DRAFT
Environmental Assessment
For
Enhancement of Pilot Training By Expanding Special Use Airspace in Eastern North Carolina
Marine Corps Installations East

August 2022

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Abstract

Designation:	Environmental Assessment
Title of Proposed Action:	Enhancement of Pilot Training by Establishing Special Use Airspace in Eastern North Carolina
Project Location:	Marine Corps Base Camp Lejeune and Marine Corps Air Station Cherry Point
Lead Agency for the EA:	Department of Navy/Marine Corps
Cooperating Agency:	Federal Aviation Administration
Affected Region:	Eastern North Carolina
Action Proponent:	Marine Corps Installations East – Marine Corps Base Camp Lejeune
Point of Contact:	Jessi Baker Marine Corps Installations East – Marine Corps Base Camp Lejeune 12 Post Lane Camp Lejeune, NC 28547 Email Address: jessi.baker@usmc.mil
Date:	August 2022

The U.S. Marine Corps, along with the Federal Aviation Administration as a cooperating agency, has prepared this Environmental Assessment in accordance with the National Environmental Policy Act, as implemented by the Council on Environmental Quality Regulations and Marine Corps and Federal Aviation Administration regulations for implementing the National Environmental Policy Act. The Proposed Action would increase the Special Use Airspace available for essential Marine Corps training in eastern North Carolina contiguous with the existing Cherry Point Operations Area. This Environmental Assessment evaluates the potential environmental impacts associated with the two action alternatives, Alternatives 1 and 2, and the No Action Alternative to the following resource areas: airspace, noise, biological resources, cultural resources, and environmental justice.

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Draft
Environmental Assessment for Enhancement of Pilot Training by Establishing Special Use Airspace in Eastern North Carolina

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Abbreviations and Acronyms

Acronym	Definition
A-	Alert Areas
AGL	Above Ground Level
ALTRVs	Stationary Altitude Reservations
APE	Area of Potential Effect
ARTCC	Air Route Traffic Control Center
ATCAA	Air Traffic Control Assigned Airspace
BASH	Bird Aircraft Strike Hazard
C2	Command and Control
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulation
CZMA	Coastal Zone Management Act
dB	decibels
dBA	A-weighted decibels
DNL	Day-Night Average Sound Level
DoD	Department of Defense
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FL	Flight Level
FONSI	Finding of No Significant Impact
GHG	Greenhouse Gases
Hz	hertz
IFR	Instrument Flight Rules
JTAC	Joint Terminal Attack Controller
kHz	kilohertz
LFE	Large Force Exercise
L_{max}	maximum sound exposure
LOA	Letter of Agreement
MBTA	Migratory Bird Treaty Act
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCIEAST	Marine Corps Installations East
MCO	Marine Corps Order
MCRP	Marine Corps Reference Publication
MOA	Military Operation Area
MSL	Mean Sea Level
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOTAM	Notice to Air Missions
NRHP	National Register of Historic Places
NWR	National Wildlife Refuges
OPAREA	Operations Area
R-	Restricted Areas
RTA	Range and Training Area
SAA	Special Activity Airspace
SEL	Sound Exposure Level
SHPO	State Historic Preservation Office
SUA	Special Use Airspace
T&R	Training and Readiness
U.S.	United States
U.S.C	U.S. Code
USAF	U.S. Air Force
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USMC	U.S. Marine Corps
USN	U.S. Navy
VFR	Visual Flight Rules
W-	Warning Areas

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1. Purpose of and Need for the Proposed Action

1.1 Introduction

The Marine Corps Installations East (MCIEAST) (hereinafter, referred to as the Marine Corps) proposes to enhance current and future Marine Corps pilot training within the Cherry Point Operations Area (OPAREA) in eastern North Carolina by establishing permanent Special Use Airspace (SUA). The permanent SUA would provide larger contiguous, over-land airspace, with appropriate altitudes, to address existing SUA shortfalls and provide a more realistic training environment, by establishing two new Military Operations Areas (MOAs), a type of SUA, and expanding an existing MOA.

The Cherry Point OPAREA is the training airspace used by the Marine Corps in eastern North Carolina (see Section 1.3.1 for additional information) and is used for the full spectrum of training. The Marine Corps Base (MCB) Camp Lejeune Range and Training Areas (RTAs), in conjunction with the Cherry Point OPAREA, represent the only location on the U.S. East Coast where U.S. Marines, Navy, and other Joint and Combined Forces can conduct large force, combined-arms, amphibious training. To continue to support this training with the introduction of 5th Generation aircraft such as the F-35, new ordnance systems, and evolving tactics, the SUA within the Cherry Point OPAREA needs to be enlarged and improved to provide the necessary training for Marine Corps forces to meet their 10 U.S. Code Section 5063 requirements.

The Marine Corps has prepared this Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA), as implemented by the Council on Environmental Quality (CEQ) Regulations (40 Code of Federal Regulations [CFR] parts 1500–1508); Department of Navy regulations for implementing NEPA (32 CFR 775); Marine Corps Order (MCO) 5090.2, Volume 12; and Federal Aviation Administration (FAA) Order 1050.1F, *Environmental Impacts: Policies and Procedures*.

The FAA is responsible for all navigable airspace in the United States (U.S.) as defined in 14 CFR Chapter 1, Subchapter E, Parts 71-77. As such, this EA has been prepared to comply with NEPA requirements for both the Marine Corps and the FAA. The FAA's proposed action is to establish the SUA in support of the Marine Corps' training requirements, and, as a cooperating agency, will adopt this EA, in whole or in part, to comply with their NEPA procedures defined in FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*. The FAA will issue their own determination to include, if warranted, a Finding of No Significant Impact (FONSI) for the proposed SUA, separate from the Marine Corps' final determination.

1.2 Procedures to Establish SUA

The FAA processes requests for the establishment of SUA in accordance with FAA JO 7400.2N, *Procedures for Handling Airspace Matters*. SUA consists of defined dimensions of airspace wherein activities must be confined because of their nature, or wherein limitations are imposed upon non-participating aircraft operations, or both. FAA Headquarters is the final approval authority for SUA.

The FAA process for establishing SUA is two-fold, comprising both aeronautical and environmental analyses. These processes occur concurrently to the extent possible. The proponent (in this case, the Marine Corps) submits a formal airspace proposal to the FAA defining the proposed SUA (dimensions

and altitudes), times of use, and activities to occur in the SUA. The FAA ensures the proposed SUA is compliant with airspace regulations and the safe and efficient use of the navigable airspace, and then circulates the airspace proposal for public review.

SUA actions are subject to NEPA. As such, in addition to its aeronautical analysis, the FAA has participated in the preparation of this EA as a cooperating agency, and will issue its own determination, to complete its environmental process. The aeronautical and environmental processes must be complete prior to FAA approval of any SUA. Once approved, the new SUA is published in FAA Order JO 7400.10C, *Special Use Airspace* (published annually) and illustrated on section aeronautical charts, which are updated every 56 days. Once published, the SUA is available for military use.

1.3 Background

1.3.1 Existing Cherry Point OPAREA

The Cherry Point OPAREA consists of the training airspace used by the Marine Corps in eastern North Carolina and includes different types of airspace, including SUA (**Figure 1.3-1**), that are integrated with ground training areas and targets. Definitions of the types of airspace shown in the figure and discussed throughout this EA are described below.

A Restricted Area is SUA established under 14 CFR Part 73 within which the flight of non-participatory aircraft, while not wholly prohibited, is subject to restriction. Restricted Areas (designated with an 'R-' on aeronautical charts) are established to segregate military activities considered hazardous from non-participating aircraft.

MOAs are established outside of class A airspace for the purpose of separating certain military training activities from Instrument Flight Rules (IFR) traffic. Military pilots flying in an active MOA may be waived certain FAA, part 91, provisions. Examples of activities conducted in MOAs include air combat tactics, aerobatics, formation training, and low-altitude tactics. When a MOA is in use, air traffic control will normally reroute or restrict non-participating IFR traffic. Non-participating civil and military aircraft flying under Visual Flight Rules (VFR) may transit an active MOA by employing see-and-avoid procedures.

An Air Traffic Control Assigned Airspace (ATCAA) is airspace of defined vertical and lateral limits, assigned by air traffic control, for the purpose of providing air traffic segregation between the specified activities being conducted, within the assigned airspace and other IFR traffic. ATCAAs are not classified as SUA and are not published on aeronautical charts, but rather designated in a Letter of Agreement (LOA) with the FAA. An ATCAA can be used to support training like that occurring in MOAs. When requested, an ATCAA is released by the FAA for military use when not required for other air traffic control purposes, such as for commercial air traffic.

An Alert Area is SUA which may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft. These areas (designated with an 'A-' on aeronautical charts) are designated to inform non-participating pilots of areas that contain a high volume of military aircraft operations they might not otherwise expect to encounter.

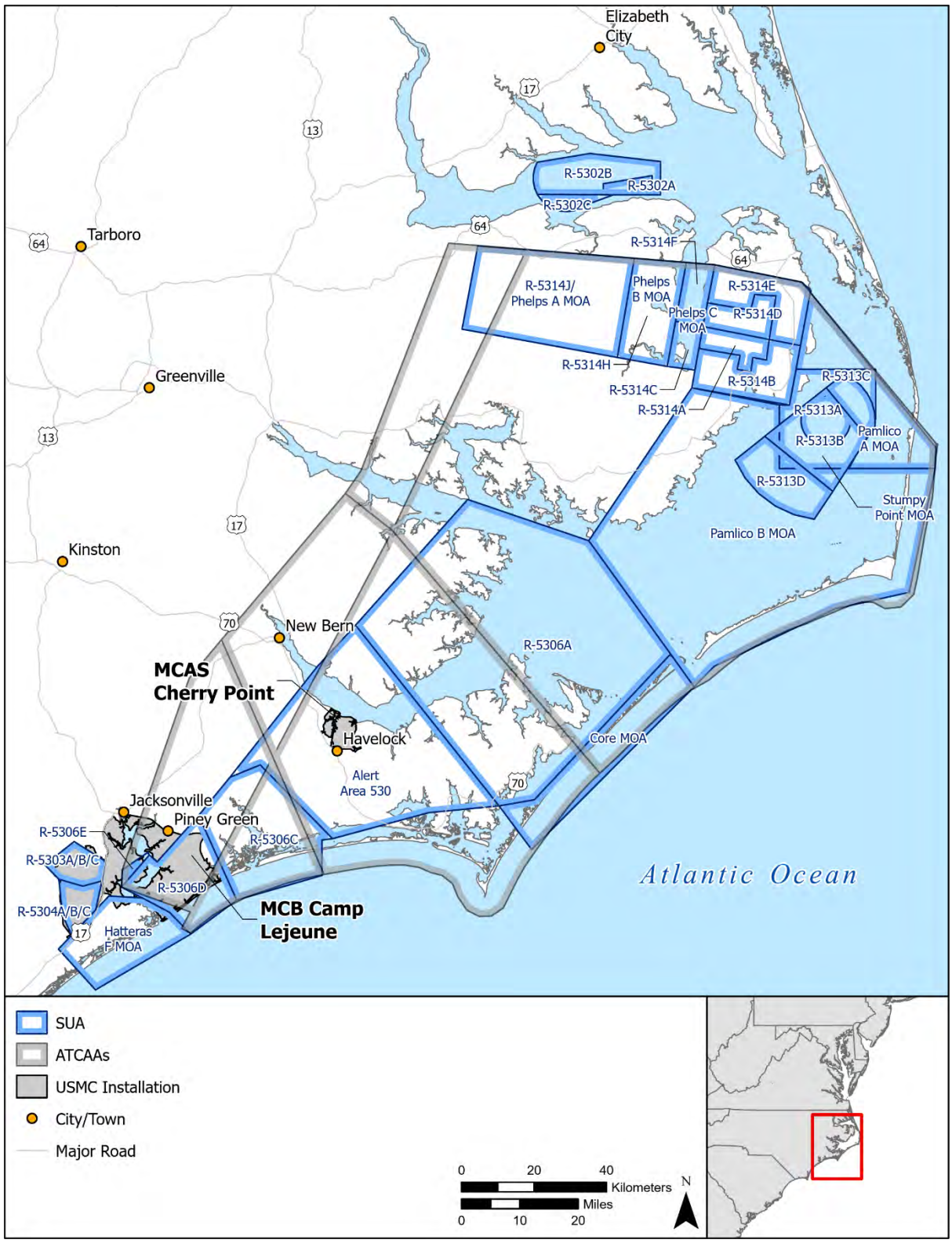

Figure 1.3-1. Existing SUA in Cherry Point OPAREA

A Warning Area is SUA of defined dimensions (extending from three nautical miles outward from the coast of the U.S.), designated to contain activity that may be hazardous to non-participating aircraft. Several Warning Areas (designated with a 'W-' on aeronautical charts) managed by the U.S. Navy cover the Atlantic Ocean in eastern North Carolina adjacent to the Cherry Point OPAREA. The Warning Areas are used by the Marine Corps in conjunction with the Cherry Point OPAREA, but they are not part of the OPAREA and are not illustrated on **Figure 1.3-1** (Please refer to **Figure 2.4-1** in **Section 2.4.3** for an illustration of Warning Areas).

1.3.2 Training Requirements and SUA Shortfalls

Marine Corps Reference Publication (MCRP) 8-10B.1, *Operational Training Ranges Required Capabilities,* provides guidance to ensure range assets and capabilities are properly established to support training operations and requirements. When significant transitions in weapons, technology, and doctrine are introduced, training ranges must be assessed and, where necessary, modified to ensure the Marine Corps can meet its responsibilities under 10 U.S. Code Section 5063 to train and equip Marines to support combatant commanders around the world. Training must evolve as required by changes in equipment and doctrine to produce Marines who can survive in diverse and challenging operational environments. Accordingly, it is critical the supporting infrastructure necessary to accomplish this training, including airspace, must also evolve.

Training requirements for pilots, aircrew, and the "command and control" (C2) system that supports them cover a wide range of capabilities ranging from individual skills to complex multi-aircraft combat maneuvers. At the individual skills level, pilots start with takeoff and landing and progress to operation of every sensor and system on an aircraft, weapons employment, maneuvering, etc. Pilots then progress to tactical training involving two aircraft, then four aircraft, etc. Finally, pilots and the C2 system supporting them, train in large force exercises (LFE) simulating real-world wartime operations, involving multiple flights of varying types of aircraft in various combat scenarios to include, in conjunction with C2, coordination with and support of ground force maneuver and fires.

The Cherry Point OPAREA is used for the full spectrum of training. The MCB Camp Lejeune RTAs, in conjunction with the Cherry Point OPAREA, represent the only location on the U.S. East Coast where U.S. Marines, Navy, and other Joint and Combined Forces can conduct large force, combined-arms, amphibious training. To continue to support this training with the introduction of 5th Generation aircraft such as the F-35, new ordnance systems, and evolving tactics, the SUA within the Cherry Point OPAREA needs to be enlarged and improved consistent with MCRP 8-10B.1 to provide the necessary training for Marine Corps forces to meet their 10 U.S. Code Section 5063 requirements. Broader over-land SUA is required for the performance of Offensive Counter-Air, Attach Operations, and Suppression of Enemy Air Defenses training mission sets. Exasperating the existing shortfalls are 5th Generation aircraft capabilities that have created a new evolution of formations and tactics.

Shortfalls of the existing SUA include overall size and volume of SUA, altitude stratum, and ability to provide sufficiently sized over-land training airspace.

- Additional SUA contiguous with Restricted Areas: Restricted Areas established over target areas or surface ranges were originally established for legacy aircraft weapons systems that operated

in very close proximity to targets. Use of evolving weapons systems that allow for greater standoff (air-to-ground missiles or other precision-guided munitions) require more space to train.

- Additional SUA contiguous with other SUA: As tactics evolve to accommodate better sensors and weapons, it is necessary to train across more than one block of SUA. Such a large, connected block of airspace, is critical for LFEs involving multiple aircraft and coordination with ground forces.
- Lateral dimensions: Increased lateral dimensions are required for increased "standoff" from simulated targets due to new sensor and weapon capabilities and increased "standoff" from simulated enemy air defense systems to train for survival against evolving enemy defensive capabilities.
- Vertical dimensions: Being able to use SUA at either lower or higher altitudes is required for use of vertical standoff for sensors, weapons, and evolving enemy defensive systems, or, in the case of lower altitudes, for required training in scenarios where proximity to the ground is needed for survivability or to train to employ weapons from below a weather layer.

1.4 Purpose and Need for the Proposed Action

The purpose of the Proposed Action is to enhance current and future Marine Corps pilot training by increasing permanent SUA within the Cherry Point OPAREA.

The Proposed Action is needed to address existing SUA shortfalls to include inadequate size and volume, altitude stratum, and ability to provide sufficiently sized over-land training airspace to ensure the Marine Corps can meet their requirements under 10 U.S. Code Section 5063.

10 U.S. Code Section 5063: The Marine Corps shall be organized, trained, and equipped to provide fleet marine forces of combined arms, together with supporting air components, for service with the fleet in the seizure or defense of advanced naval bases and for the conduct of such land operations as may be essential to the prosecution of a naval campaign.

1.5 Scope of Environmental Analysis

This EA includes an analysis of potential environmental impacts associated with the action alternatives. The environmental resource areas analyzed in this EA include airspace, noise, biological resources, cultural resources, and environmental justice. The study area for each resource analyzed may differ due to how the Proposed Action interacts with or impacts the resource.

1.6 Key Documents

Key documents are sources of information incorporated into this EA and include documents of similar actions, analyses, or impacts that may apply to this Proposed Action. CEQ guidance encourages incorporating documents by reference. Documents incorporated by reference in part or in whole include:

Final United States Marine Corps F-35B East Coast Basing Environmental Impact Statement (EIS) (U.S. Marine Corps 2010). This EIS addresses environmental impacts associated with basing the F-35B at Marine Corps Air Station (MCAS) Cherry Point and MCAS Beaufort to include construction, demolition,

and renovation of airfield infrastructure and facilities, changes to personnel at the base, and conducting F-35B readiness and training operations to attain and maintain proficiency in the operational employment of the F-35B. At the time the EIS was prepared, the Marine Corps did not propose changes to the airspace and ranges since the full Training and Readiness (T&R) requirements had not been defined for the new aircraft. Also, of specific relevance to this EA, the basing EIS determined that the replacement of the existing AV-8 and F-18 aircraft at MCAS Cherry Point with the F-35B would have a positive impact on the air quality in the region as the criteria pollutant emissions would be less with the newer aircraft.

1.7 Relevant Laws and Regulations

The Marine Corps has prepared this EA based upon federal and state laws, statutes, regulations, and policies pertinent to the implementation of the Proposed Action, including the following:

- NEPA (42 U.S.C. sections 4321–4370h)
- CEQ Regulations for Implementing the Procedural Provisions of NEPA (40 CFR parts 1500–1508, published September 2020)
- Department of Navy regulations for implementing NEPA (32 CFR part 775)
- Marine Corps Order 5090.2, Volume 12
- FAA Order 1050.1F, Environmental Impacts: Policies and Procedures
- Clean Air Act (42 U.S.C. section 7401 et seq.)
- National Historic Preservation Act (54 U.S.C. section 306108 et seq.)
- Endangered Species Act (16 U.S.C. section 1531 et seq.)
- Migratory Bird Treaty Act (16 U.S.C. section 703–712)
- Bald and Golden Eagle Protection Act (16 U.S.C. section 668–668d)
- Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations
- EO 13045, Protection of Children from Environmental Health Risks and Safety Risks
- EO 13175, Consultation and Coordination with Indian Tribal Governments

1.8 Public Agency Participation and Intergovernmental Coordination

The Marine Corps is coordinating with the North Carolina State Historic Preservation Office for this action. The Marine Corps determined the action would not have an adverse effect on historic properties listed on the National Register of Historic Places. Correspondence with the North Carolina State Historic Preservation Office is provided in **Appendix A**.

The Marine Corps is consulting with the Catawba Indian Nation and Tuscarora Nation. Available records indicate there are no sacred sites or traditional cultural properties within the project area. The Marine Corps is consulting with these Nations to confirm they have adequately identified historic properties that may be of religious and cultural significance to the Nations. Correspondence with these tribes is provided in **Appendix A**.

The Marine Corps is providing this Draft EA to the North Carolina State Clearinghouse for review concurrent with the public release of the Draft EA.

2. Proposed Action and Alternatives

2.1 Proposed Action

The Proposed Action is to enhance current and future Marine Corps pilot training within the Cherry Point OPAREA in eastern North Carolina by establishing permanent SUA. The proposed increase in permanent SUA would provide larger contiguous, over-land airspace with appropriate altitudes to address SUA shortfalls and provide a more realistic training environment. The FAA, as a cooperating agency, is responsible for formally establishing the SUA in support of the Marine Corps (see **Section 1.2,** *Procedures to Establish SUA*). The Proposed Action **does not include** changes to:

- Infrastructure or personnel at any of the bases.
- Airfield or runway operations (frequency or types of aircraft) at any of the bases.
- Aircraft inventory or squadron assignments at any of the bases.
- Ground disturbance to land beneath any of the airspace.

The Proposed Action would establish MOAs to be used alone, or in conjunction with, other existing MOAs and restricted areas to address T&R gaps as a result of the existing SUA shortfalls described in **Section 1.3.2**, *Training Requirements and SUA Shortfalls*. The proposed MOAs would be used to support critical training for U.S. Marine Corps assets as well as U.S. Navy (USN) and U.S. Air Force (USAF) pilot training for the AV-8B, F-35B/C, F-15E, F-16, and FA-18. The proposed training consists of one or more aircraft performing aerial maneuvers like those required in actual combat and other missions. The training in the proposed MOAs would not include supersonic flight (which is flight that exceeds the speed of sound) or the release of ordnance or defensive countermeasures (chaff and flares). Training in the proposed MOAs would fall into two general categories: Air-to-Ground training and Air-to-Air training.

In the air-to-ground category of training, the proposed MOAs would provide the space necessary to support more realistic real-world training using simulated ordnance. The training spectrum includes individual practice in maneuvering, use of sensors to find stationary and moving targets, and simulated delivery of ordnance. The proposed MOAs, in conjunction with existing restricted areas and surface ranges, would allow for run-ins, separation, and practicing of various tactics with attack and supporting aircraft.

In the Air-to-Air category of training, the proposed MOAs would allow aircraft handling, as well as fighter maneuvers up through LFE training with “opposition” forces. The proposed MOAs would provide the larger contiguous area necessary for this complex training, allowing for a range of training scenarios more representative of those expected in real-world combat and other missions.

2.2 Screening Factors

NEPA’s implementing regulations provide guidance on the consideration of alternatives to a federally proposed action and require an evaluation of reasonable alternatives to the Proposed Action. Only those alternatives determined to be reasonable and to meet the purpose and need require detailed analysis.

Potential alternatives were evaluated against the following screening factors:

- The MOA(s) must be of sufficient size to allow for the requisite training identified in MCRP 8-10B.1, *Operational Training Ranges Required Capabilities.*
- The MOA(s) must be permanent to support recurring Marine Corps training operations.
- The MOA(s) must be contiguous to the existing Cherry Point OPAREA and MCB Camp Lejeune RTAs to correct existing training deficiencies and emerging training requirements.
- The MOA(s) must be situated over-land as the required training includes coordination of air and ground assets such as over-land sensor usage, target acquisition, and coordination with ground forces.
- The MOA(s) must be designed and used to minimize environmental impacts to the extent practicable.

2.3 Alternatives Carried Forward

Alternatives carried forward for analysis in this EA are described in the following sections.

2.3.1 No Action Alternative

Under the No Action Alternative, no new permanent MOAs would be established and enhanced training for Marine Corps' pilots would not occur. The T&R gaps would not be addressed. The No Action Alternative does not meet the purpose and need; however, the No Action Alternative is included to provide a comparative baseline for analysis.

2.3.2 Alternative 1: Establish Pamlico C and D MOAs, and Expand Hatteras F MOA (Preferred Alternative)

Under Alternative 1 (the Preferred Alternative), the Pamlico C and D MOAs would be established, and the existing Hatteras F MOA would be expanded to surround R-5303 and R-5304 (**Figure 2.3-1**). The proposed MOAs would be used individually and in conjunction with existing SUA for air-to-ground and Air-to-Air training as described in **Section 2.1**. As stated in **Section 2.1**, the proposed MOAs would not result in changes to the aircraft inventory or runway/airfield operations. The new MOAs would just provide larger, more realistic training airspace to address the T&R gaps associated with the SUA shortfalls described in **Section 1.3.2**.

The three areas proposed as MOAs have been used to support training and operations on a temporary basis as Special Activity Airspace (SAA) in the form of Stationary Altitude Reservations (ALTRVs). Stationary ALTRVs are a temporary measure and the type of flight operations within an ALTRV are limited and well short of the activities needed to meet T&R requirements. Establishing these three areas as permanent MOAs addresses SUA shortfalls described in **Section 1.3.2**, *Training Requirements and SUA Shortfalls*.

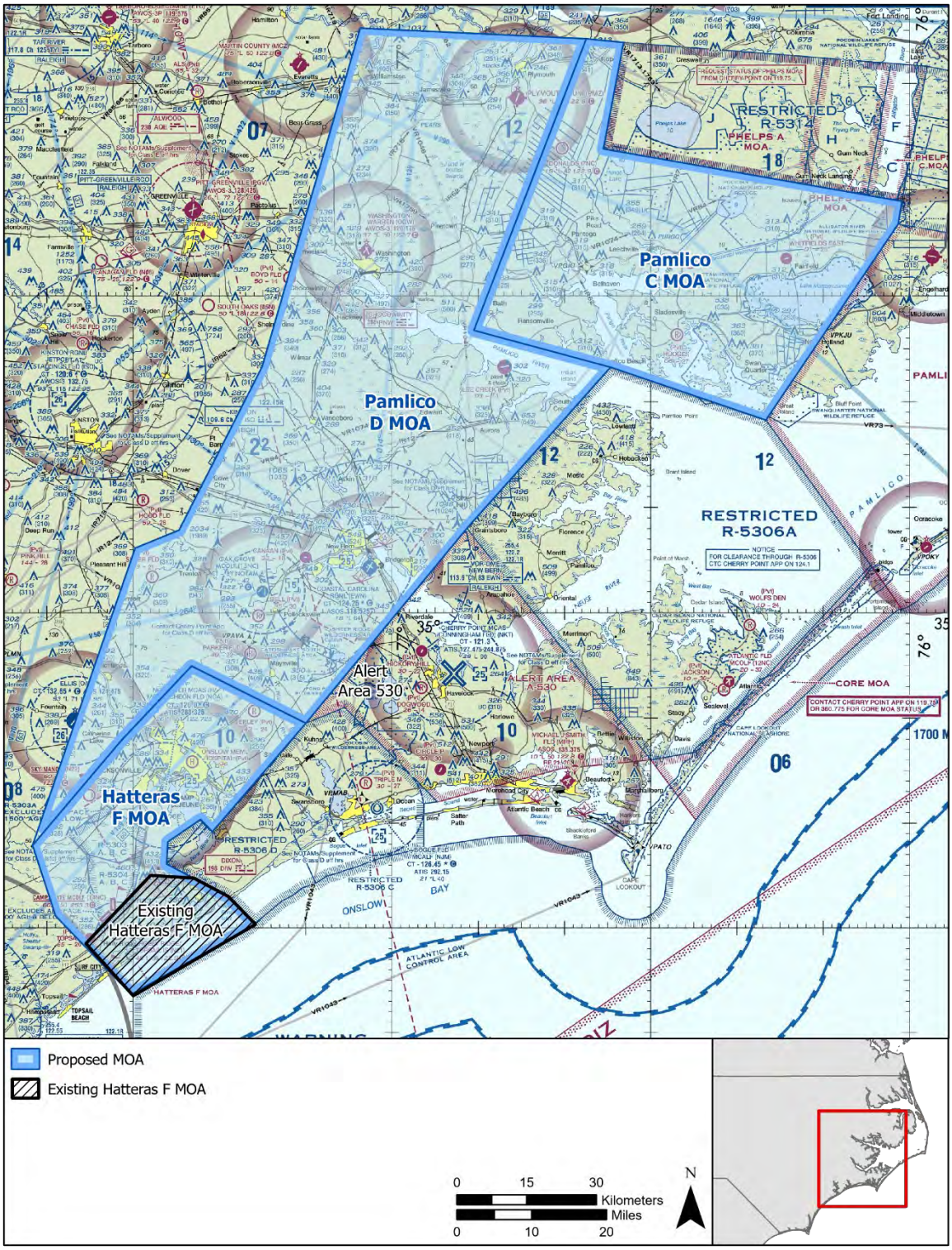

Figure 2.3-1. Alternative 1 (Preferred Alternative): Proposed MOAs

The altitude floor and ceiling[1] and the published times of use for the proposed MOAs under Alternative 1 are provided in **Table 2.3-1**. Each MOA is discussed in detail in the following sections.

Table 2.3-1. Alternative 1 Proposed MOAs

Name	Floor	Ceiling	Proposed Published Times of Use
Pamlico C MOA	8,000 feet MSL	Up to but not including FL180	Monday through Friday, 0800 – 2200 Other times by NOTAM
Pamlico D MOA	10,000 feet MSL	Up to but not including FL180	Intermittent by NOTAM
Hatteras F MOA	3,000 feet MSL	Up to but not including FL180	Monday through Friday 0800 – 2200 Other times by NOTAM

Legend: MOA = Military Operation Area; MSL = Mean Sea Level; NOTAM = Notice to Air Missions; FL = Flight Level.

2.3.2.1 Pamlico C MOA

Proposed Airspace

The proposed Pamlico C MOA would be located northeast of MCAS Cherry Point, with vertical dimensions of 8,000 feet MSL up to, but not including, FL180 (**Figure 2.3-2a,b**). The MOA would overlay portions of Beaufort, Hyde, Tyrell, and Washington counties.

The Pamlico C MOA would be to the west of and contiguous to the existing Pamlico B MOA (with its vertical dimensions of 8,000 feet MSL up to, but not including, FL180), and contiguous on the north to the existing Phelps A MOA (with its 6,000 feet MSL up to, but not including FL180), R-5314 C/F (200 feet above surface to 15,000 feet MSL), R-5314 H (500 feet above surface to 10,000 feet MSL) and R-5314 J (1,000 feet above the surface to 6,000 feet MSL).

The published times of use would be Monday through Friday, 0800 – 2200 local and other times by Notice to Air Missions (NOTAM). The Controlling Agency would be U.S. Marine Corps, MCAS Cherry Point Center Radar Approach Control, and the Using Agency would be U.S. Marine Corps, Commanding Officer, MCAS Cherry Point, NC.

Proposed Operations

The Pamlico C MOA would alleviate some training deficiencies and establish airspace necessary for training pilots and aircrews from the Marine Corps, Navy, and Air Force to counter evolving threats, including legacy and new Surface-to-Air Missile threats. The proposed Pamlico C MOA would be used in conjunction with surrounding SUA to allow aircrews to practice new and evolving tactics and maneuvering as described in **Section 2.1**.

[1] Altitude references for aircraft operations are presented in several units of measure: above ground level (AGL), above mean sea level (MSL), and Flight Level (FL):

- AGL references are usually used at lower altitudes (almost always below 10,000 feet), when clearance from terrain is more of a concern for aircraft operation.
- MSL altitudes are used most across aviation when operating at or below 18,000 feet when clearance from terrain is less of a concern for aircraft operation.
- FL is used to describe the cruising altitudes for aircraft traveling long distances above 18,000 feet. Flight Levels are given in hundreds of feet, e.g. FL300 is 30,000 feet.

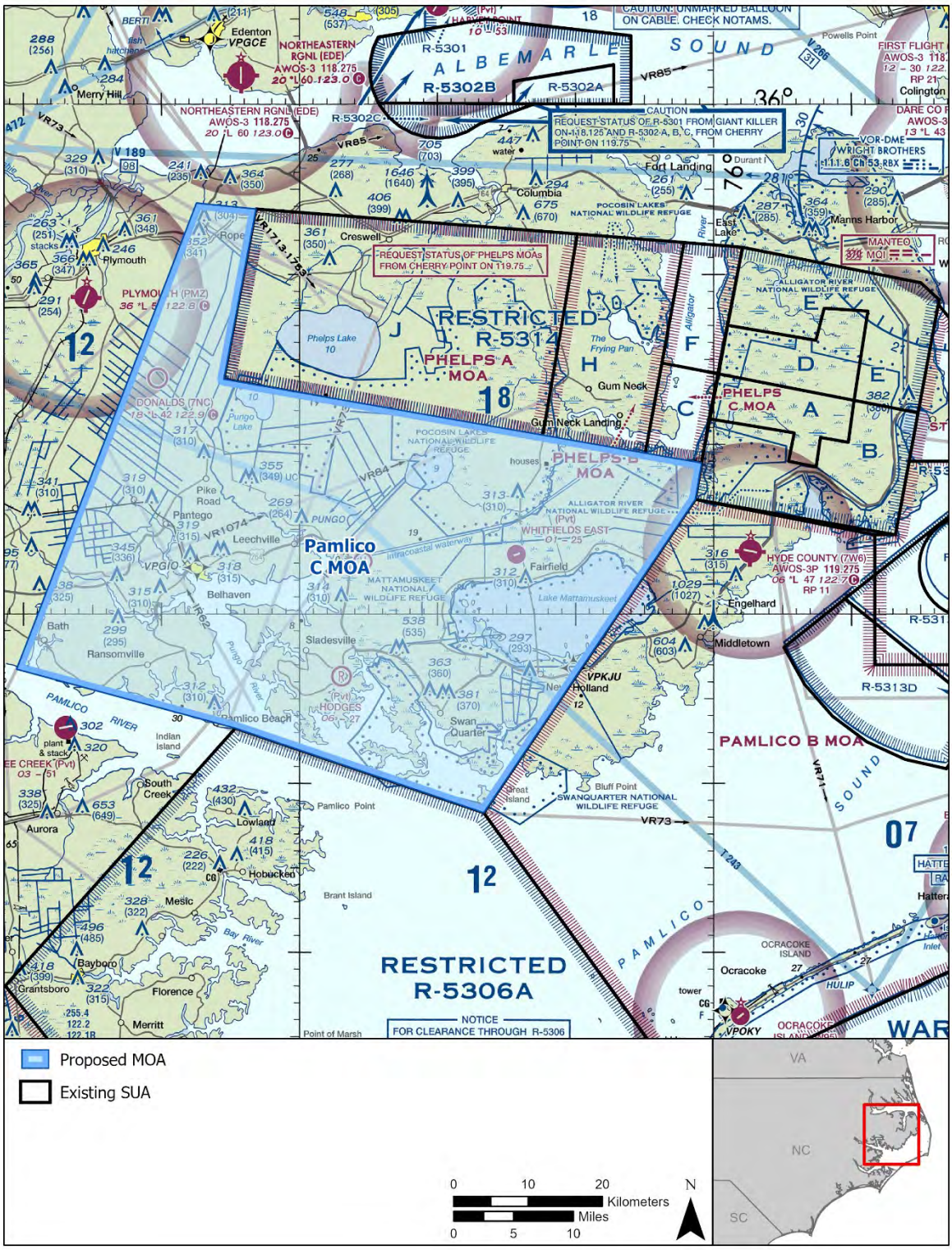

Figure 2.3-2a. Proposed Pamlico C MOA – Aeronautical View

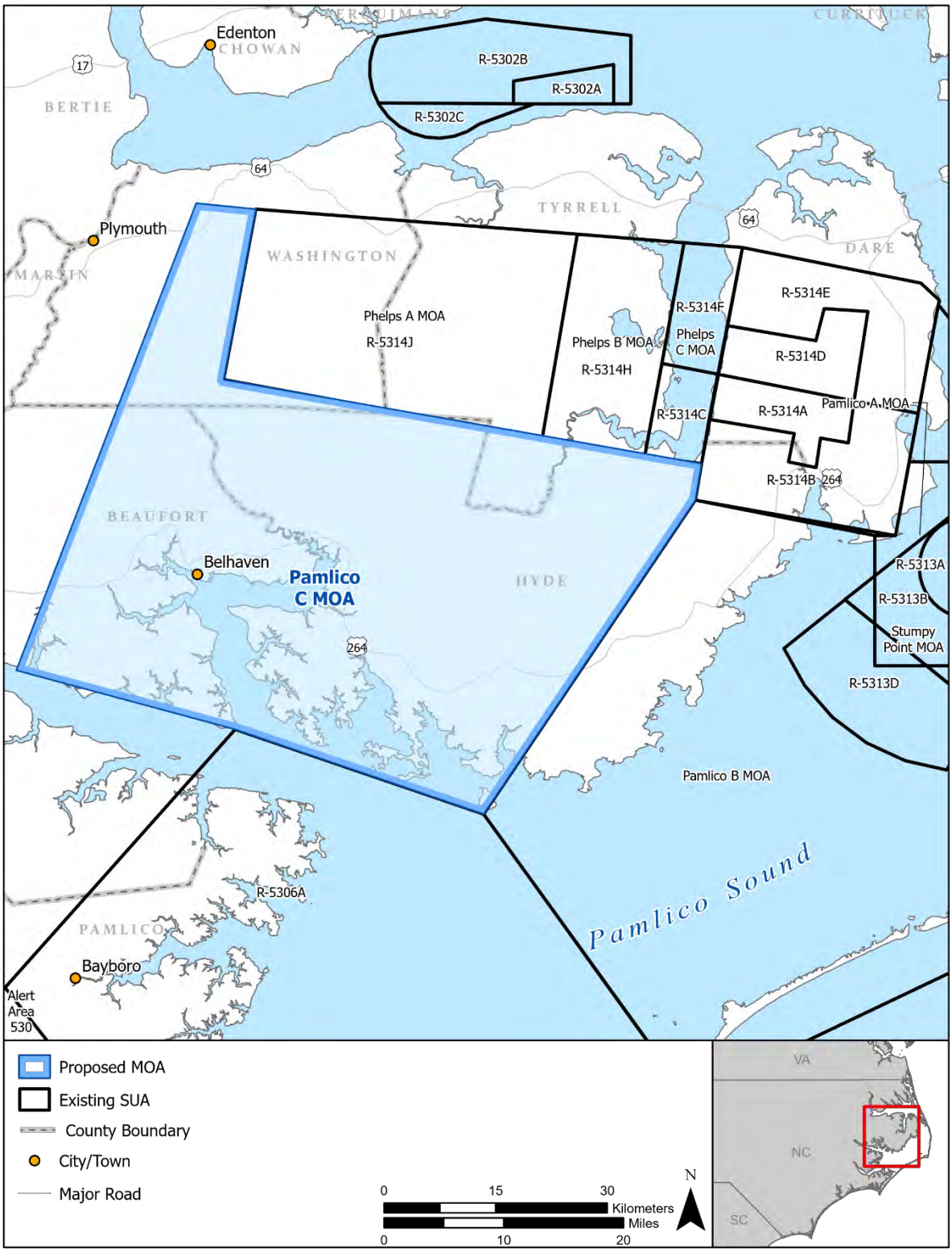

Figure 2.3-2b. Proposed Pamlico C MOA – Map View

The Pamlico C MOA would not only provide maneuver space but would also allow threat systems already in place in R-5314 and R-5306A to be used in conjunction with one another to create more complex threat training scenarios. As shown in **Figure 2.3-2**, the Pamlico C MOA would provide significant medium altitude training airspace connecting existing SUA (Phelps MOA, R-5314, Pamlico B MOA, and R-5306), thereby correcting the training deficiencies in this area.

The Pamlico C MOA would provide the space necessary to execute more realistic and challenging tactical scenarios. As **Figures 2.3-2** illustrates, the proposed Pamlico C MOA permits a direct ingress route from the R-5314/Phelps MOA airspace to the W-122 complex (located offshore in the Atlantic Ocean, not shown on figure due to scale). This allows for scenarios simulating opposing forces originating in the very low-altitude regime (within R-5314, simulating takeoff from an enemy airfield), transitioning to medium altitude (Pamlico C MOA), and advancing directly at defensive forces in higher altitudes.

In addition to more realistic air threat replication, the Pamlico C MOA would provide expanded airspace to train against Surface-to-Air Missile threats. As **Figures 2.3-2** depicts, the current airspace surrounding R-5314A and R-5306 does not provide enough space to practice tactics against these advanced threat systems, particularly with the introduction of the F-35B, which has larger airspace requirements than legacy aircraft.

Proposed annual sorties are provided in **Table 2.3-2**. Approximately 25 percent of the activation time would be after sunset.

Table 2.3-2. Annual Sorties in Proposed Pamlico C MOA

Aircraft	Proposed Sorties[1]
USMC AV-8, F-35 B/C[2]	200
USAF F-15E	450
USN FA-18E/F	360
USMC FA-18, F-35 B/C[2]	60
Total	***1,070***

Notes:

[1] A sortie is the takeoff, mission, and landing of one aircraft.

[2] The F-35 B/C will ultimately replace the AV-8 and FA-18 aircraft; therefore, both aircraft are listed in this table.

Legend: USMC = U.S. Marine Corps; USAF = U.S. Air Force; USN = U.S. Navy; MOA = Military Operation Area.

2.3.2.2 Pamlico D MOA

Proposed Airspace

The proposed Pamlico D MOA would be located west of MCAS Cherry Point with vertical dimensions of 10,000 feet MSL up to, but not including, FL180 (**Figure 2.3-3a, b**). This MOA would overlie portions of Beaufort, Bertie, Craven, Jones, Pitt, Onslow, Pamlico, Pender, Washington, and Martin Counties.

The published times of use would be Monday through Friday intermittent by NOTAM, 24 hours in advance. The Controlling Agency would be FAA Washington Air Route Traffic Control Center (ARTCC), and the Using Agency would be U.S. Marine Corps, Commanding Officer, MCAS Cherry Point, NC.

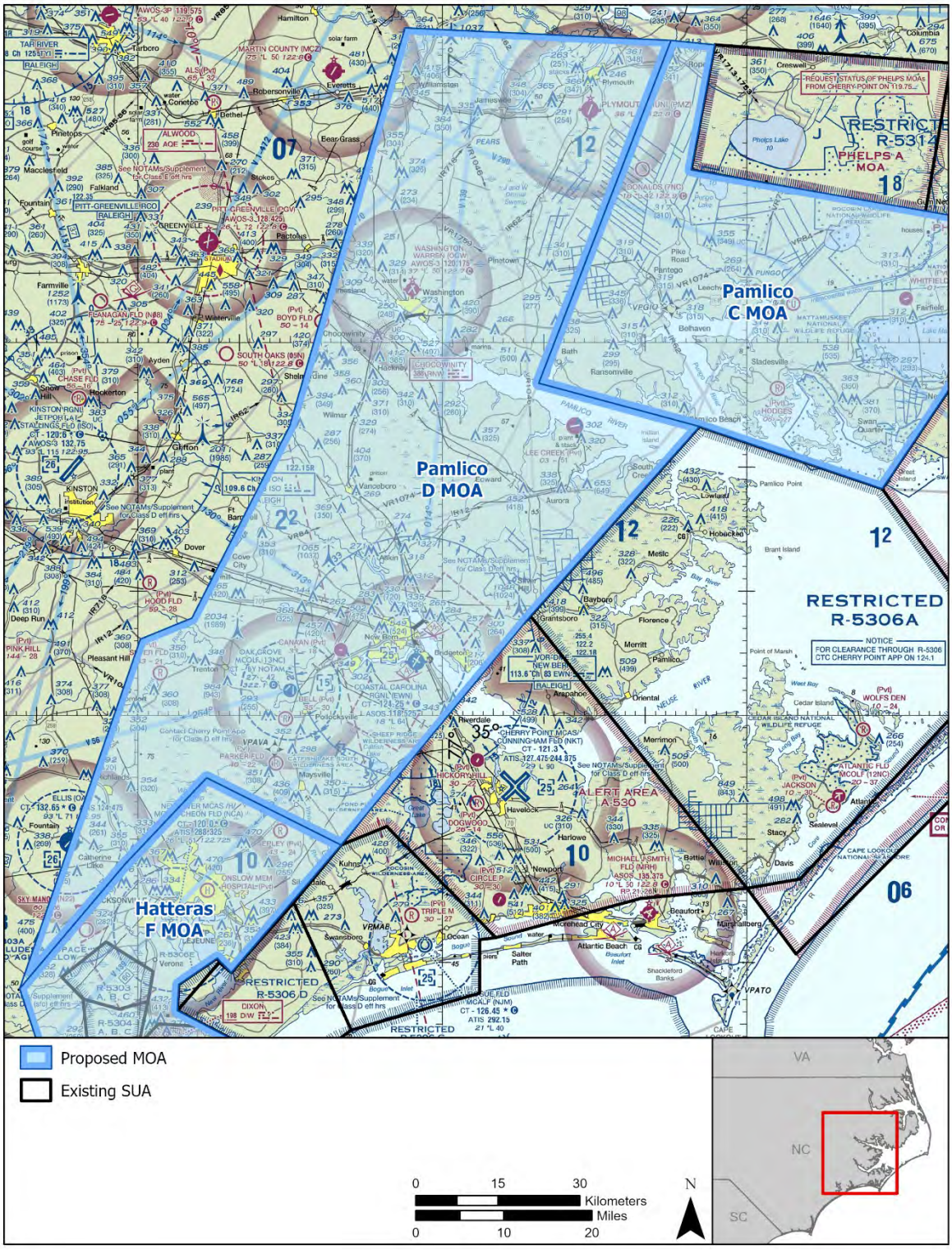

Figure 2.3-3a. Proposed Pamlico D MOA – Aeronautical View

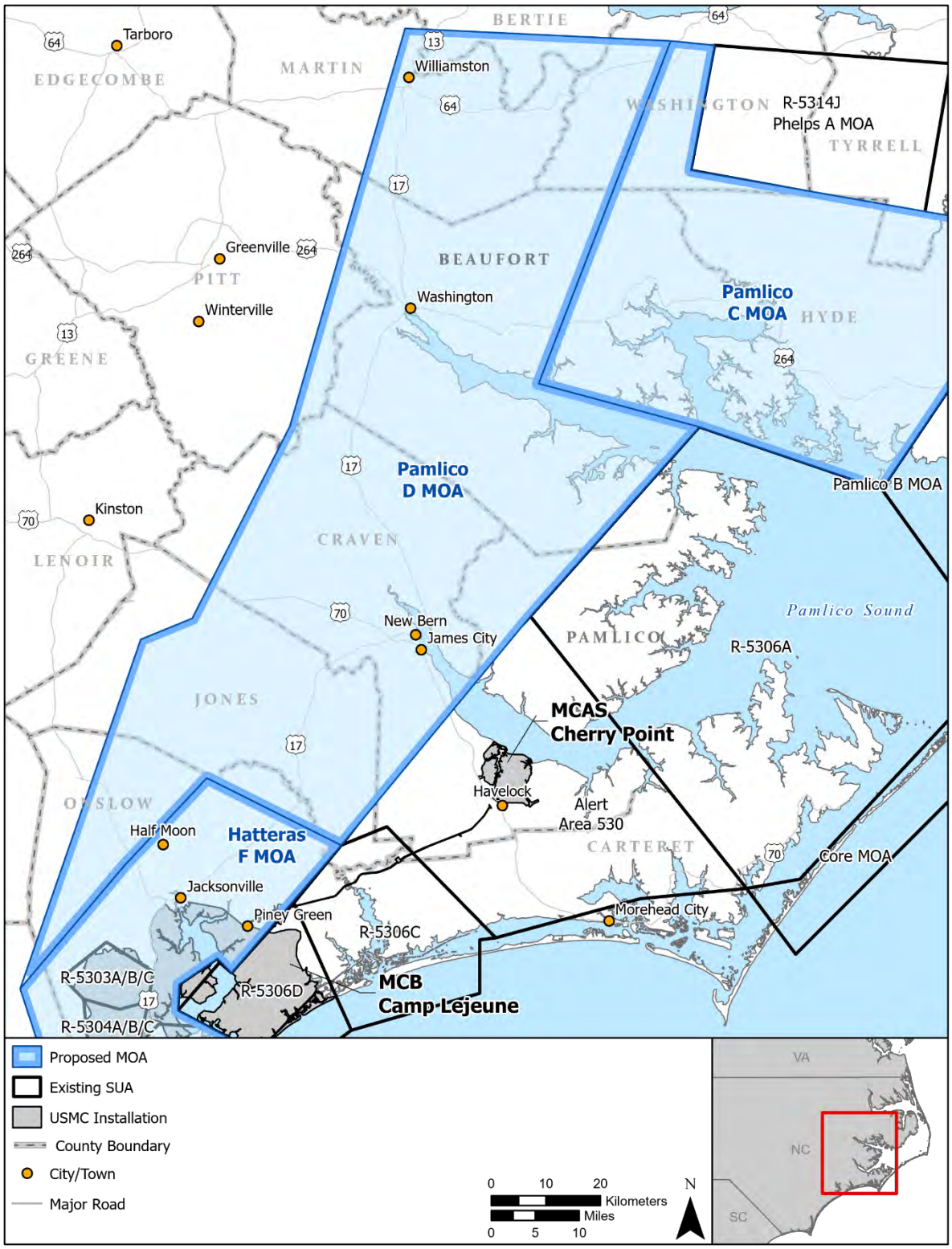

Figure 2.3-3b. Proposed Pamlico D MOA – Map View

Proposed Operations

In addition to Marine Corps, the Pamlico D MOA would serve the Air Force F-15E and Navy F/A-18E/F aircraft. In conjunction with the proposed Pamlico C MOA, the Pamlico D MOA would create a larger training environment to execute LFEs. In LFEs, numerous aircraft of a variety of types conduct simultaneous activities across a spectrum of missions. For instance, in a large, real-world, complex scenario, there may be fighter aircraft protecting the force against enemy aircraft while attack aircraft find and prosecute targets avoiding surface-to-air threats that are being suppressed by electronic-warfare aircraft. These scenarios may involve movement of ground forces by helicopter and tiltrotor, inflight refueling, intelligence gathering and other tasks. Integration with air and ground forces from other Services (primarily Navy and Air Force) is a significant training objective since that is how the U.S. fights its real battles. Putting all these forces together in an integrated way relies heavily on the command-and-control system, which is best exercised when these activities are occurring simultaneously in contiguous airspace.

The proposed annual sorties within the Pamlico D MOA are provided in **Table 2.3-3**. Approximately 25 percent of the activation time would be after sunset.

Table 2.3-3. Annual Sorties in Proposed Pamlico D MOA

Aircraft	Proposed Sorties
USMC AV-8B / F-35B/C[1]	50
USAF F-15E	120
USN FA-18E/F	90
USMC FA-18/F-35B/C[1]	30
Total	***290***

Note: [1] The F-35 B/C will ultimately replace the AV-8 and FA-18 aircraft; therefore, both aircraft are listed in this table.

Legend: USMC = U.S. Marine Corps; USAF = U.S. Air Force; USN = U.S. Navy; MOA = Military Operation Area.

2.3.2.3 Hatteras F MOA

Proposed Airspace

The existing Hatteras F MOA would be expanded west and north of MCB Camp Lejeune with vertical dimensions of 3,000 feet MSL up to, but not including, FL180 (**Figure 2.3-4a, b**). This MOA would overlie much of Onslow County, the City of Jacksonville, and portions of Jones and Pender counties.

The expanded Hatteras F MOA would overlap with existing R-5303 and R-5304, both of which consist of SUA from the surface up to, but not including, FL180. The expanded MOA would align with the western edge of R-5306D, which exists from the surface up to, but not including, FL180.

The published times of use would be 0800 to 2200, Monday through Friday and other times by NOTAM. The Controlling Agency would be FAA Washington ARTCC, and the Using Agency would be U.S. Marine Corps, Commanding Officer, MCAS Cherry Point, NC.

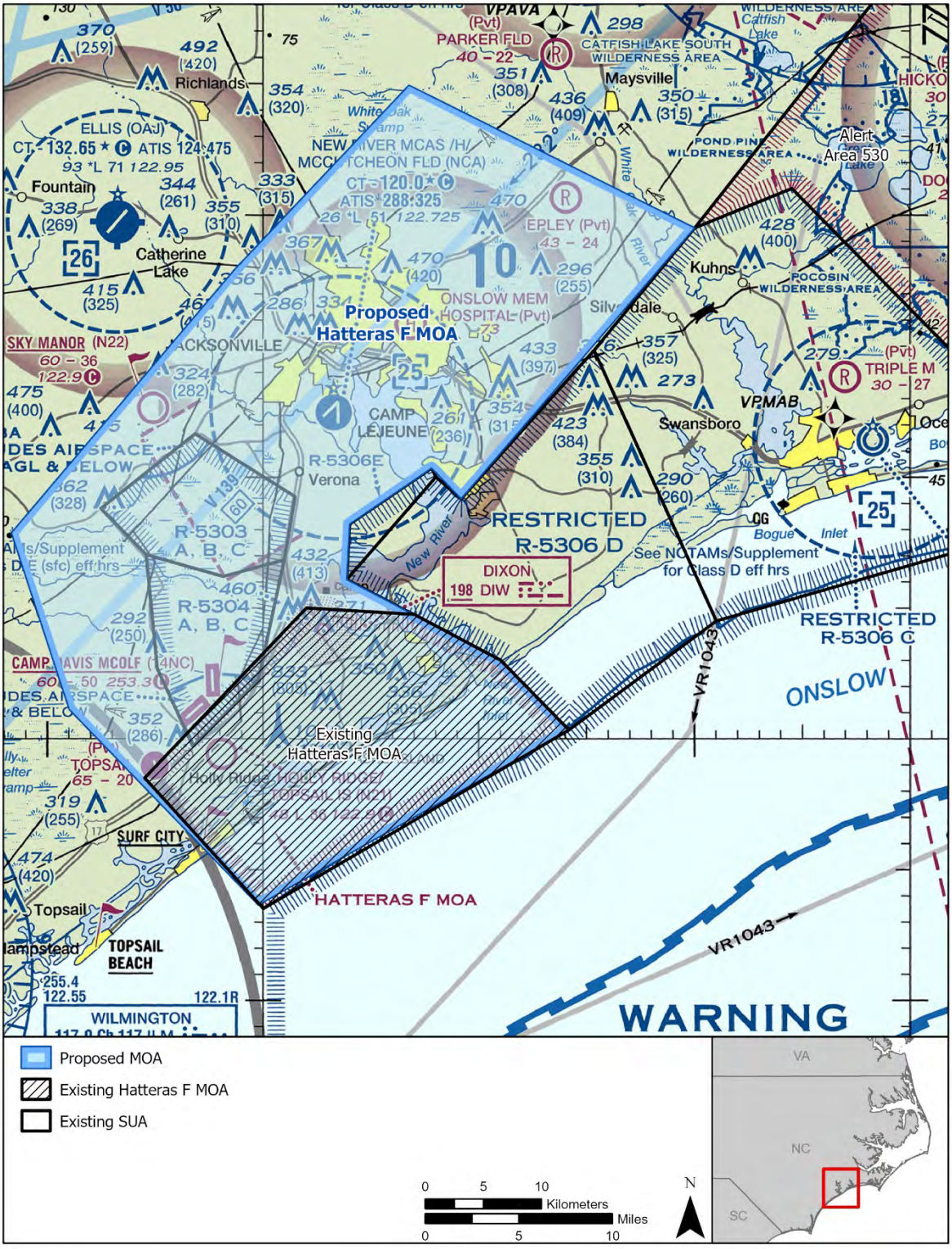

Figure 2.3-4a. Proposed Hatteras F MOA – Aeronautical View

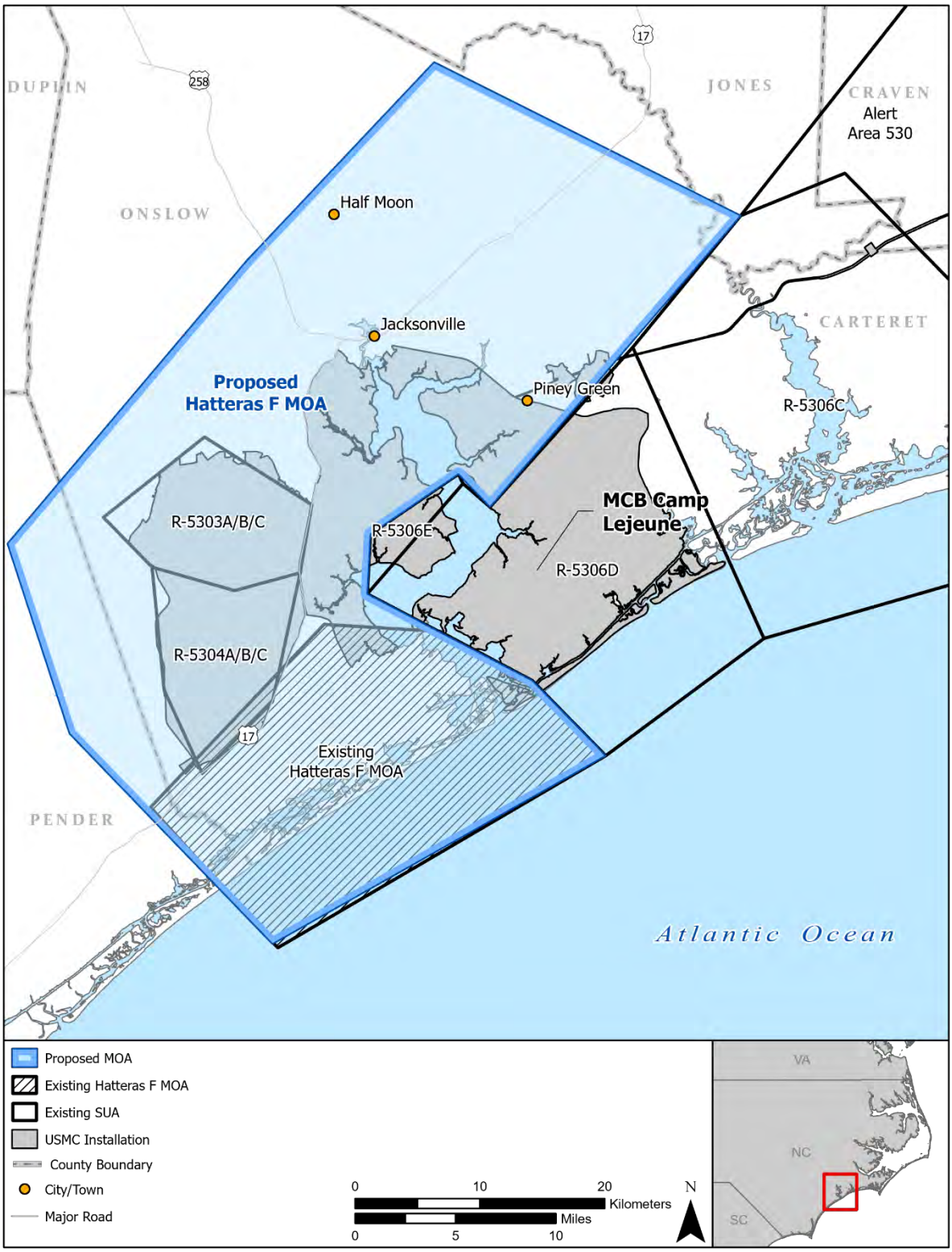

Figure 2.3-4b. Proposed Hatteras F MOA – Map View

Proposed Operations

The proposed expansion of Hatteras F MOA would provide appropriate maneuver space for fixed-wing aircraft around the R-5303 and R-5304 which currently are too small to support use of the targets by fixed-wing aircraft. The MOA expansion would create turning room for both fixed-wing and rotary-wing aircraft, allowing them to train using tactical ordnance deliveries at the targets in the R-5303 and R-5304 airspace. Used in conjunction with each other, the restricted areas and the proposed Hatteras F MOA expansion would collectively provide a training area that would allow for Joint Terminal Attack Controller (JTAC) training, supporting the training syllabi at JTAC schools at MCB Camp Lejeune. Current JTAC training is only done in the G-10 impact area and the airspace around it, which is in high demand by Marine Corps units of all types. Creating a new location for JTAC training would enhance not only that specific training but would open numerous other training opportunities that are commonly displaced by JTAC training on the G-10.

The Hatteras F MOA expansion would abut R-5306 C/D. The current size of R-5306 C/D does not allow for complete scenario-based training using multiple aircraft. Like the description above, the proposed expansion would provide aircraft maneuver space to improve utilization of the targets within the restricted areas.

The existing Hatteras F MOA was used for approximately 375 sorties in FY20. With the proposed expansion the total annual sorties are expected to increase to 450. Proposed annual sorties for the Hatteras F MOA are provided in **Table 2.3-4**. Approximately 20 percent of the activation time would be after sunset.

Table 2.3-4. Annual Sorties in Proposed Hatteras F MOA

Aircraft	Proposed Sorties
USMC AV-8B / F-35B/C[1]	225
USAF F-15E	30
USAF F-16	10
USMC FA-18/F-35B/C[1]	185
Total	***450***

Note: [1] The F-35 B/C will ultimately replace the AV-8 and FA-18 aircraft; therefore, both aircraft are listed in this table.
Legend: USMC = U.S. Marine Corps; USAF = U.S. Air Force; MOA = Military Operation Area.

2.3.3 Alternative 2: Establish Pamlico C MOA and Expand Hatteras F MOA

Under Alternative 2, only the Pamlico C MOA and the expanded Hatteras F MOA would be established (**Figure 2.3-5,** refer to Figures 2.3-2 and 2.3-4 for details of each MOA). The proposed altitudes and published times of use for the Pamlico C MOA and expanded Hatteras F MOA would be the same as described in Alternative 1 and are summarized in **Table 2.3-5.** The proposed sorties within each of these MOAs would be the same as described for Alternative 1 and are summarized in **Table 2.3-6** (refer to Tables 2.3-2 and 2.3-4 for breakdown on types of aircraft by sortie). Under this Alternative, the Pamlico D MOA would not be established, and the Marine Corps would lose enhanced training capability supporting LFEs and other aviation training.

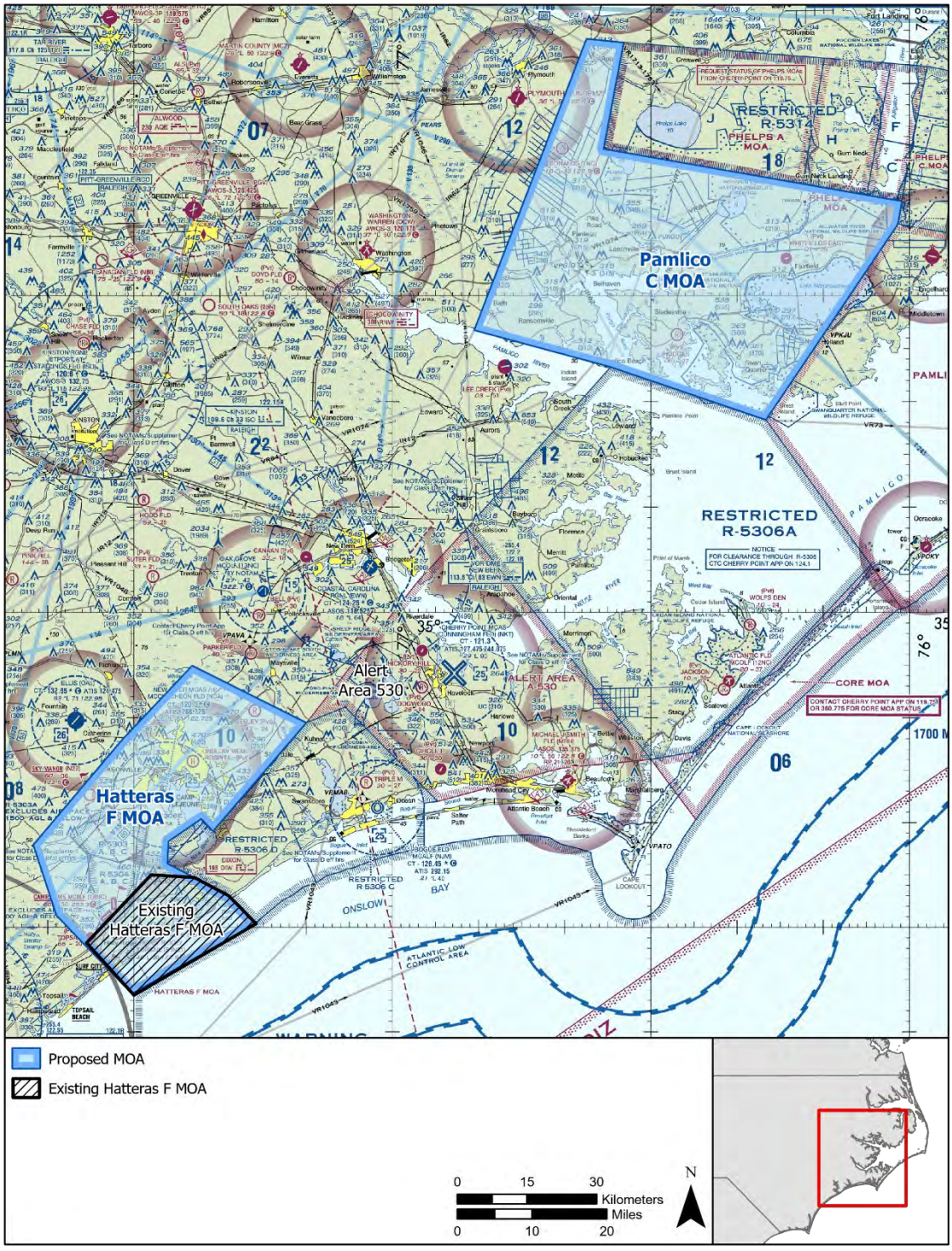

Figure 2.3-5. Alternative 2: Proposed MOAs

Table 2.3-5. Alternative 2 Proposed MOAs			
Name	**Floor**	**Ceiling**	**Proposed Published Times of Use**
Pamlico C MOA	8,000 feet MSL	Up to but not including FL180	Monday through Friday, 0800 – 2200 Other times by NOTAM
Hatteras F MOA	3,000 feet MSL	Up to but not including FL180	Monday through Friday 0800 – 2200 Other times by NOTAM

Legend: MOA = Military Operation Area; MSL = Mean Sea Level; NOTAM = Notice to Air Missions; FL = Flight Level.

Table 2.3-6. Alternative 2 Proposed Annual Sorties	
Name	**Proposed Sorties**
Pamlico C MOA	1,070
Hatteras F MOA	450

Legend: MOA = Military Operation Area

2.4 Alternatives Considered but not Carried Forward for Detailed Analysis

The following alternatives were considered, but not carried forward for detailed analysis in this EA as they did not meet the purpose and need.

2.4.1 Increased Use of Temporary Airspace Actions

In the past, much of the airspace within the proposed MOAs has been used to support specific training events through the creation of ALTRVs. However, allowable actions within Stationary ALTRVs are limited and cannot be used for all activities needed to meet T&R requirements. While ALTRVs add some value to training, they are temporary SAA, not SUA. A permanent, charted MOA that can be used for all the required training activities is necessary to ensure adequate training airspace is available for sufficient periods to ensure training needs are met. Charted airspace also provides better awareness of military activity by non-participating aircraft than temporary ALTRVs which are not charted. Therefore, continuing to use the airspace through temporary actions was not carried forward since it does not satisfy the screening factor that the MOA(s) must be permanent to support recurring Marine Corps training requirements.

2.4.2 Conduct Additional Marine Corps Aviation Training Using Simulators

Aircrew simulators are used daily by the Marine Corps aviation community to satisfy a myriad of training requirements. While simulators are valuable training support systems, they do not provide the same degree of realism and cannot replace the feel and physiological conditions experienced through live training that replicates a combat environment and other missions. Since live training environments are required under MCRP 8-10B.1, and a training imperative, this alternative did not meet the minimum screening criteria and was not carried forward.

2.4.3 Increase Use of Warning Areas to Meet T&R Gaps

The existing Warning Areas adjacent to the Cherry Point OPAREA offer large contiguous areas for some types of aviation training, and a good deal of tactical training is already conducted in these Warning Areas (**Figure 2.4-1**). SUA over the water cannot replace SUA over-land with its significant topography, and such Warning Areas do not meet the MCRP 8-10B.1 "overlay land area with significant topography" requirement for Anti-Air Warfare. There is also a requirement for aircraft to perform activities associated with land, such as over-land sensor usage, target acquisition, and coordination with ground forces. Additionally, larger amphibious exercises, which require a combination of connected overwater and over-land airspace areas, make some types of training impossible to accomplish strictly in Warning Areas. Therefore, increasing the use of Warning Areas to address the existing T&R gaps was not carried forward.

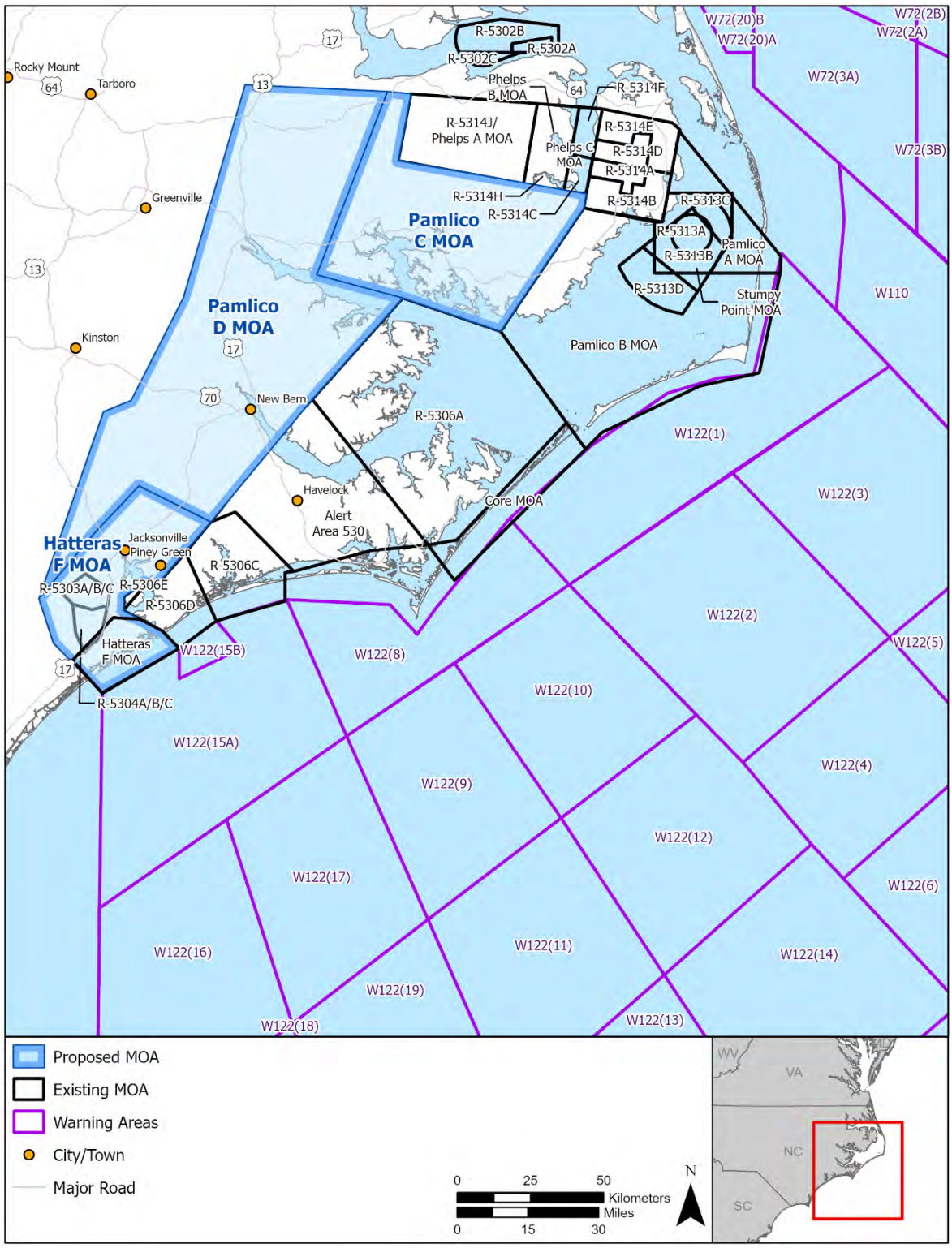

Figure 2.4-1. Existing Warning Areas Adjacent to Proposed Action

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3. Affected Environment and Environmental Consequences

This chapter presents a description of the environmental resources and baseline conditions that could be affected from implementing any of the alternatives and an analysis of the potential effects of each alternative.

All potentially relevant environmental resource areas were initially considered for analysis in this EA. In compliance with NEPA, the CEQ, Department of Navy, and FAA regulations, orders, and guidelines, the discussion of the affected environment (i.e., existing conditions) focuses only on those resource areas potentially subject to impacts. Additionally, the level of detail used in describing a resource is commensurate with the anticipated level of potential environmental impact.

The environmental resources potentially affected by the actions carried forward and evaluated in this EA are presented in **Table 3.1-1.** The environmental resources evaluated in this EA include those identified in both the Marine Corps NEPA Regulations and the FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*. As a cooperating agency, the FAA has independently reviewed this EA prepared by the Marine Corps and assessed whether it met the agency's standards for adequacy under NEPA. The FAA will adopt the Final EA document, in whole or in part, to fulfill its NEPA obligations and sign its own FONSI, if warranted, for the proposed airspace action.

Table 3.1-1. Environmental Resources Analyzed in the EA

Resource	Carried Forward for Detailed Analysis
Department of Transportation Act, Section 4(f)	No
Airspace	Yes
Noise; Noise Compatible Land Use	Yes
Air Quality; Climate Change	No
Biological Resources, Migratory Birds	Yes
Land Use	No
Aesthetic and Visual Impacts; Visual Effects	No
Prime or Unique Farmlands	No
Socioeconomics, Protection of Children	No
Environmental Justice	Yes
Cultural Resources	Yes
Hazardous Materials, Solid Waste, and Pollution Prevention	No
Water Resources, Wetlands, Floodplains	No
Infrastructure	No
Natural Resources and Energy Supply	No
Geology, Topography and Soils	No
Coastal Zone; Coastal Resources	No
Health and Safety	No

The potential impacts to the following resource areas are negligible or nonexistent so they were not analyzed in detail in this EA:

Department of Transportation Act, Section 4(f): Section 4(f) protects significant publicly owned parks, recreational areas, wildlife and waterfowl refuges, and public and private historic sites. Section 4(f)

applies only to agencies within the U.S. Department of Transportation. The proposal would not require the use or modification of any publicly owned land. In addition, SUA actions are exempt from the requirements of Section 4(f) (FAA 2015).

Air Quality: None of the alternatives include changes to the type of aircraft operating at the airfield or within the Cherry Point OPAREA or the total operations for takeoff, landing, and transition to SUA in the OPAREA. It should be noted that the AV-8B and the FA-18 aircraft currently stationed in North Carolina will ultimately be replaced with the F-35B. The future operation of the F-35B at the airfield and within SUA in the OPAREA was assessed in a previous EIS, the F-35B East Coast Basing EIS (U.S. Marine Corps 2010). The air quality analysis in that EIS determined that the replacement of the existing AV-8B and FA-18 aircraft at MCAS Cherry Point with the F-35B would have a positive impact on the air quality in the region as the criteria pollutant emissions would be less with the newer aircraft. That air quality analysis is incorporated by reference to this EA (see **Section 1.6**, *Key Documents*).

The air quality analysis must consider a vertical dimension because emissions occur in a volume of air. The vertical dimension depends upon climatic conditions and is defined from ground level to a certain "mixing height". The mixing height is generally defined as between ground level and 3,000 feet and is based on historical climatic data (U.S. Environmental Protection Agency 1972), thus the default mixing height of 3,000 feet Above Ground Level (AGL) was considered for this analysis. This height was selected as a conservative estimate of the average height of a stable temperature inversion common to the coastal maritime airshed. This type of inversion can inhibit, if not effectively block, vertical and widespread horizontal dispersion of air pollutants. Thus, pollutants can be considered confined between the ground and the base of the inversion (i.e., 3,000 feet AGL). Criteria pollutant emissions generated above the mixing height are thus excluded from further analysis. Since the floors of the proposed SUA would be 3,000 feet MSL, 8,000 feet MSL, and 10,000 feet MSL, no air emissions would occur below the mixing height, thus air quality impacts within the proposed SUA are not evaluated in further detail.

Climate Change: Greenhouse gases (GHGs) are gases that trap heat in the atmosphere. The accumulation of GHGs in the atmosphere regulates the earth's temperature. Observations show that warming of the climate is unequivocal. GHG analysis describes the incremental change in activity and its contributions to GHGs. The alternatives would establish new areas of SUA but would not change the total military aircraft operations that already occur in eastern North Carolina or are planned to occur with the basing of the F-35B. As analyzed in the F-35B East Coast Basing EIS, there is no expected increase in GHGs. Therefore, climate change is not evaluated in detail in this EA.

Land Use: Current land use beneath the proposed MOAs would not be affected from the establishment of MOAs under any of the alternatives. The anticipated noise from aircraft training activities would not be at a level that would require land use restrictions (see **Section 3.2**, Noise). Therefore, land use is not evaluated in detail in this EA.

Aesthetics and Visual Impacts; Visual Effects: Aesthetics includes the natural and built features of the landscape visible from public views that contribute to an area's visual quality. An analysis of visual effects is required in FAA NEPA Desk Reference (FAA 2015) to determine the extent to which a Proposed Action and alternatives would produce light emissions that would create annoyance or interfere with activities or contrast with or detract from the visual character of the existing environment. Given the

proposed altitude for the SUA under any of the alternatives (3,000 feet MSL, 8,000 feet MSL, and 10,000 feet MSL), aircraft operating within the MOA(s) are not expected to create a visual impact to observers on the ground. As illustrated in **Figure 3.1-1,** even at the lowest proposed altitude the aircraft would cover 0.01% of the field of vision from an observer on the ground. Military aircraft are routinely present in eastern North Carolina and would not represent a new visual impact; likewise, the areas proposed for MOAs are currently used on a temporary basis for military training. Therefore, evaluation of visual effects is limited to cultural resources impacts under Section 106 of the National Historic Preservation Act (see **Section 3.4**).

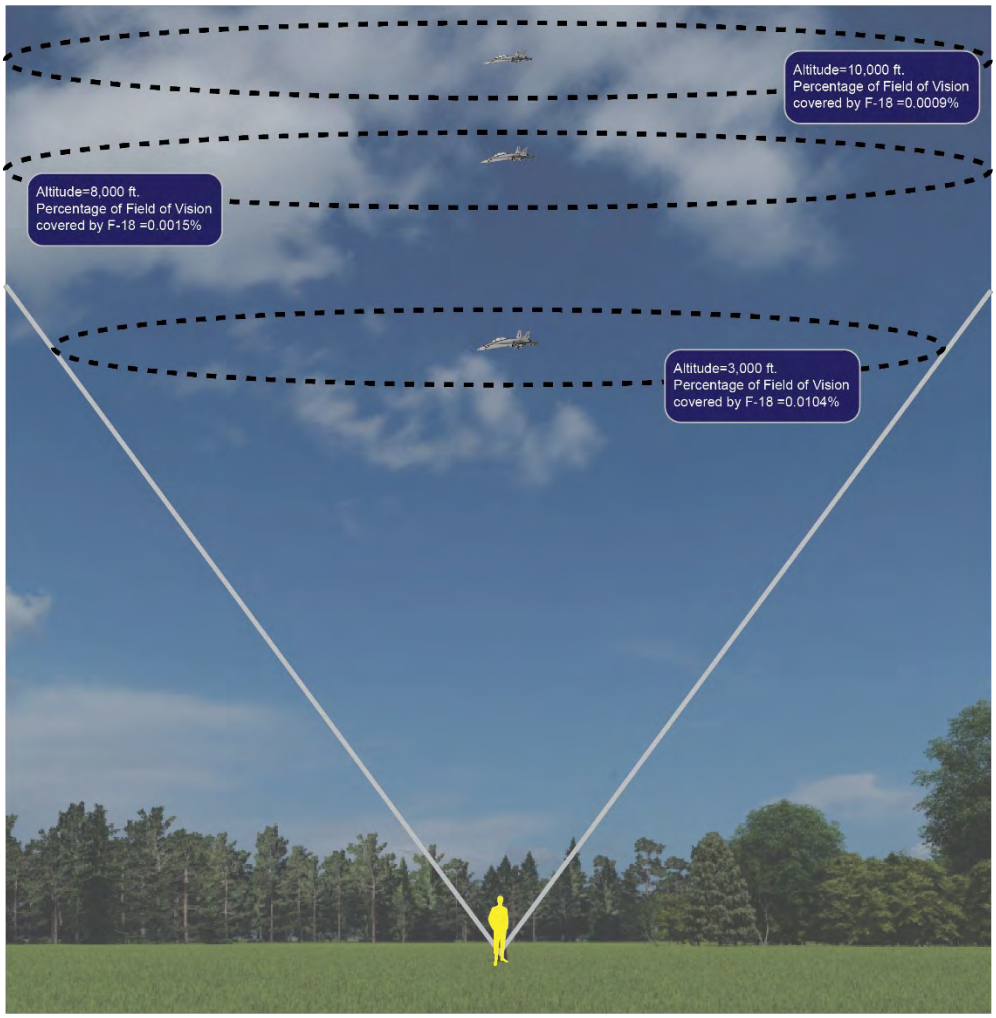

Figure 3.1-1. Visual Effects Perspective

Prime or Unique Farmlands: Farmlands are defined as those agricultural areas considered important and protected by Federal, state, and local regulations (FAA 2015). The Farmland Protection Policy Act regulates Federal actions with the potential to convert farmland to non-agricultural uses. None of the alternatives would involve any ground disturbance or conversion of farmland to non-agricultural uses, therefore, prime farmlands were not evaluated in detail in this EA.

Socioeconomics, Protection of Children: The establishment of MOAs would not affect the socioeconomics of the local area. The MOAs would be established contiguous with the existing Cherry Point OPAREA and contain similar types of training activities. These activities do not currently pose a significant threat to the public or children. Potential impacts to non-participating aircraft (civil and commercial airspace users) are addressed in **Section 3.1**, Airspace. Therefore, socioeconomics and protection of children were not evaluated in detail in this EA.

Hazardous Materials, Solid Waste, and Pollution Prevention: Hazardous materials are identified and regulated under the Comprehensive Environmental Response, Compensation and Liability Act; the Occupational Safety and Health Act; and the Emergency Planning and Community Right-to-Know-Act. None of the alternatives would change the types or amount, storage procedures, or disposal procedures with regards to hazardous materials and waste at the Marine Corps installations, therefore, hazardous materials were not evaluated in detail in this EA.

Water Resources, Wetlands, Floodplains: The alternatives would be limited to the modification or establishment of airspace only and would not have any impact on surface water, ground water, or wetland resources. Floodplains are protected by EO 11988, *Floodplain Management*, which requires that each Federal agency "…take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains". The alternatives do not include any activities that would impact floodplains.

Infrastructure. The Proposed Action does not include changes to or otherwise impact any existing infrastructure. Therefore, infrastructure is not evaluated in detail in this EA.

Natural Resources and Energy Supply. A discussion of natural resources and energy supply is required under FAA NEPA guidance to determine a proposal's consumption of natural resources such as water, asphalt, aggregate, wood, etc., and use of energy supplies such as coal for electricity, natural gas for heating, etc. Consumption of natural resources and use of energy supplies would typically result from construction, operation, and maintenance activities of a proposed action. None of the alternatives evaluated in this EA include the construction or maintenance of any facilities. The use of energy supplies would be jet fuel used during training operations which may increase slightly since the aircraft could train within a larger area of SUA, however, this is not expected to be a substantial increase or use of energy supplies beyond what is used currently. Therefore, natural resources and energy supply are not evaluated in detail in this EA.

Coastal Zone; Coastal Resources. Coastal Zone Management Act (CZMA) imparts an obligation upon Federal agencies, whose actions or activities affect any land or water use or natural resource of the coastal zone, be conducted in a manner consistent to the maximum extent practicable with the enforceable policies of federally approved state coastal management programs. Neither of the alternatives would result in any ground disturbance or impacts to the coastal zone or coastal resources. None of the enforceable policies in North Carolina's Coastal Management Program apply to this action, therefore, a federal consistency determination is not required.

Geology, Topography, and Soils. There are no activities proposed that would impact the geology, topography, or soils in the affected environment. As such, these resources are not evaluated in detail in this EA.

Health and Safety. The health and safety analysis includes consideration for any activities, occurrences, or operations that have the potential to affect the safety, well-being, or health of members of the public. A safe environment is one in which there is no, or optimally reduced, potential for death, serious bodily injury or illness, or property damage. The primary goal is to identify and prevent potential accidents or impacts on the general public. The expanded SUA would expose new areas to military aircraft training; however, the proposed activities with the SUA are the same types of training activities that currently occur throughout the region. Continued adherence to the existing health and safety procedures designed to protect the public from military training or other activities would result in a negligible safety risk. Completion of the FAA aeronautical analysis of the airspace proposal ensures the proposed SUA is compliant with airspace regulations and the safe and efficient use of the navigable airspace (see **Section 1.2**, *Procedures to Establish SUA*). Therefore, this resource is not evaluated in detail in this EA.

3.1 Airspace

This discussion of airspace includes current uses of the airspace. The FAA manages all airspace within the United States and the U.S. territories. Airspace, which is defined in vertical and horizontal dimensions and by time, is considered to be a finite resource that must be managed for the benefit of all aviation sectors including commercial, general, and military aviation.

3.1.1 Regulatory Setting

Specific aviation and airspace management procedures and policies to be used by the Navy are provided by OPNAVINST 3710.7, *Naval Aviation Training and Operating Procedure Standardization*. Applicable Marine Corps aviation and airspace management procedures are provided by MCO P3500.14G, *Aviation T&R Manual, Administrative*. Other applicable regulations regarding SUA management include specific FAA Orders.

FAA Order 1050.1F (issued July 16, 2015), Environmental Impacts: Policies and Procedures, provides FAA policy and procedures to ensure agency compliance with the requirements set forth in the CEQ regulations for implementing the provisions of the NEPA, Department of Transportation Order 5610.1C, Procedures for Considering Environmental Impacts, and other related statutes and directives.

FAA Order JO 7400.2M (issued February 28, 2019), *Procedures for Handling Airspace Matters,* provides procedures for administration of the airspace program. Specifically, Part 5. SUA, Chapter 21, prescribes specific policies and procedures to establish/designate airspace in the interest of National Defense, security and/or welfare. SUA is published annually in FAA Order JO 7400.10C, *SUA* (current effective publication is February 16, 2021).

3.1.2 Affected Environment

The Proposed Action would establish new MOAs and expand an existing MOA in eastern North Carolina congruent to existing SUA. The proposed use of the MOAs would be during the proposed published

times of use. **Table 3.1-2** provides the expected hours of activation annually and daily based on the proposed times of use and the proposed sorties in each proposed MOA. Non-participating aircraft would only have the potential to be impacted when the MOAs are activated.

Table 3.1-2. Expected Hours of Activation for Proposed MOAs

Airspace	Published Times of Use	Proposed Sorties (annual)	Expected Hours of Activation (annual/daily)
Pamlico C	Monday – Friday, 0800- 2200; other times by NOTAM	1,070	710 / <3
Pamlico D	Intermittent by NOTAM[1]	290	190 / <1
Hatteras F	Monday – Friday, 0800 – 2200; other times by NOTAM	450	300 / <1

Note: [1] Expected Hours of Activation for Pamlico D assume that it would be active with Pamlico C (Monday-Friday, 0800- 2200). Actual activation would likely be much less given the low number of proposed sorties.

Legend: NOTAM = Notice to Air Missions; MOA = Military Operation Area.

3.1.3 Environmental Consequences

The analysis of airspace use considers the potential impact to civilian aircraft users from the establishment of SUA where there was not any previously. A detailed Airspace Impact Analysis is provided in Appendix B. That analysis describes the potential impacts to Air Carrier traffic and other non-military traffic (Air Taxi and General Aviation); the results of that analysis are summarized here. The impact to non-military users is described in terms of the additional travel time that would be required to avoid an active MOA. The Airspace Impact Analysis is based on a year's worth of radar data from FY2019 (see Appendix B for methodology).

3.1.3.1 No Action Alternative

Under the No Action Alternative, no new permanent MOAs would be established and enhanced training for Marine Corps' pilots would not occur. There would be no change to existing airspace.

3.1.3.2 Alternative 1: Establish Pamlico C and D, and Expand Hatteras F MOA (Preferred Alternative)

As shown in **Table 3.1-2**, the expected activation of the Pamlico C, Pamlico D, and Hatteras F MOAs would be approximately less than three and less than 1 hours daily (weekdays only), respectively. The potential impacts to Air Carrier and other non-military traffic would only occur while the MOAs are active unless clearance is received from air traffic control. It should be noted that aircraft operating under VFR could cross an active MOA at the pilot's discretion with no impact. Aircraft operating under IFR would have to avoid an active MOA.

Impacts to Air Carrier Traffic

In FY2019, there were eight Air Carrier flights that crossed the area proposed for Pamlico C MOA, about less than one per month. Based on the most common origin-destination airport pairings, re-routing these flights to avoid the active MOA would add one minute or less of travel time for each of those eight

flights. Air Carrier flights almost always already avoid the proposed airspace because of activation of other SUA (R-5314 or Pamlico B MOA) in the area.

In FY2019, there were 2,563 Air Carrier flights that crossed the area proposed for Pamlico D MOA, or about 10 per weekday. Based on the most common origin-destination airport pairings, re-routing these flights to avoid the active MOA would add less than half a minute of travel time to each flight.

In FY2019, there were 2,178 Air Carrier flights that crossed the area proposed for Hatteras F MOA, or about 8 per weekday. Based on the most common origin-destination airport pairings, re-routing these flights to avoid the active MOA would add less than 2 minutes of travel time to each flight.

Impacts to Other Non-Military Traffic

In FY2019, there were 995 Air Taxi, General Aviation, or Unknown flights that crossed the proposed Pamlico C MOA, about four flights per weekday. While the MOA is active, non-military flights could operate below the floor of the MOA (8,000 feet MSL) without any impact. This would be a reasonable choice for most of the aircraft crossing this area, as they do not regularly operate at higher altitudes. For those pilots not wanting to go below the MOA, re-routing around the MOA would add 2 to 4 minutes of travel time based on the most common origin-destination airport pairings. The Hyde County Airport and Billy Mitchell airport are located beneath the adjacent Pamlico B MOA (that also has a floor of 8,000 feet MSL). Flights to/from these airports would need to remain below 8,000 feet MSL until clear of the proposed Pamlico C MOA.

In FY2019, there were 4,488 Air Taxi, General Aviation, or Unknown flights that crossed the proposed Pamlico D MOA, about 17 flights per weekday. While the MOA is active, non-military flights could operate below the floor of the MOA (10,000 feet MSL) without any impact. This would be a reasonable choice for most of the aircraft crossing this area, as they do not regularly operate at higher altitudes. For those pilots not wanting to go below the MOA, re-routing around the MOA would add 1 minute to 3 minutes of travel time based on the most common origin-destination airport pairings.

In FY2019, there were 3,442 Air Taxi, General Aviation, or Unknown flights that crossed the proposed Hatteras F MOA, about 13 flights per weekday. While the MOA is active, non-military flights could operate below the floor of the MOA; however, unlike Pamlico C and D MOAs, this is a less desirable option since the floor of the MOA would be 3,000 feet MSL. Based on the most common origin-destination pairings, re-routing these flights to avoid the active MOA would add 1 to 3 minutes of travel time to each flight.

Because of the relatively light air traffic through the proposed areas, the ability of aircraft to avoid most of the proposed airspace, and the very minor increase in flight times where avoidance is not possible, implementation of Alternative 1 would not result in significant impacts to airspace management and operations.

3.1.3.3 Alternative 2: Establish Pamlico C MOA and Expand Hatteras F MOA

The impacts associated with Pamlico C and Hatteras F MOAs to Air Carrier and other non-military traffic would be the same as described for Alternative 1 (**Section 3.1.3.2**). Therefore, implementation of Alternative 2 would not result in significant impacts to airspace management and operations.

3.1.4 Other Reasonably Foreseeable Actions

Other reasonably foreseeable planned actions relevant to cumulative effects on airspace include planned airspace proposals contiguous with the Cherry Point OPAREA (refer to **Figure 1.3-1**). The Marine Corps plans to submit rulemaking airspace proposals for the establishment of restricted areas contiguous with the Cherry Point OPAREA. These airspace proposals are still under development and a separate EA is anticipated to determine the impacts associated with their establishment and use. These proposals are described below to the extent possible:

- Establish a restricted area to fill the small gap between existing R-5303, R-5304, and R-5306 above MCB Camp Lejeune to increase the volume of airspace needed to use longer-range platform sensors, new tactics, and new weapons. Connecting these restricted areas provides the necessary maneuver space to perform more complex and realistic training scenarios.
- Establish a restricted area in place of and expanding around the existing Alert Area (A-530). This proposed restricted area would connect current SUA (R-5306, Hatteras F MOA, Pamlico A/B MOAs, R-5314, and R-5313) with proposed SUA addressed in this EA (Pamlico C and D, and expanded Hatteras F) as one large, contiguous SUA with multiple air-to-ground bombing ranges, outlying and auxiliary fields, and threat emitter sites.

Both restricted areas would further address T&R gaps from the existing SUA shortfalls for those training activities that specifically require restricted airspace (i.e., unmanned aerial vehicles, weapons deployment, use of lasers, etc.).

In terms of airspace impacts, these reasonably foreseeable restricted areas would be joint use SUA and returned in real-time to the Controlling Agency when not in use. These areas would be located contiguous with the existing Cherry Point OPAREA and the proposed MOAs addressed in this EA (Pamlico C, Pamlico D, and expanded Hatteras F) filling small gaps in the current SUA structure improving its usability. The civil use of these areas is expected to be limited and minor given the current extent of SUA in this general area that is already avoided by civil aircraft. As such, it is expected these reasonably foreseeable restricted areas would also have minimal impacts on civil aviation. It is not expected that these reasonably foreseeable actions would have additional substantial airspace impacts to the proposed MOAs in either alternative in this EA.

3.2 Noise

3.2.1 Resource Definition

Noise is unwanted sound that interferes with normal activities or otherwise diminishes the quality of the environment. Noise may be intermittent or continuous, steady or impulsive, stationary or transient. Stationary sources are normally related to specific land uses, e.g., housing tracts or industrial plants. Transient noise sources move through the environment, either along relatively established paths (e.g., highways, railroads, and aircraft flight tracks around airports), or randomly. There is wide diversity in responses to noise according to the type of noise and the characteristics of the sound source, the sensitivity and expectations of the receptor, the time of day, and the distance between the noise source (e.g., an aircraft) and the receptor (e.g., a person or animal).

The physical characteristics of noise and sound include its intensity, frequency, and duration. Sound is created by acoustic energy, which produces minute pressure waves that travel through a medium, like air, and are sensed by the eardrum, much like how ripples in water move when a stone is dropped into it. As the acoustic energy increases, the intensity or amplitude of these pressure waves increase, and the ear senses louder noise. The unit used to measure the intensity of sound is the decibel (dB). Sound intensity varies widely (from a soft whisper to a jet engine) and is measured on a logarithmic scale. Human hearing ranges from 0 dB (barely audible) to 120 dB, where physical discomfort is caused by the sound.

The frequency of sound is measured in cycles per second, or hertz (Hz). This measurement reflects the number of times per second the air vibrates from the acoustic energy. Low frequency sounds are heard as rumbles or roars, and high frequency sounds are heard as screeches. Sound measurement is further refined by "weighting." The normal human ear can detect sounds that range in frequency from about 20 Hz to 15,000 Hz, with the human ear most sensitive to frequencies in the 1,000 to 4,000 Hz range. Sound measurements are "A-weighted," and are indicated in terms of A-weighted decibels (dBA). A-weighting accounts for the frequency sensitivity of the human ear. The dBA is also appropriate for measuring continuous sounds.

3.2.1.1 Noise Metrics

The word "metric" is used to describe a standard of measurement. Many different types of noise metrics have been developed to represent the effects of environmental noise.

The metrics supporting the assessment of noise from aircraft operations used in this EA are the Day-Night Average Sound Level (DNL), Maximum Sound Level (L_{max}), and Sound Exposure Level (SEL). Each metric is briefly explained below.

DNL

The DNL is an A-weighted cumulative noise metric that measures noise based on annual average daily aircraft operations. DNL is the U.S. Government standard for modeling the cumulative noise exposure and assessing community noise impacts. DNL uses two time periods: daytime (acoustic day) and nighttime (acoustic night). Daytime hours are from 7:00 a.m. to 10:00 p.m., and nighttime hours are from 10:00 p.m. to 7:00 a.m. local time. DNL weights operations occurring during its nighttime period by adding 10 dB to their single event sound level.

L_{max} and SEL

A common metric used to describe a single aircraft noise event is the maximum sound level, or L_{max}, measured in dB. L_{max} is the highest A-weighted sound level that occurs during the aircraft overflight. L_{max} describes the maximum level of a noise event but does not take into account its duration. The SEL, measured in dB, is a composite metric that represents both the magnitude and duration of an aircraft overflight. The SEL is a measure of the total acoustic energy in the event, but does not directly represent the sound level heard at any given time. The SEL is the building block for calculating DNL.

3.2.1.2 Relationship Between Noise and Annoyance

Annoyance, which is based on perception, represents the primary effect associated with aircraft noise. Generally, the louder the noise, the more annoyance it causes. Attitudinal surveys conducted over several decades show a consistent relationship between DNL and the percentages of groups of people who express various degrees of annoyance. This relationship was originally suggested by Schultz (1978) and has been periodically re-examined and reaffirmed. The updated relationship by Finegold et al. (1994) which does not differ substantially from the original, is the current preferred form and is shown in **Table 3.2-1**. These data provide a perspective on the level of annoyance that might occur. The study results summarized in **Table 3.2-1** are based on outdoor noise levels.

Table 3.2-1. Relationship of Annoyance to DNL

DNL (dBA)	Percentage of Persons Highly Annoyed
45	0.83
50	1.66
55	3.31
60	6.48
65	12.29
70	22.10

Source: Finegold et al. 1994.

Note: Noise impacts on individuals vary as do individual reactions to noise. This is a general prediction of the percentage of the community potentially highly annoyed based on environmental noise surveys conducted around the world.

Legend: <-less than; >-greater than; dBA- A-weighted decibels; DNL- Day-Night Average Sound Level.

3.2.1.3 Noise Induced Hearing Loss

Noise induced hearing loss risk has been extensively studied, with the consensus that populations exposed to noise greater than 80 DNL are at the greatest risk of potential hearing loss (Department of Defense [DoD] 2009). Because no person or place would be exposed to noise levels greater than 80 DNL, noise induced hearing loss is not discussed further in this analysis.

3.2.2 Affected Environment

The noise associated with aircraft operations can be subsonic or supersonic. Subsonic noise is noise generated by an aircraft's engines and airframe. This is the most familiar form of noise. Supersonic noise is the noise generated when an aircraft flies faster than the speed of sound and has the potential to create sonic booms. A sonic boom is the sound associated with shock waves generated when the aircraft travels at supersonic speeds. This Proposed Action does not include any supersonic activity within the MOAs; therefore, this analysis focuses only on subsonic noise.

The noise analysis was performed using the accepted suite of noise modeling programs, known as NOISEMAP (Wyle 1998; Wasmer Consulting 2006). This software was used to define noise levels associated with military aircraft operations for both baseline (no action) and proposed conditions. Military training within a MOA is dispersed throughout the confines of the MOA; as such, the software

assumes an even distribution of noise across the entire airspace modeled and calculates a single DNL value. Therefore, noise contour results are not illustrated for subsonic aircraft noise in MOAs.

The noise report for this Proposed Action is provided in **Appendix C** (Noise Report) and a summary of the results is presented in this section. The noise from the proposed aircraft operations could impact other resource areas such as biological resources, cultural resources, and environmental justice. Those impacts are addressed in their respective sections of this document.

3.2.3 Environmental Consequences

The analysis of the acoustic environment and use involves consideration of many factors including the types, locations, and frequency of aerial operations, the classification of existing airspace, and the amount of air traffic using or transiting through a given area. This analysis quantifies the anticipated subsonic noise from military aircraft activity within the existing and proposed airspace.

The U.S. Environmental Protection Agency (USEPA) has identified 55 DNL as a level that protects public health and welfare with an adequate margin of safety (USEPA 1982). This means that 55 DNL is a threshold below which adverse noise effects are not expected to occur. According to the Federal Interagency Committee on Urban Noise, noise exposure greater than 65 DNL is considered generally incompatible with residential, public use (i.e., schools), or recreational and entertainment areas (Federal Interagency Committee on Urban Noise 1980).

The FAA defines a threshold for significant noise impacts as "[t]he action would increase noise by DNL 1.5 dB or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a 1.5 dB or greater increase, when compared to the No Action Alternative for the same timeframe" FAA Order 1050.1F.

3.2.3.1 No Action Alternative

Under the No Action Alternative, no new permanent MOAs would be established and enhanced training for Marine Corps' pilots would not occur. There would be no change to the current noise environment. The current noise environment in the areas proposed for Pamlico C and D would remain unchanged and includes noise exposure from routine overflight by various types of civilian aircraft at various altitudes (see **Section 3.1**, *Airspace*, for details on the number of civilian flights in each proposed MOA area).

The noise environment within the existing Hatteras F MOA would remain unchanged. The noise exposure in Hatteras F MOA from the existing military aircraft operations is estimated at 46 DNL.

3.2.3.2 Alternative 1: Establish Pamlico C and D MOAs, and Expand Hatteras F MOA (Preferred Alternative)

DNL is the U.S. Government standard for modeling the cumulative noise exposure and assessing community noise impacts. The noise analysis uses approved software to predict the DNL in each of the proposed MOA areas to compare against the U.S. Environmental Protection Agency, Federal Interagency Committee on Urban Noise, and FAA thresholds described above in **Section 3.2.3.** While not a determination of significance, the resulting DNL is also compared against **Table 3.2-1** to provide an estimate of the percentage of the population that would be "highly annoyed" by the noise.

While DNL is the U.S. Government standard metric for assessing noise impacts, supplemental metrics are used to provide more detailed noise exposure information for the decision process and to improve communication with the public and stakeholders. Supplemental metrics are not intended to replace the DNL metric as the primary descriptor of cumulative noise exposure and anticipated significance of impacts, but rather are useful tools to supplement the impact information disclosed by the DNL metric. Thus the noise analysis includes supplemental data for single events to better describe the "loudness" of individual aircraft overflights for the aircraft proposed to operate in the MOAs at various power settings at the lowest possible altitudes (i.e., the floor of the MOA). It should be noted that these metrics are different from DNL and therefore, cannot be compared against **Table 3.2-1** to predict annoyance.

Cumulative Noise Metric (DNL)

Under Alternative 1, Pamlico C and D MOAs would be established, and the existing Hatteras F MOA would be expanded. **Table 3.2-2** shows the modeled DNL for annual military aircraft operations within each of these MOAs. The largest value would occur within the proposed Hatteras F MOA (48 DNL). All MOAs would operate below 55 DNL. These levels would not exceed U.S. Environmental Protection Agency or FAA thresholds for noise impacts. From a land use perspective, these levels would be compatible with all land use types to include residential, public use (i.e., schools), or recreational and entertainment areas. In addition, the percentage of the population highly annoyed by the noise would range from less than 0.83 in Pamlico C and D MOAs up to 1.66 in the Hatteras F MOA (see **Table 3.2-1**).

Table 3.2-2. DNL Values for Annual Aircraft Operations in Proposed Airspace

Airspace	DNL (dBA)	Estimated Percentage of Population "Highly Annoyed"
Pamlico C MOA	41	<0.83
Pamlico D MOA	<35	<0.83
Hatteras F MOA	48	<1.66

Legend: MOA = Military Operation Area; DNL = day-night average sound level; dBA = A-weighted decibels.

Single Event Metrics

The noise analysis calculated single event metrics (i.e., a single overflight directly overhead) for each of the types of military aircraft that would use the proposed MOAs. These metrics were calculated for each aircraft at varying power settings at the lowest possible altitude within each MOA, that is, the floor of the MOA. In general, during training events aircraft do not travel substantial distances on the floor of the MOA, but rather start at the floor and quickly climb to higher altitudes. It is estimated that aircraft would operate in the lowest altitude bands of each MOA for only 10 to 15 percent of the time of the full sortie duration (see **Tables A-2, A-3, and A-4** of **Appendix C**, Noise Report for the aircraft operation assumptions by aircraft by MOA). **Table 3.2-3** provides only the loudest possible event within each MOA to provide additional perspective on what an observer on the ground may experience (see **Appendix C** for the full results). As one might expect, aircraft using higher power at lower altitude produces the greatest noise levels; as shown, an F-18 or F-35 in afterburner at 3,000 feet results in the loudest peak noise exposure at 103 dBA. This scenario only has the potential to occur within the proposed Hatteras F MOA. It should be noted that the existing Hatteras F MOA currently has this same floor and the MOA

overlies the existing RTAs at MCB Camp Lejeune that routinely experience high levels of noise from air and ground military training activities. At 3,000 feet MSL, a direct overflight by any of the aircraft that would be using the airspace would likely be noticeable but would last only a few seconds. Additionally, these noise levels are estimated for an observer being outdoors at the time of the overflight. Being indoors with windows closed would account for a 25 dB reduction in sound level (15 dB reduction for open windows) which would lessen noise exposure for a direct overflight. Experiencing such an overflight would be very rare given the number of proposed sorties and the fact that aircraft would spend very little time at these low altitudes during the training scenarios. For example, in the proposed Hatteras F MOA, it is estimated that the proposed sorties would spend 10 percent of flying time in the 3,000 to 5,000-foot altitude band and of that time only 15 percent would be in afterburner power (see **Table A-4, Appendix C** for Aircraft Operation Assumptions).

Table 3.2-3. Maximum Sound Level for Single Overflight by Proposed Airspace

Airspace	Lowest Altitude	Maximum Sound Level (L_{max}) (dBA)	Aircraft
Pamlico C MOA	8,000 feet MSL	90	F-18 E/F with afterburner F-35B with afterburner
Pamlico D MOA	10,000 feet MSL	86	F-18 C/E/F with afterburner F-35B with afterburner
Hatteras F MOA	3,000 feet MSL	103	F-18 E/F with afterburner F-35B with afterburner

Legend: MOA = Military Operation Area; dBA = A-weighted decibels; L_{max} = maximum sound exposure; MSL = mean sea level.

Normally, the most sensitive components of a structure to noise are the windows and, infrequently, the plastered walls and ceilings. Conservatively, only sound lasting more than one second above a sound level of 130 dB are potentially damaging to structural components (Committee on Hearing, Bioacoustics, and Biomechanics 1977). Noise induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations or rattling of objects within the dwelling. Windowpanes may also vibrate noticeably when exposed to high levels of airborne noise. Sound levels from normal aircraft operations are typically much less than 130 dB. Even sound from low-altitude flyovers of heavy aircraft do not reach the potential for damage (Sutherland et al, 2000). Since the highest L_{max} of a single overflight under this proposal would be 103 dB, structural damage and secondary vibration impacts are not expected to occur with this Proposed Action.

As described above, the cumulative noise (DNL) associated with the proposed aircraft operations would be below the significance levels established by the USEPA, Federal Interagency Committee on Urban Noise, and FAA. The percentage of the population expected to be highly annoyed by the cumulative noise would be extremely low (<0.83 to <1.66 percent). Direct overflights at lower altitudes (3,000 feet) while noticeable would be very rare and last for only a few seconds or less. Structural damage or secondary vibration impacts are not expected to occur based on the maximum sound exposure. An individual location is not expected to experience this scenario on a recurring or routine basis since aircraft operations would be distributed over such a wide area (the MOAs geographically cover several counties). As such, Alternative 1 would not have significant impacts from noise.

3.2.3.3 Alternative 2: Establish Pamlico C MOA and Expand Hatteras F MOA

The noise associated with proposed operations in Pamlico C and the expanded Hatteras F MOAs would be the same as described for Alternative 1 (**Section 3.2.3.2**). The geographic area exposed to noise from military operations would be less under Alternative 2 since Pamlico D would not be established. Noise associated with aircraft operations within the proposed MOAs would not be significant.

3.2.4 Other Reasonably Foreseeable Actions

Other reasonably foreseeable actions relevant to cumulative effects on noise include planned airspace proposals contiguous with the Cherry Point OPAREA (see Section 3.1.4 for descriptions). Like the MOAs proposed in this EA, those foreseeable actions would address T&R gaps associated with the current SUA by improving the volume and usability of the SUA. The total military operations originating from the airfields and using all of the SUA in the Cherry Point OPAREA would not increase, but rather occur in a larger volume of SUA. Military operations already occur within the existing A-530 and establishing this area as restricted airspace would likely have minor changes in the noise environment. The other foreseeable proposal would establish a restricted area to fill the small gap between existing R-5303, R-5304, and R-5306, the new land area exposed to noise would be minimal and it is expected the noise impact would be relatively minor since this area is already surrounded by existing restricted airspace used for military training. The noise within those foreseeable airspace areas, like with the Pamlico and Hatteras MOAs, would be relatively minor and would not have a cumulative noise impact.

3.3 Biological Resources

Biological resources include living, native, or naturalized plant and animal species, and the habitats within which they occur. For the Proposed Action, biological resources are limited to terrestrial wildlife that may be impacted by the noise associated with the aircraft operations in the proposed MOAs.

3.3.1 Regulatory Setting

Special status species are those species listed as threatened or endangered under the Endangered Species Act (ESA), and species afforded federal protection under the Migratory Bird Treaty Act (MBTA).

The purpose of the ESA is to conserve the ecosystems upon which threatened and endangered species depend and to conserve and recover listed species. Section 7 of the ESA requires action proponents to consult with the U.S. Fish and Wildlife Service (USFWS) to ensure their actions are not likely to jeopardize the continued existence of federally listed threatened and endangered species.

Birds, both migratory and most native-resident bird species, are protected under the MBTA, and their conservation by federal agencies is mandated by EO 13186 (Migratory Bird Conservation). Under the MBTA, it is unlawful to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, or possess migratory birds or their nests or eggs at any time. The 2003 National Defense Authorization Act gave the Secretary of the Interior authority to prescribe regulations exempting the Armed Forces from the incidental taking of migratory birds during military activities. The final rule authorizing the DoD to take migratory birds in such cases includes a requirement that the Armed Forces must confer with the USFWS to develop and implement appropriate conservation measures to minimize or mitigate adverse

effects of the Proposed Action, if the action will have a significant negative effect on the sustainability of a population of a migratory bird species.

Bald and golden eagles are protected by the Bald and Golden Eagle Protection Act. This Act prohibits anyone without a permit issued by the Secretary of the Interior from taking bald eagles, including their parts, nests, or eggs. The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

3.3.2 Affected Environment

The affected environment for this EA includes the protected species potentially occurring beneath the proposed MOAs. Also addressed in this section are the National Wildlife Refuges (NWRs) that exist beneath the proposed MOAs.

3.3.2.1 Protected Species

Table 3.3-1 provides a list of federally threatened and endangered bat and bird species known to occur or potentially occurring beneath all the proposed MOAs that could potentially be affected by the Proposed Action. The table also provides the state listing status for these species. Descriptions of each of these species is provided in the following sections. The species listed in **Table 3.3-1** apply to each proposed MOA area, that is, all of these species could occur beneath all three MOAs.

Table 3.3-1. Federally Threatened and Endangered Species Known to Occur or Potentially Occurring in the Region of Influence

Common Name	Scientific Name	Federal Listing Status	State Listing Status
Mammals			
Northern Long-eared Bat	*Myotis septentrionalis*	Threatened	Threatened
Red Wolf	*Canis rufus*	Experimental, Non-essential	Threatened
Birds			
Eastern Black Rail	*Laterallus jamaicensis*	Threatened	Special Concern
Piping Plover	*Charadrius melodus*	Threatened	Endangered; Threatened[1]
Red Knot	*Calidris canutus rufa*	Threatened	Threatened
Red-cockaded Woodpecker	*Picoides borealis*	Endangered	Endangered

Sources: USFWS 2021a and North Carolina Department of Natural and Cultural Resources 2020.
Note: [1] The Interior subspecies is Endangered; the Atlantic coastal subspecies is Threatened.

Northern Long-eared Bat. The Northern Long-eared bat was listed as threatened on April 2, 2015 (80 Federal Register 17974). The bat is a wide-ranging species found in a variety of forested habitats in summer, and hibernates in caves, mines, and other locations in winter (referred to as the hibernaculum). Like most bats, Northern Long-eared bats emerge at dusk to feed. They primarily fly through the understory of forested areas feeding on insects, which they catch while in flight using echolocation or by gleaning motionless insects from vegetation. The area proposed for the MOAs is located on the southern edge of this species' range.

Red Wolf. The Red Wolf was listed as a non-essential experimental population in portions of North Carolina under section 10(j) of the ESA on November 19, 1986 (51 Federal Register 41790). The wolf may

be found in swamps, pocosins, and extensive forests in the region of influence. Any non-essential population located outside a NWR System is treated as a proposed species for the purposes of section 7 consultation. The Red Wolf is known to occur in the Alligator River and Mattamuskeet NWRs, which overlap with the Proposed Pamlico C and D MOAs (NWRs are discussed in **Section 3.3.2.2**).

Eastern Black Rail. The Eastern Black Rail was listed as threatened under the ESA on October 8, 2020 (85 Federal Register 63764). The Eastern Black Rail is broadly distributed, living in salt and freshwater marshes. Its range extends along the southeastern coastline from Virginia to Texas. North Carolina showed a severe decline in the number of occupied sites between 2010 and 2017.

Piping Plover. The Piping Plover (Atlantic Coast and Northern Great Plains populations) was listed as threatened on December 11, 1985 (50 Federal Register 50726). The Piping Plover is a small North American shorebird that spends time feeding within the shoreline, washover area, sandflats, and mudflats. The species' range in North Carolina covers all ocean beaches and barrier island flats.

Red Knot. The Red Knot was listed as threatened on January 12, 2015 (79 Federal Register 73706). The Red Knot is a migratory shorebird that winters in parts of the United States, and primarily uses well-known spring and fall stopover areas on the Atlantic coast. Six subspecies are recognized, each with distinctive migration routes, and annual cycles. One of the four wintering regions for the Red Knot is the southeast U.S./Caribbean which has a core area of Florida to North Carolina.

Red-cockaded Woodpecker. The Red-cockaded Woodpecker was listed as endangered on October 13, 1970 (35 Federal Register 16047). It was proposed for reclassification to threatened on October 8, 2020 (85 Federal Register 63474). The Red-cockaded Woodpecker is a non-migratory, territorial bird that lives in cooperative breeding social units called groups. They are the only North American woodpecker that requires old, living pine trees to excavate roosts and nest cavities, usually in trees infected with a fungus known as red-heart disease. The species range covers all eastern North Carolina.

Eastern North Carolina is beneath one of four main bird migration corridors in North America, the Atlantic Flyway. The migratory bird species potentially occurring beneath the proposed MOAs are listed in **Table 3.3-2**. This list also includes the Bald Eagle (*Haliaeetus leucocephalus)* and the Golden Eagle (*Aquila chrysaetos)* that are protected by the Bald and Golden Eagle Protection Act. Not all of the migratory bird species breed in this area and the breeding timeframe for those that do varies greatly throughout the year.

3.3.2.2 National Wildlife Refuges

Parts of the Roanoke River, Pocosin Lakes, Alligator River, Mattamuskeet, and Swanquarter NWRs overlap with the proposed Pamlico C and D MOAs (**Figure 3.3-1**). All of these NWRs, except for the Roanoke River NWR, are currently beneath existing SUA within the Cherry Point OPAREA. All of the NWRs lie within the South Atlantic Coastal Plain physiographic region, which serves as primary migration habitat for migratory songbirds returning from Central and South America. It also provides wintering, breeding, and migrating habitat for mid-continental wood duck and colonial bird populations. As such, the NWRs share a general purpose to protect and conserve migratory birds (USFWS 2005, 2007, 2008a, 2008b, and 2008c).

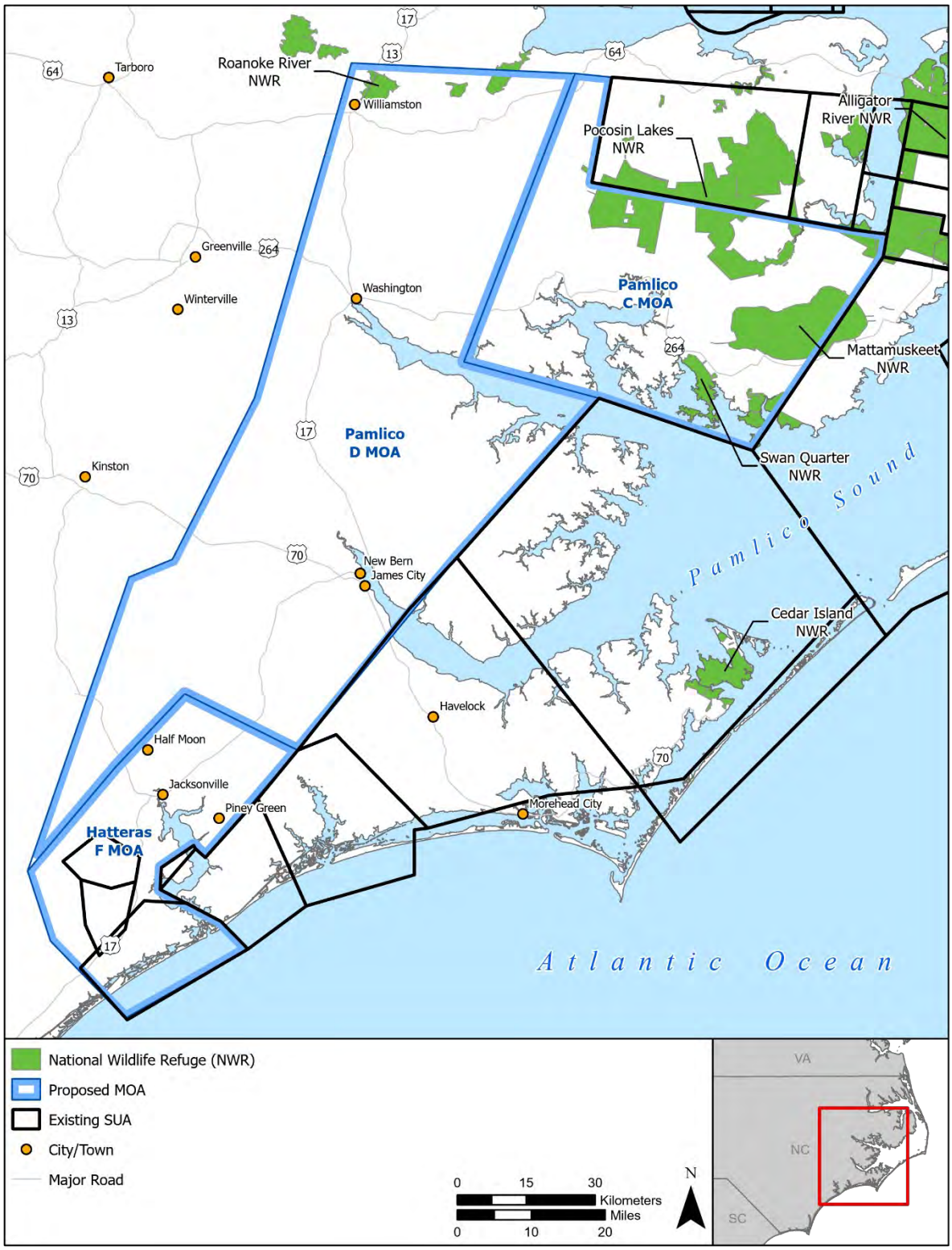

Figure 3.3-1. National Wildlife Refuges within Region of Influence

Table 3.3-2. Migratory Birds Beneath Proposed MOAs				
Bird	***Pamlico C MOA***	***Pamlico D MOA***	***Hatteras F MOA***	***Breeding Season***
American Kestrel	X	X	X	April 1 to August 31
American Oystercatcher		X	X	April 15 to August 31
Audubon's Shearwater			X	March 1 to August 5
Bachman's Sparrow		X	X	May 1 to September 30
Bald Eagle	X	X	X	September 1 to July 31
Black Scoter	X	X	X	Breeds elsewhere
Black Skimmer			X	May 20 to September 15
Black-legged Kittiwake			X	Breeds elsewhere
Brown Pelican	X	X	X	January 15 to September 30
Common Loon	X	X	X	April 15 to October 31
Double-crested Cormorant	X	X	X	April 20 to August 31
Eastern Whip-poor-will		X	X	May 1 to August 20
Golden Eagle	X			Breeds elsewhere
Gull-billed Tern	X		X	May 1 to July 31
Henslow's Sparrow	X	X		Breeds elsewhere
Kentucky Warbler		X	X	April 20 to August 20
King Rail	X	X	X	May 1 to September 5
Le Conte's Sparrow		X		Breeds elsewhere
Lesser Yellowlegs	X	X	X	Breeds elsewhere
Long-tailed Duck	X			Breeds elsewhere
Marbled Godwit	X	X	X	Breeds elsewhere
Pomarine Jaeger			X	Breeds elsewhere
Prairie Warbler	X	X	X	May 1 to July 31
Prothonotary Warbler	X	X	X	April 1 to July 31
Razorbill			X	June 15 to September 10
Red-breasted Merganser	X	X	X	Breeds elsewhere
Red-headed Woodpecker	X	X	X	May 10 to September 10
Red-throated Loon	X	X	X	Breeds elsewhere
Ring-billed Gull	X	X	X	Breeds elsewhere
Royal Tern	X	X	X	April 15 to August 31
Ruddy Turnstone	X		X	Breeds elsewhere
Rusty Blackbird	X	X	X	Breeds elsewhere
Short-billed Dowitcher	X	X	X	Breeds elsewhere
Surf Scoter	X	X	X	Breeds elsewhere
Swallow-tailed Kite			X	March 10 to June 30
White-winged Scoter		X	X	Breeds elsewhere
Willet	X	X	X	April 20 to August 5
Wilson's Plover			X	April 1 to August 20
Wilson's Storm-petrel			X	Breeds elsewhere
Wood Thrush	X	X	X	May 10 to August 31

Source: USFWS 2021b.
Legend: MOA = Military Operation Area.

3.3.3 Environmental Consequences

This analysis focuses on wildlife that are important to the function of the ecosystem or are protected under federal or state law or statute.

Many animal species use sound to communicate, to detect prey and avoid predation. Noise can mask communication, cause behavioral changes, interfere with daily cycles, and can cause stress (Shannon et al. 2016). Increased noise levels reduce the distance and area over which animals can perceive important acoustic signals (Barber et al. 2009). The potential for external noise to mask these important signals is of greater concern for continuous and near continuous noise sources than for intermittent brief noise exposures such as military jet overflight.

Other potential impacts associated with noise may include stress and hypertension; behavioral modifications; interference with mating or reproduction; and impaired ability to obtain adequate food, cover, or water. Other environmental variables (e.g., predators, weather, changing prey base, ground-based disturbance) confound the ability to identify the ultimate factor in limiting productivity of a certain nest, area, or region (Smith et al. 1988). Overall, the literature suggests that species differ in their response to various types, duration, and sources of noise; and that, response of unconfined wildlife and domestic animals to aircraft overflight under most circumstances has minimal biological significance (Manci et al. 1988; Radle 2007; Shannon et al. 2016).

A 1997 review revealed that the noise produced by an aircraft plays a minor role in disturbance to animals when the animal cannot see the aircraft. This was illustrated in examples of nearly soundless paragliders causing panic flights (Kempf and Huppop 1997). This research indicated that aircraft noise can cause startle responses; but the severity of response depends on the animal's previous exposure to the noise source and does not result in severe consequences. These authors felt that aside from the rare panic flights causing accidents, negative consequences of aircraft noise on individuals and populations are not proven (Kempf and Huppop 1997).

Although concerns listed above have been raised in the literature and examples have been documented, studies of unconfined wildlife and domestic animals to overflight by military jet aircraft at 500 feet AGL or higher have not shown measurable changes in population size or reproductive success at the population level or other significant biological impact under normal conditions.

3.3.3.1 No Action Alternative

Under the No Action Alternative, no new permanent MOAs would be established and enhanced training for Marine Corps' pilots would not occur. There would be no change to biological resources in the area.

3.3.3.2 Alternative 1: Establish Pamlico C and D MOAs, and Expand Hatteras F MOA (Preferred Alternative)

Training within the proposed MOAs could potentially disturb wildlife residing beneath the airspace; however, any disturbance would not be significant. The MOAs would support a variety of training activities involving various aircraft types, speeds, and maneuvers within various altitudes, with the resulting noise spread across a vast area comprised of several counties. The proposed training is episodic, and would not create a consistent, significant noise source in any one location. In addition, the

average DNL throughout the Pamlico C and D MOAs and the Hatteras F MOA from all the proposed aircraft operations would be 41, <35, and 48 DNL, respectively (see **Table 3.2-2, Section 3.3.3.2**). Collectively, this low DNL, coupled with the episodic nature of the training over a large geographic area at heights above 3,000 feet results in no significant impact to wildlife from the Proposed Action.

While a rare event due to size of MOAs and height and frequency of operation, there is the possibility that wildlife could be subjected to a very brief direct overflight and experience a peak noise level (L_{max}) of 103 dB (an F-35B or F-18 in the Hatteras F MOA), 90 dB (an F-18 in the Pamlico C MOA), and 86 dB (an F-18 or F-35 in the Pamlico D MOA). Exposure to these peak noise levels would last only a few seconds and the animal would need to be directly beneath the flight path to experience this level of noise as the noise reduces drastically the further the animal is from the flight path. Finally, even at 103 dB, no harm is anticipated as damage to hearing only occurs at levels over 140 to 150 dB (Bowles 1995).

Potential impacts to the federally protected mammal and bird species as well as waterfowl and other migratory birds at the NWRs and throughout the MOAs would be disturbance from noise. However, as identified for wildlife generally, the large geographic area coupled with the episodic nature of any training at levels above 3,000 feet at high rates of speed, result in no significant impacts to any listed species within the MOAs.

Bats. Potential disturbance to bats would occur in the hours of dusk when bats would be foraging and potentially exposed to nighttime aircraft operations. Aircraft operations would not physically damage, remove, or otherwise impact habitat or hibernacula for the Northern Long-eared bat. The Northern Long-eared bat primarily forages in the understory of forested areas and would not occur at altitudes where the proposed MOAs would exist. The bat's response to aircraft noise would include startle or alerting to the noise source (Dufour 1980). Another concern would be masking of echolocation pulses that could disrupt flight or foraging. A study on New Zealand long-tailed bats found that low-level aircraft activity did not mask echolocation pulses. There were no statistically significant differences in mean bat activity during and after overflights compared with pre-aircraft activity (Le Roux and Waas 2012). While the proposed operations within the MOAs would create a noise disturbance for bats, this disturbance is expected to be intermittent and minor. Therefore, the aircraft activity within the proposed MOAs would have no effect on the Northern Long-eared bat.

Mammals. Sound levels above 90 dB may impact mammals and may be associated with a number of behaviors such as retreat from the sound source, freezing, or a strong startle response (Manci et al. 1988). Early studies of terrestrial mammals showed that noise levels of 120 dB could damage mammals' ears, and levels of 95 dB could cause temporary loss of hearing acuity. It has been speculated that repeated aircraft overflight (e.g. surveillance flights along a pipeline) could affect large carnivores such as grizzly bears by causing changes in home ranges, foraging patterns, and breeding behavior (Dufour 1980). These possible effects have not been borne out in subsequent studies, and Bowles et al. (1995) indicated that acute exposure to noise only damaged an animals' hearing at levels above 140 dB. Incidental observations of wolves and bears exposed to fixed-wing aircraft and helicopters indicated a stronger reaction to helicopters. Wolves were less disturbed by helicopters than wild ungulates, while individual grizzly bears showed the greatest response of any animal species observed (Manci et al. 1988). The intermittent noise associated with the aircraft operations within the proposed MOAs would

be a negligible disturbance to mammals beneath the MOAs. Therefore, the aircraft activity within the proposed MOAs would have no effect on the Red Wolf.

Birds. Most concerns related to the effects of noise on birds involve the masking of communications among members of the same species, reducing the detectability of biologically relevant signals including the sounds of predators and prey, and temporarily or permanently decreasing hearing sensitivity (Dooling and Popper 2007). A study of captive zebra finches given a choice of foraging in noisy and quiet areas found no significant difference in the amount of time birds spent in noisy and quiet areas though those foraging in noisy areas spent more time being vigilant, resulting in less efficient foraging than those in quiet areas (Evans et al. 2018). Given the expected minor noise exposure within each of the MOAs, the proposed aircraft operations would have a negligible impact on birds in the region of influence. Therefore, the aircraft activity within the proposed MOAs would have no effect on the Red-cockaded Woodpecker, Eastern Black Rail, Piping Plover, or Red Knot.

Waterfowl. The USFWS Waterfowl management Handbook (Korschgen and Dahlgren 1992) lists "loud noise" caused by aircraft as the top disturbance category for waterfowl. Several studies showed that migratory waterfowl expend more energy when exposed to repeated aircraft overflights, at least in the short-term (Bowles 1995). Waterfowl are sensitive to disturbance because of their aggregation into large flocks during their migration and overwintering. When at rest, the flocks are typically in water bodies or wetlands exposed to the open sky and subject to aerial and ground predation. Taking flight is their defense against either type of predation. Waterfowl flocks seem to be as sensitive as their most responsive individual in the flock, so that larger flocks would have a greater chance of responding than small flocks (Bowles 1995).

The altitudes of migrating birds vary with winds, weather, terrain elevations, cloud conditions, and other environmental variables. Over 90 percent of reported bird strikes occur at or below 3,000 feet AGL but strikes at higher altitude are common during migration. Ducks and geese have been observed up to 7,000 feet AGL (FAA 2021). Due to the danger to aircraft and aircrews posed by potential collisions with waterfowl and other flocking birds, Bird Aircraft Strike Hazard (BASH) has received much attention by the military. BASH programs exist at every installation where there is an active flying mission and areas where low-level aircraft flight training takes place. BASH programs identify locations of seasonal concentrations of waterfowl and provide guidance for pilots with regard to elevational or lateral separation from these sites at specific seasons and times of day to avoid or minimize the potential for collision. This avoidance in turn reduces the potential for disturbance of migratory birds and waterfowl concentrations by military aircraft overflight. Adhering to existing BASH procedures along with a proposed floor of the MOAs in higher altitudes where it is less likely to encounter migrating birds (3,000 feet, 8,000 feet, and 10,000 feet MSL) would result in negligible impacts to migratory birds. The proposed aircraft activity within the MOAs would not result in a take or otherwise disturb migratory birds.

The proposed aircraft operations within any of the MOAs would have no effect on the federally protected species residing beneath the MOAs and, as such, no formal consultation between the Marine Corps and USFWS is required.

3.3.3.3 Alternative 2: Establish Pamlico C MOA and Expand Hatteras F MOA

The noise associated with proposed operations in Pamlico C MOA and the expanded Hatteras F MOA and thus the potential impacts to biological resources beneath those MOAs would be the same as described in Alternative 1, **Section 3.3.3.2**. While the geographic area exposed to noise would be less under Alternative 2, the potential species exposed to that noise would be the same as those described in Alternative 1. As such, implementation of Alternative 2 would not result in significant impacts to biological resources.

3.3.4 Other Reasonably Foreseeable Actions

Other reasonably foreseeable planned actions relevant to cumulative effects on biological resources include planned airspace proposals contiguous with the Cherry Point OPAREA (see **Section 3.1.4** for detailed descriptions). Like with the proposed MOAs in this EA, military operations in the foreseeable airspace proposals would generate noise that would have the potential to disturb wildlife beneath the airspace. As described in **Section 3.2.4**, the Alert Area (A-530) currently experiences military operations and changing this to a restricted area would likely have minor changes to the noise environment. The other foreseeable proposal would establish a restricted area to fill the small gap between existing R-5303, R-5304, and R-5306, the new land area exposed to noise would be minimal and it is expected the noise impact would be relatively minor since this area is already surrounded by existing restricted airspace used for military training. As such, the proposed aircraft operations within the proposed MOAs addressed in this EA and the reasonably foreseeable proposals would not have a cumulative impact to biological resources.

3.4 Cultural Resources

The discussion of cultural resources includes archaeological sites, architectural resources, and traditional cultural properties. Archaeological resources (prehistoric and historic) are locations where human activity measurably altered the earth or left deposits of physical remains. Architectural resources include standing buildings, structures, landscapes, and other built-environment resources of historic or aesthetic significance. Traditional cultural properties may include archaeological resources, structures, neighborhoods, prominent topographic features, habitat, plants, animals, and minerals that Native Americans or other groups consider essential for the preservation of traditional culture.

3.4.1 Regulatory Setting

Cultural resources is an inclusive label used to encompass any historic properties or traditional cultural properties and sacred sites valued by traditional communities (most often associated with Indian Tribes). Cultural resources are finite, nonrenewable resources, whose salient characteristics are easily diminished by physical disturbance; certain types of cultural resources also may be negatively affected by visual, auditory, and atmospheric intrusions. Historic properties are defined in the federal regulations outlining Section 106 of the National Historic Preservation Act (NHPA), as amended (54 U.S.C. 306108 et seq.), 36 CFR 800, as prehistoric and historic sites, buildings, structures, districts, or objects listed or eligible for listing in the National Register of Historic Places (NRHP), as well as artifacts, records, and remains related to such properties. Compliance with Section 106 of the NHPA, which directs federal agencies to consider the effect of a federal undertaking on a historic property, is outlined in the Advisory

Council on Historic Preservation's regulations, Protection of Historic Properties (36 CFR 800). A traditional cultural property can be defined generally as one that is eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community.

To be eligible for the NRHP, a property must possess integrity of location, design, setting, workmanship, feeling, and association, and meet the following criteria for evaluation in at least one area of significance as defined by the Secretary of the Interior's Standards for Evaluation (36 CFR 60). In addition to historic significance, a cultural resource must also retain integrity, which is the ability to convey said historic significance. The NRHP criteria recognize seven aspects of integrity: location, design, setting, materials, workmanship, feeling, and association. A resource must retain several, if not all of these aspects, to be considered eligible for listing in the NRHP. Information on cultural resources within the affected environment was derived from conducting background research to identify NRHP and the State Register of Historic Places properties beneath the affected airspace.

Government-to-government consultation with federally-recognized Tribal Nations is required per Executive Order 13175: *Memorandum on Government-to-Government Relations with Native American Tribal Governments*; DoD Instruction 4710.02: *DoD Interactions with Federally-Recognized Tribes*; Marine Corps Order 5090.2-Volume 8: *Cultural Resources Management;* and the NHPA implementing regulations at 36 CFR Part 800(f)(2).

3.4.2 Affected Environment

The affected environment for cultural resources is based on the establishment of the area of potential effects (APE) of an undertaking. An APE is defined in 36 CFR 800.16(d) as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist." For this Proposed Action, the Marine Corps determined that the APE is defined as the lands beneath the proposed Pamlico C and Pamlico D MOAs and expanded Hatteras F MOA that would be potentially exposed to noise and visual intrusions from military aircraft operations.

Table 3.4-1 provides a summary of the historic properties listed in the NRHP beneath each MOA. For a detailed list, refer to the correspondence between the Marine Corps and North Carolina State Historic Preservation Office (SHPO) provided in **Appendix A**. No archaeological sites listed in the NRHP are located beneath the proposed MOAs.

Table 3.4-1. Summary of Historic Properties beneath MOAs

Airspace	*Number of Listed Properties*	*Resource Type(s)*
Pamlico C MOA	7	Building; Structure
Pamlico D MOA	74	Building; Historic District; Object; Site; Structure
Hatteras F MOA	5	Building; Historic District

Source: National Register Information System.
Legend: MOA = Military Operation Area.

The Marine Corps has identified the Tuscarora Nation and the Catawba Indian Nation as federally-recognized tribes that may have cultural, historic, and/or religious affiliation to lands beneath the proposed MOAs. Available records indicate there are no sacred sites or traditional cultural properties beneath the proposed MOAs. However, the Marine Corps consulted with these tribes to determine if there are any issues or areas of concern within the APE. As of publication of the Draft EA, no concerns have been expressed by either Tribe. Correspondence between the Marine Corps and these Tribes is provided in **Appendix A**.

3.4.3 Environmental Consequences

The regulations implementing Section 106 of the NHPA require that federal agencies consider the effects (impacts) of their undertakings (proposed actions) on historic properties (cultural resources). Impacts to cultural resources are considered significant if a historic property, as defined in 36 CFR 60.4, would include physically altering, damaging, or destroying all or part of a resource, altering characteristics of the surrounding environment that contribute to the importance of the resource, introducing visual, atmospheric, or audible elements that are out of character for the period the resource represents (thereby altering the setting), or neglecting the resource to the extent that it deteriorates or is destroyed. Only those cultural resources that would reasonably be affected by noise and visual impacts were included in the analysis. These include architectural resources, archaeological resources with standing structures, and traditional cultural properties.

3.4.3.1 No Action Alternatives

Under the No Action Alternative, no new permanent MOAs would be established and enhanced training for Marine Corps' pilots would not occur. There would be no change to cultural resources in the area.

3.4.3.2 Alternative 1: Establish Pamlico C and D MOAs, and Expand Hatteras F MOA (Preferred Alternative)

Under Alternative 1, military training would be dispersed throughout the proposed MOAs and occur above 8-10,000 feet MSL (in proposed Pamlico C and D MOAs) or above 3,000 feet MSL (in proposed Hatteras F MOA). There would be no ground disturbing activities on lands beneath the proposed MOAs so the training would not physically impact any historic properties. Likewise, the military training would not be expected to have a visual impact given the altitudes where training would occur (refer to **Figure 3.1-1**, at the lowest proposed altitude the aircraft would cover only 0.01% of the field of vision from an observer on the ground). Military aircraft are routinely present in eastern North Carolina and would not represent a new visual impact in this area. Therefore, the potential effects to historic properties would be limited to noise exposure from military aircraft training in the MOAs.

The predicted (subsonic) noise exposure from military aircraft training within the MOAs is described in **Section 3.2**, *Noise* and detailed in **Appendix C**. The training in the MOAs would be widely dispersed in the MOAs (which geographically cover several counties) and would not be a continuous source of noise. An individual historic property beneath any of the MOAs would not be exposed to repetitive or even daily aircraft operations. Based on the proposed training, the MOAs are expected to be activated less than 3 hours per weekday in the Pamlico C MOA and less than 1 hour per weekday in the Pamlico D and Hatteras F MOAs (weekend activation would be rare in any of the MOAs). The cumulative noise

exposure would range from <35 DNL in the Pamlico D MOA to 48 DNL in the expanded Hatteras F MOA. Based on these results, the noise associated with the proposed aircraft operations would be below the level established by the U.S. Environmental Protection Agency to protect public health and safety as well as the FAA threshold for significant noise impacts (see **Section 3.2**).

The noise analysis for this Proposed Action also included an analysis of supplemental metrics to better describe the loudness of a single overflight at the lowest proposed altitudes within each MOA (see **Section 3.2**). The peak noise exposure in the Pamlico C, Pamlico D, and Hatteras F MOAs is estimated to be 90 dB, 86 dB, and 103 dB, respectively. As expected, aircraft at the lowest proposed altitude (3,000 feet) would produce the loudest noise. Also, these values represent outside noise. Outdoor-to-indoor noise level reduction provided by a building ranges from 25 dB (windows closed) to 15 dB (windows open).

Normally, the most sensitive components of a structure to noise are the windows and, infrequently, the plastered walls and ceilings. Conservatively, only sound lasting more than one second above a sound level of 130 dB are potentially damaging to structural components (Committee on Hearing, Bioacoustics, and Biomechanics 1977). Noise induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations or rattling of objects within the dwelling. Windowpanes may also vibrate noticeably when exposed to high levels of airborne noise. Sound levels from normal aircraft operations are typically much less than 130 dB. Even sound from low-altitude flyovers of heavy aircraft do not reach the potential for damage (Sutherland et al, 2000). Since the highest Lmax of a single overflight under this proposal would be 103 dB, structural damage and secondary vibration impacts are not expected to occur with this Proposed Action.

As described above, implementation of Alternative 1 would have no effect on historic properties or other cultural resources.

3.4.3.3 Alternative 2: Establish Pamlico C MOA and Expand Hatteras F MOA

Under Alternative 2, 12 properties listed on the NRHP would be exposed to military aircraft operations (see **Table 3.4-1**). The potential impacts to cultural resources beneath the Pamlico C MOA and the expanded Hatteras F MOA would be the same as described for Alternative 1, **Section 3.4.3.2**. Implementation of Alternative 2 would have no effect on historic properties or other cultural resources.

3.4.4 Other Reasonably Foreseeable Actions

Other reasonably foreseeable planned actions relevant to cumulative effects on cultural resources include planned airspace proposals contiguous with the Cherry Point OPAREA (see **Section 3.1.4** for detailed descriptions). The other planned airspace proposals would have the potential to create a noise or visual disturbance to cultural resources, however, that disturbance would be concentrated in the area directly beneath those airspace boundaries. As described in Section 3.2.4, the Alert Area (A-530) is currently used for military operations and changing this to a restricted area would likely have minor changes to the noise environment. The other foreseeable proposal would establish a restricted area to fill the small gap between existing R-5303, R-5304, and R-5306, the new land area exposed to noise would be minimal. These reasonably foreseeable proposals would be contiguous with the existing

Cherry Point OPAREA and operations within these areas would not create a new visual disturbance to any cultural resource located beneath the airspace. As such, the proposed aircraft operations within the proposed MOAs addressed in this EA and the reasonably foreseeable proposals would not have a cumulative impact to cultural resources.

3.5 Environmental Justice

USEPA defines environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (USEPA 2014).

3.5.1 Regulatory Setting

Consistent with EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994) and D*oD Strategy on Environmental Justice* (March 24, 1995), the Marine Corps' policy is to identify and address any disproportionately high and adverse human health or environmental effects of its actions on minority and low-income populations.

3.5.2 Affected Environment

The proposed MOAs would overlie portions of several counties in eastern North Carolina. The region of influence for environmental justice considerations includes all counties under the MOAs. The demographic analysis of minority and low-income populations is conducted at the county level since all communities beneath the MOAs would have the same potential for exposure to aircraft overflights and the populations within each county would be similarly affected. The total population, as well as the minority population and low-income persons for each county is provided in **Table 3.5-1.** For comparison, the same statistics are provided for the state of North Carolina. For the purposes of this evaluation, minority refers to people who identify themselves in U.S. Census as Black or African American, Asian, or Pacific Islander, American Indian or Alaskan Native, other non-White races, or as being of Hispanic or Latino origin. Persons of Hispanic and Latino origin may be of any race (CEQ 1997). The CEQ identifies these groups as minority populations when either 1) the minority population of the affected area exceeds 50 percent, or 2) the minority population percentage in the affected area is meaningfully greater than the minority population percentage in the general population or appropriate unit of geographical analysis. Low-income is determined by dollar-value thresholds that vary by family size and compositions. If a family's total income is less than the dollar-value of the appropriate threshold, then that family and every individual in it are considered low-income. A county population is considered low-income if the percentage of low-income persons is meaningfully greater than the percentage of low-income persons in the reference area of the state of North Carolina.

Pamlico C MOA overlies portions of Hyde, Tyrrell, Washington, and Beaufort counties. Pamlico D MOA overlies portions of Beaufort, Washington, Bertie, Martin, Pitt, Craven, Pamlico, Jones, and Onslow counties. Hatteras F MOA overlies portions of Onslow, Jones, and Pender counties. As shown, Bertie and Washington counties are over 50 percent minority. All the counties, except for Onslow and Pender, have a higher percentage of low-income persons than the state-level data.

Table 3.5-1. Total Population and Environmental Justice Considerations within Region of Influence			
Associated Counties	***Total Population***	***Minority (Percent)***	***Persons in Poverty (percent)***
North Carolina	10,488,084	29.4	13.6
Beaufort	46,994	28.0	17.6
Bertie	18,947	63.9	24.2
Craven	102,139	28.2	13.8
Hyde	4,937	29.9	19.2
Jones	9,419	32.9	18.8
Martin	22,440	44.7	20.6
Onslow	197,938	23.8	12.5
Pamlico	12,726	22.3	15.9
Pender	63,060	18.5	11.5
Pitt	180,742	40.8	19.2
Tyrrell	4,016	43.2	25.4
Washington	11,580	52.2	21.3

Source: U.S. Census Bureau 2020.

3.5.3 Environmental Consequences

This analysis focuses on whether the Proposed Action results in a disproportionate impact to minority or low-income populations groups to the projected adverse consequences discussed in the previous sections of this chapter.

3.5.3.1 No Action Alternative

Under the No Action Alternative, no new permanent MOAs would be established and enhanced training for Marine Corps' pilots would not occur. There would be no affect to environmental justice.

3.5.3.2 Alternative 1: Establish Pamlico C and D MOAs, and Expand Hatteras F MOA (Preferred Alternative)

The study area for environmental justice analysis is defined as communities beneath the proposed MOAs. The potential impact to these communities would be exposure to aircraft noise. Based on the proposed sorties, the MOAs are expected to be activated less than 3 hours per weekday in the Pamlico C MOA and less than 1 hour per weekday in the Pamlico D and Hatteras F MOAs (weekend activation would be rare in any of the MOAs). The predicted noise associated with the proposed aircraft operations would be minor and range from <35 dB DNL in the Pamlico D MOA to 48 dB DNL in the Hatteras F MOA. The U.S. Environmental Protection Agency has identified 55 dB DNL as a level that protects public health and welfare with an adequate margin of safety. As identified in **Section 3.2.3**, no significant noise impacts would result from the Proposed Action.

As there are no significant noise impacts to any population, there cannot be a disproportionate impact to minority or low-income populations within the area of the Proposed Action. Implementation of Alternative 1 would not cause disproportionately high and adverse human health or environmental effects on any minority or low-income populations.

3.5.3.3 Alternative 2: Establish Pamlico C MOA and Expand Hatteras F MOA

The noise associated with proposed operations in Pamlico C MOA and the expanded Hatteras F MOA and thus the potential impacts to environmental justice populations beneath these MOAs would be the same as described in Alternative 1, **Section 3.5.3.2**. Implementation of Alternative 2 would not cause disproportionately impacts on any minority or low-income populations.

3.5.4 Other Reasonably Foreseeable Actions

Other reasonably foreseeable planned actions relevant to cumulative effects on environmental justice include planned airspace proposals contiguous with the Cherry Point OPAREA (see **Section 3.1.4** for detailed descriptions). The other planned airspace proposals would have the potential to create a noise disturbance to communities beneath that airspace, however, that disturbance is expected to be relatively minor (see **Section 3.2.4**). As there are no expected significant noise impacts to any population, there cannot be a disproportionate impact to minority or low-income populations. As such, the proposed aircraft operations within the proposed MOAs addressed in this EA and the reasonably foreseeable proposals would not have a cumulative impact or disproportionate impacts to minority or low-income populations.

4. Other Considerations Required by NEPA

4.1 Irreversible or Irretrievable Commitments of Resources

NEPA requires that environmental analysis include the identification of any irreversible and irretrievable commitments of resources that would be involved if the Proposed Action is implemented. Resources that are irreversibly or irretrievably committed to a project are those that are used on a long-term or permanent basis. This includes the use of nonrenewable resources such as metal and fuel, and natural or cultural resources. Another impact that falls under this category is the unavoidable destruction of natural resources that could limit the range of potential uses of that particular environment.

The Proposed Action would involve establishment of SUA to support Marine Corps training needs. There would be no irreversible or irretrievable commitment of resources. Likewise, there would be no unavoidable destruction of natural resources.

4.2 Unavoidable Adverse Impacts

NEPA requires a description of any significant impacts resulting from implementation of a proposed action, including those that can be mitigated to a less than significant level. Based on the analysis in this EA, the Proposed Action would not result in any significant or unavoidable adverse impacts to any resource area. As such, no mitigation actions are required.

4.3 Relationship between Short-Term Use of the Environment and Long-Term Productivity

NEPA requires an analysis of the relationship between a project's short-term impacts on the environment and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This refers to the possibility that choosing one development site reduces future flexibility in pursuing other options or other uses at that site.

The Proposed Action would involve establishment of SUA to support Marine Corps training needs. While establishing these areas would limit non-military use of the airspace during times the MOAs are active, this impact would not be significant (see **Section 3.1.3**, Airspace Environmental Consequences) or impact the long-term productivity of the area.

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6. List of Preparers

This EA was prepared collaboratively between the Navy, Marine Corps, and contractor preparers. The FAA was a cooperating agency and their representatives participated in the review and development of the EA.

U.S. Department of the Navy

Angela Peyton, Naval Facilities Engineering Command, Mid-Atlantic
Contracting Officer's Representative, Lead Environmental NEPA Planner

Marine Corps

Jessi Baker, Marine Corps Installations East – Marine Corps Base Camp Lejeune
NEPA Planner

Mark Eadie, Marine Corps Installations East
Regional Airspace Coordinator, Aviation Plans and Policies

John Stuebe, Marine Corps Installations East – Marine Corps Base Camp Lejeune

NEPA Planner Contractors

Dana Banwart, AICP
B.S. in Biology
Years of Experience: 23
Project Manager

Michael Harrison
M.S. in Environmental Science
Years of Experience: 22do
Noise, GIS

Elizabeth Burak
M.S. in Biology
Years of Experience: 25
Biological Resources

Geoffrey Olander
B.S. Mechanical Engineering
Years of Experience: 30
Noise, Airspace

Oliver Pahl
B.S. Environmental Economics, Policy and Management
Years of Experience: 11
Environmental Justice

Isla Nelson
B.A. Anthropology

Years of Experience: 20
Cultural Resources

Steve Wenderoth
Juris Doctor, Environmental Law
Years of Experience: 32
Senior Legal Review, Quality Assurance/Quality Control

Sharon Simpson
B.S. in Professional Writing
Years of Experience: 19
Technical Editor

Appendix A
Interagency Coordination and Government-to-Government Consultation

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UNITED STATES MARINE CORPS
MARINE CORPS INSTALLATIONS EAST-MARINE CORPS BASE
PSC BOX 20005
CAMP LEJEUNE NC 28542-0005

5090.12
G-F/BEMD
June 16, 2022

Chief William Harris
Catawba Indian Nation
996 Avenue of the Nations
Rock Hill, SC 29730

Dear Chief Harris:

The United States Marine Corps (USMC) is preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts associated with an increase of permanent Special Use Airspace (SUA) within the Cherry Point operating area (OPAREA). The increased SUA would provide a larger contiguous, over-land airspace with appropriate altitudes to address existing SUA shortfalls and provide a more realistic training environment. Under the Proposed Action, the USMC seeks to establish the Pamlico C Military Operations Area, the Pamlico D Military Operations Area, and to expand the existing Hatteras F Military Operations Area contiguous with the existing Cherry Point OPAREA (Enclosure 1). A Military Operations Area (MOA) is a type of SUA with defined spatial boundaries within the National Airspace System designated to contain non-hazardous, military flight activities, to include high-speed aerial combat maneuvers. Since these types of activities may not be completely compatible with non-military aviation, they are only conducted in MOAs designated by the Federal Aviation Administration. The Federal Aviation Administration is a cooperating agency for this EA.

The purpose of this letter is to initiate government-to-government consultation pursuant to Executive Order 13175: *Memorandum on Government-to-Government Relations with Native American Tribal Governments* and pursuant to the terms of Section 306108 (formerly known as Section 106) of the National Historic Preservation Act (NHPA) of 1966, as amended and its implementing regulations at 36 CFR Part 800, with your Tribal Nation on lands beneath the proposed MOAs.

The Proposed Action

The Proposed Action is to increase the SUA available to support essential USMC aviation training, the USMC seeks to establish the Pamlico C MOA, the Pamlico D MOA, and to expand the Hatteras F MOA contiguous with the existing Cherry Point OPAREA. The proposed MOAs would be used to support critical training for USMC assets as well as United States (U.S.) Navy and U.S. Air Force pilot training for the AV-8B, F-35B/C, F-15E, F-16, and FA-18. The proposed training consists of one or multiple aircraft performing aerial maneuvers similar to those required in actual combat and other missions. The aerial training in the proposed MOAs would not include supersonic flight, the release of explosive ordnance, use of defensive countermeasures (chaff and flares), or result in ground disturbance to any of the land beneath the MOAs.

Training in the proposed MOAs would be similar to aerial training that already occurs in the existing Cherry Point OPAREA. The training spectrum

includes individual practice for a single aircraft up through larger, complex scenarios with multiple aircraft that would be coordinated with ground forces stationed at existing ground ranges aboard Marine Corps Base Camp Lejeune. During these larger, coordinated training events, the aircraft remain within the confines of a MOA. The proposed MOAs, in conjunction with existing restricted airspace areas and surface ranges, would allow for run-ins, separation, and practicing various tactics with attack and supporting aircraft. The proposed MOAs would provide the larger contiguous area necessary for these complex types of training, allowing for a range more representative of those expected in real-world combat.

The training within a MOA is reported by annual sorties. A sortie is the takeoff, mission, and landing of one aircraft. A single aircraft training within a MOA would count as 1 sortie. For the larger, more complex training scenarios with multiple aircraft the sortie count would be dependent on the total number of aircraft, that is, multiple sorties could occur at the same time.

The Proposed Action does not include changes to infrastructure or personnel, airfield or runway operations (frequency or types of aircraft), aircraft inventory or squadron assignments, nor ground disturbance to land beneath any of the airspace. The Area of Potential Effects (APE) for this undertaking is therefore defined as the lands and communities beneath the proposed Pamlico C and Pamlico D MOAs and the expansion of the Hatteras F MOA that could be disturbed or impacted by the aircraft noise (see Enclosure 1).

Alternative 1

Under Alternative 1, the Pamlico C and D MOAs would be established, and the existing Hatteras F MOA would be expanded to surround existing restricted areas (denoted on aeronautical charts as R-5303 and R-5304). The three areas proposed as MOAs have been previously used to support training and operations on a temporary basis. The proposed MOAs would be used individually and in conjunction with existing SUA for aerial training as described above.

The proposed Pamlico C MOA would have vertical dimensions of 8,000 feet mean sea level (MSL) up to but not including Flight Level 180 (FL180), which is approximately 18,000 feet. The proposed annual sorties within the Pamlico C MOA would be 1,070 with 25 percent occurring during the hours of darkness.

The proposed Pamlico D MOA would have vertical dimensions of 10,000 feet MSL up to but not including FL180. The proposed annual sorties within the Pamlico D MOA would be 290 with 25 percent occurring during the hours of darkness.

As proposed, the existing Hatteras F MOA would be expanded to surround and overlap existing R-5303 and R-5304. The expanded Hatteras F MOA would have the same vertical dimensions as the existing MOA, 3,000 feet MSL up

to but not including FL180. The proposed annual sorties within the Hatteras F MOA would be 450 with 20 percent occurring during the hours of darkness.

Alternative 2

Under Alternative 2, only the Pamlico C MOA and the expanded Hatteras F MOA would be established. The proposed sorties within these MOAs would be the same as described for Alternative 1: 1,070 annual sorties in Pamlico C MOA and 450 annual sorties in Hatteras F MOA. The Pamlico D MOA would not be established, and the USMC would lose its additional training capability of supporting larger, complex training scenarios.

No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur. Neither the Pamlico C nor D MOAs would be established, and the Hatteras F MOA would remain unchanged.

Historic Properties Located Under the Airspace

Based on a search using the National Register of Historic Places (NRHP), seven NRHP-listed historic properties are located beneath the proposed Pamlico C MOA; seventy-four NRHP-listed historic properties are located beneath the proposed Pamlico D MOA; and five, NRHP-listed historic properties are located beneath the proposed Hatteras F MOA (NPS 2021). These historic properties include various historic architectural resources, including buildings, structures, objects, and historic districts, but no potentially impacted archaeological resources. Per the background research conducted for this proposed undertaking, no archaeological sites that are listed in the NRHP are located on lands beneath the proposed MOAs.

Effects Analysis

Military training would be dispersed throughout the proposed airspace and occur within the confines of the MOA; above 8-10,000 feet MSL (in proposed Pamlico C and D MOAs) or above 3,000 feet MSL (in proposed Hatteras F MOA). The training would not be a visual impact given the altitudes where training would occur. As illustrated in the figure in Enclosure (2), even at the lowest proposed altitude the aircraft would cover only 0.01% of the field of vision from an observer on the ground. Military aircraft and civilian aircraft are routinely present in eastern North Carolina and would not represent a new visual impact; likewise, the areas proposed for MOAs are currently used on a temporary basis for military training. There would be no release of explosive ordnance or defensive countermeasures (chaff and flares) and no ground disturbing activities would occur on lands beneath the proposed MOAs. Therefore, the potential effects to historic properties would be limited to noise exposure from military aircraft training within the MOAs.

The noise associated with aircraft operations can be subsonic or supersonic. Subsonic noise is noise generated by an aircraft's engines and airframe. Supersonic noise is the noise generated when an aircraft flies faster than the speed of sound and has the potential to create sonic booms. Supersonic operations are not proposed within the MOAs and no sonic booms would occur; thus, the effects analysis evaluates subsonic noise. Training within a MOA does not follow designated patterns or routes but rather occurs somewhat randomly throughout the designated volume of SUA (which geographically covers several counties). An individual historic property beneath any of the MOAs would not be exposed to repetitive or daily aircraft operations and these operations would happen in a variety of altitudes from the floor to ceiling of the MOA.

A Noise Analysis was prepared for this action, using the Department of Defense prescribed suite of software programs (known as NOISEMAP), to predict the noise exposure from military aircraft activity. The software model inputs include the type of aircraft to be flown, power settings, and time spent at specified altitude bands. Based on the proposed aircraft training, the MOAs are expected to be activated less than 3 hours per weekday in the Pamlico C MOA and less than 1 hour per weekday in the Pamlico D and Hatteras F MOAs (weekend activation would be rare in any of the MOAs).

The U.S. Government standard for assessing community noise impacts is the noise metric known as the Day-Night Level (DNL), reported in decibels (dB). The DNL is an A-weighted cumulative noise metric that measures noise based on annual average daily aircraft operations. The U.S. Environmental Protection Agency (USEPA) has identified 55 DNL as a level that protects public health and welfare with an adequate margin of safety (USEPA 1982). This means that 55 DNL is a threshold below which adverse noise effects are not expected to occur. With respect to land-use, noise exposure greater than 65 DNL is considered generally incompatible with residential, public use (i.e., schools), or recreational and entertainment areas (Federal Interagency Committee on Urban Noise 1980). As determined in the Noise Analysis, the noise associated with the proposed military aircraft operations would range from <35 DNL in the Pamlico D MOA to 48 DNL in the expanded Hatteras F MOA. Therefore, the noise associated with military aircraft training within the MOAs is not expected to have a significant noise impact to the historical properties or any persons at these properties.

While DNL is the standard metric for assessing the significance of noise impacts, supplemental metrics are used to produce more detailed noise exposure information for the decision process and to improve communication with the public and stakeholders. Supplemental metrics are not intended to replace the DNL metric as the primary descriptor of cumulative noise exposure, but rather are useful tools to supplement the impact information disclosed by the DNL metric. For this proposed action, the Noise Analysis also included an analysis of the peak noise exposure to better describe the loudness of a single overflight event at the lowest proposed altitude (the floor) in each MOA (3,000 feet in Hatteras F, 8,000 feet in Pamlico C, and 10,000 feet in Pamlico D). In general, during

training events aircraft do not travel substantial distances on the floor of the MOA, but rather start at the floor and quickly climb to higher altitudes so the peak exposures reported in the Noise Analysis are not expected to occur frequently and would only last for a few seconds or less. It is estimated that aircraft would operate in the lowest altitude bands of each MOA for only 10 to 15 percent of the training time. The peak noise exposure in the Pamlico C, Pamlico D, and Hatteras F MOAs is estimated to be 90 dB, 86 dB, and 103 dB, respectively. As expected, aircraft at the lowest proposed altitude (3,000 feet) produce the loudest noise. Also, these values represent outside noise. Outdoor-to-indoor noise level reduction provided by a building ranges from 25 dB (windows closed) to 15 dB (windows open).

Normally, the most sensitive components of a structure to noise are the windows and, infrequently, the plastered walls and ceilings. Conservatively, only sound lasting more than one second above a sound level of 130 dB are potentially damaging to structural components (Committee on Hearing, Bioacoustics, and Biomechanics 1977). Noise-induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations or rattling of objects within the dwelling. Windowpanes may also vibrate noticeably when exposed to high levels of airborne noise. In general, such noise-induced vibrations occur at peak sound levels of 110 dB or greater. The maximum peak sound exposure of a single overflight at the lowest possible altitude (3,000 feet) for this proposed action would be 103 dB; therefore, structural damage and secondary vibration impacts are not expected to occur with this proposed action.

Available records do not indicate any sacred sites or Traditional Cultural Properties in the APE of the Proposed Action. Based on our evaluation of currently known historic properties data for the proposed APE, we have applied the Assessment of Adverse Effects (36 CFR Part 800.5) to the proposed undertaking, and have determined that the project described herein will not result in an adverse effect to historic properties. In this regard, the USMC is seeking your input in order to ensure that we have adequately identified historic properties that may be of religious and cultural significance to the Catawba Indian Nation.

In order to support our anticipated project timeline, the USMC would greatly appreciate receiving your input and comments on the proposed undertaking within forty-five (45) calendar days of your receipt of this letter. We respectfully request your input regarding our determination of no adverse effect as part of the Section 106 consultation process. Correspondence may be submitted by regular mail (USPS) to the address indicated in the header above; electronic responses may be submitted to the USMC’s point-of-contact (POC) for this project, via the email address indicated below. Alternately, you may also provide your tribe's response by telephone to the USMC POC at the number indicated below.

Please contact the MCIEAST Regional Environmental Program Manager, Scott Williams at (910)451-0151, scott.r.williams1@usmc.mil or at 12 Post Lane, Camp Lejeune, NC, 28547 to set up a meeting or if you have any

questions. Also available for questions is the Cultural Resources Program Manager at MCB Camp Lejeune, Mr. Rick Richardson at (910)451-7230 or rick.richardson@usmc.mil and the Natural Resources Manager at MCAS Cherry Point, Ms. Jessica Guilianelli at (252)466-4826 or jessica.guilianelli@usmc.mil.

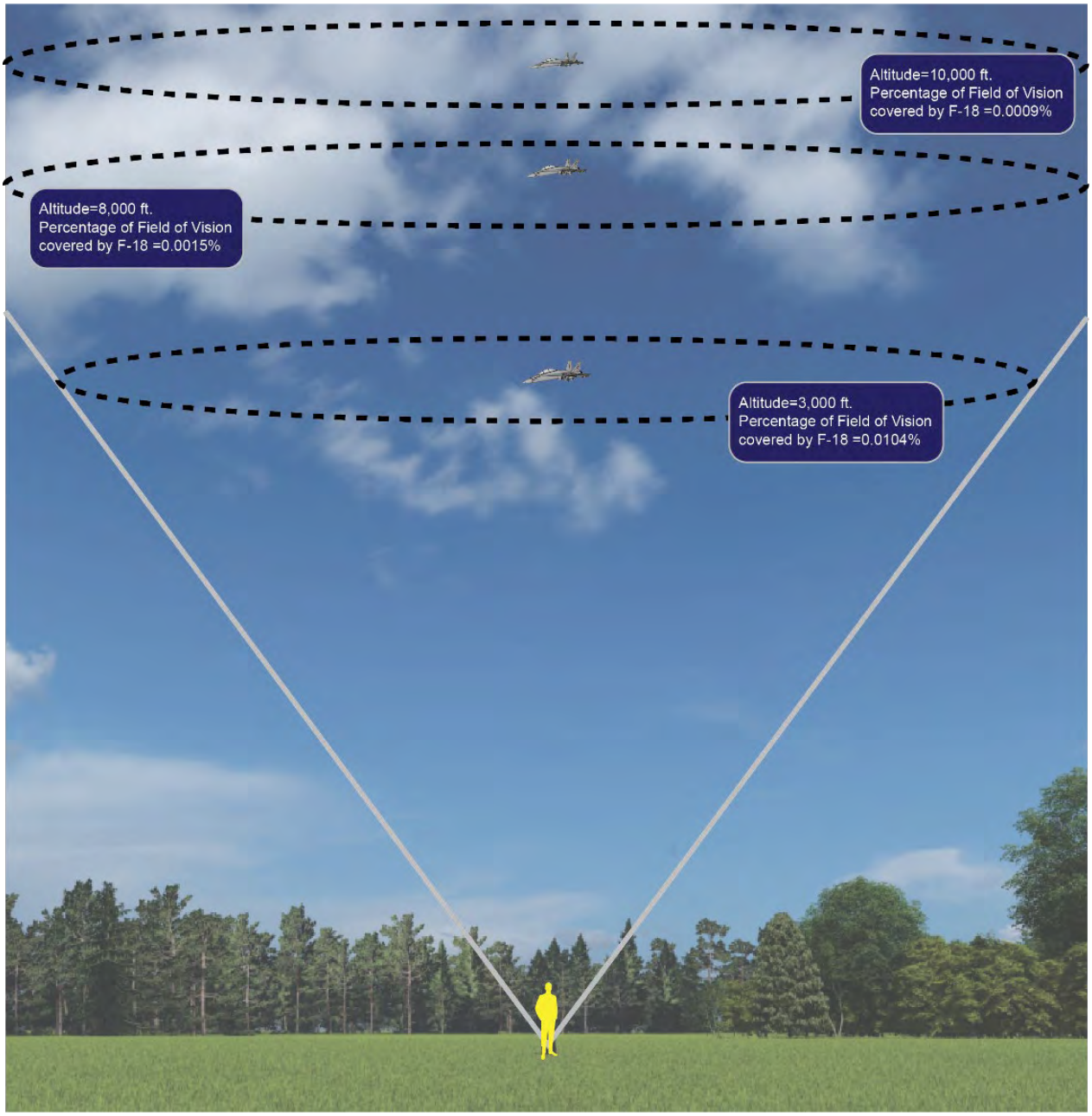
Sincerely,

A. G. SHOLAR
Deputy Assistant Chief of Staff, G-F
By direction of the
Commanding General

Enclosures: 1. Area of Potential Effects
2. Visual Effects Perspective
3. References

Copy to: Caitlin Rogers, Tribal Historic Preservation Office
(caitlin.rogers@catawba.com)

Visual Effects Perspective



Enclosure 2

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UNITED STATES MARINE CORPS
MARINE CORPS INSTALLATIONS EAST-MARINE CORPS BASE
PSC BOX 20005
CAMP LEJEUNE NC 28542-0005

5090.12
G-F/BEMD
June 16, 2022

Ms. Ramona Bartos
Deputy State Historic Preservation Officer
NC Division of Archives and History
(ATTN: Renee Gledhill-Earley)
4617 Mail Service Center
Raleigh, NC 27699-4617

Dear Ms. Bartos:

The United States Marine Corps (USMC) is preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts associated with an increase of permanent Special Use Airspace (SUA) within the Cherry Point operating area (OPAREA). The increased SUA would provide a larger contiguous, over-land airspace with appropriate altitudes to address existing SUA shortfalls and provide a more realistic training environment. Under the Proposed Action, the USMC seeks to establish the Pamlico C Military Operations Area, the Pamlico D Military Operations Area, and to expand the existing Hatteras F Military Operations Area contiguous with the existing Cherry Point OPAREA (Enclosure 1). A Military Operations Area (MOA) is a type of SUA with defined spatial boundaries within the National Airspace System designated to contain non-hazardous, military flight activities, to include high-speed aerial combat maneuvers. These types of activities may not be completely compatible with non-military aviation, they are only conducted in MOAs designated by the Federal Aviation Administration. The Federal Aviation Administration is a cooperating agency for this EA.

The purpose of this letter is to initiate consultation pursuant to the terms of Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended and its implementing regulations at 36 Code of Federal Regulations (CFR) Part 800, with your office on the increase of permanent SUA within the Cherry Point OPAREA and its effects on historic properties. The MOAs would be used by the USMC, United States Navy (USN), and United States Air Force (USAF); however, the USMC would be the primary user and serves as the lead agency for this consultation.

The Proposed Action

The Proposed Action is to increase the SUA available to support essential USMC aviation training, the USMC seeks to establish the Pamlico C MOA, the Pamlico D MOA, and to expand the Hatteras F MOA contiguous with the existing Cherry Point OPAREA. The proposed MOAs would be used to support critical training for USMC assets as well as USN and USAF pilot training for the AV-8B, F-35B/C, F-15E, F-16, and FA-18. The training that would occur within the proposed MOAs would consist of one or multiple aircraft performing aerial maneuvers similar to those required in actual combat and other missions. The aerial training in the proposed MOAs would not include supersonic flight, the release of explosive ordnance, use of defensive countermeasures (chaff and flares), or result in ground disturbance to any of the land beneath the MOAs.

Training in the proposed MOAs would be similar to aerial training that already occurs in the existing Cherry Point OPAREA. The training spectrum includes individual practice for a single aircraft up through larger, complex

scenarios with multiple aircraft that would be coordinated with ground forces stationed at existing ground ranges aboard Marine Corps Base Camp Lejeune. During these larger, coordinated training events the aircraft would remain within the confines of a MOA. The proposed MOAs, in conjunction with existing restricted airspace areas and surface ranges, would allow for run-ins, separation, and practicing various tactics with attack and supporting aircraft. The proposed MOAs would provide the larger contiguous area necessary for these complex types of training, allowing for a range more representative of those expected in real-world combat.

The training within a MOA is reported by annual sorties. A sortie is the takeoff, mission, and landing of one aircraft. A single aircraft training within a MOA would count as 1 sortie. For the larger, more complex training scenarios with multiple aircraft the sortie count would be dependent on the total number of aircraft, that is, multiple sorties could occur at the same time.

The Proposed Action does not include changes to infrastructure or personnel, airfield or runway operations (frequency or types of aircraft), aircraft inventory or squadron assignments, nor ground disturbance to land beneath any of the airspace. The Area of Potential Effects (APE) for this undertaking is therefore defined as the lands beneath the proposed Pamlico C and Pamlico D MOAs and the expansion of the Hatteras F MOA that would be potentially exposed to noise and visual intrusions from the aircraft operations as described in Enclosure (1).

Alternative 1

Under Alternative 1, the Pamlico C and D MOAs would be established, and the existing Hatteras F MOA would be expanded to surround existing restricted areas (denoted on aeronautical charts as R-5303 and R-5304). The three areas proposed as MOAs have been previously used to support training and operations on a temporary basis. The proposed MOAs would be used individually and in conjunction with existing SUA for aerial training as described above.

The proposed Pamlico C MOA would have vertical dimensions of 8,000 feet mean sea level (MSL) up to but not including Flight Level 180 (FL180), which is approximately 18,000 feet. The proposed annual sorties within the Pamlico C MOA would be 1,070 with 25 percent occurring during the hours of darkness.

The proposed Pamlico D MOA would have vertical dimensions of 10,000 feet MSL up to but not including FL180. The proposed annual sorties within the Pamlico D MOA would be 290 with 25 percent occurring during the hours of darkness.

As proposed, the existing Hatteras F MOA would be expanded to surround and overlap existing R-5303 and R-5304. The expanded Hatteras F MOA would have the same vertical dimensions as the existing MOA, 3,000 feet MSL up to but not including FL180. The proposed annual sorties within the Hatteras F MOA would be 450 with 20 percent occurring during the hours of darkness.

Alternative 2

Under Alternative 2, only the Pamlico C MOA and the expanded Hatteras F MOA would be established. The proposed sorties within these MOAs would be the same as described for Alternative 1: 1,070 annual sorties in Pamlico C MOA and 450 annual sorties in Hatteras F MOA. The Pamlico D MOA would not be

established, and the USMC would lose its additional training capability of supporting larger, complex training scenarios.

No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur. Both the Pamlico C nor D MOA would be established, and the Hatteras F MOA would remain unchanged.

Historic Properties Located Under the Airspace

Pursuant to 36 CFR 800.4(b)(1), the USMC has made a reasonable and good faith effort to carry out appropriate identification efforts for historic properties beneath the proposed SUA. The historic properties identified are listed on the National Register of Historic Places.

Pamlico C MOA

Seven historic properties are located beneath the proposed Pamlico C MOA (NPS 2021). These properties are summarized in Table 1 and depicted on Enclosure (2).

Table 1. Historic Properties within Pamlico C MOA

Resource Name	NRIS Reference Number	Resource Type	Location (County)
Bath School	07001495	Building	Beaufort
Belhaven City Hall	81000420	Building	Beaufort
Bonner House	70000438	Building	Beaufort
Palmer-Marsh House	70000439	Building	Beaufort
Pantego Academy	84000114	Building	Beaufort
St. Thomas Episcopal Church	70000440	Building	Beaufort
Lake Mattamuskeet Pump Station	80002849	Structure	Hyde

Note: NRIS=National Register Information System

Pamlico D MOA

Seventy-four historic properties are located beneath the proposed Pamlico D MOA (NPS 2021). These properties are summarized in Table 2 and depicted on Enclosure (2).

Table 2. Historic Properties within Pamlico D MOA

Resource Name	NRIS Reference Number	Resource Type	Location (County)
Bank of Washington, West End Branch	71000566	Building	Beaufort
Beaufort County Courthouse	71000567	Building	Beaufort
Belfont Plantation House	76001305	Building	Beaufort
Bowers--Tripp House	99000424	Building	Beaufort
Rosedale	82003424	Building	Beaufort
Ware Creek School	96001443	Building	Beaufort
Zion Episcopal Church	988	Building	Beaufort
Trinity Cemetery	11000545	Historic District	Beaufort
Jordan House	71000569	Building	Bertie

Attmore-Oliver House	72000932	Building	Craven
Bellair	72000933	Building	Craven
Blades House	72000934	Building	Craven
Bryan House and Office	72000935	Building	Craven
Cedar Street Recreation Center	3000802	Building	Craven
Centenary Methodist Church	72000937	Building	Craven
Central Elementary School	72000938	Building	Craven
Christ Episcopal Church and Parish House	73001320	Building	Craven
Clear Springs Plantation	73001318	Building	Craven
Coor-Bishop House	72000939	Building	Craven
Coor-Gaston House	72000940	Building	Craven
Ebenezer Presbyterian Church	97000573	Building	Craven
First Baptist Church	72000941	Building	Craven
First Church of Christ, Scientist	73001321	Building	Craven
First Missionary Baptist Church	97000574	Building	Craven
First Presbyterian Church and Churchyard	72000942	Building	Craven
Gull Harbor	73001322	Building	Craven
Harvey Mansion	71000574	Building	Craven
Hawks House	72000943	Building	Craven
Hollister, William, House	72000944	Building	Craven
Jerkins, Thomas, House	72000945	Building	Craven
Jerkins--Duffy House	88000232	Building	Craven
Jones-Jarvis House	73001323	Building	Craven
Mace, Ulysses S., House	73001324	Building	Craven
Masonic Temple and Theater	72000946	Building	Craven
Mount Shiloh Missionary Baptist Church	7000093	Building	Craven
New Bern Municipal Building	73001326	Building	Craven
Rhem-Waldrop House	72000947	Building	Craven
Rue Chapel AME Church	97000572	Building	Craven
Sloan, Dr. Earl S., House	86001627	Building	Craven
Slover-Bradham House	73001327	Building	Craven
Smallwood, Eli, House	72000948	Building	Craven
Smith Jr., Isaac H., House	2000965	Building	Craven
Smith, Benjamin, House	72000949	Building	Craven
Smith-Whitford House	72000950	Building	Craven
St. John's Missionary Baptist Church	97000575	Building	Craven
St. Paul's Roman Catholic Church	72000951	Building	Craven
St. Peter's AME Zion Church	97000571	Building	Craven
Stanly, Edward R., House	72000952	Building	Craven
Stanly, John Wright, House	70000450	Building	Craven
Stevenson House	71000575	Building	Craven
Taylor, Isaac, House	72000953	Building	Craven
Tisdale-Jones House	72000954	Building	Craven
York-Gordon House	73001328	Building	Craven
New Bern Historic District	73001325	Historic District	Craven
Baxter Clock	73001319	Object	Craven
New Bern National Cemetery	97000023	Site	Craven
Cedar Grove Cemetery	72000936	Structure	Craven
Foscue Plantation House	71000598	Building	Jones

Grace Episcopal Church	72000966	Building	Jones
Lavender, Bryan, House	85000904	Building	Jones
Sanderson House	71000599	Building	Jones
Biggs, Asa, House and Site	79003335	Building	Martin
Burras House	78001962	Building	Martin
Griffin, W.W., Farm	1001134	Building	Martin
Jamesville Primitive Baptist Church and Cemetery	84000556	Building	Martin
Liberty Hall	82003433	Building	Martin
Martin County Courthouse	79001733	Building	Martin
Skewarkey Primitive Baptist Church	5000355	Building	Martin
Smithwick's Creek Primitive Baptist Church	5000324	Building	Martin
Sunny Side Inn	95001396	Building	Martin
Garrett's Island House	1000047	Building	Washington
Latham House	76001348	Building	Washington
Perry-Spruill House	85000905	Building	Washington
Washington County Courthouse	79001761	Building	Washington

Note: NRIS=National Register Information System

Hatteras F MOA

Five historic properties are located beneath the proposed Hatteras F MOA (NPS 2021). These properties are summarized in Table 3 and depicted on Enclosure (2).

Table 3. Historic Properties within Hatteras F MOA

Resource Name	NRIS Reference Number	Resource Type	Location (County)
Bank of Onslow and Jacksonville Masonic Temple	89001850	Historic District	Onslow
Bracebridge Hall	71000579	Building	Onslow
Palo Alto Plantation	79003338	Building	Onslow
Pelletier House and Wantland Spring	89001852	Historic District	Onslow
Yopps Meeting House	99000868	Building	Onslow

Note: NRIS=National Register Information System

Effects Analysis

Military training would be dispersed throughout the proposed airspace and occur within the confines of the MOA; above 8-10,000 feet MSL (in proposed Pamlico C and D MOAs) or above 3,000 feet MSL (in proposed Hatteras F MOA). The training would not result in a visual impact given the altitudes where training would occur. As illustrated in the figure in Enclosure (3), even at the lowest proposed altitude the aircraft would cover only 0.01% of the field of vision from an observer on the ground. Military aircraft and civilian aircraft are routinely present in eastern North Carolina and would not represent a new visual impact; likewise, the areas proposed for MOAs are currently used on a temporary basis for military training. There would be no release of explosive ordnance or defensive countermeasures (chaff and flares) and no ground disturbing activities would occur on lands beneath the proposed MOAs. Therefore, the potential effects to historic properties would be limited to noise exposure from military aircraft training within the MOAs.

The noise associated with aircraft operations can be subsonic or supersonic. Subsonic noise is noise generated by an aircraft's engines and airframe. Supersonic noise is the noise generated when an aircraft flies faster than the speed of sound and has the potential to create sonic booms. Supersonic operations are not proposed within the MOAs and no sonic booms would occur; thus, the effects analysis evaluates subsonic noise. It should be noted that the aircraft operations and associated noise within MOAs are very different from those that occur at an airfield or airport environment. In that situation, there are several takeoffs and landings daily and properties beneath these approach and departure corridors are routinely exposed to high levels of noise exposure. Training within a MOA does not follow designated patterns or routes but rather occurs somewhat randomly throughout the designated volume of SUA (which geographically covers several counties). An individual historic property beneath any of the MOAs would not be exposed to repetitive or daily aircraft operations and these operations would happen in a variety of altitudes from the floor to ceiling of the MOA.

A noise analysis was prepared for this proposed action and is included as Enclosure (4), the results are summarized herein. The noise analysis uses the Department of Defense prescribed suite of software programs, known as NOISEMAP, to predict the noise exposure from military aircraft activity. The software model inputs include the type of aircraft to be flown, power settings, and time spent at specified altitude bands. Based on the proposed aircraft training, the MOAs are expected to be activated less than 3 hours per weekday in the Pamlico C MOA and less than 1 hour per weekday in the Pamlico D and Hatteras F MOAs (weekend activation would be rare in any of the MOAs).

The U.S. Government standard for assessing community noise impacts is the noise metric known as the Day-Night Level (DNL), reported in decibels (dB). The DNL is an A-weighted cumulative noise metric that measures noise based on annual average daily aircraft operations. The U.S. Environmental Protection Agency (USEPA) has identified 55 DNL as a level that protects public health and welfare with an adequate margin of safety (USEPA 1982). This means that 55 DNL is a threshold below which adverse noise effects are not expected to occur. With respect to land-use, noise exposure greater than 65 DNL is considered generally incompatible with residential, public use (i.e., schools), or recreational and entertainment areas (Federal Interagency Committee on Urban Noise 1980). As illustrated in the Noise Study, the noise associated with the proposed military aircraft operations would range from <35 DNL in the Pamlico D MOA to 48 DNL in the expanded Hatteras F MOA. Therefore, the noise associated with military aircraft training within the MOAs is not expected to have a significant noise impact to the historical properties or any persons at these properties.

While DNL is the standard metric for assessing the significance of noise impacts, supplemental metrics are used to produce more detailed noise exposure information for the decision process and to improve communication with the public and stakeholders. Supplemental metrics are not intended to replace the DNL metric as the primary descriptor of cumulative noise exposure, but rather are useful tools to supplement the impact information disclosed by the DNL metric. For this proposed action, the Noise Analysis also included an analysis of the peak noise exposure to better describe the loudness of a single overflight event at the lowest proposed altitude (the floor) in each MOA (3,000 feet in Hatteras F, 8,000 feet in Pamlico C, and 10,000 feet in Pamlico D). In general, during training events aircraft do not travel substantial distances on the floor of the MOA, but rather start at the floor and quickly climb to higher altitudes so the peak exposures

reported in the Noise Analysis are not expected to occur frequently and would only last for a few seconds or less. It is estimated that aircraft would operate in the lowest altitude bands of each MOA for only 10 to 15 percent of the training time (see Tables A-2, A-3, and A-4 of the Noise Analysis for the aircraft operation assumptions for each MOA). The peak noise exposure in the Pamlico C, Pamlico D, and Hatteras F MOAs is estimated to be 90 dB, 86 dB, and 103 dB, respectively. As expected, aircraft at the lowest proposed altitude (3,000 feet) produce the loudest noise. Also, these values represent outside noise. Outdoor-to-indoor noise level reduction provided by a building ranges from 25 dB (windows closed) to 15 dB (windows open).

Normally, the most sensitive components of a structure to noise are the windows and, infrequently, the plastered walls and ceilings. Conservatively, only sound lasting more than one second above a sound level of 130 dB are potentially damaging to structural components (Committee on Hearing, Bioacoustics, and Biomechanics 1977). Noise-induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations or rattling of objects within the dwelling. Windowpanes may also vibrate noticeably when exposed to high levels of airborne noise. In general, such noise-induced vibrations occur at peak sound levels of 110 dB or greater. The maximum peak sound exposure of a single overflight at the lowest possible altitude (3,000 feet) for this proposed action would be 103 dB; therefore, structural damage and secondary vibration impacts are not expected to occur with this proposed action.

Finding of Effect

Based on identification efforts (36 CFR 800.4(b)(1), the USMC has determined that eighty-six (86) historic properties are located within the APE. In accordance with 36 CFR 800 5(a)(1), the USMC applied the criteria for adverse effects and found that the qualifying characteristics of these buildings will not be adversely affected by noise, structural damage, or secondary vibration impacts under the proposed action. Subject to 36 CFR 800.5(b), USMC has made a finding of “No Historic Properties Affected” to historic properties regarding the increase of permanent SUA. The USMC recognizes that some unknown and/or undocumented historic properties may exist within the APE. The undertaking will not affect historic structures and districts where setting is an important criterion for significance and where noise vibrations from subsonic noise could adversely impact those types of resources.

Government-to-government consultation with federally recognized Tribal Nations is also being conducted for this proposed undertaking per Executive Order 13175: *Memorandum on Government-to-Government Relations with Native American Tribal Governments* and the NHPA implementing regulations at 36 CFR Part 800.3(f)(2). The USMC has identified the Tuscarora Nation and the Catawba Indian Nation as federally recognized Tribal Nations that may have cultural, historic, and/or religious affiliation to lands beneath the proposed SUA. Available records do not indicate any sacred sites or Traditional Cultural Properties in the APE of the Proposed Action. Based on our evaluation of currently known historic properties data for the proposed APE, we have applied the Assessment of Adverse Effects (36 CFR Part 800.5) to the proposed undertaking, and have determined that the project described herein will not result in an adverse effect to significant cultural resources. However, the USMC is seeking their input in order to ensure that we have adequately identified historic properties of religious and cultural significance.

5090.12
G-F/BEMD
June 16, 2022

Request for Concurrence

The USMC requests your concurrence with the finding of effect under 36 CFR 800.5(b), our definition of the APE (36 CFR 800.4(a), and identification efforts, in accordance with 36 CFR 800.4(b)(1) and 800.4(c)(2). In accordance with 36 CFR 800.3(f), we request your assistance in identifying any additional potential consulting parties that you feel the USMC should contact regarding the proposed SUA expansion. Any information or assistance you can provide would be appreciated and taken into consideration.

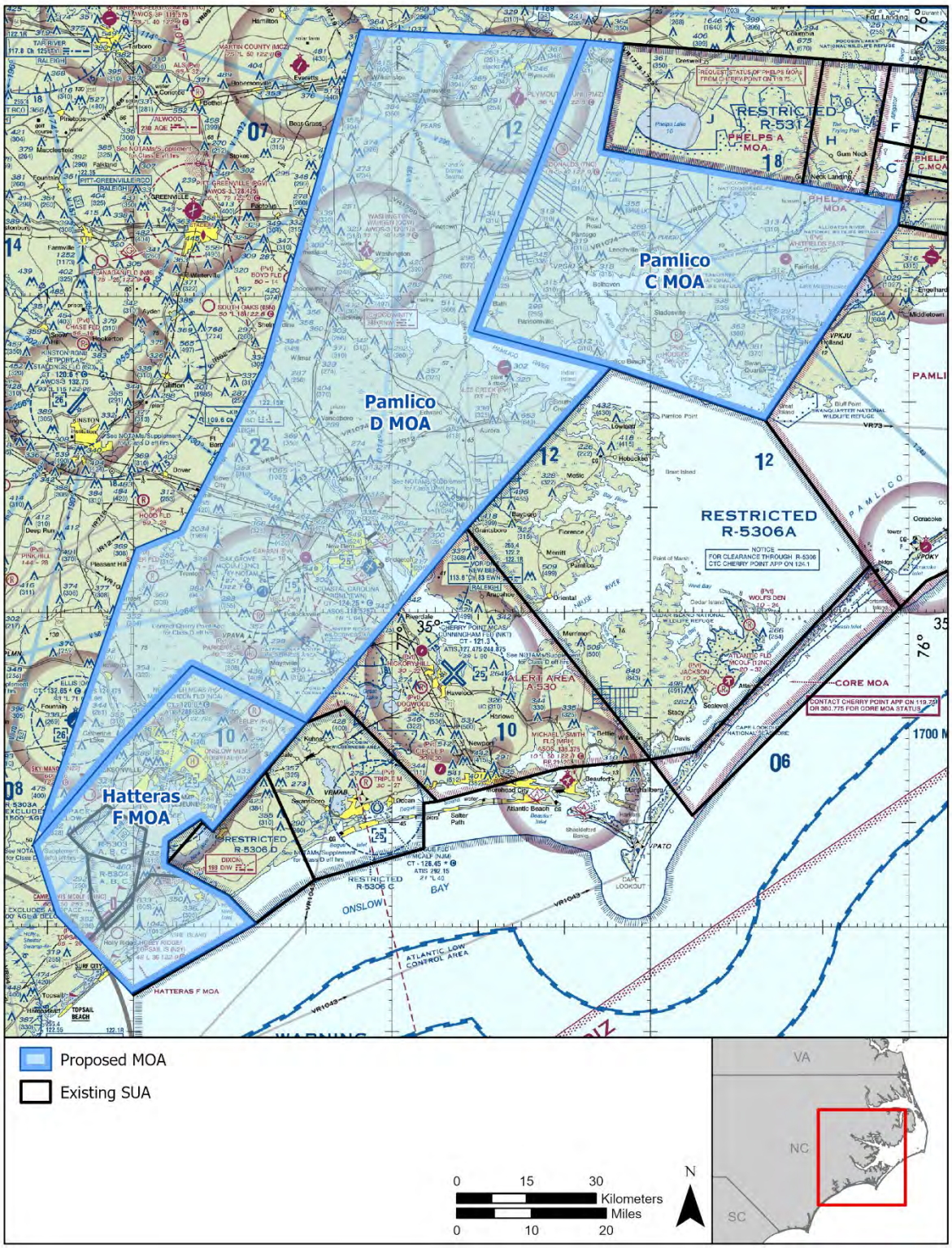
Please contact the MCIEAST Regional Environmental Program Manager, Scott Williams at (910)451-0151, scott.r.williams1@usmc.mil or at 12 Post Lane, Camp Lejeune, NC, 28547 to set up a meeting or if you have any questions. Also available for questions is the Cultural Resources Program Manager at MCB Camp Lejeune, Mr. Rick Richardson at (910)451-7230 or rick.richardson@usmc.mil and the Natural Resources Manager at MCAS Cherry Point, Ms. Jessica Guilianelli at (252)466-4826 or jessica.guilianelli@usmc.mil.

Sincerely,

A. G. SHOLAR
Deputy Assistant Chief of Staff, G-F
By direction of the
Commanding General

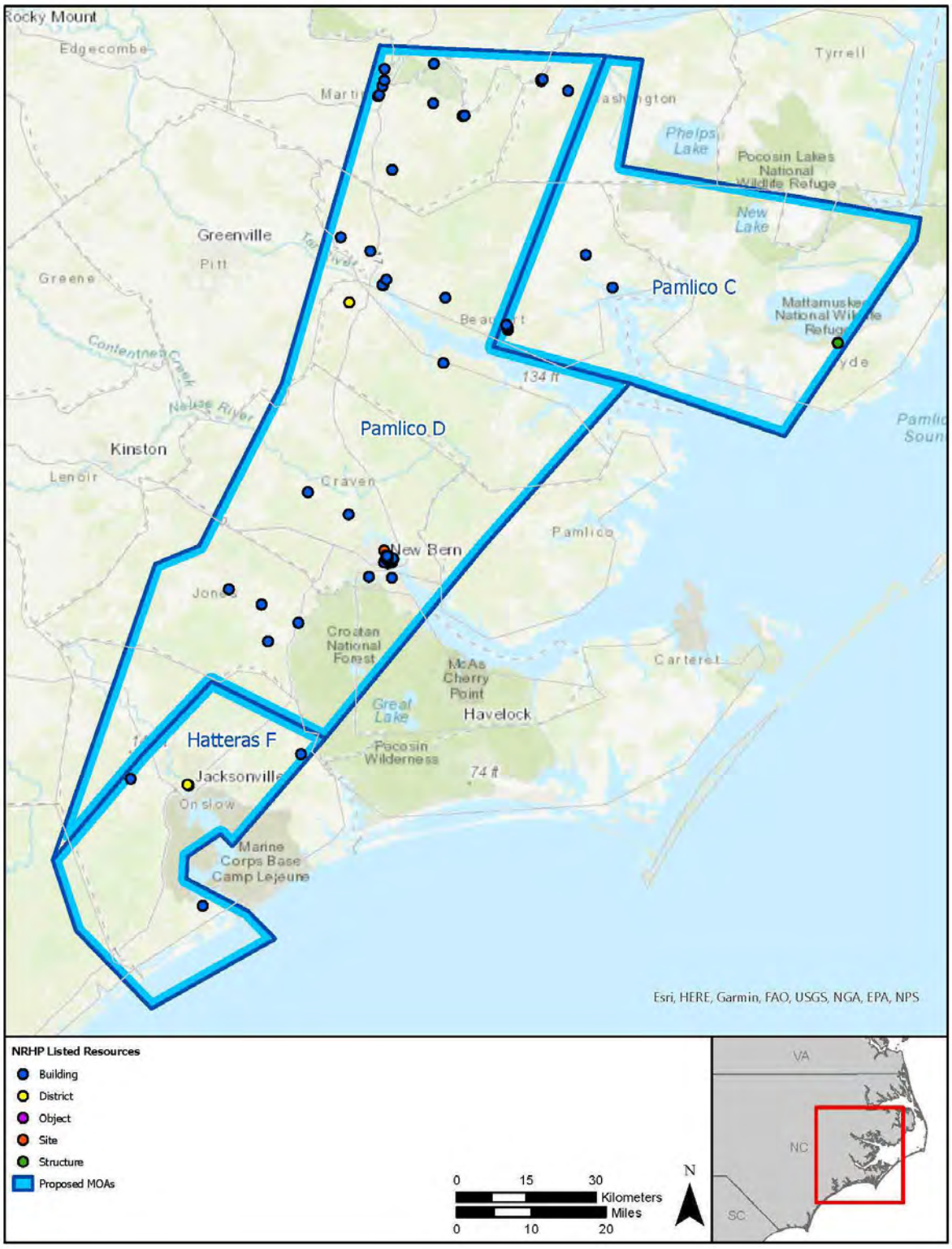
Enclosures:
1. Area of Potential Effects
2. Historic Properties Located within the Area of Potential Effects
3. Visual Effects Perspective
4. Draft Noise Analysis
5. References

Area of Potential Effects (Proposed MOAs)



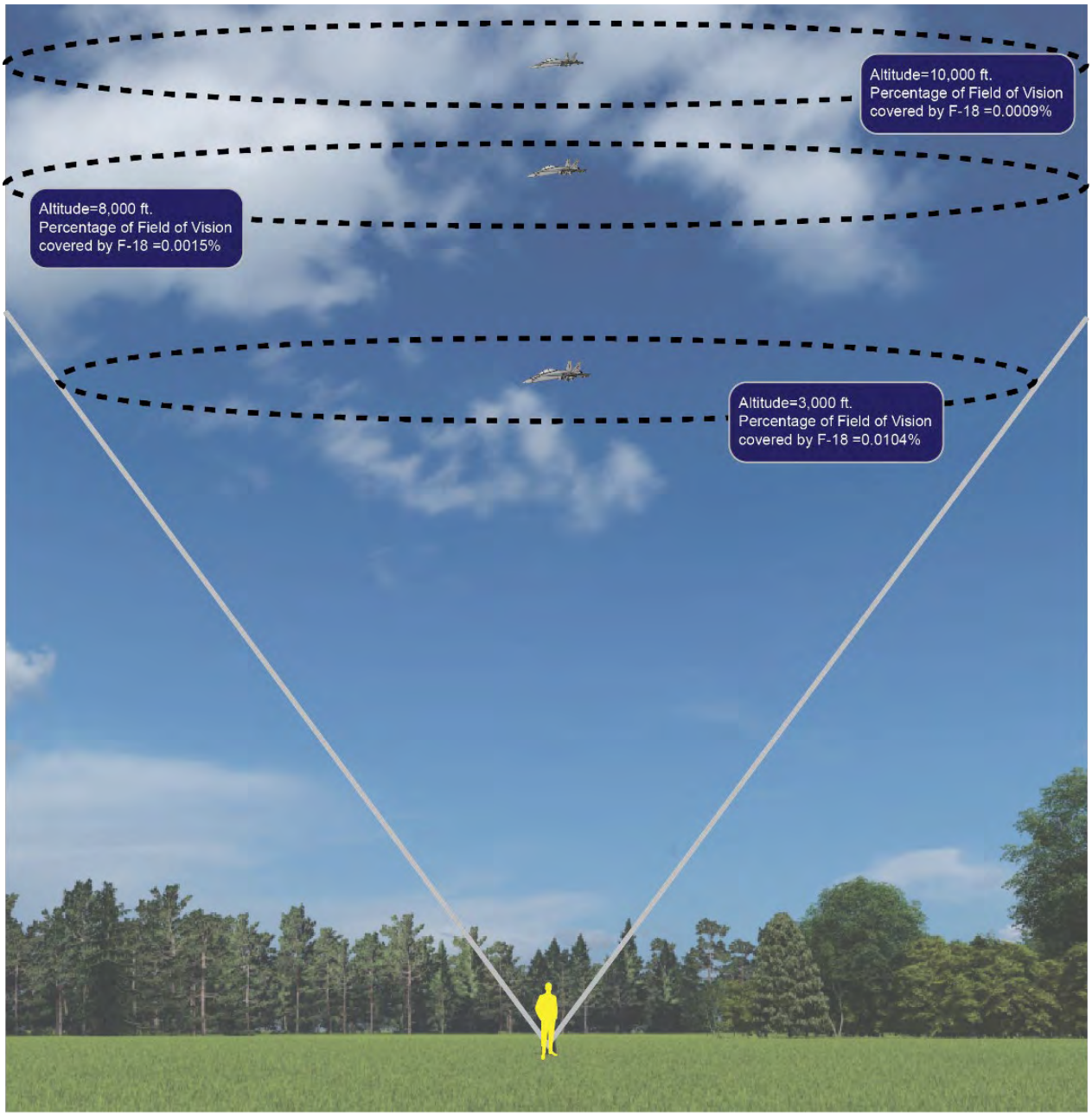
Enclosure 1

Historic Properties Located within the Area of Potential Effects



Enclosure 2

Visual Effects Perspective



Enclosure 3

Enclosure 4. Draft Noise Analysis

UNITED STATES MARINE CORPS
MARINE CORPS INSTALLATIONS EAST-MARINE CORPS BASE
PSC BOX 20005
CAMP LEJEUNE NC 28542-0005

5090.12
G-F/BEMD
June 16, 2022

Chief Tom Jonathan
Tuscarora Nation
5226 Walmore Road
Lewistown, NY 14092

Dear Chief Jonathan:

The United States Marine Corps (USMC) is preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts associated with an increase of permanent Special Use Airspace (SUA) within the Cherry Point operating area (OPAREA). The increased SUA would provide a larger contiguous, over-land airspace with appropriate altitudes to address existing SUA shortfalls and provide a more realistic training environment. Under the Proposed Action, the USMC seeks to establish the Pamlico C Military Operations Area, the Pamlico D Military Operations Area, and to expand the existing Hatteras F Military Operations Area contiguous with the existing Cherry Point OPAREA (Enclosure 1). A Military Operations Area (MOA) is a type of SUA with defined spatial boundaries within the National Airspace System designated to contain non-hazardous, military flight activities, to include high-speed aerial combat maneuvers. Since these types of activities may not be completely compatible with non-military aviation, they are only conducted in MOAs designated by the Federal Aviation Administration. The Federal Aviation Administration is a cooperating agency for this EA.

The purpose of this letter is to initiate government-to-government consultation pursuant to Executive Order 13175: *Memorandum on Government-to-Government Relations with Native American Tribal Governments* and pursuant to the terms of Section 306108 (formerly known as Section 106) of the National Historic Preservation Act (NHPA) of 1966, as amended and its implementing regulations at 36 CFR Part 800, with your Tribal Nation on lands beneath the proposed MOAs.

The Proposed Action

The Proposed Action is to increase the SUA available to support essential USMC aviation training, the USMC seeks to establish the Pamlico C MOA, the Pamlico D MOA, and to expand the Hatteras F MOA contiguous with the existing Cherry Point OPAREA. The proposed MOAs would be used to support critical training for USMC assets as well as United States (U.S.) Navy and U.S. Air Force pilot training for the AV-8B, F-35B/C, F-15E, F-16, and FA-18. The proposed training consists of one or multiple aircraft performing aerial maneuvers similar to those required in actual combat and other missions. The aerial training in the proposed MOAs would not include supersonic flight, the release of explosive ordnance, use of defensive countermeasures (chaff and flares), or result in ground disturbance to any of the land beneath the MOAs.

Training in the proposed MOAs would be similar to aerial training that already occurs in the existing Cherry Point OPAREA. The training spectrum

includes individual practice for a single aircraft up through larger, complex scenarios with multiple aircraft that would be coordinated with ground forces stationed at existing ground ranges aboard Marine Corps Base Camp Lejeune. During these larger, coordinated training events, the aircraft remain within the confines of a MOA. The proposed MOAs, in conjunction with existing restricted airspace areas and surface ranges, would allow for run-ins, separation, and practicing various tactics with attack and supporting aircraft. The proposed MOAs would provide the larger contiguous area necessary for these complex types of training, allowing for a range more representative of those expected in real-world combat.

The training within a MOA is reported by annual sorties. A sortie is the takeoff, mission, and landing of one aircraft. A single aircraft training within a MOA would count as 1 sortie. For the larger, more complex training scenarios with multiple aircraft the sortie count would be dependent on the total number of aircraft, that is, multiple sorties could occur at the same time.

The Proposed Action does not include changes to infrastructure or personnel, airfield or runway operations (frequency or types of aircraft), aircraft inventory or squadron assignments, nor ground disturbance to land beneath any of the airspace. The Area of Potential Effects (APE) for this undertaking is therefore defined as the lands and communities beneath the proposed Pamlico C and Pamlico D MOAs and the expansion of the Hatteras F MOA that could be disturbed or impacted by the aircraft noise (see Enclosure 1).

Alternative 1

Under Alternative 1, the Pamlico C and D MOAs would be established, and the existing Hatteras F MOA would be expanded to surround existing restricted areas (denoted on aeronautical charts as R-5303 and R-5304). The three areas proposed as MOAs have been previously used to support training and operations on a temporary basis. The proposed MOAs would be used individually and in conjunction with existing SUA for aerial training as described above.

The proposed Pamlico C MOA would have vertical dimensions of 8,000 feet mean sea level (MSL) up to but not including Flight Level 180 (FL180), which is approximately 18,000 feet. The proposed annual sorties within the Pamlico C MOA would be 1,070 with 25 percent occurring during the hours of darkness.

The proposed Pamlico D MOA would have vertical dimensions of 10,000 feet MSL up to but not including FL180. The proposed annual sorties within the Pamlico D MOA would be 290 with 25 percent occurring during the hours of darkness.

As proposed, the existing Hatteras F MOA would be expanded to surround and overlap existing R-5303 and R-5304. The expanded Hatteras F MOA would

have the same vertical dimensions as the existing MOA, 3,000 feet MSL up to but not including FL180. The proposed annual sorties within the Hatteras F MOA would be 450 with 20 percent occurring during the hours of darkness.

Alternative 2

Under Alternative 2, only the Pamlico C MOA and the expanded Hatteras F MOA would be established. The proposed sorties within these MOAs would be the same as described for Alternative 1: 1,070 annual sorties in Pamlico C MOA and 450 annual sorties in Hatteras F MOA. The Pamlico D MOA would not be established, and the USMC would lose its additional training capability of supporting larger, complex training scenarios.

No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur. Neither the Pamlico C nor D MOAs would be established, and the Hatteras F MOA would remain unchanged.

Historic Properties Located Under the Airspace

Based on a search using the National Register of Historic Places (NRHP), seven NRHP-listed historic properties are located beneath the proposed Pamlico C MOA; seventy-four NRHP-listed historic properties are located beneath the proposed Pamlico D MOA; and five, NRHP-listed historic properties are located beneath the proposed Hatteras F MOA (NPS 2021). These historic properties include various historic architectural resources, including buildings, structures, objects, and historic districts, but no potentially impacted archaeological resources. Per the background research conducted for this proposed undertaking, no archaeological sites that are listed in the NRHP are located on lands beneath the proposed MOAs.

Effects Analysis

Military training would be dispersed throughout the proposed airspace and occur within the confines of the MOA; above 8-10,000 feet MSL (in proposed Pamlico C and D MOAs) or above 3,000 feet MSL (in proposed Hatteras F MOA). The training would not be a visual impact given the altitudes where training would occur. As illustrated in the figure in Enclosure (2), even at the lowest proposed altitude the aircraft would cover only 0.01% of the field of vision from an observer on the ground. Military aircraft and civilian aircraft are routinely present in eastern North Carolina and would not represent a new visual impact; likewise, the areas proposed for MOAs are currently used on a temporary basis for military training. There would be no release of explosive ordnance or defensive countermeasures (chaff and flares) and no ground disturbing activities would occur on lands beneath the proposed MOAs. Therefore, the potential effects to historic properties would be limited to noise exposure from military aircraft training within the MOAs.

The noise associated with aircraft operations can be subsonic or supersonic. Subsonic noise is noise generated by an aircraft's engines and airframe. Supersonic noise is the noise generated when an aircraft flies faster than the speed of sound and has the potential to create sonic booms. Supersonic operations are not proposed within the MOAs and no sonic booms would occur; thus, the effects analysis evaluates subsonic noise. Training within a MOA does not follow designated patterns or routes but rather occurs somewhat randomly throughout the designated volume of SUA (which geographically covers several counties). An individual historic property beneath any of the MOAs would not be exposed to repetitive or daily aircraft operations and these operations would happen in a variety of altitudes from the floor to ceiling of the MOA.

A Noise Analysis was prepared for this action, using the Department of Defense prescribed suite of software programs (known as NOISEMAP), to predict the noise exposure from military aircraft activity. The software model inputs include the type of aircraft to be flown, power settings, and time spent at specified altitude bands. Based on the proposed aircraft training, the MOAs are expected to be activated less than 3 hours per weekday in the Pamlico C MOA and less than 1 hour per weekday in the Pamlico D and Hatteras F MOAs (weekend activation would be rare in any of the MOAs).

The U.S. Government standard for assessing community noise impacts is the noise metric known as the Day-Night Level (DNL), reported in decibels (dB). The DNL is an A-weighted cumulative noise metric that measures noise based on annual average daily aircraft operations. The U.S. Environmental Protection Agency (USEPA) has identified 55 DNL as a level that protects public health and welfare with an adequate margin of safety (USEPA 1982). This means that 55 DNL is a threshold below which adverse noise effects are not expected to occur. With respect to land-use, noise exposure greater than 65 DNL is considered generally incompatible with residential, public use (i.e., schools), or recreational and entertainment areas (Federal Interagency Committee on Urban Noise 1980). As determined in the Noise Analysis, the noise associated with the proposed military aircraft operations would range from <35 DNL in the Pamlico D MOA to 48 DNL in the expanded Hatteras F MOA. Therefore, the noise associated with military aircraft training within the MOAs is not expected to have a significant noise impact to the historical properties or any persons at these properties.

While DNL is the standard metric for assessing the significance of noise impacts, supplemental metrics are used to produce more detailed noise exposure information for the decision process and to improve communication with the public and stakeholders. Supplemental metrics are not intended to replace the DNL metric as the primary descriptor of cumulative noise exposure, but rather are useful tools to supplement the impact information disclosed by the DNL metric. For this proposed action, the Noise Analysis also included an analysis of the peak noise exposure to better describe the loudness of a single overflight event at the lowest proposed altitude (the floor) in each MOA (3,000 feet in Hatteras F, 8,000

feet in Pamlico C, and 10,000 feet in Pamlico D). In general, during training events aircraft do not travel substantial distances on the floor of the MOA, but rather start at the floor and quickly climb to higher altitudes so the peak exposures reported in the Noise Analysis are not expected to occur frequently and would only last for a few seconds or less. It is estimated that aircraft would operate in the lowest altitude bands of each MOA for only 10 to 15 percent of the training time. The peak noise exposure in the Pamlico C, Pamlico D, and Hatteras F MOAs is estimated to be 90 dB, 86 dB, and 103 dB, respectively. As expected, aircraft at the lowest proposed altitude (3,000 feet) produce the loudest noise. Also, these values represent outside noise. Outdoor-to-indoor noise level reduction provided by a building ranges from 25 dB (windows closed) to 15 dB (windows open).

Normally, the most sensitive components of a structure to noise are the windows and, infrequently, the plastered walls and ceilings. Conservatively, only sound lasting more than one second above a sound level of 130 dB are potentially damaging to structural components (Committee on Hearing, Bioacoustics, and Biomechanics 1977). Noise-induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations or rattling of objects within the dwelling. Windowpanes may also vibrate noticeably when exposed to high levels of airborne noise. In general, such noise-induced vibrations occur at peak sound levels of 110 dB or greater. The maximum peak sound exposure of a single overflight at the lowest possible altitude (3,000 feet) for this proposed action would be 103 dB; therefore, structural damage and secondary vibration impacts are not expected to occur with this proposed action.

Available records do not indicate any sacred sites or Traditional Cultural Properties in the APE of the Proposed Action. Based on our evaluation of currently known historic properties data for the proposed APE, we have applied the Assessment of Adverse Effects (36 CFR Part 800.5) to the proposed undertaking, and have determined that the project described herein will not result in an adverse effect to historic properties. In this regard, the USMC is seeking your input in order to ensure that we have adequately identified historic properties that may be of religious and cultural significance to the Tuscarora Nation.

In order to support our anticipated project timeline, the USMC would greatly appreciate receiving your input and comments on the proposed undertaking within forty-five (45) calendar days of your receipt of this letter. We respectfully request your input regarding our determination of no adverse effect as part of the Section 106 consultation process. Correspondence may be submitted by regular mail (USPS) to the address indicated in the header above; electronic responses may be submitted to the USMC’s point-of-contact (POC) for this project, via the email address indicated below. Alternately, you may also provide your tribe's response by telephone to the USMC POC at the number indicated below.

5090.12
G-F/BEMD
June 16, 2022

Please contact the MCIEAST Regional Environmental Program Manager, Scott Williams at (910)451-0151, scott.r.williams1@usmc.mil or at 12 Post Lane, Camp Lejeune, NC, 28547 to set up a meeting or if you have any questions. Also available for questions is the Cultural Resources Program Manager at MCB Camp Lejeune, Mr. Rick Richardson at (910)451-7230 or rick.richardson@usmc.mil and the Natural Resources Manager at MCAS Cherry Point, Ms. Jessica Guilianelli at (252)466-4826 or jessica.guilianelli@usmc.mil.

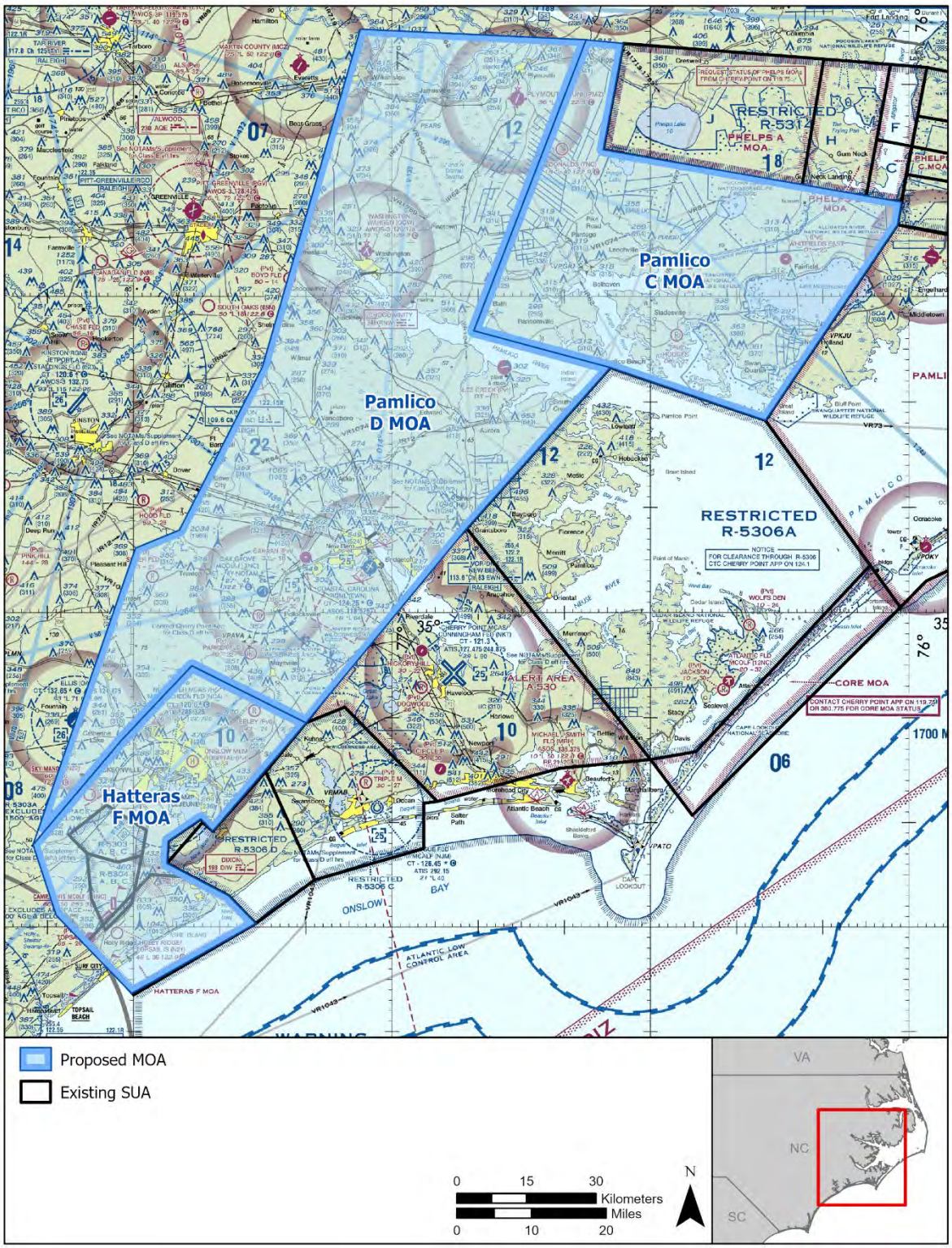
Sincerely,

A. G. SHOLAR
Deputy Assistant Chief of Staff, G-F
By direction of the
Commanding General

Enclosures: 1. Area of Potential Effects
2. Visual Effects Perspective
3. References

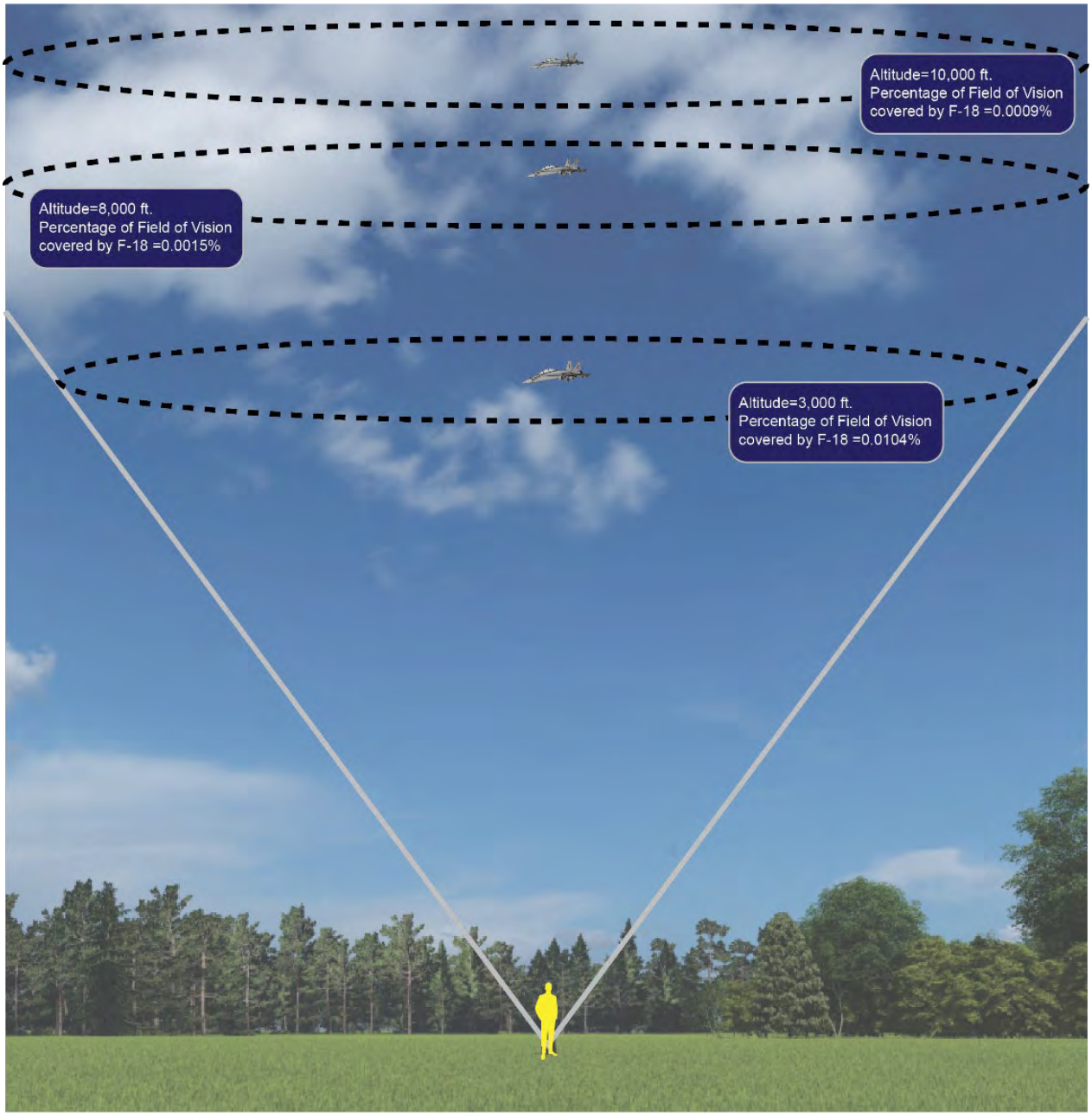
Copy to: Bryan Printup, Tribal Historic Preservation Office (via email: bprintup@hetf.org)

Area of Potential Effects (Proposed MOAs)



Enclosure 1

Visual Effects Perspective



Enclosure 2

References

Committee on Hearing, Bioacoustics, and Biomechanics 1977. Guidelines for Preparing Environmental Impact Statements on Noise: Report of Working Group 69.

Federal Interagency Committee on Urban Noise 1980. Guidelines for Considering Noise in Land Use Planning and Control. June.

National Park Service (NPS). 2021. National Register of Historic Places. Available online: https://www.nps.gov/subjects/nationalregister/data-downloads.htm. Accessed 22 June 2021.

U.S. Environmental Protection Agency (USEPA) 1982. Guidelines for Noise Impact Analysis. EPA Report No. 55/9-82-105 April.

Appendix B
Airspace Impact Analysis

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Airspace Impact Analysis to Support Proposed North Carolina Special Use Airspace

May 2022

NAVFAC
Naval Facilities Engineering Command
NAVFAC MID-ATLANTIC

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FINAL
AIRSPACE IMPACT ANALYSIS TO SUPPORT PROPOSED NORTH CAROLINA SPECIAL USE AIRSPACE

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ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
DoD	Department of Defense
EA	Environmental Assessment
FAA	Federal Aviation Administration
FY	Fiscal Year
GC	Great Circle
IFR	Instrument Flight Rules
MAW	Marine Aircraft Wing
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCIEAST	Marine Corps Installations East
MSL	Mean Sea Level
MOA	Military Operations Area
NAVAID	navigational aid
nm	nautical mile
NOTAM	Notice to Airmen
PDARS	Performance Data Analysis and Reporting System
SUA	Special Use Airspace
SWIM	System Wide Information Management
TRACON	Terminal Radar Approach Control
USAF	U.S. Air Force
USMC	U.S. Marine Corps
USN	U.S. Navy
VFR	Visual Flight Rules

1.0 INTRODUCTION

This airspace impact analysis is in support of an Environmental Assessment (EA) and a proposal to the Federal Aviation Administration (FAA) to establish new Special Use Airspace (SUA) in eastern North Carolina to support current and future training requirements of the 2d Marine Aircraft Wing (MAW). The current SUA does not meet the criterion established in Marine Corps Reference Publication 8-10B.1, *Operational Training Ranges Required Capabilities*, or the 2d MAW 2030 Plan, *Proposed Solutions Technical Report.* Marine Corps Installations East (MCIEAST) seeks to acquire only that airspace which is essential to support Marine Corps missions and use that airspace in a responsible manner. This analysis provides a detailed assessment of the potential impacts to civil aviation associated with the proposed Pamlico C Military Operations Area (MOA), Pamlico D MOA, and expansion of the Hatteras F MOA in eastern North Carolina. These proposed MOAs are part of a series of SUA proposals to the FAA to increase lateral and vertical boundaries of SUA identified in the MCIEAST Regional Airspace Plan.

The EA analyzes two action alternatives and the no action alternative. The action alternatives are:

- Alternative 1 – Establish Pamlico C and D MOAs, and Expand Hatteras F MOA
- Alternative 2 – Establish Pamlico C MOA and Expand Hatteras F MOA

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2.0 REGION OF INFLUENCE

As shown in **Figure 2-1**, the three MOA proposals analyzed in this assessment are contiguous to existing SUA (restricted areas, warning areas, and other MOAs) and would provide a continuity of training operations for the 2d MAW.

2.1 DESCRIPTION OF PROPOSED MOAS

2.1.1 Pamlico C MOA

The proposed Pamlico C MOA would be located northeast of Marine Corps Air Station (MCAS) Cherry Point with a floor of 8,000 up to 17,999 feet Mean Sea Level (MSL) (**Figure 2-2**). The MOA would overly portions of Bertie, Beaufort, Hyde, Martin, and Washington counties and the Lake Mattamuskeet and Swan Quarter National Wildlife Refuges. The Pamlico C MOA would be between the northern boundary of R-5306A and southern boundary of R-5314, creating a more robust training environment in the airspace between the R-5314 Complex/Phelps MOA, W-122, and R-5306A. The MOA would support operations from 2d MAW legacy aircraft (AV-8B and F-18A/C) and fifth generation (F-35B/C) aircraft. Other users could include the U.S. Air Force (USAF) (F-15E, F-22A) and U.S. Navy (USN) (FA-18E/F). The 2d MAW usage of Pamlico C would be significant as they transition fully to the F-35B/C at MCAS Cherry Point and MCAS Beaufort.

The published times of use would be Monday through Friday, 0800 – 2200 Local and other times by Notice to Airmen (NOTAM). The Controlling Agency would be USMC, Marine Corps Air Station Cherry Point Center Radar Approach Control and the Using Agency would be USMC, Commanding Officer, Marine Corps Air Station Cherry Point, NC.

2.1.2 Pamlico D MOA

The proposed Pamlico D MOA would be located west of MCAS Cherry Point with a floor of 10,000 up to 17,999 feet MSL (**Figure 2-3**). This MOA would overly portions of Craven, Jones, Pitt, Bertie, and Martin Counties. The proposed Pamlico D MOA would be west of the existing R-5306 and the proposed Pamlico C MOA. In conjunction with the proposed Pamlico C MOA, the Pamlico D MOA would create a more robust Large Force Exercise training environment amongst existing SUA. This MOA would serve the 2d MAW and would also support F-15Es from Seymour Johnson Air Force Base (AFB) and FA-18E/Fs from several USN Carrier Air Wings.

The published times of use would be Intermittent by NOTAM. The Controlling Agency would be FAA Washington Air Route Traffic Control Center (ARTCC) and the Using Agency would be USMC, Commanding Officer, Marine Corps Air Station Cherry Point, NC.

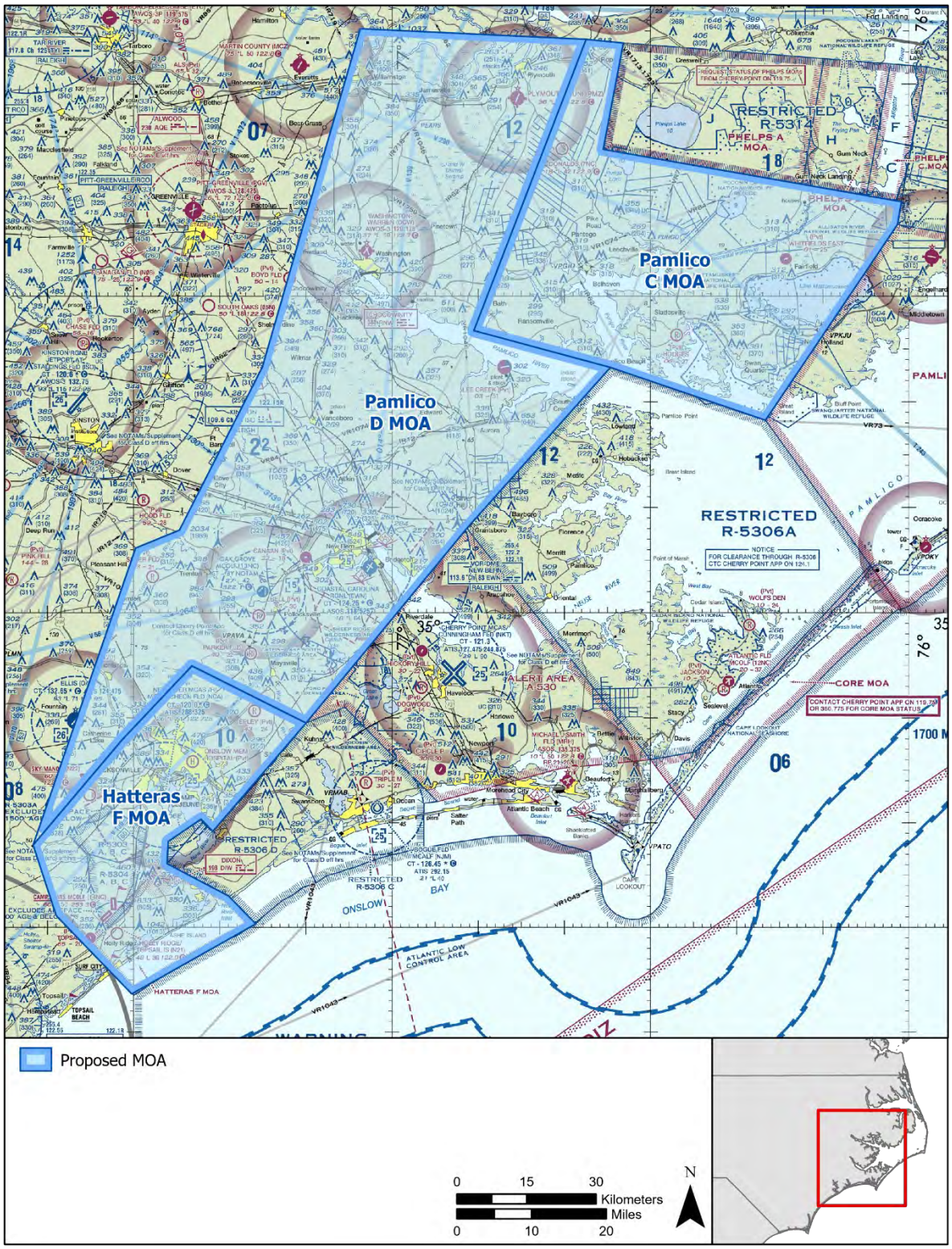

Figure 2-1. Region of Influence: Proposed MOAs

Figure 2-2. Proposed Pamlico C MOA

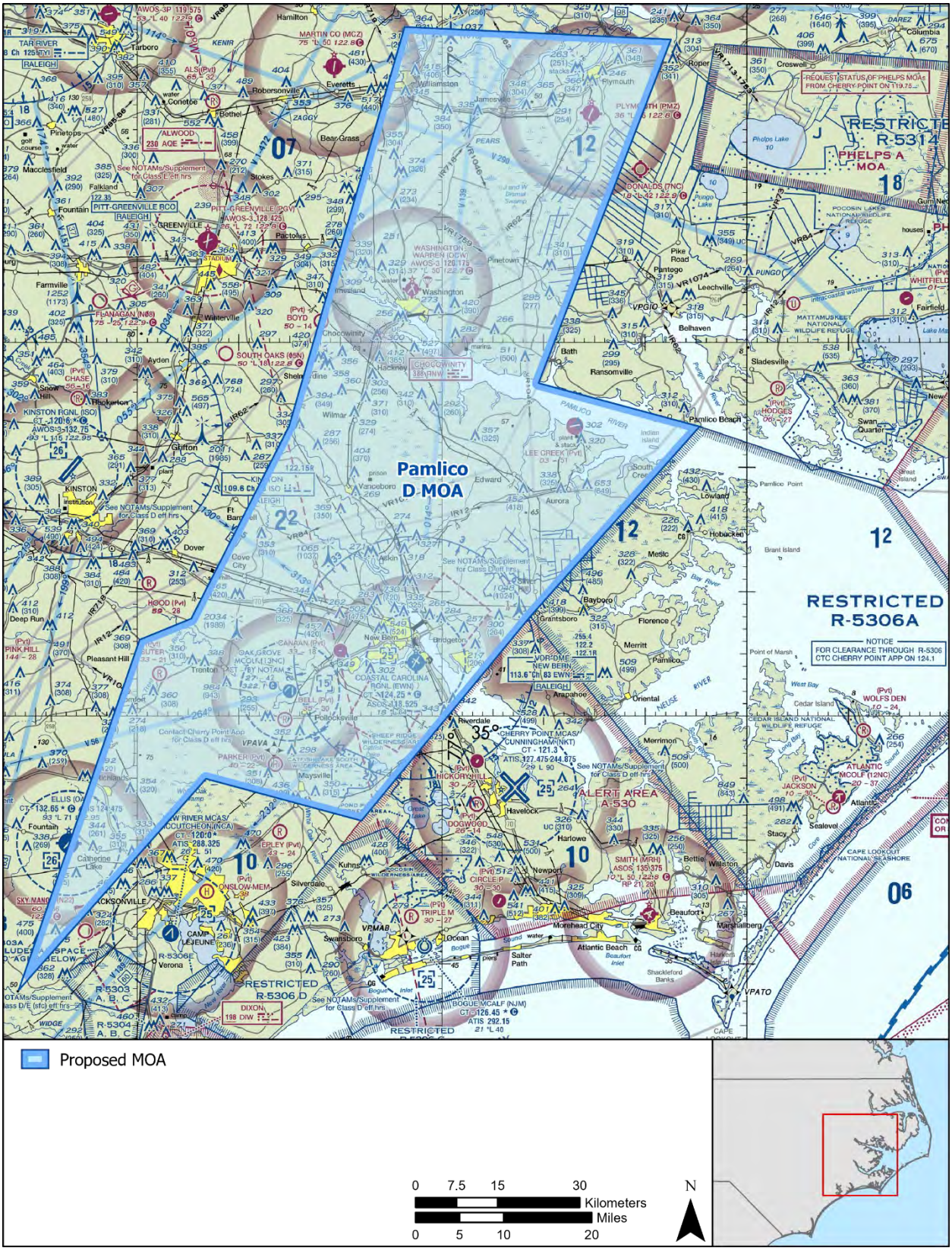

Figure 2-3. Proposed Pamlico D MOA

2.1.3 Hatteras F MOA

The proposed expanded Hatteras F MOA would be located over and west and north of Marine Corps Base (MCB) Camp Lejeune with a floor of 3,000 up to 17,999 feet MSL (**Figure 2-4**). The expanded MOA would overly much of Onslow County, the City of Jacksonville, and the New River. The expansion of this MOA would be contiguous with the existing R-5306D, and encompass R-5303 and R-5304. The proposed expansion of Hatteras F MOA would provide maneuver space around R-5303 and R-5304 and allow for the removal of the fixed-wing aircraft prohibition for these restricted areas due to their diminutive volume. In addition, the expansion would add maneuver space for aircraft in support of Military Occupational Specialty producing Joint Terminal Attack Controller schools and would mitigate airspace shortfalls involving Large Scale Exercises aboard MCB Camp Lejeune.

The published times of use would be Monday through Friday, 0800 – 2200 Local and other times by NOTAM. The Controlling Agency would be FAA Washington ARTCC and the Using Agency would be USMC, Commanding Officer, Marine Corps Air Station Cherry Point, NC.

Figure 2-4. Proposed Hatteras F MOA

3.0 METHODOLOGY

3.1 DATA SOURCE

To analyze the existing traffic in the region of influence, a request was made to the FAA to use its Performance Data Analysis and Reporting System (PDARS) data from Washington Center (ZDC) in conjunction with System Wide Information Management (SWIM) radar data from Raleigh-Durham (RDU) Terminal Radar Approach Control (TRACON). PDARS and SWIM data contain flight track data, as well as flight plan information. These two sets of radar data (PDARS and SWIM) had overlapping coverage of the region of influence and were merged to form a single dataset for the analysis. The dataset was reviewed for errors and omissions through a data validation process. A year's worth of daily flight track data was collected (Fiscal Year (FY) 2019: October 1, 2018 through September 30, 2019). In this document, we will refer to this combined list of data (from PDARS and SWIM for the period of FY 2019 as "the dataset") (ATAC 2020).

The information in the combined dataset includes the elements in **Table 3-1**.

Table 3-1. Data Elements Included in PDARS/SWIM List

Sector	Aircraft Type
Enter Sector (Date/Time)	Exit Sector (Date/Time)
Enter Location (Lat/Long)	Exit Location (Lat/Long)
Enter Speed	Exit Speed
Enter Altitude	Exit Altitude
Beacon Code	IFR/VFR
CT (Category of Aircraft)	MIL/CIV
Orig Airport	Dest Airport

3.2 FILTERING OF FLIGHT TRACKS

For each proposed SUA area, all historical flight tracks from the radar data that passed through the proposed SUA lateral boundaries and within the proposed altitudes were identified. The intent of this is to determine the number of aircraft that would be impacted by activation of the proposed airspace. The magnitude of the impact will be determined based on the changes required to avoid the proposed airspace during times of activation.

For each of the flight tracks that crossed the proposed SUA, the origin and destination airport were identified and counted – providing a list of the number of flights per year traveling to and from each airport. The number of unique combinations of origin and destination airports was in the hundreds, with many combinations occurring only once. The list was reduced to focus on the most frequently occurring airport origin-destination pairings, to represent the majority of traffic potentially affected by the proposed SUA and produce a manageable and meaningful analysis. Impacts to military aircraft are not considered – the assumption is that Department of Defense (DoD) activation of the proposed MOA airspace indicates acceptance of the impacts to their other aircraft for the duration of the MOA activation. Impacts are counted for non-military aircraft only.

One characteristic of the PDARS/SWIM dataset is that there are a lot of aircraft for which the category is listed as "Unknown", indicating that there are one or more data fields missing, to properly identify them. In this analysis, the unknowns were further filtered to determine if some were identifiable based on other

data fields. For example, an "Unknown" flight with origin and destination both being military-only airfields is assumed to be a military flight, an "Unknown" flight with an aircraft type that is a military-only aircraft type (such as F-22 or MV-22) is assumed to be a military flight, and an "Unknown" flight with a Mode 3 IFF beacon code that is uniquely assigned by a military base air traffic control (ATC) facility is also assumed to be a military flight. These "Unknown" flights were filtered out of the final analysis dataset.

3.3 IMPACTS TO FLIGHTS

The distance between each of the most common origin-destination pairings was calculated as a straight-line ("great circle" [GC] route). Though this is not likely the actual routing used, it represents a best-case straight-line distance directly from the origin airport to the destination airport. A GC calculator was used to determine the shortest distance (between two points on a sphere) for the route between the two airports to serve as the baseline.

To determine the potential impact to these common flights that cross the proposed SUA area, an alternative routing was calculated using a navigational aid (NAVAID) or "fix" that would route these flights outside the proposed SUA. GC routes were identified from origin to the intermediate fix, and from the intermediate fix to the destination, and added together to produce the total distance between the origin and destination that would result from rerouting flights around the proposed SUA. The change in distance was calculated by comparing the baseline straight-line routing to the alternative routing using NAVAIDs. The change in flight time (i.e., "extra minutes" needed to navigate around proposed SUA) was determined using a speed estimate. For aircraft crossing the MOA altitudes, the assumed true airspeed is 180 or 220 knots (dependent on type) for aircraft below 10,000 feet, and 330 knots for those between 10,000 and 18,000 feet MSL. These airspeed numbers are based on the averages in the dataset for the particular altitude bands. All calculations assume no wind.

An example of this rerouting methodology is depicted in **Figure 3-1**. The green line shows the GC route between Atlanta Hartsfield (ATL) and Dare County Regional Airport (MQI). This line intersects the proposed Pamlico C MOA area, depicted with blue shaded edges. The intermediate fix required to avoid the proposed Pamlico C MOA is the Tar River VORTAC NAVAID (TYI). The course shown in blue is the flight track that goes from ATL – TYI – MQI as an alternative to flying through the proposed Pamlico C MOA. This methodology is representative of the approach taken for all proposed SUA in this study. In this way, a flight plan that allows for avoidance of the proposed airspace can be compared in distance and time to the best/shortest possible routing available in the absence of the proposed airspace.

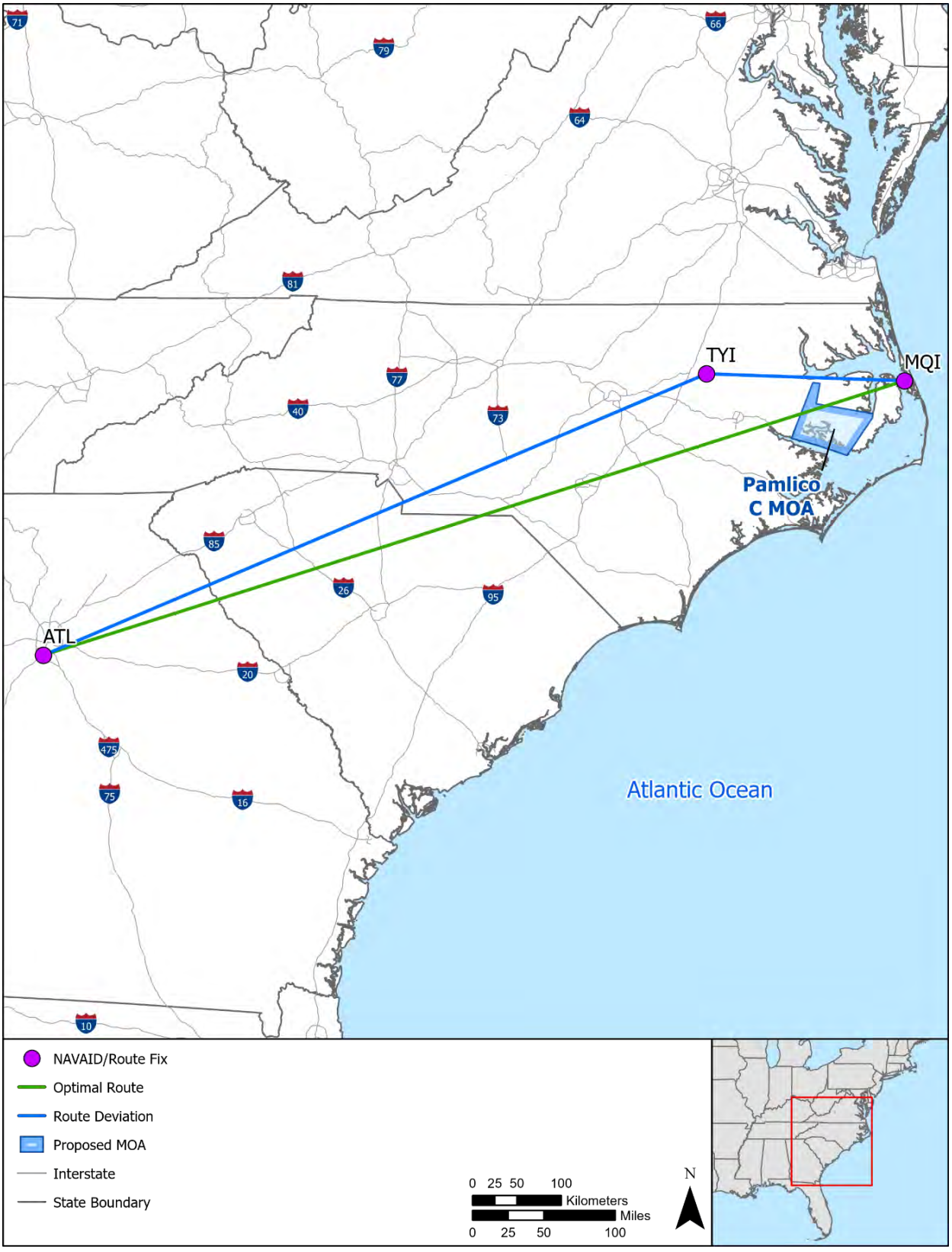

Figure 3-1. Example of Direct Flight Plan compared to Route Deviation to Avoid Proposed MOA.

3.4 SUA SCHEDULING AND ACTIVATION

In this document, several different terms are used to describe the use of the proposed MOAs at various times during the day. The definitions are below and reference **Figure 3-2**, which shows a notional depiction of the calendar for part of a fictional day regarding use of a particular MOA.

Scheduled. When a military flying unit wants to use a particular MOA, it will be scheduled ahead of time for discreet time blocks. For instance, in order to accomplish a particular training event, a squadron may schedule a MOA for one hour, with the intent to have two aircraft use it for that hour. In **Figure 3-2**, the green bars show three separate one hour periods.

Planned Activation. When military users schedule a particular MOA for discreet blocks of time, with only short times in between, the FAA will usually not try to use the airspace for other reasons during the short interludes between military use due to controller workload. In the example shown in **Figure 3-2**, there are two short "gap" times between military scheduled use, one of 20 minutes and one of 30 minutes. In cases like these, the planned activation time (shown as tan in color) will include those small gaps. It is generally more efficient for all users of the airspace to plan for MOA activation times that cover these discreet gaps. Also note that the activation typically begins slightly before the arrival of the first military user, so that they can proceed directly into the MOA without needing to hold outside of it (again, this is more efficient for all parties). In the example shown in **Figure 3-2**, the planned activation would begin 10 minutes prior to the first user, and last until the last user leaves the airspace, per the schedule.

Actual Activation. This is the amount of time that the MOA is activated in real time, and accounts for any changes from the plan. In the example shown in **Figure 3-2**, the actual activation time is shown in the maroon color. The airspace is activated as planned at 8:20, 10 minutes prior to the first scheduled user's arrival in the airspace. It is kept activated (per the plan) until it is apparent that the third user, scheduled to begin at 11:00, will not be using the airspace, at which time the MOA is deactivated, and is therefore available for other uses. A cancellation of scheduled MOA time can happen for a multitude of reasons, to include maintenance problems with the aircraft or weather conditions that preclude the aircraft from either flying or completing the training as planned. Actual activation of the MOA is what will inhibit non-participating IFR traffic from using the airspace.

Aircraft in SUA. This is simply the time that military aircraft are present in the activated MOA. In the example shown in **Figure 3-2**, aircraft presence in the MOA is shown with the blue bars. The first scheduled user arrives on time at 8:30, and departs about 10 minutes early at 9:20 (perhaps from training being complete, being low on fuel, or some other reason). The second event shown is scheduled from 9:50 until 10:50, but arrives to the MOA late (at 10:00), and leaves per their schedule. The third event is cancelled, and will not use the MOA as scheduled. When the military controller learns that the MOA will not be used as scheduled, the FAA is informed, and the MOA is deactivated. While non-participating civil aircraft can proceed through an active MOA if operating under VFR, pilots may elect to avoid a MOA when there are military aircraft present and Radar Services, which include Traffic Advisories, are not available. The pilot of civil aircraft can obtain MOA status and receive Traffic Advisories from the FAA/Military controlling agency.

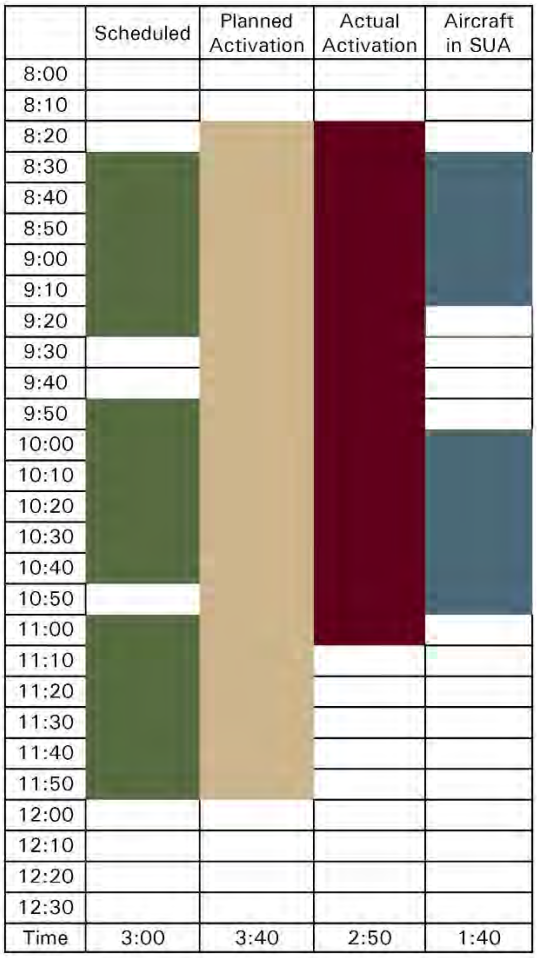

Figure 3-2. Notional Partial-Day Schedule for a MOA

In summary, **Figure 3-2** shows four different schedule terms that will be discussed in this document. In this example, the hypothetical MOA was "Scheduled" for 3 hours. It was planned to be activated for a single long block of 3 hours, 40 minutes. Its actual activation time (in real time) was just 2 hours and 50 minutes. And of that, there were military aircraft actively present in the MOA for an hour and 40 minutes. These numbers will change every day for every block of airspace – and the sections that follow will use these terms to describe the impacts of the proposed action on civil traffic (to include Air Carrier, Air Taxi, and General Aviation).

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4.0 POTENTIAL IMPACTS TO NON-PARTICIPATING AIRCRAFT

4.1 PAMLICO C MOA

4.1.1 Proposal

Table 4-1 shows that the proposed Pamlico C MOA would be used for up to 1,070 training sorties per year, which would normally occur 2 aircraft at a time. This results in a requirement for 535 blocks of training time, of which each would be an hour. The 710 hours of activation (which includes the small gaps anticipated between military flights) represent about 20% of the total time available between Monday and Friday, 0800 – 2200 Local (proposed times of use for the MOA). Outside these times of activation, there would be no need for any civil aircraft to avoid the airspace of the proposed Pamlico C MOA.

Table 4-1. Military Usage of Proposed Pamlico C

Metric	Pamlico C MOA	Assumptions
Number of Proposed Sorties	1,070	
Hours per Year – Military Aircraft In MOA	535	1 hour per 2 aircraft flight
Hours per Year – MOA Activation	710	Includes estimated gaps between military flights
Hours per Day Activation	<3 average	Up to 250 training days per year
% Military Aircraft Present	~ 15%	Monday to Friday, 0800 – 2200 Local
% Time MOA Activated	~ 20%	Monday to Friday, 0800 – 2200 Local

Note: Military aircraft would use Pamlico C MOA normally with 2 aircraft at a time.

4.1.2 Flights Impacted by the Proposal

4.1.2.1 Total Traffic

During the year examined (FY2019), the area of the proposed Pamlico C MOA had 3726 flights transit this airspace, between 8,000 and 18,000 feet MSL during the proposed times of use (Monday through Friday, 0800 – 2200 Local). The categories of flights are illustrated in **Table 4-2**. Over half of the flights through this airspace on an annual basis were military flights, classified as such in the FAA dataset. Additional screening of the dataset identified that some of the flights in the other categories were also military flights and were removed from the final dataset used for analysis. The basis for their removal is discussed in the following sections.

Table 4-2. FY19 Flights in Proposed Pamlico C MOA Airspace

Category	Full Dataset (FY2019)	Final Dataset for Analysis (Non-Military Aircraft Only)
Air Carrier	39	8
Air Taxi	32	18
General Aviation	288	236
Military	2125	0
Unknown	1242	741
TOTAL	**3726**	**1003**

Air Carrier flights that originated or terminated on military-only bases were assumed to be contract movements. The DoD often contracts airlines to move personnel and/or cargo to and from the locations of

training events or deployments. The flights removed from this dataset primarily included movements to and from MCAS Cherry Point, with a few from locations such as Seymour Johnson AFB.

General Aviation flights that originated and terminated at military bases are assumed to be military related – either from military flying clubs, Civil Air Patrol, or personal aircraft operated with permission from military bases. It is assumed that these are activities that are at the discretion of the DoD and as such are not impacted by any proposed airspace establishment.

As described in Section 3.2, the flights listed as *Unknown* in the FAA dataset were further filtered to remove flights that originated and terminated at military-only bases. Additionally, Unknown flights showing a mode 3 beacon code that is assigned by a military ATC facility were also removed. An additional subset of the unknown category was suspected to be made up of military wingmen, squawking "standby" and picked up on radar (in the SWIM data). While it is impossible to find and remove all of these, there were some that were clearly from military aircraft that were likely "spillouts" from adjacent SUA. These were aircraft operating between 8,000 and 10,000 feet MSL in the proposed airspace at high airspeeds. Civil aircraft operate below 250 knots below 10,000 feet MSL. In cases where an aircraft was operating in excess of 250 knots below 10,000 feet MSL, they were removed, with the assumption that they were military.

The end result of filtering the FY2019 dataset determined that there were 1003 non-military flights that crossed at least a part of the proposed Pamlico C airspace that could potentially be impacted by the establishment of this airspace.

4.1.2.2 Potential Impacts to Air Carrier Traffic

In FY2019, there were 8 (non-military) Air Carrier flights that crossed a part of the proposed Pamlico C MOA (see **Table 4-2**), or less than one per month. This relative scarcity is reflective of these flights operating either higher in altitude above the proposed MOA, and/or already avoiding adjacent SUA. It may also show the effect of diversions or other considerations that make penetration of this airspace rare.

Of these 8 flights, investigation of the origin/destination pairings show just 3 pairings were used twice each for the year (**Table 4-3** and **Figure 4-1**). The rest were single occurrences.

Table 4-3. Potential Impacts to Air Carrier Operations Due to Proposed Pamlico C MOA

Origin/ Destination	GC Distance (nm)	Intermediate Fix	Distance via Intermediate Fix (nm)	Delta (nm)	Delta (minutes)
ATL-MQI	452	TYI	458	5.9	1.1
MIA-MQI	652	HULIP	654	1.9	0.4
PDK-MQI	441	TYI	446	5.0	0.9

Legend: ATL – Atlanta Hartsfield International Airport; MQI – Dare County Regional/Manteo; MIA – Miami International; PDK – Dekalb/Peachtree; TYI – Tar River; HULIP – airspace fix; nm – nautical miles; GC – great circle

Each of these pairings would require a "go around" fix (Intermediate Fix) to be added to the flight plan that would slightly increase the distance of the trip and add about a minute of flight time or less. Air Carrier flights almost always already avoid the proposed airspace because of activation of other SUA (R-5314 or Pamlico B MOA) in the area. The differences from the GC route (which is likely not flown) is minimal for these flights. The additional flight times listed in Table 4-3 would occur very rarely, since normal flight tracks have to go around the proposed siting of the Pamlico C MOA already in nearly all cases.

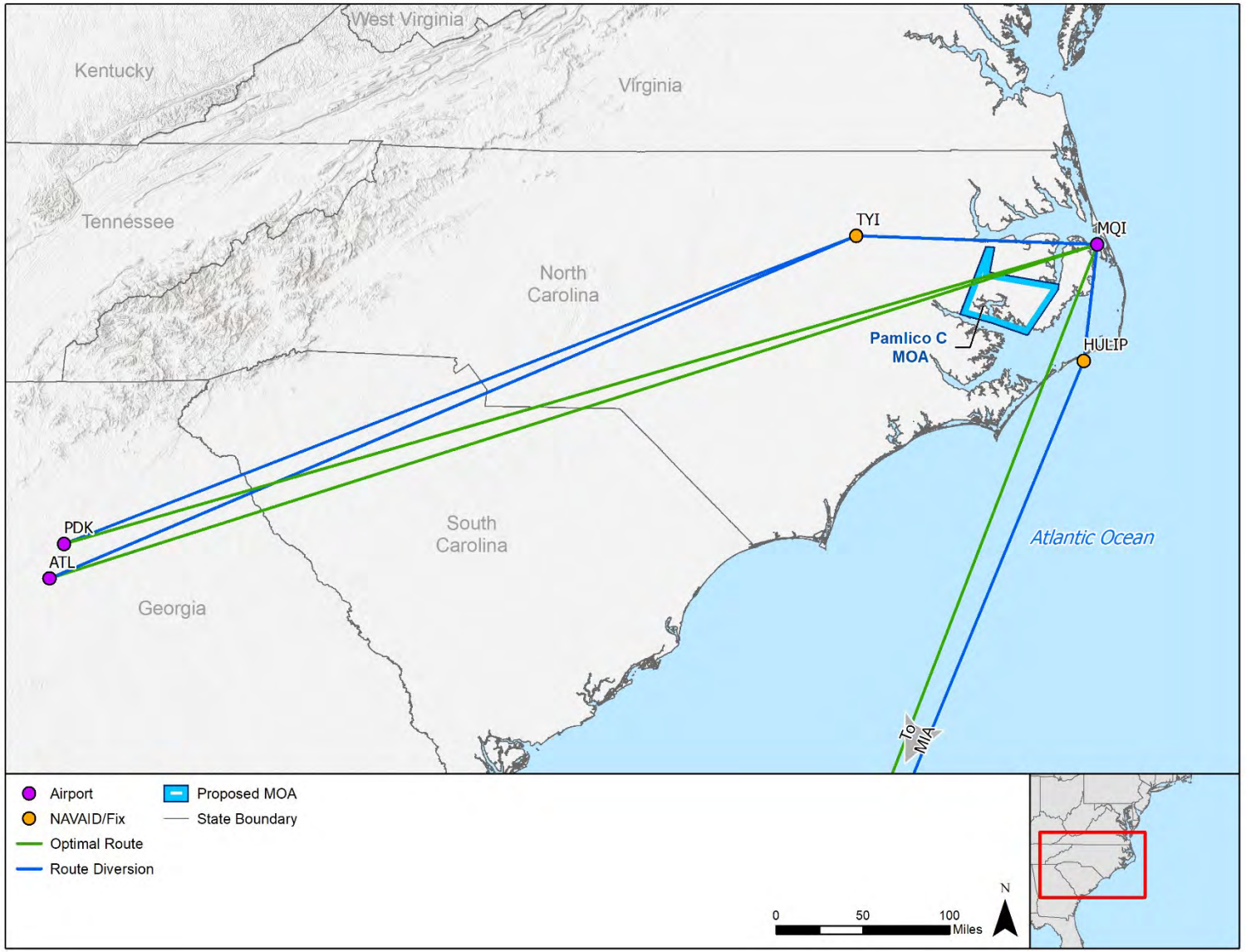

Figure 4-1. Potential Impacts to Air Carrier Operations Due to Proposed Pamlico C MOA

The proposed Pamlico C MOA airspace is rarely used by Air Carriers, and the most common routes that have used it in the past can re-route around the area with a small amount of change from their current operations, allowing them to continue to operate with minimal to no impacts.

4.1.2.3 Potential Impacts to Other Non-Military Traffic (Air Taxi, General Aviation, and Unknown)

Table 4-2 shows that the total non-military Air Taxi, General Aviation, and Unknown Flights is 995 flights for FY2019. This equates to about 4 flights per training day.

The training needs require that the Pamlico C MOA be activated approximately 20% of the time during the proposed times of use (Monday through Friday, 0800 – 2200 Local) (see **Table 4-1**). While the MOA is active, non-participating aircraft could operate below the floor of the proposed MOA (8,000 feet MSL) or go around it. Operating under the MOA (at 6,000 or 7,000 feet MSL Instrument Flight Rules [IFR] or 6,500 or 7,500 feet MSL Visual Flight Rules [VFR]) would be a reasonable choice for many of the aircraft types in the dataset (i.e., aircraft without oxygen and pressurization), as they do not operate much higher than that regularly. For VFR aircraft concerned with transiting an occupied MOA, the proposed Pamlico C MOA would have military aircraft present during 15% of the time (Monday through Friday, 0800 – 2200 Local). For those aircraft that operate at higher altitude (the higher cost/performing General Aviation aircraft with oxygen and pressurization), the preferred option may be to go around the proposed MOA. There were six origin/destination pairings that were used more than four times in FY2019. **Table 4-4** contains a list of those pairings, along with the intermediate fix required to avoid the proposed MOA and the change in distance and time to re-route; these are illustrated on **Figure 4-2**.

Table 4-4. Potential Impacts to Other Non-Military Operations Due to Proposed Pamlico C MOA

Origin/ Destination	Number of Times Used in 2019	GC Distance (nm)	Intermediate Fix	Distance via Intermediate Fix	Delta (nm)	Delta (minutes)
7W6-GWW	4	98	Hyde County (7W6) is under the adjacent Pamlico B MOA. Maintaining altitude below 8,000 feet MSL until clear of the proposed MOA is the alternative.			
HSE-RDU	11	160	Billy Mitchell (HSE) is under the adjacent Pamlico B MOA. Maintaining altitude below 8,000 feet MSL until clear of the proposed MOA is the alternative.			
ILM-MQI	8	147	BERTI	171	24	4.3
LEB-MRH	10	571	PEARS	582	11	2
MQI-DPL	5	125	BERTI	138	13	2.4
OXB-MRH	4	227	PEARS	240	13	2.3

Legend: 7W6 – Hyde County Airport; GWW – Wayne Executive/Goldsboro; HSE – Billy Mitchell/Hatteras; ILM – Wilmington; MQI – Dare County Regional/Manteo; LEB – Lebanon, NH; MRH – Michael J. Smith / Beaufort, NC; DPL – Duplin County/Kenansville; OXB – Ocean City, MD; BERTI – airspace fix; PEARS – airspace fix; GC – great circle; nm – nautical mile

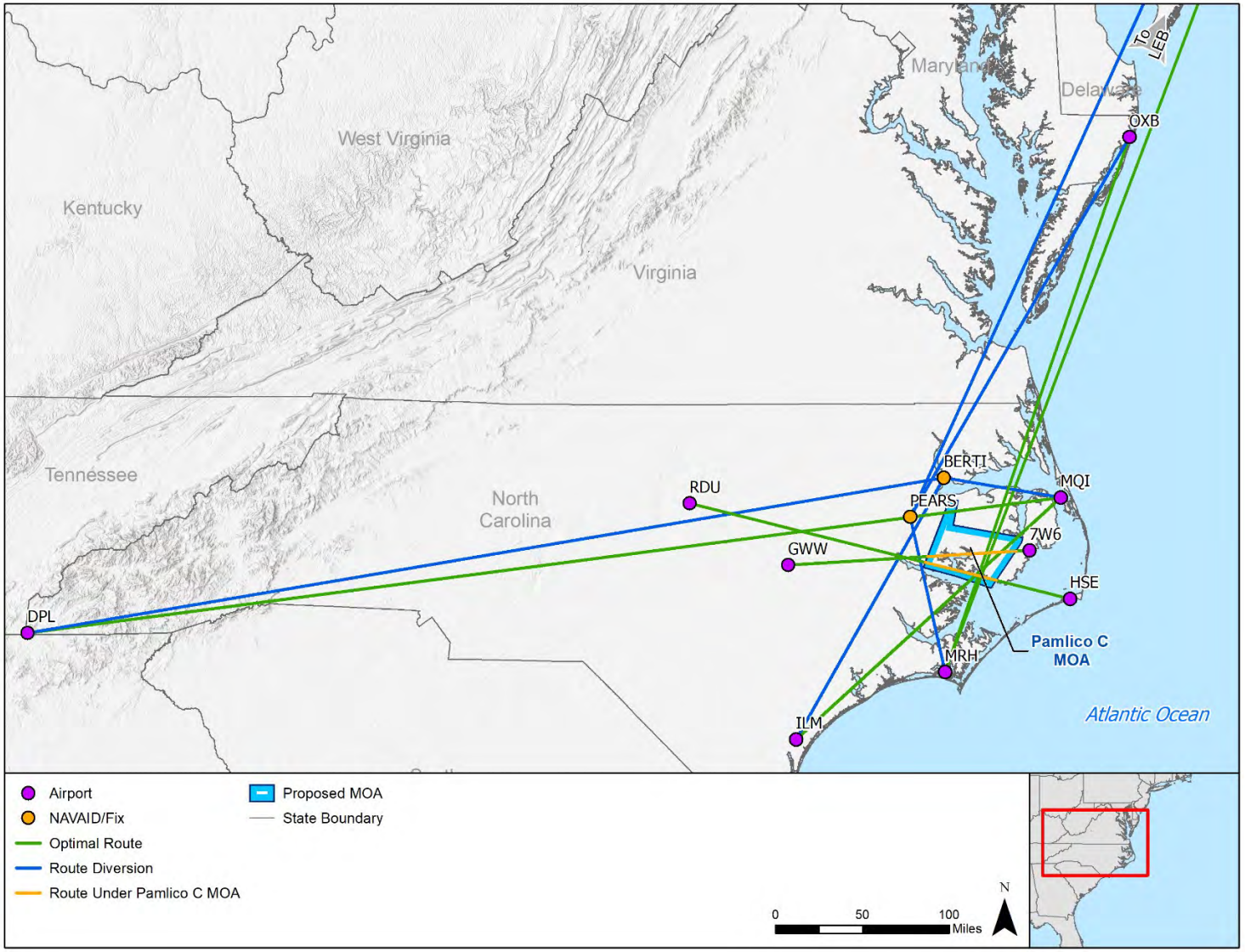

Figure 4-2. Potential Impacts to Other Non-Military Operations Due to Proposed Pamlico C MOA

Note that for the first two listed pairs in **Table 4-4**, two of the airports (Hyde County and Billy Mitchell) are under the existing Pamlico B MOA that has a floor of 8,000 feet MSL. These flights could not route around the proposed Pamlico C MOA but rather would need to remain below 8,000 feet MSL until clear of the proposed MOA during times that it is active. The flights associated with the other pairings in **Table 4-4** would have deviations of 2 to 4 minutes (increase) from the GC route. These flights would very rarely be able to fly the GC route given the existence of other SUA, such as R-5314 or R-5306. If the aircraft are already flying around the existing SUA, the deviation required to avoid the proposed Pamlico C MOA would be less than that shown in **Table 4-4**.

To summarize, the other non-military operations in the dataset (Air Taxi, General Aviation, and Unknown) show that about 4 flights per weekday utilize the area of the proposed Pamlico C MOA during the proposed times of use. Under the proposal, the MOA would be activated approximately 20% of the proposed times of use (Monday through Friday, 0800 – 2200 Local), meaning that most of the civil flights would not be affected at all. A small amount of flights using airfields beneath the existing Pamlico B MOA could remain below 8,000 feet MSL until clear of the proposed Pamlico C MOA, meaning they would need to remain below this altitude a little longer on departure or would need to descend below 8,000 feet MSL a little earlier on arrival. IFR traffic would have to avoid the MOA, and VFR traffic would be allowed to transit the MOA at the pilot's discretion. Flights that need to go around the activated MOA would have small increases in travel distance/time, however, most of this traffic is likely already routing around existing SUA in the area

4.2 PAMLICO D MOA

4.2.1 Proposal

Table 4-5 shows that the proposed Pamlico D MOA would be used for up to 290 training sorties per year, which would normally occur 4 aircraft at a time. This results in a requirement for 80 blocks of training time (rounded up slightly), of which each would be an hour each. The 100 hours of activation (which includes the small gaps anticipated between military flights) represent under 3% of the total time available between Monday through Friday, 0800 – 2200 Local. While the official proposed times of use for the Pamlico D MOA would be Intermittent by NOTAM, this MOA would most often be used in conjunction with the Pamlico C MOA, therefore, for airspace impact analysis purposes, the times of use for the Pamlico C MOA are used. Outside these times of activation, there would be no need for any civil aircraft to avoid the airspace of the proposed Pamlico D MOA.

Table 4-5. Military Usage of Proposed Pamlico D

Metric	Pamlico D MOA	Assumptions
Number of Sorties	290	
Hours per Year – Military Aircraft In MOA	80	1 hour per 4 aircraft flight, rounded up
Hours per Year – MOA Activation	100	Includes estimated gaps between military flights
Hours per Day	<1 average	Up to 250 training days per year
% Military Aircraft Present	~2%	Monday to Friday, 0800 – 2200 Local
% Time MOA Activated	~3%	Monday to Friday, 0800 – 2200 Local

Notes: [a] Military aircraft would use Pamlico D MOA normally with 2 aircraft at a time.

4.2.2 Flights Impacted by the Proposal

4.2.2.1 Total Traffic

During the year examined (FY2019), the area of the proposed Pamlico D MOA had 16,780 flights transit this airspace between 10,000 and 18,000 feet MSL during Monday through Friday, 0800 – 2200 Local. The categories of flights are illustrated in **Table 4-6**. About half of the flights through this airspace on an annual basis are military flights, classified as such in the FAA dataset. As described in **Sections 3.2 and 4.1.2**, the full dataset was further filtered to remove military aircraft from the other non-military categories. Those flights included Air Carrier flights that originated or terminated on military-only bases. There were also military flights that were miscategorized as non-military flights that were filtered out of the full dataset. For example, C-40 and P-8 are military aircraft based on the Boeing 737, and were sometimes classified as Air Carrier instead of Military; some C-12 military aircraft were accidentally labeled Pilatus PC12 and categorized as General Aviation, etc. An additional subset of the unknown category is suspected to be made up of military wingmen, squawking "standby" and picked up on radar (in the SWIM data). Without a good method to further filter these, they were included in the "other non-military" aircraft total as a conservative measure.

Table 4-6. FY19 Flights in Proposed Pamlico D MOA Airspace

Category	Full Dataset (FY2019)	Final Dataset for Analysis (Non-Military Aircraft Only)
Air Carrier	2930	2563
Air Taxi	408	408
General Aviation	2530	2416
Military	8547	0
Unknown	2365	1664
TOTAL	**16780**	**7051**

The end result of filtering the FY2019 dataset determined that there were 7,051 flights that were non-military flights that crossed at least a part of the proposed Pamlico D MOA that could potentially be impacted by the establishment of this airspace.

4.2.2.2 Potential Impacts to Air Carrier Traffic

In FY2019, there were 2563 (non-military) Air Carrier flights that crossed a part of the proposed Pamlico D MOA, or about 10 per day on the weekdays. These flights are primarily due to airline servicing of Wilmington, North Carolina and New Bern, North Carolina.

Eighty-nine percent (89%) of those flights were associated with five origin/destination pairings (**Figure 4-3** and **Table 4-7**). The table shows the difference in the shortest possible route (the GC Distance), and a route that would avoid the proposed Pamlico D MOA by using an intermediate fix.

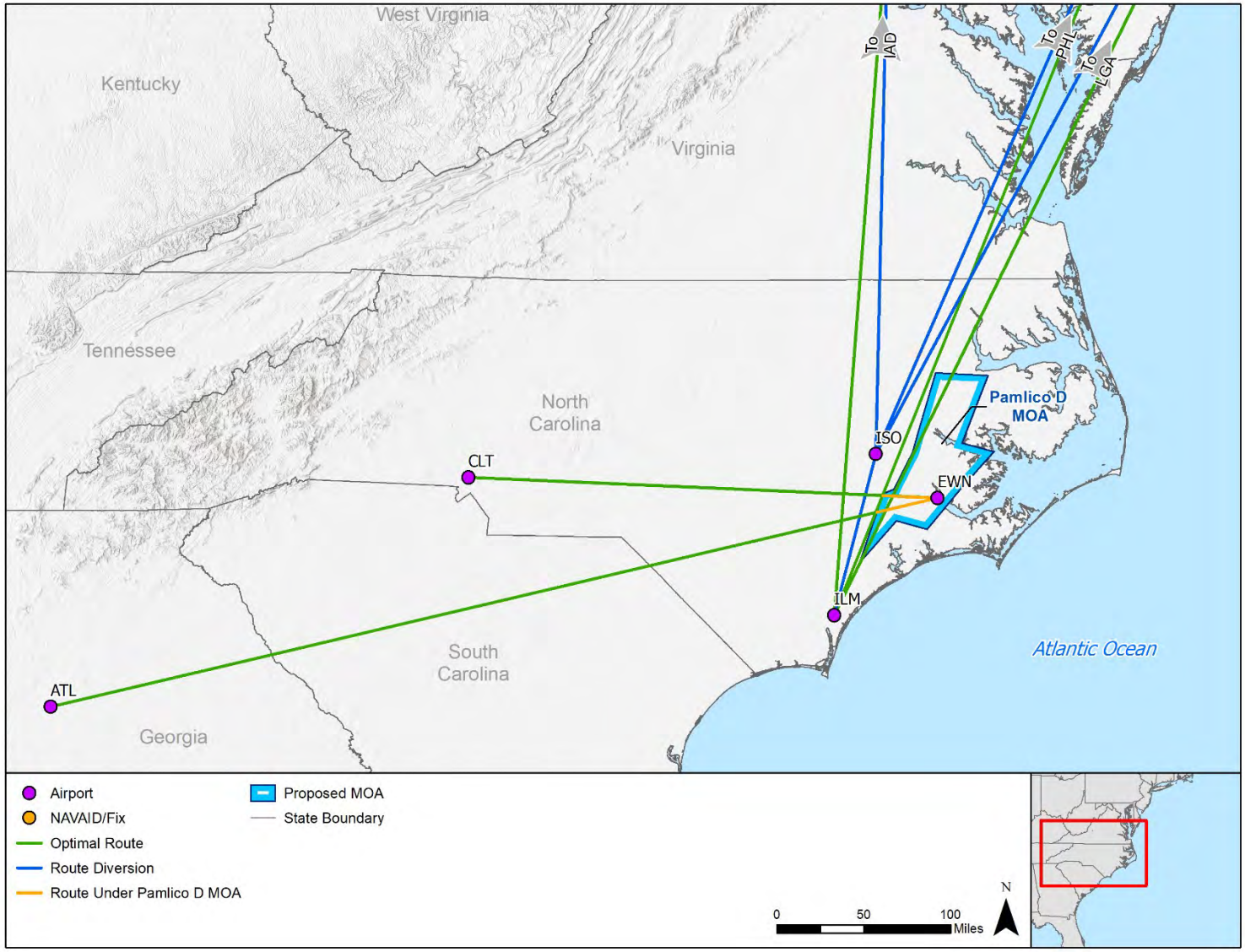

Figure 4-3. Potential Impacts to Air Carrier Operations Due to Proposed Pamlico D MOA

Table 4-7. Potential Impacts to Air Carrier Operations Due to Proposed Pamlico D MOA						
Origin/ Destination	**Number of times in 2019**	**GC Distance (nm)**	**Intermediate Fix**	**Distance via Intermediate Fix**	**Delta (nm)**	**Delta (minutes)**
ATL-EWN	464	Re-route not possible since one of the airport pairs occurs beneath MOA[1]				
CLT-EWN	1221					
IAD-ILM	62	282	ISO	283	1	0.3
ILM-PHL	957	362	ISO	363	1	0.1
LGA-ILM	823	435	ISO	436	1	0.3

Legend: ATL – Atlanta Hartsfield International Airport; EWN – Coastal Carolina/New Bern; CLT – Charlotte International Airport; IAD – Dulles; ILM – Wilmington; PHL – Philadelphia, PA; LGA – Laguardia, NY; ISO – Kinston,NC; GC – great circle; nm – nautical mile

Note [1] Both of these routes are roughly east-west routes to/from New Bern, NC, which lies beneath the proposed Pamlico D MOA. If active, there would be no way to go around the MOA, so traffic would have to go under the 10,000 feet MSL floor. For departures from EWN, this would mean reducing the rate of climb, or leveling off at 8,000 feet until past the western edge of the activated Pamlico D MOA. Arrivals into New Bern would need to be below 10,000 feet prior to crossing the western edge of the proposed airspace. This earlier descent would be a minor change, as the dataset shows that 90% of these flights enters the proposed airspace at 12,000 feet and below on the descent (with 80% below 11,000) and exit through the bottom nearly immediately.

The flights originating in New Bern, headed roughly west or southwest for Charlotte or Atlanta would have to remain below 10,000 feet MSL, if the proposed Pamlico D MOA were active, until they were clear of its western edge. This would not add significant time to the trip, but may require operating at slightly less than an optimal climb profile. In the opposite direction, the data shows that aircraft inbound to New Bern briefly touch the bottom edge of the proposed Pamlico D on the very western edge. The slightly earlier descent required to avoid the airspace during times of activation would be a negligible impact.

The other common routes (between Wilmington and Philadelphia, LaGuardia, and Dulles) could re-route to avoid the airspace laterally resulting in a change of less than a minute, when compared to the GC route. This would also be a negligible effect.

The proposed Pamlico D MOA is fairly often crossed by air carriers (10 times per day). During the estimated time of activation of the proposed Pamlico D MOA (about 5% of the time Monday through Friday, 0800 – 2200 Local), some deviation could be required. In all cases for the most common routes, the impact of the proposed Pamlico D MOA would be minimal.

4.2.2.3 Potential Impacts to Other Non-Military Traffic (Air Taxi, General Aviation, and Unknown)

Table 4-6 shows that the total FY2019 non-military Air Taxi, General Aviation, and Unknown Flights were 4,488 flights, about 17 flights per weekday.

The training needs require that the Pamlico D MOA be activated about 5% of the time between Monday through Friday, 0800 – 2200 Local (the official proposed times of use for the Pamlico D MOA would be Intermittent by NOTAM) (see **Table 4-5**). While the MOA is active, non-participating aircraft could operate below the floor of the proposed Pamlico D MOA (10,000 feet MSL) or go around it. Operating under the MOA (at 8,000 or 9,000 feet MSL IFR or 8,500 or 9,500 feet MSL VFR) would be a reasonable choice for many of the aircraft types in the dataset (i.e., aircraft without oxygen and pressurization), as they do not operate much higher than that regularly.

For those aircraft that operate at higher altitude (the higher cost/performing General Aviation aircraft with oxygen and pressurization), the preferred option may be to go around the proposed MOA. There were seven origin/destination pairings that were used more than twice per month in FY2019. A list of those parings are illustrated on **Figure 4-4**, along with the intermediate fix required to avoid the proposed MOAs, **Table 4-8** contains a list as well. Note that two of these are in locations where flying around the proposed airspace is either not possible or not practical. For each, there is an altitude option that would allow these flights to be completed with minimal impact. The other pairings all result in less than 3 minutes of change in their routings, with most less than a minute.

Table 4-8. Potential Impacts to Other Non-Military Operations Due to Proposed Pamlico D MOA

Origin/ Destination	Number of Times Used in 2019	GC Distance (nm)	Intermediate Fix	Distance via Intermediate Fix	Delta (nm)	Delta (minutes)
MRH-RDU	128	67	No re-route option [1]			
TEB-ILM	96	435	ISO	436	1	<1
ECG-ILM	53	146	KENIR	161	15	2.7
HPN-ILM	46	454	ISO	455	1	<1
EWN-RDU	32	98	No re-route option [2]			
BED-ILM	26	582	ISO	585	3	<1
ORF-ILM	25	178	ISO	181	3	<1

Legend: MRH – Michael J. Smith/Beaufort, NC; RDU – Raleigh-Durham; TEB – Teterboro, NJ; ILM – Wilmington; ECG – Elizabeth City; HPN – Westchester County/White Plains, NY; EWN – Coastal Carolina/New Bern; BED – Hanscom/Bedford, MA; ORF – Norfolk, VA; GC – great circle; nm – nautical mile

Notes: [1] MRH (Michael J Smith / Beaufort, NC) is located very near a variety of existing SUA. For this route, going around that SUA is not practical – so remaining below it is a better option. Of the aircraft on this route in 2019, 85% of them operated in this airspace below 12,000 feet, and 91% below 13,000 feet. The impact to descend slightly earlier enroute to MRH or to remain below 10,000 feet MSL for a few extra miles is very small.

[2] EWN (Coastal Carolina / New Bern, NC) is below the proposed Pamlico D MOA. When the proposed MOA was active, the IFR aircraft traveling to/from EWN would have to remain below 10,000 feet MSL until clear of it. This would be a very small impact, with 91% of these aircraft operating below 12,000 feet already.

The unknown aircraft flying in this area (see **Table 4-6**) are largely VFR traffic and are assumed to be mostly General Aviation. Nearly all of these flights have altitudes that are at or below 12,000 feet MSL. This traffic could remain below 10,000 feet MSL during times that the proposed Pamlico D MOA was activated, although the VFR traffic can transit an active MOA at the pilot's discretion. For VFR pilots wanting to avoid military aircraft in MOAs, the proposed Pamlico D MOA would have military aircraft in it about 4% of the time between Monday through Friday, 0800 – 2200 Local.

To summarize, the other non-military operations in the dataset (Air Taxi, General Aviation, and Unknown) show that on average, about 17 flights per weekday utilize the area of the proposed Pamlico D MOA. A third of these are classified as "unknown" and are nearly all General Aviation aircraft already operating at lower VFR altitudes that could be adjusted to remain below 10,000 feet when the proposed Pamlico D MOA is active. For the identified aircraft types, with known origins and destinations, the vast majority (and most common) could re-route around the MOA with simple adjustments that would add only a couple of minutes or less, or a climb/descent profile adjustment to remain below the floor of the proposed MOA. These adjustments would be required only when the MOA was activated, which would be about 5% of the time between Monday through Friday, 0800 – 2200 Local (the official proposed times of use for the Pamlico D MOA would be Intermittent by NOTAM). VFR traffic can transit through active MOAs at the pilot's discretion with no impact.

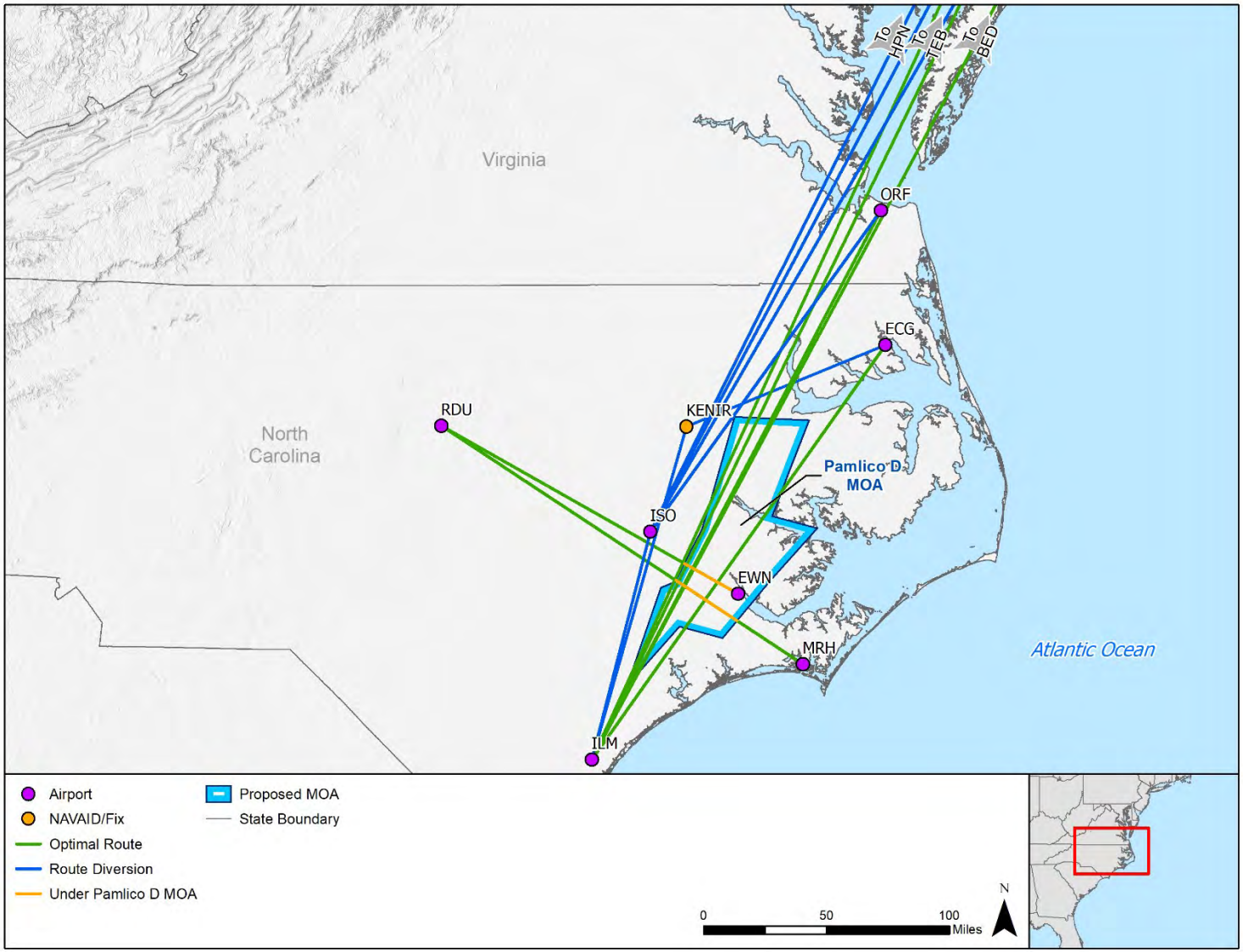

Figure 4-4. Potential Impacts to Other Non-Military Operations Due to Proposed Pamlico D MOA

4.3 HATTERAS F MOA

4.3.1 Proposal

Table 4-9 shows that the proposed expanded Hatteras F MOA would be used for up to 300 training sorties per year, which would occur 2 aircraft at a time. This results in a requirement for 150 blocks of training time, of which each would be an hour. The 300 hours of activation represent (which includes the small gaps anticipated between military flights) represent about 9% of the total time available between the proposed times of use (Monday through Friday, 0800 – 2200 Local). Outside these times of activation, there would be no need for any civil aircraft to avoid the proposed expanded Hatteras F MOA.

Table 4-9. Military Usage of Proposed Expanded Hatteras F MOA

Metric	Hatteras F MOA	Assumptions
Number of Sorties	450	
Hours per Year – Military Aircraft In MOA	225 [1]	1 hour per 2 aircraft flight
Hours per Year – MOA Activation	300	Includes estimated gaps between military flights
Hours per Day	~1 average	Up to 250 training days per year
% Military Aircraft Present	< 7%	Monday to Friday, 0800 – 2200 Local
% Time MOA Activated	<9 %	Monday to Friday, 0800 – 2200 Local

Notes: [1] Military aircraft would use Hatteras F MOA normally with 2 aircraft at a time.

4.3.2 Flights Impacted by the Proposal

4.3.2.1 Total Traffic

During the year examined (FY2019), the area of the proposed expanded Hatteras F MOA had 10,721 flights transit this airspace, between 3,000 and 18,000 feet MSL during Monday through Friday, 0800 – 2200 Local. The categories of flights are illustrated in **Table 4-10**. Almost half of the flights through this airspace on an annual basis are military flights, classified as such in the FAA dataset. As described in **Sections 3.2 and 4.1.2**, the full dataset was further filtered to remove military aircraft from the other non-military categories. Those flights included Air Carrier flights that originated or terminated on military-only bases. There were also military flights that were miscategorized as non-military flights that were filtered out of the full dataset.

Table 4-10. FY19 Flights in Proposed Expanded Hatteras F MOA Airspace

Category	Full Dataset (FY2019)	Final Dataset for Analysis (Non-Military Aircraft Only)
Air Carrier	2,331	2,178
Air Taxi	200	200
General Aviation	2,230	2,157
Military	4,672	0
Unknown	1,348	900
TOTAL	**10,721**	**5,620**

The end result of filtering the FY2019 dataset determined that there were 5,620 flights that were non-military flights that crossed at least a part of the proposed expanded Hatteras F MOA airspace that could potentially be impacted by the establishment of this airspace.

4.3.2.2 Potential Impacts to Air Carrier Traffic

In FY2019, there were 2,178 (non-military) Air Carrier flights that crossed a part of the proposed expanded Hatteras F MOA, or about 8 per day on weekdays. These are primarily due to airline servicing of Wilmington, North Carolina and New Bern, North Carolina.

Eighty-seven percent (87%) of those flights were due to six origin/destination pairings (**Table 4-11** and **Figure 4-5**). The table shows the difference in the shortest possible route (the GC Distance), and a route that would avoid the proposed expanded Hatteras F MOA by using an Intermediate fix.

Table 4-11 Potential Impacts to Air Carrier Operations Due to Proposed Expanded Hatteras F MOA

Origin/ Destination	Number of times in 2019	GC Distance (nm)	Intermediate Fix	Distance via Intermediate Fix	Delta (nm)	Delta (minutes)
EWN-CLT	1,377	192	Note [1]			
EWN-ATL	333	376	WALLO	376	0	0
ILM-PHL	333	362	WALLO	366	4	<1
LGA-ILM	300	435	WALLO	440	5	<1
EWN-ILM	159	64	BEULA	74	10	<2
IAD-ILM	72	282	BEULA	282	1	<1

Legend: ATL – Atlanta Hartsfield International Airport; EWN – Coastal Carolina/New Bern; CLT – Charlotte; ILM – Wilmington; PHL – Philadelphia, PA; LGA – LaGuardia, NY; ISO – Kinston; GC – great circle; nm – nautical mile
Note: [1] this route will get shorter if aircraft avoid the proposed expanded Hatteras F MOA.

Nearly two-thirds of the Air Carrier traffic is on the route from New Bern (EWN) to Charlotte (CLT). The GC course between these airports does not intersect the proposed expanded Hatteras F MOA; however, it appears that the traffic leaving EWN for CLT initially proceeds to the south before proceeding west. If the proposed expanded Hatteras F MOA were active (which would be about 9% of the time Monday-Friday 0800-2200 Local), these flights would have to turn earlier toward Charlotte, meaning that the time enroute would be shorter than it is currently. These flights would have to fly a more direct route to avoid the proposed expanded Hatteras F MOA during the limited times that it was active. Likewise, from New Bern (EWN) to Atlanta (ATL), the traffic appears to be routed slightly southward initially. A small modification to go direct to the intermediate fix avoids the proposed Hatteras F MOA and is essentially the same as the GC route.

The rest of the common routes listed in **Table 4-11** (between Wilmington and Philadelphia, LaGuardia, New Bern, and Dulles) could all re-route to avoid the proposed Hatteras F MOA laterally resulting in a change of less than two minutes, when compared to the GC route. This would also be a negligible effect.

The proposed expanded Hatteras F MOA is fairly often crossed by air carriers (8 times per day). However, in all cases for the most common routes the impact of avoiding the proposed Hatteras F MOA would be minimal.

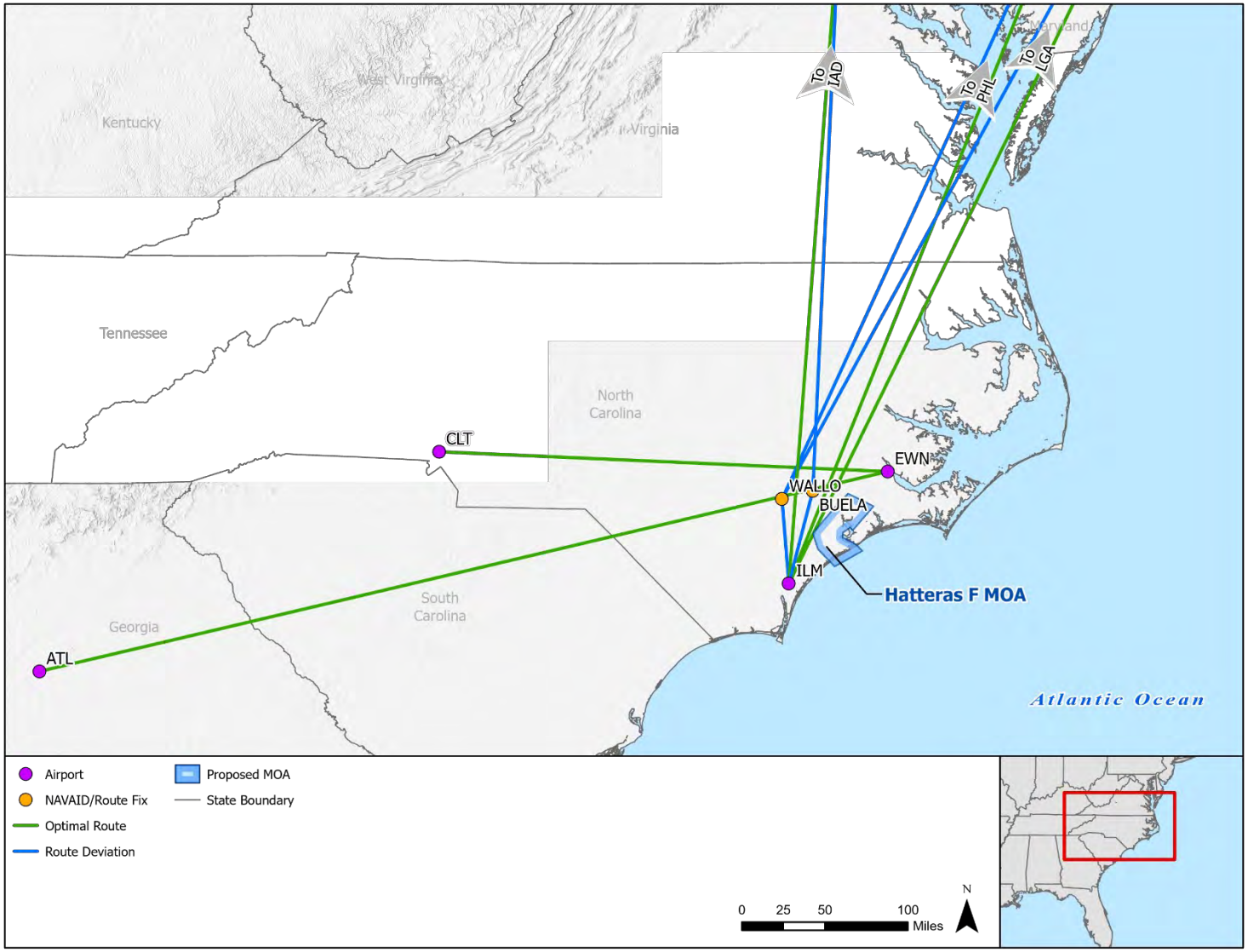

Figure 4-5. Potential Impacts to Air Carrier Operations Due to Proposed Expanded Hatteras F MOA

4.3.2.3 Potential Impacts to Other Non-Military Traffic (Air Taxi, General Aviation, and Unknown)

Table 4-10 shows that the total non-military Air Taxi, General Aviation, and Unknown Flights, operating in the airspace of the proposed expanded Hatteras F MOA between Monday through Friday, 0800 – 2200 Local, is 3,442 flights for FY2019.

The training needs require that the expanded Hatteras F MOA be activated about 9% of the time during the proposed times of use of Monday through Friday, 0800 – 2200 Local (see **Table 4-9**). While the MOA is active, non-participating aircraft could operate below the floor of the proposed Hatteras F MOA (3,000 feet MSL) or go around it. Because the floor of this proposed MOA is 3,000 feet MSL, the most likely method for avoidance would be lateral offset, and not operating below. There were six origin/destination pairings that were used more than twice per month in FY2019. **Table 4-12** contains a list of those pairings, along with the intermediate fix/fixes required to avoid the proposed MOA; this is illustrated on **Figure 4-6**. Two of these (see the notes in the table) are not compared directly to the GC routes as are the others in this analysis because the likelihood of that routing would be nearly impossible with existing SUA nearby. When compared to typical routing, the additional time needed to avoid the proposed expanded Hatteras F MOA is less than 2 minutes. The increase associated with rerouting for the other pairings would range from less than a minute up to 3.3 minutes.

Table 4-12. Potential Impacts to Other Non-Military Operations Due to Proposed Expanded Hatteras F MOA

Origin/ Destination	Number of Times Used in 2019	GC Distance (nm)	Intermediate Fix	Distance via Intermediate Fix	Delta (nm)	Delta (minutes)
EWN-ILM	79	64	BEULA	74	10	3.3
SOP-MRH	32	138	FONPU	138	1	<1
ILM-ORF	30	178	WALLO	185	7	2.3
MRH-ILM	23	67	FONPO-BEULA	95	Note 1	
AVL-MRH	22	292	FONPO	293	1	<1
ILM-MQI	22	147	BEULA-RMACK	167	Note 2	

Legend: MRH – Michael J Smith / Beaufort, NC; EWN – Coastal Carolina/New Bern; SOP – Moore County/Pinehurst; ILM – Wilmington; MQI – Dare County Regional/Manteo; AVL – Asheville, NC; ORF – Norfolk, VA; GC – great circle; nm – nautical mile

Notes: [1] MRH (Michael J Smith / Beaufort, NC) is located very near a variety of existing SUA. For this route to Wilmington, the direct route is nearly unaffected by the proposed Hatteras F MOA – however, that requires most of the straight-line distance to be over the ocean. It is expected that normally, the aircraft go around the various MOAs and restricted areas already, so while the route that avoids those areas and the proposed expanded Hatteras F MOA is about 9 minutes slower than the GC route, it is less than 2 minutes different than a normal overland route that avoids the other military airspace.

[2] The route from Wilmington to Manteo is likely only very rarely available in a straight-line or GC course due to the surrounding MOAs and restricted areas. The route shown to go around the proposed expanded Hatteras F MOA is nearly 7 minutes longer than the GC route, but is less than 1 minute different than the typical routing that would go around the other existing military airspace.

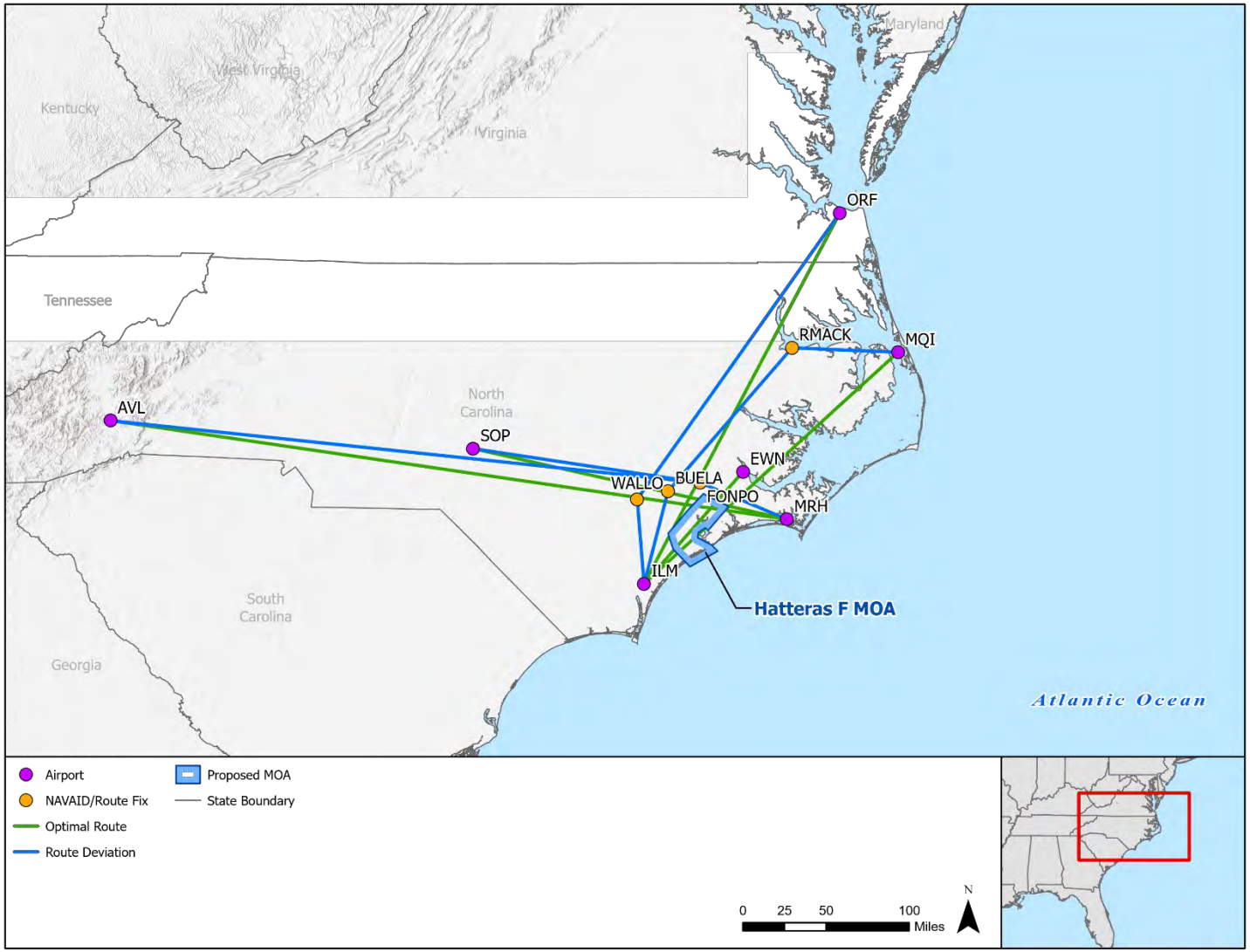

Figure 4-6. Potential Impacts to Other Non-Military Operations Due to Proposed Expanded Hatteras F MOA

To summarize, the other non-military operations in the dataset (Air Taxi, General Aviation, and Unknown) show that on average, about 13 flights per weekday utilize the area of the proposed expanded Hatteras F MOA. Analysis of the common routes show that these flights can easily avoid the proposed expanded Hatteras F MOA (when active, which would be about 9% of the time Monday-Friday 0800-2200 Local) without excessive additional time and distance. VFR traffic can pass through an active MOA at the pilot's discretion with no impact. For VFR pilots who wish to avoid transiting a MOA when military aircraft are present, that condition would only exist about 7% of the time Monday-Friday 0800-2200 local.

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5.0 REFERENCES

ATAC. 2020. Proposed Pamlico and Hatteras Military Operations Areas (MOA) Airspace Analysis in Support of Environmental Assessment.

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Appendix C
Noise Analysis

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Noise Analysis for Environmental Assessment for Enhancement of Pilot Training by Establishing Special Use Airspace in Eastern North Carolina

August 2022

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NOISE ANALYSIS
ENVIRONMENTAL ASSESSMENT FOR ENHANCEMENT OF PILOT TRAINING BY ESTABLISHING SPECIAL USE AIRSPACE IN EASTERN NORTH CAROLINA

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
A-	Alert Area
AAD	Average Annual Day
ATCAA	Air Traffic Control Assigned Airspace
BASEOPS	Base Operations
CFR	Code of Federal Regulations
dB	decibels
dBA	A-weighted decibels
DNL	Day-Night Average Sound Level
DoD	Department of Defense
EA	Environmental Assessment
ETR	engine temperature ratio
FAA	Federal Aviation Administration
FICON	Federal Interagency Committee on Noise
ft	feet
Hg	inches Mercury
Hz	hertz
IFR	Instrument Flight Rules
Ldnmr	Adjusted Day-Night Average Sound Level
L_{eq}	Equivalent Sound Level
LOA	Letter of Agreement
L_{max}	Maximum Sound Level
MICEAST	Marine Corps Installations East
MIL	military
MOA	Military Operation Area
MSL	above mean sea level
NIPTS	Noise Induced Permanent Threshold Shift
m	meters
MSL	mean sea level
OPAREA	Operations Area
PHL	potential for hearing loss
R-	Restricted Area
RPM	rotations per minute
SEL	Sound Exposure Level
SUA	Special Use Airspace
U.S.	United States
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VFR	Visual Flight Rules
W-	Warning Areas

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1.0 INTRODUCTION

1.1 BACKGROUND

Marine Corps Installations East (MCIEAST; hereafter, referred to as the Marine Corps) is preparing an Environmental Assessment (EA) to enhance pilot training by establishing additional Special Use Airspace (SUA) in eastern North Carolina within the Cherry Point Operations Area (OPAREA). The proposed SUA, in conjunction with existing SUA within the Cherry Point OPAREA, would address several training deficiencies by providing larger contiguous, over-land airspace with appropriate altitudes to allow a more realistic training environment.

The existing Cherry Point OPAREA includes a complex of different types of airspace, including SUA (**Figure 1-1**), that are integrated with ground training areas and targets. These airspace components include restricted areas (designated with an 'R-' on aeronautical charts), Military Operations Areas (MOAs), Air Traffic Control Assigned Airspace (ATCAA), and Alert Areas (designated with 'A-' on aeronautical charts).

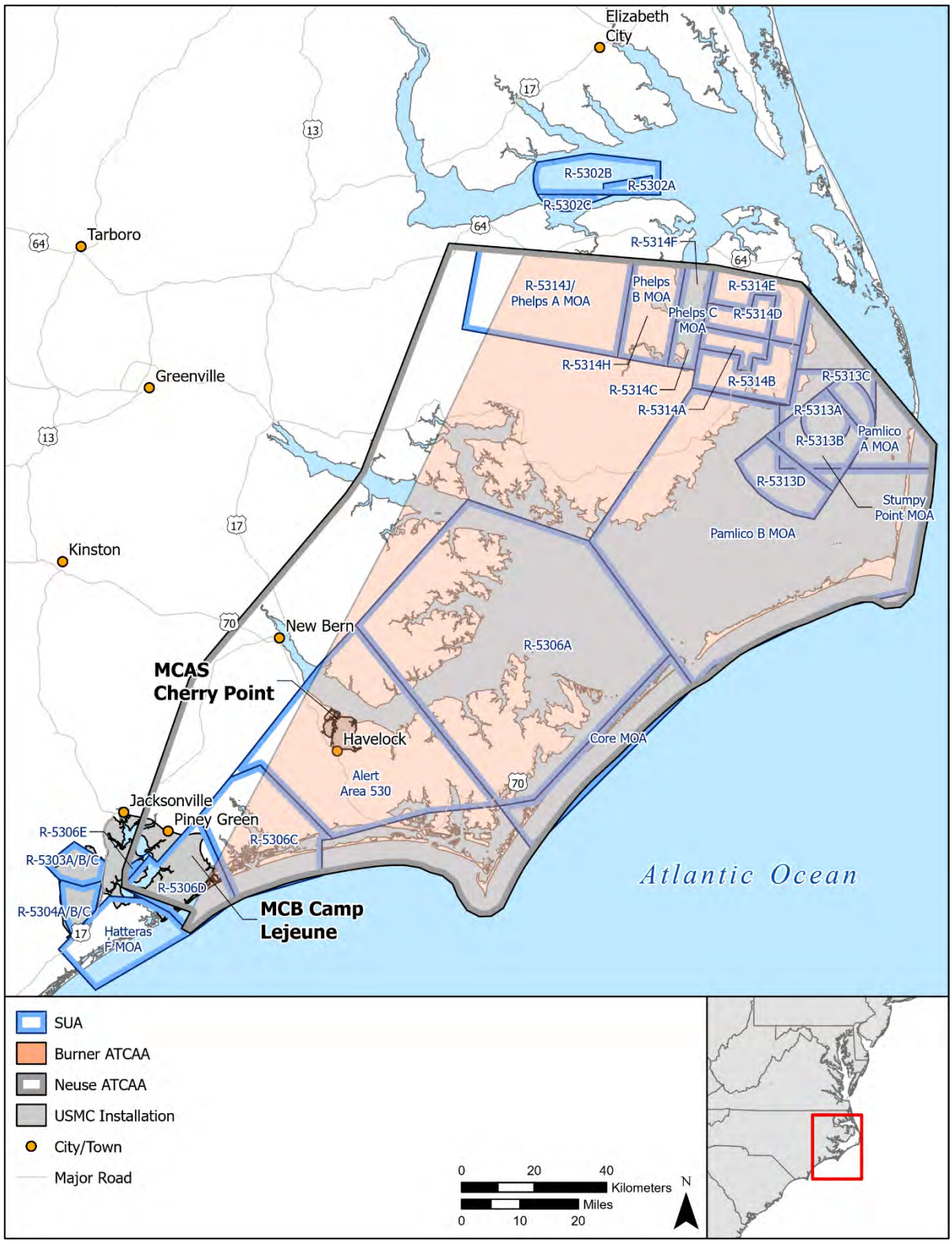

Figure 1-1. Special Use Airspace within the Cherry Point OPAREA

1.2 PROPOSED SPECIAL USE AIRSPACE

The Proposed Action is to increase permanent SUA within the Cherry Point OPAREA to provide larger contiguous, over-land airspace with appropriate altitudes to address SUA shortfalls and provide a more realistic training environment. The Federal Aviation Administration (FAA), as a cooperating agency, is responsible for formally establishing the SUA in support of the Marine Corps.

To increase the SUA available to support essential Marine Corps aviation training, the Marine Corps seeks to establish the Pamlico C MOA, the Pamlico D MOA, and to expand the Hatteras F MOA contiguous with the existing Cherry Point OPAREA. The location of the proposed MOAs in relation to existing SUA is shown on **Figure 1-2**.

The altitude floor and ceiling[1] and the published times of use for the proposed MOAs are detailed in **Table 1-1**.

Table 1-1. Proposed MOAs

Name	Floor	Ceiling	Proposed Published Times of Use
Pamlico C MOA	8,000 feet MSL	Up to but not including FL180	Monday through Friday, 0800 – 2200 Other times by NOTAM
Pamlico D MOA	10,000 feet MSL	Up to but not including FL180	Intermittent by NOTAM
Hatteras F MOA	3,000 feet MSL	Up to but not including FL180	Monday through Friday 0800 – 2200 Other times by NOTAM

1.3 DOCUMENT STRUCTURE

Section 1.0 introduces this study; while Section 2.0 describes the methodology used in the analysis. Section 3.0 provides the modeling data and the noise exposure for the Existing Conditions. Section 4.0 provides the modeling data and the noise exposure for the Proposed Action Alternatives. Section 5.0 summarizes the supplemental noise metrics analysis and the results calculated for this study. Section 6.0 provides a conclusion.

[1] Altitude references for aircraft operations are presented in several units of measure: above ground level (AGL), above mean sea level (MSL), and Flight Level (FL):

- AGL references are usually used at lower altitudes (almost always below 10,000 feet), when clearance from terrain is more of a concern for aircraft operation.
- MSL altitudes are used most across aviation when operating at or below 18,000 feet when clearance from terrain is less of a concern for aircraft operation.
- FL is used to describe the cruising altitudes for aircraft traveling long distances above 18,000 feet. Flight Levels are given in hundreds of feet, e.g. FL300 is 30,000 feet.

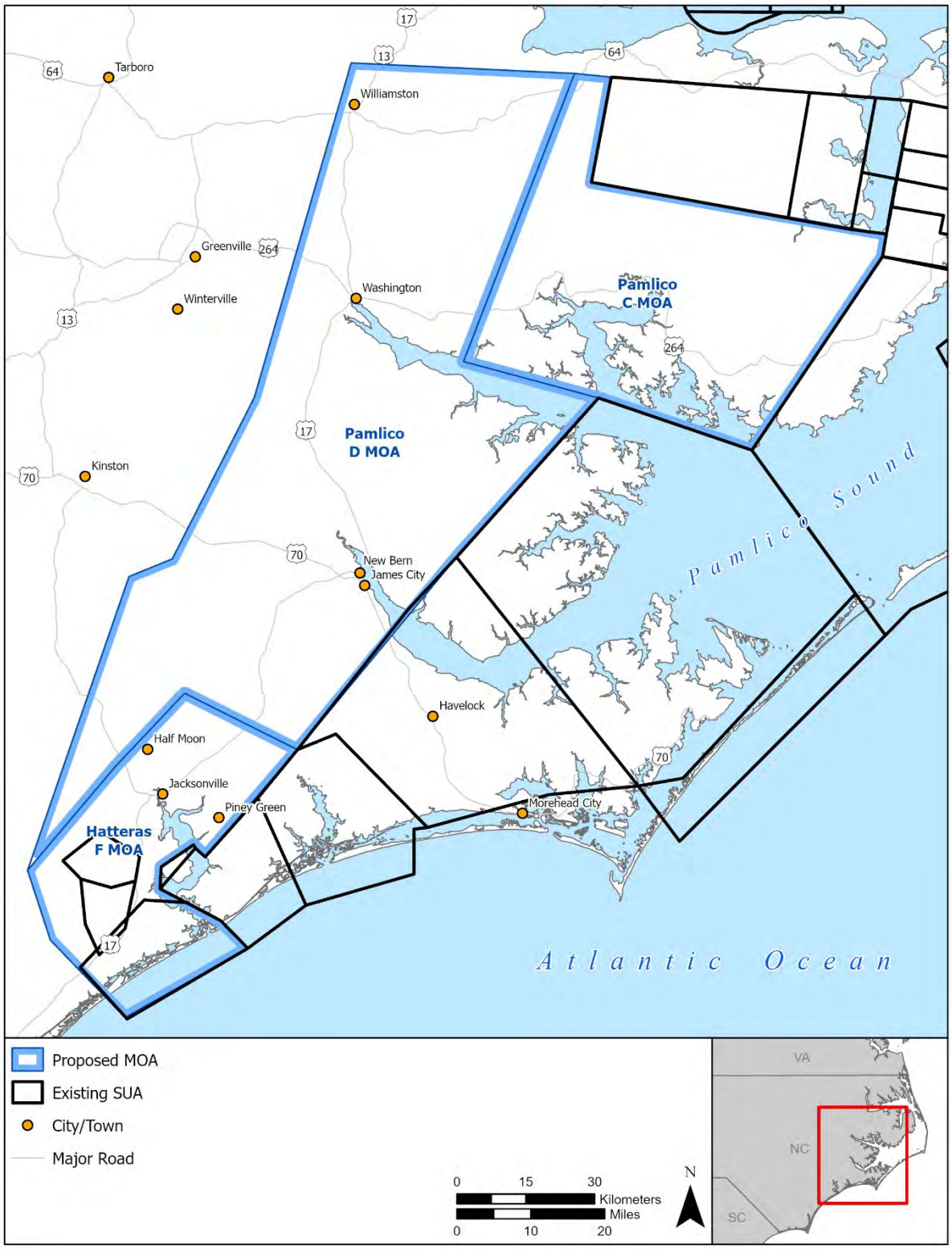

Figure 1-2. Location of Proposed SUA in Eastern North Carolina

2.0 METHODOLOGY

2.1 NOISE ANALYSIS

The Department of Defense (DoD) and the Federal Interagency Committee on Noise (FICON) (1978) outline three types of metrics to describe noise exposure for environmental impact assessment:

- A measure of the greatest sound level generated by single aircraft events: Maximum Sound Level (L_{max}),
- A combination of the sound level and duration: Sound Exposure Level (SEL), and
- A cumulative measure of multiple flight and engine maintenance activity: Day-Night Average Sound Level (L_{dn}, also written as DNL).

Human hearing sensitivity to differing sound pitch, measured in cycles per second or hertz (Hz), is not constant. To account for this effect, sound measured for environmental analysis of most aircraft noise utilizes A-weighting, which emphasizes sound roughly within the range of typical speech and de-emphasizes very low and very high frequency sounds

The noise associated with aircraft operations can be subsonic or supersonic. Subsonic noise is noise generated by an aircraft's engines and airframe. This is the most familiar form of noise. Supersonic noise is the noise generated when an aircraft flies faster than the speed of sound and has the potential to create sonic booms. A sonic boom is the sound associated with shock waves generated when the aircraft travels at supersonic speeds. This Proposed Action does not include any supersonic activity within the MOAs; therefore, this analysis focuses only on subsonic noise.

Environmental assessment of proposed scenario conditions often requires prediction of future conditions that cannot be easily measured until after implementation. The solution to this predicament includes the use of computer software to simulate the future conditions, as detailed in the following sections.

2.2 OPERATIONAL ASSUMPTIONS

The proposed Pamlico C MOA would be used in conjunction with surrounding SUA to provide the space necessary to execute more realistic and challenging tactical scenarios. The Pamlico C MOA would not only provide maneuver space but would also allow threat systems already in place in R-5314 and R-5306A to be used in conjunction with one another to create more complex threat training scenarios. The Pamlico C MOA would provide significant medium altitude training airspace connecting existing SUA (Phelps MOA, R-5314, Pamlico B MOA, and R-5306).

In conjunction with the proposed Pamlico C MOA, the Pamlico D MOA would create a larger training environment to execute Large Force Exercises (LFEs). In LFEs, numerous aircraft of a variety of types conduct simultaneous activities across a spectrum of missions. For instance, in a large, real-world, complex scenario, there may be fighter aircraft protecting the force against enemy aircraft while attack aircraft find and prosecute targets avoiding surface-to-air threats that

are being suppressed by electronic-warfare aircraft. These scenarios may involve movement of ground forces by helicopter and tiltrotor, inflight refueling, intelligence gathering and other tasks. Integration with air and ground forces from other Services (primarily Navy and Air Force) is a significant training objective since that is how the U.S. fights its real battles. Putting all these forces together in an integrated way relies heavily on the command-and-control system, which is best exercised when these activities are occurring simultaneously in contiguous airspace.

The Marine Corps' intended use for the expansion of the Hatteras F MOA is to provide additional airspace around the Restricted Areas, R-5303/5304, for use in accomplishing training tasks related to controlling and executing close air support with both rotary-wing and fixed-wing aircraft. The training involves coordination of ground- and air-based resources in various attack scenarios and requires flexibility in the number and type of aircraft used as well as the approach direction and altitude in order to effectively prepare for real-world situations.

MOAs, unlike Military Training Routes, allow for these types of training scenarios and aircraft activity at varying altitudes and trajectories within the designated boundaries of the MOA. For these reasons, there are no "normal" or "common" routes or headings aircraft would follow, aircraft activity could occur anywhere within the MOA. This allows maximum flexibility in the training scenarios which significantly improves the effectiveness of the training. **Appendix A** provides the specific altitude bands, power settings, and type of aircraft used in the modeling assumptions for each proposed MOA based on the proposed operations described in the paragraphs above.

2.3 NOISE MODELING AND PRIMARY NOISE METRICS

The DoD prescribes use of the NOISEMAP suite of computer programs (Wyle 1998; Wasmer Consulting 2006) containing the core computational programs called "NMAP," version 7.3, and "MRNMap," version 3.0 for environmental analysis of aircraft noise. For this noise study, the NOISEMAP suite of programs refers to Base Operations (BASEOPS) as the input module, NOISEMAP as the noise model for predicting noise exposure in the installation environment, and MRNMap as the noise model used to predict noise exposure in the SUA. NMPLOT is the tool used to combine the noise contours produced by NOISEMAP into a single noise exposure map. As indicated in **Table 2-1**, the grid spacing used for calculating noise exposure for each model was 500 feet.

Table 2-1. Noise Modeling Parameters		
Software	**Analysis**	**Version**
NMAP	Airfield Noise – military aircraft	7.3
MR_NMAP	Airspace Noise	3.0
Parameter	**Description**	
Receiver Grid Spacing	1,000 ft in x and y	
Metrics	DNL (primary) SEL, L_{max} (secondary)	
Basis	AAD Operations (NMAP)	
Modeled Weather (Monthly Averages 2019; April selected)		
Temperature	61 °F	
Relative Humidity	60%	
Barometric Pressure	29.98 in Hg	

Source: Cardno 2021a.

Legend*:* ft = feet; DNL = Day-Night Average Sound Level; SEL = Sound Exposure Level; L_{max} = maximum sound level; L_{eq} = Equivalent Sound Level; AAD = Average Annual Day; USGS = U.S. Geological Survey; m = meters; NED = National Elevation Dataset; DLG = Digital Line Graph; kPa-s/m^2 = kilopascal-seconds per square meter; °F = degrees Fahrenheit; in Hg = inches Mercury

The word “metric” describes a standard of measurement. Researchers developed many different types of noise metrics in the attempt to represent the effects of environmental noise. Each metric used in environmental noise analysis has a different physical meaning or interpretation.

The metrics supporting the assessment of noise from aircraft operations for this EA are the DNL, Maximum Sound Level (L_{max}), and SEL. Each metric is briefly discussed below.

2.3.1 DNL

The DNL is an A-weighted cumulative noise metric that measures noise based on annual average daily aircraft operations. DNL is the U.S. Government standard for modeling the cumulative noise exposure and assessing community noise impacts. DNL uses two time periods: daytime (acoustic day) and nighttime (acoustic night). Daytime hours are from 7:00 a.m. to 10:00 p.m., and nighttime hours are from 10:00 p.m. to 7:00 a.m. local time. DNL weights operations occurring during its nighttime period by adding 10 dB to their single event sound level. This study analyzes DNL on an annual average daily basis which means the airspace operations have been divided by 365 days per year to reflect an average day.

2.3.2 L_{max} and SEL

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. L_{max} is the maximum sound level experienced by a receptor during a noise event. The SEL combines L_{max} with the total duration in which the sound is heard. The SEL takes this sound energy from a single event and compresses it into 1 second. SEL is always greater in value than L_{max} because it compresses all sound energy into a 1-second timeframe.

2.3.3 Noise Induced Hearing Loss

Noise induced hearing loss risk has been extensively studied, with the consensus that populations exposed to noise greater than 80 DNL are at the greatest risk of potential hearing loss (DoD 2009). Because no person or place would be exposed to noise levels greater than 80 DNL, noise induced hearing loss is not discussed further in this analysis.

2.4 NOISE IMPACT THRESHOLDS

The U.S. Environmental Protection Agency (USEPA) has identified 55 DNL as a level that protects public health and welfare with an adequate margin of safety (USEPA 1982). This means that 55 DNL is a threshold below which adverse noise effects are not expected to occur.

According to the Federal Interagency Committee on Urban Noise, noise exposure greater than 65 DNL is considered generally incompatible with residential, public use (i.e., schools), or recreational and entertainment areas (Federal Interagency Committee on Urban Noise 1980).

The FAA defines a threshold for significant noise impacts as "[t]he action would increase noise by DNL 1.5 dB or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a 1.5 dB or greater increase, when compared to the No Action Alternative for the same timeframe." FAA Order 1050.1F.

3.0 EXISTING CONDITIONS

3.1 EXISTING HATTERAS F MOA

3.1.1 Subsonic Modeling Data

The Marine Corps (AV-8B and FA-18) routinely uses the existing Hatteras F MOA to access the Greater Sandy Run Area for training operations. The local airspace is depicted graphically in **Figure 3-1**. A summary of annual airspace operations is presented in **Table 3-1**. All operations are assumed to be daytime operations, or prior to 10:00 pm, local time.

Table 3-1. Annual Sorties in Existing Hatteras F MOA

Aircraft	Existing Sorties
AV-8B	300
FA-18	75
Total	***375***

3.1.2 Subsonic Noise Exposure

MRNMap takes into account aircraft power settings, aircraft speed, and altitude when calculating average annual noise for the airspace. The software also spreads the noise out throughout the entire airspace evenly. The existing Hatteras F MOA currently experiences 46 DNL (dBA) from annual aircraft operations from the Marine Corps.

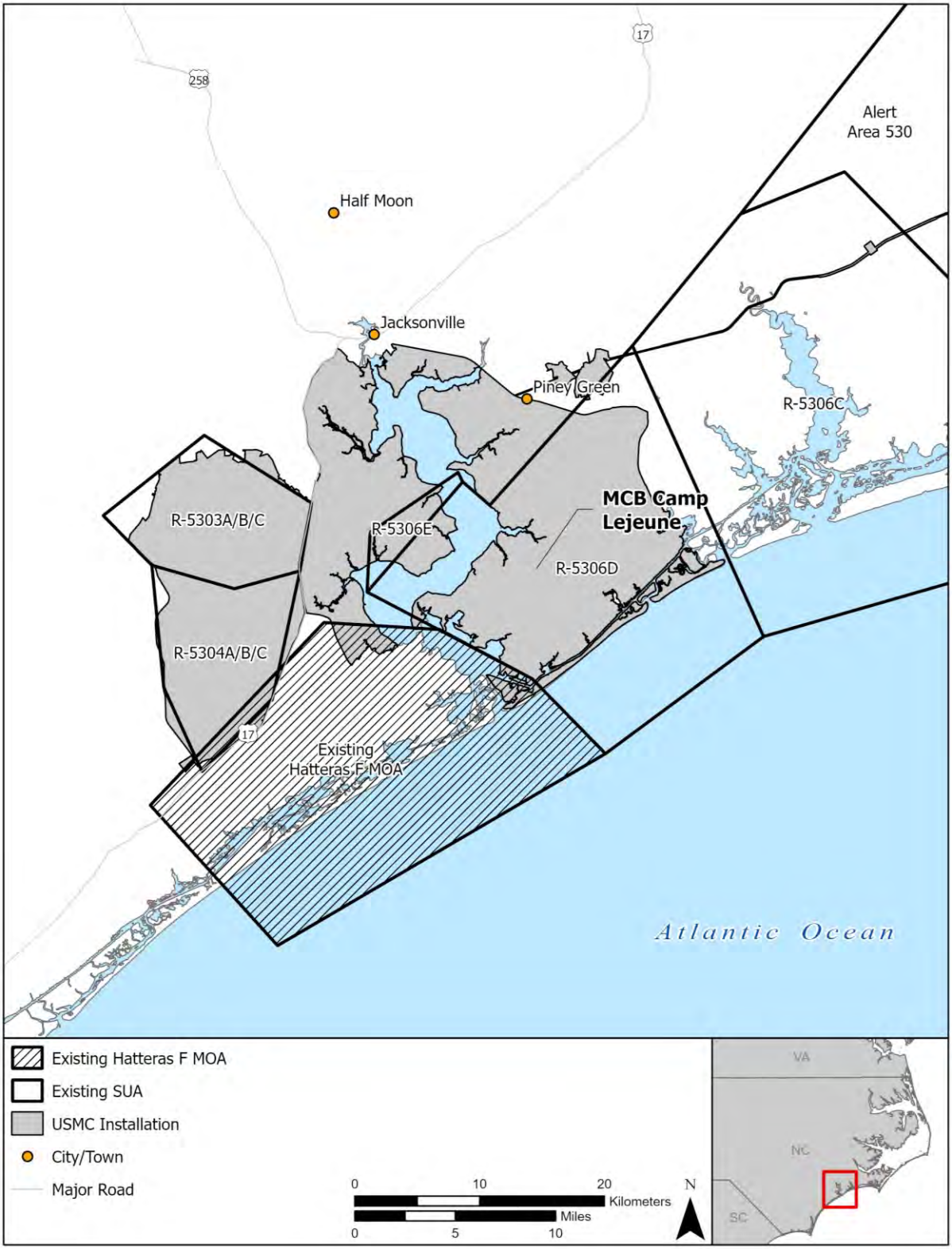

Figure 3-1. Existing Hatteras F MOA

4.0 PROPOSED ACTION SCENARIO

The following section details the modeling data and the resultant noise exposure for the Proposed Action scenarios. The EA analyzes two action alternatives. Alternative 1 would establish Pamlico C and Pamlico D MOAs and expand the existing Hatteras F MOA. Alternative 2 would establish the Pamlico C MOA and expand Hatteras F MOA only. While these comprise two distinct action alternatives, the operations for each proposed MOA remain unchanged between alternatives. Therefore, the noise modeling results for each MOA are presented together below.

4.1 SUBSONIC MODELING DATA

Annual aircraft operations for the various aircraft and branch of service by MOA are summarized in **Table 4-1.** As shown, there would be a modest increase in aircraft operations in the Hatteras F MOA from existing to proposed. While no permanent SUAs exist in the area of the proposed Pamlico C and Pamlico D MOAs, these areas are adjacent to other airspace and aircraft may use these areas transiting from one area to another. All operations would occur during daytime hours, or prior to 10:00 pm local time. Detailed tables of specific altitudes and power configurations can be found in Appendix A.

Table 4-1. Proposed Annual Sorties by MOA

Service	Aircraft	Annual Aircraft Sorties by MOA			
		Existing Hatteras F MOA	Proposed Pamlico C MOA	Proposed Pamlico D MOA	Proposed Hatteras F MOA
USMC	AV-8B	300	--	--	--
USMC	F-18A/C	75	--	--	--
USMC	F-35B/C	--	260	80	410
USN	F-18E/F	--	360	90	
USAF	F-15E	--	450	120	30
USAF	F-16C	--	--	--	10
	Total	***375***	***1,070***	***290***	***450***

Source: USMC 2021
Legend: USMC = U.S. Marine Corps; USN = U.S. Navy; USAF = U.S. Air Force

4.2 SUBSONIC NOISE EXPOSURE

Estimated noise generated from aircraft utilizing the proposed MOAs is shown in Table 4-2. As shown, DNL values are generally low. This is expected given the relatively low number of sorties, as well as the somewhat large areas of airspace that are proposed. The floors of the proposed MOAs are also different, with Hatteras F MOA being the lowest (3,000 feet mean sea level [MSL]). The highest DNL value was for the proposed Hatteras F MOA, with a value of 48 DNL. This is below the value determined by USEPA to protect public health and safety and the significance threshold defined by the FAA for noise impacts (see **Section 2.2.3**).

Table 4-2. DNL Values for Proposed Annual Aircraft Operations in Special Use Airspace	
Special Use Airspace Name	**DNL (dBA)**
Proposed Pamlico C MOA	41
Proposed Pamlico D MOA	<35
Proposed Hatteras F MOA	48

Source: Cardno 2021b
Legend: dBA = A-weighted decibel; DNL = Day-Night Average Sound Level.

5.0 SUPPLEMENTAL METRICS

While DNL is the U.S. Government standard metric for assessing noise impacts, supplemental metrics are used to produce more detailed noise exposure information for the decision process and to improve communication with the public and stakeholders. Supplemental metrics are not intended to replace the DNL metric as the primary descriptor of cumulative noise exposure and anticipated significance of impacts, but rather are useful tools to supplement the impact information disclosed by the DNL metric. For this Proposed Action, the noise analysis included peak sound exposure as a supplemental metric to better describe the loudness of a single overflight event.

5.1 SINGLE EVENT METRICS

Table 5-1 shows the results for single event metrics for the various aircraft that would use the proposed MOAs. For these calculations, each aircraft was modeled for SEL and L_{max} at three different power settings (afterburner, military [MIL] power, and 85% thrust) at three different altitudes. For this analysis, the floors of the proposed MOAs were used for the single event noise estimations since this would generate the loudest possible scenario. The DNL reported above, gives the average noise levels throughout the year but does not account for the "loudness" of an individual overflight event. **Table 5-1** shows an estimation of what an observer on the ground would experience if an aircraft flew directly overhead at the different power configurations and altitudes shown below.

Table 5-1. SEL and Lmax Values for Aircraft Overflights at Various Altitudes

Aircraft	Power Configuration	SEL and L_{max} (dBA) at Various Altitudes (MSL)					
		3,000 ft		8,000 ft		10,000 ft	
		SEL (dBA)	L_{max} (dBA)	SEL (dBA)	L_{max} (dBA)	SEL (dBA)	L_{max} (dBA)
AV-8B	Afterburner	N/A	N/A	N/A	N/A	N/A	N/A
	MIL Power	98	85	85	71	81	67
	85% RPM	90	85	77	70	74	67
F-18C	Afterburner	108	102	96	87	93	86
	MIL Power	107	97	95	83	92	80
	85% NC	82	77	69	62	66	59
F-18E/F	Afterburner	107	103	96	90	93	86
	MIL Power	102	97	90	83	86	79
	85% NC	92	85	78	70	74	66
F-35B	Afterburner	108	103	96	90	93	86
	MIL Power	102	96	90	82	87	79
	85% ETR	100	93	89	81	86	77
F-15E	Afterburner	106	100	95	87	92	83
	MIL Power	105	95	93	82	89	78
	85% NC	91	84	80	70	77	67
F-16C	Afterburner	105	100	94	87	91	84
	MIL Power	97	90	85	76	82	73
	85% NC	68	61	55	47	52	44

Notes: Speed for all aircraft for all scenarios was 400 knots. AV-8B does not have afterburner capability.
Legend: dBA = A-weighted decibel; ETR = engine temperature ratio; MSL = above mean sea level; L_{max} = maximum sound level; RPM = rotations per minute; SEL = sound exposure level; MIL = military.

Higher power configurations that are lower in altitude produce greater noise levels. As shown the highest peak sound exposure (L_{max}) within each MOA would be 103 dBA (Hatteras F MOA), 90 dBA (Pamlico C MOA), and 86 dBA (Pamlico D MOA). As the altitudes increase and power settings decrease, noise levels decrease, as would be expected. L_{max} values are less than SEL values, as L_{max} is the loudest sound experienced by an observer, while SEL takes all the sound energy of the entire overflight event and compresses it into 1 second of time. At 3,000 feet MSL, a direct overflight by any of the aircraft that would be using the airspace would likely be noticeable.

While the proposed Hatteras F MOA is one block of continuous airspace, the purpose of this airspace would be to allow fixed wing aircraft to access the Greater Sandy Run Area (GSRA) of MCB Camp Lejeune which is the area beneath R-5303 and R-5304 (see Figure 3-1). Because of this, aircraft would generally use the southern portion of the proposed Hatteras F MOA more often than the northern portion of the MOA, potentially as much as 60 percent of the time (approximately 270 sorties annually). Additionally, the training scenarios that would include lower altitude flights, those within the 3,000 to 5,000-foot altitude band, would be greater over the GSRA than within the northern portion of the MOA. Fixed wing aircraft may access the GSRA from a northerly direction, but these flights would remain at higher altitudes to deconflict with the Class D airspace surrounding MCAS New River. Lower altitude overflights of Jacksonville, or other populated areas such as Piney Green and Half Moon, that are not currently located beneath SUA would be much less likely than areas that are in proximity to GSRA and its associated target areas in the southern half of the MOA. Thus, the potential for exposure to the highest peak noise (103 dBA) would be very unlikely in Jacksonville and the other populated areas in the northern portion of the expanded MOA. The potential peak noise exposure to populated areas in the southern portion of the MOA would remain unchanged since the Hatteras F MOA and R-5303 and R-5304 already exist in this area. In any case, the potential for the highest peak exposure (103 dBA) is very low given the operations assumptions. It is estimated that the proposed F-35 sorties (the loudest aircraft) would spend 10 percent of flying time in the 3,000 to 5,000-foot altitude band and of that time only 15 percent would be in afterburner power (see Table A-4, Appendix A for Detailed Flight Operations). This equates to less than two minutes on average per training day that anyone could possibly experience the highest peak noise scenario, making this impact negligible.

6.0 CONCLUSION

The establishment of new permanent SUA in the Cherry Point OPAREA would present little change in the noise environment. The number of aircraft operations and the altitudes that they would utilize would not produce significant noise impacts for observers under the proposed airspace. The highest annual average noise exposure would occur in the proposed expanded Hatteras F MOA and would be 48 DNL which does not exceed thresholds for determining significant noise impacts. In fact, even if the proposed operations in this MOA were quadrupled, the DNL would only be 54 DNL which is still well below FAA thresholds for determining significance. The cumulative noise exposure would not be a significant impact in any of the MOAs.

Individual overflights at lower altitudes would likely be noticeable but would be very rare, end quickly, and would be unlikely to disrupt daily activities. There would be less than two minutes on average per training day that anyone could possibly experience the highest peak noise scenario (103 dB in the Hatteras F MOA), making this a negligible impact.

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APPENDIX A
DETAILED FLIGHT OPERATIONS NORTH CAROLINA SPEICAL USE AIRSPACE

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Table A-1. Aircraft Operation Assumptions for Existing Hatteras F MOA

			Percentage of Relative Time in Altitude Bands		
			Altitude Band (MSL)		
Sorties[1]	**Aircraft**		3,000 to 5,000	5,000 to 10,000	10,000 to 13,000
300	AV-8B	*Time in Altitude Band (%)*	25%	50%	25%
		Power Configuration			
		MIL (100% RPM)	15%	10%	5%
		85% RPM	85%	90%	95%

			Percentage of Relative Time in Altitude Bands		
			Altitude Band (MSL)		
Sorties[1]	**Aircraft**		3,000 to 5,000	5,000 to 10,000	10,000 to 13,000
75	F-18A/C	*Time in Altitude Band (%)*	25%	50%	25%
		Power Configuration			
		MIL (100% RPM)	15%	10%	5%
		85% RPM	85%	90%	95%

Note *[1] All sorties assumed to be 60 minutes in duration*.

Table A-2. Aircraft Operation Assumptions for Pamlico C MOA

			Percentage of Relative Time in Altitude Bands		
			Altitude Band (MSL)		
Sorties[1]	**Aircraft**		8,000 to 14,000	14,000 to 18,000	18,000 to 24,000
260	F-35B/C	*Time in Altitude Band (%)*	15%	40%	45%
		Power Configuration			
		Afterburner	15%	10%	5%
		90% ETR	85%	90%	95%

			Percentage of Relative Time in Altitude Bands		
			Altitude Band (MSL)		
Sorties[1]	**Aircraft**		8,000 to 14,000	14,000 to 18,000	18,000 to 24,000
360	F-18E/F	*Time in Altitude Band (%)*	15%	40%	45%
		Power Configuration			
		Afterburner	15%	10%	5%
		90% NC	85%	90%	95%

			Percentage of Relative Time in Altitude Bands		
			Altitude Band (MSL)		
Sorties[1]	**Aircraft**		8,000 to 14,000	14,000 to 18,000	18,000 to 24,000
450	F-15E	*Time in Altitude Band (%)*	15%	40%	45%
		Power Configuration			
		Afterburner	15%	10%	5%
		85% NC	85%	90%	95%

Note *[1] All sorties assumed to be 60 minutes in duration*.

Table A-3. Aircraft Operation Assumptions for Pamlico D MOA

			Percentage of Relative Time in Altitude Bands		
			Altitude Band (MSL)		
Sorties[1]	**Aircraft**		10,000 to 14,000	14,000 to 18,000	18,000 to 23,000
80	F-35B/C	*Time in Altitude Band (%)*	15%	40%	45%
		Power Configuration			
		Afterburner	15%	10%	5%
		90% ETR	85%	90%	95%

			Percentage of Relative Time in Altitude Bands		
			Altitude Band (MSL)		
Sorties[1]	**Aircraft**		10,000 to 14,000	14,000 to 18,000	18,000 to 23,000
90	F-18E/F	*Time in Altitude Band (%)*	15%	40%	45%
		Power Configuration			
		Afterburner	15%	10%	5%
		90% NC	85%	90%	95%

			Percentage of Relative Time in Altitude Bands		
			Altitude Band (MSL)		
Sorties[1]	**Aircraft**		10,000 to 14,000	14,000 to 18,000	18,000 to 23,000
120	F-15E	*Time in Altitude Band (%)*	15%	40%	45%
		Power Configuration			
		Afterburner	15%	10%	5%
		85% NC	85%	90%	95%

Note *[1] All sorties assumed to be 60 minutes in duration*.

Table A-4. Aircraft Operation Assumptions for Proposed Hatteras F MOA

Sorties[1]	Aircraft		***Percentage of Relative Time in Altitude Bands***			
			Altitude Band (MSL)			
			3,000 to 5,000	5,000 to 10,000	10,000 to 14,000	14,000 to 18,000
410	F-35B/C	*Time in Altitude Band (%)*	10%	20%	40%	30%
		Power Configuration				
		Afterburner	15%	10%	5%	5%
		90% ETR	85%	90%	95%	95%

Sorties[1]	Aircraft		***Percentage of Relative Time in Altitude Bands***			
			Altitude Band (MSL)			
			3,000 to 5,000	5,000 to 10,000	10,000 to 14,000	14,000 to 18,000
30	F-15E	*Time in Altitude Band (%)*	10%	20%	40%	30%
		Power Configuration				
		Afterburner	15%	10%	5%	5%
		90% NC	85%	90%	95%	95%

Sorties[1]	Aircraft		***Percentage of Relative Time in Altitude Bands***			
			Altitude Band (MSL)			
			3,000 to 5,000	5,000 to 10,000	10,000 to 14,000	14,000 to 18,000
10	F-16C	*Time in Altitude Band (%)*	10%	20%	40%	30%
		Power Configuration				
		Afterburner	10%	5%	5%	5%
		85% NC	90%	95%	95%	95%

Note *[1] All sorties assumed to be 60 minutes in duration*.

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