattamuskeet MOA would provide additional room for military aircraft to perform required training activities and maneuvers (adjacent to but outside of existing restricted airspace and associated target areas). When considered together, the establishment of these two proposed MOAs would reduce limitations in existing aviation training airspace.

Beyond the establishment of the two proposed MOAs, there would be no other changes to existing controlled or uncontrolled airspace in eastern North Carolina. While operating within the proposed MOAs, aircraft involved in training exercises could fly at altitudes no lower than 3,000 ft (914 m) MSL, except when such training activities were conducted within an established MTR.

The training aircraft would also be permitted to attain subsonic speeds greater than 250 kt within the two MOA. In addition, use of the MOA airspace could be scheduled in stratified blocks. This means that a training unit could choose to reserve specific altitude blocks within the MOA without having to reserve all the MOA airspace (for example, a training unit reservation could be for the 5,000 to 10,000 ft [1,524 to 3,048 m] MSL altitudes within the MOA).

The use of the proposed MOAs would be scheduled by MCAS Cherry Point. MCAS Cherry Point's RATCF would continue to provide radar air traffic control services for both military and civilian aircraft for all airspace under its jurisdiction, including the proposed MOAs, and would control entry and exit (i.e., radar containment services) from the MOAs and for other SUA. In addition, the RATCF would also coordinate with other air traffic control entities that have responsibilities for airspace close to the footprint of the proposed MOAs, including the FAA's Washington Air Route Traffic Control Center and the Navy's FACSFAC VACAPES. Moreover, military pilots training in the MOAs would also be responsible for avoiding all other aircraft (civilian or other military) that could be flying IFR or VFR near to or within the proposed MOAs. With this level of control, coordination, and vigilance, there would be safe separation of all aircraft flying within or in proximity to the proposed MOAs and minimal potential for airspace conflicts.

4.1.1.3 Core and Cherry MOAs Alternative

The potential airspace impacts of implementing this alternative would be the same as previously described for the Core and Mattamuskeet MOAs Alternative.

4.1.1.4 Core MOA Alternative

Establishing the Core MOA would connect existing R-5306A and W-122 and would remove the speed restriction currently in place across the Core Banks. There would be no lingering of aircraft within the proposed MOA as flights would be perpendicular to (i.e., across) the Core Banks, not parallel to the island. However, implementing only this alternative, would not establish additional airspace for conducting essential aviation training activities. While the training value of this MOA would be beneficial, Marine Corps aviators would not meet the full spectrum of their formation flying and air combat maneuver needs in North Carolina.

Scheduling of the MOA would be the same as described for the other alternatives. Furthermore, the RATCF at MCAS Cherry Point would provide radar air traffic control services for the MOA, controlling entries and exits, and coordinate with the FAA's Washington Center and FACSFAC VACAPES, as needed. Military pilots flying through the MOA would be responsible for avoiding all other aircraft (civilian or other military) that could be flying IFR or VFR near to or within the proposed Core MOA. This level of control, coordination, and vigilance would provide for safe separation of all aircraft and minimal potential for airspace conflicts.

4.1.1.5 Mattamuskeet MOA Alternative

With implementation of this alternative, the Marine Corps would provide additional room for military aircraft to perform required training activities and maneuvers (adjacent to but outside of existing restricted airspace and associated target areas). It would not provide connecting airspace between R-5306A and W-122. Thus, implementation of this MOA has beneficial stand-alone training value, but would not, by itself, satisfy all the Marine Corps' training needs within eastern North Carolina.

The RATCF at MCAS Cherry Point would provide radar air traffic control services for the proposed Mattamuskeet MOA, control entries and exits from the MOA, and coordinate with the FAA's Washington Center and FACSFAC VACAPES, as needed. Military pilots flying through the MOA would be responsible for avoiding all other aircraft (civilian or other military) that could be flying IFR or VFR near to or within the proposed Core MOA. This level of control, coordination, and vigilance would provide for safe separation of all aircraft and minimal potential for airspace conflicts.

4.1.1.6 Cherry MOA Alternative

Similar airspace impacts would occur with implementation of the Cherry MOA alternative as described for the Mattamuskeet MOA alternative above.

4.1.2 Aircraft Operations

4.1.2.1 No Action Alternative

The number of aircraft operations conducted in eastern North Carolina SUA would be the same as identified under baseline conditions in Table 3.1-7. In addition, military training flights would continue to be randomly conducted by the Marine Corps and the other services over the Core Banks and in the Cherry and Mattamuskeet areas under the No Action Alternative. These flights would continue to comply with FAA regulations as published in 14 CFR 91 (i.e., flights would be conducted at airspeeds below 250 kt when aircraft are at altitudes less than 10,000 ft [3,048 m] MSL). In addition, approach control services to local civil airports in eastern North Carolina would continue to be provided by the RATCF at MCAS Cherry Point. As there would be no change in existing conditions, there would be no additional impact on civilian airports or aircraft operations or the operations of other military aircraft in eastern North Carolina.

4.1.2.2 Core and Mattamuskeet MOAs Alternative

Project Sorties and Flight Hours

Military aircraft operations would increase under this alternative when compared to the No Action Alternative (Table 4.1-1). Sorties would be flown over the Core Banks as well in the area overlying Lake Mattamuskeet that is within the boundaries of the proposed Mattamuskeet MOA. The annual number of sorties that would be flown within the Core and Mattamuskeet MOAs would be 1,460 sorties (these are not new operations but rather existing ingress/egress operations occurring at higher speeds) and 2,423 (this includes movement of existing Marine Corps operations from R-5306A and some new Navy operations), respectively. (Note that a sortie in the context of training operations is defined as “one aircraft or a flight of aircraft entering a region of airspace, operating there for a period of time and leaving.”) Projected flight activity can be further broken down as follows:

- **Core MOA** - In the Core MOA, there would be 1,404 day sorties and 56 night sorties or about 6 higher speed sorties per 24-hour period (assuming 260 training days per year). Furthermore, based on an average duration per sortie of one minute, the number of flight hours that would be expended within the Core MOA would be relatively few, totaling only about 24 hours per year (5.6 minutes per training day).

Table 4.1-1

Annual Sorties by Airspace and Aircraft Type with Core and Mattamuskeet MOAs Alternative

Aircraft Type	Annual Sorties by Airspace									
	Day (7:00-10:00 pm)				Night (10:00-7:00 am)				Total Sorties	Change from Baseline
	Core MOA	Matta-muskeet MOA	R-5306A[1]	BT-9/ BT-11[2]	Core MOA	Matta-muskeet MOA	R-5306A[1]	BT-9/ BT-11[2]		
Air Force										
A-10	0	8	29	0	0	0	0	0	37	+8
F-15C/D	62	14	54	438	1	0	0	10	579	+77
F-16	148	56	202	800	1	2	4	9	1,222	+207
Total Air Force	210	78	285	1,238	2	2	4	19	1,838	+292
Marine Corps										
AV-8 (Fleet)	940	659	1,794	1,322	34	13	9	46	4,817	+764
AV-8 (FRS)[3]	25	536	1,979	830	0	2	38	14	3,424	+240
F/A-18C/D	142	27	100	580	8	0	0	28	885	+177
Helicopters	0	68	134	482	0	0	0	0	684	+68
KC-130	0	0	0	3	0	0	0	1	4	0
Total Marine Corps	1,107	1,290	4,007	3,217	42	15	47	89	9,814	+1,249
Navy										
F-14C/D (NAS Oceana Fleet)	23	170	0	436	3	0	0	0	632	+196
F-14C/D (NAS Oceana FRS)[3]	0	0	0	96	0	0	0	0	96	0
F/A-18C/D (NAS Oceana Fleet)	58	197	0	824	9	18	0	60	1,166	+282
F/A-18C/D (NAS Oceana FRS)[3]	0	582	0	0	0	41	0	0	623	+623
Total Navy	81	949	0	1,356	12	59	0	60	2,517	+1101
Other Military										
Other Military Jets	6	8	61	249	0	0	0	0	324	+14
Other Military Props	0	22	90	41	0	0	0	0	153	+22
Other Military Helicopter	0	0	0	152	0	0	0	16	168	0
Total Other	6	30	151	442	0	0	0	16	645	+36
Total	1,404	2,347	4,443	6,253	56	76	51	184	14,814	+2678

Notes:
1. Exclusive of BT-9/BT-11 use.
2. Area within a 5 NM (9.3 km) radius of each target.
3. FRS = Fleet Replacement Squadron.
Source: ATAC Corporation, 2001; Wyle Laboratories, June 11, 2002.

- **Mattamuskeet MOA** - The use of the Mattamuskeet MOA would be more substantial, a projected 2,423 sorties per year (2,347 day sorties, and 76 night sorties). This would equate to 9.3 sorties per day where the average duration of each sortie would be about 45 minutes. Put another way, this level of military activity represents one sortie operating somewhere over the 875 NM^2 (2990 km^2) underlying the Mattamuskeet MOA for 7 hours in any 24 hour period.

Flight operations that will occur in each MOA will be unstructured (i.e., random and widely dispersed), as no specific flight tracks exist. Aircraft would be free to maneuver anywhere within the boundaries of the "three-dimensional" box comprising the MOA as necessary to meet mission needs. However, the Marine Corps would be imposing the following restrictions on flight operations within the Core MOA: (1) flights will be perpendicular to (i.e., across) the Core Banks, not parallel to the island; and (2) there would be no lingering of aircraft within the proposed Core MOA.

Use of altitude strata has been estimated and would vary by aircraft type and mission. For the Core MOA, about 35 percent of the sorties would be conducted between 3,000 (914 m) and 5,000 (1,524 m) ft MSL; 45 percent would occur between 5,000 ft (1,524 m) and 10,000 ft (3,048 m) MSL; and the remaining 20 percent would be conducted between 10,000 ft (3,048 m) and 18,000 ft (5,486 m) MSL. The altitude distribution projected for the Mattamuskeet MOA shows 25 percent of sorties would occur between 3,000 ft (914 m) and 10,000 (3,048 m) ft MSL and 75 percent would occur above 10,000 ft (3,048 m) MSL.

Effects on Nonparticipating Civil Aircraft Operations

When scheduled for use, the proposed MOAs would affect "boxes" of airspace between 3,000 ft (914 m) and 18,000 ft (5,486 m) MSL. In addition, these altitude restrictions would allow for minimal potential conflicts between nonparticipatory civil aircraft operations and military operations within the MOAs because civil aircraft operations would be able to continue to occur at all times below the floor of the MOA and above the ceiling without restriction. This situation would be compatible with existing commercial jet routes, which are typically from 18,000 ft (5,486 m) to 60,000 ft (18,288 m) MSL, altitudes above those proposed for the Core and Mattamuskeet MOAs. General aviation aircraft would continue to be able to fly at all times at altitudes up to 3,000 ft (914 m) MSL.

However, fixed-wing aircraft, helicopters, ultralight vehicles, balloons, and gliders that would fly over the national wildlife refuges that lie beneath the proposed Mattamuskeet MOA are subject to voluntary minimum altitudes of 2,000 ft (610 m) MSL. This voluntary minimum altitude was agreed upon in an Interagency Agreement co-signed by the US Bureau of Land Management, Fish and Wildlife Service, National Park Service, and the FAA in 1993. Placing a 3,000 ft (914 m) MSL altitude ceiling in the areas overlying the national wildlife refuges could have a

potential negative impact on general aviation use of this airspace. However, several factors are in place that would reduce the potential for significant impact:

- The proposed Core and Mattamuskeet MOAs would be considered in use (i.e., "active") only when scheduled by military aircraft. When not active, the use of the airspace would be available to all non-military aviation users. Accordingly, the proposed MOAs could potentially be active during specific scheduled time slots any time from 7:00 am to 11:00 pm Monday through Friday and occasionally on Saturdays and Sundays. However, the proposed MOAs would not be active for that entire period.

- In addition, only those altitude blocks within the proposed MOAs, required for training, will be activated. The worst-case scenario for civilian air traffic is the concentration of traffic within the 1,000 ft (305 m) window between the voluntary minimum elevation of 2,000 ft (610 m) MSL and the floor of the proposed MOAs at 3,000 ft (914 m) MSL. However, as indicated previously in this subchapter, 75% of all sorties in the proposed Mattamuskeet MOA, where concern for general aviation is highest, will be conducted at altitudes greater than 10,000 ft (3,048 m) MSL. Only 25% of sorties would be conducted at altitudes between 3,000 and 10,000 ft (914 and 3,048 m) MSL. On an average training day, this translates to 105 minutes (1.75 hours) per day when the proposed Mattamuskeet MOA would be active at altitudes below 10,000 ft (3,048 m) MSL.

- Even if a MOA was active, a nonparticipatory aircraft would still be allowed to enter and fly through the airspace when the pilot was:

  - flying IFR and IFR separation could be provided by MCAS Cherry Point RATCF. Otherwise, the RATCF would reroute nonparticipating IFR air traffic around the MOA.

  - flying VFR and the pilot was using "see and avoid" techniques.

As stated previously in this subchapter, on those days when training is occurring within the proposed Mattamuskeet MOA there would be between 9 and 10 training sorties per day there lasting for about 45 minutes each. Given that the proposed MOA overlays approximately 875 NM^2 (2990 km^2) of land area, the actual time during which nonparticipatory aircraft operations would be constrained by training operations is expected to be limited. Use of the proposed Core MOA for Marine Corps training is expected to be of even less consequence to nonparticipatory aircraft operations since this airspace will be utilized for only 5 to 6 minutes each training day leaving the greatest part of each day available for general aviation use.

There is no potential for conflict between the establishment of the Core MOA and existing Victor Airways in eastern North Carolina. While two established Victor Airways (V56 and V290) cross the Mattamuskeet MOA, both routes are identified as "unusable" as navigation aids in the underlying area have been decommissioned. Therefore, there would be no potential for conflicts between military training operations being conducted in proposed Mattamuskeet MOA and V56 and V290.

In addition, MCAS Cherry Point RATCF would insure that military aircraft engaged in training exercises would cause no "spillouts" from the MOA.

Effects on Civilian Airport Operations

No public airports are located within the land areas underlying either the proposed Core or Mattamuskeet MOAs. However, three private air strips (Tim Whitfield Aviation in Fairfield, Riverside in Leachville and Hodges in Sladesville) and one North Carolina Forest Service air strip are situated beneath the proposed MOA airspace. The 3,000-ft (914-m) MSL floor of the proposed MOA would provide sufficient separation between aviation activities conducted on or in proximity to these private airstrips and the training activities that would be conducted within the MOA. As a result, there would be no impact to non-military civilian aviation operations.

4.1.2.3 Core and Cherry MOAs Alternative

Project Sorties and Flight Hours

The level of military aircraft operations that would occur under this alternative are shown in Table 4.1-2. These operations would be the same as previously described for the Core and Mattamuskeet MOAs Alternative.

Effects on Nonparticipating Civil Aircraft Operations

The potential for effects on nonparticipating civil aircraft operations from military aviation training operations being conducted in the proposed MOAs would be the same as previously described for the Core and Mattamuskeet MOAs Alternative with one exception. The exception concerns the potential for conflicts between operations of the proposed Cherry MOA and civilian aviation activities on V139 between New Bern, NC and PEARS intersection. This heavily used airway provides for navigation between points north such as Cofield VORTAC and Norfolk, VA and points south such as Wilmington and New Bern, NC. This airway also funnels traffic from North of New Bern to points southeast such as Beaufort, NC and the outer banks near Cape Lookout.

When operations are being conducted in the proposed MOA, IFR operations along V139 will experience rerouting by Cherry Point RATCF. Radar vectors around the proposed MOA would provide the least route delay by adding approximately 10 NM to the flight. When rerouting is

Table 4.1-2

Annual Sorties by Airspace and Aircraft Type with Core and Cherry MOAs Alternative

Aircraft Type	Annual Sorties by Airspace									
	Day (7:00-10:00 pm)				Night (10:00-7:00 am)				Total Sorties	Change from Baseline
	Core MOA	Cherry MOA	R-5306A[1]	BT-9/ BT-11[2]	Core MOA	Cherry MOA	R-5306A[1]	BT-9/ BT-11[2]		
Air Force										
A-10	0	8	29	0	0	0	0	0	37	+8
F-15C/D	62	14	54	438	1	0	0	10	579	+77
F-16	148	56	202	800	1	2	4	9	1,222	+207
Total Air Force	210	78	285	1,238	2	2	4	19	1,838	+292
Marine Corps										
AV-8 (Fleet)	940	659	1,794	1,322	34	13	9	46	4,817	+764
AV-8 (FRS)[3]	25	536	1,979	830	0	2	38	14	3,424	+240
F/A-18C/D	142	27	100	580	8	0	0	28	885	+177
Helicopters	0	68	134	482	0	0	0	0	684	+68
KC-130	0	0	0	3	0	0	0	1	4	0
Total Marine Corps	1,107	1,290	4,007	3,217	42	15	47	89	9,814	+1,249
Navy										
F-14C/D (NAS Oceana Fleet)	23	170	0	436	3	0	0	0	632	+196
F-14C/D (NAS Oceana FRS)[3]	0	0	0	96	0	0	0	0	96	0
F/A-18C/D (NAS Oceana Fleet)	58	197	0	824	9	18	0	60	1,166	+282
F/A-18C/D (NAS Oceana FRS)[3]	0	582	0	0	0	41	0	0	623	+623
Total Navy	81	949	0	1,356	12	59	0	60	2,517	+1101
Other Military										
Other Military Jets	6	8	61	249	0	0	0	0	324	+14
Other Military Props	0	22	90	41	0	0	0	0	153	+22
Other Military Helicopter	0	0	0	152	0	0	0	16	168	0
Total Other	6	30	151	442	0	0	0	16	645	+36
Total	1,404	2,347	4,443	6,253	56	76	51	184	14,814	+2678

Notes:
1. Exclusive of BT-9/BT-11 use.
2. Area within a 5 NM (9.3 km) radius of each target.
3. FRS = Fleet Replacement Squadron.
Source: ATAC Corporation, 2001; Wyle Laboratories, June 11, 2002.

necessary via the airway structure, aircraft would incur 27 more flying miles from New Bern to the PEARS intersection by navigating via the Kinston VORTAC. For example, an aircraft experiencing these route changes and cruising at 120 knots would experience additional flight time of approximately 5 to 13 minutes. Increased fuel costs would also be incurred. Routing beneath the proposed MOA at 2,000 ft (610 m) MSL would be possible, but largely impractical.

Effects on Civilian Airport Operations

No public airports are located within the land areas underlying either the proposed Core or Cherry MOAs. However, three private air strips (Lee Creek in Aurora, Hodges in Sladesville, and Welbourn-Woolard in Vanceboro) are situated beneath the proposed MOA airspace. The 3,000-ft (914-m) MSL floor of the proposed MOA would provide sufficient separation between aviation activities conducted on or in proximity to these private airstrips and the training activities that would be conducted within the MOA. As a result, there would be no impact to non-military civilian aviation operations.

4.1.2.4 Core MOA Alternative

Project Sorties and Flight Hours

Implementation of the Core MOA Alternative would result in 1,404 day sorties and 56 night sorties conducted over the Core Banks (Table 4.1-3). This would equate to about 6 sorties of one minute duration per 24-hour period (assuming 260 training days per year). Cumulatively, the Core MOA would be used for a total of about 24 hours per year (5.6 minutes per training day). As previously mentioned in this subchapter, the Core MOA would provide an essential training benefit to Marine Corp aviators by allowing entry to and exit from W-122 (the Atlantic Ocean) into existing R-5306A at a minimum altitude of 3,000 ft (914 m) MSL and at speeds less than supersonic. The projected altitude distributions of sorties would be as follows:

- 35 percent between 3,000 ft (914 m) and 5,000 ft (1,524 m) MSL.
- 45 percent between 5,000 ft (1,524 m) and 10,000 ft (3,048 m) MSL.
- 20 percent between 10,000 ft (3,048 m) and 18, 000 ft (5,486 m) MSL.

Effects on Nonparticipating Civil Aircraft Operations

There would be no potential to adversely affect nonparticipating civil aircraft operations as a result of establishing the proposed Core MOA for military aviation training operations because the level of projected operations is low and there are no public or private airports located in the land areas underlying the proposed MOA.

Table 4.1-3
Annual Sorties by Airspace and Aircraft Type with Core MOA Alternative

Aircraft Type	Annual Sorties by Airspace							
	Day (7:00-10:00 pm)			Night (10:00-7:00 am)			Total Sorties	Change from Baseline
	Core MOA	R-5306A[1]	BT-9/ BT-11[2]	Core MOA	R-5306A[1]	BT-9/ BT-11[2]		
Air Force								
A-10	0	29	0	0	0	0	29	0
F-15C/D	62	54	438	1	0	10	565	+63
F-16	148	202	800	1	4	9	1,164	+149
Total Air Force	210	285	1,238	2	4	19	1,758	+212
Marine Corps								
AV-8 (Fleet)	940	2,638	1,322	34	51	46	5,031	+978
AV-8 (FRS)[3]	25	2,330	830	0	11	14	3,210	+26
F/A-18C/D	142	100	580	8	0	28	858	+150
Helicopters	0	134	482	0	0	0	616	0
KC-130	0	0	3	0	0	1	4	0
Total Marine Corps	1,107	5,202	3,217	42	62	89	9,719	+1,154
Navy								
F-14C/D (NAS Oceana Fleet)	23	0	436	3	0	0	462	+26
F-14C/D (NAS Oceana FRS)[3]	0	0	96	0	0	0	96	0
F/A-18C/D (NAS Oceana Fleet)	58	0	824	9	0	0	891	+7
F/A-18C/D (NAS Oceana FRS)[3]	0	0	0	0	0	0	0	0
Total Navy	81	0	1,356	12	0	0	1,449	+33
Other Military								
Other Military Jets	6	61	249	0	0	0	316	+6
Other Military Props	0	90	41	0	0	0	131	0
Other Military Helicopter	0	0	152	0	0	16	168	0
Total Other	6	151	442	0	0	16	615	+6
Total	1,404	5,639	6,253	56	66	184	13,602	+1,466

Notes:
1. Exclusive of BT-9/BT-11 use.
2. Area within a 5 NM (9.3 km) radius of each target.
3. FRS = Fleet Replacement Squadron.
Source: ATAC Corporation, 2001.

Effects on Civilian Airport Operations

Since there are no public or private airports located in the land areas underlying the proposed MOA there will be no adverse effect on civilian airport operations. Neither would this alternative conflict with an established federal airway.

4.1.2.5 Mattamuskeet MOA Alternative

Project Sorties and Flight Hours

The establishment of the proposed Mattamuskeet MOA Alternative would result in a projected 2,423 sorties per year (2,347 day sorties, and 76 night sorties) as shown in the Mattamuskeet MOA portions of Table 4.1-1. This would equate to 9.3 sorties per day where the average duration of each sortie would be about 45 minutes. Total average flight time per training day would thus be about 7 hours. The altitude distribution projected for the Mattamuskeet MOA shows 25 percent of sorties would occur between 3,000 ft (914 m) and 10,000 (3,048 m) ft MSL and 75 percent would occur above 10,000 ft (3.048 m) MSL.

Effects on Nonparticipating Civil Aircraft Operations

The potential for effects on nonparticipating civil aircraft operations from the military aviation training operations that would be conducted in the proposed MOA would be similar to those previously described for the Core and Mattamuskeet MOAs Alternative.

Effects on Civilian Airport Operations

The potential for effects on civilian airport operations from the military aviation training operations that would be conducted in the proposed MOA would be similar to those previously described for the Core and Mattamuskeet MOAs Alternative.

4.1.2.6 Cherry MOA Alternative

Project Sorties and Flight Hours

The establishment of the proposed Cherry MOA Alternative would be the same as described for the proposed Mattamuskeet MOA Alternative -- a projected 2,423 sorties per year (2,347 day sorties, and 76 night sorties). The 9.3 sorties per day would result in an average usage of 7 hours per training day. The altitude distribution projected for the Cherry MOA shows that 25 percent of sorties would occur between 3,000 ft (914 m) and 10,000 ft (3,048 m) MSL, and 75 percent would occur above 10,000 ft (3.048 m) MSL.

Effects on Nonparticipating Civil Aircraft Operations

The potential for effects on nonparticipating civil aircraft operations from the military aviation training operations that would be conducted in the proposed MOA would be similar to those previously described for the Core and Cherry MOAs Alternative.

Effects on Civilian Airport Operations

The potential for effects on civilian airport operations from the military aviation training operations that would be conducted in the proposed MOA would be similar to those previously described for the Core and Cherry MOAs Alternative.

4.2 Noise

The effects of noise on human health can be considered from both physiological and behavioral perspectives. Historically, physiological hearing loss was considered the most serious effect of exposure to excessive or prolonged noises, with such effects largely related to human activities in the workplace (i.e., manufacturing) and near construction activities. With efforts by the manufacturing and construction industries and regulatory agencies having successfully lessened the likelihood of physical hearing damage from noise exposure, the analysis of environmental noise effects from such sources as aircraft has shifted to behavioral (or nuisance) effects -- annoyance, speech interference, and sleep disturbance. The extent of these effects varies among individuals and is a function of the characteristics of the noise source (e.g., overall loudness, duration of exposure, time distribution of occurrence, and sound frequency). The potential for the following types of noise effects on humans has been considered in this EA:

- Hearing loss.
- Nonauditory health effects.
- Annoyance.
- Speech interference.
- Sleep disturbance.

Noise effects on domestic animals and wildlife are addressed in this EA (see Subchapter 4.4).

As can be seen in Table 4.2-1, considerable data has been collected and analyzed on the effects of noise on humans. It has been well-established that continuous exposure to high noise levels (such as that occurring in a closed environment like a factory) will damage hearing (USEPA, 1978). Hearing loss is generally interpreted as shifting the ear's sensitivity to a higher sound level to perceive or hear sound (sound must be louder to be heard). This change can be either temporary or permanent. Federal workplace standards for protection from hearing loss allow an A-weighted time-average level of 90 dB over an 8-hour work period, or 85 dB averaged over a 16-hour period.

Studies on community hearing loss from exposure to aircraft flyovers near commercial airports have shown that there is no danger, under normal circumstances, of hearing loss due to aircraft noise (Newman and Bettie, 1985 in: US Air Force, April 2001). If there is no danger of hearing loss near a commercial airport, where flight activities are continuous and frequent and follow well-defined patterns, there would be little or no danger of hearing loss caused by Marine Corps training operations in the proposed MOAs. Military aircraft would fly at various altitudes between 3,000 ft (914 m) and 18,000 ft (5,486 m) MSL, with 65 percent of sorties flown at an altitude greater than 5,000 ft (1,524 ft). These flights would be dispersed throughout the area of the MOA, reflecting typical combat maneuvers. Thus, there would be almost no chance for aircraft to repeatedly fly over the same point on the ground for long periods and thereby cause any auditory or nonauditory health-related noise impacts to residents of the land areas underlying

Table 4.2-1

Summary of Effects of Direct Noise Exposure on Humans

Effect	Explanation
Hearing Loss	Noise-induced hearing loss is probably the best defined of the potential effects of human exposure to excessive noise. Federal workplace standards that protect individuals from on-the-job hearing losses allow a time-averaged level of 90 dB over an 8-hour work period, or 85 dB over a 16-hour period. Even the most protective criterion -- no measurable hearing loss for the most sensitive portion of the population at the ear's most sensitive frequency (4,000 hertz) after a 40-year exposure -- suggests a time-average sound level of 70 dB over a 24-hour period. This means that for even the possibility of hearing loss to occur, persons and communities underlying the proposed MOAs would have to remain outside their homes 24 hours per day for an extended time exposed to a daily noise level (DNL) of 75+ dB, an extremely conservative and unlikely situation.
Nonauditory Health Effects	Nonauditory health effects of long-term noise exposure include stress, hypertension, and other nervous disorders. While noise may act as a risk factor, most studies of such health effects have found that regulatory standards established for hearing protection also protect against potential nonauditory health effects, at least in workplace conditions. Thus, there is no scientific basis for a claim that potential health effects exist for aircraft time-average sound levels below 75 dB.
Annoyance	The primary effect of aircraft noise on communities is annoyance. The USEPA (1972) defines noise annoyance as “any negative subjective reaction of an individual or group.” The best measure of community annoyance is the L_{dn} metric and the criterion of 65 DNL is used. The public, however, has suggested that a L_{dn} of 60 or 55 dB be adopted as the threshold for community noise annoyance when aircraft noise environmental impacts are assessed. While there is no technical reason that a lower level could not be measured or calculated for comparison purposes, a L_{dn} of 65 dB: • Provides a valid basis for comparing and assessing community noise effects. • Represents a noise exposure level normally dominated by aircraft noise. • Reflects FAA's threshold for grant-in-aid funding for airport noise mitigation.
Speech Interference	Speech interference associated with aircraft noise is a primary cause of annoyance to exposed individuals. The disruption of routine activities such as radio or television listening, telephone use, or family conversation gives rise to frustration and aggravation. The quality of speech communication is also important in classrooms, offices, and industrial settings and those who attempt to communicate over the noise can experience fatigue and vocal strain. Research has shown that “whenever intrusive noise exceeds approximately 60 dB indoors, there will be interference with speech communication” (FICON, 1992).

Table 4.2-1

Summary of Effects of Direct Noise Exposure on Humans

Effect	Explanation
Speech Interference (con't)	Indoor speech interference can be expressed as a percentage of "Sentence Intelligibility" between two people speaking in relaxed conversation approximately one m (three ft) apart in a typical living room or bedroom. In technical terms, the percentage of Sentence Intelligibility is a non-linear function of the (steady) indoor background A-weighted sound level. While Sentence Intelligibility is 100 percent when background levels are below 57 dB, it less than 10 percent when background levels are above 73 dB.
Sleep Disturbance	Sleep disturbance is another source of annoyance associated with aircraft noise, especially given its intermittent nature and content. Sleep disturbance can be measured in either of two ways: sleep interruption or awakening from sleep, or a change in sleep stage (i.e., a shift from one of four sleep stages to another stage of lighter sleep without waking up). In general, sleep interruption requires a higher noise level than does a change in sleep stage. In terms of average L_{dn}, some guidance is available to judge sleep disturbance. The USEPA (1972) has identified an indoor L_{dn} of 45 dB as necessary to protect against sleep interference. Assuming a conservative structural noise insulation of 20 dB for a typical dwelling, 45 dB would correspond to an outdoor L_{dn} of 65 dB.
Noise-Induced Vibrations on Humans	Noise-induced structural vibration may cause annoyance to a dwelling's occupants because of induced secondary vibrations or "rattle" of objects within the dwelling (e.g., rattle of hanging pictures, dishes, plaques, and bric-a-brac, etc.). Window panes may also vibrate when exposed to high levels of airborne noise, causing homeowners to fear breakage. In general, noise-induced vibrations occur at sound levels above those considered normally incompatible with residential land use. Thus, assessments of noise exposure levels for compatible land use should also be protective of noise-induced secondary vibrations.

the boundaries of the MOAs. Therefore, auditory and non-auditory health-related noise impacts will not be discussed further in this EA. Impacts associated with the annoyance effects of aircraft noise (including speech interference and sleep disturbance) are discussed below for each alternative.

A noise analysis of existing and future airspace operations in the proposed MOAs has been prepared, and the results are summarized in the following subchapters. The sound levels that result from these operations have been characterized by two noise metrics, L_{dnmr} and SEL. Calculation of operational noise levels is dependent on several inputs including the type of aircraft, aircraft speed, and power settings. The typical conditions used for the noise modeling presented herein are shown in Table 4.2-2, below. In some limited instances, values other than those listed below were used for the noise analysis. Detailed information concerning the parameters used for each individual analysis can be found in Appendix C (Noise Analysis Report). Flight profile information (number of sorties for each particular type of aircraft and the altitude of the flights) also affects results of the noise analysis, and is discussed in the appropriate subchapters, below.

Table 4.2-2

Typical Aircraft Power Settings and Speeds Used in Noise Analysis

Aircraft Type	Typical	
	Power Setting	Indicated Airspeed (Knots)
F-14 C/D	92% NC	400
F/A-18 C/D	88% NC	400
F/A-18 C/D	77% NC	250
T-34	850 C TIT	220
AV-8B (Fleet)	90% RPM	500
AV-8B (FRS)	85% RPM	500
AV-8B	72% RPM	250
KC-130	850 C TIT	220
F-15 C/D	81% NC	520
F-16	87% NC	450
CH-46	94% Q-BPA	130
CH-53	90% Q-BPA	150
UH-1	100% RPM	80
Army Helo	150 KNTS	150
Other Jet	88% NC	400
Other Prop	850 C TIT	220

4.2.1 No Action Alternative

Under the No Action Alternative, there would be no change to the noise conditions that currently occur, as discussed in Subchapter 3.2. Aircraft noise would continue to be generated in the areas underlying existing SUA at the levels identified in Table 3.2-4.

4.2.2 Core and Mattamuskeet MOAs Alternative

4.2.2.1 Noise Exposure in Areas Underlying the Proposed MOAs

Under the Core and Mattamuskeet MOAs Alternative, new aviation training operations that would generate noise would occur in the new SUA. The results of the noise model for implementation of the Core and Mattamuskeet MOAs Alternative are shown in Table 4.2-3.

Table 4.2-3

Average L_{dnmr} (dB) for Core and Mattamuskeet MOAs Alternative

Airspace Component	Average L_{dnmr} (dB)
Core MOA	<50
Mattamuskeet MOA	<50
R-5306A (exclusive of BT-9/BT-11)	56
Targets: BT-9 BT-11	62 68
Source: Appendix C	

As can be seen, the greatest noise impacts would continue to occur in the vicinity of the target areas (BT-9/BT-11), but the noise levels in these areas would remain the same as identified under the No Action Alternative. The L_{dmnr} value for noise in R-5306A (exclusive of the BT-9 and BT-11 targets) would be 56 dB, a decrease of 1 dB from existing conditions. However, this decrease would not be perceptible, as the minimum change in sound level that an average human ear can detect is about 3 dB.

Similarly, noise levels in the areas underlying the Core and Mattamuskeet MOAs would be at an average L_{dnmr} value of less than 50 dB. This would represent little change in ambient noise conditions in the land areas lying beneath the boundaries of the MOAs, assuming ambient noise levels are in the range for small towns and rural environments as indicated in Table 3.2-2. When the L_{dmnr} values associated with aviation training operations in the proposed Core and Mattamuskeet MOAs are considered in the context of the Schultz Curve, less than 5 percent of persons, residing on or visiting lands beneath the MOAs, would be expected to be “highly annoyed” by the predicted noise levels.

Several factors, that have been incorporated in the noise modeling, tend to mitigate the noise impacts of aircraft overflights in both the Core and Mattamuskeet MOAs:

- First, the airspace would be used intermittently. As identified in Subchapter 4.1, the projected 1,460 annual sorties within the Core MOA would only average about 6 sorties per 24 hour period (assuming 260 training days per year), lasting about one minute each. Operations in the Mattamuskeet MOA would be somewhat more intense, with a projected 2,438 flight hours per year equating to 9.3 sorties per day (about 7 hours average total flight time per training day).

- Second, approximately 65 percent of the sorties flown in the Core MOA would be at altitudes above 5,000 ft (1,524 m) MSL, and about 75% of the sorties flown in the Mattamuskeet MOA would be above 10,000 ft (3,048 m) MSL. The maximum noise level experience for a listener would decrease as altitude increases, thereby reducing the overall impact of the proposed operations.

- Third, it is highly unlikely that the same location would be repeatedly overflown during aircraft training operations. As a result, individual aircraft noise events in any single location underlying the MOAs would typically be heard for only brief periods. This is because operations in a MOA are random and widely dispersed over an average day, reflecting typical combat maneuvers. There are no established "tracks" that aircraft would regularly and repetitively follow. Therefore, the same individuals would not be subjected to repeated levels of aircraft noise.

4.2.2.2 Noise Exposure from a Single-Event

While the L_{dnmr} values provide valid measures of the total aircraft noise exposure that would be associated with the aviation training operations conducted in the proposed MOAs, it does not provide a sense for the "loudness" that they might personally experience from an individual high speed aircraft overflight. For this purpose, representative SELs for selected aircraft flying at various altitudes close to or at full power were calculated (see Table 4.2-4). To provide a comparison to the "loudness" of existing flights in the affected area, SELs for aircraft flying at the existing civilian air speed limit of 250 KIAS are also presented.

For the case where an aircraft passes directly overhead, the maximum instantaneous noise level would be low at the beginning and end of the overflight. As the aircraft approached the listener, the sound level would increase to some maximum depending on the airspeed and power settings of the aircraft and its proximity to the person on the ground. If the aircraft (e.g., F/A-18C/D) passed overhead at 3,000 ft (914 m) MSL, and the aircraft were operating at full power, the maximum instantaneous A-weighted level would be about 96 dB at ground level (see Table 4.2-4). This noise value represents a worst case situation, where the F/A-18C/D is under full power

(but still at a subsonic airspeed) and at the lowest altitude possible in the proposed MOAs. If the aircraft were operated at less than full power, the SEL would be less than 96 dB. In addition, if the aircraft were not directly overhead, the maximum noise level experience would be lower, and if the aircraft were several miles from the receptor, it may not be heard at all.

Table 4.2-4

Sound Exposure Level (SEL) in dB for Selected Aircraft
Traveling at High Subsonic Airspeeds at Various Altitudes

Aircraft Type	Power Setting	Speed (KIAS)[1]	Altitude in Feet (Meters) AGL		
			3,000 (914)	5,000 (1,524)	10,000 (3,048)
AV-8[2]	85%	470	94 dB	87 dB	77 dB
	72%	250	89 dB	83 dB	74 dB
F/A-18C/D[3]	92%	500	96 dB	89 dB	77 dB
	77%	250	78 dB	73 dB	65 dB

Notes:
1. KIAS = knots indicated airspeed.
2. NOISEMAP limits AV-8 speed to 449 KIAS at specified power setting. High speed noise data for the AV-8 aircraft is not available in NOISEMAP, therefore, airframe noise at high speeds was estimated.
3. F/A-18C/D noise levels based on training route conditions.

Source: Appendix C

The operational characteristics of the proposed MOAs will limit the frequency of events that result in exposure to high sound levels. The flight profiles in the proposed Core MOA, under expected training conditions, are depicted in Table 4.2-5 (Distribution of Training Sorties by Altitude). On average, only six sorties would occur daily in the proposed MOA, and only two would be at an altitude of less than 5,000 ft (1,524 m) MSL. For these two events, assuming F/A-18 C/D aircraft, noise at ground level would be in the range of 89 to 96 dB (SEL). Under existing conditions, (speed of 250 KIAS or less), these flights generate noise levels ranging from 73 to 78 dB (SEL). The change from existing conditions is even less for AV-8B flights occurring below 5,000 ft (1,524 m) MSL. In this case, the existing sound level range of 83 to 89 dB would increase to a range of 87 to 94 dB, an increase of 5 dB or less.

Since it would take a military aircraft less than one minute to cross the proposed Core MOA, the estimated noise levels would be experienced for less than two minutes on each typical training day, and only in areas near the flight path. The remaining sorties (those above 5,000 ft [1,524 m] MSL) would result in noise levels no greater then 89 dB at ground level, in comparison to those generated by existing military flights, which approach 83 dB. Furthermore, increasing distance from the flight path reduces the intensity of noise at ground level. For example, a person standing 4,000 ft (1219 m) laterally from the centerline of a flight path along the floor of the proposed MOA (3,000 ft [914 m]) would be exposed to an SEL equivalent to that of a flight directly overhead at 5,000 ft (1,524 m). In view of these analyses, and the fact that aircraft would operate

within the Core MOA for only 5 to 6 minutes on the average training day, significant impacts due to training aircraft noise are not expected.

Table 4.2-5
Distribution of Core MOA Training Sorties by Altitude

Altitude (AGL)	Sorties/Year	Sorties/Day	F/A-18C/D Noise Level (SEL)
3,000 to 5,000 ft	511	2	96 dB or less
5,000 to 10,000 ft	657	2 or 3	89 dB or less
10,000 ft and above	292	1 or 2	77 dB or less
	1,460 total	5 or 6 typical	

The flight profiles in the proposed Mattamuskeet MOA are shown in Table 4.2-6. The operational characteristics of the proposed Mattamuskeet MOA are different than the proposed Core MOA, in that the Mattamuskeet MOA would be utilized for high-speed combat maneuvers and other training activities, whereas the Core MOA is intended to enable aircraft to transit between training areas. Consequently, the length of sorties in the proposed Mattamuskeet MOA will be greater, averaging 45 minutes as opposed to less than one minute for the Core MOA. However, the proposed flight profiles will tend to reduce the impact of noise on lands underlying the MOA.

Table 4.2-6
Distribution of Mattamuskeet MOA Training Sorties by Altitude

Altitude (AGL)	Sorties/Year	Sorties/Day	F/A-18C/D Noise Level (SEL)
3,000 to 10,000 ft	606	2 or 3	96 dB or less
10,000 ft and above	1,817	6 or 7	77 dB or less
	2,423 total	8 or 10 typical	

Important aspects of the flight profiles in the proposed Mattamuskeet MOA to be considered when assessing the impacts of jet noise are the altitude distribution and the random and transitory natures of the overflights at any given location beneath the MOA. The majority of the sorties (75% of the total) in the proposed Mattamuskeet MOA will occur at an altitude of 10,000 ft (3,048 m) MSL or higher. Flights, at these altitudes, of aircraft with the strongest acoustic signal, the F/A-18C/D, will result in SELs of 77 dB or less at ground level, a sound level which is classified as moderately loud (Figure 3.2-1).

The remaining flights would be at altitudes ranging between 3,000 ft (914 m) and 10,000 ft (3,048 m) MSL. For flights at maximum power settings, SELs would range between 77 and 96 dB, depending on altitude. Flights conducted at lower power settings will result in lower SELs. Flight paths, however, will be random and transitory, limiting the exposure of any single location

beneath the MOA. For example, at the lowest training altitude of 3,000 ft (914 m), areas extending out to approximately 9,500 ft (2,896 m) from the centerline of the flight path would experience sound levels equivalent to a training aircraft at 10,000 ft (3,048 m) MSL directly overhead (i.e., 77 dB). This represents a footprint of approximately 7.7 nm, or roughly 1.2% of the land area beneath the MOA exposed to SELs in excess of 77 dB at any given time during a sortie. Assuming that flights are evenly distributed throughout the MOA over the course of a training year, any specific point underlying the MOA could be exposed to SELs in excess of 77 dB, but not more than 96 dB, for an average of 2.3 minutes per day.

For a sortie of two aircraft, the total sound level that would be produced would only be slightly greater than that that identified for a single aircraft. This is a result of the logarithmic nature of the decibel unit ("energy addition" not "arithmetic addition"). For example, a flight of two F/A-18C/Ds at 3,000 ft (914 m) AGL, each producing an SEL of 96 dB, would result in a cumulative sound level of 99 dB.

4.2.2.3 Potential for Speech Interference

A nonauditory effect of exposure to aircraft noise and a primary source of annoyance to individuals is disruption of conversation. This disruption could also be extended to activities such as listening to the radio, watching television, or speaking on the telephone. A study by Pearson et al., 1977 (as cited in US Air Force, January 2001), suggests that people can communicate acceptably in background A-weighted noise levels of 80 dB. The study further indicates that people begin to raise their voices when noise levels exceed 45 dB, and that some speech interference occurs when background noise levels exceed 65 dB. Based on the noise modeling results shown in Table 4.2-3, average L_{dmnr} values in the land areas underlying the proposed MOAs and beneath R-5306A (exclusive of the targets) would be less than 50 dB and 56 dB, respectively. These noise values would be significantly and perceptibly less than 65 dB. Although some single-event aircraft flyovers may occasionally disrupt speech communication, given the intermittent nature of aircraft operations in a MOA, any such disruption would last for very short periods, generally less than a minute, and would not result in significant impact on speech intelligibility.

4.2.2.4 Potential for Sleep Interruption

Another issue associated with aircraft noise exposure is the potential for sleep interruption (i.e., noise waking people up). An estimated 56 and 76 nighttime sorties would be flown in the proposed Core and Mattamuskeet MOAs annually. An average of about 20 of the annual nighttime sorties flown in the Core MOA would occur at the minimum altitude of 3,000 ft (914 m) MSL. Only about 19 of the annual nighttime sorties that would be flown in the Mattamuskeet MOA would occur at the lowest altitude. All remaining annual nighttime sorties in either MOA would be flown above 10,000 ft (3,048 m) MSL. As previously stated, the L_{dmnr} values for both MOAs are less than 50 dB, well below the 65 dB threshold for noise-related sleep interruption in insulated houses (see Table 4.2-3).

4.2.2.5 Effects on Park and Wildlife Refuge Visitors

The effects of noise on visitors to parks and wildlife refuges may be different than those on the general population, as park and wildlife refuge visitors may have a greater expectation of serene conditions. Visitor expectation of quiet is variable, depending on the nature of the location being visited. It is hypothesized that visitors to a scenic outlook located along or not far from a roadway, for example, will have an expectation of at least some background noise (i.e., vehicles on the roadway) and are less likely to report a negative experience due to aircraft noise, whereas visitors who have invested some time walking away from potential sources of manmade noise have a greater expectation of natural quiet. When questioned, these visitors were more likely to report both an interruption to the natural quiet and annoyance at intrusive noise than were visitors to areas with higher ambient sound levels (Miller 1998).

The ambient sound level for ocean surf is estimated at 61 to 64 dB (see Table 3.2-2), which would be classified as moderately loud (see Figure 3.2-1). Therefore, impacts of military jet overflights to visitors at the Cape Lookout National Seashore, which underlies the proposed Core MOA, are more accurately estimated by comparison to areas with elevated ambient sound levels. As described in Subchapter 4.2.2.2 and Table 4.2-5, an average of 6 sorties would occur daily through the Core MOA. However, as discussed in Subchapter 4.2.2.2, it is estimated that maximum noise levels from F/A-18C/D aircraft flying at the maximum speed (500 KIAS) and the lowest permissible altitude in the MOA (3,000 ft [914 m] AGL) would climb from 77 dB to 96 dB and fall back to 77 dB within 23 seconds. Assuming that noise levels due to a training flight will be above ambient (61 dB) for one minute, the total time above ambient per average training day would be 7 minutes. The percentage of park visitors that reported interference with the natural quiet, and the percentage annoyed by aircraft noise was related to the percentage of the time that the aircraft noise was audible according to Miller (1998). Assuming all flights occur during the standard 15 hour training day (0700-2200), park visitors would be exposed to aircraft noise for 7 minutes per day, or less than 1% of the time. At that exposure level, less than 10% of park visitors would be expected to experience interference with natural conditions, and less than 3% might become annoyed. Because flight paths are expected to be random, the likelihood of any specific portion of the National Seashore being overflown repeatedly is minimal, further reducing the likely time of exposure for any person to aircraft noise.

The proposed Mattamuskeet MOA would overlie portions of several National Wildlife Refuge areas (Alligator River, Mattamuskeet, Swanquarter, and Pocosin Lakes), and the Swanquarter Wilderness Area. The nature of these areas is such that visitors are likely to have an expectation of natural quiet; therefore these refuges are most appropriately compared to areas with low ambient noise levels. It can be expected that the proportion of visitors likely to report interruption of the natural quiet or annoyance will be greater than along the seashore. Actual ambient sound levels for these areas are not available and the range of typical ambient sound levels in wilderness areas is rather large, lying between 28 and 54 dB (see Subchapter 3.2.2.1 and

Table 3.2-2), making it difficult to estimate the time that visitors may be exposed to excessive noise from the training operations.

Based on the speed of training aircraft, the number of planned sorties and the total area of the proposed Mattamuskeet MOA, it is estimated that any one location will experience approximately 20 overflights on an average training day. If the length of exposure to aircraft noise is estimated at one minute, as per the Core MOA analysis, any given point in a wildlife refuge would be subject to approximately 20 minutes of aircraft noise per training day, or approximately 2.5% of a standard 15-hour training day. At this level of exposure, approximately 30% of visitors might experience interference with natural quiet and less than 10% of visitors are likely to be annoyed by this exposure. It should be noted, however, that these estimates of exposure length are based on flights at the lowest permissible altitude in the proposed MOA, 3,000 ft (914 m) MSL. The vast majority of the flights in the proposed Mattamuskeet MOA would be at altitudes in excess of 10,000 m (3,048 m) MSL, significantly decreasing both the length and intensity of exposure. Therefore, 10% should be considered an upper limit of refuge visitors likely to be annoyed by aircraft noise.

Impacts to park and refuge visitors can be further reduced by management actions. Miller (2001) found that visitors who were informed of the potential for aircraft noise prior to entering a park were consistently less likely to register annoyance. Furthermore, visitors who were previously informed about aircraft noise were annoyed at less than half the rate as those who were not previously informed across the entire range of noise levels surveyed (ranging as high as 70 dB above ambient).

4.2.3 Core and Cherry MOAs Alternative

4.2.3.1 Noise Exposure in Areas Underlying the Proposed MOAs

The results of the noise prediction modeling for implementing the proposed Core and Cherry MOAs Alternative are shown in Table 4.2-7. The potential impacts under this alternative would be the same as discussed for the Core and Mattamuskeet MOAs Alternative.

Table 4.2-7

Average L_{dnmr} (dB) for Core and Cherry MOAs Alternative

Airspace Component	Average L_{dnmr} (dB)
Core MOA	<50
Cherry MOA	<50
R-5306A (exclusive of BT-9/BT-11)	56
Targets: BT-9 BT-11	62 68
Source: Appendix C	

4.2.3.2 Noise Exposure from a Single-Event

The impacts from exposure to single events with establishment of the Core and Cherry MOAs would be the same as previously described for the Core and Mattamuskeet MOAs. Flight profiles in the proposed Cherry MOA would be the same as the Mattamuskeet MOA, thus impacts would be the same as previously described.

4.2.3.3 Potential for Indoor Speech Interference

The potential for indoor speech interference with establishment of the Core and Cherry MOAs would be the same as previously described for the Core and Mattamuskeet MOAs.

4.2.3.4 Potential for Sleep Interruption

The potential for noise-related sleep interruption would be the same with establishment of the Core and Cherry MOAs as previously described for the Core and Mattamuskeet MOAs.

4.2.3.5 Effects on Park and Wildlife Refuge Visitors

The potential for noise-related impacts on National Parks would be the same with establishment of the Core and Cherry MOAs as previously described for the Core and Mattamuskeet MOAs. Only a portion of the Swanquarter National Wildlife Refuge underlies the proposed Cherry MOA. Impacts to visitors of this portion of the Swanquarter NWR would be the same as previously described for the Mattamuskeet MOA. The proposed Cherry MOA does not overlie any other NWRs.

4.2.4 Core MOA Alternative

4.2.4.1 Noise Exposure in Areas Underlying the Proposed MOA

The results of the noise prediction modeling for implementing the proposed Core MOA Alternative are shown in Table 4.2-8. The potential impacts under this alternative would be similar to those previously discussed for the Core and Mattamuskeet MOAs Alternative, except that the noise level (L_{dmnr} value of 57 dB) predicted for R-5306A (exclusive of the BT-9 and BT-11 target areas) would be the same as identified for the No Action Alternative.

Table 4.2-8
Average L_{dnmr} (dB) for Core MOA Alternative

Airspace Component	Average L_{dnmr} (dB)
Core MOA	<50
R-5306A (exclusive of BT-9/BT-11)	57
Targets: BT-9 BT-11	62 68
Source: Appendix C	

4.2.4.2 Noise Exposure from a Single-Event

The impacts from exposure to single events with establishment of the Core MOA would be the same as previously described for the Core and Mattamuskeet MOAs Alternative.

4.2.4.3 Potential for Indoor Speech Interference

The potential for indoor speech interference with establishment of the Core MOA would be the same as previously described for the Core and Mattamuskeet MOAs.

4.2.4.4 Potential for Sleep Interruption

The potential for noise-related sleep interruption would be the same as previously described for the Core and Mattamuskeet MOAs.

4.2.4.5 Effects on Park and Wildlife Refuge Visitors

The potential for noise-related impacts on National Parks would be the same with establishment of the Core MOA as previously described for the Core and Mattamuskeet MOAs. The Core MOA does not overlie any National Wildlife Refuges.

4.2.5 Mattamuskeet MOA Alternative

4.2.5.1 Noise Exposure in Areas Underlying the Proposed MOA

The results of the noise prediction modeling for the proposed Mattamuskeet MOA Alternative are shown in Table 4.2-9. The potential impacts associated with this alternative would be similar to those previously discussed for the Core and Mattamuskeet MOAs Alternative, except that noise level (L_{dmnr} value of 56 dB) predicted for R-5306A (exclusive of the BT-9 and BT-11 target areas) would be the same as identified for the No Action Alternative.

Table 4.2-9

Average L_{dnmr} (dB) for Mattamuskeet MOA Alternative

Airspace Component	Average L_{dnmr} (dB)
Mattamuskeet MOA	<50
R-5306A (exclusive of BT-9/BT-11)	56
Targets: BT-9 BT-11	62 68
Source: Appendix C	

4.2.5.2 Noise Exposure from a Single-Event

The impacts from exposure to single events with establishment of the Mattamuskeet MOA would be the same as previously described for the Core and Mattamuskeet MOAs Alternative.

4.2.5.3 Potential for Indoor Speech Interference

The potential for indoor speech interference with establishment of the Mattamuskeet MOA would be the same as previously described for the Core and Mattamuskeet MOAs.

4.2.5.4 Potential for Sleep Interruption

The potential for noise-related sleep interruption would be the same as previously described for the Core and Mattamuskeet MOAs.

4.2.5.5 Effects on Park and Wildlife Refuge Visitors

The potential for noise-related impacts on National Wildlife Refuges would be the same with establishment of the Mattamuskeet MOA as previously described for the Core and Mattamuskeet MOAs. The Mattamuskeet MOA does not overlie any National Parks.

4.2.6 Cherry MOA Alternative

4.2.6.1 Noise Exposure in Areas Underlying the Proposed MOA

The results of the noise prediction modeling for the proposed Cherry MOA Alternative are shown in Table 4.2-10. The potential impacts associated with this alternative would be similar to those previously discussed for the Core and Mattamuskeet MOAs Alternative, except that noise level (L_{dmnr} value of 56 dB) predicted for R-5306A (exclusive of the BT-9 and BT-11 target areas) would be the same as identified for the No Action Alternative.

Table 4.2-10

Average L_{dnmr} (dB) for Cherry MOA Alternative

Airspace Component	Average L_{dnmr} (dB)
Cherry MOA	<50
R-5306A (exclusive of BT-9/BT-11)	56
Targets: BT-9 BT-11	62 68
Source: Appendix C	

4.2.6.2 Noise Exposure from a Single-Event

The impacts from exposure to single events with establishment of the Cherry MOA would be the same as previously described for the Core and Mattamuskeet MOAs Alternative.

4.2.6.3 Potential for Indoor Speech Interference

The potential for indoor speech interference with establishment of the Cherry MOA would be the same as previously described for the Core and Mattamuskeet MOAs.

4.2.6.4 Potential for Sleep Interruption

The potential for noise-related sleep interruption would be the same as previously described for the Core and Mattamuskeet MOAs.

4.2.6.5 Effects on Park and Wildlife Refuge Visitors

The potential for noise-related impacts on National Wildlife Refuges would be the same with establishment of the Cherry MOA as previously described for the Core and Mattamuskeet MOAs. The Cherry MOA does not overlie any National Parks.

4.3 Safety and Hazardous Materials Management

4.3.1 No Action Alternative

4.3.1.1 Aircraft Safety

Under the No Action Alternative, there would be no change to the level of military aircraft operations that is currently being flown in eastern North Carolina (see Subchapter 4.1). There would be no change with respect to aviation safety risks from BASH incidents compared to baseline conditions as described in Subchapter 3.3. With an active program in effect to avoid BASH problems, MCAS Cherry Point has an excellent safety record. Only eight reported BASH incidents occurred at MCAS Cherry Point since 1996 (Naval Safety Center [web site], September 5, 2001), not all of which were associated with range operations.

4.3.1.2 Hazardous Materials Management

In the event an aircraft mishap occurs, the effect of any released fuel or hydraulic fluids would be controlled through compliance with existing rescue and spill response procedures. These procedures are generally described in Subchapter 3.3.

4.3.2 Core and Mattamuskeet MOAs Alternative

4.3.2.1 Aircraft Safety

Based on information contained in the FAA NMAC database (Subchapter 3.3.1) the potential for mishaps during military aircraft training operations is low and is not expected to change under the Core and Mattamuskeet alternative. The outstanding safety record for SUA in eastern North Carolina is expected to continue under this alternative.

The potential risk for bird/aircraft strike hazards is assessed as a function of flight hours flown in a given airspace as well as the population and distribution of waterfowl (e.g., geese, ducks, and swans) and raptors that may be present annually and seasonally in the same area. According to the US Bird Avoidance Model (US BAM), moderate to severe seasonal BASH risks would theoretically exist in the proposed MOAs. These risks would be associated with waterfowl movements during the dawn and dusk periods while fall and spring migrations are in progress. However, based on documented US Air Force experience (Subchapter 3.3), over 98 percent of BASH incidents occur at or below an altitude of 3,000 ft (914 m) MSL. Since, the floor of the proposed Core and Mattamuskeet Alternative is 3,000 ft (914 m), in actuality bird strike risk is expected to be low for this alternative.

4.3.2.2 Hazardous Materials Management

In the event that an aircraft mishap occur, fuel or hydraulic fluids could be released. These fuels and fluids would be controlled and contained as discussed in Subchapter 3.3.

4.3.3 Core and Cherry MOAs Alternative

As is the case for the Core and Mattamuskeet alternative, the outstanding safety record for SUA in eastern North Carolina is expected to continue under the Core and Cherry MOAs alternative. The potential risk for bird/aircraft strike hazards would be less for this alternative than for the Core and Mattamuskeet MOAs Alternative, as the proposed Cherry MOA is located further inland and would overlie a much smaller area of eastern North Carolina's national wildlife refuges and thus be less affected by seasonal waterfowl migration. In fact, a review of the US BAM for the various MTRs that cross the area that would be overlain by the proposed Cherry MOA shows only moderate risks during the fall and spring migratory periods for waterfowl.

4.3.4 Core MOA Alternative

As is the case for the combination alternatives, the outstanding safety record for SUA in eastern North Carolina is expected to continue under the Core MOA alternative. Also, as with the other alternatives, the potential risk for BASH theoretically would be moderate to severe, depending on the season. However, BASH risk depends heavily on flight hours actually expended in a particular airspace. Since the actual time that will be spent over the Core Banks under this alternative will be low (six sorties per day with each lasting about one minute), actual bird strike risk hazards for the Core MOA are expected to be low.

4.3.5 Mattamuskeet MOA Alternative

Under the Mattamuskeet MOA Alternative, the potential for BASH would be no greater than that identified for the Core and Mattamuskeet MOA Alternative. Aircraft safety considerations for this alternative will not differ significantly from those for the combination alternatives.

4.3.6 Cherry MOA Alternative

Under the Cherry MOA Alternative, the potential for BASH would be no greater than that identified for the Core and Cherry MOA Alternative. Aircraft safety considerations for this alternative will not differ significantly from those for the combination alternatives.

4.4 Natural Resources

4.4.1 Wildlife

In a November 2000 letter to MCAS Cherry Point, the Raleigh North Carolina Field Office of the US Fish and Wildlife Service (USFWS) summarized the concerns of the refuge managers whose refuges occur within the proposed project footprint. These concerns were also expressed at a meeting on October 30, 2000 and were discussed again in more detail at a meeting on February 11, 2003. The discussed issues are summarized in the following bullets:

- The disturbance of wintering waterfowl population at Mattamuskeet National Wildlife Refuge during November through January, and large numbers of diving ducks at Swanquarter National Wildlife Refuge in late winter. (These issues are addressed in this Subchapter)

- The confinement of civilian aircraft activity over national wildlife refuge lands to an effective operational airspace of 1000 ft (305 m) (between 2,000 and 3,000 ft [610 and 914 m] MSL). (This issue is addressed in Subchapter 4.1)

- The potential for mid-air collisions (bird strikes) between military aircraft and wintering waterfowl during spring and fall migrations. Approximately 200,000 waterfowl migrate through the area annually. (This issue is addressed in this Subchapter and Subchapter 4.3)

- The potential for conflicts between US Fish and Wildlife Service aircraft conducting natural resources missions (e.g., aerial surveys or wildfire control) and military aircraft operations conducted in the proposed MOAs. (This issue is addressed in Subchapter 4.1)

- Maintaining the character of the Swanquarter Wilderness Area (8,800 acres [1,232 hectares]) as required under the Wilderness Act of 1964 (16 US Code 1 1 21 (note): lands included in a Wilderness Area "…shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character…." (National Wilderness Preservation System [web site] December 20, 2000).

The primary issues concerning biological resources within the areas proposed for the new MOAs are the potential for adverse impacts to wildlife from:

- The visual effect of the approaching military aircraft.

- Associated aircraft noise.

The effects of noise and startle effects on wildlife and domestic animals have been examined in a variety of studies and reviews over the past 30 to 35 years (see Chapter 10 – References). These studies show a wide variety of animal responses to aircraft overflight (or simulated aircraft noise) by different types of animals and even differing responses by the same species under similar conditions.

4.4.1.1 No Action Alternative

Implementation of the No Action Alternative would continue the current nature and scope of flight activities in the areas of the proposed action, and therefore would continue the current level of impacts experienced by wildlife in these areas. Under the "no action" Marine Corps aircraft would continue existing training flight activities over the Core Banks and in the Cherry and Mattamuskeet areas at airspeeds below 250 kt when at altitudes less than 10,000 ft (3,048 m) MSL in accordance with FAA regulations published in 14 CFR 91. Overflights of Wilderness areas and noise sensitive areas (including National Parks and National Recreational Areas and others as described in Subchapter 1.1.2) would continue to occur. In accordance with Chief of Naval Operations in OPNAVINST 3710.7, aircraft would operate at an altitude no lower than 3,000 ft (914 m) MSL, except when training activities are conducted on military training routes or within existing SUA. These areas would continue to be exposed to noise from military aircraft flying overhead within civilian air speed limits. Existing sound exposure levels (SELs) due to military aircraft operating at up to 250 KIAS range as high as 89 dB.

4.4.1.2 Core and Mattamuskeet MOAs Alternative

Marine Mammals

Many marine mammals (mysticetes and odontocetes) migrate and forage in the waters to the east of the Cape Hatteras/Core Banks. However, they do not use those waters as a calving area and generally do not linger in any one offshore area off the coast. Bottlenose dolphin are common in the Pamlico/Albemarle Sound. Manatees are infrequent visitors to North Carolina in the Atlantic Ocean and the Pamlico/Albemarle Sound. In addition, manatees spend most of their time below the surface, and individuals do not startle readily (Bowles et al. 1991).

The potential for aircraft overflights in the proposed MOAs to affect marine mammals (mysticetes, odontocetes, and manatees) was considered in the context of the following operational factors:

- Overflights would be subsonic.
- Duration of each flight over an individual animal would be extremely brief.
- Flight paths and altitudes used would continually vary.

The transient presence of marine mammals coupled with the operational factors identified above would make it highly unlikely that individual marine mammals would be repeatedly exposed to military aircraft overflights. Therefore, the potential for injury or mortality to marine mammals from implementation of the proposed Core and Mattamuskeet MOAs Alternative would not be significant and would have no additional effect nor result in a reasonably foreseeable take of marine mammals. This conclusion is supported by a "no effect" determination made by the US Air Force, and agreed to by the National Marine Fisheries Services, for a US Air Force proposal involving subsonic military aircraft overflights at 5,000 ft (1,524 m) MSL off the coast of Virginia (National Marine Fisheries Service, 2001).

Sea Turtles

Potential effects to sea turtles would be from two sources: aircraft noise and lights on aircraft at night. Very little information is currently available about the hearing capabilities of sea turtles or the effects of noise on sea turtles on land or in the ocean. One behavioral study (which is still ongoing) is being conducted at the New England Aquarium (Streeter and Floyd, 1999) using a captive adult female green sea turtle (*Chelonia mydas*). Preliminary data from this study indicates that the turtle hears tones ranging from 100 Hz to 500 Hz. Noise threshold data has been collected on 200 Hz and 400 Hz frequencies. The turtle's threshold for 200 Hz sound is approximately 119 dB and the threshold for 400 Hz sound it is approximately 121 dB (Office of Naval Research, Biomolecular & Biosystems Group Programs [web site], May 10, 2002).

Another study was performed investigating acoustic orientation and sound discrimination in leatherback (*Dermochelys coriacea*) and olive ridley (*Lepidochelys olivacea*) sea turtle hatchlings (Standora et al., 1999). The goal of this study was to determine if sea turtle hatchlings could localize airborne surf sounds and discriminate between different acoustic stimuli in sea-finding behavior. Results showed that leatherback hatchlings could discriminate between different acoustic stimuli, and exhibited a positive response towards surf sounds. However, leatherback hatchlings oriented down a 10-degree slope (mimicking a beach slope) when confronted with sound and slope as conflicting cues. The olive ridley hatchlings exhibited no response to acoustic stimuli, but rather exhibited movement toward a fixed compass heading.

For several reasons, these two experiments lend credence to the determination that the sound generated by military aircraft overflights would not negatively impact sea turtles. The Streeter and Floyd experiment indicates that the auditory threshold for green turtles underwater begins at 107 dB, higher levels than he modeled noise levels for aircraft projected to utilize the MOAs. Additionally, only an average of one sortie per day would be both at 3,000 to 5,000 ft (914 to 1,524 m) MSL and at night, when sea turtles haul out onto the beach to nest. Assuming that loggerhead turtles, which are the most numerous species nesting on the Core Banks, possess auditory abilities similar to green turtles, it is anticipated that there would be no potential impacts to adult sea turtles from the noise of overflights.

Furthermore, overflight noise is not expected to affect hatchling sea turtles. Hatchling sea turtles of different species appear to react in varying ways to sound. The sound of surf noise does play a role in the orientation of leatherback sea turtles, but is not the sole source of directional cues, and is not a factor at all in the orientation of olive ridley turtles. Because it is possible that other cues such as beach slope and innate compass headings override the presence or absence of surf noise, it is unlikely that a short-duration (about one minute) noise event (20 overflights at night per year) such as an intermittent overflight would interfere with hatchling orientation to the sea.

Finally, lights from military aircraft overflights would not affect sea turtle hatchlings. Much research has been focused on the disorientation of sea turtle hatchlings by artificial lighting (Salmon and Reiners et al., 1995; Salmon and Tolbert et al., 1995; Peters and Verhoeven, (1994); Witherington and Martin, 1996). Hatchlings possess an inborn tendency to move in the direction of the brightest illumination at night. On a natural beach, this brightest direction is most often the open view of the night sky over, and reflected by, the ocean. Because of this tendency, sea turtle hatchlings are very susceptible to disorientation or misorientation by artificial lighting. Although military aircraft do have lights on at night for proper identification, the lights on aircraft flying at 3,000 ft (914 m) MSL or higher would be dim to a viewer on a beach, and would not serve to light up the landscape. More importantly, the aircraft would be moving rapidly, crossing the Core Banks in about a minute, so any potential for a hatchling to temporarily orient upon swiftly moving aircraft lighting would be quickly corrected. As mentioned previously, only 20 sorties per year are expected to take place over the Core Banks at night.

Fisheries

There would be no significant impact to fishery resources in the study area from overflights associated with implementation of the Core and Mattamuskeet MOAs Alternative. Impacts to fishery resources are limited to those resulting from a fuel or hydraulic fluid spill in the event of an aircraft crash. These effects are limited by the finite quantity of such fluids contained within each aircraft, and would be minimized by the response of the MCAS Cherry Point Open Water Spill Team, as described in Subchapter 3.3.3. Furthermore, the proposed action would have no effect on essential fish habitat.

Birds

This section assesses the likelihood that increasing the amount of airspace used for military aircraft operations in the form of MOAs above the Mattamuskeet and Swanquarter National Wildlife Refuges would impact birds, particularly waterbirds such as swans, geese, and ducks. Although the avian wildlife in the region may be somewhat habituated to overflights of many kinds, and not negatively affected by them, the number of overflights would increase (Subchapter 4.1), which may result in more frequent flushing of some species, such as snow geese, that appear to be more sensitive to aircraft noise. Flushing due to overflights could result in decreased feeding time or an increase in energy expenditure that could contribute to the many causes of stress-induced mortality during migration. However, based on the nature of the

proposed action, the available research, and comparisons to other areas of eastern North Carolina with heavy military overflight activity, we do not expect significant levels of these impacts to occur.

A review of available research on behavioral responses and breeding success of wildlife subjected to aircraft noise is summarized in the following sections. Many studies have focused on the impacts of aircraft noise on waterbirds such as ducks, geese, wading birds, and shorebirds (Manci et al., 1988). A majority of the earlier studies addressed piston-engine driven aircraft, while recently there has been a greater focus on the effects of military jet noise.

Research results have documented little if any effect to wildlife from aircraft noise. Operations within the MOAs would occur at much higher altitudes than those described in the research. The available research is not specific to the location of the proposed MOAs. However the species groups examined, and the habitats within which they occurred, are similar enough to make reasonable inferences about the potential for effects from overflights that would occur at much higher altitudes.

Wading Birds and Colonial Waterbirds

Results from a comprehensive study indicated that the effects of military overflights on waterbirds in Florida did not adversely affect breeding success, colony establishment, or size (Black et al., 1984). Birds in this study were exposed to overflights by F-16 aircraft traveling at 420 knots and 500 ft (152 m) altitude. Sound levels ranged up to 100 dBA. Some of the birds in this study (e.g., great egrets, snowy egrets, and cattle egrets) occur within the study area for the proposed airspace as well.

The US Fish and Wildlife Service (1995) reports that a great blue heron colony on the Winona District of the Upper Mississippi Wildlife and Fish Refuge was almost entirely abandoned shortly after low-level military flights were conducted at or below 1,000 ft (305 m) AGL, indicating that rookeries of colonial waterbirds can be extremely sensitive to any source of disturbance. Flights at 3000 ft (914 m) MSL are not expected to cause abandonment of colony sites. Figure 4.4-1 shows the general location of existing colony sites in coastal North Carolina. The number and extent of colonial waterbird nesting sites in areas that are currently experiencing aircraft activity (see Figures 2-1 and 3.1-1 and 3.1-2) indicates that colony sites are not likely to be abandoned due to the proposed action.

In contrast to the preceding study, Grubb (1978) addressed the general subject of the effects of increased noise levels on nesting herons and decibel levels that nesting herons will tolerate. When a small plane flew over the rookery at elevations ranging from 150 to 800 ft (46 to 244 m) AGL, there was no response from the nesting birds to either the increased noise levels or the presence of the aircraft. The fact that these herons were residing in an urbanized environment may have resulted in their habituation to noise disturbance.

Kushlan (1979) studied behavioral responses of wading birds to helicopter overflights and compared them to responses to light, fixed-wing overflights as low as 197 ft (60 m) AGL. The study found that any bird that left its nest returned within five minutes, and in 92 percent of the 192 observations, birds either showed no reaction or merely looked up. No serious consequences, such as egg loss or nest abandonment, were observed.

Black et al. (1984) studied the effect of low-altitude (500 ft [152 m] AGL), high-speed (420 knots indicated airspeed), military F-16 jet flights on establishment, size, and reproductive success of wading bird colonies. They found no demonstrated effect of military activity on colony establishment or size on a statewide basis, and turnover rates (colonies changing use each year) were within 2 percent when military and non-military areas were compared. Breeding wading birds exhibited either no response or looked up and changed position due to sound levels ranging from 55-100 dBA, and no productivity limiting responses were observed. Reproductive activity, including such factors as nest success, nestling survival, nestling mortality, and nesting chronology was independent of F-16 overflights but related to ecological factors such as colony location, characteristics, and climatology. The most drastic response to disturbance observed during the study was "severe flushing and panic flights" caused by airboats approaching the waterbird colony.

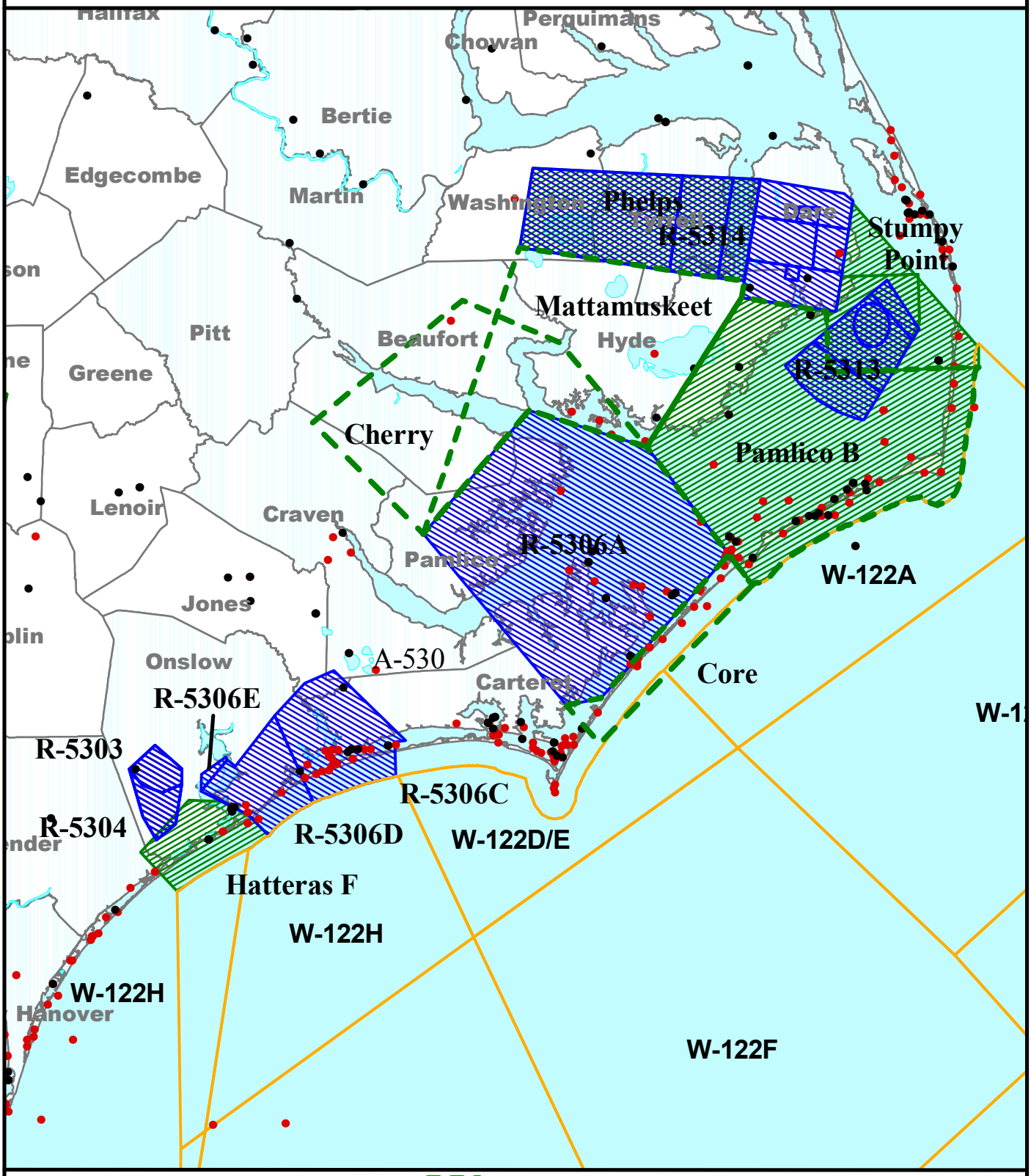
Shorebirds

Burger (1981) studied the effects of noise from JFK airport in New York on herring gulls that nested less than 0.63 miles (1 km) from the airport. Noise levels over the nesting colony were 85 to 100 dBA on approach and 94 to 105 dBA on takeoff. No effects of subsonic aircraft on nesting were noted, although some birds flushed when supersonic aircraft flew overhead and, when they returned, they engaged in aggressive behavior. Groups of gulls tended to loaf in the area of the nesting colony, and these birds remained at the roost when subsonic aircraft flew overhead. Up to 208 of the loafing gulls flew when supersonic aircraft flew overhead. These birds would circle around and immediately land in the loafing flock.

The piping plover, a federally listed endangered species, is known to occur in eastern North Carolina. The USFWS has recently designated critical habitat for wintering piping plovers in the vicinity of the proposed MOAs and such habitat occurs directly beneath only the proposed Core MOA. Figure 4.4-2 (Critical Habitat for Wintering Piping Plovers) shows the designated critical habitat in the immediate vicinity of the proposed MOAs.

Since there is critical habitat directly beneath the Core MOA, it is necessary to assess whether the proposed action would affect not only the species, but also the critical habitat. An effect on critical habitat would occur if the proposed action affected one of the constituent elements for which the habitat was designated. The habitat elements required by the piping plover include intertidal beaches, flats and/or associated dunes, extending down to the lowest low-tide mark (USFWS website [http://plover.fws.gov] accessed on June 5, 2002). The proposed action would

Existing Bird Colonies in Eastern North Carolina



Wading Birds

Non-Wading Birds

Restricted Airspace

Warning Area

Existing Military Operations Area (MOA)

Proposed Military Operations Area (MOA)

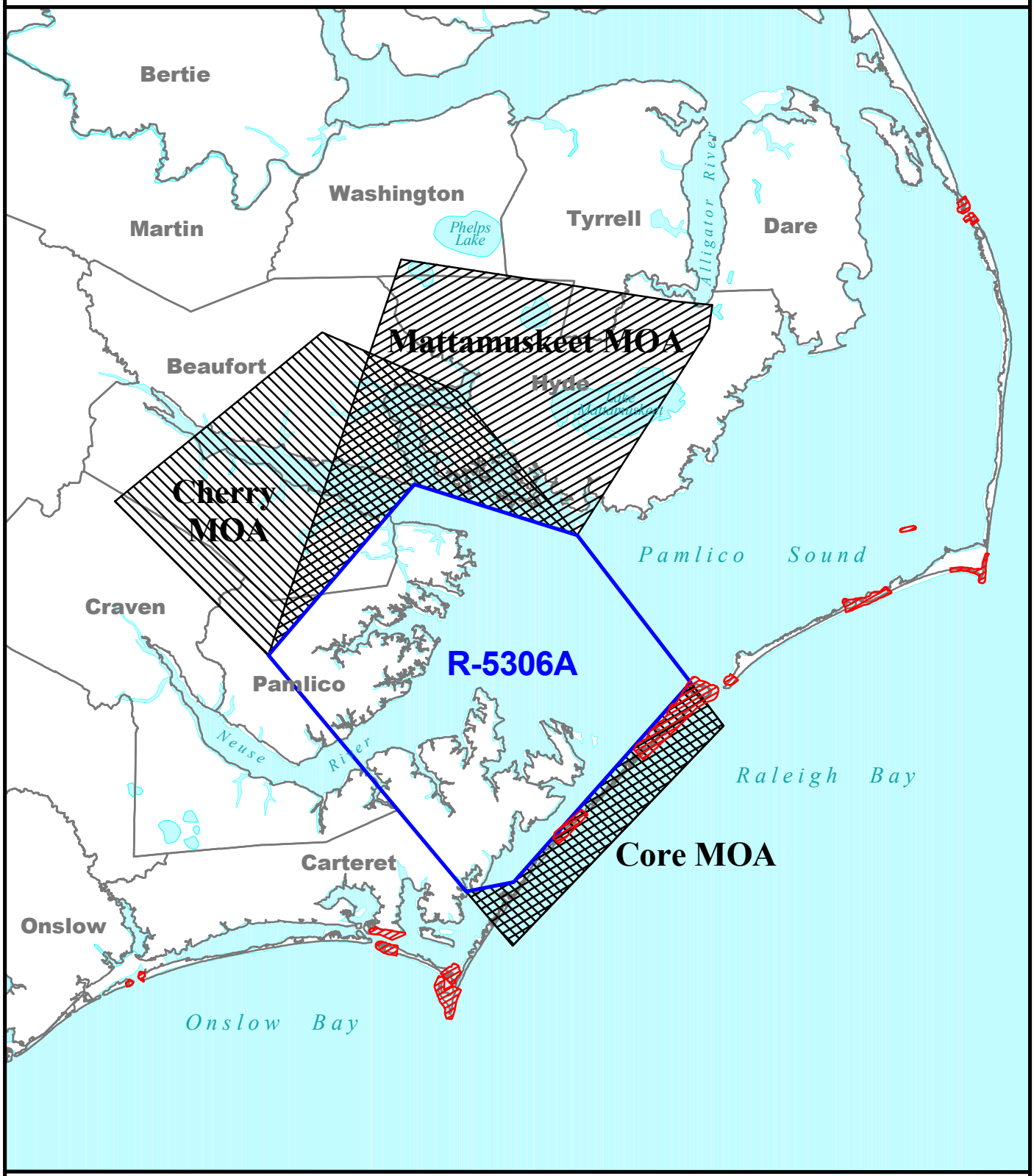
15 0 15 30 Miles

20 0 20 40 Kilometers

N

Figure 4.4-1

Critical Habitat for Wintering Piping Plovers



Critical Habitat for Wintering Piping Plovers
Core and Cherry Alternative
Core and Mattamuskeet Alternative
R-5306 (Existing SUA)
County Boundary

10 0 10 20 Miles
10 0 10 20 Kilometers

N

Figure 4.4-2

not impact beaches, flats and dunes and thus, it would have no affect on designated critical habitat for wintering piping plovers.

Further, the proposed action would not be likely to adversely affect the piping plovers themselves because the effects would be so insignificant, so minor in scale that they would never reach the level where a take would occur. The snowy plover is a west coast species with very similar biological characteristics to the piping plover. Numerous studies and observations have been conducted for the California least tern at Vandenberg Air Force Base, California culminating in a Biological Opinion for rocket launches potentially affecting the California least tern and the snowy plover. Studies completed for the Biological Opinion determined that while snowy plovers were more prone to flush than the California least tern, there were no detectable impacts to the snowy plovers' continued use of wintering or nesting areas or to their nesting success. Observers at the Air Force Base found that snowy plovers nesting within 0.5 miles of the launch site flushed and settled in a somewhat different flock configuration in response to the launch of a Delta II rocket. Farther away (about 2.5 miles [4 km]), minimal discernible response occurred during launch.

The snowy plovers stood from roost sites and walked 3 ft (1 meter) from the original roosting position. The reaction exhibited resembled the response to a perceived predator threat, including a return to normal behavior when the perceived threat had passed (Read 1996a,b). Since the species' exposure to an aircraft flying over their habitat would be far shorter in duration than for the snowy plovers that were exposed to a rocket launch, it supports a conclusion that the piping plover would be expected to show minimal response to brief overflight encounters in the event that they should be present in or under the proposed airspace.

The roseate tern (*Sterna Dougallii*) is also a federally listed endangered species known to occur in eastern North Carolina, however no critical habitat has been designated for the species. The roseate tern is considered an occasional visitor along the Outerbanks, south of Cape Hatteras, particularly at Cape Point (USFWS website, accessed 3/17/03). The North Carolina Natural Heritage Program (website accessed 3/17/03) classifies the roseate tern as an accidental or casual species to the state, and states that North Carolina is outside the normal range of the species. Dare County, which does not underlie any of the proposed MOAs, is the only county in North Carolina listed as an active range for the tern by NCNHP. Carteret County, which underlies the Core MOA, is listed as an historic range, indicating that although the species is known to have been present in the County, there have not been any sightings of the species for more than 20 years.

It should also be noted that effects of noise on shorebirds, and the piping plover in particular, is expected to be limited by the operational characteristics of the proposed Core MOA. As stated previously, the designated critical habitat for over-wintering piping plover occurs only beneath the proposed Core MOA, and the character of training operations anticipated there would reasonably be expected to pose little or no threat to this species. Table 4.4-1 (Distribution of Training Sorties by Altitude) illustrates the point that under expected training conditions, only 2

daily sorties would take place, on average, through the proposed MOA below an altitude of 5,000 ft (1,524 m) AGL. If the aircraft involved in these two sorties were F/A-18 C/D, noise at ground level beneath the aircraft flight path, for the two events, would be in the range of 89 dB to 96 dB (SEL). Since it would take a military aircraft less than one minute to cross the proposed MOA, these noise levels would be experienced for less than two minutes on each typical training day.

Table 4.4-1
Distribution of Training Sorties by Altitude

Altitude (AGL)	Sorties/Year	Sorties/Day	F/A-18C/D Noise Level (SEL)
3,000 to 5,000 ft	511	2	96 dB or less
5,000 to 10,000 ft	657	2 or 3	89 dB or less
10,000 ft and above	292	1 or 2	77 dB or less
	1460 total	5 or 6 typical	

However, in addition to the relatively low number of training flights expected to cross the proposed Core MOA, two additional facets of the training operations should be noted. The first is that no specific route would be assigned across the Core MOA and therefore no one area beneath the MOA, which extends 35 NM (65 km) along the Core Banks, would be likely to receive even 2 sorties below 5,000 ft (1,524 m) AGL per average training day.

The second facet to note is that noise levels presented in Table 4.4-1 apply only to the landmass directly beneath the sortie flight path. The farther away the point on the ground is from the flight path, the lower the received sound would be at that point. In the typical sortie circumstance where a single F/A-18C/D sortie flies at 3,000 ft (914 m) AGL, it is estimated that only 4% of the landmass beneath the proposed Core MOA would experience sound levels in excess of 89dB. Thus, the combination of flight frequency, flight randomness, and the geometry of the proposed MOA suggest that impacts to plover, the roseate tern and other shorebirds residing in areas beneath the MOA, would be insignificant.

Waterfowl

Geese

Extensive studies of the effects of low-level flight training on waterfowl over Goose Bay, Labrador, Canada have been conducted. Training operations in Goose Bay involve between 5,000 and 6,000 flights over a 28 to 31 week cycle, operating at altitudes between 100 and 1,000 ft (30 and 305 m) AGL. Typical noise levels during jet overflights are 104 dB. Bateman et al. (1999) studied the effects of 2,440 military jet overflights, 50% at altitudes under 350 ft (75 m), on all species of waterfowl. Bateman et al. concluded that high densities of waterfowl such as

Canada Geese (*branta canadensis)* can inhabit areas used for low-level jet training without apparent density effects, but that additional annual surveys would be required to definitively assess the impact of overflights.

Turner and Hicks (2000) later re-addressed the effects, on Canada Geese, of low-level military jet flights in Goose Bay, Canada. Additional surveys of the same plots investigated in Bateman et al. (1999) were performed, and results suggest that jet overflights have not had a negative impact on waterfowl breeding populations. However, although additional data collected since the 1999 survey was available to the authors, the authors stated that the limited sample size would not have allowed detection of population changes of less than 10%. Further, the reaction of waterfowl during and after overflights was not observed as part of these studies. Thus, the effects of overflights on energy budgets were not determined by this study.

Snow Geese

A literature search for snow geese presented several studies. Lamp (1989) reported that some waterbird species were sensitive to both subsonic and supersonic military overflights, with snow geese exhibiting adverse responses (alert calling, alert posture, flight) 59 percent of the time.

Davis and Salter (1972) conducted a study of snow geese disturbances by aircraft on the North Slope. They found that a Cessna 185, flying at altitudes ranging from 300 to 10,000 ft (91 to 3,048 m) AGL disturbed all resting snow geese, and that snow geese tended to flush at greater distances when aircraft were under 1,000 ft (305 m). Flocks were found to flush when aircraft were as far away as 9 miles (14.4 km).

Davis and Wiseley (1973) conducted another study on normal snow geese behavior on the Yukon-Alaska North Slope. In particular, they were interested in documenting the effect of aircraft disturbances on snow geese when they were staging, that is, increasing their energy reserves prior to fall migration. They observed that undisturbed flocks spent 57 percent of daylight hours feeding. Flocks were equally prone to flush as a result of disturbance by fixed-wing aircraft or helicopters, and while they flushed at greater distances from helicopters, they flew longer and exhibited longer overall interruption of normal behavior in response to fixed-wing aircraft. The authors projected an 8.5 percent decrease in feeding time for experimental aircraft disturbances at two-hour intervals, which then might result in a 20.4 percent decrease in energy reserves that would be needed for migration. Noise levels from the aircraft and helicopters were not measured as a part of this study, nor does the study account for habituation by the birds to the disturbance or for increased feeding rate following disturbances. One critical review of this study stated that the decreases in energy intake calculated for disturbed birds represented a rather worse case situation for individuals rather than an average value for a population.

Belanger and Bedard (1989) authored a study observing the effects of human disturbances on staging in greater snow geese (*Chen caerulescens atlantica*) in the spring and fall in Quebec.

They recorded 652 disturbances (any event causing all or part of the goose flock to take flight) in 471 hours of observations and found a higher rate of disturbance in the fall versus spring. The entire flock was disturbed in 20 percent of all cases, and mean time in flight was 56 seconds in the fall and 76 seconds in the spring.

Hupp, et al. (2002) studied the effects of overflights by helicopters on staging lesser snow geese in the Arctic National Wildlife Refuge. Snow geese flushed at a mean distance of 5.2 km during 19 overflights conducted during 1988-1993. The flocks were displaced an average of 1.8 km. Noise data was not quantified during the study.

Based on the literature, and discussions with experienced waterfowl biologists familiar with the habits of snow geese in North Carolina, it appears that snow geese are more sensitive to aircraft disturbance than most other waterfowl species. What is not clear from the research is whether snow geese react primarily to the sight or noise of aircraft; also, the sound levels required to cause a reaction to the noise component of aircraft disturbances has not been established. It is reasonable to assume that snow geese will react more often than other waterfowl species to aircraft flying missions in the proposed MOA's. There is not enough information available to determine if the level of disturbance would actually have an impact on feeding times, energy budgets, or other physiological factors. Based on the research conducted on other waterfowl species, it seems unlikely that the low numbers of flights at 3000 ft (914 m) MSL would cause significant impacts.

Ducks

A number of important studies to evaluate the effects of aircraft noise and activity on waterfowl have been conducted. Fleming et al. (1996), a study by the NC Cooperative Fish and Wildlife Research Unit, looked specifically at the effects of low-level military jet aircraft noise on wintering and breeding waterfowl at a site in eastern North Carolina. Military operations in this area consisted of frequent, low altitude (550 ft [170 m] AGL), high speed (greater than 250 KIAS) flights. Waterfowl observed during the 2 year study were exposed to aircraft noise of greater than 80 dBA (SEL) an average of 6 times per hour, and a maximum of 44 times per hour. The mean duration of the noise "exceedences" was 5.1 seconds. The range of SEL levels associated with the exceedences was 80 –109 dBA. The average L_{eq} for the study area was 63.2. In summary, the study area was a very high noise environment. The researchers looked at behavior of wild waterfowl, reviewed historical population records, and measured physiological and behavioral responses and reproductive success of captive, wild-strain black ducks located in high and low noise environments. They also assessed the responses of captive black ducks and mallards to simulated aircraft noise in a controlled environment. Observations of behavior, and calculation of time-activity budgets for 22 species of wild wintering waterfowl at the Piney Island Bombing Range in Carteret County, North Carolina led to a finding that the birds most often did not respond to aircraft activity, that time-activity budgets did not differ from birds in an environment without aircraft activity, and that the energetic costs of reacting to aircraft was low. Birds reacted to helicopter and propeller aircraft more often than jets. A review of historical

population records over a 30-year period, comparing the high noise environment of the bombing range to other areas of coastal North Carolina and the Atlantic Flyway, showed no differences that would indicate effects due to noise. Physiological and behavioral studies of black ducks held in a high noise environment near a bombing target showed that black ducks rapidly habituated to the noise. In the part of the study where both wood ducks and black ducks were subjected to a high noise environment, the wood duck did not habituate to the noise. The researchers did find that a high noise environment had a negative effect on the growth of mallard ducklings, and that elevated corticosterone levels in the ducklings indicated that the noise was a physiological stressor.

Bateman et al. (1999) also examined the impact of low-level military jet flights on ducks in Goose Bay, Labrador, Canada. Black duck was found to be the most numerous species, although substantial numbers of surf scooters and scaup were identified on plots subjected to military jet overflights. There was no evidence of a decrease in black duck density in the study area, although the same caveats identified in the analysis for Canada Geese in this study (discussed above) apply to black duck, and year-to-year monitoring of scaup was not provided. Turner and Hicks (2000) further studied the effects of low-level military jet flights in the same area, and also provided data relevant to the populations of both dabblers and divers. Dabbling ducks exhibited no consistent trend in population density changes within either the control area or plots subjected to overflights. Population densities for diving ducks showed a positive trend on the plots subjected military overflights, but the control areas during the study period showed no consistent trend. Once again, however, neither study analyzed the behavior of the waterfowl during or immediately following overflights. In a manner similar to the analysis of Canada Geese, however, the authors still concluded the results suggest that the overflights did not have a negative effect on duck populations.

Habituation of dabbling ducks species is supported by the research of Conomy et al. (1998a and 1998b), also conducted at Piney Island and the Cedar Island National Wildlife Refuge. Species studied were black duck, American widgeon, gadwall, and American green-winged teal. The authors found that waterfowl spend no more than 1.4% of their time responding to military aircraft overflights, and the mean response times varied by species, ranging between 10 and 40 seconds per event. The researchers caution that, due to different responses to varying types of aircraft, inferences should not be extended to other species or locations. However, since both Piney Island and the Cedar Island NWR are in the vicinity of the proposed MOAs, and are subject to overflights of the same types of aircraft as the proposed MOAs, the results of this study are applicable to this impact assessment.

Noffsinger (1989) conducted ground and aerial surveys of waterfowl on the Alligator River National Wildlife Refuge during the winter of 1988-89. The work was funded by the US Air Force and conducted by refuge staff. The purpose of the study was to help address concerns by the USAF that waterfowl management would increase BASH hazards to aircraft within the R-5314 restricted airspace that was established prior to creation of the refuge. Active management of farm fields for waterfowl on the refuge began in 1988. In addition to counting the numbers of

birds present on the refuge, the study recorded observations of the birds and their reaction to different types of disturbance. Vehicles used in the survey, and the presence of survey personnel caused the birds to flush. The typical reaction of waterfowl to low flying (200 to 300 ft [61 to 91 m] altitude) aircraft, both military and civilian, was to flush and fly at altitudes of 300 ft (91 m) or less. Higher flying aircraft (estimated at over 1000 ft [305 m]) did not cause birds to flush. Noise data was not collected as part of the study. Species of birds observed included mallards, green-winged teal, wood ducks, "mixed puddle ducks" and ring-necked ducks.

Studies directed specifically towards evaluating the effects of aircraft noise on wintering diving ducks such as scaup, canvasback, and redheads were not found during the literature search. The large, open waters that these birds occupy in their wintering areas can make research a logistically difficult proposition. Fleming, et al. (1996) analyzed Midwinter Waterfowl Inventory data for 1961-1991, to test the hypothesis that populations and species richness of waterfowl are similar to areas not impacted by military aircraft activity. The data used in the analysis include information for diving ducks as well as dabblers. The study concluded that there was no evidence to disprove the hypothesis.

Fleming also examined the results of aerial waterfowl surveys conducted by the Fish and Wildlife Service over the Piney Island Bombing Range. The surveys were done in conjunction with the surveys conducted at the nearby Cedar Island NWR. Twenty-two (22) surveys were flown during between October 1989 and March 1992. Surveys were flown during the months of October to May. These surveys counted diving ducks as well as dabblers and the survey areas included open water bays used by diving ducks. Although the study concentrated on noise effects on dabbling ducks, the survey results showed that diving ducks used open water adjacent to high noise areas.

In general, the research cited above shows that many duck species use habitat in high noise areas, and that the noise has little physiological or behavioral impact on mature birds, even in areas where overflights of aircraft are very low. The difference in impacts due to aircraft noise between species or groups of species is not well studied. However there is nothing in the literature to suggest that any duck species or group of species such as diving ducks, is so sensitive that a low number of overflights from aircraft at 3000 ft (914 m) would have significant effects on individual birds.

Songbirds

Several studies have found that impacts to songbirds and other birds from aircraft low-level flights were found to be brief and insignificant and not detrimental to reproductive success (Smith et al., 1988, Lamp, 1989, Ellis et al., 1991, Grubb and Bowerman, 1997). A study by the Engineer Research and Development Center of the Army Corps of Engineers ([web site] January 15, 2002) found that the endangered red cockaded woodpecker *(Picoides borealis)* acclimates to military noise including small arms, artillery, armor, helicopter, and maneuver noise. While the

frequency of flushing increased proportionately with nearness and volume of noise, all birds returned to their nests within 12 minutes. In addition, the noise exposure did not produce any mortality or statistically detectable changes in reproductive success.

A study was initiated in the summer of 2000 to determine whether intense jet noise at Eielson Air Force Base has a negative effect on songbirds nesting in adjacent woodlands. Songbird data collected at Eielson were compared to data collected at a control site located outside a military operations area. It was found that there was no difference in nesting success between Eielson and the control site. Seventy-seven percent of nests found at each site fledged young; nest failures at both sites were found to be largely caused by predation (not noise disturbance).

Based upon the results of these studies, it is expected that implementation of the proposed Core and Mattamuskeet MOAs Alternative would not result in impacts to songbirds.

Raptors

Several studies have evaluated the effects of aircraft, military training, and blasting on raptors. Raptor responses to noise and disturbance in these studies have varied. Most impacts reported appeared to be minor and temporary (Lamp, 1989) and, where evaluated, did not noticeably affect reproduction. The studies discussed below evaluated noise sources from ground-based activities and aircraft. Sensitivity to noise and other disturbances varies among raptor species and among individuals within species, due in part to differences in hearing acuity and previous exposure to noise. Sensitivity to noise is also dependent upon timing; birds and other animals are typically most sensitive to disturbance during the breeding season. Few studies have been conducted on the impacts of jet aircraft noise on raptors. The few studies available are summarized below:

- An account of a single female northern harrier hunting within the target area of a Navy bombing range reported no change in hunting behavior, despite jet noise of 80 to 87 dB at a distance of approximately 1,500 ft (457 m) (Jackson et al., 1977).

- A two-year study was conducted on the effects of low-level jet aircraft flights on cliff-nesting raptors (Ellis et al., 1991). Nests of eight raptor species (including prairie falcon and peregrine falcon nests, red-tailed hawk, Cooper's hawk, and golden eagle) were subjected to almost 1,000 overflights by military jets as well as simulated mid- to high-altitude sonic booms. Overflight noise levels in the study ranged from 82 to 114 A-weighted decibel (dB[A]). All significant responses (i.e., cowering, calling, fleeing, interruption of incubation, or feeding of young) were observed when jets passed within 500 ft (152 m) of the nest; adults showed alarm when jets operated within 984 ft (300 m). Jet aircraft were generally ignored when more than 1,642 ft (500 m) from the nests. Moreover, although 20 of 22 nests fledged young after being disturbed, 21 of those were reoccupied during the second year. The results of this study indicate that low-

level jet overflights (and even mid- to high-altitude sonic booms) do not have long-term adverse impacts to nesting raptors. However, it is important to recognize that the birds in the study were not naïve (i.e., except for nestlings, they had all previously been subjected to moderate levels of low-altitude overflights). In addition, nests were exposed to an average of 11 overflights during the first year of the study (with a maximum of 32) and an average of 38 overflights (maximum 229) during the second year. It is not known whether higher numbers of low-level overflights would cause more severe responses, particularly in naïve birds.

- A study at Bellingham International Airport in Whatcom County, Washington, undertook to analyze the effect of jet aircraft flights on the behavior of resident bald eagles when Pacific Southwest Airlines began to fly jets into the airport (cited in Manci et al., 1988). During field observations, bald eagles reacted to the presence of aircraft in the study area during 12 percent of the eagle-aircraft observations. A differential response to aircraft types was observed: helicopters and small jets had the greatest effect on bald eagles. Eagles reacted to Pacific Southwest Airlines jets 11 percent of the time, to propeller airplanes 2 percent of the time, to helicopters 40 percent of the time, and to small jet aircraft 55 percent of the time. Observed reactions to Pacific Southwest Airlines jets included turning of the head to look at the jet (5 percent of the observations) and flying from a perch site (5 percent). Eagle reactions to Pacific Southwest Airlines jets were twice as frequent when the eagle-jet distance was 0.5 mile (0.8 km) or less. The authors concluded that the existing level of jet flights appeared to have a minor effect on bald eagles within the airport project area, but that if overflights occurred more frequently, repeated flight from perches and interrupted eagle interactions due to aircraft disturbances could have a negative impact on bald eagles.

- Grubb and King (1991) focused on nesting bald eagles did note increased reaction to jet overflights as the distance from the nest to the aircraft decreased. However, pedestrians and helicopters elicited far greater responses than the aircraft. Responses of nesting raptors to fixed-wing aircraft have been investigated for several species. However, Poole (1981) reported that osprey rarely left the nest when exposed to fixed-wing aircraft. Similarly, White and Thurow (1985) reported that ferruginous hawks did not respond to fixed-wing aircraft within 100 ft (30 m) of their nests.

There are several aspects of the proposed project which, based on the literature discussed above, indicate that there would be no significant impacts to raptors:

- The decibel levels investigated in the Jackson et al. (1977) and Ellis et al. (1991) studies were higher than that which would be generated as a result of this

proposal. Moreover, there would only be an average of 6 sorties over a 24-hour period, 45 percent of which would be conducted at altitudes greater than 5,000 ft (1,524 m).

- All aircraft operations in the proposed MOAs would be subsonic.

Because no long-term adverse effects occurred in projects with noise levels equal to or higher than this proposal, no impacts to raptors would be expected from the aircraft noise that would be generated under the proposed Core and Mattamuskeet MOAs Alternative.

These studies also discussed the various distances at which aircraft appeared to have a visual effect on raptors of different species. While the results of each study varied, they suggested that at a distance of 1,640 ft (500 m) or greater, raptors tended to ignore jets aircraft. In an Air National Guard (2000) SUA proposal similar to this proposed action, the US Fish and Wildlife Service recommended maintaining a distance of 1,320 ft (402 m) to avoid impacts to bald eagle nests, bald eagle wintering areas; wildlife in wilderness areas; and colonial birds' nesting sites (US Fish and Wildlife Service, 1995). Aircraft operations in the proposed MOAs would allow aircraft to fly no closer than 3,000 ft (914 m) to any of these types of nesting sites, well within the recommendation of the US Fish and Wildlife Service and the studies previously mentioned. Although the annual number of sorties that would occur in the proposed airspace would be more than that described in the Ellis et al. (1991) study, the higher altitudes at which aircraft would be flown would likely serve to mitigate the potential impacts associated with a higher number of sorties.

Terrestrial Mammals

Effects of aircraft noise on canids are largely unknown. No studies were found specifically investigating noise and visual effects of aircraft on red wolves (*Canis rufus*), but a few studies have been done on a similar species, the gray wolf (*Canis lupus*). Coyotes and wolves rely strongly on auditory stimuli for detecting prey (Manci et al., 1988). Wolves have been reported to exhibit a strong startle response to overflights by helicopters and fixed-wing aircraft (Manci et al., 1988; Krausman et al., 1986). Another study by Klein (1973) investigated the reaction of some northern mammals in Alaska to aircraft disturbance. Although the study focused on the specific reactions of caribou, incidental observations were also made of moose, grizzly bears, and gray wolves. The moose and wolves did not react strongly to the controlled aircraft disturbances, but the grizzly bears ran for cover as soon as they detected the aircraft. No measurements of decibel levels associated with the aircraft overflights were available from these studies, so the effects of aircraft noise on wolves remains unknown.

Radio-collared red wolves within the proposed project area are currently tracked using fixed-wing aircraft by the US Fish and Wildlife Service once a week year-round, but more frequently (two to three times per week) during the breeding season (February-March). Because these reintroduced wolves have been exposed to very low-altitude (100 up to 2,500 ft [30 to 762 m]

AGL) aircraft disturbance as a routine part of managing their reintroduction and recovery program, some habituation to aircraft overflights can be expected to have occurred within the red wolf population. Portions of the counties in which the wolves are listed (Hyde, Tyrrell, and Washington) are already overflown at low-altitudes by military aircraft using R-5314 for the delivery of ordnance on target. Red wolves have expanded their range into these areas from the east despite the low-level military aircraft overflights already taking place, indicating that the wolves are somewhat habituated to, and not negatively affected by, aircraft overflights. Only 25 percent of sorties in the proposed Mattamuskeet MOA would be at the lowest altitudes of 3,000 to 10,000 ft (3,048 m). Because of these factors, as well as the likelihood of habituation, there would be no effects on red wolves anticipated as a result of implementation of the proposed Core and Mattamuskeet MOAs Alternative.

The presence of the eastern cougar (*Felis concolor couguar*) in Carteret County is only known from an obscure data reference (US Fish and Wildlife Service [web site], August 13, 2001). While sightings of cougars have occurred in counties in the interior of North Carolina (US Fish and Wildlife Service [web site], June 4, 2001), no recent data (<20 years) indicates that a population of cougars is still in existence in Carteret County. The barrier island ecosystem of the Core Banks is not appropriate habitat (does not have sufficient cover or prey species) to sustain occupation by the cougar. For this reason, no impacts to the eastern cougar are anticipated from implementation of the proposed airspace.

Lamp (1989) found that responses of mule deer to overflights at Naval Air Station Fallon, Nevada were temporary behavioral changes and minor changes in winter habitat use. However, Lamp (1989) suggested that long-term cumulative impacts are unknown and need to be evaluated in future studies. Weisenberger et al. (1996) suggested that bighorn sheep and mule deer habituated to low-level aircraft noise with increased exposure. In support of this opinion, mule deer and bighorn sheep populations continue to exist under airspace where low-level aircraft sorties having been flown for years at such training areas as the Nellis Range, Nevada, and the Barry M. Goldwater Range, Arizona. No impacts to white-tailed deer, feral horses, or other large mammals are anticipated to occur as a result of implementation of the proposed Core and Mattamuskeet MOAs Alternative.

Bats and Other Small Mammals

The Rafinesque's big-eared bat (*Plecotus rafinesquii*) is a federal species of concern in Beaufort and Washington Counties. Few studies have been conducted on the effects of anthropogenic noise on free-ranging bats. Howell (1992) found that noise from unmanned aerial vehicles overlapped with lesser long-nosed bat's hearing at only one frequency (30 kilohertz), and flights at operational cruising altitude (3,000 ft [914 m] AGL) were inaudible. Another study conducted on the same bat species found no apparent short-term effects of low-flying jet aircraft on bats in maternity roosts within a mine; however, the researchers warned that their results might not be adequate for extrapolation to other areas because of differences in roost site geometry and the outside terrain (Dalton and Dalton, 1993). Dalton and Dalton (1993) remained concerned that

long-term effects may have a negative impact on the colony, but no study has yet been conducted to test that hypothesis.

Griffin et al. (1963) found that echolocating Townsend's big-eared bats were able to resist jamming from a constant noise field by orienting to second harmonics. Jamming resistance and an ability to navigate and locate targets despite acoustical clutter and interference has also been demonstrated for numerous other bat species (Simmons et al., 1974; McCarty and Jen, 1983; Troest and Mohl, 1986; and Schmidt and Joermann, 1987). Many of these adaptations appear designed to allow for echolocation in the presence of conspecifics. Based on the results of these studies, there would be no significant impacts on the Rafinesque's big-eared bat as a result of implementation of the proposed airspace.

Reptiles and Amphibians

Although few field studies have been conducted to evaluate the impacts of noise on wild populations of amphibians and reptiles, Manci et al. (1988) summarized the results of several laboratory studies that demonstrated the sensitivity of amphibians and reptiles to sound. Desert iguanas and Mojave fringe-toed sand lizards were shown to experience hearing losses or decreases in hearing sensitivity after exposure to simulated off-highway vehicle noise of 95 to 114 dB. Neotropical tree frogs redistributed their calls to fall within spaces between tone bursts of up to 41 dB. Spadefoots, which appear to use auditory cues (such as thunderstorms) to emerge from hibernation, emerged from burrows in a laboratory setting after exposure to motorcycle sounds of 95 dB. Emergence during a period when water is not available may negatively impact spadefoot populations in arid regions. These studies indicate that exposure to high noise levels at certain times of year may cause amphibians and reptiles to respond inappropriately or with reduced sensitivity to auditory stimuli. However, these studies do not describe how long the noise persisted before creating the negative effects described. Within the Core MOA, an overflight would be completed in one minute, and no single location would be impacted for more than several minutes within the Mattamuskeet MOA. Due to the brief and intermittent nature of the noise generated by this proposal, there would be no significant impacts on reptiles or amphibians as a result of implementation of the Core and Mattamuskeet MOAs Alternative.

Invertebrate Species

There would be no affect on invertebrate species associated with implementation of this proposed airspace alternative as there would be no disturbance of topography or soils or any construction activities. Only overflights of the land areas would occur.

Threatened and Endangered Species

Threatened and endangered species present within the proposed action footprint include marine mammals (fin whale, humpback, northern right whale, sei whale, sperm whale, and West Indian Manatee), sea turtles (loggerhead, green, Kemp's ridley, leatherback, and hawksbill), fish (short-

nose sturgeon), birds (piping plover, roseate tern, red-cockaded woodpecker, and bald eagle), terrestrial mammals (red wolf, eastern cougar), and a reptile (American alligator). The Rafinesque big eared bat, a federal species of concern, also occurs within the proposed project footprint. The potential impacts that implementation of the proposed Core and Mattamuskeet MOAs may have on each of these species have been examined in detail in the above discussions in this subchapter. The analysis has determined that the proposed alternative would be not likely to adversely affect the piping plover or roseate tern because the effects would be insignificant. The proposed action would have no effect on the other federally-listed threatened or endangered species within the proposed action footprint. The Marine Corps has received USFWS concurrence that the implementation of this alternative would not adversely affect the piping plover, roseate tern, or any other federally listed species, their formally designated critical habitat, or species currently proposed for federal listing under the Endangered Species Act (Appendix A).

4.4.1.3 Core and Cherry MOAs Alternative

Impacts to wildlife resources under this alternative would be the same as described for the Core and Mattamuskeet MOAs Alternative. The Marine Corps has received USWFS concurrence that there would be no adverse impact to any federally-listed or currently proposed threatened or endangered species due to implementation of this alternative (Appendix A).

4.4.1.4 Core MOA Alternative

Impacts to wildlife resources under this alternative would be the same as described for the Core and Mattamuskeet MOAs Alternative. The Marine Corps has received USWFS concurrence that there would be no adverse impact to any federally-listed or currently proposed threatened or endangered species due to implementation of this alternative (Appendix A).

4.4.1.5 Mattamuskeet MOA Alternative

Impacts to wildlife resources under this alternative would be the same as described for the Core and Mattamuskeet MOAs Alternative. The Marine Corps has received USWFS concurrence that there would be no adverse impact to any federally-listed or currently proposed threatened or endangered species due to implementation of this alternative (Appendix A).

4.4.1.6 Cherry MOA Alternative

Impacts to wildlife resources under this alternative would be the same as described for the Core and Mattamuskeet MOAs Alternative. The Marine Corps has received USWFS concurrence that there would be no adverse impact to any federally-listed or currently proposed threatened or endangered species due to implementation of this alternative (Appendix A).

4.5 Cultural Resources

Section 106 of the National Historic Preservation Act of 1966 states that federal agencies must take into account the effects of their actions on any district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places. The regulations for Section 106, as stated in 36 CFR 800, *Protection of Historic Properties*, provide specific criteria for evaluating the effects of federal actions and assessing adverse effects on historic resources. In accordance with the regulations, federal agencies, with guidance from the Advisory Council on Historic Preservation and the State Historic Preservation Officer, must also actively seek methods to either reduce or avoid adverse effects from the proposed undertakings.

The significant features or distinguishing elements of a historic resource, combined with the design and anticipated results of the proposed action, are examined in order to determine any potential effects. Such effects on cultural resources included in or eligible for inclusion in the National Register are further evaluated with regard to the Advisory Council's *Criteria of Effect and Adverse Effect* (36 CFR 800.9). This regulation states that "an undertaking has an effect on a historic property when the undertaking may alter characteristics of the property that may qualify the property for inclusion in the National Register. For the purpose of determining effect, alteration to features of the property's location, setting, or use may be relevant depending on a property's significant characteristics and should be considered" (36 CFR 800.9[a]). Likewise, an adverse effect on a historic resource "may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association." Examples include, though are not limited to:

- Physical destruction, damage, or alteration of all or part of the property.
- Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for the National Register.
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting.
- Neglect of a property resulting in its deterioration or destruction.
- Transfer, lease, or sale of the property (36 CFR 800.9[b]).

Thus, in summary, when applying the *Criteria of Effect and Adverse Effect* to historic properties, there are three possible outcomes:

- **No Effect** - no effect of any kind, either harmful or beneficial.

- **No Adverse Effect -** the effect is not harmful enough to disqualify the resource from inclusion in the National Register.

- **Adverse Effect** - the effect is harmful enough to lessen the resource's integrity and its ability to qualify for inclusion in the National Register.

4.5.1 No Action Alternative

Under the No Action Alternative, there would be no changes to airspace structure, altitude, numbers of sorties, or noise levels when compared to existing conditions as described in Subchapters 3.1 and 3.2. The No Action Alternative would result in no effect to cultural resources.

4.5.2 Core and Mattamuskeet MOAs Alternative

Aircraft overflights (and associated noise) would be the only potential source of impacts to cultural resources in the land areas underlying the proposed MOAs. Consequently, this analysis examines noise, vibration, and visual impacts as well as how these effects might impact the audio and visual "settings" of cultural resources.

4.5.2.1 Effects of Subsonic Noise-Induced Vibrations on Structures

The sound from an aircraft travels from the exterior to the interior of a structure in one of two ways: either through the solid structural elements or directly through the air (Wyle Research, January 1998). Normally, the most sensitive components of a structure to airborne noise are windows and, infrequently, plaster walls and ceilings. A summary of the impacts of noise-induced vibrations on sensitive structures is shown in Table 4.5-1.

Studies on the nature of subsonic noise-related vibration damage to structures have found that high decibel levels (above 130 dB) must be generated close to a structure (no more than 150 ft [45 m]) and at a sufficiently low frequency for a structure, such as a historic building, to be damaged (US Forest Service, 1992, in US Department of the Air Force, January 1998). Neither condition is expected to occur within land areas beneath the proposed Core and Mattamuskeet MOAs since the maximum SEL for both MOAs would be 96 dB and the aircraft would be flying at 3,000 ft (914 m) MSL or higher.

Table 4.5-1

Summary of Noise-Induced Effects on Structures and Historic/Archaeological Sites

Effect	Explanation
Noise-Induced Vibrations on Structures	The sound from an aircraft travels from the exterior to the interior of a structure through the solid structural elements and directly through the air. The most sensitive components of a structure to airborne noise are normally windows and, infrequently, plaster walls and ceilings. An evaluation of peak sound pressures impinging on the structure is normally sufficient to determine the possibility of damage. In general, sound levels above 130 dB can result in possible structural damage. While certain frequencies (such as 30 hertz for window breakage) may be of more concern than others, conservatively, only sounds lasting more than one second above a sound level of 130 dB are potentially damaging to structural components (von Gierke and Ward, 1991).
Noise Effects on Historical and Archaeological Sites	Because of the potential for increased fragility of structural components of historical buildings and other historical sites, aircraft noise may affect such sites more severely than newer, modern structures. One study of the effects of sound and structural vibration occurred in 1977, when noise level measurements were made in a restored plantation house located 1,500 ft (457 m) from the centerline of Runway 19L at Washington Dulles International Airport. Of special concern was the impact of takeoffs and landings of the *Concorde* on the building's windows. Researchers found no instances of structural damage from the aircraft's operation. Interestingly, despite the high levels of noise that occurred during *Concorde* takeoffs, induced structural vibration levels were actually less than those of touring groups and vacuum cleaning.

Moreover, since the proposed Core MOA does not include the location of the Cape Lookout Lighthouse and Keeper's Quarters, there would be no overflights of these historic structures at altitudes less than 10,000 ft (3,048 m) at speeds greater than 250 kt. There would be overflights of Portsmouth Village, which is situated at the northeastern end of Portsmouth Island. The maximum SEL of 96 dB is well below the 130 dB noise level that could cause possible structural damage to structures. Therefore, there would be no effect to cultural resources underlying the proposed Core and Mattamuskeet MOAs due to noise and vibrations from aircraft overflights.

4.5.2.2 Effects of Aircraft Noise on "Setting"

The Advisory Council on Historic Preservation considers "setting" an important factor in maintaining a cultural resource's historic integrity. While aircraft noise and overflights could potentially affect the setting of cultural resources in the land area underlying the proposed Core and Mattamuskeet MOAs, this impact would be brief and transitory in nature. Therefore, implementing the Core and Mattamuskeet MOAs Alternative would not adversely impact qualities of integrity or jeopardize a property's eligibility for listing on the National Register of Historic Places.

4.5.3 Core and Cherry MOAs Alternative

Under this alternative, the effects of aircraft overflights on cultural resources would be the same as described for the Core and Mattamuskeet MOAs Alternative.

4.5.4 Core MOA Alternative

Under this alternative, the effects of aircraft overflights on cultural resources would be the same as described for the Core and Mattamuskeet MOAs Alternative.

4.5.5 Mattamuskeet MOA Alternative

Under this alternative, the effects of aircraft overflights on cultural resources would be the same as described for the Core and Mattamuskeet MOAs Alternative.

4.5.6 Cherry MOA Alternative

Under this alternative, the effects of aircraft overflights on cultural resources would be the same as described for the Core and Mattamuskeet MOAs Alternative.

4.6 Socioeconomics and Community Facilities

4.6.1 No Action Alternative

Under the No Action Alternative, Marine Corps aircraft would continue existing training flight activities over the Core Banks and in the Cherry and Mattamuskeet areas at airspeeds of 250 kt or less when operating at altitudes less than 10,000 ft (3,048 m), in accordance with FAA regulations published in 14 CFR 91. Furthermore, overflights of wilderness areas and noise sensitive areas (including national parks and national recreational areas and others as described in Subchapter 1.1.2) would continue to occur. In accordance with OPNAVINST 3710.7, aircraft would operate at an altitude no lower than 3,000 ft (914 m) MSL, except when training activities are conducted on a military training route (MTR) or within existing SUA.

4.6.1.1 Demographics

Population growth in the study counties has been projected by the North Carolina Department of Commerce. As shown in Table 4.6-1, between the 2000 Census and 2010, population in the region as a whole is projected to increase by more than 17,000 residents, an increase of more than 7 percent. When projections for individual study area counties are examined, it can be seen that all but Washington County are anticipated to grow between 5 and 10 percent during the next decade. The population of Washington County is expected to decrease by more than 3 percent during the same time period.

Table 4.6-2 presents current and projected population densities for study area counties. Overall, the study area will retain its rural character over the next decade, with a population density of about 67 persons per sq mi (26 persons per sq km). Carteret and Craven Counties will continue to be the most densely populated counties in the study area, with 126 and 140 persons per sq mi (48 and 54 persons per sq km), respectively. Even so, these counties will be substantially less densely populated than other urban centers in North Carolina such as Wilmington or Charlotte. For reference, the state of North Carolina estimates that 2010 population densities in these latter communities will reach 995 and 1,688 persons per sq mi (383 and 649 persons per sq km), respectively. The least densely populated counties in the study area are Hyde and Tyrrell, with generally less than 11 persons per sq mi (3.8 persons per sq km).

Table 4.6-1

Population Projections for Counties Underlying MOAs

County	Existing Population (2000)	Population Projections		Population Change 2000-2010	
		2005	2010	Number of Persons	%
Beaufort	44,958	46,207	47,231	2,273	+5.1
Carteret	59,383	62,542	65,303	5,920	+10.0
Craven	91,436	95,841	99,126	7,690	+8.4
Hyde	5,826	6,021	6,132	306	+5.3
Pamlico	12,934	13,559	14,157	1,223	+9.5
Tyrrell	4,149	4,248	4,373	224	+5.4
Washington	13,723	13,537	13,299	-424	-3.1
Regional Total	230,409	243,960	251,631	17,212	+7.4
North Carolina	8,049,313	8,784,896	9,468,786	1,419,472	+17.6

Sources:
1. US Department of Commerce, Bureau of the Census, State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing.
2. North Carolina State Demographer [web page], May 16, 2001.

Table 4.6-2

Population Density in the Study Area in 2000 and Projected to 2010

County	2000		2010		% Change
	Persons Per Sq Mile	Persons Per Sq Km	Persons Per Sq Mile	Persons Per Sq Km	
Beaufort	54.3	20.9	57.0	21.9	+5.0
Carteret	114.2	43.9	125.6	48.3	+10.0
Craven	129.1	49.7	139.9	53.8	+8.4
Hyde	9.5	3.7	10.0	3.8	+5.3
Pamlico	38.4	14.8	42.0	16.2	+9.4
Tyrrell	10.6	4.1	11.2	4.3	+5.7
Washington	39.4	15.2	38.2	14.7	-3.1
Study Area	62.1	23.8	66.7	25.7	+7.4
North Carolina	165.3	63.6	194.4	74.8	+17.6

Source: North Carolina State Demographer [web page], May 16, 2001.

4.6.1.2 Income and Employment

Based on data available from the North Carolina Department of Commerce, the following economic trends have been identified for those eastern North Carolina's counties in the study area (North Carolina Department of Commerce [website], January 10, 2002):

- Carteret, Craven, and Pamlico Counties are expected to maintain their current employment base in wholesale/retail trade, government, and manufacturing. Trends also indicate growth in agriculture and services. Per capita income will remain about 13 percent below the state level. The unemployment and poverty rates will stay above the state averages.

- Beaufort, Hyde, Washington, and Tyrrell Counties will continue to depend on agriculture, manufacturing, retail trade, and services, though tourism and second-home development would likely become "major economic contributors". Trends in this region indicate growth in agriculture, construction, and services. Per capita income would be approximately 20 percent below the state level. Unemployment and poverty rates would be above the state averages.

Selection of the No Action Alternative would result in no changes to existing income and employment trends nor would there be effects on any specific sectors of the local economies, including commercial fisheries and agriculture.

4.6.1.3 Tourism and Recreation

Tourism

According to the North Carolina Department of Commerce, the state's coastal region has a larger share of visitors that are more likely to go to the beach (53 percent) or participate in outdoor activities (18 percent) than the rest of the state (11 percent for both categories). In 1999, 10 percent of visitors went to state or national parks in the coastal region. The counties in the study area, with the exception of Carteret County, experienced an annual growth in tourism in the 1990s.

Under the No Action Alternative, it is anticipated that this preference of activity type would continue, as the primary open space and recreation attractions of the North Carolina coast are its beaches, seashore recreational areas, wildlife refuges, and boating and fishing opportunities. It is reasonable to assume that in terms of numbers of visitors, the annual increase would be proportionate to the anticipated annual increase in tourism in the state in general. With implementation of the No Action Alternative, current trends would continue and there would be no effect on tourism, open space and recreation, or sport fishing, boating, and sailing in the study area counties.

4.6.1.4 Housing

Because there would be no change in population levels associated with implementation of the No Action Alternative, there would also be no impacts on housing.

4.6.1.5 Taxes and Revenues

Under the No Action Alternative, taxes and revenues in the study area counties would remain as described in Subchapter 3.6.

4.6.1.6 Community Facilities and Services and Infrastructure and Utilities

No additional demands would be placed on existing community facilities and services such as police, fire, schools and libraries, and hospitals with implementation of the No Action Alternative. In addition, there would be no additional demands on infrastructure and utilities under the No Action Alternative.

4.6.2 Core and Mattamuskeet MOAs Alternative

4.6.2.1 Direct Impacts on Socioeconomic Resources

With the exception of airport/airfield-related activity, there are no known published data or studies assessing the potential for direct impacts on socioeconomic resources as a result of overflights conducted in military airspace. Establishing the proposed Core and Mattamuskeet MOAs would involve no on-ground disturbances such as aircraft takeoffs and landings at a runway nor military construction projects such as aircraft hangars or aprons. In addition, establishment of the proposed Core and Mattamuskeet MOAs would not require realignment or construction of military facilities or changes in personnel, or generate related shifts in spending, housing, or populations distribution. In the absence of such definable relationships, or links, there would be no direct impacts to socioeconomic resources from implementation of the proposed Core and Mattamuskeet MOAs.

4.6.2.2 Indirect Impacts on Socioeconomic Resources

The primary issue regarding potential indirect impacts to socioeconomic resources is the noise that would be generated by the military aircraft operations conducted in the proposed MOAs. Specifically, concern revolves around the potential for indirect effects on property valuations and tourism earnings. For example, the perception exists that noise generated during aircraft overflights of potentially sensitive areas (e.g., wildlife refuges or seashores), could cause these areas to be less desirable to tourists. The resultant changes in tourist activity could indirectly affect the status of local economies.

The assessment of the potential for indirect noise impacts needs to be made in the context of two basic facts (which would also be relevant to all alternatives under evaluation in this EA):

- Judging impacts of noise on individuals is difficult and essentially subjective. It is virtually impossible to accurately predict how a given individual will react to a noise event. To some people, the sound of opera music filling a home at full volume is a wonderful experience; others would prefer quieter melodies or no sound at all. To some individuals, overflights of military aircraft are inspiring and exciting; to others, overflights are a nuisance. At any point in time, it is impossible to predict whether a person would happen to be affected positively or negatively by an aircraft overflight in a MOA.

- Military aircraft operations in MOAs are characterized by random and widely dispersed flights in both space and time. Aircraft are free to maneuver anywhere within the boundaries of the "three-dimensional" box comprising the MOA, reflecting typical combat maneuvers. The intentionally random nature of operations and the wide altitude structure within most MOAs make it highly unlikely that any one location would be overflown repeatedly.

Indirect Demographic Impacts

The potential for aircraft noise to directly impact residents of the land areas that would underlie the proposed MOAs is discussed in detail in Subchapter 4.2. This analysis shows that the predicted L_{dmnr} value would be less than 50 dB for both the Core and Mattamuskeet MOAs, which would represent little change in ambient noise conditions in the land areas lying beneath the boundaries of the proposed MOAs.

In general, all of the counties that would underlie the proposed MOAs have historically experienced some aircraft operations, both military and civilian. Routine aircraft operations already occur within R-5306A and the associated targets (BT-9 and BT-11) and, as well, in and around the MCAS Cherry Point airfield. Aircraft operations also occur routinely along existing MTRs and as aircraft fly between W-122, R-5306A, or the Pamlico B MOA and the SUA associated with the Dare County Bombing Range. In addition, eastern North Carolina is home to several major airports and numerous public and private airstrips (see Table 3.1-3). The Craven County Regional and Michael J. Smith Airports (Craven and Carteret Counties, respectively) support several commercial air carriers, including those that operate jet aircraft. These airports experience well over 100 aircraft operations per day. More than 75 aircraft operations are conducted per day at Warren Field (city of Washington, Beaufort County) and about 11 aircraft operations occur at Hyde County Airport in Engelhard.

In summary, residents of eastern North Carolina are already experiencing significant levels of aircraft operations, including routine takeoffs, landings, and overflights associated with public and private airports as well as military activities. Additionally, given the significant agricultural

uses present in the study area, it is likely that routine crop dusting occurs. While individuals may occasionally notice aircraft and air activity, no one group or individual would be bothered all the time or to any significant extent; therefore, no significant indirect demographic impacts are anticipated from implementation of the Core and Mattamuskeet MOAs Alternative.

Indirect Impacts on Employment, Income, and Housing

There would be no significant indirect impacts on employment, income, or housing in the land areas that would underlie the proposed MOAs for the same reasons discussed immediately above.

Indirect Impacts on Tourism and Recreation

Limited data and research exist that specifically assess the impacts of military aircraft overflights on tourists or recreation visitors. However, in 1987, Congress in Public Law 100-91 directed the US Forest Service and the National Park Service to conduct studies of aircraft overflights that might be affecting visitors of the National Forest System wilderness areas and National Parks and report the results to Congress. The *Potential Impacts of Aircraft Overflights of National Forest System Wildernesses* (US Forest Service, 1992) and *Potential Impacts of Aircraft Overflights on the National Park System* (National Park Service, July 1995) are the results of that directive and represent efforts to apply quantitative methods to the problems of measuring outdoor recreationists' reactions to aircraft noise exposure (generated by both civilian and military aircraft) in wilderness areas and the national park system. The major emphasis of these studies was on determining the effects of aircraft overflights on visitor enjoyment. Visitors were interviewed during and shortly after their wilderness or park visits to assess the actual impact from exposure to aircraft overflights during that visit. Some key findings of the two studies were:

- The primary reasons for visits to national parks were to enjoy the natural resources and the natural quiet (natural quiet being defined as natural ambient sound conditions, including "self noise" or the noise generated by the visitor, but in the absence of mechanical noise).

- In spite of the foregoing, interviews indicated that aircraft noise intrusions did not appear to appreciably impair surveyed users' overall enjoyment of their visits.

- The majority of users interviewed were not annoyed by overflights. In fact, about 2 percent of visitors reported either interference with enjoyment of their park experience or annoyance. Less than 3 percent of visitors indicated that the aircraft noise interfered with their enjoyment of natural quiet.

- Visitors who have committed some time to a particular park experience (e.g., back country hikers) are likely to be more sensitive to aircraft noise that those that visit more accessible sites (e.g., visit an automobile accessible overlook).

- Low-altitude, high-speed aircraft were reported as the most annoying type of aircraft to hear or see. This was attributed to the "startle effect." The startle effect occurs when a very loud noise (e.g., low-altitude jet aircraft) is experienced in a setting where it is not expected (e.g., a wilderness area), and when there is no visual or audible warning of the noise source. However, the term "low-altitude" was not defined.

This background information is directly applicable to the study area counties, which offer a wide range of tourism and recreational opportunities, including beach visits (along the barrier islands), hiking, swimming, picnicking, camping, wildlife viewing, bird-watching, hunting, and others. The Cape Lookout National Seashore is a special management area that would underlie the proposed Core MOA. Several national wildlife refuges would underlie the proposed Mattamuskeet MOA.

As previously described in this subchapter, the land areas underlying the proposed MOAs are already subject to aircraft overflights, both military and civilian. Aircraft operations occur routinely along existing MTRs that cross the Core Banks and the Lake Mattamuskeet area as aircraft fly between W-122, R-5306A, or the Pamlico B MOA and the SUA associated with the Dare County Bombing Range. Extensive aircraft operations are associated with the use of R-5306A and associated targets (BT-9 and BT-11). Eastern North Carolina is also home to several major airports and numerous public and private airstrips (see Table 3.1-3). Of further note is the fact that the Alligator River National Wildlife Refuge is already bisected by the Dare County Bombing Range where aircraft conduct training operations, including the delivery of ordnance on targets. Hunting regularly occurs at the surrounding wildlife refuge as well as on the range on weekends, with no apparent significant negative impacts from aircraft noise on either the hunters or the animals.

The noise analysis conducted for this EA predicts that L_{dnmr} values for the Core and Mattamuskeet MOA would be less than 50 dB, representing little change from ambient noise conditions. Similar low-level L_{dmnr} values are predicted for noise exposures at each of the seven identified sensitive noise receptors that are located beneath the proposed airspace.

Individual aircraft flyovers could impact the solitude and natural quiet associated with the special management areas underlying the proposed airspace. However, this impact should be considered in the context of such factors as overflight frequency and duration, altitude, and flight paths, all of which would tend to minimize adverse reactions of seashore or wildlife refuge visitors to aircraft noise, as follows:

- The airspace would be used intermittently with projected 1,460 annual sorties to the Core MOA averaging only about six sorties per 24 hour period for about one minute each. Operations in the Mattamuskeet MOA would be somewhat more intense, a projected 2,423 sorties hours per year equating to 9.3 sorties per day (about 7 hours average total flight time per training day).

- About 65 and 75 percent of the sorties flown in the Core and Mattamuskeet MOAs, respectively, would be at altitudes above 5,000 ft (1,524 m) MSL. The maximum noise level experience for a listener would decrease as altitude increases thereby minimizing the overall impact of the noise. In addition, all over flights would be at least 1,000 ft (305 m) higher than the voluntary minimum altitude for overflights of national parks, national wildlife refuges, and similar lands as identified in a Memorandum of Understanding signed by the National Park Service, Fish and Wildlife Service, and Bureau of Land Management with the FAA (1993).

- It is highly unlikely that the same specific location would be repeatedly overflown during aircraft training operations. As a result, individual aircraft noise events in any single location underlying the MOAs would typically be heard only for brief periods.

In addition, the sound of the ocean surf along the Cape Lookout National Seashore, would tend to provide some natural masking of aircraft overflight noise.

Indirect Impacts on Taxes and Revenues

There is little to suggest that the sporadic and dispersed nature of overflights associated with use of the proposed Core and Mattamuskeet MOAs would impact taxes and revenues in the study area counties. Land value studies have been conducted around urban airports and military bases (Fidell et al., 1996 as cited in: US Air Force, January 2000) and measures of change in value (e.g., noise depreciation sensitivity index) have been defined. These studies indicate residential property values in the vicinity of airfields are affected by a variety of non-noise factors such as national, regional, and community economic conditions; national and regional trends in employment, inflation, and interest rates; local population changes; and real estate development. However, the research also found no reliable correlation between aircraft noise and residential property sale prices even at an active Air Force airfield such as Langley Air Force Base, in Virginia.

Unlike Langley Air Force Base, the land areas that would underlie the proposed Core and Mattamuskeet MOAs would experience dispersed, higher altitude, and episodic noise. For example, the majority of overflights would occur at altitudes higher than 5,000 ft (1,524 m) MSL and most would be of short duration. In the proposed Core MOA, sorties are estimated to have a duration of approximately one minute as aircraft cross the Core Banks to enter R-5306A. Individual missions to the proposed Mattamuskeet MOA would be longer, about 45 minutes, with an average daily use of the MOA of about 7 hours. In addition, missions could occur anywhere within the 750 sq mi (2,576 sq km) airspace. As a result, it would be highly unlikely that any single location would be subject to consistent direct overflights and the associated noise (as at an airfield). Therefore, there would be no significant measurable impacts on the economic value of the underlying land from implementation of the proposed alternative.

Indirect Impacts on Community Facilities and Infrastructure and Utilities

There would be little potential for significant indirect impacts on community facilities and infrastructure and utilities in the land areas that would underlie the proposed MOAs. Because there would be no significant impacts on such factors as demographics, employment and income, and housing (see the foregoing discussion), there would be no change in or effect on demand for community facilities and infrastructure and utilities.

4.6.2.3 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs all federal departments and agencies to incorporate environmental justice in achieving their mission. Each federal department and agency is to accomplish this by conducting programs, policies, and activities that substantially affect human health or the environment in a manner that does not exclude communities from participation in, deny communities the benefits of, nor subject communities to discrimination under such actions because of their race, color, or national origin.

Factors used in determining consistency with this policy focus on the racial, income, and ethnic composition of nearby communities. Ethnic makeup and income of the study area population are described in Subchapter 3.6 and summarized in Table 3.6-1. Briefly:

- The population of study area counties, and specifically of those counties that would underlie the proposed Core and Mattamuskeet MOAs, is predominantly white (an average of about 66 percent overall), with other ethnic groups dispersed throughout.

- With regard to income, in 1999, all counties in the area under the proposed MOAs had median family incomes below North Carolina's state median family income of $46,000 (US Dept of Housing [website], August 29, 2001). The highest 1999 median family income was $40,000, in Carteret County, which marginally underlies the Core MOA. This income level was still below the state and federal median. In the counties underlying the proposed Mattamuskeet MOA, median family incomes ranged from a low of $23,400 (Tyrell County) to a high of $35,900 (Pamlico), a difference of only $12,500.

Further review of the study area, based on local land use plans and other studies, indicates that there are scattered concentrations of minority or low-income households within the study area. However, based on the results of the noise analysis, none of these households would be subjected to consistent direct overflights and associated aircraft noise. In fact, the L_{dnmr} values would be minimal, less than 50 dB throughout both MOAs, and represent little change from ambient noise conditions. Therefore, with respect to Executive Order (EO) 12898, *Environmental Justice*, implementation of this alternative would not cause disproportionately high and adverse

environmental or health impacts to any groups or individuals residing in the area, including those from minority or low-income populations.

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, requires each federal agency to identify and assess environmental health and safety risks to children. "Environmental health and safety risks" are defined as "risks to health or to safety that are attributable to products or substances that the child is likely to come in contact with or ingest." Federal actions that are covered and affected by this EO are those substantive actions that concern an environmental health risk or safety risk that an agency has reason to believe may disproportionately affect children. As evaluated in accordance with the Executive Order 13045, the Core and Mattamuskeet Alternative would not disproportionately affect children. In particular, based on results of the noise analysis presented herein (Subchapter 4.2), noise levels expected from implementation of the alternative would not disproportionately affect children.

Covered regulatory actions that are affected by this EO are those substantive actions that concern an environmental health risk or safety risk that an agency has reason to believe may disproportionately affect children. As evaluated in accordance with the Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks, this Proposed Action would not disproportionately affect children.

4.6.3 Core and Cherry MOAs Alternative

4.6.3.1 Direct Impacts on Socioeconomic Resources

As with the Core and Mattamuskeet MOAs Alternative, establishing the proposed Core and Cherry MOAs would involve no on-ground disturbances such as aircraft takeoffs and landings at a runway or military construction projects such as aircraft hangars or aprons. No realignment or construction of military facilities or changes in personnel would be required, and related shifts in spending, housing, or populations distribution would not occur. As a result, there would be no direct impacts to socioeconomic resources from implementation of the proposed Core and Cherry MOAs.

4.6.3.2 Indirect Impacts on Socioeconomic Resources

There would be no significant indirect impacts on other socioeconomic factors (demographics, employment, income, housing, tourism and recreation, taxes and revenues, community facilities, and infrastructure and utilities) for the same reasons discussed for the proposed Core and Mattamuskeet MOAs Alternative.

4.6.3.3 Environmental Justice

As indicated in Tables 3.6-1 and 3.6-3, the population of counties underlying the proposed Core and Cherry MOA is predominantly white, with other ethnic groups dispersed throughout. With regard to income, in 1999 all counties in the area under the proposed MOAs had median family incomes below North Carolina's state median family income of $46,000 (US Department of Commerce [website], August 29, 2001). The lowest median family was found in Hyde County ($25,100). Based on the results of the noise analysis, none of these households would be subjected to consistent direct overflights and associated aircraft noise. In fact, the L_{dnmr} values would be minimal, less than 50 dB throughout both MOAs, and represent little change from ambient noise conditions. Therefore, with respect to Executive Order (EO) 12898, *Environmental Justice*, implementation of this alternative would not cause disproportionately high and adverse environmental or health impacts to any groups or individuals residing in the area, including those from minority or low-income populations.

With regard to Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, as with the Core and Mattamuskeet Alternative, based on the results of the noise analysis (Subchapter 4.2), implementing the Core and Cherry MOA would not disproportionately affect children.

4.6.4 Core MOA Alternative

4.6.4.1 Direct Impacts on Socioeconomic Resources

There would be no direct impacts to socioeconomic resources with implementation of the proposed Core MOA Alternative, as discussed in Subchapter 4.6.2.1.

4.6.4.2 Indirect Impacts on Socioeconomic Resources

The same indirect impacts on socioeconomic resources that were described in Subchapter 4.6.2.2 would apply to implementation of the proposed Core MOA Alternative.

4.6.4.3 Environmental Justice

As demonstrated in Subchapter 4.6.2.3, there would be no environmental justice issues connected with implementation of the proposed Core MOA Alternative.

4.6.5 Mattamuskeet MOA Alternative

4.6.5.1 Direct Impacts on Socioeconomic Resources

There would be no direct impacts to socioeconomic resources with implementation of the proposed Mattamuskeet MOA Alternative, as discussed in Subchapter 4.6.2.1.

4.6.5.2 Indirect Impacts on Socioeconomic Resources

The same indirect impacts on socioeconomic resources that were described in Subchapter 4.6.2.2 would apply to implementation of the proposed Mattamuskeet MOA.

4.6.5.3 Environmental Justice

As demonstrated in Subchapter 4.6.2.3, there would be no environmental justice issues connected with implementation of the proposed Mattamuskeet MOA.

4.6.6 Cherry MOA Alternative

4.6.6.1 Direct Impacts on Socioeconomic Resources

There would be no direct impacts to socioeconomic resources with implementation of the proposed Cherry MOA Alternative, as discussed in Subchapter 4.6.3.1.

4.6.6.2 Indirect Impacts on Socioeconomic Resources

The same indirect impacts on socioeconomic resources that were described in Subchapter 4.6.3.2 would apply to implementation of the proposed Cherry MOA Alternative.

4.6.6.3 Environmental Justice

As demonstrated in Subchapter 4.6.3.3, there would be no environmental justice issues connected with implementation of the proposed Cherry MOA Alternative.

4.7 Land Use and Coastal Zone Management

This subchapter discusses the potential land use impacts of implementing the proposed action or its alternatives on eastern North Carolina. Future land use trends for the counties in the study area are summarized in Table 4.7-1. This information was used to identify land use impact associated with implementation of the proposed action. Potential impacts of the proposed project on the federally approved coastal zone management program in effect in North Carolina are also discussed.

4.7.1 No Action Alternative

4.7.1.1 Land Use

Based on this information, under the No Action Alternative, there would be no direct or indirect changes to existing land use conditions in any of the study area counties as a result of military aircraft operations. Marine Corps aircraft would continue existing training flight activities over the Core Banks and in the Cherry and Mattamuskeet areas at airspeeds below 250 kt when at altitudes less than 10,000 ft (3,048 m), in accordance with FAA regulations published in 14 CFR 91. Furthermore, overflights of wilderness areas and noise sensitive areas (including national parks and national recreational areas and others as described in Subchapter 1.1.2) would continue to occur. In accordance with OPNAVINST 3710.7, aircraft would operate at an altitude no lower than 3,000 ft (914 m) MSL, except when training activities are conducted on a military training route (MTR) or within existing SUA.

4.7.1.2 Coastal Zone Management and Land Use Zoning and Policy

A review and analysis of the applicable coastal zone management policies identified in the Coastal Area Management Plan for North Carolina (see Appendix B) was conducted for this EA. Under the No Action Alternative there would be no effects on the coastal uses and resources of eastern North Carolina. In summary:

- **Manmade Hazards (coastal airspace)** - There would be no change in existing SUA configuration under the No Action Alternative.

- **Economic Development** - The No Action Alternative would have no effect on Craven County's policy to support the growth/development of MCAS Cherry Point and its infrastructure.

- **Emergency Airspace Use** - There would be no change in aircraft operations in eastern North Carolina that could potentially affect use of airspace by emergency aircraft.

Table 4.7-1

Future Land Use Trends in the Study Area Counties

County	Land Use Trends Summary
Beaufort	• Shoreline areas will continue to attract residential development. • Strip commercialization along major transportation arteries will continue to occur unless regulated. • Most high density development will continue to occur in the vicinity of municipalities. • The majority of the county's non-municipal areas will remain in undeveloped to low density land use.
Carteret	• Each year wetland areas will come under pressure due to either agriculture use or land development. • Agricultural areas adjacent to incorporated areas and along the NC 24 and US 70 corridors will continue to be converted to urban uses. • Residential use in the "Down East" area will increase as the significance of the area for retirement develops and sewage disposal problems will occur. • The Bogue and Core Sound "outstanding resource waters" designations will slow or prohibit shoreline developments that cause additional point source pollution discharge.
Craven	• Much of the growth or decline in population within the county, and the effect on land use patterns, is tied to the increase or decrease in military operations at MCAS Cherry Point.
Hyde	• Growth on the mainland will occur along existing state routes and to a greater degree in and around Fairfield, Engelhard, and Swan Quarter. • The most significant redevelopment issues facing Hyde County through 2007 are substandard housing, historic preservation, and reconstruction following a major storm.
Pamlico	• As development continues near fragile areas, resource protection will assume greater significance in the public eye. • Continued development will strain the capacity of the existing transportation system and public services. • Basic demand for affordable housing for the year-round population will need to be addressed. • The most rapid residential development will be centered in unincorporated areas in waterfront areas near Oriental and Broad Creek and the Bay River. • Industrial demand for available land will be relatively minor compared to residential/commercial demand throughout the planning period.
Tyrrell	• Land use is not expected to change greatly from existing conditions because (1) most conversions of agricultural land to residential development have already occurred, (2) the remaining agricultural land is now being legally protected from conversion; and (3) the establishment of the Pocosin Lakes National Wildlife Refuge protects wetlands from potential conversion.
Washington	• New developments in towns will be clustered onto already developed areas with vacant land. • Possible expansion of the Weyerhauser Corporation could change the pattern of residential and commercial development.
Sources: Land Use Plans for the counties of Beaufort (1997), Carteret (1996), Craven (1998), Hyde (1997), Pamlico (1992), Tyrrell (1996), and Washington (1994).	

- **Cultural and Historic Resources** - There would be no change in aircraft operations that could have the potential to affect cultural or historic resources.

- **Continued Public Participation Policies** - the Marine Corps would continue its current practice of keeping residents of eastern North Carolina aware of activities occurring at MCAS Cherry Point and its associated airspace through the efforts of the MCAS Cherry Point Public Affairs Office.

4.7.2 Core and Mattamuskeet MOAs Alternative

4.7.2.1 Land Use

The aircraft overflights associated with military operations in the proposed MOAs would not alter the landscape. There would be no construction activities or other on-ground activities associated with implementation of the proposed action. Thus, there would be no direct impacts on land use resources and management. This means that the proposed action would not result in the displacement, alteration, or otherwise physically affect residential, commercial, industrial, or government facilities.

However, there could be the potential for indirect effects. This potential is assessed in the context of established federal guidelines for land uses compatibility with noise generated by aircraft in areas near airports. As adopted by FICON, the 65 dB L_{dn} has been identified as a criterion that protects those most affected by noise and that can be achieved on a practical basis. In general, noise exposure greater than 65 L_{dn} over residential, recreational, cultural, and entertainment areas, as well as public services, is considered unacceptable (FICON, 1992). While this criterion has been primarily applied to urban locations in proximity to airports, it can also be helpful in developing a basic understanding of the potential effects of aircraft noise in areas underlying special use airspace, such as MOAs. The potential for increasing noise levels by three dB or greater (the minimum change in sound level that is perceptible by an average human ear) is also a consideration in this analysis.

Based on the noise modeling conducted for this alternative (Table 4.2-2), the land areas that would underlie the proposed MOAs would be exposed to L_{dmnr} noise values of less than 50 dB. This noise value is well below the 65 L_{dn} criterion, indicating the proposed action would be generally compatible with underlying land uses, including residential, commercial, and recreational land uses.

While single aircraft flyovers will generate higher levels than the predicted L_{dmnr} values, as mentioned previously, because of the random and widely dispersed way that aircraft operations are typically conducted in a MOA, individual aircraft noise events in any single location underlying the proposed MOAs would typically be heard for only brief periods. Thus, it would be highly unlikely that the same location would be repeatedly and consistently overflown on a

daily or weekly basis. It should be noted, however, that observations of aircraft are not always considered to be negative experiences.

The effects of establishing the proposed airspace action on the Cape Lookout National Seashore and the national wildlife refuges (including the Swanquarter Wilderness Area) are discussed in Subchapter 4.6.2.2.

4.7.2.2 Coastal Zone Management and Land Use Zoning and Policy

The proposed action would be undertaken in a manner consistent to the maximum extent practicable with enforceable coastal zone management policies of the state of North Carolina, as shown in Appendix B (Determination of Consistency with the North Carolina Coastal Area Management Act) and summarized below:

- **Manmade Hazards (Coastal Airspace)** - Three counties (Beaufort, Hyde, and Tyrrell) support the North Carolina Coastal Resources Commission's Aircraft Operations Standards (15A NCAC 07H .0600, and 15A NCAC 07M .0900 and .1000). These policies include FAA minimum altitude standards, noise guidelines, and access corridors to, from, and along the barrier islands up to an altitude of 6,000 ft (1,830 m) except where radar and communication allow positive aircraft control. In addition, a policy adopted by Pamlico County indicates that military activity in and around the county should be consistent with their land use plan to the maximum extent feasible, and that they are opposed to low-level military flights not in compliance with minimum safe altitudes for aircraft operation as described in Federal Aviation Regulations (FAR) part 91. With regard to the above policies, the Marine Corps will consistently adhere to FAA policies, where applicable. In addition, proposed military aircraft training operations would continue to be conducted in adherence with published military range safety procedures and the Department of the Navy's *Naval Aviation Training and Operating Procedure Standardization* (NATOPS). This strict compliance with published safety procedures would minimize the potential for noise impacts and ensure operational safety.

- **Economic Development** - The proposed project is consistent with Craven County's stated policy that the county supports the growth/development of MCAS Cherry Point and its infrastructure. The proposed new airspace will enhance MCAS Cherry Point's mission to maintain the combat readiness of Marine Corps aviators.

- **Emergency Airspace Use** - The proposed action is also consistent with two policies adopted by Beaufort, Hyde, Tyrrell Counties (and the town of Columbia) that stress (1) support for and facilitation of aircraft use by local, state, and federal government agencies for resource management, law enforcement, and public

health, safety, and welfare; and (2) periodic access to restricted areas for routine enforcement flights/emergencies. The floor of the proposed MOAs, at 3,000 ft (914 m) MSL, provides local, state, and other federal government agencies with sufficient opportunity for unrestricted access to the land areas underlying the proposed MOAs. Additionally, MCAS Cherry Point would have control on the use of the airspace and could restrict military operations in event of an emergency.

- **Cultural and Historic Resources** - Aircraft noise-related vibrations and frequencies generated during proposed training exercises are not expected to damage historic structures; furthermore, the brief and transitory nature of aircraft noise and overflights would not adversely impact qualities of integrity or affect a property's eligibility for listing in the National Register of Historic Places.

- **Public Participation** - the proposed action is consistent with policies underscoring the importance of providing opportunities for public participation. Opportunity for public participation are integral to this EA process, as outlined in Chapters 1 and 10 of this EA.

This EA serves as the Marine Corps' Federal coastal consistency determination. The Marine Corps has received North Carolina Department of Environment and Natural Resources (NC DENR) concurrence that the proposed action is consistent to the maximum extent practicable with the enforceable policies of North Carolina's approved State Coastal Plan. The NC DENR Coastal Consistency Determination is included in Appendix B.

4.7.3 Core and Cherry MOAs Alternative

4.7.3.1 Land Use

As with the Core and Mattamuskeet MOAs Alternative, establishing the proposed Core and Cherry MOAs would result in aircraft overflights that would not alter the landscape and involve no on-ground disturbances. Therefore, there would be no direct land use impacts associated with implementation of this alternative.

For the proposed Core MOA, the potential for indirect effects would be similar to those previously described for the Core and Mattamuskeet MOAs Alternative. However, while L_{dmnr} noise values for the Cherry MOA would be the same as identified for the Mattamuskeet MOA (less than 50 dB), the proposed Cherry MOA would only overlie a small portion of the Swanquarter National Wildlife Refuge which suggests somewhat diminished impacts in comparison to the proposed Mattamuskeet MOA. The NC DENR Coastal Consistency Determination is included in Appendix B.

4.7.3.2 Coastal Zone Management and Land Use Zoning and Policy

The impacts of those coastal zone management policies applicable to operations in the proposed Core and Cherry MOAs would be the same as described for the Core and Mattamuskeet MOAs Alternative. The Marine Corps has received NC DENR concurrence that the proposed action is consistent to the maximum extent practicable with the enforceable policies of North Carolina's approved State Coastal Plan.

4.7.4 Core MOA Alternative

4.7.4.1 Land Use

The potential for direct and indirect land use impacts would be the same as previously described for the Core MOA in Subchapter 4.7.2, Core and Mattmuskeet MOA Alternative.

4.7.4.2 Coastal Zone Management and Land Use Zoning and Policy

The impacts of those coastal zone management policies applicable to operations in the proposed Core MOA would be the same as described for the Core and Mattamuskeet MOAs Alternative. The Marine Corps has received NC DENR concurrence that the proposed action is consistent to the maximum extent practicable with the enforceable policies of North Carolina's approved State Coastal Plan. The NC DENR Coastal Consistency Determination is included in Appendix B.

4.7.5 Mattamuskeet MOA Alternative

4.7.5.1 Land Use

The potential for direct and indirect land use impacts would be the same as previously described for the Mattamuskeet MOA under the Core and Mattmuskeet MOA Alternative.

4.7.5.2 Coastal Zone Management and Land Use Zoning and Policy

The impacts of those coastal zone management policies applicable to operations in the proposed Mattmuskeet MOA would be the same as described for the Core and Mattamuskeet MOAs Alternative. The Marine Corps has received NC DENR concurrence that the proposed action is consistent to the maximum extent practicable with the enforceable policies of North Carolina's approved State Coastal Plan. The NC DENR Coastal Consistency Determination is included in Appendix B.

4.7.6 Cherry MOA Alternative

4.7.6.1 Land Use

The potential for direct and indirect land use impacts would be the same as previously described for the Cherry MOA under the Core and Cherry MOA Alternative.

4.7.6.2 Coastal Zone Management and Land Use Zoning and Policy

The impacts of those coastal zone management policies applicable to operations in the proposed Cherry MOA would be the same as described for the Core and Mattamuskeet MOAs Alternative. The Marine Corps has received NC DENR concurrence that the proposed action is consistent to the maximum extent practicable with the enforceable policies of North Carolina's approved State Coastal Plan. The NC DENR Coastal Consistency Determination is included in Appendix B.

4.8 Air Quality

4.8.1 No Action Alternative

The existing air quality conditions identified in Subchapter 3.8 would also be applicable to air quality conditions under the No Action Alternative.

4.8.2 MOA Alternatives

Military aircraft are mobile and normally fly at altitudes where emissions would tend to be dispersed. From earth's surface extending up to altitudes of a few thousand feet, the atmosphere is completely mixed. The vertical limit of this mixing zone is known as the mixing height. Emissions of pollutants released below the mixing height may have an affect on ground-level air quality. Emissions released above the mixing height have no measurable ground-level effects because they become too widely dispersed before reaching ground level. Generally, in the summer season the mixing zone is at a higher altitude for a given time of day than in winter. USEPA (1992) recommends that a mixing height of 3,000 ft (914 m) be used in assessing the effects of aircraft emissions. This 3,000-ft (914-m) mixing height is meant to approximate summertime conditions.

The likelihood for air quality impacts associated with the proposed MOAs was evaluated based on their floor altitude (3,000 ft [914 m] MSL). This floor is the same as the mixing height for pollutants. Thus, all flight activities would occur consistently (100 percent) above the mixing height of 3,000 ft (914 m) MSL for all proposed MOAs. As a result, pollutants from aircraft operations in the MOAs would be dispersed and there would be no significant impact on ground-level air quality conditions.

4.9 Cumulative Impacts

Cumulative effects have been defined by the Council on Environmental Quality (CEQ) in 40 CFR 1508.7 as:

> *impacts on the environment which result 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.*

Accordingly, a cumulative impacts analysis must identify and define the scope of other actions and their interrelationship with the proposed action or its alternatives if there is an overlap in space and time. Cumulative effects are most likely to occur when a proposed action is related to actions that could occur in the same or overlapping geographic location or at the same or a similar time. The following questions were considered in identifying the potential for cumulative impacts in this EA:

- Would the proposed action affect or interact with the same resources that have been or would be affected by past, present, or reasonably foreseeable actions? If so, would the proposed action affect or be affected by impacts of the other action?

- If an interrelationship exists between the proposed actions and other past, present or reasonably foreseeable actions, are there any potentially significant impacts not identified when the proposed action is considered alone?

4.9.1 Scope of the Cumulative Impact Analysis

For the purposes of this analysis, public documents prepared by federal, state, and local government agencies were the primary sources of information for identifying reasonably foreseeable future actions (past and present actions have been considered in the environmental baseline presented in Chapter 3). Consequently, the focus of this cumulative impact analysis is on:

- The land area that would underlie the boundaries of the proposed MOA alternatives, which would include all or portions of seven eastern North Carolina counties (Beaufort, Carteret, Craven, Hyde, Pamlico, Tyrrell, and Washington).

- Reasonably foreseeable future actions occurring within or near the proposed MOA footprints.

The timeframe for cumulative effects would start in early 2003 when the airspace proposed in this EA would likely be implemented and would continue into the foreseeable future.

The No Action Alternative represents environmental conditions that currently exist. However, as is apparent from the analysis of potential environmental impacts in this EA (see Chapter 4), the effects of the MOA alternatives are very similar. For that reason, these MOA alternatives are treated in a combined fashion in this cumulative analysis.

4.9.2 Reasonably Foreseeable Future Proposed Actions

The following four proposed actions were examined and included in this cumulative impacts analysis:

- Introduction of F/A-18E/F aircraft to the US Atlantic Fleet.
- Retirement of F-14 aircraft.
- Development of a new Department of the Navy Outlying Landing Field (OLF).
- Initial F-22 operational wing beddown.

Each of these proposed actions are examined in more detail below.

4.9.2.1 Introduction of F/A-18E/F Aircraft to the US Atlantic Fleet

The Department of the Navy is proposing introduction of 11 new F/A-18E/F Super Hornet squadrons to the US East Coast. These aircraft would replace older F/A-18C/D and F-14 aircraft currently operating out of NAS Oceana. Training activities would occur in the proposed MOAs. Among alternatives being considered are basing the squadrons at NAS Oceana (Virginia Beach, Virginia) or MCAS Cherry Point (Havelock, North Carolina). It is anticipated that the introduction of the F/A-18 E/F squadrons would be completed by Fiscal Year (FY) 2010. Estimated sorties that would use the proposed MOAs were identified for each of these alternatives and are shown in Tables 4.9-1 and 4.9-2, and are also summarized below for each combination alternative (the same trends would also be applicable to the single MOA alternatives):

- **Core and Mattamuskeet MOAs Alternative**

  - If the new F/A-18E/F squadrons were based at NAS Oceana, total sorties associated with the Core MOA would decrease by 212 when compared to present conditions that are shown in Table 4.1-1. Total sorties associated with the Mattamuskeet MOA would increase by 531.

  - Should F/A-18E/F squadrons be based at MCAS Cherry Point, total sorties in the Core MOA would decrease by 4, while sorties in the Mattamuskeet MOA would increase by 523.

Table 4.9-1

Annual Sorties by Airspace and Aircraft Type with Core and Mattamuskeet MOAs Alternative (F/A-18E/F Aircraft Based at NAS Oceana)

Aircraft Type	Annual Sorties by Airspace									
	Day (7:00-10:00 pm)				Night (10:00-7:00 am)				Total Sorties	Total Change from Table 4.1-1
	Core MOA	Matta-muskeet MOA	R-5306A[1]	BT-9/ BT-11[2]	Core MOA	Matta-muskeet MOA	R-5306A[1]	BT-9/ BT-11[2]		
Air Force										
Total Air Force	172	81	285	1,488	1	0	4	12	2,043	+205
Marine Corps										
AV-8 (Fleet)	843	679	2,037	1,328	36	23	67	74	5,087	+270
AV-8 (FRS)[3]	25	562	1,880	867	0	3	11	15	3,363	-61
F/A-18C/D	144	26	100	668	9	0	0	40	987	+102
Helicopters	0	67	134	515	0	0	0	2	718	+34
KC-130	0	0	0	2	0	0	0	2	4	0
Total Marine Corps	1,012	1,334	4,151	3,380	45	26	78	133	10,159	+345
Navy										
F-14C/D (NAS Oceana Fleet)	0	0	0	0	0	0	0	0	0	-632
F-14C/D (NAS Oceana FRS)[3]	0	0	0	0	0	0	0	0	0	-96
F/A-18C/D (Fleet/FRS)	12	613	0	408	0	63	0	80	1,176	-613
F/A-18E/F (Fleet)	0	4	0	610	0	2	0	80	696	+696
F/A-18E/F (FRS)	0	772	0	0	0	28	0	0	800	+800
Total Navy	12	1,389	0	1,018	0	93	0	160	2,672	+155
Other Military										
Other Military Jets	6	9	61	60	0	0	0	0	136	-188
Other Military Props	0	22	90	45	0	0	0	0	157	+4
Other Military Helicopter	0	0	0	186	0	0	0	24	210	+42
Total Other	6	31	151	291	0	0	0	24	503	-142
Total	1,202	2,835	4,587	6,177	46	119	82	329	15,377	+563

Notes:
1. Exclusive of BT-9/BT-11 use.
2. Area within a 5 NM (9.3 km) radius of each target.
3. FRS = Fleet Replacement Squadron.
Source: ATAC Corporation, 2001.

Table 4.9-2

Annual Sorties by Airspace and Aircraft Type with Core and Mattamuskeet MOAs Alternative (F/A-18E/F Aircraft Based at MCAS Cherry Point)

Aircraft Type	Annual Sorties by Airspace									
	Day (7:00-10:00 pm)				Night (10:00-7:00 am)				Total Sorties	Total Change from Table 4.1-1
	Core MOA	Matta-muskeet MOA	R-5306A[1]	BT-9/ BT-11[2]	Core MOA	Matta-muskeet MOA	R-5306A[1]	BT-9/ BT-11[2]		
Air Force										
Total Air Force	170	80	341	1,424	1	0	4	8	2,028	+190
Marine Corps										
AV-8 (Fleet)	810	657	1,970	1,308	41	29	87	76	4,978	+161
AV-8 (FRS)[3]	25	554	1,855	863	1	3	10	16	3,327	-97
F/A-18C/D	142	27	100	664	6	0	0	40	979	+94
Helicopters	0	67	134	518	0	0	0	4	723	+39
MV-22	0	0	0	416	0	0	0	4	420	+420
KC-130	0	0	0	2	0	0	0	2	4	0
Total Marine Corps	977	1,305	4,059	3,771	48	32	97	142	10,431	+617
Navy										
F-14C/D (NAS Oceana Fleet)	0	0	0	0	0	0	0	0	0	-632
F-14C/D (NAS Oceana FRS)[3]	0	0	0	0	0	0	0	0	0	-96
F/A-18C/D (Fleet)	16	76	0	322	0	14	0	76	504	-662
F/A-18C/D (FRS)[3]	0	546	0	0	0	31	0	0	577	-46
F/A-18E/F (Fleet)	159	179	0	812	36	17	0	180	1,383	+1,383
F/A-18E/F (FRS)	41	597	0	444	3	38	0	32	1,155	+1,155
Total Navy	216	1,398	0	1,578	39	100	0	288	3,619	+1,102
Other Military										
Other Military Jets	5	9	61	69	0	0	0	7	151	-173
Other Military Props	0	22	90	45	0	0	0	0	157	+4
Other Military Helicopter	0	0	0	182	0	0	0	24	206	+38
Total Other	5	31	151	296	0	0	0	31	514	-131
Total	1,368	2,814	4,551	7,069	88	132	101	469	16,592	+1,778

Notes:
1. Exclusive of BT-9/BT-11 use.
2. Area within a 5 NM (9.3 km) radius of each target.
3. FRS = Fleet Replacement Squadron.
Source: ATAC Corporation, 2001.

- **Core and Cherry MOAs Alternative** - The same future usage trends with F/A-18E/F squadrons shown above for the Core and Mattamuskeet MOAs Alternative would hold true for this alternative.

In summary, overall there would be an increase in usage of the proposed MOAs when the cumulative effects of East Coast basing of F/A-18E/F squadrons is considered in conjunction with the proposed action. The increase in operational usage of the proposed MOAs has been evaluated in terms of noise impacts using the analytical techniques described in Subchapter 3.2. The results of the analysis are presented in Table 4.9-3 and lead to the conclusion that average noise level increases will not be significant should the F/A-18 E/F be based at either NAS Oceana or MCAS Cherry Point.

Table 4.9-3
Average Noise Levels for F/A-18 E/F based at either NAS Oceana or MCAS Cherry Point

Proposed MOA	Average L_{dnmr} (dB)
Core MOA	< 50
Mattamuskeet MOA	< 50
Cherry MOA	< 50

4.9.2.2 Retirement of F-14 Aircraft

By Fiscal Year 2010 (FY2010), the proposed decommissioning of F-14 squadrons in the Navy is anticipated to be complete. The sorties identified in Tables 4.9-1 and 4.9-2 account for the decommissioning of the F-14 squadrons.

4.9.2.3 Development of a New Department of the Navy Outlying Landing Field (OLF)

The Department of the Navy has begun a study to identify sites that would support the development of an OLF to support MCAS Cherry Point and Beaufort and would supplement Naval Auxiliary Landing Field Fentress near NAS Oceana. There are six alternatives currently under consideration, five of which are located in eastern North Carolina and one in Georgia. Of those alternatives in eastern North Carolina, three would be within or in proximity to the footprint of the proposed MOAs:

- **Alternative C** - Located in southern Washington and northern Beaufort Counties, this OLF would be about 50 NM (93 km) north of MCAS Cherry Point. It would underlie the proposed Cherry MOA but be west of the proposed Mattamuskeet MOA. There would be no interaction with the proposed Core MOA.

- **Alternative D** - This alternative site is in eastern Hyde County, about 59 NM (110 km) northeast of MCAS Cherry Point. It would underlie the proposed Mattamuskeet MOA, but be east of the proposed Cherry MOA and have no interaction with the proposed Core MOA.

- **Alternative E** - This alternative site is in the north-central portion of Craven County, adjacent to portions of both the Mattamuskeet and Cherry MOAs. There would be no interaction with the proposed Core MOA. The site is about 38 NM (71 km) northwest of MCAS Cherry Point.

Details on use of the OLF (i.e., number of sorties, etc.) are not yet available. However, the level of use at any alternative would be heavily dependent on the Navy decision concerning the basing of the F/A-18E/F aircraft. A decision on the basing issue is anticipated to be about one year away.

4.9.2.4 Initial F-22 Operational Wing Beddown

On January 15, 2002, the US Air Force signed a Record of Decision to beddown its initial F-22 operational wing at Langley Air Force Base, Hampton, Virginia. The action would involve establishing three squadrons at Langley for a total of 72 primary aircraft and 6 backup aircraft. The F-22 squadrons would replace existing combat F-15C aircraft over a period of approximately five years beginning in 2004. The primary SUA that these aircraft would train in would include warning areas over the Atlantic Ocean (W-72, W-107, W-110, W-122, W-386, and W-387), and the Farmville MOA over south central Virginia. In North Carolina, the only SUA identified for occasional use is the Seymour Johnson Echo MOA and the Dare County Bombing Range. The F-22 is not anticipated to train in airspace under the control of MCAS Cherry Point, which would include the proposed MOAs. Therefore, there are no cumulative effects from the F-22 operational wing beddown at Langley Air Force Base when considered in conjunction with the proposed action.

5 MITIGATION MEASURES

Based upon the anticipated impacts under each alternative, the implementation of mitigation measures is not necessary.

6 RELATIONSHIP OF THE PROPOSED ACTION TO FEDERAL, STATE, AND LOCAL PLANS, POLICIES AND CONTROLS

The proposed action would comply with existing federal regulations and with state, regional, and local policies and programs. These federal, state, and local regulations, policies, and controls, as well as the relationship of the proposed action to them, are summarized below:

- **National Environmental Policy Act (NEPA)** - This EA has been prepared pursuant to the National Environmental Policy Act (NEPA) of 1969, in accordance with Council on Environmental Quality and Navy regulations implementing NEPA (40 CFR 1500-1508, and 32 CFR 775, respectively).

- **RCRA, CERCLA, and SARA** - The Resource Conservation and Recovery Act (RCRA), passed in 1976, continued earlier provisions relating to solid waste and resource recovery, including hazardous waste, by setting standards for hazardous waste treatment, storage, and disposal facilities. Subsequently, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) was passed in 1980 to provide a Superfund for cleanup of sites with uncontrolled releases of hazardous substances. This program was continued in the Superfund Amendments and Reauthorization Act (SARA) of 1986. Section 211 of SARA established the DoD Environmental Restoration Program and the Defense Environmental Restoration Account. Major responsibilities for monitoring compliance with these acts rest with the USEPA.

  The Navy recognizes its responsibilities for control and management of hazardous substances and wastes in compliance with federal, state, and local requirements. Although there are no hazardous wastes or materials specifically associated with aircraft utilization of the MOAs, aircraft do carry hazardous materials that may be released in the event of a mishap. The magnitude and duration of the spill would be controlled through rescue and spill response procedures. The primary response to any mishap is installation/range personnel. The second-tier response is provided by a local oil spill removal organization capable of responding within one hour. This planned response allows for quick containment of any spill and minimize any potential land or water contamination.

- **Clean Water Act (CWA)** - The Clean Water Act of 1977, as amended, was designed to assist in restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. The CWA covers discharge of pollutants into navigable waters (including wetlands), wastewater treatment management, and protection of relevant fish, shellfish, and wildlife. Spills of hazardous materials that occur as a result of an

aircraft accident would be controlled through rescue and spill response procedures as described immediately above.

- **Clean Air Act (CAA)** - The Federal Air Pollution Control Act of 1955, the succeeding Clean Air Act of 1970, and subsequent amendments specify regulations for control of the nation's air quality. Federal and state ambient air standards have been established for specific criteria pollutants. The 1990 amendments to the Act require federal facility compliance with all substantive and administrative requirements for air pollution control. Because the floor altitude of the proposed MOAs would be 3,000 ft (914 m) MSL, all flight activities would occur consistently above the mixing height (i.e., emissions released above the mixing height have no measurable ground-level effects because they become too widely dispersed before reaching ground level). As a result, pollutants from aircraft operations in the MOAs would be dispersed and there would be no significant impact on ground-level air quality conditions.

- **Endangered Species Act (ESA)** - The Endangered Species Act of 1973, as amended, provides for the conservation of threatened and endangered species of animals and plants, and the habitats in which they are found. The proposed action would have no effect or impacts on threatened or endangered species of plants and animals.

- **Marine Mammal Protection Act (MMPA)** - The Marine Mammal Protection Act strictly prohibits the intentional or unintentional "taking" of marine mammals without a permit from the federal regulatory agencies: National Marine Fisheries Service and the US Fish and Wildlife Service (USFWS). "Taking" is defined as to **harass**, hunt, capture, or kill a marine mammal. There are no exemptions for national defense, and the provisions of the act apply to US flagged ships within US territorial waters and on the high seas. Many marine mammals, principally the whales, are listed as endangered or threatened, and are protected under the Endangered Species Act (ESA). Based on the analysis contained in this EA, there would be no take by harm or harassment of marine mammals.

- **National Historic Preservation Act (NHPA)** - The National Historic Preservation Act of 1966, as amended, and its implementing regulations provide for the protection, enhancement, and preservation of any property that possesses significant architectural, archaeological, or historical characteristics. Section 106 of the Act states that federal agencies must take into account the effects of their actions on any district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places. The regulations for Section 106, as stated in 36 CFR 800, *Protection of Historic Properties*, provide specific criteria for evaluating the effects of federal actions and assessing adverse effects on historic resources.

Given the altitude of, and noise-levels generated by, the aircraft that would use the proposed MOAs (described in Subchapter 4.5), no noise induced structural damage to any historic resources that may be found in the footprint or vicinity of the MOAs would occur. In addition, while aircraft noise and overflights could potentially affect the setting of the cultural resources in the land area underlying the proposed MOAs, such impact would be brief and transitory in nature. Therefore, it would not adversely impact qualities of integrity or jeopardize a property's eligibility for listing on the National Register of Historic Places. Thus, the proposed action would have no adverse effects on cultural resources.

- **Coastal Zone Management Act** - The Coastal Zone Management Act (CZMA) of 1972 (16 USC 1451, as amended) provides assistance to states, in cooperation with federal and local agencies, for developing land and water use programs in coastal zones. Section 307 of the CZMA stipulates that federal projects that affect coastal resources or uses of a state's coastal zone must be consistent to the maximum extent practicable with the relevant enforceable policies of the affected state's federally-approved coastal management plan.

  The proposed action will occur within airspace overlying North Carolina's coastal zone. The North Carolina's Coastal Area Management Act (CAMA) was passed in accordance with the federal CZMA. CAMA required local governments in each of the 20 coastal counties in the state to prepare and implement a land use plan and ordinances for its enforcement. Upon approval by the North Carolina Coastal Resources Commission, the plan becomes part of the North Carolina Coastal Management Plan.

  The proposed action has been evaluated for consistency with the North Carolina Coastal Zone Management Plan. The results of that evaluation are documented in the Coastal Consistency Determination presented in Appendix B of this EA. Based on this evaluation, the Department of the Navy has determined that the proposed action will be consistent to the maximum extent practicable with the relevant enforceable policies of the federally-approved North Carolina Coastal Zone Management Plan.

- **Executive Order (EO) 11990, Protection of Wetlands** - This order of May 24, 1977 directs federal agencies to take action to protect wetlands on their property, and mandates review of proposed actions on wetlands through procedures established by the NEPA. The proposed action would not affect wetlands.

- **Executive Order 11988, Floodplain Management** - This order sets forth the responsibilities of federal agencies in reducing the risk of flood loss or damage to personal property, minimizing the impact of flood loss, and restoring the natural and beneficial functions of floodplains. The proposed action would not affect floodplains.

- **Executive Order 12898 Environmental Justice** - Executive Order 12898 directs all federal departments and agencies to incorporate environmental justice in achieving their mission by conducting programs, policies, and activities that substantially affect human health or the environment in a manner that does not exclude communities from participation in, deny communities the benefits of, nor subject communities to discrimination under such actions because of their race, color, or national origin. The ethnic makeup and income of the study area population are described in Subchapter 3.6 and summarized in Table 3.6-1 of this EA. Based on this data and the assessment of impacts conducted for this EA, the Navy has concluded that the proposed action would not cause disproportionately high and adverse environmental or health impacts to any minority or low-income populations.

- **Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks** - This executive order requires each federal agency to identify and assess environmental health and safety risks to children. "Environmental health and safety risks" are defined as "risks to health or to safety that are attributable to products or substances that the child is likely to come in contact with or ingest." Regulatory actions that are covered and affected by this EO are those substantive actions in a rule-making, and concern an environmental health risk or safety risk that an agency has reason to believe may disproportionately affect children. This proposed action would not disproportionately affect children.

- **Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds** – Executive Order 13186 directs federal agencies that are taking actions that may have negative effects on migratory bird populations to develop and implement a Memorandum of Understanding (MOU) with the USFWS that promotes the conservation of migratory bird populations. The EO states that "each agency is encouraged to immediately begin implementing the conservation measures set forth" within the Order, "as appropriate and practicable." As this relates to the NEPA process, it is stated that federal agencies should ensure that environmental analyses required by NEPA evaluate the effects of actions on migratory birds, with emphasis on species of concern. Based on the assessment of impacts conducted for this EA, the Navy has concluded that the proposed action would not have significant negative effects on migratory bird populations.

- **State and Local Plans and Policies** - The Navy pursues close and harmonious planning relations with local and regional agencies and planning commissions of adjacent cities, counties, and states for cooperation and resolution of mutual land use- and environment-related problems. In addition, coordination may be made with state and regional planning clearinghouses as established pursuant to Executive Order 12372 of 1982. In preparing this EA, information from relevant state, regional, and local agencies was reviewed for data on potential impacts of the proposed project.

7 UNAVOIDABLE ADVERSE EFFECTS

Based upon the anticipated impacts under each alternative, no unavoidable adverse effects would be expected.

8 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Short-term uses of the environment are considered those that occur over a period of less than the life of the proposed action. Conversely, long-term uses of the environment include those impacts that would persist for a period of five years or the life of the proposed action. However, it is apparent that the long-term impacts are directly related to the short-term usage of the land. In general, for the proposed action, short-term uses would be limited to only above ground military aircraft use of the proposed MOAs. Impacts associated with this airspace use are essentially short-term in nature and would not be expected to affect long-term productivity of the environment.

9 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that use of these resources may have on future generations. The use or destruction of specific resources (e.g., energy and minerals) that cannot be replaced within a reasonable time frame are termed an irreversible resource commitment of that resource. Commitments of resources associated with the action would include the consumption of aviation fuel by aircraft during training missions within the proposed airspace.

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11 GLOSSARY

Ambient Air Quality Standards: measures established on a state or federal level which define the limits for airborne concentrations of designated "criteria" pollutants (nitrogen dioxide, sulfur dioxide, carbon monoxide, ozone, lead, and particulate matter) to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards).

Conformity Rule: effective since January 31, 1994 to ensure that activities of federal agencies do not inhibit reaching goals of federal and state implementation plans. The rule requires federal agencies to review new actions and decide whether the actions would worsen an existing NAAQS violation, cause a new NAAQS violation, delay the implementation plan attainment schedule of the NAAQS, or otherwise contradict implementation plan requirements.

Controlled Airspace: An 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.

Criteria Pollutants: includes nitrogen dioxide, carbon monoxide, sulfur dioxide, ozone, lead, and particulate matter. The Clean Air Act required the USEPA to establish air quality standards for common and widespread pollutants after preparing "criteria documents" summarizing scientific knowledge on their human health effects.

Critical Habitat: the area where the species of concern resides that contains physical or biological characteristics essential to the survival of the species, or the areas surrounding such habitat which are essential to the survival of the species. However, it does not include all habitat that could be used by the species.

Cultural Resources: Buildings, structures, sites, districts, and objects eligible for or included in the National Register of Historic Places; "cultural items," including but not limited to those defined in 25 USC 3001; American Indian, Eskimo, Aleut, or Native Hawaiian sacred sites for which access is protected under 42 USC 1996; "archaeological resource" as defined by Section 470a-11 of 16 USC; and "archaeological artifact collections and associated records" defined under 36 CFR 70.

Cumulative Impact: two or more individual effects that, when considered together, are significant, or which compound or increase other environmental impacts.

Day-Night Average Sound Level: For the evaluation of community noise effects, and particularly aircraft noise effects, the Day-Night Average Sound Level (abbreviated L_{dn} or DNL) is used. This metric averages aircraft sound levels at a location over a 24-hour period, with a 10-decibel (dB) adjustment added to those noise events that occur between 10:00 pm and 7:00 am

(local time). This 10-dB "penalty" represents the added intrusiveness of sounds that occur during normal sleeping hours, both because of the increased sensitivity to noise during those hours and because ambient sound levels during nighttime are typically 10 dB lower than during daytime hours.

Endangered Species: defined in 16 USC 1532 as any species that is in danger of extinction throughout all or a significant portion of its range (other than a species of the Class Insect designated as pest). Federally endangered species are listed in 50 CFR 17.12.

Estuarine: relating to a water passage where the tide meets a river current; an arm of the sea at the lower end of a river (Webster's Dictionary 1990). Relating to the embayment at the junction of a river with the sea, typically containing water of low salinity (Barnes 1987).

Finding of No Significant Impact (FONSI): A public document that briefly describes why a proposed action, not otherwise excluded from NEPA, would not have a significant effect on the human environment and, therefore, does not require preparation of an EIS.

Fixed-Wing Aircraft: A generic term used to refer to the broadest class of aircraft – those in which the aerodynamic lift is generated when the airframe including the fixed- or non-rotating wing is moved through the air by forward thrust from a jet engine or engine-driven propeller. Examples of a fixed-wing aircraft flying in the MCAS Cherry Point area are AV-8B Harriers and C-130 Hercules.

Flight: One or more aircraft departing at an base airfield, conducting one or more missions, possibly including landings and takeoffs at other airfields and returning to base.

Flight Hour: An hour of airborne flight time, excluding ground taxi and other ground operations.

General Aviation: That portion of civil aviation other than scheduled airlines, charter air carriers, and large aircraft commercial operators (such as Federal Express). Examples of general aviation operations range from pleasure or business flights in small single-engine aircraft to corporate flight activities in high performance aircraft such as business jets.

Habitat: Place where an animal or plant normally lives, often characterized by a dominant plant form or physical characteristic.

Instrument Flight Rules: Rules governing the procedures for conducting instrument flight.

Landings: a going or bringing to a surface (as land or shore) after a voyage or flight (e.g., catches) (Webster's Dictionary 1990).

Maximum Sound Level: The highest A-weighted sound level measured during a single event in which the sound level changes value as time goes on (e.g., an aircraft overflight) is called the maximum A-weighted sound level or maximum sound level, for short. It is abbreviated L_{max}, or L_{Amax}. The maximum sound level is important in judging the interference caused by a noise event with conversation, television, or radio listening, sleep, or other activities.

Military Operations Area: A type of special use airspace of defined vertical and lateral dimensions established outside Class A airspace (i.e., below 18,000 ft [5,400 m] above MSL) to separate/segregate certain military activities from IFR traffic and to identify for VFR traffic where these activities are conducted.

Military Training Route: Airspace of defined vertical and lateral dimensions established for the conduct of military flight training at airspeeds in excess of 250 knots.

Notice of Intent: a written notice published in the *Federal Register* that announces the intent to prepare an EIS and provides information about a proposed federal action, alternatives, and the scoping process.

Onset-Rate Adjusted Day-Night Average Sound Level: A noise metric that accounts for the "surprise" effect of the onset rate of aircraft noise on humans associated with aircraft operations along low-altitude Military Training Routes (MTRs) and in Military Operating Areas (MOAs) and Restricted Areas/Ranges. Because of the sporadic occurrences of aircraft overflights along MTRs, in MOAs, and Restricted Areas/Ranges, the number of average daily operations is determined from the calendar month with the highest number of operations in each area. This monthly average is denoted L_{dnmr}.

Restricted Area: A type of special use airspace within which the flight of aircraft, while not wholly prohibited, is subject to restriction.

Scoping: early consultation with federal and state agencies, and interested public to identify possible alternatives and the significant issues to be addressed in an EIS.

Sortie: (1) In the context of squadron operations: one aircraft making one departure and arrival; (2) in the context of training area operations: one aircraft entering a region of airspace, operating there for a period of time, and leaving.

Sound Exposure Level (SEL): Sound Exposure Level (SEL) - This metric accounts for both the maximum sound level (described above) and the length of time a sound lasts. However, this metric 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 one second. SELs decrease as altitude increases and varies according to the type of aircraft, its altitude or distance from the observer, and its speed. Since aircraft overflights are usually longer than one second in duration, the SEL of an overflight is usually greater than L_{max}. Because the SEL is a composite

metric which represents both the intensity and duration of a sound, it is well established within the scientific community that it measures the impacts of sound more reliably than L_{max}.

Sound Frequency: The number of times per second air vibrates or oscillates. Low-frequency sounds are characterized as rumbles or roars, while sirens or screeches typify high-frequency sounds.

Special Use Airspace: Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities.

Threatened Species: any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Threatened species are also listed in 50 CFR 17.12.

Visual Flight Rules: Rules that govern the procedures for conducting flight under visual conditions.

Warning Area: A type of special use airspace that may contain hazards to nonparticipating aircraft in international airspace.

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APPENDIX A

LETTER OF CONCURRENCE FROM US FISH AND WILDLIFE SERVICE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

June 2, 2003

Mr. G. W. Radford
Environmental Affairs Officer
Marine Corps Air Station
PSC Box 8003
Cherry Point, North Carolina 28533-0003

Dear Mr. Radford:

The U.S. Fish and Wildlife Service (Service) has reviewed your letter of March 25, 2003 regarding the proposed designation of two independent Military Operations Areas (MOAs) in coastal North Carolina. These MOAs would provide special use airspace in support of tactical, military aircraft training. Their purpose is to provide a more realistic training environment for U. S. Navy and Marine Corps aviators. Our comments are provided in accordance with section 7(a)(2) of the Endangered Species Act (Act) of 1973, as amended (16 USC 1531 *et seq.*).

Your March 25, 2003 letter seeks the Service's concurrence on the Marine Corps' determination of effects on federally-listed species regarding proposed operations in the Core MOA and the Mattamuskeet MOA. The locations for these MOAs are described in the Marine Corps' Environmental Assessment for the Proposed Military Operations Areas in Eastern North Carolina, dated June 2002 (EA). Electronic mail, forwarded by Ms. Robin Ferguson of your staff, provided updated information supplementing the June 2002 EA regarding federally-listed species.

Based on the information contained in the EA, your letter states that the proposed operations within the Core and Mattamuskeet MOAs (the proposed action) will have no effect on the West Indian manatee (*Trichechus manatus*), loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas*), Kemp's ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), hawksbill turtle (*Eretmochelys imbricata*), red wolf (*Canis rufus*), eastern cougar (*Felis concolor couguar*), American alligator (*Alligator mississippiensis*), Short-nosed sturgeon (*Acipenser brevirostrum*), red-cockaded woodpecker (*Picoides borealis*; RCW) or Rafinesque's big-eared bat (*Plectocus rafinesqueii*). Your letter also contains the Marine Corps' biological conclusion that the proposed action is not likely to adversely affect the piping plover (*Charadrius melodus*) or the roseate tern (*Sterna dougallii*).

According to the summary information contained in the EA revision, the roseate tern is an occasional visitor to North Carolina's Outer banks and is considered by the North Carolina Natural Heritage Program as "..an accidental or casual species to the state." Potter et al. (1980, pg. 178) make reference to one roseate tern nest documented near Core Banks in 1973. This is

the only known nest in Carteret County, to date. The likelihood that the proposed establishment and use of the Core MOA will impact the roseate tern appears remote.

The Core MOA contains critical habitat for wintering piping plovers. This critical habitat is comprised of intertidal beaches, dunes and flats between the annual low and annual high tide marks as well as associated dunes and flats above the annual high tide line. The proposed action does not involve any disturbance to critical habitat for piping plovers and the Marine Corps does not anticipate any effects on critical habitat.

While there is little information that specifically addresses potential impacts of the proposed action on piping plovers, the EA references observations made on snowy plovers (*Charadrius alexandrinus nivosus*) and their reaction to rocket launches on Vandenberg Air Force Base, California. In the research cited in the EA, Snowy plovers appeared to have a minor instantaneous reaction to man-caused disturbances. However, no changes were detected in snowy plovers' use of wintering habitat and nesting areas or in nesting success. According to the EA, effects of the proposed action are expected to be more brief and less intense than the disturbance-causing activities monitored at Vandenberg.

The Marine Corps expects that of the two proposed MOAs, the one with the greatest potential for affecting shorebirds, including the piping plover, is the Core MOA. According to the information provided by Ms. Ferguson, effects of the proposed use of the Core MOA on piping plovers would be limited due to the operational characteristics of this unit. The Marine Corps anticipates five or six sorties per day to pass through the Core MOA. Of these, two passes might be within the lowest altitude category (3,000 to 5,000 feet).

No specific route would be assigned across the Core MOA and aircraft might pass over Core Banks anywhere within the 35 nautical mile - long MOA. It is unlikely that aircraft flying through the MOA at the lowest altitude will pass over the same point on the earth twice in one day. The loudest sound will be experienced only on the landmass directly beneath the passing airplane. The farther away a given point on the ground is from the flight path, the lower the intensity of the sound at that point.

Tactical air traffic would be passing perpendicularly across Core Banks. The time an F/A-18 C/D or similar aircraft would require to pass through the Core MOA is less than one minute. Therefore, Core Banks might receive maximum sound exposure levels of approximately 96 decibels for a period of between one and two minutes per day. It appears that the potential for the effects of this moderately loud sound intensity on shorebirds, including the piping plover and roseate tern, will be offset by the low flight frequency and randomness of flights within the Core MOA.

Based on the information provided in your March 25, 2002 letter and information provided by Ms. Robin Ferguson, the Service concurs with the determination that the proposed designation of the Core and Mattamuskeet Military Operations Areas in coastal North Carolina is not likely

to adversely affect the piping plover, roseate tern, or any other federally listed species, their formally designated critical habitat, or species currently proposed for federal listing under the Endangered Species Act, as amended. For species under the jurisdiction of the Service, we believe that the requirements of section 7(a)(2) of the Act have been satisfied. We remind you that obligations under section 7 consultation must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is subsequently modified in a manner that was not considered in this review; or, (3) a new species is listed or critical habitat determined that may be affected by the identified action.

If you have any questions regarding this matter, please contact Mr. John Hammond at (919) 856-4520 (Ext. 28). Thank you for your continued cooperation with our agency.

Sincerely,

Garland B. Pardue

Garland B. Pardue, Ph.D.
Ecological Services Supervisor

Literature Cited:

Potter, Eloise F., James F. Parnell, and Robert P. Teulings. Birds of the Carolinas. The University of North Carolina Press, Chapel Hill. Chapel Hill, North Carolina. pp. 1 - 408.

APPENDIX B

DETERMINATION OF CONSISTENCY
WITH THE NORTH CAROLINA COASTAL AREA MANAGEMENT ACT

APPENDIX B

DETERMINATION OF CONSISTENCY WITH THE NORTH CAROLINA COASTAL AREA MANAGEMENT ACT

B.1 Introduction and Statement of Consistency

The Coastal Zone Management Act (CZMA) of 1972 (16 USC 1451, as amended) provides assistance to states, in cooperation with federal and local agencies, for developing land and water use programs in coastal zones. Section 307 of the CZMA stipulates that federal projects that affect coastal resources or uses of a state's coastal zone must be consistent to the maximum extent practicable with the relevant enforceable policies of the affected state's federally-approved coastal management plan.

The proposed action will occur within airspace overlying North Carolina's coastal zone. The North Carolina's Coastal Area Management Act (CAMA) was passed in accordance with the federal CZMA. CAMA required local governments in each of the 20 coastal counties in the state to prepare and implement a land use plan and ordinances for its enforcement. Upon approval by the North Carolina Coastal Resources Commission, the plan becomes part of the North Carolina Coastal Management Plan.

The proposed action, the establishment of new special use airspace (SUA) in form of Military Operations Areas (MOAs) in eastern North Carolina, has been evaluated for consistency with the North Carolina Coastal Zone Management Plan. The results of that evaluation are documented in this Coastal Consistency Determination. Based on this evaluation, the Department of the Navy has determined that the proposed action will be consistent to the maximum extent practicable with the relevant enforceable policies of the federally-approved North Carolina Coastal Zone Management Plan.

B.2 Description of the Proposed Action and Alternatives

MCAS Cherry Point is located midway along the Atlantic Coast of North Carolina on the south bank of the Neuse River. The air station is about 20 miles (32 kilometers [km]) north of Atlantic Beach, North Carolina, and about 90 miles (144 km) west-southwest of Cape Hatteras, North Carolina. The air station currently serves as the Marine Corps' major East Coast tactical aviation training facility.

The Marine Corps proposes to enhance existing and future training opportunities for the Second Marine Aircraft Wing (2d MAW) and other aircraft operating out of Marine Corps Air Station (MCAS) Cherry Point. This would be achieved by establishing new SUA in eastern North Carolina in the form of MOAs (Figure 2-2, General Location of Alternative Military Operations Areas). These MOAs would provide the following training enhancements: (1) entry to and exit from a Warning Area over the Atlantic Ocean into existing restricted airspace at a minimum altitude of 3,000 ft (914 m) MSL and at speeds less than supersonic; and (2) additional room for military aircraft to perform required training activities and maneuvers (adjacent to but outside of existing restricted airspace and associated target areas). With these training enhancements, limitations in existing aviation training airspace would be reduced, thereby meeting the need of 2d MAW aviators and pilots from other military services to effectively acquire and maintain the critical skills essential to air combat, now and in the future.

The alternatives identified below are basically independent of each other and have stand-alone value for improving the quality of training available to Marine Corps aviators in eastern North Carolina. However, while full implementation of any one of the identified alternatives would have a positive effect on the quality of training for Marine Corps aviation, a combination of the Core MOA (Core Banks Area) with any of the other proposed MOAs would result in the greatest training benefit. Also, it should be made clear that the Marine Corps is not proposing to create all of these MOAs, rather, at most the Marine Corps desires to create two (Core MOA plus one other). Consequently, this EA examines the impacts of no action and of establishing a combination of two MOAs (Core plus 1) or a single MOA:

- Core and Mattamuskeet MOAs.
- Core and Cherry MOAs.
- Core MOA.
- Mattamuskeet MOA.
- Cherry MOA.

The proposed Core MOA would overlie a portion of North Carolina's Core Banks (Carteret County), extending 30 miles (48 km) along the Core Banks from about eight miles (13 km) northeast of the Cape Lookout lighthouse to about 1.25 miles (2 km) from the northeastern end of Portsmouth Island. The MOA would also extend about three nautical miles (NM) (5.6 km) to the southeast over the Atlantic Ocean. The floor of the proposed MOA would be at 3,000 ft (914 m) MSL and the ceiling would be at 17,999 ft (5,486 m) MSL.

The proposed Mattamuskeet MOA would overlie portions of North Carolina's Beaufort, Hyde, Pamlico, Tyrell, and Washington counties with approximate dimensions of 25 by 30 miles (40 by 48 km). The floor and ceiling of the Mattamuskeet MOA would be the same as identified for the proposed Core MOA, from 3,000 ft (914 m) MSL to 17,999 ft (5,486 m) MSL. The new airspace would overlie portions of several National Wildlife Refuges (Alligator River, Lake Mattamuskeet, Swanquarter, and Pocosin Lakes) as well as the Swanquarter Wilderness Area.

The proposed Cherry MOA alternative would be an airspace with the approximate dimensions of 25 by 30 miles (40 by 48 km). It is situated over portions of Beaufort, Craven, Hyde, Pamlico and Washington counties of North Carolina and the Pamlico and Pungo rivers (Figure 2-2). It would also overlie a portion of the Swanquarter National Wildlife Refuge. The floor and ceiling of the Mattamuskeet MOA would be the same as identified for the proposed Core MOA, from 3,000 ft (914 m) MSL to 17,999 ft (5,486 m) MSL.

The Marine Corps has selected the Core and Mattamuskeet MOA combination as the preferred alternative.

B.3 Identification of Reasonably Foreseeable Effects and Consistency with Relevant Enforceable Policies of the State CZMP

CAMA of 1974 was passed in accordance with the federal CZMA of 1972. CAMA required local governments in each of the 20 coastal counties in the state to prepare and implement a land use plan and ordinances for its enforcement. Upon approval by the North Carolina Coastal Resources Commission, the plan becomes part of the North Carolina Coastal Area Management Plan. Coastal zone management policies adopted in each plan must be consistent with established state and federal policies. Specifically, policy statements are required for resource protection; resource production and management; economic and community development; continuing public participation; and storm hazard mitigation, post-disaster recovery, and evacuation plans. The coastal zone policies of the counties of Beaufort, Carteret, Craven, Dare, Hyde, Pamlico, Tyrrell, and Washington, as well as the Beaufort County towns of Aurora, Bath and Belhaven are presented in tables at the end of this appendix.

Land Use Plan CZM policies of interest to the proposed action include:

- Manmade Hazards (coastal airspace).
- Protection of Significant Cultural Resources.
- Continued Public Participation Policies.

In order for a County or City land use policy to be relevant to a federal action, the individual policy must be enforceable. Enforcement is usually accomplished through the issuance of a permit, license, or other similar process. If there is no means for enforcing a policy (i.e., no permit or other means of regulating that policy), then the policy may be considered guidance, which should be considered by a federal agency, but the requirement for an agency to be consistent to the maximum extent practicable does not apply. The protection of cultural resources is the only enforceable policy of the three listed above. Proposed actions that may have effects on cultural resources will be reviewed by the State Historic Preservation Officer (SHPO) under Section 106 of the National Historic Preservation Act (36 CFR Part 800). The SHPO may issue a

finding of no effect, no adverse effect, or adverse effect on resources listed or eligible for listing on the National Register of Historic Places. Beaufort, Carteret, Craven, Hyde, Pamlico, Washington, and the Town of Bath made reference in their Land Use Plans to coordinating land use with the North Carolina SHPO (Department of Cultural Resources/Division of Archives and History).

Three counties (Beaufort, Hyde, and Tyrrell) discuss under the Manmade Hazards or Coastal Airspace sections their support of the North Carolina Coastal Resources Commission's Aircraft Operations Standards (15A NCAC 07H .0600, and 15A NCAC 07M .0900 and .1000). These policies include FAA minimum altitude standards, noise guidelines, and access corridors to, from, and along the barrier islands up to an altitude of 6,000 ft (1,830 m) except where radar and communication allow positive aircraft control. In addition, a policy adopted by Pamlico County indicates that military activity in and around the county should be consistent with their land use plan to the maximum extent feasible, and that they are opposed to low-level military flights not in compliance with minimum safe altitudes for aircraft operation as described in Federal Aviation Regulations (FAR) part 91. With regard to the above policies, the Marine Corps will consistently adhere to FAA policies, where applicable.

In addition, the proposed project is consistent with Craven County's stated policy that the county supports the growth/development of MCAS Cherry Point and its infrastructure. The proposed new airspace will enhance MCAS Cherry Point's mission to maintain the combat readiness of Marine Corps aviators.

The proposed action is also consistent with two policies adopted by Beaufort, Hyde, Tyrell Counties (and the Town of Columbia) that stress (1) support for and facilitation of aircraft use by local, state, and federal government agencies for resource management, law enforcement, and public health, safety, and welfare; and (2) periodic access to restricted areas for routine enforcement flights/emergencies. The floor of the proposed MOAs, at 3,000 ft (914 m) MSL provides local, state, and other federal government agencies with sufficient opportunity for unrestricted access to the land areas underlying the proposed MOAs.

Finally, the proposed action is consistent with policies underscoring the importance of providing opportunities for public participation. Opportunity for public participation are integral to this NEPA process, as outlined in Chapter 1 of this EA.

Table B-1

Beaufort County (1997) Land Use/Coastal Zone Management Policies

Resource Protection Policies	Applicability to Project
Community Attitude Toward Resource Protection	Not Applicable
Soils	Not Applicable
Flood Hazard Areas	Not Applicable
Groundwater/Protection of Potable Water Supplies	Not Applicable
Manmade Hazards	
• Support state technical requirements and program approval for underground storage tanks	Not Applicable
• Opposes disposal of toxic wastes in planning jurisdiction	Not Applicable
• Expansions of Aviation Military Restricted Areas or Military Operations Areas must be consistent with civil aviation regulations, state, and federal regulations	Consistent.
• Supports North Carolina Coastal Resources Commission aircraft operations standards (15A NCAC 07H .0600, 15A NCAC 07M .0900 and .1000)	Consistent.
• Supports minimum altitude standards of FAA	Consistent.
• Airspace activity associated with coastal development shall not impose an increase in average noise exceeding 10 dBA above background levels.	Not an Enforceable Policy
• The maximum noise level associated with any single event shall not exceed 85 dBA.	Not an Enforceable Policy
• Supports NC policy that access corridors free of special use airspace designations shall be preserved along the length of the barrier islands and laterally at intervals not to exceed 25 miles to provide unobstructed access	Not an Enforceable Policy
• Supports NC policy that access corridors shall extend from the surface to an altitude of 6,000 ft AGL except where communication and radar services allow positive aircraft control at lower altitudes	Not an Enforceable Policy
• Supports facilitation of aircraft use by local, state, and federal government agencies for resource management, law enforcement, and public health, safety, and welfare	Consistent
• Supports periodic access to restricted areas for routine enforcement flights/emergencies	Consistent
• Public trust waters subject to surface water restrictions for use in military training shall be opened to commercial fishing at appropriate times for harvest	Not Applicable
• Area of restricted surface waters shall be as least as large as recommended safety zone in areas where laser weaponry is used	Not Applicable
• Water quality shall be tested periodically in surface water restricted areas surrounding targets	Not Applicable
Stormwater Runoff	Not Applicable
Cultural/Historic Resources	
• Coordinate housing code enforcement/redevelopment projects, county public works projects with North Carolina Department of Affordable Housing	Not Applicable
• Encourage citizen awareness/public educational opportunities for county historic /natural resources	Not Applicable
Industrial Impacts on Fragile Areas	Not Applicable
Package Treatment Plant Use	Not Applicable
Marina and Floating Home Development	Not Applicable
Mooring Fields	Not Applicable
Bulkhead Construction	Not Applicable
Development of Sound and Estuarine Islands	Not Applicable
Sea Level Rise	Not Applicable
Maritime Forests – no major maritime forests in Beaufort County	Not Applicable
Water Quality Management	Not Applicable
Resource Production and Management Policies	
Community Attitude Towards Resource Production and Management	Not Applicable
Recreation Resources	Not Applicable
Productive Agricultural Lands	Not Applicable
Productive Forestlands	Not Applicable
Aquaculture Activities	Not Applicable
Residential, Commercial, and Industrial Development Impacts on Resources	Not Applicable
Solid Waste	Not Applicable
Marine Resource Areas	Not Applicable
Peat or Phosphate Mining and Mineral Production	Not Applicable
Community Attitude on Economic and Community Development	Not Applicable
Economic Growth/Expansion	Not Applicable

Table B-1

Beaufort County (1997) Land Use/Coastal Zone Management Policies

Resource Protection Policies	Applicability to Project
Water Supply	Not Applicable
Sewer System	Not Applicable
Stormwater	Not Applicable
Energy Facility Siting and Development	Not Applicable
Redevelopment of Developed Areas	Not Applicable
Types and Locations of Desired Industry	Not Applicable
Estuarine Access	Not Applicable
Commitment to State and Federal Programs	Not Applicable
Community Facilities	
• Consider development of community services/facilities plan, not including school system needs	Not Applicable
Land Use Regulation	Not Applicable
Assistance in channel maintenance	Not Applicable
Assistance in interstate waterways	Not Applicable
Tourism	Not Applicable
Transportation	
• Identifies specific roadway improvements	Not Applicable
• Adoption of county-wide thoroughfare plan	Not Applicable
• Identifies specific improvements to Warren Field (CIP)	Not Applicable
Affordable Housing	Not Applicable
Land Use Trends	Not Applicable
Continuing Public Participation Policies	Not Applicable
Storm Hazard Mitigation/Post Disaster Recovery/Evacuation Planning Goals, Objectives, Policies	Not Applicable

Table B-2

Carteret County (1996) Land Use/Coastal Zone Management Policies

Resource Protection Policies	Applicability to Project
Community Attitude toward Resource Protection	Not Applicable
Soils	Not Applicable
Flood Hazard Area	Not Applicable
Groundwater/Protection of Potable Water Supplies	Not Applicable
Manmade Hazards	
• Expansions of aviation MOAs or MOAs in eastern North Carolina must be consistent with civil aviation regulations	Consistent
• Opposes expansion of Cherry I and Core MOAS	Not an Enforceable Policy
• Supports growth and expansion of North Carolina State Port Terminal	Not Applicable
• Supports expansion of Michael J. Smith Airport	Not Applicable
• Opposes bulk storage of hazardous materials in urban areas	Not Applicable
• Opposes expansion of fuel tanks facilities on Navy's Radio Island	Not Applicable
• Coordinate UST regulations with state	Not Applicable
• Opposes agricultural quarantine and decontamination facilities on Navy's Radio Island	Not Applicable
• Opposed to any low level military training flights that are not in compliance with the minimum safe altitudes for aircraft operation as described in the FAA regulations	Consistent
Stormwater Runoff	Not Applicable
Cultural/Historic Resources	
• Protect historic and archaeological resources	Consistent
Industrial Impacts on Fragile Areas	Not Applicable
Package Treatment Plant Use	Not Applicable
Marina and Floating Home Development	Not Applicable
Mooring Fields	Not Applicable
Development of Sound and Estuarine Islands	Not Applicable
Bulkhead Construction	Not Applicable
Sea Level Rise	Not Applicable
Maritime Forests – no forests in Carteret County	Not Applicable
Water Quality Management in White Oak and Neuse Basins	Not Applicable
Resource Production and Management Policies	
Community attitude toward Resource Management and Production	Not Applicable
Recreation Resources	
• Wetlands Protection	Not Applicable
• Support access to waterfront/shoreline	Not Applicable
Productive Agricultural Lands	Not Applicable
Aquaculture Activities	Not Applicable
Productive Forestlands	Not Applicable
Residential, commercial, and industrial development impacts on resources	Not Applicable
Marine Resource Areas	Not Applicable
Off-Road Vehicles	Not Applicable
Peat or Phosphate Mining	Not Applicable
Economic and Community Development Policies	
Community Attitude Toward Economic and Community Development	Not Applicable
Water Supply	
• Supports extension of central water service in county	Not Applicable
Sewer System	Not Applicable
Solid Waste	
• Supports a multi-county approach to solid waste management	Not Applicable
Energy Facility Siting and Development	Not Applicable
Community Facilities	
• Supports provision of adequate community facilities for residents and visitors	Not Applicable
Redevelopment of Developed Areas	Not Applicable
Land Use Regulation	Not Applicable
Estuarine Access	Not Applicable
Types and Locations of Desired Industry	Not Applicable
Commitment to State and Federal Programs	Not Applicable

Table B-2

Carteret County (1996) Land Use/Coastal Zone Management Policies

Resource Protection Policies	Applicability to Project
Assistance in Channel Maintenance	Not Applicable
Assistance in Interstate Waterways	Not Applicable
Tourism	Not Applicable
Transportation	
• Support of improvements to highway safety, regional accessibility, traffic flow	Not Applicable
Land Use Trends	Not Applicable
Continuing Public Participation Policies	Consistent
Storm Hazard Mitigation, Post-Disaster Recovery, Evacuation Plans	Not Applicable

Table B-3

Craven County (1998) Land Use/Coastal Zone Management Policies

Resource Protection Policies	Applicability to Project
Community Attitude Toward Resource Protection	Not Applicable
Soils	Not Applicable
Flood Hazard Areas	Not Applicable
Groundwater/Protection of Potable Water Supplies	Not Applicable
Manmade Hazards	
• Support underground storage tanks regulatory program	Not Applicable
• Opposed to toxic waste disposal in planning jurisdiction	Not Applicable
• Support growth/development of MCAS Cherry Point and Craven County Regional Airport	Not Applicable
• Support development of MCAS Cherry Point and its infrastructure	Consistent
• Development near MCAS Cherry Point must be compatible with Cherry Point AICUZ	Not Applicable
Stormwater Runoff	Not Applicable
Cultural/Historic Resources	
• Coordinate all public works projects with Division of Archives and History to identify and preserve significant historic and archaeological sites	Not Applicable
• Recognize national/regional significance of Cherry Point; encourage protection of its historic sites	Not Applicable
Industrial Impacts on Fragile Areas	Not Applicable
Package Treatment Plant Use	Not Applicable
Marina and Floating Home Development	Not Applicable
Mooring Fields	Not Applicable
Beautification	Not Applicable
Development of Sound and Estuarine Islands	Not Applicable
Bulkhead Construction	Not Applicable
Sea Level Rise	Not Applicable
Water Quality Management	Not Applicable
Resource Production and Management Policies	
Community Attitude Toward Resource Production and Management	Not Applicable
Recreation Resources	Not Applicable
Productive Agricultural Lands	Not Applicable
Aquaculture Activities	Not Applicable
Off-Road Vehicles	Not Applicable
Solid Waste	Not Applicable
Productive Forest Lands	Not Applicable
Residential, Commercial, and Industrial Development Impacts on Resources	Not Applicable
Marine Resource Areas	Not Applicable
Community Attitude Toward Economic and Community Development	
• Expansion of economic base, including Cherry Point, tourism, commercial fishing, retail and wholesale trade, real estate and construction, and industrial development	Not Applicable
Water Supply	Not Applicable
Sewer System	Not Applicable
Stormwater	Not Applicable
Energy Facility Siting and Development	Not Applicable
Redevelopment of Developed Areas	Not Applicable
Estuarine Areas	Not Applicable
Types and Locations of Desired Industry	Not Applicable
Commitment to State and Federal Programs	Not Applicable
Assistance in Channel Maintenance	Not Applicable
Assistance in Interstate Waterways	Not Applicable
Transportation	
• Identifies specific roadway, Craven County Airport, and bicycle and pedestrian improvements	Not Applicable
Continuing Public Participation Policies	Consistent
Storm Hazard Mitigation	Not Applicable

Table B-4

Hyde County (1997) Land Use/Coastal Zone Management Policies

Resource Protection Policies	Applicability to Project
Soils and Septic Tank Use	Not Applicable
Flood Prone Areas	Not Applicable
Areas of Environmental Concern and Fragile Areas	
• Ocean Hazard Area of Environmental Concern – Support CAMA guidelines and North Carolina Department of Environment and Natural Resources, Division of Coastal Management, and Coastal Resources Commission to protect ocean, coastal wetlands, estuarine waters, estuarine shorelines, and public trust waters	Not Applicable
• Estuarine Shoreline Areas of Environmental Concern	Not Applicable
• Supports Best Management Practices recommendations of the US Soil Conservation Service	Not Applicable
• Freshwater Swamps and Marshes – Supports US Army Corps of Engineers, CAMA, and local ordinances to regulate development in freshwater swamps and marshes	Not Applicable
• Maritime Vegetation and Forests	Not Applicable
• Pocosins and 404 Wetlands	Not Applicable
• Outstanding Resource Waters	Not Applicable
• Coastal Wetlands	Not Applicable
• Estuarine Waters and Public Trust Areas	Not Applicable
Protecting Potable Water Supply and Groundwater Quality	Not Applicable
Package Treatment Plants	Not Applicable
Stormwater Runoff and Its impact on Coastal Wetlands, Surface Waters, other fragile areas	Not Applicable
Marinas	Not Applicable
Floating Structures	Not Applicable
Dry Stack Storage Facilities	Not Applicable
Docks and Piers	Not Applicable
Temporary Moorings and Mooring Fields	Not Applicable
Industrial Impact on Fragile Areas	Not Applicable
Sea Level Rise	Not Applicable
Upland Excavation for Marina Basins	Not Applicable
Bulkhead Installation	Not Applicable
Development of Sound and Estuarine Islands	Not Applicable
Manmade Hazards	
• Supports local, state, and federal efforts to minimize adverse impacts of man-made hazards	Not Applicable
• Opposes, with certain exceptions, the bulk storage of manmade hazardous materials (as defined by USEPA) in Ocracoke Village	Not Applicable
• Opposes the disposal of any toxic wastes, as defined by USEPA's listing of Hazardous Substances and Priority Pollutants within its jurisdiction	Not Applicable
Water Quality Management	Not Applicable
Importance of Agriculture, Forestry, Mining, Fisheries, and Recreational Resources	Not Applicable
Productive Agricultural Lands	Not Applicable
Commercial Forest Lands	Not Applicable
Existing and Potential Mineral Production Areas	Not Applicable
Commercial and Recreational Fisheries, Shell fishing Waters, and Nursery and Habitat Areas	
• Opposes any expansion of federal wildlife reserves that preempt any lands within Hyde County	Not Applicable
Trawling Activities in Estuarine Waters	Not Applicable
Off-Road Vehicles	Not Applicable
Residential, Commercial, and Industrial Land Development Impacts on any Resource	Not Applicable
Peat or Phosphate Mining's Impact on Any Resource	Not Applicable
Aquaculture Activities	Not Applicable
Types and Locations of Industries Desired	Not Applicable
Local Commitment to Providing Service to Development	Not Applicable
Types of Urban Growth Patterns Desired	Not Applicable
Redevelopment of Developed Areas	Not Applicable
Commitment to State and Federal Programs	
• Generally supports state and federal Programs, but reserves right to object to 404 wetlands regulations and the designation of additional outstanding resource waters within the county	Not Applicable
• Opposes expansion of military restricted airspace in eastern North Carolina	Not an Enforceable Policy
Channel Maintenance and Beach Nourishment	Not Applicable

Table B-4

Hyde County (1997) Land Use/Coastal Zone Management Policies

Resource Protection Policies	Applicability to Project
Energy Facility Siting and Development	Not Applicable
Tourism	Not Applicable
Coastal and Estuarine Water Beach Access	Not Applicable
Types, Densities, Location, and Units Per Acre of Anticipated Residential Development	Not Applicable
Existing Tax Base and Employment Opportunities	Not Applicable
Signs	Not Applicable
Community Appearance and Litter Control and Removal	Not Applicable
Recreational Facilities	Not Applicable
Public Safety	Not Applicable
Education	Not Applicable
Electrical Facilities	Not Applicable
Cable Television	Not Applicable
Public Water Facilities	Not Applicable
Public Sewer Facilities	Not Applicable
Transportation System	
• Beautification	Not Applicable
• Ferry System	Not Applicable
• Vehicular Movement	Not Applicable
Uses of and Activities In and On Ocean, Rivers, and Sound	Not Applicable
Point Source Wastewater Discharge	Not Applicable
Cultural or Historic Resources	
• Supports preservation of important cultural resources and local, State, and Federal efforts to protect historic properties within its borders and to perpetuate its cultural heritage	Consistent
Facilities for Physically Challenged Persons	Not Applicable
Hospital and Access to Medical Care	Not Applicable
Picnic Areas	Not Applicable
Public Water Accesses	Not Applicable
Coastal Airspace	
• Opposes expansion of any restricted airspace within its boundaries or jurisdiction	Not an Enforceable Policy
• Supports North Carolina Coastal Resources Commission aircraft operations standards (15A NCAC 07H .0600, 15A NCAC 07M .0900 and .1000)	Consistent
• Supports minimum altitude standards of FAA	Consistent
• Airspace activity associated with coastal development shall not impose an increase in average noise exceeding 10 dBA above background levels.	Not an Enforceable Policy
• The maximum noise level associated with any single event shall not exceed 85 dBA.	Not an Enforceable Policy
• Supports NC policy that access corridors free of special use airspace designations shall be preserved along the length of the barrier islands and laterally at intervals not to exceed 25 miles to provide unobstructed access	Not an Enforceable Policy
• Supports NC policy that access corridors shall extend from the surface to an altitude of 6,000 ft AGL except where communication and radar services allow positive aircraft control at lower altitudes	Not an Enforceable Policy
• Supports facilitation of aircraft use by local, state, and federal government agencies for resource management, law enforcement, and public health, safety, and welfare	Consistent
• Supports periodic access to restricted areas for routine enforcement flights/emergencies	Consistent
• Public trust waters subject to surface water restrictions for use in military training shall be opened to commercial fishing at appropriate times for harvest	Not Applicable
• Area of restricted surface waters shall be as least as large as recommended safety zone in areas where laser weaponry is used	Not Applicable
• Water quality shall be tested periodically in surface water restricted areas surrounding targets	Not Applicable
Private Sewage Utilities	Not Applicable
Mosquito Control	Not Applicable
Solid Waste and Recycling	Not Applicable
Dredging	Not Applicable
Facilities for Senior Citizens	Not Applicable
Public Participation	Consistent
Storm Hazard Mitigation, Evacuation, and Post-Disaster Reconstruction	Not Applicable

Table B-5

Pamlico County (1994) Land Use/Coastal Zone Management Policies

Resource Protection Policies	Applicability to Project
Soils	Not Applicable
Flood Hazard Areas	Not Applicable
Groundwater/Protection of Potable Water Supplies	Not Applicable
Manmade Hazards	
• Military activity in and around county should be consistent with this plan to maximum extent feasible	Consistent
• Opposes any low level military flights not in compliance with minimum safe altitudes for aircraft operation as described in the Federal Aviation Regulations, Part 91.	Consistent
• Opposes bulk fuel storage of man-made materials identified by the USEPA as hazardous in areas classified as community or limited transition	Not Applicable
• Opposed to establishment of dump sites for any wastes defined by USEPA as hazardous	Not Applicable
Stormwater Runoff	Not Applicable
Cultural/Historic Resources	
• Coordinate all housing code enforcement/redevelopment projects with the NC Department of Archives and History	Not Applicable
• Coordinate all county public works projects with the North Carolina Department of Archives and History, to ensure the identification and preservation of significant sites	Not Applicable
• Supports state clearinghouse review process and comments received for the preservation of historically-significant properties which may be affected by state and federally funded projects	Consistent
Industrial Impacts on Fragile Areas	Not Applicable
Package Treatment Plan Use	Not Applicable
Marina and Floating Home Development	Not Applicable
Development of Sound and Estuarine Islands	Not Applicable
Bulkhead Construction	Not Applicable
Sea Level Rise	Not Applicable
Maritime Forests – none located in county	Not Applicable
Recreation Resources	Not Applicable
Productive Agricultural and Forest Lands	Not Applicable
Aquaculture	Not Applicable
Residential, Commercial, and Industrial Development Impacts on Resources	Not Applicable
Marine Resource Areas	Not Applicable
Off-Road Vehicles	Not Applicable
Peat or Phosphate Mining	Not Applicable
Water Supply and Sewer Systems	Not Applicable
Solid Waste	Not Applicable
Stormwater	Not Applicable
Energy Facility Siting and Development	Not Applicable
Community Facilities	Not Applicable
Redevelopment of Developed Areas	Not Applicable
Estuarine Access	Not Applicable
Types and Locations of Desired Industry	Not Applicable
Commitment to State and Federal Programs	Not Applicable
Assistance in Channel Maintenance	Not Applicable
Tourism	Not Applicable
Transportation	
• Identifies specific roadway improvements	Not Applicable
Aesthetic and Visual Resources	
• Recognizes importance of architectural, archaeological and historic resources and encourages their preservation	Consistent
Continuing Public Participation Policies	Consistent
Storm Hazard Mitigation	Not Applicable

Table B-6

Tyrrell County And Town Of Columbia (1996) Land Use/Coastal Zone Management Policies

Resource Protection Policies	Applicability to Project
Community Attitude Towards Resource Protection	Not Applicable
Soils	Not Applicable
Flood Hazard Areas	Not Applicable
Groundwater/Protection of Potable Water Supplies	Not Applicable
Manmade Hazards	
• Supports state program approval and technical requirements for underground storage tanks	Not Applicable
• Expansions of aviation military Restricted Areas or MOAs in eastern North Carolina must be consistent with civil aviation regulations, must comply with other applicable state and federal regulations, and must be supported by environmental impact statements	Consistent
• Supports Coastal Resources Commission aircraft operations standards (15A NCAC 07H .0600, 15A NCAC 07M .0900/1000)	Consistent
• Supports minimum altitude standards of FAA	Consistent
• Airspace activity associated with coastal development shall not impose an increase in average noise exceeding 10 dBA above background levels.	Not an Enforceable Policy
• The maximum noise level associated with any single event shall not exceed 85 dBA.	Not an Enforceable Policy
• Supports North Carolina policy that access corridors free of special use airspace designations shall be preserved along the length of the barrier islands and laterally at intervals not to exceed 25 miles to provide unobstructed access	Not an Enforceable Policy
• Supports North Carolina policy that access corridors shall extend from the surface to an altitude of 6,000 ft AGL except where communication and radar services allow positive aircraft control at lower altitudes	Not an Enforceable Policy
• Supports facilitation of aircraft use by local, state, and federal government agencies for resource management, law enforcement, and public health, safety, and welfare	Consistent
• Supports periodic access to restricted areas for routine enforcement flights/emergencies	Consistent
• Public trust waters subject to surface water restrictions for use in military training shall be opened to commercial fishing at appropriate times for harvest	Not Applicable
• Area of restricted surface waters shall be as least as large as recommended safety zone in areas where laser weaponry is used	Not Applicable
• Water quality shall be tested periodically in surface water restricted areas surrounding targets	Not Applicable
• Opposes the expansion of any restricted airspace in Tyrrell County	Not an Enforceable Policy
• Does not favor the continued existence or expansion of the existing airspace restriction imposed by the presence of Air Force bombing ranges in the Albemarle Sound area near the county	Not an Enforceable Policy
• Opposes the disposal of any toxic wastes, as defined by USEPA's Listing of Hazardous Substances and Priority Pollutants	Not Applicable
Stormwater Runoff	Not Applicable
Cultural/Historic Resources	Not Applicable
Industrial Impacts on Fragile Areas	Not Applicable
Package Treatment Plant Use	Not Applicable
Marina and Floating Home Development	Not Applicable
Mooring Fields	Not Applicable
Development of Sound and Estuarine Islands	Not Applicable
Bulkhead Construction	Not Applicable
Sea Level Rise	Not Applicable
Maritime Forests – none located in county	Not Applicable
Water Quality Management	Not Applicable
Outstanding Resource Waters	Not Applicable
Community Attitude Toward Resource Production and Management	Not Applicable
Recreation Resources	Not Applicable
Productive Agricultural Lands	Not Applicable
Aquaculture Activities	Not Applicable
Productive Forestlands	Not Applicable
Residential, Commercial, and Industrial Development Impacts on Resources	Not Applicable
Marine Resource Areas	Not Applicable
Off-Road Vehicles	Not Applicable
Peat or Phosphate Mining	Not Applicable
Community Attitude Toward Economic and Community Development	Not Applicable
Economic Growth/Expansion	Not Applicable

Table B-6

Tyrrell County And Town Of Columbia (1996) Land Use/Coastal Zone Management Policies

Resource Protection Policies	Applicability to Project
Water Supply	Not Applicable
Sewer System	Not Applicable
Solid Waste	Not Applicable
Stormwater	Not Applicable
Energy Facility Siting and Development	Not Applicable
Community Facilities	Not Applicable
Consider development of Community Services/Facilities Plan	Not Applicable
Redevelopment of Developed Areas	Not Applicable
Land Use Regulation	Not Applicable
Estuarine Access	Not Applicable
Types and Locations of Desired Industry	Not Applicable
Commitment to State and Federal Programs	
• Opposes expansion of military restricted airspace in eastern North Carolina	Not an Enforceable Policy
• Opposes expansion of state and federal lands within the county for activities which do not generate jobs or revenues for the county	Not Applicable
Assistance in Channel Maintenance	Not Applicable
Assistance in Interstate Waterways	Not Applicable
Tourism	Not Applicable
Transportation	
• Identifies specific roadway improvements	Not Applicable
Land Use Trends	Not Applicable
Continuing Public Participation Policies	Consistent
Storm Hazard Mitigation, Post-Disaster Recovery, and Evacuation Plans	Not Applicable

Table B-7

Washington County (1994) Land Use/Coastal Zone Management Policies

Resource Protection Policies	Applicability to Project
Define and delineate land areas with development constraints	Not Applicable
Flood Hazard Areas and physiographic conditions which impact septic tank use, wells, construction feasibility	Not Applicable
Preserve and Protect Areas of Environmental Concern within Washington County	
• Opposes the introduction of the "Red Wolf" to any part of the county	Not Applicable
• Objects to further expansion of federal and/or state refuges (wildlife or other)	Not Applicable
Preserve and Protect Natural, Cultural, and Historic Resources within the County	
• Encourage land use proposals which will have no negative impact on historic, cultural, and/or archaeological resources	Consistent
• Review, revise, and update inventory of historic properties in county periodically, with assistance from Coastal Resources Commission and State Preservation Office	Not Applicable
• Support citizens' awareness programs and public educational opportunities for County Historic and Natural Resources	Not Applicable
Water Supplies and Potable Water Resources	Not Applicable
Sewer Treatment Package Plants	Not Applicable
Stormwater Runoff	Not Applicable
Marina and Floating Homes	Not Applicable
Industrial Impacts on Fragile Areas	Not Applicable
Development of Sound and Estuarine System Islands	Not Applicable
Sea Level Rise	Not Applicable
Upland Excavations for Marina Basins	Not Applicable
Bulkhead Installation	Not Applicable
Productive Agricultural Lands	Not Applicable
Productive Forest Lands	Not Applicable
Commercial and Recreational Fishing	Not Applicable
Peat Production	Not Applicable
Mineral Production Areas	Not Applicable
Off-Road Vehicles	Not Applicable
Provision of Public Services	Not Applicable
Location and Development Characteristics for Economic Development Activities, Including Redevelopment	Not Applicable
Commitment to State and Federal Programs	Not Applicable
Tourism	Not Applicable
Coastal and Estuarine Water Beach Access	Not Applicable
Land Use Trends	Not Applicable
Quality of Life Issues	
• Schools	Not Applicable
• Police Protection	Not Applicable
Channel Maintenance	Not Applicable
Energy Facility Siting	Not Applicable
Public Participation	Consistent
Storm Hazard Mitigation, Post-Disaster Recovery and Evacuation Planning	Not Applicable

Table B-8

Town Of Aurora (1997) Land Use/Coastal Zone Management Policies

Resource Protection Policies	Applicability to Project
Development In Areas With Constraints	
• Flood-prone areas, soils, septic tank use	Not Applicable
Local Resource Development Issues Relative to Areas of Environmental Concern	Not Applicable
Protection of Wetlands	Not Applicable
Hazardous and Fragile Areas	
• If archaeological sites are identified, investigation must be conducted by North Carolina Department of Cultural Resources before any building permit is granted	Not Applicable
• Encourage preservation of historic sites by providing town assistance in locating funds for historic preservation efforts	Not Applicable
• If eagle nest sites are discovered, North Carolina Wildlife Resources Commission will be notified	Not Applicable
• Changes to zoning ordinance	Not Applicable
Means of Protection of Potable Water	Not Applicable
Use of Package Treatment Plants	Not Applicable
Stormwater Runoff	Not Applicable
Marina, Floating Home, and Dry Stack Development	Not Applicable
Industrial Impacts Around Fragile Areas	Not Applicable
Sound and Estuarine System Islands	Not Applicable
Areas Affected by Sea Level Rise	Not Applicable
Upland Excavation for Marina Basins	Not Applicable
Bulkhead Installation	Not Applicable
Water Quality Problems and Management Measures Designed to Reduce or Eliminate Local Sources of Surface Water Quality Problems	Not Applicable
Productive Agricultural Land	Not Applicable
Commercial Forest Lands	Not Applicable
Existing and Potential Mineral Production Areas	Not Applicable
Commercial and Recreational Fisheries	Not Applicable
Off-Road Vehicles	Not Applicable
Residential, Commercial, and Industrial Land Development Impacts on any Resources	Not Applicable
Peat or Phosphate Mining's Impact on any Resource	Not Applicable
Location and Types of Industries Desired	Not Applicable
Local Commitment to Providing Services	Not Applicable
Desired Urban Growth Patterns	Not Applicable
Types, Densities, and Location of Anticipated Development	Not Applicable
Redevelopment of Developed Areas	Not Applicable
Commitment to State and Federal Programs	
• General commitment to state and federal programs, with comment in text opposing expansion of Military Operating Airspace due to potential conflicts with local air traffic community and noise issues.	Not an Enforceable Policy
Assistance to Channel Maintenance	Not Applicable
Energy Facility Siting	Not Applicable
Tourism	Not Applicable
Public Beach and Water Access	Not Applicable
Continuing Public Participation	Consistent
Storm Hazards Mitigation, Post-Disaster Recovery and Evacuation Plans	Not Applicable

Table B-9

Town Of Bath (1997) Land Use/Coastal Zone Management Policies

Resource Protection Policies	Applicability to Project
Discussion of Areas of Environmental Concern	Not Applicable
Soils, Floodprone Areas	Not Applicable
Local Resource Development Issues Relative to Areas of Environmental Concern	
• Protection of Wetlands	Not Applicable
• Other Wetlands, shellfish waters	Not Applicable
Cultural/Historic Resources	
• Shall protect and preserve valuable cultural, historic, and scenic resources	Consistent
• Development shall not cause major or irreversible damage to valuable, documented historic architectural or archaeological resources, and shall be consistent with state regulations	Not Applicable
• Encourages compatible development within Bath Historic District	Not Applicable
• Protect and preserve the scenic beauty of the Town	Not Applicable
• Development shall not be allowed to block or transform the scenic vistas in the Town	Not Applicable
Protection of Potable Water Supplies	Not Applicable
Package Treatment Plants	Not Applicable
Stormwater Runoff	Not Applicable
Marinas and Floating Homes	Not Applicable
Moorings/Mooring Fields/Dry Stack Facilities	Not Applicable
Industrial Impacts on Fragile Areas	Not Applicable
Sea Level Rise	Not Applicable
Upland Excavation for Marinas	Not Applicable
Bulkhead Installation	Not Applicable
Development of Sound and Estuarine Islands	Not Applicable
Community Attitude Toward Resource Production and Management	Not Applicable
Productive Agricultural Lands	Not Applicable
Commercial Forest Lands	Not Applicable
Existing/Potential Mineral Production Areas	Not Applicable
Commercial/Recreational Fishing	Not Applicable
Off-Road Vehicles	Not Applicable
Residential, Commercial/Industrial Development Impacts	Not Applicable
Peat/Phosphate Mining Impacts	Not Applicable
Community Attitude Toward Growth	Not Applicable
Types and Locations of Desired Industries	Not Applicable
Local Commitment to Providing Services	Not Applicable
Desired Urban Growth Patterns	Not Applicable
Redevelopment of Developed Areas	Not Applicable
Commitment to State/Federal Programs	Not Applicable
• Opposed to Expanding Military Air Space	Not an Enforceable Policy
Channel Maintenance	Not Applicable
Energy Facility Siting and Development	Not Applicable
Tourism	Not Applicable
Public Beach/Water Access	Not Applicable
Continued Public Participation	Consistent
Storm Hazard Mitigation, Reconstruction, and Evacuation	Not Applicable

Table B-10

Town Of Belhaven (1997) Land Use/Coastal Zone Management Policies

Resource Protection Policies	Applicability to Project
Community Attitude Toward Resource Protection	Not Applicable
Soils, Flood Prone Areas, Septic Tank Suitability	Not Applicable
Local issues relative to Areas of Environmental Concern	Not Applicable
Protections of Wetlands	Not Applicable
Other Hazardous or Fragile Lands, Wetlands, Shellfish waters	Not Applicable
Cultural Resources	
• Protection of Old Town Hall which is listed on National Register	Not Applicable
• Support volunteer historic preservation efforts and initiation of local ordinances if necessary	Not Applicable
Protection of Potable Water Supply	Not Applicable
Use of Package Treatment Plants	Not Applicable
Stormwater Runoff Impacts	Not Applicable
Marina, Floating Homes, Dry Stack Facilities, Moorings	Not Applicable
Industrial Impact on Fragile Areas	Not Applicable
Sea Level Rise	Not Applicable
Upland Excavation for Marinas	Not Applicable
Marsh Damage by Bulkheads	Not Applicable
Development of Islands	Not Applicable
Management of Local Sources of Water Quality Problems	Not Applicable
Community Attitude Toward Resource Protection and Management	Not Applicable
Productive Agricultural Lands	Not Applicable
Commercial Forest Lands	Not Applicable
Existing and Potential Mineral Resource Areas	Not Applicable
Commercial and Recreational Fisheries	Not Applicable
Off-Road Vehicles	Not Applicable
Development Impacts on Resources	Not Applicable
Peat or Phosphate Mining Impacts	Not Applicable
Community Attitude Toward Growth	Not Applicable
Types/Locations of Desired Industries	Not Applicable
Local Commitment to Provision of Services	Not Applicable
Types of Urban Growth Patterns	Not Applicable
Residential Development Patterns	Not Applicable
Redevelopment of Developed Areas	Not Applicable
Commitment to State/Federal Programs	
• Opposes Military Operating Airspace	Not an Enforceable Policy
Assistance to Channel Maintenance	Not Applicable
Energy Facility Siting/Development	Not Applicable
Tourism	Not Applicable
Public Water Access	Not Applicable
Public Participation	Consistent
Hurricane and Storm Hazard Mitigation, Reconstruction, Evacuation	Not Applicable

NCDENR
North Carolina Department of Environment and Natural Resources
Division of Coastal Management
Michael F. Easley, Governor | **Donna D. Moffitt, Director** | William G. Ross Jr., Secretary

September 16, 2002

G. W. Radford
Environmental Affairs Officer
US Marine Corps Air Station
PSC Box 8003
Cherry Point, NC 28533-0003

Dear Officer Radford:

Reference: DCM02-45 Proposed Military Operations Areas in Eastern NC

On September 12, 2002, the State of North Carolina completed its review, pursuant to 15 CFR 931 Subpart C, Consistency for Federal Activities, of the U.S. Marine Corps' consistency determination for the proposed establishment of two new Military Operations Areas (MOAs) within counties of the state's coastal zone. The proposed action is necessary to improve the effectiveness and capabilities of military aircraft training exercises. The MOAs, known as Core and Mattamuskeet, will overlie several counties and municipalities therein. The proposed new MOAs were reviewed for consistency with the Land Use Plans of each affected county and several municipalities within. It was determined that the proposed action is not inconsistent with any of the Land Use Plans' policies that are enforceable through federal consistency procedures.

Based upon our review, we cannot disagree with your determination that the activity is consistent with the North Carolina Coastal Management Program, provided all training activities within the MOAs are conducted as described in the Environmental Assessment (EA) and in accordance with the Consistency Determination submitted on June 26, 2002. If there are any significant changes in the types of aircraft, number of sorties, nature of training exercises, etc., the Division of Coastal Management shall be notified to determine whether a new or supplemental consistency determination is required pursuant to 15 CFR 930.41(d).

During the course of our review, the Division of Coastal Management received comments from several state agencies expressing concerns about the potential impacts of the proposal and the adequacy of the

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Environmental Assessment. While these comments and concerns were not sufficient to lead to a negative consistency finding on the proposed project, the issues raised certainly warrant further investigation.

The North Carolina Wildlife Resources Commission (WRC) is concerned about the effects the proposed action could have on their game laws enforcement air patrols. The WRC indicated that during active periods of MOA use, there would be reasonable concern for the safety of their pilots while on patrol, given the flight rules and enforcement flight requirements. The WRC would prefer flexible MOA operations similar to those currently coordinated by the Marine Corps and the WRC within restricted air space in North Carolina. The WRC is also concerned that the MOAs might adversely impact waterfowl and shorebirds that use the project area as both wintering and breeding habitat. The increased flight activity associated with the new MOAs could have a contributory and cumulative disturbing effect on birds, given the numerous military overflights that already occur over the eastern part of the state.

The Wildlife Resources Commission does not concur with the Finding of No Significant Impact presented by the Marine Corps for this project. To address their concerns, the WRC has provided suggestions and comments (copy attached), and has requested they be considered by the Marine Corps in an amended Environmental Assessment or Environmental Impact Statement.

The North Carolina Division of Marine Fisheries (DMF) has habitat and fisheries concerns about the proposal, and cites a lack of data and deficient review of available data in the EA. Of particular concern to the DMF is the issue of hazardous materials management and the effects of aircraft crashes on marine resources. The DMF requests that the effects of air crashes in the MOAs be examined, and that a mitigation plan be developed to address environmental damages from aircraft crashes. In addition, the DMF has requested assurances that Marine Patrol aerial patrol activities will not be restricted by the establishment and use of the new MOAs.

Comments submitted by the Department of Environment and Natural Resources (DENR) address in detail the nature and adequacy of the Environmental Assessment and the National Environmental Policy Act (NEPA) documentation. Comments included military airspace issues in general and also how the state's resources and their uses could be affected by the proposed action. DENR has provided many suggestions for improving the use, establishment, and environmental documentation for military airspace in North Carolina. These comments were submitted to the Marine Corps through the State Clearinghouse review process.

North Carolina has a history of cooperation and partnership with the United States military, and recognizes the need and importance of safe, effective military training in the interests of national security. We do, however, request that you give our comments and concerns full consideration prior to initiating the proposed action.

Please call Ms. Caroline Bellis, Division of Coastal Management, at (919) 733-2293, extension 249, if you have any questions about our finding, conditions, or requests. We look forward to continuing cooperation and partnership with the Marine Corps, and we thank you for your consideration of the North Carolina Coastal Management Program.

Sincerely,

Donna D. Moffitt

cc: Bill Flournoy, DENR
Terry Moore, Division of Coastal Management
Ted Tyndall Division of Coastal Management
Kathy Vinson Division of Coastal Management
Ed Lynch, Division of Coastal Management
Mike Christenbury, Division of Coastal Management
Mike Street, Division of Marine Fisheries
David McHenry, Wildlife Resources Commission

North Carolina Wildlife Resources Commission Comments and Suggestions
DCM02-45 Core, Mattamuskeet MOAs

1. MOA operating criteria that allow safe use by NCWRC aircraft should be considered. For example, alternative MOA operating criteria that allow periodic elevation of the basement to 5000 feet AGL, either wholly or in specific areas, would allow unhindered and safe access of the airspace for NCWRC air patrol activities. These periodic alterations could be coordinated between our enforcement personnel and the Marine Corps Air Traffic Control at Cherry Point on an as needed basis.

2. Additional review should be conducted or more information presented about the potential impacts of the proposed project on wildlife. The NCWRC understands that the US Fish and Wildlife Service will be examining the available literature with regard to the potential wildlife impacts of the project. As stated earlier, the NCWRC does not maintain that there will be adverse impacts of the project, and therefore, requests the opportunity to provide future comments on the proposed project as additional information becomes available.

3. Because the EA acknowledges potential impacts of the MOAs on waterfowl, alternative MOA operating criteria should be analyzed including, but not limited to, shorter active periods or restricted seasons that coincide with peak waterfowl abundance. For example, there are several public areas that only allow waterfowl hunting from ½ hour before sunrise to 1300 hours to allow undisturbed daylight periods for waterfowl to rest and feed. A similar approach to operations in the MOAs might be considered. In addition, prohibited operations or higher basement elevations in the MOAs from October to March when waterfowl are abundant in eastern North Carolina might reduce the potential disturbance effects.

4. Additional Military Training Routes (MTR) over the Core Banks and away from designated critical habitat for piping plovers should be explored in lieu of the Core MOA. Although the number and duration of daily overflights with the proposed Core MOA might not lead to disturbance effects on this species, this apparently can not be definitively determined based on the available literature for similar species. Therefore, consideration might be given to the establishment of additional MTRs, which would allow multiple egress and ingress routes over Core Banks.

5. Of considerable importance to the potential wildlife impacts of the project is a characterization of the projected noise in the proposed MOAs. Table 4.2-2 of the EA presents results of the MR_NMAP noise modeling that quantify the anticipated average sound levels. It is recognized from the text that this metric describes a time-averaged daily sound level that is weighted to factors such as the intensity and number of sound events. However, information about each of these factors individually may have important influences on wildlife. Although the average sound levels will reflect differences based on the frequency of events, it is impossible to determine from this multi-factor metric how influential the number of events or other factors are to the overall metric value. Additional information such as summarized data (e.g., number of events, intensities, durations) used as input variables for the modeling, as are probably described in the referenced modeling report, would provide a better basis to ascertain any potential effects of the MOAs on wildlife. Moreover, information concerning the errors (e.g. confidence interval) and distributions (e.g. quartiles) of the projected average sound levels would help characterize the expected ambient noise levels on temporal and spatial scales. This characterization may be particularly useful since Table 4.2-2 is labeled as average values of the sound metric, which itself represents an average value.

APPENDIX C

NOISE ANALYSIS REPORT

Wyle Report
WR 01-15
Noise Analysis of Proposed Core, Mattamuskeet and Cherry Military Operations Areas Near Marine Corps Air Station Cherry Point Cherry Point, North Carolina

Prepared For

EARTH TECH / TAMS
655 Third Avenue
New York, NY 10017

Contract No. N-62470-97-D-3456

Prepared By

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May 2003

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1.0 Introduction

The purpose of this report is to document the noise environment associated with existing and proposed Special Use Airspace (SUA) controlled by Marine Corps Air Station (MCAS) Cherry Point in eastern North Carolina. This assessment was completed for the baseline conditions defined as Calendar Year 2000 (CY00) sorties of existing airspace, as well as for seven proposed scenarios of a combination of existing and proposed airspace, one of which would be implemented. The proposed scenarios result from the need to provide realistic flight training environments to military personnel. Data generated in this report would be used to support preparation of an Environmental Impact Statement (EIS) produced by the Department of the Navy (DoN), pursuant to the National Environmental Policy Act of 1969.

This report also incorporates changes to sortie data and results of additional analysis documented in letter reports to TAMS A&E of February 04, 2002 and June 04, 2002. The additions to this report include:

- Changes to Bombing Target BT-11 sortie data
- Changes to sortie data for the Core and Mattamuskeet MOAs Alternative
- Analysis of noise impact of aircraft sorties within the proposed MOAs for the siting of the F/A-18E/F aircraft at NAS Oceana
- Analysis of noise impact of aircraft sorties within the proposed MOAs for the siting of the F/A-18E/F aircraft at MCAS Cherry Point
- Updated Single Event Levels for the F/A-18C/D and the AV-8B aircraft under various flight conditions

2.0 Noise

2.1 Noise Metrics

Noise represents one of the most prominent environmental issues associated with aircraft operations. Although many other sources of noise are present in today's communities, aircraft noise is readily identifiable. For the airspace studied, aircraft overflights can be identified as the primary contributors to the noise environment. An assessment of aircraft noise requires a general understanding of how sound is measured and how it affects people and the natural environment. This section provides a brief overview of noise metrics and their use. Appendix A provides a more detailed discussion of noise and its effect on people and the environment.

Individual, single noise events are described in terms of the Sound Exposure Level (SEL or LAE) in units of decibels (dBs). SEL takes into account the amplitude of a sound and the length of time during which each noise event occurs. It thus provides a direct comparison of the relative intrusiveness among single noise events of different intensities and duration.

The metrics used to describe the noise environment on and in the vicinity of airbases is normally described in terms of the time-average sound level generated by the aircraft operating at the facility. The Federal noise metric used for this purpose is the Day-Night Average Sound Level (abbreviated DNL, or sometimes Ldn), which is defined in units of dB. DNL is an average sound level generated by all aviation-related operations during an average or busy 24-hour period with sound levels of nighttime noise events emphasized by adding a 10 dB weighting. Nighttime is defined as the period from 2200 local time to 0700 local time the following morning. The 10 dB weighting accounts for the generally lower background sound levels and greater community sensitivity to noise during nighttime hours.

The metrics used for airbases differ from those used to describe the noise associated with special-use airspace such as ranges, Military Operation Areas (MOAs) and Military Training Routes (MTRs). Military aircraft have a requirement for combat training over land and water at low altitudes and high speeds. For such training to occur at altitudes less than 10,000 feet above Mean Sea Level (MSL) and at speeds in excess of 250 Knots Indicated Airspeed (KIAS), the Federal Aviation Administration (FAA) has granted a waiver for military aircraft (US Department of Transportation, 1998). Likewise, because these military aircraft seem to come from nowhere with a great noise and just as quickly disappear, they require the use of a modified noise metric to appropriately account for the "surprise" effect that exists under these conditions. The SEL (and subsequently the DNL metric) is adjusted to account for the "surprise" effect of the onset rate of aircraft noise on humans. Onset-Rate Adjusted SEL is denoted SEL_r. The adjusted DNL is designated as Onset-Rate Adjusted Day-Night Average Sound Level abbreviated L_{dnr}.

Another rather unique characteristic of military aircraft is that they operate in a sporadic fashion in designated low-altitude airspace. This sporadic nature could be as frequently as tens of times per day in a range, for example, to less than a couple of times per year in a temporary MOA designed for exercises. Because of the sporadic occurrences of aircraft, the number of average daily operations is determined from the number of flying days in the

calendar month with the highest number of operations in the affected airspace. This metric is designated Onset-Rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}).

SEL, DNL, and L_{dnmr} employ A-weighted sound levels. "A-weighted" denotes the adjustment of the frequency content of a noise event to represent the way in which the average human ear responds to the noise.

2.2 Regulatory Background

The Noise Control Act of 1972 was enacted by Congress and, in part, directed the Administrator of the Environmental Protection Agency (EPA) to "publish information on the levels of environmental noise, the attainment and maintenance of which in defined areas under various conditions are requisite to protect the public health and welfare with an adequate margin of safety." It also states, in part "...that it is the policy of the United States to promote an environment for all Americans free from noise that jeopardizes their health or welfare" and that federal agencies "...(1) having jurisdiction over any property or facility, or (2) engaged in any activity resulting, or which may result, in the emission of noise, shall comply with federal, state, interstate, and local requirements...."

Based on these requirements, the EPA published a report entitled Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare With an Adequate Margin of Safety (U.S. EPA, 1972). This report provided two noise metrics that allow the effects of environmental noise to be described in a uniform manner. These metrics are the Long-Term Equivalent A-Weighted Sound Level (Leq) and the Day-Night Average Sound Level (DNL), symbolized as L_{dn}. Many federal and state agencies, including the Department of Defense, accept the DNL as the standard for describing environmental noise impact.

In 1977 the National Academy of Science's Committee on Hearing, Bioacoustics, and Biomechanics (CHABA) Working Group 69 published Guidelines for Preparing Environmental Impact Statements on Noise (CHABA, 1977). These guidelines are used to determine the various noise environments potentially requiring an EIS. The Quiet Communities Act of 1978 was enacted by Congress to promote various measures that allow local, state, and federal agencies to implement noise control programs, conduct experimental noise studies, and develop techniques for the control of noise, among other things.

The Federal Interagency Committee on Urban Noise (FICUN) was formed in 1979 and published Guidelines for Considering Noise In Land-Use Planning and Control (FICUN, 1980). These guidelines complement federal agency criteria by providing for the consideration of noise in all land-use planning and interagency/intergovernmental processes. The FICUN established DNL as the most appropriate descriptor for all noise sources. Guidelines for Noise Impact Analysis (U.S. EPA, 1982) provided all types of decision-makers with analytic procedures to uniformly express and quantify impacts from noise.

The American National Standards Institute (ANSI) endorsed DNL in 1990 as the "acoustical measure to be used in assessing compatibility between various land uses and outdoor noise environment." In 1992 the Federal Interagency Committee on Noise (FICON) reaffirmed

the use of L_{dn} as the principal aircraft noise descriptor in the document entitled Federal Agency Review of Selected Airport Noise Analysis Issues (FICON, 1992).

2.3 Computerized Noise Exposure Model MR_NMAP

The computer program used to compute the noise exposure for the purposes of this study (MR_NMAP) was developed for DoD by the United States Air Force (USAF) (Lucas and Calamia, 1994). This program is most appropriate for comparing "before-and-after" noise effects, which would result from proposed changes or alternative noise control actions, when the calculations are made in a consistent manner. They allow noise predictions for such proposed actions without the actual implementation and noise monitoring of those actions.

MR_NMAP is a model, based on NOISEMAP technology, for predicting aircraft noise from aircraft operating in three types of special-use airspace: MOAs, Range/Restricted Areas, and MTRs. NOISEMAP technology is addressed in detail in Air Force Procedure for Predicting Noise Around Airbases, (Air Force, 1992).

A MOA is a defined volume of airspace with an altitude structure normally ranging from the ground to, but not including 18,000 MSL. MOAs are designated to separate or segregate certain non-hazardous military aircraft activities, such as air combat maneuvers, intercepts, etc., from IFR traffic. When flying through a MOA, VFR traffic must exercise extreme caution. ATC provides separation for IFR traffic.

An MTR is a defined volume of airspace designed for use by military aircraft. MTRs generally have an altitude structure below 10,000 feet MSL and military aircraft operations in excess of 250 KIAS. The purpose for developing and charting MTRs on maps is to enable non-participating aircraft to be aware of the presence of high-speed military air traffic in the vicinity. Non-participating civil and military aircraft may fly within an MTR, but are required to maintain visual separation from other aircraft in visual meteorological conditions and, under instrument meteorological conditions, air traffic control is required to provide separation between all aircraft.

Restricted Areas or ranges are airspace of specific dimensions where activities must be confined because of their nature and which may be considered hazardous to non-participating aircraft. Non-participating aircraft are prohibited from flying through Restricted Areas when they are active. Most Restricted Areas are joint use, and Instrument Flight Rules/Visual Flight Rules (IFR/VFR) operations in the area may be authorized by the controlling DoD agency when the airspace is not in use. Restricted Areas are depicted on enroute charts. A range is defined as a portion of ground which underlies a Restricted Area and is utilized for ordnance delivery.

The MR_NMAP suite of computer programs consists of MR_OPS Version 1.0, OMEGA10R, MR_NMAP Version 1.10, NMPLOT Version 3.05, and NOISEFILE Version 6.4. The MR_OPS program allows for entry of airspace information, the horizontal distribution of operations, flight profiles (average power settings, altitude distributions, and speeds), and numbers of sorties. "Horizontal distribution of operations" refers to the modeling of lateral airspace utilization via three general representations: broadly distributed operations for modeling of

MOA and range events, operations distributed among parallel tracks for modeling of MTR events, and operations on specific tracks for modeling of unique MOA, range, MTR, or target area activity.

OMEGA10R extrapolates/interpolates the reference SELs for each model of aircraft from the NOISEFILE database, taking into consideration the specified speeds, engine thrust settings, and environmental conditions appropriate to each flight operation, and generates tables of SEL for increasing altitude. The core program, called MR_NMAP, incorporates the number of daytime (0700–2200) and nighttime (2200–0700) operations, specified horizontal distributions, volume of the airspace, and profiles of the aircraft to primarily calculate: (a) L_{dnmr} at many points on the ground, (b) average L_{dnmr} for the entire airspace, or (c) maximum L_{dnmr} under MTRs or specific tracks. From calculations of L_{dnmr} for many points on the ground, the NMPLOT program draws contours of equal L_{dnmr} for overlay onto land-use maps.

In calculating time-average sound levels for airspace, the reliability of the results decreases at lower levels (below 55 dB). This arises from the increasing variability of individual aircraft sound levels at the longer distances due to atmospheric effects on sound propagation and to the presence of other sources of noise. Also, when flight activity is infrequent, the time-averaged sound levels are generated by only a few individual aircraft noise events, which may not be statistically representative of the given aircraft modeled. Time-average outdoor sound levels less than 45 dB are well below any currently accepted guidelines for aircraft noise compatibility. As discussed in Appendix A, most of the guidelines for the acceptability of aircraft noise are on the order of 65 dB and higher. Therefore, all calculated levels less than 50 dB are stated in this report only as "<50 dB."

3.0 Baseline Conditions

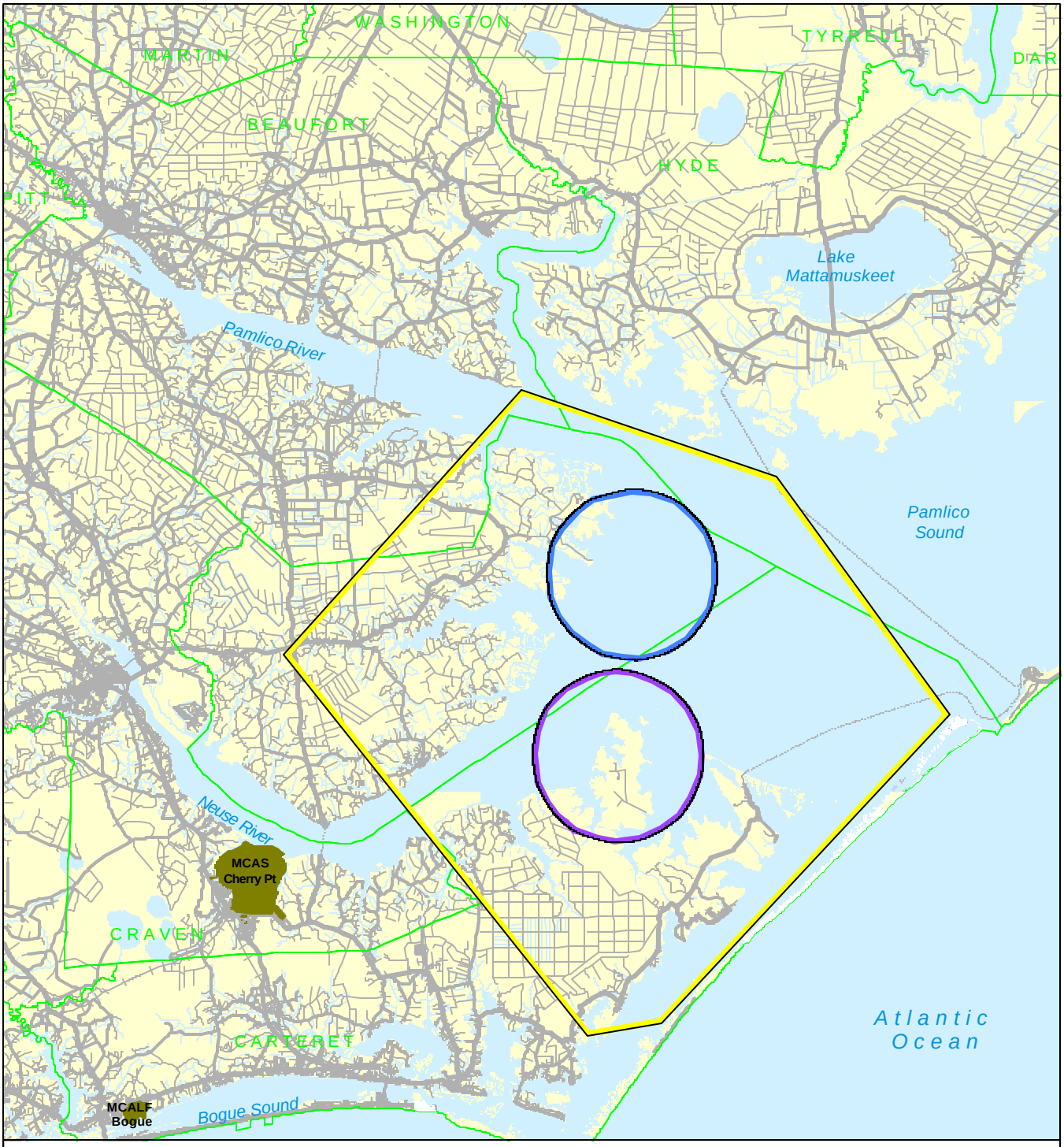
As mentioned in Section 1.0 of this report, baseline conditions are defined as CY00 utilization levels for the airspace studied. The training of aircrew members in order to achieve and maintain combat-ready status requires the use of specially designated airspace. The study airspace, as defined for the baseline conditions, consists of two associated bombing targets (BT-9 and BT-11) within Restricted Area R-5306A. These airspace units were geographically located using information contained in the Charlotte aeronautical sectional chart and are briefly described in the following sections (U.S. Department of Commerce, September 2000). The existing airspace is used primarily by aircraft based at MCAS Cherry Point as well as aircraft operated by other DoD entities such as the Air Force, Navy and Air National Guard.

3.1 Description of Airspace

A wide array of DoD aircraft (Navy, Marine, Air Force, Army; Guard, Reserve and active duty) utilize the airspace analyzed in this report for a variety of training operations. A brief description of each airspace unit is provided in the following paragraphs and a graphical depiction is provided in Figure 3.1.

Along with BT-9 and BT-11, Restricted Area R-5306A is located in eastern North Carolina south of the Pamlico River and north of MCAS Cherry Point and Morehead airfields. The airspace overlies the Pamlico Sound and the North Carolina coastline to the east and extends westerly approximately 15 nautical miles. Aircraft operations within R-5306A can be conducted anywhere from the surface to, but not including 18,000 MSL, also noted as Flight Level 180 (FL 180).

BT-9 lies within the northern portion of R-5306A. BT-11 lies directly to the south of BT-9, over Cedar Island. BT-9 and BT-11 are circular ranges of a radius of approximately five nautical miles.



Special Use Airspace

Restricted Airspace 5306A

Bombing Target Area BT-9

Bombing Target Area BT-11

County

Military Property

Stream

Large Water Body

Rail

Road

0 5 10 miles

N W E S

BaselineSUAs.wor

Figure 3.1

Special Use Airspace for Baseline Conditions

wyle laboratories

3.2 Airspace Sorties

Airspace flight operations presented in Table 3-1 for the baseline conditions were obtained from "Airfield and Airspace Study for the Introduction of F/A-18 E/F to the East Coast" (ATAC, 2001) and reviewed by MCAS Cherry Point personnel (Brown, 2001). These sorties are representative of CY00 tempo of operations. For the modeled aircraft, transitions through R-5306A in order to reach BT-9 and BT-11 were considered random sorties in R-5306A. For example, having entered R-5306A, ingress and egress to a target (BT-9 or BT-11) can occur from almost any point. Due to the fact that BT-9 and BT-11 are integral parts of R-5306A, and cannot be used without aircraft transiting through R-5306A, annual sorties for BT-9 and BT-11 were also modeled for R-5306A.

For BT-9, AV-8B Harrier aircraft were dominant in terms of total number of sorties. They conducted 31 percent, of all BT-9 sorties. Air Force jets (F-15E and F-16 aircraft) and Naval Air Station (NAS) Oceana and USMC F/A-18C/D aircraft were the next highest contributors to BT-9 sorties and represented 26 and 22 percent of all sorties, respectively.

For BT-11, AV-8B Harrier aircraft conducted 36 percent, of all sorties in the bombing target area. The next major contributor of sorties were NAS Oceana and USMC F/A-18 C/D aircraft (24 percent) and Air Force jets (F-15E and F-16 aircraft) (21 percent) of all BT-11 sorties.

For R-5306A, Table 3-1 shows the number of operations that utilized R-5306A exclusively without also utilizing BT-9 and BT-11. AV-8B Harrier aircraft flew over 88 percent of random sorties in R-5306A.

Also shown in Table 3-1 is the average duration, in minutes, of the sorties in the respective airspace. The average sortie duration in BT-9, BT-11 and R-5306A were obtained from "Aircraft Noise Study for the 1995 BRAC Realignment of Navy F/A-18 Aircraft" (Czech et al., 1998) and reviewed by MCAS Cherry Point personnel (Brown, 2001). They represent the ratio of the total time spent by an individual aircraft in the airspace by the total number of sorties of that aircraft in the airspace.

In addition to the number of sorties in the airspace, other modeling parameters include average power settings, speed, altitude ranges and the percentage of the total sorties of an aircraft that occurs within a designated altitude range, all of which are shown in Table 3-2.

Table 3.1.
Annual Sorties for Baseline Conditions for BT-9, BT-11 and R-5306A

(1) BT-9

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-14B/D (NAS Oceana Fleet)	39	0	39	12
F-14B/D (NAS Oceana FRS)	53	0	53	12
F/A-18C/D (NAS Oceana Fleet)	200	10	210	11
F/A-18C/D (US Marine Corps)	204	12	216	21
T-34[1]	3	0	3	41
AV-8B (Fleet)	178	4	182	26
AV-8B (FRS)	424	6	430	21
F-15E (Air Force Jets)	59	0	59	19
F-16 (Air Force Jets)	432	9	441	21
CH-46 (US Marine Corps)	130	0	130	20
CH-53 (US Marine Corps)	16	0	16	19
UH-1 (US Marine Corps)	50	0	50	20
Army Helo[2]	76	0	76	28
Other Jet[3]	20	0	20	39
Other Prop[1]	20	0	20	41
Total	1,904	41	1,945	

(2) BT-11

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-14B/D (NAS Ocean Fleet)	397	0	397	18
F-14B/D (NAS Oceana FRS)	43	0	43	18
F/A-18C/D (NAS Oceana Fleet)	624	50	674	18
F/A-18C/D (US Marine Corps)	376	16	392	17
T-34[1]	5	0	5	44
AV-8B (Fleet)	1,144	38	1,182	26
AV-8B (FRS)	406	7	413	22
KC-130 (MCAS Cherry Point Fleet)	3	1	4	36
F-15E (Air Force Jets)	379	10	389	19
F-16 (Air Force Jets)	368	0	368	22
F-16 (Air National Guard)	188	0	188	17
CH-46 (US Marine Corps)	197	0	197	21
CH-53 (US Marine Corps)	21	0	21	17
UH-1 (US Marine Corps)	69	0	69	20
Army Helo[2]	76	16	92	64
Other Jet[3]	37	0	37	45
Other Prop[1]	18	0	18	44
Total	4,349	138	4,487	

(3) R-5306A (exclusive of BT-9 and BT-11)

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F/A-18C/D (US Marine Corps)	100	0	100	39
AV-8B (Fleet)	2,638	51	2,689	47
AV-8B (FRS)	2,330	11	2,341	36
A-10 (Air Force Jets)	30	0	30	18
F-15E (Air Force Jets)	54	0	54	37
F-16 (Air Force Jets)	202	4	206	28
F-16 (Air National Guard)	25	0	25	27
AH-1 (US Marine Corps)	134	0	134	5
Other Jet[3]	36	0	36	64
Other Prop[1]	90	0	90	74
Total	5,639	66	5,705	

[1] Modeled as C-130 H

[2] Modeled as AH-64

[3] Modeled as F/A-18C/D

Table 3.2.
Flight Profiles for Baseline Conditions for BT-9, BT-11 and R-5306A

(1) BT-9

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-14 BD (NAS Ocean Fleet)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F-14 B/D (NAS Oceana FRS)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F/A-18 C/D (NAS Oceana Fleet)	88% NC	400			2%	3%	10%	20%	65%
F/A-18 C/D (US Marine Corps)	88% NC	400			2%	3%	10%	20%	65%
T-34[1]	850 C TIT	220		10%	60%	15%	15%		
AV-8B (Fleet)	90% RPM	500				36%	12%	12%	40%
AV-8B (FRS)	85% RPM	500				17%	17%	16%	50%
F-15E (Air Force Jets)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force Jets)	87% NC	450			20%	24%	23%	23%	10%
CH-46 (US Marine Corps)	94 % O-BPA	130		100%					
CH-53 (US Marine Corps)	90 % O-BPA	150		100%					
UH-1 (US Marine Corps)	100 % RPM	80		100%					
Army Helo[2]	150 KNTS	150		100%					
Other Jet[3]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[1]	850 C TIT	220		10%	60%		30%		

(2) BT-11

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-14 B/D (NAS Ocean Fleet)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F-14 B/D (NAS Oceana FRS)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F/A-18 C/D (NAS Oceana Fleet)	88% NC	400			2%	3%	10%	20%	65%
F/A-18 C/D (US Marine Corps)	88% NC	400			2%	3%	10%	20%	65%
T-34[1]	850 C TIT	220		10%	60%		30%		
AV-8B (Fleet)	90 % RPM	500			25%	12%	12%	11%	40%
AV-8B (FRS)	85 % RPM	500			10%	14%	13%	13%	50%
KC-130 (MCAS Cherry Point Fleet)	850 C TIT	220		10%	60%		30%		
F-15E (Air Force Jets)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force Jets)	87% NC	450			20%	24%	23%	23%	10%
F-16 (Air National Guard)	87% NC	450			20%	24%	23%	23%	10%
CH-46 (US Marine Corps)	94 % O-BPA	130		100%					
CH-53 (US Marine Corps)	90 % O-BPA	150		100%					
UH-1 (US Marine Corps)	100 % RPM	80		100%					
Army Helo[2]	150 KNTS	150		100%					
Other Jet[3]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[1]	850 C TIT	220		10%	60%		30%		

(3) R-5306A (exclusive of BT-9 and BT-11)

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F/A-18 C/D (US Marine Corps)	88% NC	400	5%	5%	25%	10%	10%	20%	25%
AV-8B (Fleet)	85% RPM	350				35%	25%		40%
AV-8B (FRS)	75% RPM	350				40%	20%		40%
A-10 (Air Force Jets)	5333 NF	275		2%	30%	20%	20%	20%	8%
F-15E (Air Force Jets)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force Jets)	87% NC	450			20%	24%	23%	23%	10%
F-16 (Air National Guard)	87% NC	450			20%	24%	23%	23%	10%
AH-1 (US Marine Corps)		150		100%					
Other Jet[3]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[1]	850 C TIT	220		10%	60%		30%		

[1]Modeled as C-130 H
[2]Modeled as AH-64
[3]Modeled as F/A-18 C/D
[4]Modeled as AH-1

As shown in Table 3.2, 80 percent of Air Force F-15E sorties occur below 1,000 feet. All other jets generally conduct less than 35 percent of their total sorties below 1,000 feet. Noise associated with military jet sorties is expected to dominate the overall noise impact within the restricted areas and ranges. Fixed wing propeller aircraft were modeled as a C-130H. For fixed wing propeller aircraft, 70 percent of sorties occur below 1,000 feet. Of all rotary wing aircraft sorties in BT-9, BT-11 and R-5306A, 100 percent occur at 500 feet and below.

Though the airspace of interest may be available every day of the month, military aircraft do not typically utilize them daily. To accommodate the sporadic nature of military operations, the computerized noise model calculates noise levels based on the number of flying days in the busiest month of the year. MCAS Cherry Point personnel provided modeling periods of 16, 23 and 23 days for BT-9, BT-11 and R-5306A, respectively.

Flight operations within BT-9, BT-11 and R-5306A were conducted over a range of altitudes, depending on the type of aircraft, available airspace, target, and training mission requirements, and generally not in a pattern that can be easily identified as common for a given aircraft. As such, random distribution was deemed the best method of analyzing the sorties in this airspace. The variability of power settings and airspeeds of the aircraft types studied did not lend itself to seeking common power settings/airspeed combinations. Typical airspeeds for jet aircraft range from about 275 knots to as high as 520 knots or more and a number of power/attitude combinations can be used to achieve these speeds. As such, representative average power settings/airspeeds were deemed adequate for the modeling of random operations in the airspace addressed in this analysis.

3.3 Noise Exposure

Using the data shown in Table 3-1 and Table 3-2, values of L_{dnmr} were calculated using the MR_NMAP computer program to simulate a random distribution of sorties within BT-9, BT-11 and R-5306A. This calculation represents an estimation of the existing average noise exposure levels within each airspace, and the results are presented in Table 3.3.

Table 3.3.
Average L_{dnmr} (dB) Within BT-9, BT-11 and R-5306A for Baseline Conditions

Airspace Component	Average L_{dnmr} (dB)
BT-9 (within 5 nm radius)	62
BT-11 (within 5 nm radius)	68
R-5306A	57

Due to the more concentrated activity of the modeled aircraft within BT-9 and BT-11 in R-5306A, the L_{dnmr} values in those areas are moderately high at 62 and 68 dB, respectively. Noise levels generated by aircraft operating in R-5306A were calculated to have an L_{dnmr} level of 57 dB.

4.0 Proposed Alternatives

The Marine Corps proposes to enhance existing and future training opportunities for the Second Marine Aircraft Wing (2d MAW) and other aircraft operating out of MCAS Cherry Point. The proposed action is to create two functionally independent MOAs. While each of these MOAs would have beneficial stand-alone training value, implementing both MOAs would provide the greatest improvement of the quality of aviation training for aircraft operating out of MCAS Cherry Point. The purpose of this section is to provide an analysis of future noise exposure should one or more of the proposed MOA alternatives be implemented.

As described in Section 2, a MOA is established for the purpose of separating military training activities from IFR traffic and to alert VFR traffic of the possible existence of a high concentration of military aircraft activities. Generally, MOAs are utilized for military training requiring acrobatic or abrupt flight maneuvers that could pose hazards to other aircraft in the airspace. To increase pilot awareness while flying through these areas, MOAs are depicted on sectional navigation charts.

The proposed alternative MOAs analyzed in this report include:

- Core MOA
- Mattamuskeet MOA
- Cherry MOA
- Core and Mattamuskeet MOAs
- Core and Cherry MOAs
- F/A-18E/F Aircraft Siting at NAS Oceana
- F/A-18E/F Aircraft Siting at MCAS Cherry Point

However, while full implementation of anyone of the identified alternatives would have a positive effect on the quality of training for Marine Corps aviation, a combination of the Core MOA (Core Banks Area) with any of the other proposed MOAs would result in the greatest training benefit. Also, it should be made clear that the marine Corps is not proposing to create all these MOAs, rather, at most the Marine Corps desires to create two (Core MOA plus one other). One out of the proposed scenarios would be implemented. For each proposed alternative, airspace description, operations and noise exposure are discussed in the following sections.

4.1 Core MOA Alternative

Under this alternative, only the proposed Core MOA would be implemented. The creation of the Core MOA would allow for realistic ingress and egress from Warning Area W-122 to R-5306A without the FAA-imposed restriction on airspeed as described in Section 2.1. The following sections describe the airspace of interest under this alternative, their operations and noise exposure.

4.1.1 Description of Airspace

Figure 4.1 provides a graphical depiction of the airspace under this alternative. The proposed Core MOA is adjacent to the eastern boundaries of R-5306A described in Section 3 and the Pamlico Sound area. It overlies the Core Banks (Cape Lookout National Seashore) from approximately 10 miles east of the Morehead Airport (but not including the airspace over the Cape Lookout Lighthouse) to about 1.25 miles from the eastern end of Portsmouth Island. The Core MOA would average approximately 3 nautical miles in width. Aircraft operations within Core MOA are allowed from 3,000 Above Ground Level (AGL) to, but not including, FL 180. However, according to information received from MCAS Cherry Point personnel, these operations are expected to occur between 3,000 AGL and 10,000 AGL. No sustained operations are proposed for this airspace. R-5306A and the associated bombing target areas BT-9 and BT-11 were previously described in Section 3.1.

4.1.2 Airspace Sorties

Airspace sorties presented in this section for the proposed Core MOA alternative were obtained from "Airfield and Airspace Study for the Introduction of F/A-18E/Fs To The East Coast", (ATAC, 2001) and validated by MCAS Cherry Point personnel (Brown, 2001). Table 4.1-1 presents the sorties and average sortie duration associated with all airspace of interest under this alternative.

Of all Core MOA sorties, 60 percent are in flights of two aircraft, 30 percent in flights of four aircraft and 10 percent are single aircraft. The number of flying days in the busiest month would be 23 for Core MOA. The sortie duration for Core MOA represents the time it takes an individual aircraft to ingress and egress through the MOA. In order to remain conservative, the Core MOA sortie duration was estimated to be one minute.

For R-5306A and associated bombing targets BT-9 and BT-11, individual aircraft airspace sorties, sortie duration and average power, speed and altitude distributions would remain unchanged from the baseline conditions as described in Section 3.2. Further, the number of flying days in the busiest month would remain at 23 for R-5306A, the same as under existing conditions.

Table 4.1-1 presents annual sorties for all airspace of interest under this alternative. For Core MOA, the dominant aircraft in terms of sorties would be expected to be the AV-8B Harrier aircraft with approximately 68 percent of the MOA sorties. USAF F-16 and USMC F/A-18 C/D are the second most dominant aircraft with approximately 10 percent of Core MOA sorties each. The aircraft mix and number of sorties expected to utilize BT-9, BT-11 and R-5306A would remain unchanged from baseline conditions.

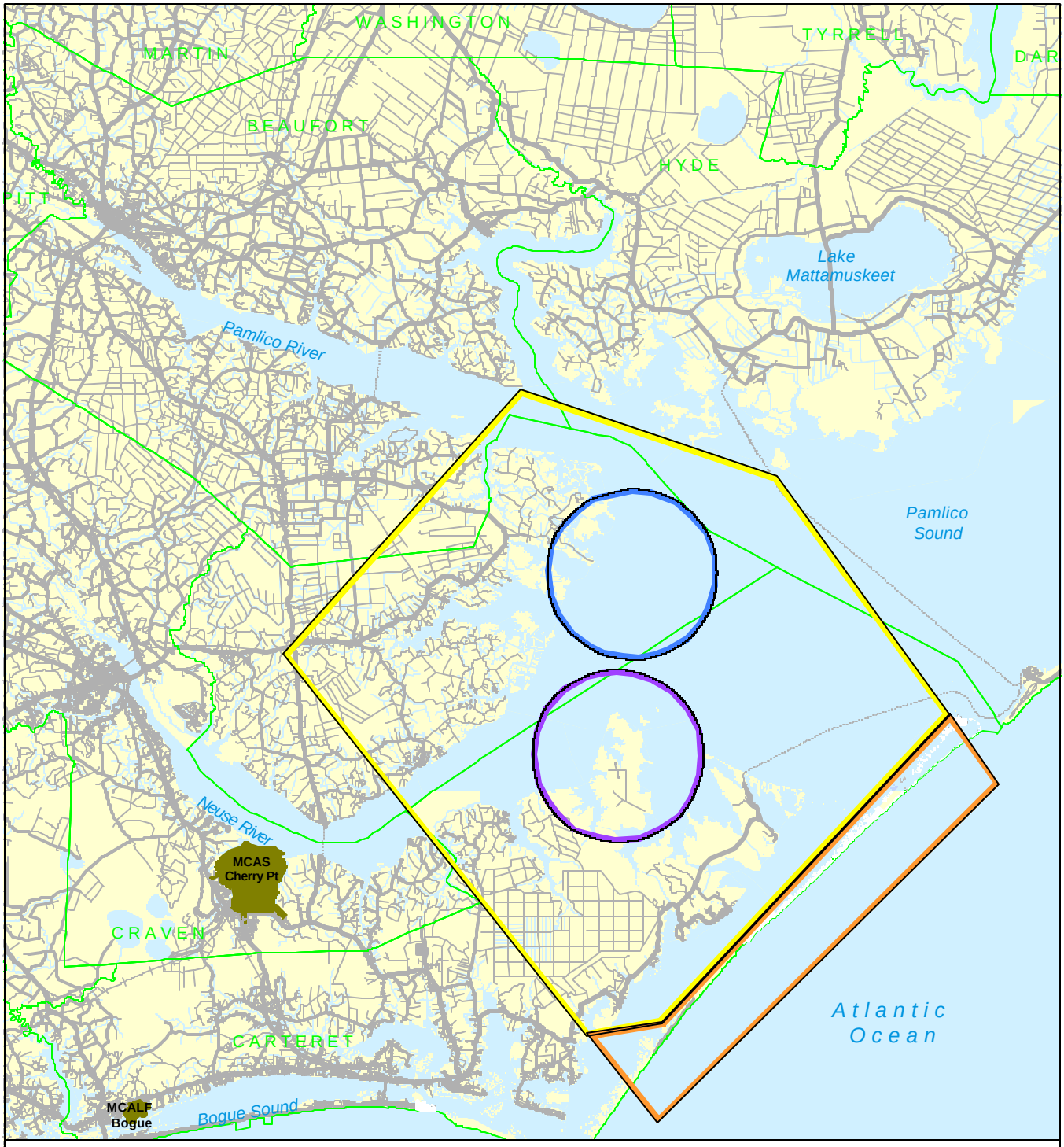


Figure 4.1

Special Use Airspace for the Core MOA Alternative

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Table 4.1-1.
Annual Sorties for the Core MOA Alternative for Core MOA, BT-9, BT-11 and R-5306A

(1) Core MOA

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-15E (Air Force)	62	1	63	1
F-16 (Air Force)	148	1	149	1
AV-8B (US Marine Corps FRS)	25	0	25	1
AV-8B (US Marine Corps Gun)	940	34	974	1
F/A-18C/D (US Marine Corps)	142	8	150	1
F/A-18C/D (Navy USS Fleet)	58	9	67	1
F-14B/D (Navy USS Fleet)	23	3	26	1
Other Jets[1]	6	0	6	1
Total	1,404	56	1,460	

(2) BT-9

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-14B/D (NAS Ocean Fleet)	39	0	39	12
F-14B/D (NAS Oceana FRS)	53	0	53	12
F/A-18C/D (NAS Oceana Fleet)	200	10	210	11
F/A-18C/D (US Marine Corps)	204	12	216	21
T-34[2]	3	0	3	41
AV-8B (Fleet)	178	4	182	26
AV-8B (FRS)	424	6	430	21
F-15E (Air Force)	59	0	59	19
F-16 (Air Force)	432	9	441	21
CH-46 (US Marine Corps)	130	0	130	20
CH-53 (US Marine Corps)	16	0	16	19
UH-1 (US Marine Corps)	50	0	50	20
Army Helo[3]	76	0	76	28
Other Jet[1]	20	0	20	39
Other Prop[2]	20	0	20	41
Total	1,904	41	1,945	

(3) BT-11

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-14B/D (NAS Ocean Fleet)	397	0	397	18
F-14 B/D (NAS Oceana FRS)	43	0	43	18
F/A-18C/D (NAS Oceana Fleet)	624	50	674	18
F/A-18C/D (US Marine Corps)	376	16	392	17
T-34[1]	5	0	5	44
AV-8B (Fleet)	1,144	38	1,182	26
AV-8B (FRS)	406	7	413	22
KC-130 (MCAS Cherry Point Fleet)	3	1	4	36
F-15E (Air Force Jets)	379	10	389	19
F-16 (Air Force Jets)	368	0	368	22
F-16 (Air National Guard)	188	0	188	17
CH-46 (US Marine Corps)	197	0	197	21
CH-53 (US Marine Corps)	21	0	21	17
UH-1 (US Marine Corps)	69	0	69	20
Army Helo[2]	76	16	92	64
Other Jet[3]	37	0	37	45
Other Prop[1]	18	0	18	44
Total	4,349	138	4,487	

Table 4.1-1.
Annual Sorties for the Core MOA Alternative for Core MOA, BT-9, BT-11 and R-5306A-continued
(4) R-5306A (exclusive of BT-9 and BT-11)

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F/A-18C/D (US Marine Corps)	100	0	100	39
AV-8B (Fleet)	2,638	51	2,689	47
AV-8B (FRS)	2,330	11	2,341	36
A-10 (Air Force)	29	0	29	18
F-15E (Air Force)	54	0	54	37
F-16 (Air Force)	202	4	206	28
F-16 (Air National Guard)	25	0	25	27
AH-1 (US Marine Corps)	134	0	134	5
Other Jet[1]	36	0	36	64
Other Prop[2]	90	0	90	74
Total	5,639	66	5,705	

[1]Modeled as F/A-18 C/D

[2]Modeled as C-130 H

[3]Modeled as AH-64

*60 percent of all sorties in Core are in a flight of two aircraft, 30 percent in a flight of four aircraft and 10 percent indivial aircraft; thus the modeled number of sorties equals 2.5 times sorties presented in Table 4.1-1

Table 4.1-2 shows that for jets traversing the Core MOA, 35 percent of the total sorties would be expected to occur between 3,000 and 5,000 feet AGL; the remaining sorties would be expected to fly above 5,000 feet AGL. For BT-9, BT-11 and R-5306A, average power, speed and altitude ranges are the same as were discussed in Section 3.2.

Table 4.1-2.
Flight Profiles for the Core MOA Alternative for Core MOA, BT-9, BT-11 and R-5306A

(1) Core MOA

Aircraft Type	Typical		Typical Altitude Distribution (ft, Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-15E (Air Force)	81% NC	520					35%	45%	20%
F-16 (Air Force)	87% NC	450					35%	45%	20%
AV-8B (US Marine Corps FRS)	90% RPM	500					35%	45%	20%
AV-8B (US Marine Corps Gun)	85% RPM	500					35%	45%	20%
F/A-18C/D (US Marine Corps)	88% NC	400					35%	45%	20%
F/A-18C/D (Navy USS Fleet)	88% NC	400					35%	45%	20%
F-14B/D (Navy USS Fleet)	92% NC	400					35%	45%	20%
Other Jets[1]	88% NC	400					35%	45%	20%

Table 4.1-2.
Flight Profiles for the Core MOA Alternative for Core MOA, BT-9, BT-11 and R-5306A-*continued*

(2) BT-9

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-14B/D (NAS Ocean Fleet)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F-14B/D (NAS Oceana FRS)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F/A-18 C/D (NAS Ocean Fleet)	88% NC	400			2%	3%	10%	20%	65%
F/A-18 C/D (US Marine Corps)	88% NC	400			2%	3%	10%	20%	65%
T-34[2]	850 C TIT	220		10%	60%	15%	15%		
AV-8B (Fleet)	90% RPM	500				36%	12%	12%	40%
AV-8B (FRS)	85% RPM	500				17%	17%	16%	50%
F-15E (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
CH-46 (US Marine Corps)	94 % Q-BPA	130		100%					
CH-53 (US Marine Corps)	90 % Q-BPA	150		100%					
UH-1 (US Marine Corps)	100 % RPM	80		100%					
Army Helo[3]	150 KNTS	150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

(3) BT-11

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-14B/D (NAS Ocean Fleet)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F-14B/D (NAS Oceana FRS)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F/A-18C/D (NAS Ocean Fleet)	88% NC	400			2%	3%	10%	20%	65%
F/A-18C/D (US Marine Corps)	88% NC	400			2%	3%	10%	20%	65%
T-34[2]	850 C TIT	220		10%	60%		30%		
AV-8B (Fleet)	90 % RPM	500			25%	12%	12%	11%	40%
AV-8B (FRS)	85 % RPM	500			10%	14%	13%	13%	50%
KC-130 (MCAS Cherry Point Fleet)	850 C TIT	220		10%	60%		30%		
F-15E C/D (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
F-16 (Air National Guard)	87% NC	450			20%	24%	23%	23%	10%
CH-46 (US Marine Corps)	94 % Q-BPA	130		100%					
CH-53 (US Marine Corps)	90 % Q-BPA	150		100%					
UH-1 (US Marine Corps)	100 % RPM	80		100%					
Army Helo[3]	150 KNTS	150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

(4) R-5306A (exclusive of BT-9 and BT-11)

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F/A-18C/D (US Marine Corps)	88% NC	400	5%	5%	25%	10%	10%	20%	25%
AV-8B (Fleet)	85% RPM	350				35%	25%		40%
AV-8B (FRS)	75% RPM	350				40%	20%		40%
A-10 (Air Force)	5333 NF	275		2%	30%	20%	20%	20%	8%
F-15E (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
F-16 (Air National Guard)	87% NC	450			20%	24%	23%	23%	10%
Marine Corps Helicopters[4]	NR	150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

[1]Modeled as F/A-18 C/D

[2]Modeled as C-130 H

[3]Modeled as AH-64

[4]Modeled as AH-1

4.1.3 Noise Exposure

Using the data shown in Table 4.1-1 and Table 4.1-2, values of L_{dnmr} were calculated using the MR_NMAP computer program to simulate a random distribution of sorties within Core, BT-9, BT-11 and R-5306A. This calculation represents an estimation of the average noise exposure levels within each airspace if the Core MOA Alternative is implemented.

The calculated L_{dnmr} values for all airspace under this alternative are shown in Table 4.1-3. The resulting noise level for Core MOA would be expected to be less than 50 dB. For BT-9, BT-11 and R-5306A, the noise levels under this alternative would remain unchanged from baseline conditions.

Table 4.1-3.
Average L_{dnmr} (dB) Within Core MOA, BT-9, BT-11 and R-5306A for the Core MOA Alternative

Airspace Component	Average L_{dnmr} (dB)
Core MOA	<50
BT-9 (within 5 nm radius)	62
BT-11 (within 5 nm radius)	68
R-5306A	57

4.1.4 Sensitive Receptor Analysis

Under this alternative, the locations presented in Table 4.1-4 and depicted among others in Figure 4.1-1 were evaluated for noise exposure. Onset-rate adjusted sound levels related to aircraft sorties in the Core MOA were computed and were found to be less than 50 dB.

Table 4.1-4. Nominal Sound Exposure Level at Sensitive Receptors Within the Core MOA

Special Use Airspace	Receptor Name	Address (if available)	West Longitude		North Latitude		L_{dnmr} Value (dB)
			Degrees	Minutes	Degrees	Minutes	
Core MOA	Ferry Landing North		76	13	34	56	<50
	Ferry Landing South		76	25	34	45.5	<50
	Portsmouth Village		76	04	35	04	<50

Special Use Airspace

- Restricted Airspace 5306A
- Bombing Target Area BT-9
- Bombing Target Area BT-11
- County
- Military Property
- Stream
- Large Water Body
- Rail
- Road

0 5 10 miles

N W E S

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Figure 4.1.1

Sensitive Receptor Locations

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The results provided by the computing program MR_NMAP are widely accepted for quantifying noise impact within airspace. However, it does not provide an intuitive description of the noise environment. People often desire to know what the loudness of individual aircraft are; MR_NMAP and its supporting programs can provide the SEL for individual aircraft at various distances and altitudes. Table 4.1-5 shows the SEL noise levels at various altitudes for the dominant aircraft in this analysis: the AV-8B and the F/A-18 C/D aircraft.

Table 4.1-5.
Single Event Level (SEL) in dB at Various Altitudes

Aircraft Type	Flight conditions[c]		3000 Feet AGL	5000 Feet AGL	10,000 Feet AGL
	Power Setting	Speed (KIAS)[d]	SEL (dB)		
AV-8B	85% RPM[e]	470[a]	94	87	77
	72% RPM	250	89	83	74
F/A-18 C/D	92%NC[f]	500[b]	96	89	77
	77%NC	250	78	73	65

Source: NOISEMAP
a AV-8B data in NOISEFILE was collected for speeds below 449 KIAS.
For speeds above 449 KIAS (High Speed Operations), airframe noise was estimated
b F/A-18C/D Training Route Conditions
c Power/Speeds conditions provided by Earth Tech/TAMS on April 10, 2003
d KIAS=Knot Indicated Airspeed
e RPM=Revolution Per Minute
f NC=Engine Core Speed

4.2 Mattamuskeet MOA Alternative

Under this alternative, only the Mattamuskeet MOA would be implemented within the time frame of the proposed action. There would be no change to BT-9, BT-11 and R-5306A, airspace currently used by MCAS Cherry Point based aircraft and other DoD aircraft. The creation of the Mattamuskeet MOA would permit MCAS Cherry Point based aircraft operations not requiring the use of restricted airspace to be accommodated in a MOA located within a reasonable distance of MCAS Cherry Point. This would increase training opportunities, as well as improve training efficiency. The following sections describe the airspace of interest under this alternative, their proposed operations and the resulting noise exposure.

4.2.1 Description of Airspace

Figure 4.2 provides a graphical depiction of all airspace under this alternative. The proposed Mattamuskeet MOA, of approximate dimensions of 25 nm by 30 nm, is adjacent to the northern boundary of R-5306A and western boundary of the Pamlico Sound area. The northern boundary extends westward to Pungo Lake, then southward to a point east of the Bay River. The MOA overlies portions of Hyde, Tyrrell, and Washington counties in the state of North Carolina and would span the area between SUA associated with the existing Dare County Bombing Range (R-5314), R-5306A and the Pamlico B MOA. Aircraft operations within Core MOA are allowed anywhere from 3,000 Above Ground Level (AGL) to, but not including, FL 180. However, according to information received from MCAS Cherry Point

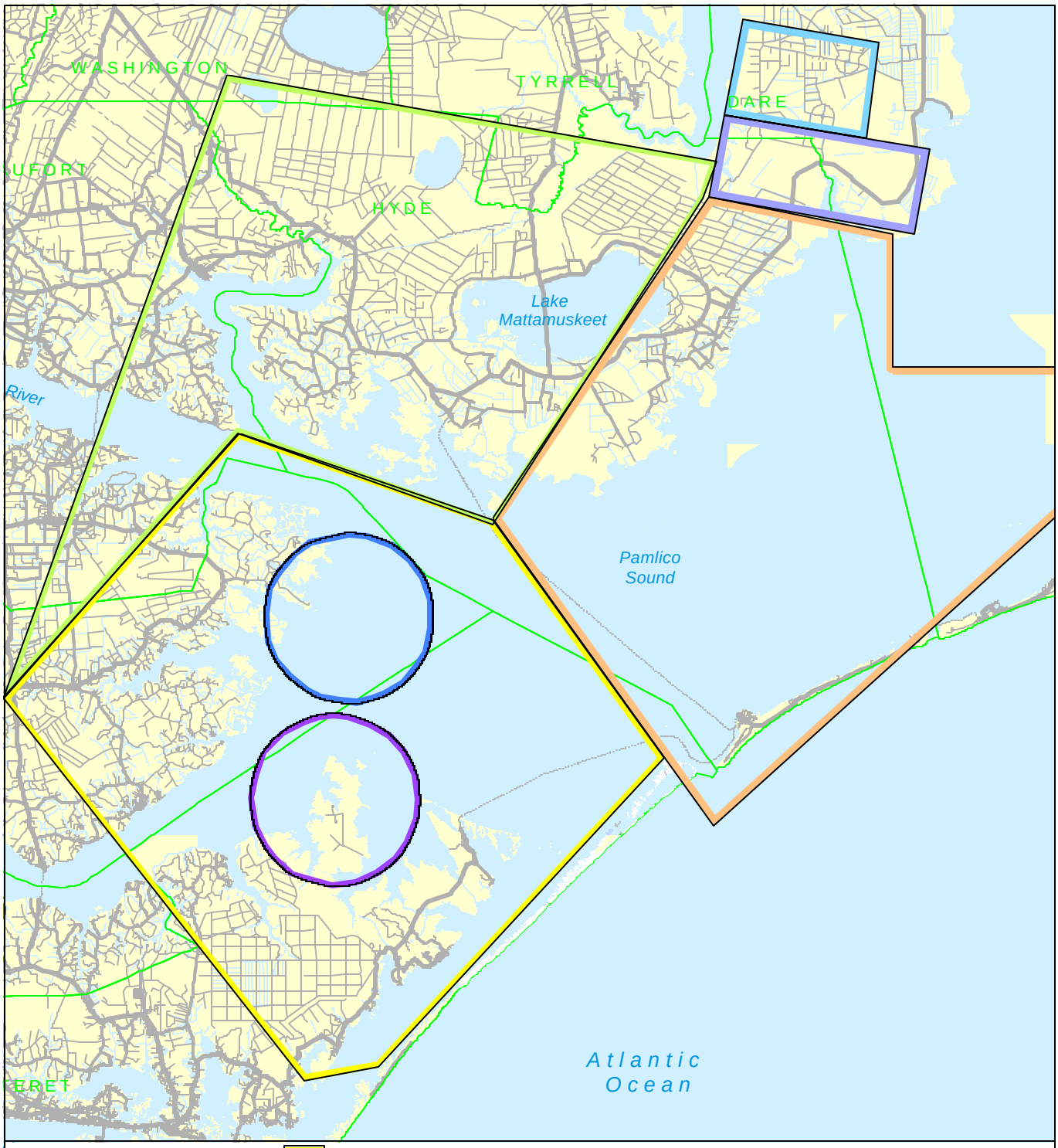
personnel, these operations are expected to occur between 3,000 AGL and 10,000 AGL. The following section describes operations associated with this alternative.

4.2.2 Airspace Sorties

Airspace sorties presented in this section for the proposed Mattamuskeet MOA alternative were obtained from "Airfield and Airspace Study for the Introduction of F/A-18E/Fs To the East Coast" (ATAC, 2001) and reviewed by MCAS Cherry Point personnel (Brown, 2001). Table 4.2-1 presents the number of sorties and average mission duration associated with all airspace of interest under this alternative.

For bombing targets BT-9, BT-11 individual aircraft sorties, mission duration and average power, speeds and altitude distributions would remain unchanged from the baseline conditions as described in Section 3.2. For R-5306A, AV-8B sorties would decrease by approximately 30 percent. The number of flying days in the busiest month for R-5306A would remain at 23.

Table 4.2-2 shows that for jets operating in the Mattamuskeet MOA, 75 percent of the total sorties would occur between 3,000 and 10,000 feet AGL. The remainder would occur above 10,000 feet AGL. For BT-9, BT-11 and R-5306A, average power, speed and altitude ranges were discussed in Section 3.2.



Special Use Airspace
- Mattamuskeet MOA
- Bombing Target Area BT-9
- Bombing Target Area BT-11
- Restricted Airspace 5306A
- Pamlico B MOA
- Restricted Airspace 5314A
- Restricted Airspace 5314B
- County
- Military Property
- Stream
- Large Water Body
- Rail
- Road

0 5 10 miles

N W E S

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Figure 4.2

Special Use Airspace for the Mattamuskeet MOA Alternative

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Table 4.2-1 Annual Sorties for the Mattamuskeet MOA Alternative for Mattamuskeet MOA, BT-9, BT-11 and R-5306A

(1) Mattamuskeet MOA

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
A-10 (Air Force)	8	0	8	45
F-15E (Air Force)	14	0	14	45
F-16 (Air Force)	56	2	58	45
AV-8B (US Marine Corps FRS)	343	0	343	45
AV-8B (US Marine Corps Gun)	39	0	39	45
F/A-18C/D (US Marine Corps)	27	0	27	45
US Marine Corps Helicopters	68	0	68	45
F/A-18C/D (US Navy Fleet)	197	18	215	45
F/A-18C/D (US Navy FRS)	582	41	623	45
F-14B/D (US Navy Fleet)	170	0	170	45
Other Military Jets[1]	8	0	8	45
Other Military Props[2]	22	0	22	45
Total	1,534	61	1,595	

(2) BT-9

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-14B/D (NAS Ocean Fleet)	39	0	39	12
F-14B/D (NAS Oceana FRS)	53	0	53	12
F/A-18C/D (NAS Oceana Fleet)	200	10	210	11
F/A-18C/D (US Marine Corps)	204	12	216	21
T-34[2]	3	0	3	41
AV-8B (Fleet)	178	4	182	26
AV-8B (FRS)	424	6	430	21
F-15E (Air Force)	59	0	59	19
F-16 (Air Force)	432	9	441	21
CH-46 (US Marine Corps)	130	0	130	20
CH-53 (US Marine Corps)	16	0	16	19
UH-1 (US Marine Corps)	50	0	50	20
Army Helo[3]	76	0	76	28
Other Jet[1]	20	0	20	39
Other Prop[2]	20	0	20	41
Total	1,904	41	1,945	

(3) BT-11

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-14B/D (NAS Ocean Fleet)	397	0	397	18
F-14 B/D (NAS Oceana FRS)	43	0	43	18
F/A-18C/D (NAS Oceana Fleet)	624	50	674	18
F/A-18C/D (US Marine Corps)	376	16	392	17
T-34[1]	5	0	5	44
AV-8B (Fleet)	1,144	38	1,182	26
AV-8B (FRS)	406	7	413	22
KC-130 (MCAS Cherry Point Fleet)	3	1	4	36
F-15E (Air Force Jets)	379	10	389	19
F-16 (Air Force Jets)	368	0	368	22
F-16 (Air National Guard)	188	0	188	17
CH-46 (US Marine Corps)	197	0	197	21
CH-53 (US Marine Corps)	21	0	21	17
UH-1 (US Marine Corps)	69	0	69	20
Army Helo[2]	76	16	92	64
Other Jet[3]	37	0	37	45
Other Prop[1]	18	0	18	44
Total	4,349	138	4,487	

Table 4.2-1 Annual Sorties for the Mattamuskeet MOA Alternative for Mattamuskeet MOA, BT-9, BT-11 and R-5306A - continued

(4) R-5306A (exclusive of BT-9 and BT-11)

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F/A-18C/D (US Marine Corps)	100	0	100	39
AV-8B (Fleet)	1,825	51	1,876	47
AV-8B (FRS)	1,610	11	1,621	36
A-10 (Air Force)	29	0	29	18
F-15E (Air Force)	54	0	54	37
F-16 (Air Force)	202	4	206	28
F-16 (Air National Guard)	25	0	25	27
AH-1 (US Marine Corps)	134	0	134	5
Other Jet[1]	36	0	36	64
Other Prop[2]	90	0	90	74
Total	4,106	66	4,172	

[1]Modeled as F/A-18 C/D

[2]Modeled as C-130 H

[3]Modeled as AH-64

Table 4.2-2. Flight Profiles for the Mattamuskeet MOA Alternative for Mattamuskeet MOA, BT-9, BT-11, and R-5306A

(1) Mattamuskeet MOA

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-10000		Over 10000
A-10 (Air Force)	5333 NF	275					25%		75%
F-15E (Air Force)	81% NC	520					25%		75%
F-16 (Air Force)	87% NC	450					25%		75%
AV-8B (US Marine Corps FRS)	90% RPM	500					25%		75%
AV-8B (US Marine Corps Gun)	85% RPM	500					25%		75%
F/A-18C/D (US Marine Corps)	88% NC	400					25%		75%
US Marine Corps Helicopters		150					25%		75%
F/A-18C/D (US Navy Fleet)	88% NC	400					25%		75%
F/A-18C/D (US Navy FRS)	88% NC	400					25%		75%
F-14B/D (US Navy Fleet)	92% NC	400					25%		75%
Other Military Jets[1]	88% NC	400					25%		75%
Other Military Props[2]	850 C TIT	220					25%		75%

(2) BT-9

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-14B/D (NAS Ocean Fleet)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F-14B/D (NAS Oceana FRS)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F/A-18C/D (NAS Ocean Fleet)	88% NC	400			2%	3%	10%	20%	65%
F/A-18C/D (US Marine Corps)	88% NC	400			2%	3%	10%	20%	65%
T-34[2]	850 C TIT	220		10%	60%	15%	15%		
AV-8B (Fleet)	90% RPM	500				36%	12%	12%	40%
AV-8B (FRS)	85% RPM	500				17%	17%	16%	50%
F-15E (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
CH-46 (US Marine Corps)	94 % Q-BPA	130		100%					
CH-53 (US Marine Corps)	90 % Q-BPA	150		100%					
UH-1 (US Marine Corps)	100 % RPM	80		100%					
Army Helo[3]	150 KNTS	150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

Table 4.2-2. Flight Profiles for the Mattamuskeet MOA Alternative for BT-9, BT-11, and R-5306A - continued

(3) BT-11

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-14B/D (NAS Ocean Fleet)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F-14B/D (NAS Oceana FRS)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F/A-18C/D (NAS Ocean Fleet)	88% NC	400			2%	3%	10%	20%	65%
F/A-18C/D (US Marine Corps)	88% NC	400			2%	3%	10%	20%	65%
T-34[2]	850 C TIT	220		10%	60%		30%		
AV-8B (Fleet)	90 % RPM	500			25%	12%	12%	11%	40%
AV-8B (FRS)	85 % RPM	500			10%	14%	13%	13%	50%
KC-130 (MCAS Cherry Point Fleet)	850 C TIT	220		10%	60%		30%		
F-15EC/D (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
F-16 (Air National Guard)	87% NC	450			20%	24%	23%	23%	10%
CH-46 (US Marine Corps)	94 % Q-BPA	130		100%					
CH-53 (US Marine Corps)	90 % Q-BPA	150		100%					
UH-1 (US Marine Corps)	100 % RPM	80		100%					
Army Helo[3]	150 KNTS	150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

(4) R-5306A (exclusive of BT-9 and BT-11)

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F/A-18C/D (US Marine Corps)	88% NC	400	5%	5%	25%	10%	10%	20%	25%
AV-8B (Fleet)	85% RPM	350				35%	25%		40%
AV-8B (FRS)	75% RPM	350				40%	20%		40%
A-10 (Air Force)	5333 NF	275		2%	30%	20%	20%	20%	8%
F-15E (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
F-16 (Air National Guard)	87% NC	450			20%	24%	23%	23%	10%
Marine Corps Helicopters[4]	NR	150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

[1]Modeled as F/A-18C/D
[2]Modeled as C-130 H
[3]Modeled as AH-64
[4]Modeled as AH-1

4.2.3 Noise Exposure

Using the data shown in Table 4.2-1 and Table 4.2-2, values of L_{dnmr} were calculated using the MR_NMAP computer program to simulate a random distribution of sorties within the Mattamuskeet MOA, BT-9, BT-11 and R-5306A. This calculation represents an estimation of the average noise exposure levels within each airspace should the Mattamuskeet MOA alternative be implemented. The calculated L_{dnmr} values for all airspace under this alternative are shown in Table 4.2-3.

Table 4.2-3. Average L_{dnmr} (dB) Within Mattamuskeet MOA, BT-9, BT-11 and R-5306A for the Mattamuskeet MOA Alternative

Airspace Component	Average L_{dnmr} (dB)
Mattamuskeet MOA	<50
BT-9 (within 5 nm radius)	62
BT-11 (within 5 nm radius)	68
R-5306A	56

The resulting noise level for Mattamuskeet MOA would be expected to be less than 50 dB. For BT-9, BT-11, the noise levels under this alternative would remain unchanged from baseline conditions. For R-5306A, the noise level would decrease by approximately 1 dB due to decreased AV-8B aircraft sorties.

4.2.4 Sensitive Receptor Analysis

Under this alternative, the locations presented in Table 4.2-4 and depicted in Figure 4.1-1 were evaluated for noise exposure. Onset-Rate Adjusted Sound Levels related to aircraft sorties in the Mattamuskeet MOA were computed and were all found to be less than 50 dB.

Table 4.2-4. Nominal Sound Exposure Level at Sensitive Receptors Within the Mattamuskeet MOA

Special Use Airspace	Receptor Name	Address (if available)	West Longitude		North Latitude		L_{dnmr} Value (dB)
			Degrees	Minutes	Degrees	Minutes	
Mattamuskeet MOA	Mattamuskeet Middle School	20400 US 264, Swan Quarter, NC 27885	76	18.8	35	24.3	<50
	Swanquarter Wilderness Area, Great Island	South of Juniper Bay	76	16	35	20	<50
	Cape Hatteras Elementary		76	13.55	35	32.48	<50
	Fairfield Historic District	Bordered by State Routes 1308, 1309, 1305 and NC 94 in Fairfield	76	14.38	35	32.59	<50

Noise levels presented in Table 4.1-5 can be used to assess intrusiveness of individual aircraft at various distance and altitudes.

4.3 Cherry MOA Alternative

Under this alternative, only the Cherry MOA would be implemented within the time frame of the proposed action. The Cherry MOA, like the proposed Mattamuskeet MOA, would permit MCAS Cherry Point based aircraft operations not requiring restricted airspace to be accommodated in a MOA located within a reasonable distance of MCAS Cherry Point. The creation of a new Cherry MOA would increase training opportunities as well as improve training efficiency. The following sections describe the airspace of interest under this alternative, their operations and noise exposure.

4.3.1 Description of Airspace

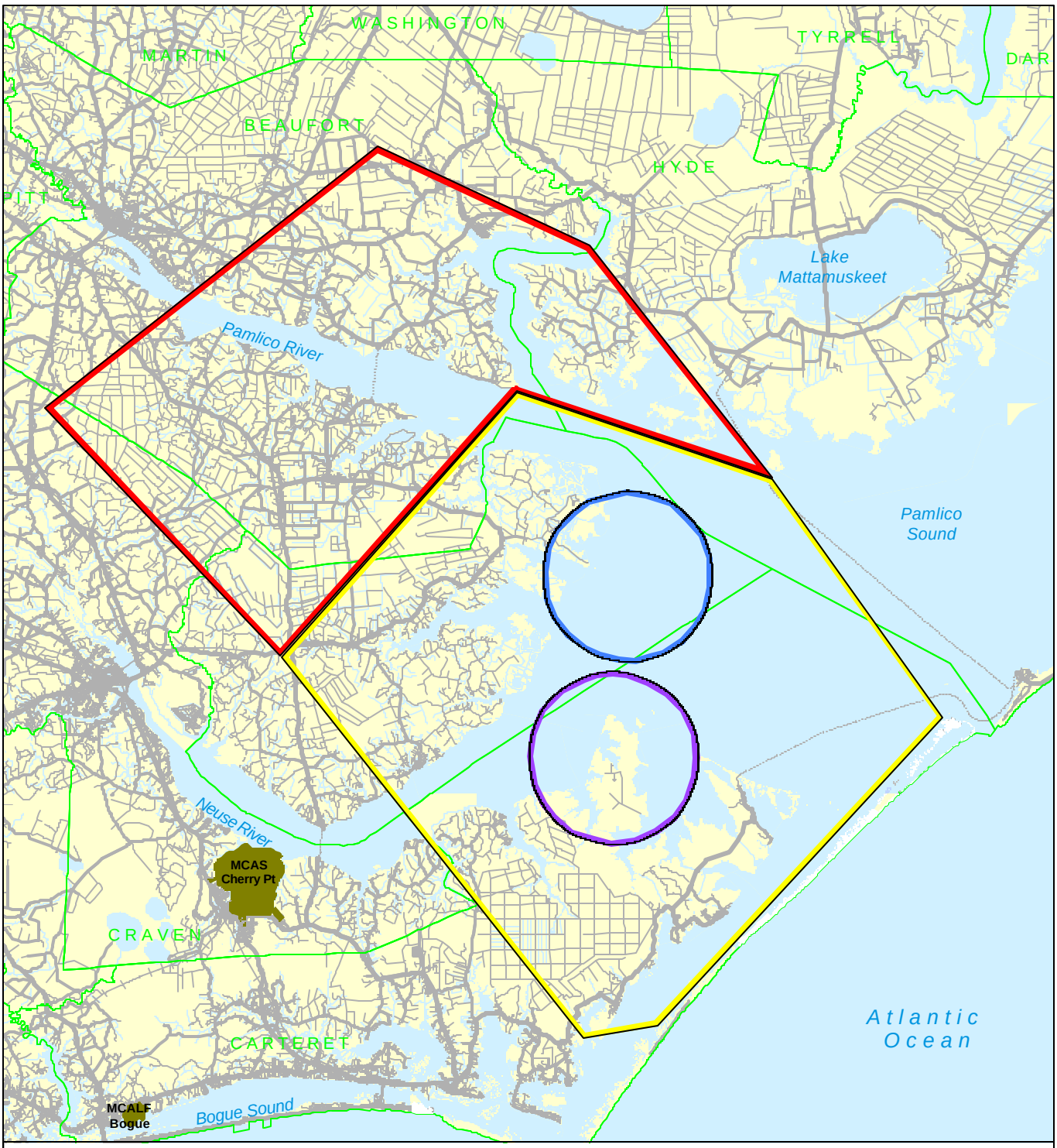
Figure 4.3 provides a graphical depiction of all airspace under this alternative. The proposed Cherry MOA is comparable in size and shape to the proposed Mattamuskeet MOA. It extends from the northwestern edge of R-5306A northwest approximately 25 miles and then northeast across the Pamlico River to a point approximately 15 miles northeast of Washington Airport. Subsequently, Cherry MOA extends southeast to Pamlico Sound and finally to Great Island at the northern intersection of R-5306A and Pamlico Sound. The proposed Cherry MOA overlies Beaufort, Craven, Hyde, Pamlico and Washington counties in North Carolina.

4.3.2 Airspace Sorties

Airspace sorties presented in this section for the proposed Cherry MOA alternative were obtained from Airfield and Airspace Study for the Introduction of F/A-18E/Fs To the East Coast (ATAC, 2001) and reviewed by MCAS Cherry Point personnel (Brown, 2001). Table 4.3-1 presents the number of sorties and average mission duration associated with all airspace of interest under this alternative.

The proposed sorties and flight profiles for Cherry MOA would be the same as presented and discussed for Mattamuskeet MOA. For BT-9, BT-11, airspace sorties, mission duration, average power, speed and altitude distributions would remain unchanged from baseline conditions as described in Section 3.2. For R-5306A, sorties would remain unchanged from Section 4.2 as a result of the decrease in AV-8B aircraft sorties. The number of flying days in the busiest month for R-5306A would remain constant at 23.

Table 4.3-2 shows average power, speeds, and altitude ranges for all airspace under this alternative. Operations in BT-9, BT-11 and R-5306A were previously discussed in Section 3.2.



Special Use Airspace

- Cherry MOA
- Bombing Target Area BT-9
- Bombing Target Area BT-11
- Restricted Airspace 5306A
- County
- Military Property
- Stream
- Large Water Body
- Rail
- Road

0 5 10 miles

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Figure 4.3

Special Use Airspace for the Cherry MOA Alternative

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Table 4.3-1. Annual Sorties for the Cherry MOA Alternative for Cherry MOA, BT-9, BT-11 and R-5306A

(1) Cherry MOA

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
A-10 (Air Force)	8	0	8	45
F-15E (Air Force)	14	0	14	45
F-16 (Air Force)	56	2	58	45
AV-8B (US Marine Corps FRS)	343	0	343	45
AV-8B (US Marine Corps Gun)	39	0	39	45
F/A-18C/D (US Marine Corps)	27	0	27	45
US Marine Corps Helicopters	68	0	68	45
F/A-18C/D (US Navy Fleet)	197	18	215	45
F/A-18C/D (US Navy FRS)	582	41	623	45
F-14B/D (US Navy Fleet)	170	0	170	45
Other Military Jets[1]	8	0	8	45
Other Military Props[2]	22	0	22	45
Total	1,534	61	1,595	

(2) BT-9

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-14B/D (NAS Ocean Fleet)	39	0	39	12
F-14B/D (NAS Oceana FRS)	53	0	53	12
F/A-18C/D (NAS Oceana Fleet)	200	10	210	11
F/A-18C/D (US Marine Corps)	204	12	216	21
T-34[2]	3	0	3	41
AV-8B (Fleet)	178	4	182	26
AV-8B (FRS)	424	6	430	21
F-15E (Air Force)	59	0	59	19
F-16 (Air Force)	432	9	441	21
CH-46 (US Marine Corps)	130	0	130	20
CH-53 (US Marine Corps)	16	0	16	19
UH-1 (US Marine Corps)	50	0	50	20
Army Helo[3]	76	0	76	28
Other Jet[1]	20	0	20	39
Other Prop[2]	20	0	20	41
Total	1,904	41	1,945	

(3) BT-11

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-14B/D (NAS Ocean Fleet)	397	0	397	18
F-14 B/D (NAS Oceana FRS)	43	0	43	18
F/A-18C/D (NAS Oceana Fleet)	624	50	674	18
F/A-18C/D (US Marine Corps)	376	16	392	17
T-34[1]	5	0	5	44
AV-8B (Fleet)	1,144	38	1,182	26
AV-8B (FRS)	406	7	413	22
KC-130 (MCAS Cherry Point Fleet)	3	1	4	36
F-15E (Air Force Jets)	379	10	389	19
F-16 (Air Force Jets)	368	0	368	22
F-16 (Air National Guard)	188	0	188	17
CH-46 (US Marine Corps)	197	0	197	21
CH-53 (US Marine Corps)	21	0	21	17
UH-1 (US Marine Corps)	69	0	69	20
Army Helo[2]	76	16	92	64
Other Jet[3]	37	0	37	45
Other Prop[1]	18	0	18	44
Total	4,349	138	4,487	

Table 4.3-1. Annual Sorties for the Cherry MOA Alternative for Cherry MOA, BT-9, BT-11 and R-5306A - continued

(4) R-5306A (exclusive of BT-9 and BT-11)

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F/A-18C/D (US Marine Corps)	100	0	100	39
AV-8B (Fleet)	1,825	51	1,876	47
AV-8B (FRS)	1,610	11	1,621	36
A-10 (Air Force)	29	0	29	18
F-15E (Air Force)	54	0	54	37
F-16 (Air Force)	202	4	206	28
F-16 (Air National Guard)	25	0	25	27
AH-1 (US Marine Corps)	134	0	134	5
Other Jet[1]	36	0	36	64
Other Prop[2]	90	0	90	74
Total	4,106	66	4,172	

[1]Modeled as F/A-18 C/D

[2]Modeled as C-130 H

[3]Modeled as AH-64

Table 4.3-2. Flight Profiles for the Cherry MOA Alternative for Cherry MOA, BT-9, BT-11 and R-5306A

(1) Cherry MOA

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-10000		Over 10000
A-10 (Air Force)	5333 NF	275					25%		75%
F-15E (Air Force)	81% NC	520					25%		75%
F-16 (Air Force)	87% NC	450					25%		75%
AV-8B (US Marine Corps FRS)	90% RPM	500					25%		75%
AV-8B (US Marine Corps Gun)	85% RPM	500					25%		75%
F/A-18C/D (US Marine Corps)	88% NC	400					25%		75%
US Marine Corps Helicopters		150					25%		75%
F/A-18C/D (US Navy Fleet)	88% NC	400					25%		75%
F/A-18C/D (US Navy FRS)	88% NC	400					25%		75%
F-14B/D (US Navy Fleet)	92% NC	400					25%		75%
Other Military Jets[1]	88% NC	400					25%		75%
Other Military Props[2]	850 C TIT	220					25%		75%

(2) BT-9

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-14B/D (NAS Ocean Fleet)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F-14B/D (NAS Oceana FRS)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F/A-18C/D (NAS Ocean Fleet)	88% NC	400			2%	3%	10%	20%	65%
F/A-18C/D (US Marine Corps)	88% NC	400			2%	3%	10%	20%	65%
T-34[2]	850 C TIT	220		10%	60%	15%	15%		
AV-8B (Fleet)	90% RPM	500				36%	12%	12%	40%
AV-8B (FRS)	85% RPM	500				17%	17%	16%	50%
F-15E (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
CH-46 (US Marine Corps)	94 % Q-BPA	130		100%					
CH-53 (US Marine Corps)	90 % Q-BPA	150		100%					
UH-1 (US Marine Corps)	100 % RPM	80		100%					
Army Helo[3]	150 KNTS	150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

Table 4.3-2. Flight Profiles for the Cherry MOA Alternative for Cherry MOA, BT-9, BT-11 and R-5306A – continued

(3) BT-11

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-14B/D (NAS Ocean Fleet)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F-14B/D (NAS Oceana FRS)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F/A-18C/D (NAS Ocean Fleet)	88% NC	400			2%	3%	10%	20%	65%
F/A-18C/D (US Marine Corps)	88% NC	400			2%	3%	10%	20%	65%
T-34[2]	850 C TIT	220		10%	60%		30%		
AV-8B (Fleet)	90 % RPM	500			25%	12%	12%	11%	40%
AV-8B (FRS)	85 % RPM	500			10%	14%	13%	13%	50%
KC-130 (MCAS Cherry Point Fleet)	850 C TIT	220		10%	60%		30%		
F-15EC/D (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
F-16 (Air National Guard)	87% NC	450			20%	24%	23%	23%	10%
CH-46 (US Marine Corps)	94 % Q-BPA	130		100%					
CH-53 (US Marine Corps)	90 % Q-BPA	150		100%					
UH-1 (US Marine Corps)	100 % RPM	80		100%					
Army Helo[3]	150 KNTS	150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

(4) R-5306A (exclusive of BT-9 and BT-11)

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F/A-18C/D (US Marine Corps)	88% NC	400	5%	5%	25%	10%	10%	20%	25%
AV-8B (Fleet)	85% RPM	350				35%	25%		40%
AV-8B (FRS)	75% RPM	350				40%	20%		40%
A-10 (Air Force)	5333 NF	275		2%	30%	20%	20%	20%	8%
F-15E (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
F-16 (Air National Guard)	87% NC	450			20%	24%	23%	23%	10%
Marine Corps Helicopters[4]	NR	150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

[1]Modeled as F/A-18C/D

[2]Modeled as C-130 H

[3]Modeled as AH-64

[4]Modeled as AH-1

4.3.3 Noise Exposure

Using the data shown in Table 4.3-1 and Table 4.3-2, values of L_{dnmr} were calculated using the MR_NMAP computer program to simulate a random distribution of sorties within Cherry MOA, BT-9, BT-11 and R-5306A. This calculation represents an estimation of the average noise exposure levels within each airspace should the Cherry MOA alternative be implemented. The L_{dnmr} values for all airspace under this alternative were calculated to be less than 50 dB and are shown in Table 4.3-3.

Table 4.3-3. Average Ldnmr (dB) Within Cherry MOA, BT-9, BT-11 and R-5306A for the Cherry MOA Alternative

Airspace Component	Average L_{dnmr} (dB)
Cherry MOA	<50
BT-9 (within 5 nm radius)	62
BT-11 (within 5 nm radius)	68
R-5306A	56

4.3.4 Sensitive Receptor Analysis

Under this alternative, the locations presented in Table 4.3-4 and Figure 4.1-1 were evaluated for noise exposure. Onset-Rate Adjusted Sound Levels related to aircraft sorties in the Cherry MOA were computed and were all found to be less than 50 dB.

Table 4.3-4. Nominal Sound Exposure Level at Sensitive Receptors Within the Cherry MOA

Special Use Airspace	Receptor Name	Address (if available)	West Longitude		North Latitude		L_{dnmr} Value (dB)
			Degrees	Minutes	Degrees	Minutes	
Cherry MOA	St. Thomas Episcopal Church	Craven and Main St., Bath, NC 27808	76	46.03	35	27.65	<50
	Bath Elementary School	110 S. King St., Bath, NC 27808	76	68	35	28.6	<50
	Pungo District Hospital	210 E. Front St., Belhaven, NC 27810	76	43.02	35	18.75	<50
	S.W. Snowden Elementary School	Stadium Dr. (Rte 1925), Aurora, NC 27806	76	37.22	35	32.15	<50

Noise levels presented in Table 4.1-5 can be used to assess intrusiveness of individual aircraft at various distance and altitudes.

4.4 Core and Mattamuskeet MOA Alternative

Under this alternative, the proposed Core and Mattamuskeet MOAs would both be implemented. This alternative would achieve both goals stated in Section 3.1 for Core MOA and Section 3.2 for the Mattamuskeet MOA: realistic ingress and egress to and from the warning area and BT-9, BT-11 and R-5306A as well as practical training experience for MCAS Cherry Point aircrews not requiring a restricted area. The following sections describe the airspace of interest under this alternative, their sorties and noise exposure.

4.4.1 Description of Airspace

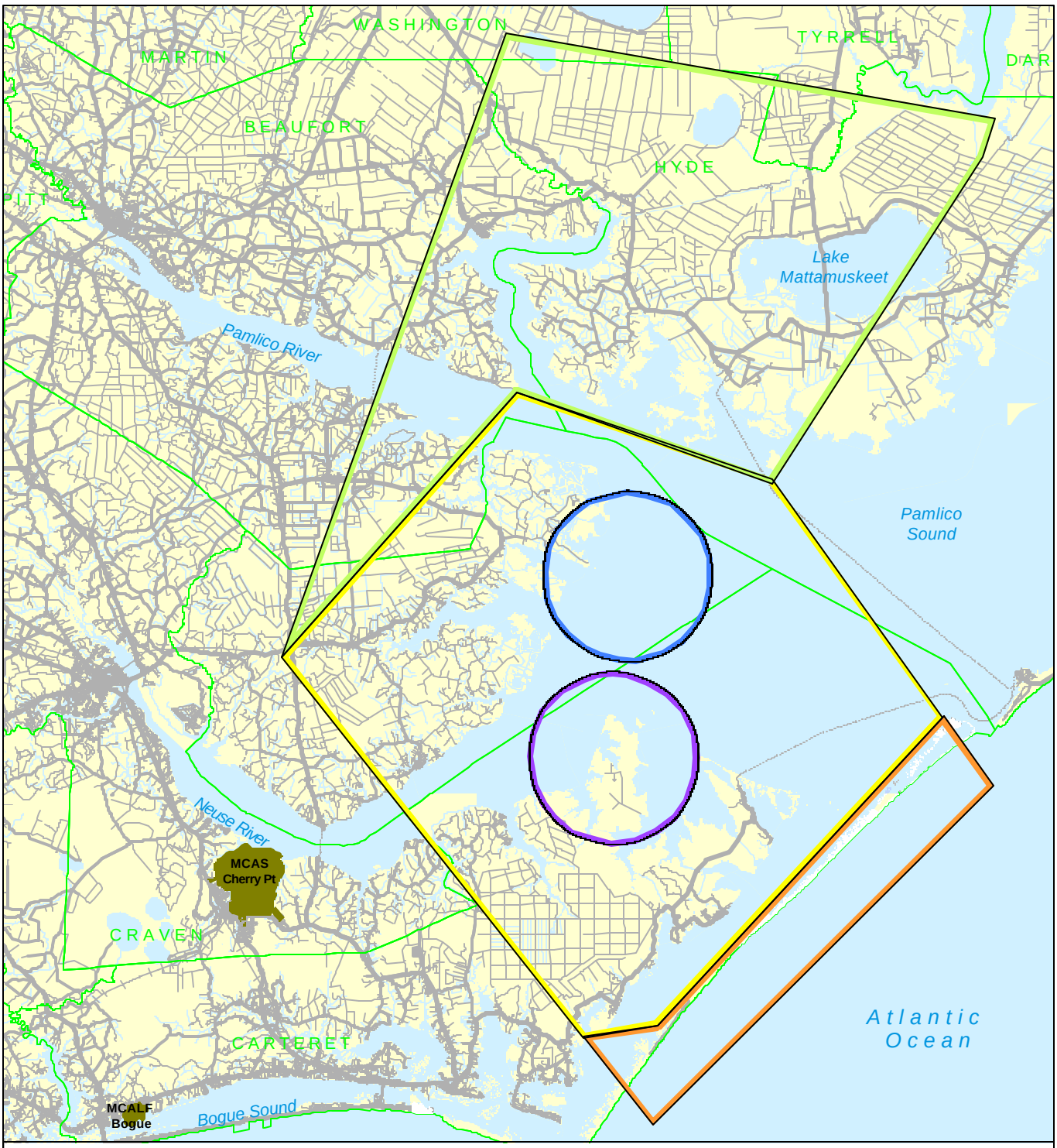
Figure 4.4 provides a graphical depiction of all airspace under this alternative. The proposed Core and Mattamuskeet MOAs were described in Sections 4.1 and 4.2, respectively. BT-9, BT-11 and R-5306A were previously described in Section 3.1.

4.4.2 Airspace Sorties

Airspace sorties presented in this section for the proposed Core and Mattamuskeet MOAs alternative were obtained from Airfield and Airspace Study for the Introduction of F/A-18E/Fs To The East Coast, (ATAC, 2001) and validated by MCAS Cherry Point personnel (Brown, 2001). Table 4.1-1 presents the sorties and average sortie duration associated with all airspace of interest under this alternative.

Table 4.4-1 presents the number of sorties and average sortie duration associated with all airspace of interest under this alternative. Airspace sorties presented in this section for the proposed Core and Mattamuskeet MOAs were described in Sections 4.1 and 4.2.

For BT-9, BT-11, individual aircraft sorties, mission duration and average power, speeds and altitude distributions would remain unchanged from the baseline conditions as described in Section 3.2. For R-5306A, AV-8B aircraft sorties would decrease by approximately 30 percent. The number of flying days in the busiest month for R-5306A would remain constant at 23.



Special Use Airspace

- Core MOA
- Mattamuskeet MOA
- Bombing Target Area BT-9
- Bombing Target Area BT-11
- Restricted Airspace 5306A
- County
- Military Property
- Stream
- Large Water Body
- Rail
- Road

0 5 10 miles

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Figure 4.4

Special Use Airspace for the Core and Mattamuskeet MOAs Alternative

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Table 4.4-1. Annual Sorties for the Core and Mattamuskeet MOAs Alternative for Core MOA, Mattamuskeet MOA, BT-9, BT-11 and R-5306A

(1) Core MOA

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-15E (Air Force)	62	1	63	1
F-16 (Air Force)	148	1	149	1
AV-8B (US Marine Corps FRS)	25	0	25	1
AV-8B (US Marine Corps Gun)	940	34	974	1
F/A-18C/D (US Marine Corps)	142	8	150	1
F/A-18C/D (Navy USS Fleet)	58	9	67	1
F-14B/D (Navy USS Fleet)	23	3	26	1
Other Jets[1]	6	0	6	1
Total	1,404	56	1,460	

(2) Mattamuskeet MOA

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
A-10 (Air Force)	8	0	8	45
F-15E (Air Force)	14	0	14	45
F-16 (Air Force)	56	2	58	45
AV-8B (US Marine Corps FRS)	536	2	538	45
AV-8B (US Marine Corps Gun)	659	13	672	45
F/A-18C/D (US Marine Corps)	27	0	27	45
US Marine Corps Helicopters	68	0	68	45
F/A-18C/D (US Navy Fleet)	197	18	215	45
F/A-18C/D (US Navy FRS)	582	41	623	45
F-14B/D (US Navy Fleet)	170	0	170	45
Other Military Jets[1]	8	0	8	45
Other Military Props[2]	22	0	22	45
Total	2,347	76	2,423	

(3) BT-9

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-14B/D (NAS Ocean Fleet)	39	0	39	12
F-14B/D (NAS Oceana FRS)	53	0	53	12
F/A-18C/D (NAS Oceana Fleet)	200	10	210	11
F/A-18C/D (US Marine Corps)	204	12	216	21
T-34[2]	3	0	3	41
AV-8B (Fleet)	178	4	182	26
AV-8B (FRS)	424	6	430	21
F-15E (Air Force)	59	0	59	19
F-16 (Air Force)	432	9	441	21
CH-46 (US Marine Corps)	130	0	130	20
CH-53 (US Marine Corps)	16	0	16	19
UH-1 (US Marine Corps)	50	0	50	20
Army Helo[3]	76	0	76	28
Other Jet[1]	20	0	20	39
Other Prop[2]	20	0	20	41
Total	1,904	41	1,945	

Table 4.4-1. Annual Sorties for the Core and Mattamuskeet MOAs Alternative for Core MOA, Mattamuskeet MOA, BT-9, BT-11 and R-5306A – continued

(4) BT-11

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-14B/D (NAS Ocean Fleet)	397	0	397	18
F-14 B/D (NAS Oceana FRS)	43	0	43	18
F/A-18C/D (NAS Oceana Fleet)	624	50	674	18
F/A-18C/D (US Marine Corps)	376	16	392	17
T-34[1]	5	0	5	44
AV-8B (Fleet)	1,144	38	1,182	26
AV-8B (FRS)	406	7	413	22
KC-130 (MCAS Cherry Point Fleet)	3	1	4	36
F-15E (Air Force Jets)	379	10	389	19
F-16 (Air Force Jets)	368	0	368	22
F-16 (Air National Guard)	188	0	188	17
CH-46 (US Marine Corps)	197	0	197	21
CH-53 (US Marine Corps)	21	0	21	17
UH-1 (US Marine Corps)	69	0	69	20
Army Helo[2]	76	16	92	64
Other Jet[3]	37	0	37	45
Other Prop[1]	18	0	18	44
Total	4,349	138	4,487	

(5) R-5306A (exclusive of BT-9 and BT-11)

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F/A-18C/D (US Marine Corps)	100	0	100	39
AV-8B (Fleet)	1,794	9	1,803	47
AV-8B (FRS)	1,979	38	2,017	36
A-10 (Air Force)	29	0	29	18
F-15E (Air Force)	54	0	54	37
F-16 (Air Force)	202	4	206	28
F-16 (Air National Guard)	25	0	25	27
AH-1 (US Marine Corps)	134	0	134	5
Other Jet[1]	36	0	36	64
Other Prop[2]	90	0	90	74
Total	4,443	51	4,494	

[1]Modeled as F/A-18 C/D

[2]Modeled as C-130 H

[3]Modeled as AH-64

*60 percent of all sorties in Core are in a flight of two aircraft, 30 percent in a flight of four aircraft and 10 percent indivial aircraft; thus the modeled number of sorties equals 2.5 times sorties presented in Table 4.1-1

Table 4.4-2 presents the flight profiles and altitude distributions for all aircraft under this alternative. A discussion of the Core and Mattamuskeet MOAs sorties, sortie duration and flight profiles is presented in Sections 4.1 and 4.2, respectively. For BT-9, BT-11 and R-5306A, average power, speed and altitude ranges were discussed in Section 3.2.

Table 4.4-2. Flight Profiles for Core and Mattamuskeet MOAs Alternative for Core MOA, Mattamuskeet MOA, BT-9, BT-11 and R-5306A

(1) Core MOA

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-15E (Air Force)	81% NC	520					35%	45%	20%
F-16 (Air Force)	87% NC	450					35%	45%	20%
AV-8B (US Marine Corps FRS)	90% RPM	500					35%	45%	20%
AV-8B (US Marine Corps Gun)	85% RPM	500					35%	45%	20%
F/A-18C/D (US Marine Corps)	88% NC	400					35%	45%	20%
F/A-18C/D (Navy USS Fleet)	88% NC	400					35%	45%	20%
F-14B/D (Navy USS Fleet)	92% NC	400					35%	45%	20%
Other Jets[1]	88% NC	400					35%	45%	20%

(2) Mattamuskeet MOA

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-10000		Over 10000
A-10 (Air Force)	5333 NF	275					25%		75%
F-15E (Air Force)	81% NC	520					25%		75%
F-16 (Air Force)	87% NC	450					25%		75%
AV-8B (US Marine Corps FRS)	90% RPM	500					25%		75%
AV-8B (US Marine Corps Gun)	85% RPM	500					25%		75%
F/A-18C/D (US Marine Corps)	88% NC	400					25%		75%
US Marine Corps Helicopters		150					25%		75%
F/A-18C/D (US Navy Fleet)	88% NC	400					25%		75%
F/A-18C/D (US Navy FRS)	88% NC	400					25%		75%
F-14B/D (US Navy Fleet)	92% NC	400					25%		75%
Other Military Jets[1]	88% NC	400					25%		75%
Other Military Props[2]	850 C TIT	220					25%		75%

(3) BT-9

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-14B/D (NAS Ocean Fleet)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F-14B/D (NAS Oceana FRS)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F/A-18C/D (NAS Ocean Fleet)	88% NC	400			2%	3%	10%	20%	65%
F/A-18C/D (US Marine Corps)	88% NC	400			2%	3%	10%	20%	65%
T-34[2]	850 C TIT	220		10%	60%	15%	15%		
AV-8B (Fleet)	90% RPM	500				36%	12%	12%	40%
AV-8B (FRS)	85% RPM	500				17%	17%	16%	50%
F-15E (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
CH-46 (US Marine Corps)	94 % Q-BPA	130		100%					
CH-53 (US Marine Corps)	90 % Q-BPA	150		100%					
UH-1 (US Marine Corps)	100 % RPM	80		100%					
Army Helo[3]	150 KNTS	150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

Table 4.4-2. Flight Profiles for Core and Mattamuskeet MOAs Alternative for Core MOA, Mattamuskeet MOA, BT-9, BT-11 and R-5306A – continued

(4) BT-11

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-14B/D (NAS Ocean Fleet)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F-14B/D (NAS Oceana FRS)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F/A-18C/D (NAS Ocean Fleet)	88% NC	400			2%	3%	10%	20%	65%
F/A-18C/D (US Marine Corps)	88% NC	400			2%	3%	10%	20%	65%
T-34[2]	850 C TIT	220		10%	60%		30%		
AV-8B (Fleet)	90 % RPM	500			25%	12%	12%	11%	40%
AV-8B (FRS)	85 % RPM	500			10%	14%	13%	13%	50%
KC-130 (MCAS Cherry Point Fleet)	850 C TIT	220		10%	60%		30%		
F-15EC/D (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
F-16 (Air National Guard)	87% NC	450			20%	24%	23%	23%	10%
CH-46 (US Marine Corps)	94 % Q-BPA	130		100%					
CH-53 (US Marine Corps)	90 % Q-BPA	150		100%					
UH-1 (US Marine Corps)	100 % RPM	80		100%					
Army Helo[3]	150 KNTS	150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

(5) R-5306A (exclusive of BT-9 and BT-11)

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F/A-18C/D (US Marine Corps)	88% NC	400	5%	5%	25%	10%	10%	20%	25%
AV-8B (Fleet)	85% RPM	350				35%	25%		40%
AV-8B (FRS)	75% RPM	350				40%	20%		40%
A-10 (Air Force)	5333 NF	275		2%	30%	20%	20%	20%	8%
F-15E (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
F-16 (Air National Guard)	87% NC	450			20%	24%	23%	23%	10%
Marine Corps Helicopters[4]	NR	150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

[1]Modeled as F/A-18C/D
[2]Modeled as C-130 H
[3]Modeled as AH-64
[4]Modeled as AH-1

4.4.3 Noise Exposure

Using the data shown in Tables 4.4-1 and 4.4-2, values of L_{dnmr} were calculated using the MR_NMAP computer program to simulate a random distribution of sorties within Core MOA, Mattamuskeet MOA, BT-9, BT-11 and R-5306A. This calculation represents an estimation of the average noise exposure levels within each airspace if the Core and Mattamuskeet MOAs alternative is implemented. The average noise exposure level for all airspace under this alternative were found to be less than 50 dB and are shown in Table 4.4-3.

Table 4.4-3. Average Ldnmr (dB) Within the Core MOA, the Mattamuskeet MOA, BT-9, BT-11 and R-5306A for the Core and Mattamuskeet MOAs Alternative

Airspace Component	Average L_{dnmr} (dB)
Core MOA	<50
Mattamuskeet MOA	<50
BT-9 (within 5 nm radius)	62
BT-11 (within 5 nm radius)	68
R-5306A	56

4.4.4 Sensitive Receptor Analysis

Under this alternative, the locations presented in Table 4.4-4 and Figure 4.1-1 were evaluated for noise exposure. Onset-Rate Adjusted Sound Levels related to aircraft sorties in the Core and Mattamuskeet MOAs were computed using MR_NMAP, and all Sound Exposure Level were found to be less than 50 dB.

Table 4.4-4. Average Sound Exposure Level at Sensitive Receptors Within the Core and Mattamuskeet MOAs

Special Use Airspace	Receptor Name	Address (if available)	West Longitude		North Latitude		L_{dnmr} Value (dB)
			Degrees	Minutes	Degrees	Minutes	
Core MOA	Ferry Landing North		76	13	34	56	<50
	Ferry Landing South		76	25	34	45.5	<50
	Portsmouth Village		76	04	35	04	<50
Mattamuskeet MOA	Mattamuskeet Middle School	20400 US 264, Swan Quarter, NC 27885	76	18.8	35	24.3	<50
	Swanquarter Wilderness Area, Great Island	South of Juniper Bay	76	16	35	20	<50
	Cape Hatteras Elementary		76	13.55	35	32.48	<50
	Fairfield Historic District	Bordered by State Routes 1308, 1309, 1305 and NC 94 in Fairfield	76	14.38	35	32.59	<50

4.5 The Core and Cherry Alternative

Under this alternative, the proposed Core and Cherry MOAs would be implemented. This would be in addition to BT-9, BT-11 and R-5306A currently used by MCAS Cherry Point based aircraft and other DoD aircraft. This alternative would achieve both goals stated in Section 4.1 for Core MOA and Section 4.3 for the Cherry MOA: realistic ingress and egress to and from the warning area as well as permitting practical training experience for MCAS Cherry Point aircrews not requiring a restricted area. The following sections describe the airspace of interest under this alternative, their sorties and the resulting noise exposure.

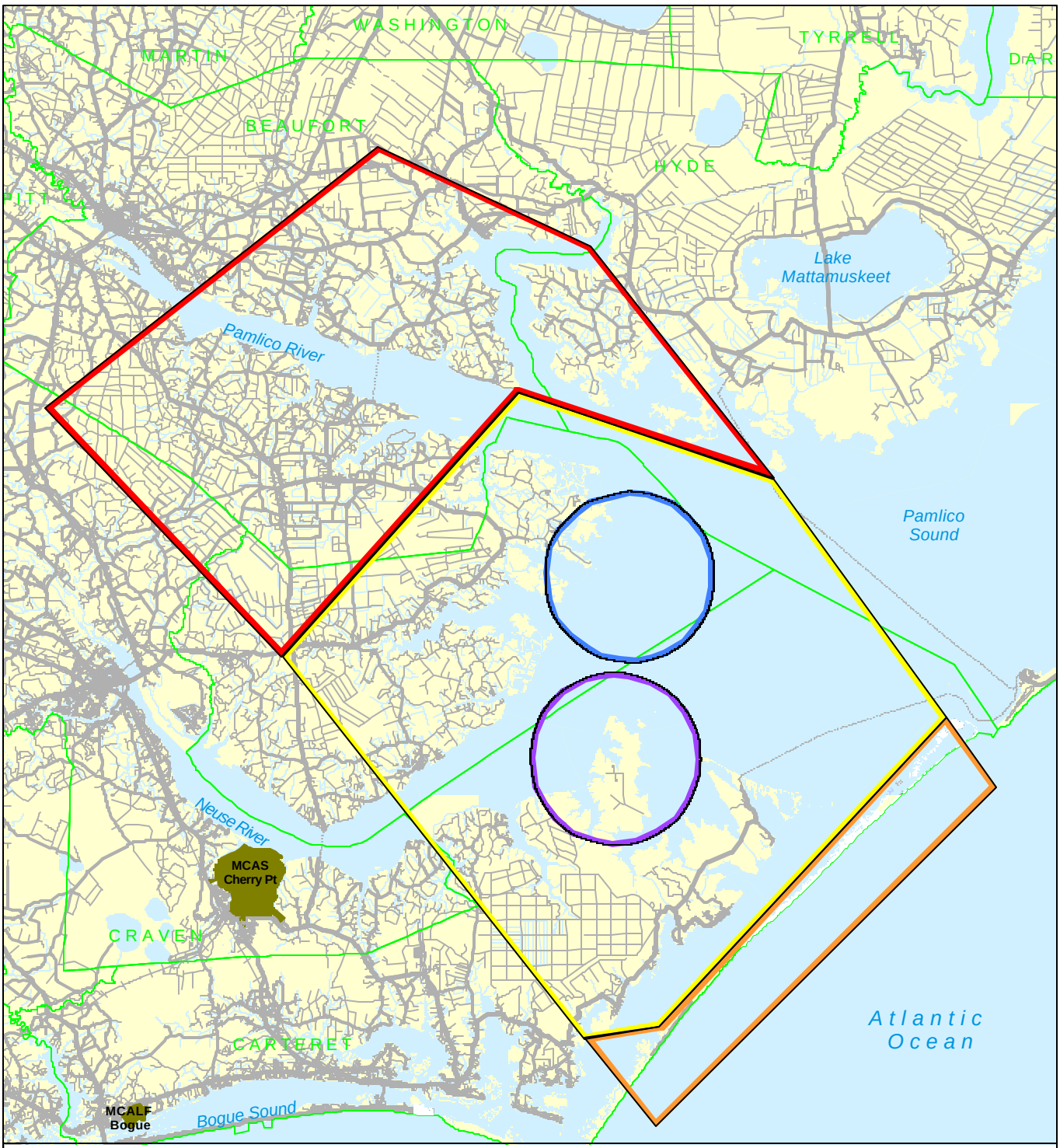
4.5.1 Description of Airspace

Figure 4.5 provides a graphical depiction of all airspace under this alternative. The proposed Core and Cherry MOAs were described in Sections 4.1 and 4.3, respectively. BT-9, BT-11 and R-5306A were previously described in Section 3.1.

4.5.2 Airspace Sorties

Airspace sorties presented in this section for the proposed Core and Cherry MOAs alternative were obtained from Airfield and Airspace Study for the Introduction of F/A-18E/Fs To The East Coast, (ATAC, 2001) and validated by MCAS Cherry Point personnel (Brown, 2001).

Table 4.5-1 presents the number of sorties and average mission duration associated with all airspace of interest under this alternative. Airspace sorties presented in this section for the proposed Core and Cherry MOA alternative were described in Sections 4.1 and 4.3, respectively. For Bombing targets areas BT-9 and BT-11, individual aircraft sorties, mission duration and average power, speeds and altitude distributions would remain unchanged from the baseline conditions as described in Section 3.2.



Special Use Airspace

- Core MOA
- Cherry MOA
- Bombing Target Area BT-9
- Bombing Target Area BT-11
- Restricted Airspace 5306A
- County
- Military Property
- Stream
- Large Water Body
- Rail
- Road

0 5 10 miles

N W E S

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Figure 4.5

Special Use Airspace for the Core and Cherry MOAs Alternative

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Table 4.5-1. Annual Sorties for the Core and Cherry MOAs Alternative for Core MOA, Cherry MOA, BT-9, BT-11 and R-5306A

(1) Core MOA

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-15E (Air Force)	62	1	63	1
F-16 (Air Force)	148	1	149	1
AV-8B (US Marine Corps FRS)	25	0	25	1
AV-8B (US Marine Corps Gun)	940	34	974	1
F/A-18C/D (US Marine Corps)	142	8	150	1
F/A-18C/D (Navy USS Fleet)	58	9	67	1
F-14B/D (Navy USS Fleet)	23	3	26	1
Other Jets[1]	6	0	6	1
Total	1,404	56	1,460	

(2) Cherry MOA

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
A-10 (Air Force)	8	0	8	45
F-15E (Air Force)	14	0	14	45
F-16 (Air Force)	56	2	58	45
AV-8B (US Marine Corps FRS)	343	0	343	45
AV-8B (US Marine Corps Gun)	39	0	39	45
F/A-18C/D (US Marine Corps)	27	0	27	45
US Marine Corps Helicopters	68	0	68	45
F/A-18C/D (US Navy Fleet)	197	18	215	45
F/A-18C/D (US Navy FRS)	582	41	623	45
F-14B/D (US Navy Fleet)	170	0	170	45
Other Military Jets[1]	8	0	8	45
Other Military Props[2]	22	0	22	45
Total	1,534	61	1,595	

(3) BT-9

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-14B/D (NAS Ocean Fleet)	39	0	39	12
F-14B/D (NAS Oceana FRS)	53	0	53	12
F/A-18C/D (NAS Oceana Fleet)	200	10	210	11
F/A-18C/D (US Marine Corps)	204	12	216	21
T-34[2]	3	0	3	41
AV-8B (Fleet)	178	4	182	26
AV-8B (FRS)	424	6	430	21
F-15E (Air Force)	59	0	59	19
F-16 (Air Force)	432	9	441	21
CH-46 (US Marine Corps)	130	0	130	20
CH-53 (US Marine Corps)	16	0	16	19
UH-1 (US Marine Corps)	50	0	50	20
Army Helo[3]	76	0	76	28
Other Jet[1]	20	0	20	39
Other Prop[2]	20	0	20	41
Total	1,904	41	1,945	

Table 4.5-1. Annual Sorties for the Core and Cherry MOAs Alternative for Core MOA, Cherry MOA, BT-9, BT-11 and R-5306A - continued

(4) BT-11

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-14B/D (NAS Ocean Fleet)	397	0	397	18
F-14 B/D (NAS Oceana FRS)	43	0	43	18
F/A-18C/D (NAS Oceana Fleet)	624	50	674	18
F/A-18C/D (US Marine Corps)	376	16	392	17
T-34[1]	5	0	5	44
AV-8B (Fleet)	1,144	38	1,182	26
AV-8B (FRS)	406	7	413	22
KC-130 (MCAS Cherry Point Fleet)	3	1	4	36
F-15E (Air Force Jets)	379	10	389	19
F-16 (Air Force Jets)	368	0	368	22
F-16 (Air National Guard)	188	0	188	17
CH-46 (US Marine Corps)	197	0	197	21
CH-53 (US Marine Corps)	21	0	21	17
UH-1 (US Marine Corps)	69	0	69	20
Army Helo[2]	76	16	92	64
Other Jet[3]	37	0	37	45
Other Prop[1]	18	0	18	44
Total	4,349	138	4,487	

(5) R-5306A (exclusive of BT-9 and BT-11)

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F/A-18C/D (US Marine Corps)	100	0	100	39
AV-8B (Fleet)	1,825	51	1,876	47
AV-8B (FRS)	1,610	11	1,621	36
A-10 (Air Force)	29	0	29	18
F-15E (Air Force)	54	0	54	37
F-16 (Air Force)	202	4	206	28
F-16 (Air National Guard)	25	0	25	27
AH-1 (US Marine Corps)	134	0	134	5
Other Jet[1]	36	0	36	64
Other Prop[2]	90	0	90	74
Total	4,106	66	4,172	

[1]Modeled as F/A-18 C/D

[2]Modeled as C-130 H

[3]Modeled as AH-64

*60 percent of all sorties in Core are in a flight of two aircraft, 30 percent in a flight of four aircraft and 10 percent indivial aircraft; thus the modeled number of sorties equals 2.5 times sorties presented in Table 4.1-1

For R-5306A, AV-8B aircraft sorties would decrease by approximately 30 percent. The number of flying days in the busiest month for R-5306A would remain constant at 23.

Table 4.5-2 presents the flight profiles and altitude distributions for all aircraft under this alternative. An overview of the Core and Cherry MOAs sorties, sortie duration and flight profiles are presented in Sections 4.1 and 4.3, respectively. For BT-9, BT-11 and R-5306A, average power, speed and altitude ranges were discussed in Section 3.2.

Table 4.5-2. Flight Profiles for the Core and Cherry MOAs Alternative for Core MOA, Cherry MOA, BT-9, BT-11 and R-5306A

(1) Core MOA

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-15E (Air Force)	81% NC	520					35%	45%	20%
F-16 (Air Force)	87% NC	450					35%	45%	20%
AV-8B (US Marine Corps FRS)	90% RPM	500					35%	45%	20%
AV-8B (US Marine Corps Gun)	85% RPM	500					35%	45%	20%
F/A-18C/D (US Marine Corps)	88% NC	400					35%	45%	20%
F/A-18C/D (Navy USS Fleet)	88% NC	400					35%	45%	20%
F-14B/D (Navy USS Fleet)	92% NC	400					35%	45%	20%
Other Jets[1]	88% NC	400					35%	45%	20%

(2) Cherry MOA

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-10000		Over 10000
A-10 (Air Force)	5333 NF	275					25%		75%
F-15E (Air Force)	81% NC	520					25%		75%
F-16 (Air Force)	87% NC	450					25%		75%
AV-8B (US Marine Corps FRS)	90% RPM	500					25%		75%
AV-8B (US Marine Corps Gun)	85% RPM	500					25%		75%
F/A-18C/D (US Marine Corps)	88% NC	400					25%		75%
US Marine Corps Helicopters		150					25%		75%
F/A-18C/D (US Navy Fleet)	88% NC	400					25%		75%
F/A-18C/D (US Navy FRS)	88% NC	400					25%		75%
F-14B/D (US Navy Fleet)	92% NC	400					25%		75%
Other Military Jets[1]	88% NC	400					25%		75%
Other Military Props[2]	850 C TIT	220					25%		75%

(3) BT-9

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-14B/D (NAS Ocean Fleet)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F-14B/D (NAS Oceana FRS)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F/A-18C/D (NAS Ocean Fleet)	88% NC	400			2%	3%	10%	20%	65%
F/A-18C/D (US Marine Corps)	88% NC	400			2%	3%	10%	20%	65%
T-34[2]	850 C TIT	220		10%	60%	15%	15%		
AV-8B (Fleet)	90% RPM	500				36%	12%	12%	40%
AV-8B (FRS)	85% RPM	500				17%	17%	16%	50%
F-15E (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
CH-46 (US Marine Corps)	94 % Q-BPA	130		100%					
CH-53 (US Marine Corps)	90 % Q-BPA	150		100%					
UH-1 (US Marine Corps)	100 % RPM	80		100%					
Army Helo[3]	150 KNTS	150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

Table 4.5-2. Flight Profiles for the Core and Cherry MOAs Alternative for Core MOA, Cherry MOA, BT-9, BT-11 and R-5306A - continued

(4) BT-11

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-14B/D (NAS Ocean Fleet)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F-14B/D (NAS Oceana FRS)	92% NC	400	5%	5%	25%	10%	10%	20%	25%
F/A-18C/D (NAS Ocean Fleet)	88% NC	400			2%	3%	10%	20%	65%
F/A-18C/D (US Marine Corps)	88% NC	400			2%	3%	10%	20%	65%
T-34[2]	850 C TIT	220		10%	60%		30%		
AV-8B (Fleet)	90 % RPM	500			25%	12%	12%	11%	40%
AV-8B (FRS)	85 % RPM	500			10%	14%	13%	13%	50%
KC-130 (MCAS Cherry Point Fleet)	850 C TIT	220		10%	60%		30%		
F-15EC/D (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
F-16 (Air National Guard)	87% NC	450			20%	24%	23%	23%	10%
CH-46 (US Marine Corps)	94 % Q-BPA	130		100%					
CH-53 (US Marine Corps)	90 % Q-BPA	150		100%					
UH-1 (US Marine Corps)	100 % RPM	80		100%					
Army Helo[3]	150 KNTS	150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

(5) R-5306A (exclusive of BT-9 and BT-11)

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F/A-18C/D (US Marine Corps)	88% NC	400	5%	5%	25%	10%	10%	20%	25%
AV-8B (Fleet)	85% RPM	350				35%	25%		40%
AV-8B (FRS)	75% RPM	350				40%	20%		40%
A-10 (Air Force)	5333 NF	275		2%	30%	20%	20%	20%	8%
F-15E (Air Force)	81% NC	520	10%	50%	20%	4%	4%	2%	10%
F-16 (Air Force)	87% NC	450			20%	24%	23%	23%	10%
F-16 (Air National Guard)	87% NC	450			20%	24%	23%	23%	10%
Marine Corps Helicopters[4]		150		100%					
Other Jet[1]	88% NC	400			2%	3%	10%	20%	65%
Other Prop[2]	850 C TIT	220		10%	60%		30%		

[1]Modeled as F/A-18C/D
[2]Modeled as C-130 H
[3]Modeled as AH-64
[4]Modeled as AH-1

4.5.3 Noise Exposure

Using the data shown in Tables 4.5-1 and 4.5-2, values of L_{dnmr} were calculated using the MR_NMAP computer program to simulate a random distribution of sorties within Core and Cherry MOAs, BT-9, BT-11 and R-5306A. This calculation represents an estimation of the average noise exposure level within each airspace if the Core and Cherry MOAs alternative is implemented. The average noise exposure levels for all airspace under this alternative were found to be less than 50 dB and are shown in Table 4.5-3.

Table 4.5-3. Average Ldnmr (dB) Within the Core MOA, the Cherry MOA, BT-9, BT-11 and R-5306A for the Core and Cherry MOAs Alternative

Airspace Component	Average L_{dnmr} (dB)
Core MOA	<50
Cherry MOA	<50
BT-9 (within 5 nm radius)	62
BT-11 (within 5 nm radius)	68
R-5306A	56

4.5.4 Sensitive Receptor Analysis

Under this alternative, the locations presented in Table 4.5-4 and Figure 4.1-1 were evaluated for noise exposure. Onset-Rate Adjusted Sound Levels related to aircraft sorties in the Core and Cherry MOAs were computed using MR_NMAP and all were found to be under 50 dB.

Table 4.5-4. Nominal Sound Exposure Level at Sensitive Receptors Within the Core and Cherry MOAs

Special Use Airspace	Receptor Name	Address (if available)	West Longitude		North Latitude		L_{dnmr} Value (dB)
			Degrees	Minutes	Degrees	Minutes	
Core MOA	Ferry Landing North		76	13	34	56	<50
	Ferry Landing South		76	25	34	45.5	<50
	Portsmouth Village		76	04	35	04	<50
Cherry MOA	St. Thomas Episcopal Church	Craven and Main St., Bath, NC 27808	76	46.03	35	27.65	<50
	Bath Elementary School	110 S. King St., Bath, NC 27808	76	68	35	28.6	<50
	Pungo District Hospital	210 E. Front St., Belhaven, NC 27810	76	43.02	35	18.75	<50
	S.W. Snowden Elementary School	Stadium Dr. (Rte 1925), Aurora, NC 27806	76	37.22	35	32.15	<50

4.6 Full Siting of F/A-18E/F Aircraft at NAS Oceana (NTU Scenario)

Under this alternative, noise exposure is assessed for the proposed Core, Cherry, and Mattamuskeet airspace, with 10 Fleet and 1 FRS F/A-18E/F aircraft (Super Hornet) squadrons based at NAS Oceana. The status of BT-9, BT-11 and R-5306A under this alternative are addressed by the "Noise Study for Introduction of F/A-18E/F to the East Coast" (Downing et al., 2003).

4.6.1 Airspace Sorties

Airspace sorties presented in this section for the proposed Core, Cherry and Mattamuskeet MOAs alternative were obtained from Airfield and Airspace Study for the Introduction of F/A-18E/Fs To The East Coast, (ATAC, 2002). Table 4.6-1 presents the number of sorties and average mission duration associated with all airspace of interest under this alternative.

Table 4.6-1. Annual Sorties for NTU Scenario for the Core, Cherry and Mattamuskeet MOAs

(1) Core MOA

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-15E (Air Force)	61	1	62	1
F-16 (Air Force)	111	0	111	1
AV-8B (US Marine Corps FRS)	25	0	25	1
AV-8B (US Marine Corps Gun)	843	36	879	1
F/A-18 (US Marine Corps)	144	9	153	1
F/A-18 (Navy USS Fleet)	12	0	12	1
F-14 (Navy USS Fleet)	0	0	0	1
Other Jets[1]	6	0	6	1
Total	1,202	46	1,248	

(2) Mattamuskeet MOA

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
A-10 (Air Force)	8	0	8	45
F-15E (Air Force)	15	0	15	45
F-16 (Air Force)	58	0	58	45
AV-8B (US Marine Corps FRS)	562	3	565	45
AV-8B (US Marine Corps Gun)	679	23	702	45
F/A-18C/D (US Marine Corps)	26	0	26	45
US Marine Corps Helicopters	67	0	67	45
F/A-18C/D (US Navy Fleet)	89	14	103	45
F/A-18C/D (US Navy FRS)	524	49	573	45
F/A-18E/F (Navy Fleet)	4	2	6	45
F/A-18E/F (Navy FRS)	772	28	800	45
F-14C/D (US Navy Fleet)	0	0	0	45
Other Military Jets[1]	9	0	9	45
Other Military Props[2]	22	0	22	45
Total	2,835	119	2,954	

(3) Cherry MOA

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
A-10 (Air Force)	8	0	8	45
F-15E (Air Force)	15	0	15	45
F-16 (Air Force)	58	0	58	45
AV-8B (US Marine Corps FRS)	562	3	565	45
AV-8B (US Marine Corps Gun)	679	23	702	45
F/A-18C/D (US Marine Corps)	26	0	26	45
US Marine Corps Helicopters	67	0	67	45
F/A-18C/D (US Navy Fleet)	89	14	103	45
F/A-18C/D (US Navy FRS)	524	49	573	45
F/A-18E/F (Navy Fleet)	4	2	6	45
F/A-18E/F (Navy FRS)	772	28	800	45
F-14C/D (US Navy Fleet)	0	0	0	45
Other Military Jets[1]	9	0	9	45
Other Military Props[2]	22	0	22	45
Total	2,835	119	2,954	

1Modeled as F/A-18C/D

2Modeled as C-130 H

Table 4.6-2 presents the flight profiles and altitude distributions for all aircraft under this alternative.

Table 4.6-2. Flight Profiles for the Core, Cherry and Mattamuskeet MOAs for NTU Scenario

(1) Core MOA

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-15E (Air Force)	81% NC	520					35%	45%	20%
F-16 (Air Force)	87% NC	450					35%	45%	20%
AV-8B (US Marine Corps FRS)	90% RPM	500					35%	45%	20%
AV-8B (US Marine Corps Gun)	85% RPM	500					35%	45%	20%
F/A-18C/D (US Marine Corps)	88% NC	400					35%	45%	20%
F/A-18C/D (Navy USS Fleet)	88% NC	400					35%	45%	20%
F-14B/D (Navy USS Fleet)	92% NC	400					35%	45%	20%
Other Jets[1]	88% NC	400					35%	45%	20%

(2) Cherry MOA

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-10000		Over 10000
A-10 (Air Force)	5333 NF	275					25%		75%
F-15E (Air Force)	81% NC	520					25%		75%
F-16 (Air Force)	87% NC	450					25%		75%
AV-8B (US Marine Corps FRS)	90% RPM	500					25%		75%
AV-8B (US Marine Corps Gun)	85% RPM	500					25%		75%
F/A-18C/D (US Marine Corps)	88% NC	400					25%		75%
US Marine Corps Helicopters		150					25%		75%
F/A-18C/D (US Navy Fleet)	88% NC	400					25%		75%
F/A-18C/D (US Navy FRS)	88% NC	400					25%		75%
F-14B/D (US Navy Fleet)	92% NC	400					25%		75%
Other Military Jets[1]	88% NC	400					25%		75%
Other Military Props[2]	850 C TIT	220					25%		75%

(2) Mattamuskeet MOA

Aircraft Type	Typical		Typical Altitude Distribution (ft. Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-10000		Over 10000
A-10 (Air Force)	5333 NF	275					25%		75%
F-15E (Air Force)	81% NC	520					25%		75%
F-16 (Air Force)	87% NC	450					25%		75%
AV-8B (US Marine Corps FRS)	90% RPM	500					25%		75%
AV-8B (US Marine Corps Gun)	85% RPM	500					25%		75%
F/A-18C/D (US Marine Corps)	88% NC	400					25%		75%
US Marine Corps Helicopters		150					25%		75%
F/A-18C/D (US Navy Fleet)	88% NC	400					25%		75%
F/A-18C/D (US Navy FRS)	88% NC	400					25%		75%
F-14B/D (US Navy Fleet)	92% NC	400					25%		75%
Other Military Jets[1]	88% NC	400					25%		75%
Other Military Props[2]	850 C TIT	220					25%		75%

[1]Modeled as F/A-18C/D

[2]Modeled as C-130 H&N&P

4.6.2 Noise Exposure

Using the data shown in Tables 4.6-1 and 4.6-2, values of L_{dnmr} were calculated using the MR_NMAP computer program to simulate a random distribution of sorties within Core, Cherry and Mattamuskeet MOAs. This calculation represents an estimation of the average noise exposure level within each airspace if the Core, Cherry and Mattamuskeet MOAs alternative is implemented. The average noise exposure levels for all airspace under this alternative were found to be less than 50 dB and are shown in Table 4.6-3.

Table 4.6-3. Average Ldnmr (dB) Within the Core MOA, the Cherry MOA and Mattamuskeet MOAs for the NTU Scenario

Airspace Component	Average L_{dnmr} (dB)
Core MOA	<50
Cherry MOA	<50
Mattamuskeet MOA	<50

4.7 Full Siting of F/A-18E/F Aircraft at MCAS Cherry Point (NKT Scenario)

Under this alternative, noise exposure is assessed for the proposed Core, Cherry, and Mattamuskeet airspace, with 10 Fleet and 1 FRS F/A-18E/F aircraft (Super Hornet) squadrons based at MCAS Cherry Point. The status of BT-9, BT-11 and R-5306A under this alternative are addressed by the "Noise Study for Introduction of F/A-18E/F to the East Coast" (Downing et al., 2003).

4.7.1 Airspace Sorties

Airspace sorties presented in this section for the proposed Core, Cherry and Mattamuskeet MOAs alternative were obtained from Airfield and Airspace Study for the Introduction of F/A-18E/Fs To The East Coast, (ATAC, 2002). Table 4.6-1 presents the number of sorties and average mission duration associated with all airspace of interest under this alternative.

Table 4.7-1. Annual Sorties for NKT Scenario for the Core, Cherry and Mattamuskeet MOAs

(1) Core MOA

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
F-15E (Air Force)	58	1	59	1
F-16 (Air Force)	112	0	112	1
AV-8B (US Marine Corps FRS)	25	1	26	1
AV-8B (US Marine Corps Gun)	810	41	851	1
F/A-18C/D (US Marine Corps)	142	6	148	1
F/A-18E/F (Navy Fleet)	159	36	195	1
F/A-18E/F (Navy FRS)	41	3	44	1
F/A-18 (Navy USS Fleet)	16	0	16	1
F-14 (Navy USS Fleet)	0	0	0	1
Other Jets[1]	5	0	5	1
Total	1,368	88	1,456	

(2) Mattamuskeet MOA

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
A-10 (Air Force)	8	0	8	45
F-15E (Air Force)	14	0	14	45
F-16 (Air Force)	58	0	58	45
AV-8B (US Marine Corps FRS)	554	3	557	45
AV-8B (US Marine Corps Gun)	657	29	686	45
F/A-18C/D (US Marine Corps)	27	0	27	45
US Marine Corps Helicopters	67	0	67	45
F/A-18C/D (US Navy Fleet)	76	14	90	45
F/A-18C/D (US Navy FRS)	546	31	577	45
F/A-18E/F (Navy Fleet)	179	17	196	45
F/A-18E/F (Navy FRS)	597	38	635	45
F-14C/D (US Navy Fleet)	0	0	0	45
Other Military Jets[1]	9	0	9	45
Other Military Props[2]	22	0	22	45
Total	2,814	132	2,946	

(3) Cherry MOA

Aircraft Type	Annual Sorties			Average Duration per Sortie (Minute)
	0700-2200	2200-0700	Total	
A-10 (Air Force)	8	0	8	45
F-15E (Air Force)	14	0	14	45
F-16 (Air Force)	58	0	58	45
AV-8B (US Marine Corps FRS)	554	3	557	45
AV-8B (US Marine Corps Gun)	657	29	686	45
F/A-18C/D (US Marine Corps)	27	0	27	45
US Marine Corps Helicopters	67	0	67	45
F/A-18C/D (US Navy Fleet)	76	14	90	45
F/A-18C/D (US Navy FRS)	546	31	577	45
F/A-18E/F (Navy Fleet)	179	17	196	45
F/A-18E/F (Navy FRS)	597	38	635	45
F-14C/D (US Navy Fleet)	0	0	0	45
Other Military Jets[1]	9	0	9	45
Other Military Props[2]	22	0	22	45
Total	2,814	132	2,946	

1Modeled as F/A-18C/D

2Modeled as C-130 H

Table 4.7-2 presents the flight profiles and altitude distributions for all aircraft under this alternative.

Table 4.7-2. Flight Profiles for the Core, Cherry and Mattamuskeet MOAs for NKT Scenario

(1) Core MOA

Aircraft Type	Typical		Typical Altitude Distribution (ft, Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-5000	5000-10000	Over 10000
F-15E (Air Force)	81% NC	520					35%	45%	20%
F-16 (Air Force)	87% NC	450					35%	45%	20%
AV-8B (US Marine Corps FRS)	90% RPM	500					35%	45%	20%
AV-8B (US Marine Corps Gun)	85% RPM	500					35%	45%	20%
F/A-18C/D (US Marine Corps)	88% NC	400					35%	45%	20%
F/A-18C/D (Navy USS Fleet)	88% NC	400					35%	45%	20%
F-14B/D (Navy USS Fleet)	92% NC	400					35%	45%	20%
Other Jets[1]	88% NC	400					35%	45%	20%

(2) Cherry MOA

Aircraft Type	Typical		Typical Altitude Distribution (ft, Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-10000		Over 10000
A-10 (Air Force)	5333 NF	275					25%		75%
F-15E (Air Force)	81% NC	520					25%		75%
F-16 (Air Force)	87% NC	450					25%		75%
AV-8B (US Marine Corps FRS)	90% RPM	500					25%		75%
AV-8B (US Marine Corps Gun)	85% RPM	500					25%		75%
F/A-18C/D (US Marine Corps)	88% NC	400					25%		75%
US Marine Corps Helicopters		150					25%		75%
F/A-18C/D (US Navy Fleet)	88% NC	400					25%		75%
F/A-18C/D (US Navy FRS)	88% NC	400					25%		75%
F-14B/D (US Navy Fleet)	92% NC	400					25%		75%
Other Military Jets[1]	88% NC	400					25%		75%
Other Military Props[2]	850 C TIT	220					25%		75%

(2) Mattamuskeet MOA

Aircraft Type	Typical		Typical Altitude Distribution (ft, Above Ground Level)						
	Power Setting	Indicated Airspeed (knots)	100-300	300-500	500-1000	1000-3000	3000-10000		Over 10000
A-10 (Air Force)	5333 NF	275					25%		75%
F-15E (Air Force)	81% NC	520					25%		75%
F-16 (Air Force)	87% NC	450					25%		75%
AV-8B (US Marine Corps FRS)	90% RPM	500					25%		75%
AV-8B (US Marine Corps Gun)	85% RPM	500					25%		75%
F/A-18C/D (US Marine Corps)	88% NC	400					25%		75%
US Marine Corps Helicopters		150					25%		75%
F/A-18C/D (US Navy Fleet)	88% NC	400					25%		75%
F/A-18C/D (US Navy FRS)	88% NC	400					25%		75%
F-14B/D (US Navy Fleet)	92% NC	400					25%		75%
Other Military Jets[1]	88% NC	400					25%		75%
Other Military Props[2]	850 C TIT	220					25%		75%

[1]Modeled as F/A-18C/D

[2]Modeled as C-130 H&N&P

4.7.2 Noise Exposure

Using the data shown in Tables 4.7-1 and 4.7-2, values of L_{dnmr} were calculated using the MR_NMAP computer program to simulate a random distribution of sorties within Core, Cherry and Mattamuskeet MOAs. This calculation represents an estimation of the average noise exposure level within each airspace if the Core, Cherry and Mattamuskeet MOAs alternative is implemented. The average noise exposure levels for all airspace under this alternative were found to be less than 50 dB and are shown in Table 4.7-3.

Table 4.7-3. Average Ldnmr (dB) Within the Core MOA, the Cherry MOA and Mattamuskeet MOAs for the NKT Scenario

Airspace Component	Average L_{dnmr} (dB)
Core MOA	<50
Cherry MOA	<50
Mattamuskeet MOA	<50

4.8 The No Action Alternative

Under this alternative, none of the proposed SUAs would be implemented. As a result, baseline CY00 aircraft operations in BT-9, BT-11 and R-5306A would remain unchanged. The resultant noise exposure would remain unchanged from the baseline conditions.

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APPENDIX A

DISCUSSION OF NOISE AND ITS EFFECT ON THE ENVIRONMENT

A.1 NOISE

A.1.1 General

Noise, often defined as unwanted sound, is one of the most common environmental issues associated with aircraft operations. Of course, aircraft are not the only sources of noise in an urban or suburban surrounding, where interstate and local roadway traffic, rail, industrial, and neighborhood sources also intrude on the everyday quality of life. Nevertheless, aircraft are readily identifiable to those affected by their noise and are typically singled out for special attention and criticism. Consequently, aircraft noise problems often dominate analyses of environmental impacts.

Sound is a physical phenomenon consisting of minute vibrations which travel through a medium, such as air, and are sensed by the human ear. Whether that sound is interpreted as pleasant (for example, music) or unpleasant (for example, aircraft noise) depends largely on the listener's current activity, past experience, and attitude toward the source of that sound. It is often true that one person's music is another person's noise.

The measurement and human perception of sound involves two basic physical characteristics – intensity and frequency. Intensity is a measure of the acoustic energy of the sound vibrations and is expressed in terms of sound pressure. The higher the sound pressure, the more energy carried by the sound and the louder the perception of that sound. The second important physical characteristic is sound frequency which is the number of times per second the air vibrates or oscillates. Low-frequency sounds are characterized as rumbles or roars, while high-frequency sounds are typified by sirens or screeches.

The loudest sounds which can be detected comfortably by the human ear have intensities which are 1,000,000,000,000 times larger than those of sounds which can just be detected. Because of this vast range, any attempt to represent the intensity of sound using a linear scale becomes very unwieldy. As a result, a logarithmic unit known as the decibel (abbreviated dB) is used to represent the intensity of a sound. Such a representation is called a sound level.

A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above about 120 dB begin to be felt inside the human ear as discomfort and eventually pain at still higher levels.

Because of the logarithmic nature of the decibel unit, sound levels cannot be added or subtracted directly and are somewhat cumbersome to handle mathematically. However, some simple rules of thumb are useful in dealing with sound levels. First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. Thus, for example:

60 dB + 60 dB = 63 dB, and

80 dB + 80 dB = 83 dB.

The total sound level produced by two sounds of different levels is usually only slightly more than the higher of the two. For example:

60.0 dB + 70.0 dB = 70.4 dB.

Because the addition of sound levels behaves differently than that of ordinary numbers, such addition is often referred to as "decibel addition" or "energy addition." The latter term arises from the fact that what we are really doing when we add decibel values is first converting each decibel value to its corresponding acoustic energy, then adding the energies using the normal rules of addition, and finally converting the total energy back to its decibel equivalent.

An important facet of decibel addition arises later when the concept of time-average sound levels is introduced to explain Day-Night Average Sound Level. Because of the logarithmic units, the time-average sound level is dominated by the louder levels which occur during the averaging period. As a simple example, consider a sound level which is 100 dB and lasts for 30 seconds, followed by a sound level of 50 dB which also lasts for 30 seconds. The time-average sound level over the total 60-second period is 97 dB, not 75 dB.

The minimum change in the sound level of individual events which an average human ear can detect is about 3 dB. A change in sound level of about 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness, and this relation holds true for loud sounds and for quieter sounds. A decrease in sound level of 10 dB actually represents a 90 percent decrease in sound <u>intensity</u> but only a 50 percent decrease in perceived <u>loudness</u> because of the nonlinear response of the human ear (similar to most human senses).

<u>Sound frequency</u> is measured in terms of cycles per second (cps), or hertz (Hz), which is the preferred scientific unit for cps. The normal human ear can detect sounds which range in frequency from about 20 Hz to about 15,000 Hz. All sounds in this wide range of frequencies, however, are not heard equally well by the human ear, which is most sensitive to frequencies in the 1000 to 4000 Hz range. In measuring community noise, this frequency dependence is taken into account by adjusting the very high and very low frequencies to approximate the human ear's lower sensitivity to those frequencies. This is called "A-weighting" and is commonly used in measurements of community environmental noise.

Sound levels measured using A-weighting are most properly called A-weighted sound levels while sound levels measured without any frequency weighting are most properly called sound levels. However, since most environmental impact analysis documents deal only with A-weighted sound levels, the adjective "A-weighted" is often omitted, and A-weighted sound levels are referred to simply as sound levels. In some instances, the author will indicate that the levels have been A-weighted by using the abbreviation dBA or dB(A), rather than the abbreviation dB, for decibel. As long as the use of A-weighting is understood to be used, there is no difference implied by the terms "sound level" and "A-weighted sound level" or by the units dB, dBA, and dB(A).

A.1.2 Noise Metrics

A "metric" is defined as something "of, involving, or used in measurement." As used in environmental noise analyses, a metric refers to the unit or quantity which quantitatively measures the effect of noise on the environment. Noise studies have typically involved a confusing proliferation of noise metrics as individual researchers have attempted to understand and represent the effects of noise. As a result, past literature describing environmental noise or environmental noise abatement has included many different metrics.

Various federal agencies involved in environmental noise mitigation have agreed on common metrics for environmental impact analysis documents, and both the Department of Defense and the Federal Aviation Administration have specified those which should be used for federal aviation noise assessments. These metrics are as follows.

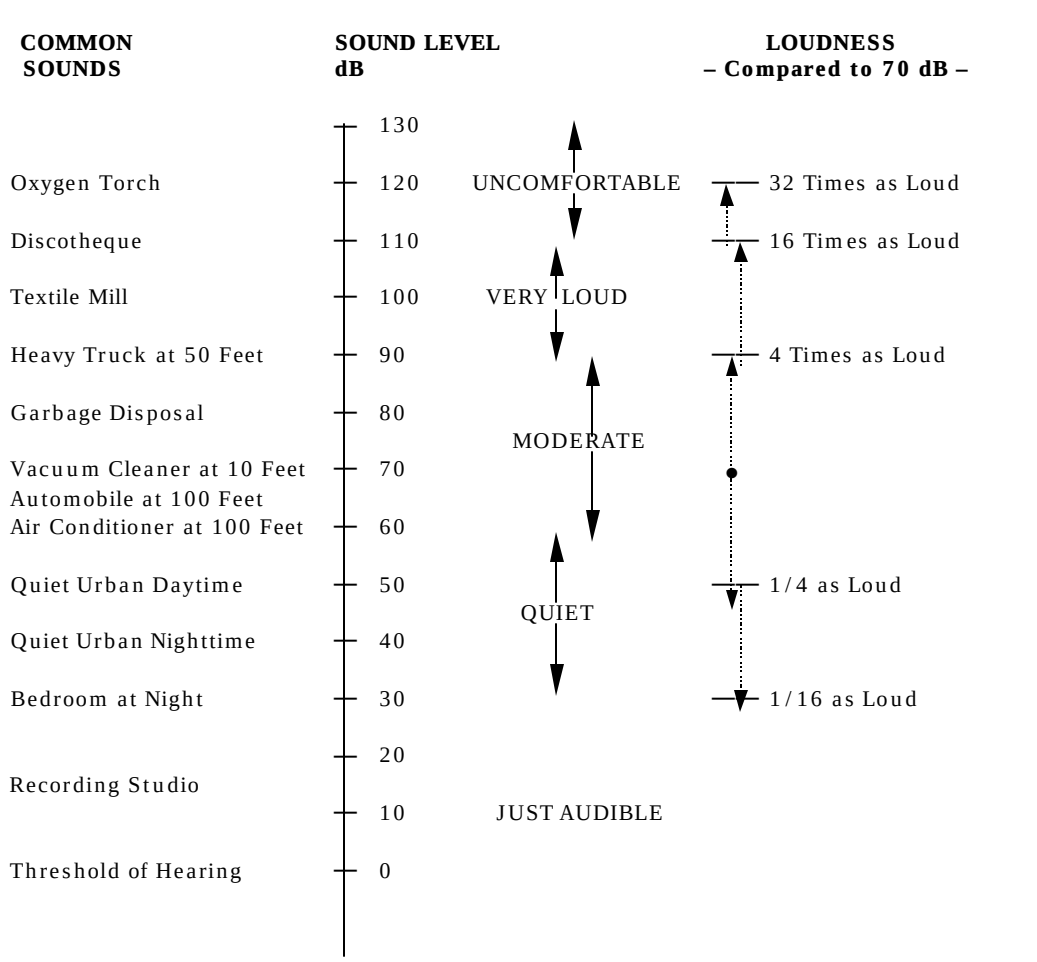
A.1.2.1 Maximum Sound Level

The highest A-weighted sound level measured during a single event in which the sound level changes value as time goes on (e.g., an aircraft overflight) is called the maximum A-weighted sound level or maximum sound level, for short. It is usually abbreviated by ALM, L_{max} or L_{Amax}.

The maximum sound levels of typical events are shown in Figure A-1. The maximum sound level is important in judging the interference caused by a noise event with conversation, TV or radio listening, sleep, or other common activities.

A.1.2.2 Sound Exposure Level

Individual time-varying noise events have two main characteristics – a sound level which changes throughout the event and a period of time during which the event is heard. Although the maximum sound level, described above, provides some measure of the intrusiveness of the event, it alone does not completely describe the total event. The period of time during which the sound is heard is also significant. The Sound Exposure Level (abbreviated SEL or L_{AE}) combines both of these characteristics into a single metric.



Source: *Handbook of Noise Control*, C.M. Harris, Editor, McGraw-Hill Book Co., 1979, and FICAN 1992.

Figure A-1. Typical A-Weighted Sound Levels of Common Sounds.

Sound Exposure Level is a logarithmic measure of the total acoustic energy transmitted to the listener during the event. Mathematically, it represents the sound level of the constant sound that would, in one second, generate the same acoustic energy as did the actual time-varying noise event. Since aircraft overflights usually last longer than one second, the Sound Exposure Level of an overflight is usually greater than the maximum sound level of the overflight.

Note that Sound Exposure Level is a composite metric which represents both the intensity of a sound and its duration. It does not directly represent the sound level heard at any given time, but rather provides a measure of the net impact of the entire acoustic event. It has been well established in the scientific community that Sound Exposure Level measures this impact much more reliably than just the maximum sound level.

Because the Sound Exposure Level and the maximum sound level are both A-weighted sound levels expressed in decibels, there is sometimes confusion between the two, so the specific metric used should be clearly stated.

A.1.2.3 Day-Night Average Sound Level

Time-average sound levels are measurements of sound levels which are averaged over a specified length of time. These levels provide a measure of the average sound energy during the measurement period.

For the evaluation of community noise effects, and particularly aircraft noise effects, the Day-Night Average Sound Level (abbreviated DNL or L_{dn}) is used. Day-Night Average Sound Level averages aircraft sound levels at a location over a complete 24-hour period, with a 10-decibel adjustment added to those noise events which take place between 10:00 p.m. and 7:00 a.m. (local time) the following morning. This 10-decibel "penalty" represents the added intrusiveness of sounds which occur during normal sleeping hours, both because of the increased sensitivity to noise during those hours and because ambient sound levels during nighttime are typically about 10 dB lower than during daytime hours.

Ignoring the 10-decibel nighttime adjustment for the moment, Day-Night Average Sound Level may be thought of as the continuous A-weighted sound level which would be present if all of the variations in sound level which occur over a 24-hour period were smoothed out so as to contain the same total sound energy.

Day-Night Average Sound Level provides a single measure of overall noise impact, but does not provide specific information on the number of noise events or the individual sound levels which occur during the day. For example, a Day-Night Average Sound Level of 65 dB could result from a very few noisy events, or a large number of quieter events.

As noted earlier for Sound Exposure Level, Day-Night Average Sound Level does not represent the sound level heard at any particular time, but rather represents the total sound exposure. Scientific studies and social surveys which have been conducted to appraise community annoyance to all types of environmental noise have found the Day-Night Average Sound Level to be the best measure of that annoyance. Its use is endorsed by the scientific community (References A1 through A5).

There is, in fact, a remarkable consistency in the results of attitudinal surveys about aircraft noise conducted in different countries to find the percentages of groups of people who express various degrees of annoyance when exposed to different levels of Day-Night Average Sound Level. This is illustrated in Figure A-2, which summarizes the results of a large number of social surveys relating community responses to various types of noises, measured in Day-Night Average Sound Level.

Reference A6, from which Figure A-2 was taken, was published in 1978. A more recent study has reaffirmed this relationship (Reference A7). In general, correlation coefficients of 0.85 to 0.95 are found between the percentages of <u>groups</u> of people highly annoyed and the level of average noise exposure. The correlation coefficients for the annoyance of <u>individuals</u> are relatively low, however, on the order of 0.5 or less. This is not surprising, considering

the varying personal factors which influence the manner in which individuals react to noise. Nevertheless, findings substantiate that community annoyance to aircraft noise is represented quite reliably using Day-Night Average Sound Level.

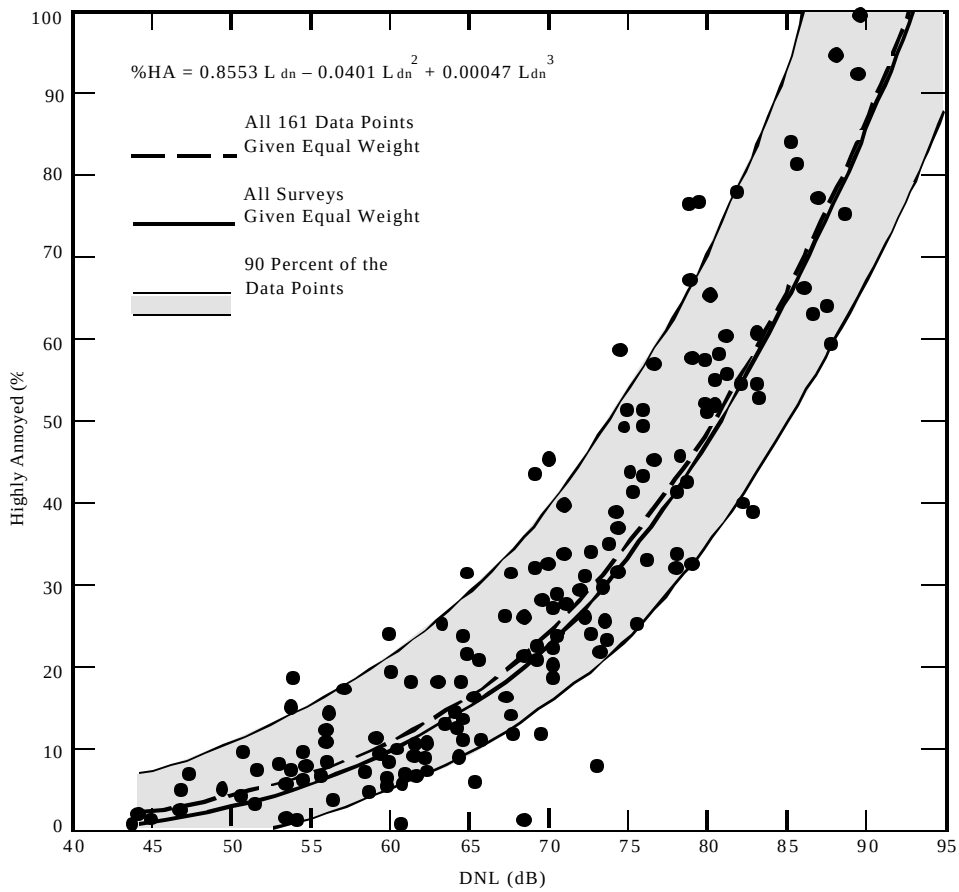


Figure A-2. Community Surveys of Noise Annoyance (Schulz, 1978)

This relation between community annoyance and time-average sound level has been confirmed, even for infrequent aircraft noise events. Reference A9 reported the reactions of individuals in a community to daily helicopter overflights, ranging from 1 to 32 per day. The stated reactions to infrequent helicopter overflights correlated quite well with the daily time-average sound levels over this range of numbers of daily noise events.

The use of Day-Night Average Sound Level has been criticized as not accurately representing community annoyance and land-use compatibility with aircraft noise. Much of that criticism stems from a lack of understanding of the basis for the measurement or calculation of L_{dn}. One frequent criticism is based on the inherent feeling that people react more to single noise events and not as much to "meaningless" time-average sound levels.

In fact, a time-average noise metric, such as L_{dn}, takes into account both the noise levels of all individual events which occur during a 24-hour period and the number of times those

events occur. As described briefly above, the logarithmic nature of the decibel unit causes the noise levels of the loudest events to control the 24-hour average.

As a simple example of this characteristic, consider a case in which only one aircraft overflight occurs in daytime during a 24-hour period, creating a sound level of 100 dB for 30 seconds. During the remaining 23 hours, 59 minutes, and 30 seconds of the day, the ambient sound level is 50 dB. The Day-Night Average Sound Level for this 24-hour period is 65.5 dB. Assume, as a second example, that ten such 30-second overflights occur in daytime hours during the next 24-hour period, with the same ambient sound level of 50 dB during the remaining 23 hours and 55 minutes of the day. The Day-Night Average Sound Level for this 24-hour period is 75.4 dB. Clearly, the averaging of noise over a 24-hour period does not ignore the louder single events and tends to emphasize both the sound levels and number of those events. This is the basic concept of a time-average sound metric, and specifically the Day-Night Average Sound Level.

A.1.2.4 Onset-Rate Adjusted Day-Night Average Sound Level

Aircraft operations along low-altitude Military Training Routes (MTRs) and in Military Operating Areas (MOAs) and Restricted Areas/Ranges generate a noise environment different from other community noise environments. Overflights can be highly sporadic, ranging from many (e.g., ten per hour) to few (less than one per week). This situation differs from most community noise environments in which noise tends to be continuous or patterned.

Individual military overflight events also differ from typical community noise events because of the low-altitude and high-airspeed characteristics of military aircraft. These characteristics result in aircraft that exhibit a rate of increase in sound level (onset rate) of up to 30 dB per second. The Day-Night Average Sound Level metric is adjusted to account for the “surprise” effect of the onset rate of aircraft noise on humans with an adjustment ranging up to 11 dB added to the normal Sound Exposure Level (Reference A10). Onset rates between 15 to 150 dB per second require an adjustment of from 0 to 11 dB, while onset rates below 15 dB per second require no adjustment. The adjusted Day-Night Average Sound Level is designated as Onset-Rate Adjusted Day-Night Average Sound Level (abbreviated L_{dnr}). Because of the sporadic occurrences of aircraft overflights along MTRs, in MOAs and Restricted Areas/Ranges, the number of average daily operations is determined from the calendar month with the highest number of operations in each area. This monthly average is denoted L_{dnmr}.

A.2 NOISE EFFECTS

A.2.1 Hearing Loss

Noise-induced hearing loss is probably the best defined of the potential effects of human exposure to excessive noise. Federal workplace standards for protection from hearing loss allow a time-average level of 90 dB over an 8-hour work period, or 85 dB averaged over a 16-hour period. Even the most protective criterion (no measurable hearing loss for the most sensitive portion of the population at the ear's most sensitive frequency, 4000 Hz, after a

40-year exposure) suggests a time-average sound level of 70 dB over a 24-hour period. Since it is unlikely that airport neighbors will remain outside their homes 24 hours per day for extended periods of time, there is little possibility of hearing loss below a Day-Night Average Sound Level of 75 dB, and this level is extremely conservative.

A.2.2 Nonauditory Health Effects

Nonauditory health effects of long-term noise exposure, where noise may act as a risk factor, have never been found to occur at levels below those protective against noise-induced hearing loss, described above. Most studies attempting to clarify such health effects have found that noise exposure levels established for hearing protection will also protect against any potential nonauditory health effects, at least in workplace conditions. The best scientific summary of these findings is contained in the lead paper at the National Institutes of Health Conference on Noise and Hearing Loss, held on 22–24 January 1990 in Washington, D.C.:

> "The nonauditory effects of chronic noise exposure, when noise is suspected to act as one of the risk factors in the development of hypertension, cardiovascular disease, and other nervous disorders, have never been proven to occur as chronic manifestations at levels below these criteria (an average of 75 dBA for complete protection against hearing loss for an eight-hour day). At the 1988 International Congress on Noise as a Public Health Problem, most studies attempting to clarify such health effects did not find them at levels below the criteria protective of noise-induced hearing loss, and even above these criteria, results regarding such health effects were ambiguous. Consequently, one comes to the conclusion that establishing and enforcing exposure levels protecting against noise-induced hearing loss would not only solve the noise-induced hearing loss problem but also any potential nonauditory health effects in the work place." (Reference A11; parenthetical wording added for clarification.)

Although these findings were directed specifically at noise effects in the work place, they are equally applicable to aircraft noise effects in the community environment. Research studies regarding the nonauditory health effects of aircraft noise are ambiguous, at best, and often contradictory. Yet, even those studies which purport to find such health effects use time-average noise levels of 75 dB and higher for their research.

For example, in an often-quoted paper, two UCLA researchers apparently found a relation between aircraft noise levels under the approach path to Los Angeles International Airport (LAX) and increased mortality rates among the exposed residents by using an average noise exposure level greater than 75 dB for the "noise-exposed" population (Reference A12). Nevertheless, three other UCLA professors analyzed those same data and found no relation between noise exposure and mortality rates (Reference A13).

As a second example, two other UCLA researchers used this same population near LAX to show a higher rate of birth defects in 1970–1972 when compared with a control group residing away from the airport (Reference A14). Based on this report, a separate group at the U.S. Centers for Disease Control performed a more thorough study of populations near Atlanta's Hartsfield International Airport (ATL) for 1970–1972 and found no relation in their study of 17 identified categories of birth defects to aircraft noise levels above 65 dB (Reference A15).

In summary, there is no scientific basis for a claim that potential health effects exist for aircraft time-average sound levels below 75 dB.

A.2.3 Annoyance

The primary effect of aircraft noise on exposed communities is one of annoyance. Noise annoyance is defined by the U.S. Environmental Protection Agency as any negative subjective reaction on the part of an individual or group (Reference A3). As noted in the discussion of Day-Night Average Sound Level above, community annoyance is best measured by that metric.

It is often suggested that a lower Day-Night Average Sound Level, such as 60 or 55 dB, be adopted as the threshold of community noise annoyance for airport environmental analysis documents. While there is no technical reason why a lower level cannot be measured or calculated for comparison purposes, a Day-Night Average Sound Level of 65 dB:

1. provides a valid basis for comparing and assessing community noise effects,
2. represents a noise exposure level which is normally dominated by aircraft noise and not other community or nearby highway noise sources, and
3. reflects the FAA's threshold for grant-in-aid funding of airport noise mitigation projects.

The U.S. Department of Housing and Urban Development also established a Day-Night Average Sound Level standard of 65 dB for eligibility for federally guaranteed home loans.

For this environmental study, levels of Day-Night Average Sound Level equal to and greater than 65 dB were used for assessing community noise impact. Figure A-3 shows the relationship between the percentage of the population highly annoyed and the Day-Night Average Sound Levels (References A6 and A8)

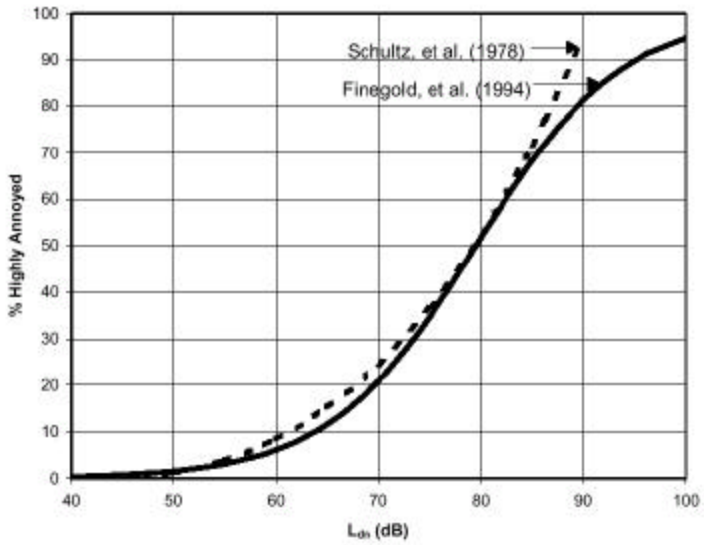


Figure A-3. Response of Communities to Noise; Comparison of Original (Schultz, 1978) and Current (Finegold et al., 1994) Curve Fits

A.2.4 Speech Interference

Speech interference associated with aircraft noise is a primary cause of annoyance to individuals on the ground. The disruption of routine activities such as radio or television listening, telephone use, or family conversation gives rise to frustration and agravation. The quality of speech communication is also important in classrooms, offices, and industrial settings and can cause fatigue and vocal strain in those who attempt to communicate over the noise. Research has shown that "whenever intrusive noise exceeds approximately 60 dB indoors, there will be interference with speech communication" (Reference A5).

Indoor speech interference, per Reference A3, can be expressed as a percentage of sentence intelligibility among two people speaking in relaxed conversation approximately 1 meter apart in a typical* living room or bedroom. The percentage of sentence intelligibility is a non-linear function of the (steady) indoor background A-weighted sound level as shown in Figure A-4.

Criteria for sleep disturbance, including those specified by the Federal Interagency Committee On Noise (FICON) in 1992, were traditionally based on the aggregate of available data. The applicability of much of that data, in particular laboratory studies and in-home studies with artificial noises, has come into question.

This curve was digitized and curve-fitted for the purposes of this appendix. Such a curve-fit yields 100 percent sentence intelligibility for background levels below 57 dB and yields less than 10 percent intelligibility for background levels above 73 dB. Note that the function is especially sensitive to changes in sound level between 65 dB and 75 dB. As an example of the sensitivity, a 1 dB increase in background sound level from 70 dB to 71 dB yields a 14 percent decrease in sentence intelligibility.

* "Typical" is defined as a room with about 300 sabins of sound absorption which, according to Reference A3, is representative of living rooms and bedrooms.

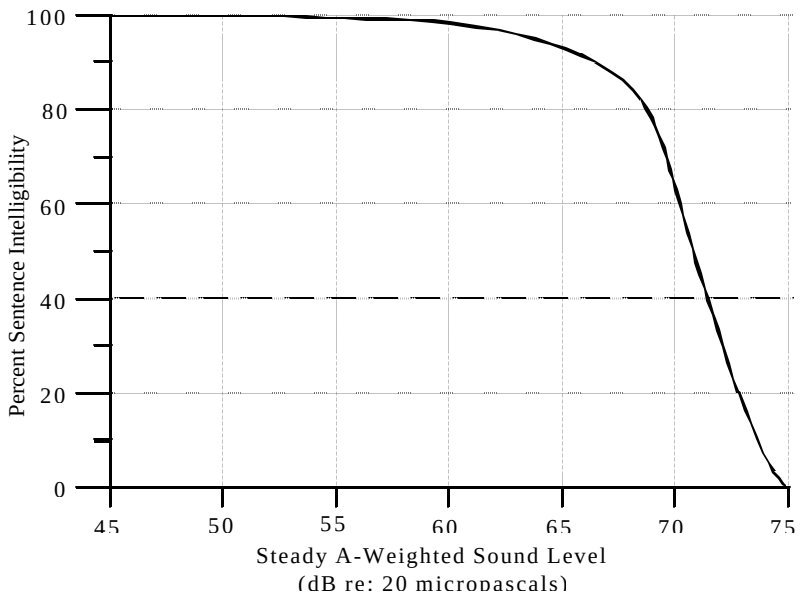


Figure A-4. Percent Sentence Intelligibility (Reference A3)

A.2.5 Sleep Disturbance

Sleep disturbance is another source of annoyance associated with aircraft noise. This is especially true because of the intermittent nature and content of aircraft noise, which is more disturbing than continuous noise of equal energy and neutral meaning.

Sleep disturbance can be measured in either of two ways. “Arousal” represents awakening from sleep, while a change in “sleep stage” represents a shift from one of four sleep stages to another stage of lighter sleep without awakening. In general, arousal requires a higher noise level than does a change in sleep stage.

In terms of average daily noise levels, some guidance is available to judge sleep disturbance. The U.S. Environmental Protection Agency identified an indoor DNL of 45 dB as necessary to protect against sleep interference (Reference A3). Assuming a conservative structural noise insulation of 20 dB for typical dwellings, 45 dB corresponds to an outdoor DNL of 65 dB as minimizing sleep interference.

In June 1997, the Federal Interagency Committee on Aviation Noise (FICAN) reviewed the sleep disturbance issue and presented a sleep disturbance dose-response prediction curve (Reference A16), which was based on data from field studies in References A17 through A20, as the recommended tool for analysis of potential sleep disturbance for residential areas. Figure A-5 shows this curve which, for an indoor Sound Exposure Level of 60 dB, predicts that a maximum of approximately 5 percent of the residential populaton exposed are expected to be behaviourally awakened. FICAN cautions that this curve should only be applied to long-term adult residents.

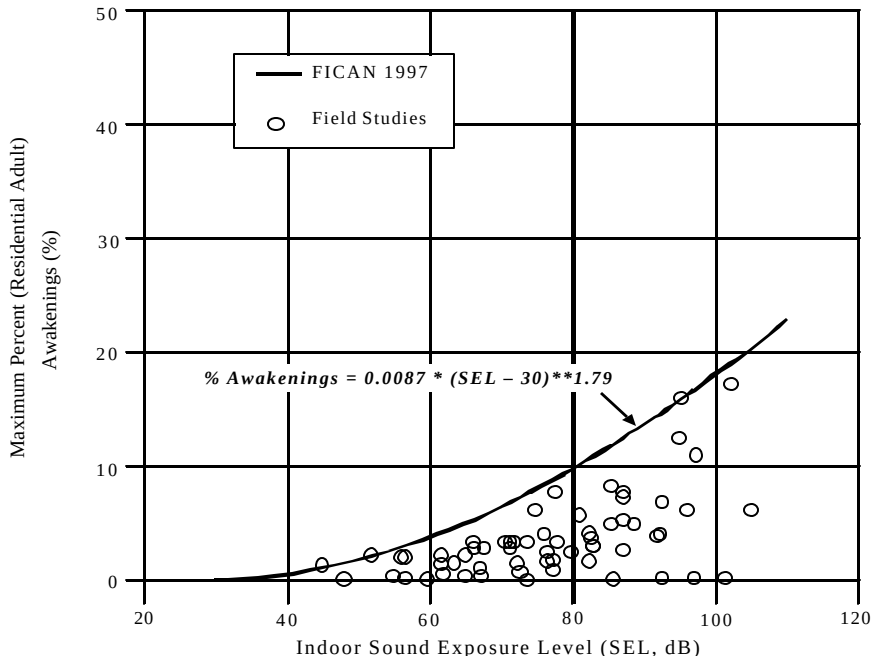


Figure A-5. Sleep-disturbance Dose-response Relationship

A.2.6 Noise Effects on Domestic Animals and Wildlife

Animal species differ greatly in their responses to noise. Each species has adapted, physically and behaviorally, to fill its ecological role in nature, and its hearing ability usually reflects that role. Animals rely on their hearing to avoid predators, obtain food, and communicate with and attract other members of their species. Aircraft noise may mask or interfere with these functions. Secondary effects may include nonauditory effects similar to those exhibited by humans – stress, hypertension, and other nervous disorders. Tertiary effects may include interference with mating and resultant population declines.

There are available many scientific studies regarding the effects of noise on wildlife and some anecdotal reports of wildlife "flight" due to noise. Few of these studies or reports include any reliable measures of the actual noise levels involved.

In the absence of definitive data on the effect of noise on animals, the Committee on Hearing, Bioacoustics, and Biomechanics of the National Research Council has proposed that protective noise criteria for animals be taken to be the same as for humans (Reference A17).

A.2.7 Effects on Noise-Induced Vibration Structures and Humans

The sound from an aircraft overflight travels from the exterior to the interior of the house in one of two ways: through the solid structural elements and directly through the air. Figure A-6 illustrates the sound transmission through a wall constructed with a brick exterior, stud framing, interior finish wall, and absorbent material in the cavity. The sound

transmission starts with noise impinging on the wall exterior. Some of this sound energy will be reflected away and some will make the wall vibrate. The vibrating wall radiates sound into the airspace, which in turn sets the interior finish surface vibrating, with some energy lost in the airspace. This surface then radiates sound into the dwelling interior. As the figure shows, vibrational energy also bypasses the air cavity by traveling through the studs and edge connections.

Normally, the most sensitive components of a structure to airborne noise are the windows and, infrequently, the plastered walls and ceilings. An evaluation of the peak sound pressures impinging on the structure is normally sufficient to determine the possibility of damage. In general, at sound levels above 130 dB, there is the possibility of structural damage. While certain frequencies (such as 30 hertz for window breakage) may be of more concern than other frequencies, conservatively, only sounds lasting more than one second above a sound level of 130 dB are potentially damaging to structural components (Reference A21).

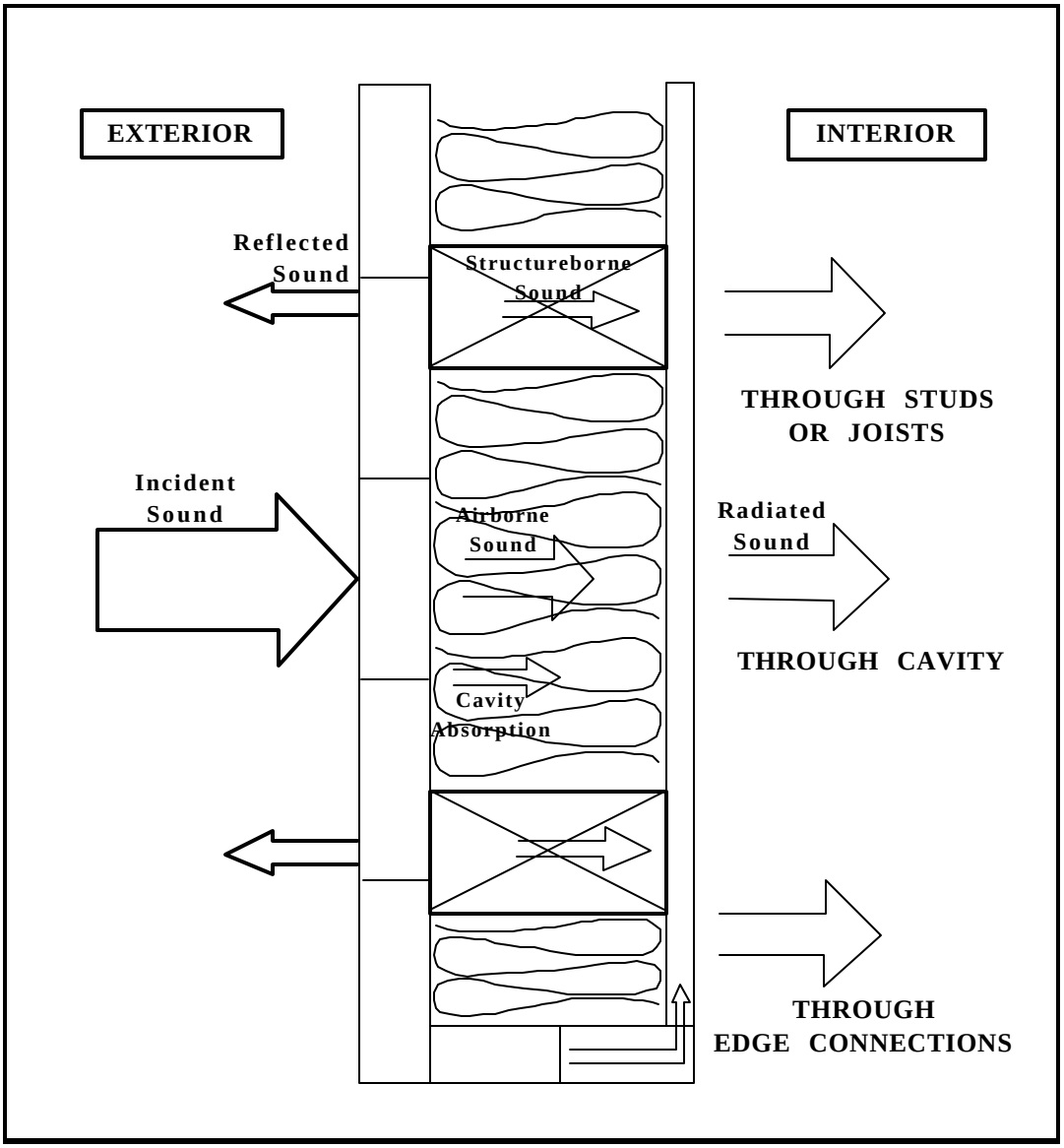


Figure A-6. Pictorial Representation of Sound Transmission Through Built Construction

In terms of average acceleration of wall or ceiling vibration, the thresholds for structural damage (Reference A22) are:

- 0.5 m/s/s – is the threshold of risk of damage to sensitive structures (i.e., ancient monuments, etc.).
- 1.0 m/s/s – is the threshold of risk of damage to normal dwellings (i.e., houses with plaster ceiling and walls).

Noise-induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations, or "rattle", of objects within the dwelling – hanging pictures, dishes, plaques, and bric-a-brac. Loose window panes may also vibrate noticeably when exposed to high levels of airborne noise, causing homeowners to fear breakage. In general, such noise-induced vibrations occur at sound levels above those considered normally compatible with residential land use. Thus assessments of noise exposure levels for compatible land use should also be protective of noise-induced secondary vibrations.

In the assessment of vibration on humans, the following factors determine if a person will perceive and possibly react to building vibrations:

1. Type of excitation: steady state, intermittent, or impulsive vibration.

2. Frequency of the excitation. ISO 2631-2 (Reference A22) recommends a frequency range of 1 to 80 Hz for the assessment of vibration on humans.

3. Orientation of the body with respect to the vibration.

4. The use of the occupied space (i.e., residential, workshop, hospital).

5. Time of day.

Table A-1 lists the whole-body vibration criteria from Reference A22 for one-third octave frequency bands from 1 to 80 Hz.

Table A-1
Vibration Criteria for the Evaluation of Human Exposure to Whole-Body Vibration

Frequency (Hz)	RMS Acceleration (m/s/s)		
	Combined Criteria Base Curve	Residential Night	Residential Day
1	0.0036	0.0050	0.0072
1.25	0.0036	0.0050	0.0072
1.6	0.0036	0.0050	0.0072
2	0.0036	0.0050	0.0072
2.5	0.0037	0.0052	0.0074
3.15	0.0039	0.0054	0.0077
4	0.0041	0.0057	0.0081
5	0.0043	0.0060	0.0086
6.3	0.0046	0.0064	0.0092
8	0.0050	0.0070	0.0100
10	0.0063	0.0088	0.0126
12.5	0.0078	0.0109	0.0156
16	0.0100	0.0140	0.0200
20	0.0125	0.0175	0.0250
25	0.0156	0.0218	0.0312
31.5	0.0197	0.0276	0.0394
40	0.0250	0.0350	0.0500
50	0.0313	0.0438	0.0626
63	0.0394	0.0552	0.0788
80	0.0500	0.0700	0.1000

Source: Reference A22.

A.2.8 Noise Effects on Terrain

It has been suggested that noise levels associated with low-flying aircraft may affect the terrain under the flight path by disturbing fragile soil or snow structures, especially in mountainous areas, causing landslides or avalanches. There are no known instances of such effects, and it is considered improbable that such effects will result from routine, subsonic aircraft operations.

A.2.9 Noise Effects on Historical and Archaeological Sites

Because of the potential for increased fragility of structural components of historical buildings and other historical sites, aircraft noise may affect such sites more severely than newer, modern structures. Again, there are few scientific studies of such effects to provide guidance for their assessment.

One study involved the measurements of sound levels and structural vibration levels in a superbly restored plantation house, originally built in 1795, and now situated approximately 1,500 feet from the centerline at the departure end of Runway 19L at Washington Dulles International Airport (IAD). These measurements were made in connection with the proposed scheduled operation of the supersonic Concorde airplane at Dulles (Reference A23). There was special concern for the building's windows, since roughly half of the 324 panes were original. No instances of structural damage were found. Interestingly, despite the high levels of noise during Concorde takeoffs, the induced structural vibration levels were actually less than those induced by touring groups and vacuum cleaning.

As noted above for the noise effects of noise-induced vibrations of normal structures, assessments of noise exposure levels for normally compatible land uses should also be protective of historic and archaeological sites.

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