APPENDIX B. BIOLOGICAL ASSESSMENT

DATE	FROM	TO
July 13, 2009	NOAA National Marine Fisheries Service	Wallops Flight Facility
August 24, 2010	NOAA National Marine Fisheries Service	Wallops Flight Facility
June 10, 2011	Wallops Flight Facility	U.S. Fish and Wildlife Services
September 22, 2011	U.S. Fish and Wildlife Services	Wallops Flight Facility
June 2011	Draft Biological Assessment for the Wallops Flight Facility Unmanned Aerial Systems Airstrip	

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

JUL 13 2009

Joshua A. Bundick
National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, Virginia 23337
Attn: 250.W

Dear Mr. Bundick,

This is in response to your letter dated June 26, 2009 regarding the National Aeronautics and Space Administration's (NASA) Goddard Space Flight Center's Wallops Flight Facility's proposed Unmanned Aerial Systems Airstrip, located on the north end of Wallops Island in Accomack County, Virginia. The proposed work would have a ground disturbance impact of 125 feet x 5,200 feet to accommodate the grading and surfacing of the 75-foot runway for its entire proposed length. Work proposed includes: construction of two 100 foot x 100 foot hangars; improvement of the existing site access roads; and clearing of vegetation.

Several species of sea turtles listed by NOAA's National Marine Fisheries Service (NMFS) as threatened and endangered occur seasonally in the coastal waters of Virginia. However, as no in water work is proposed, no listed species will be affected by the proposed project. As such, no consultation pursuant to Section 7 of the Endangered Species Act of 1973, as amended, is required. Should project plans change or new information become available that changes the basis for this determination, consultation should be reinitiated. If you have any questions about these comments, please contact Danielle Palmer at (978)282-8468.

Sincerely,

Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

File Code: Sec 7/Technical Assistance 2009

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

AUG 24 2010

Joel T. Mitchell
National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, Virginia 23337
Attn: 250.W

Dear Mr. Mitchell,

This is in response to your letter dated July 14, 2010 regarding the National Aeronautics and Space Administration's (NASA) Goddard Space Flight Center's Wallops Flight Facility's proposed Unmanned Aerial Systems Airstrip, located on the north end of Wallops Island in Accomack County, Virginia.

Several species of sea turtles listed by NOAA's National Marine Fisheries Service (NMFS) as threatened and endangered occur seasonally in the coastal waters of Virginia. However, as no in water work is proposed, no listed species will be affected by the proposed project. As such, no consultation pursuant to Section 7 of the Endangered Species Act of 1973, as amended, is required. Should project plans change or new information become available that changes the basis for this determination, consultation should be reinitiated. If you have any questions about these comments, please contact Danielle Palmer at (978)282-8468.

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Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

File Code: Sec 7 Technical Assistance 2010

National Aeronautics and
Space Administration

Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, VA 23337

Reply to Attn of: 250.W

June 10, 2011

Ms. Cindy Schulz
Virginia Field Office
U.S. Fish and Wildlife Service
6669 Short Lane
Gloucester, Virginia 23061

Dear Ms. Schulz:

In accordance with Section 7(c) of the Endangered Species Act of 1973 (ESA), the National Aeronautics and Space Administration (NASA) has prepared a Biological Assessment for the construction and operation of an Unmanned Aerial Systems (UAS) Airstrip at Goddard Space Flight Center's Wallops Flight Facility (WFF) on the north end of Wallops Island in Accomack County, Virginia. Three copies of the Biological Assessment are enclosed with this letter.

NASA has determined that the proposed UAS airstrip will not contribute to the future listing of the candidate species, red knot. The project may affect but is not likely to adversely affect the piping plover and will have no effect on the loggerhead sea turtle. Please consider this correspondence as NASA's request to begin formal consultation pursuant to the ESA. NASA respectfully requests that your agency's Opinion be provided within 135 days of receiving this correspondence.

If you have any questions or require any additional information please contact me at (757) 824-1127, or Ms. Shari Silbert at (757) 824-2327.

Sincerely,

Joel Mitchell

Joel Mitchell
Natural Resources Program Manager

Enclosures

cc:
200/Ms. C. Massey
228/Mr. P. Bull
250/Mr. E. Connell
250/Ms. C. Turner
802/Mr. M. Hitch

DRAFT

BIOLOGICAL ASSESSMENT
WALLOPS FLIGHT FACLILITY
UNMANNED AERIAL SYSTEMS AIRSTRIP

Prepared for:

National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility

WALLOPS ISLAND, VIRGINIA
JUNE 2011

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ACRONYMS AND ABBREVIATIONS

AGL	above ground level
cm	centimeters
dB	decibel
DNL	Day-Night Average Sound Level
ESA	Endangered Species Act
FAA	Federal Aviation Administration
ft	feet
GTM	Generic Transport Model
in	inch
JP	jet propellant
km	kilometer
L_{max}	Maximum Level
m	meters
NMFS	National Marine Fisheries Service
SEL	Sound Exposure Level
UAS	unmanned aerial systems
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
VACAPES OPREA	Virginia Capes Operating Area
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries
WFF	Wallops Flight Facility

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CHAPTER 1 PROJECT OVERVIEW

1.1 INTRODUCTION

NASA Goddard Space Flight Center owns and operates Wallops Flight Facility (WFF). The mission of WFF is to support aeronautical research, science technology, and education. WFF provides NASA and other U.S. government agencies as well as foreign and commercial organizations access to resources such as special use (i.e., controlled/restricted) airspace, airstrips, launch pads, and the technical expertise and project oversight to conduct a wide-variety of scientific research in a low-cost environment. Much of the research at WFF is conducted via various carrier systems such as rockets, balloons, and unmanned aerial systems (UAS).

1.2 PROJECT AREA AND SETTING

WFF is located in the northeast portion of Accomack County, Virginia on the Delmarva Peninsula. The facility is comprised of three separate land masses: Main Base, Wallops Mainland, and Wallops Island (Figure 1). NASA Goddard Space Flight Center's Suborbital and Special Orbital Projects Directorate is responsible for management of Wallops Research Range located on Wallops Island. The Research Range is where the majority of scientific research launch activities occur. To support suborbital missions, restricted airspace R-6604A/B was established through the Federal Aviation Administration (FAA). Restricted airspace is established when it is determined necessary to confine or segregate activities considered hazardous to nonparticipating aircraft (14 Code of Federal Regulation Part 1.1). R-6604A/B, owned and operated by WFF, is available 24 hours a day, 7 days a week from the surface to unlimited altitude. This restricted airspace covers the entirety of Wallops Island and extends over the Atlantic Ocean for approximately 5.0 kilometers (km) (3 miles) (Figure 2).

UAS launch operations, which require restricted airspace, are an important business at WFF. UAS perform a wide variety of functions; the majority of these functions are some form of remote sensing (*e.g.*, atmospheric monitoring and testing, hurricane analysis, etc.). Due to the temperate climate in the region, commercial UAS manufacturers and others come from around the world to WFF to conduct product trials, pilot training, and science missions from a UAS airstrip located on the south end of Wallops Island (Figure 2).

1.3 PROJECT NEED

Since 2003, UAS have been operating from an airstrip on a then remote portion of south Wallops Island. The airstrip (Figure 3), formerly a paved road, measured 230 meters (m) long by 15 m wide (750 feet [ft] long by 50 ft wide). In 2005, the airstrip was expanded to accommodate larger classes of UAS. The airstrip was lengthened to 450 m (1,500 ft); two staging pads were also added (Figure 4). While this airstrip met an immediate and emerging need, the location has proven to be unsatisfactory for continued UAS flight operations.

Figure 1. Location of NASA's Wallops Flight Facility

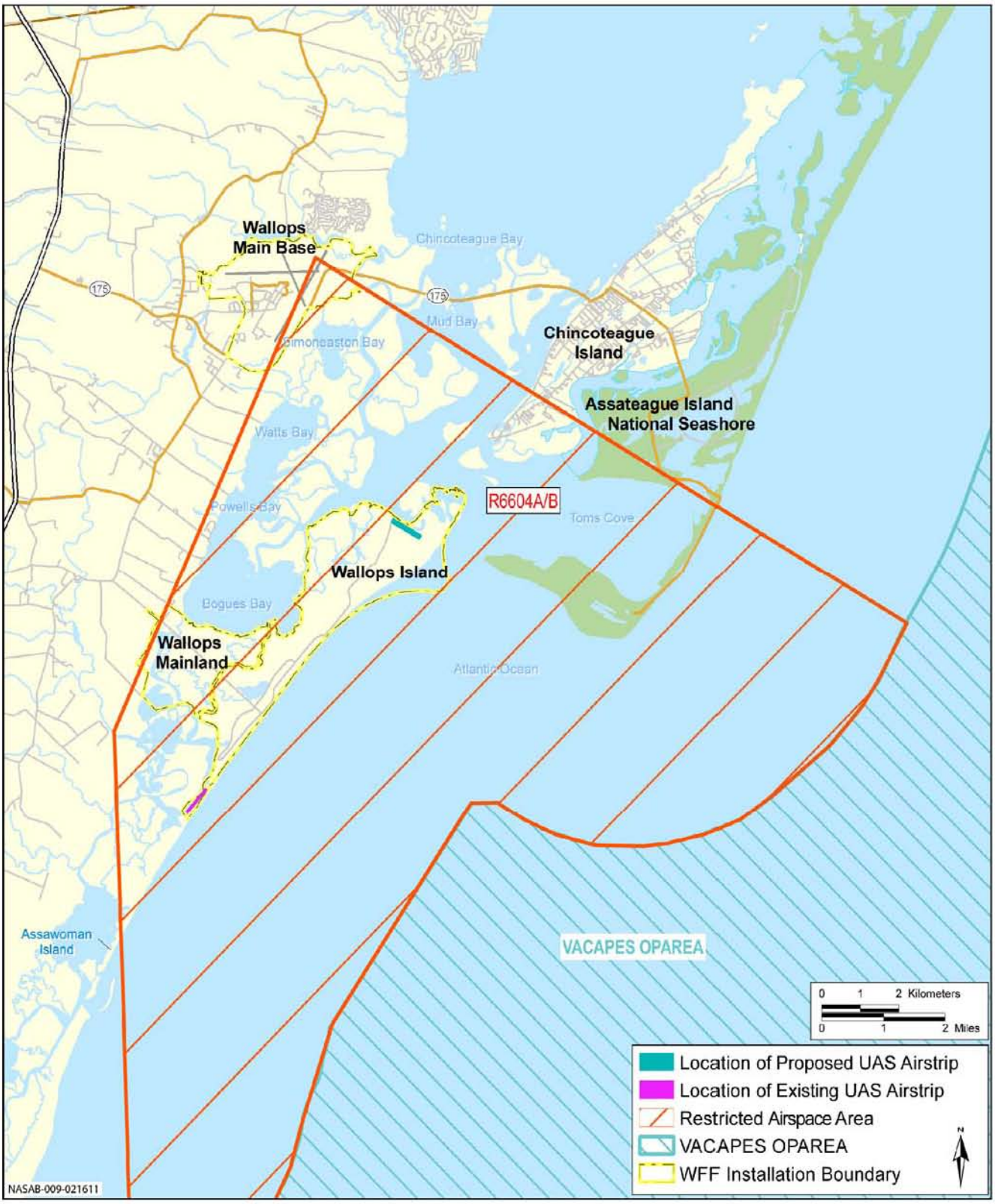

Figure 2. NASA Controlled/Restricted Airspace R-6604A/B and Location of the Existing and Proposed UAS Airstrip

Figure 3. Initial UAS Airstrip (2003)

Figure 4. Expanded UAS Airstrip (2005)

The most common and largest UAS that currently operate from the south Wallops Island airstrip are shown in Table 1 and provided in Figure 5. As shown in Table 1, the Viking 100 and 300 models require a 450 m (1,500 ft) airstrip for safe takeoff and landing and are therefore the largest UAS capable of operating from the existing airstrip. The Viking 400 is proposed for future operations at WFF.

Table 1. UAS Operating and Proposed for Operations on Wallops Island

Model	*Wingspan (meters/feet)*	*Length (meters/feet)*	*Maximum Weight with Payload (kilogram/pounds)*	*Takeoff/Landing Minimum Requirement (meters/feet)*
Aerosonde[1]	3.0 / 9.5	1.5/ 5.6	14 / 30	none
GTM AirSTAR[2]	2.0 / 7.0	2.5 / 8.0	23 / 50	450 / 1,500
Viking 100[3]	4.5 / 15.0	2.5 / 8.0	68 / 150	450 / 1,500
Viking 300[3]	5.5 / 17.5	4.0 / 13.5	144 / 318	450 / 1,500
Viking 400[3]	6.0 / 20.0	4.5 / 14.7	240 / 530	760 / 2,500
Exdrone[4]	3.0 / 9.5	2.0 / 6.2	2 / 6	100 / 300
Scan Eagle[5]	3.0 / 9.5	2.0 / 5.6	2 / 6	10 / 30
Shadow 200[6]	6.0 / 20.0	4.0 / 12.0	4 / 12	30 / 500
Blimp (tethered)	2.0 / 7.0	7.0 / 23.0	7 / 23	none

Notes: [1] Manufactured by Aerosonde. [2] GTM (Generic Transport Model) AirSTAR is manufactured by NASA Langley Research Center. The GTM is similar to an upscale model airplane and is the smallest of the UAS piloted at WFF. [3] Manufactured by L3 BAI Systems. [4] Launched via catapult; stopped by chute or skid. [5] Launched via catapult; stopped via SkyHook. [6] Launched via catapult; wheel landing.

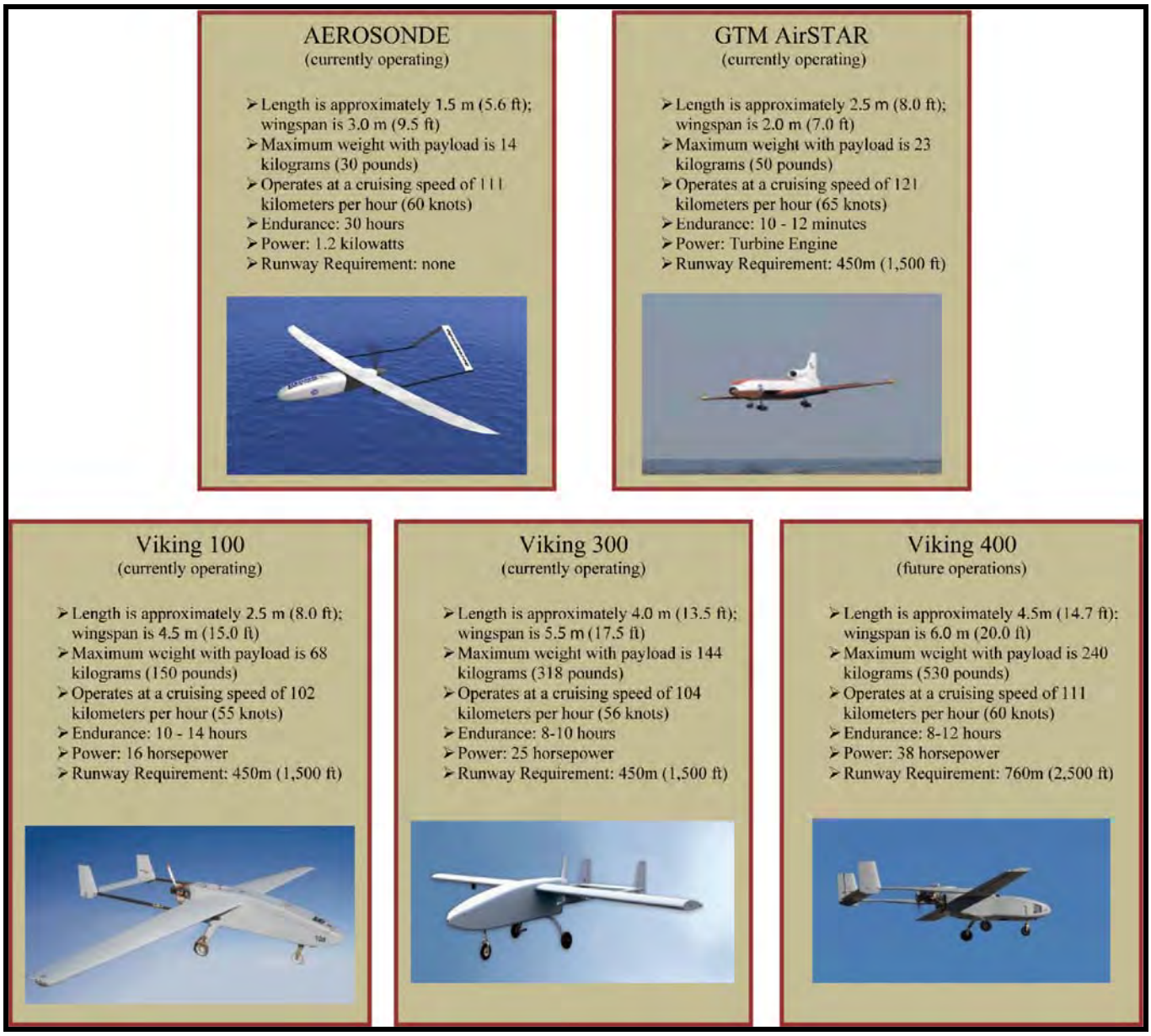

Figure 5. UAS Currently Operating and Proposed for Future Operations at WFF

In recent years, however, WFF has determined that the size and location of the existing airstrip has placed limitations on its use, constraining opportunities for scientific testing and research at WFF. Limitations on use of the existing UAS airstrip are outlined below:

- The airstrip has a north/south orientation making it susceptible to (east/west) cross winds. Due to the small size and light weight of most UAS, strong east/west winds often preclude and/or limit UAS operations. Historical wind data for Wallops Island indicates that winds are generally from the west/northwest or east/southeast directions (NASA 2010a).

- During storm events, the existing airstrip is often inundated with surf and sand. Severe beach erosion from hurricanes and nor'easters (as evident in Figure 6) has virtually eliminated the beachfront and dunes that provided protection in the past. Although, WFF is in the process of restoring the Wallops Island shoreline (NASA 2010b), the beach restoration project will not prevent storm driven flood waters from the back bays from inundating the existing UAS airstrip.
- WFF's rocket launch program has expanded with the current construction of a new launch pad north of the UAS airstrip. Mandatory safety constraints from increased rocket launch activities at the nearby Mid-Atlantic Regional Spaceport are anticipated to further reduce UAS research opportunities. The airstrip is inactivated prior to and immediately following rocket launch activities and static test firing of the rocket engines. Approximately 18 orbital launches, 60 sounding rockets, and 2 static test firing of rockets will occur each year (NASA WFF 2009a). Each of these activities has the potential to reduce opportunities for UAS flight operations.
- The existing airstrip (450 m [1,500 ft] long) would not be capable of supporting the next generation of Viking UAS; the Viking 400 would require, at a minimum, 760 m (2,500 ft) long airstrip for take-offs and landings; an additional 75 m (250 ft) clearance zone on each end would provide for safe operations.

Figure 6. South Wallops Island UAS Airstrip after a Storm

Based on the limitations presented, the requirement to operate UAS in restricted airspace, and NASA Goddard Space Flight Center's Suborbital and Special Orbital Projects Directorate's mission to provide the infrastructure and support services for scientific research and discovery, NASA has determined the need to construct a new UAS airstrip on the north end of Wallops Island.

1.4 PROJECT DESCRIPTION

As described above, WFF has determined that a new airstrip is needed to provide an adequately-sized facility that will be capable of supporting the testing and deployment of existing and future UAS and UAS-based scientific instruments at WFF. UAS test and UAS-based research opportunities form an important objective of NASA Goddard Space Flight Center's Suborbital and Special Orbital Projects Directorate and as such, this type of mission need requires an unencumbered operating environment. The new airstrip will have an asphalt surface and will measure approximately 900 m (3,000 ft long [2,500 ft plus an additional 500 ft clear zone]) by 25 m (75 ft) wide. Figure 7 offers a representative plan view of the proposed airstrip.

Design

The UAS airstrip will incorporate typical aircraft airstrip design elements such as the necessary airstrip length, width, shoulders, and clear zone. The length and width of the airstrip will be the minimum required to support the takeoff/landing requirements of the largest UAS proposed (i.e., Viking 400) for operations at the airstrip. The unpaved shoulders of the airstrip will provide passage of maintenance or other vehicles and the occasional UAS that could veer of course. The clear zones will extend beyond the end of the airstrip and will provide additional area for takeoff operations. The airstrip will be designed to ensure that the surface area is flat, without humps, depressions, or other surface variations and the shoulders of the airstrip will be sloped to direct water to an infiltration trench.

Construction

Prior to the start of construction activity, silt fencing and other approved measures to control erosion, sedimentation, stormwater runoff, and the integrity of a known archaeological site will be put in place. Following these control measures, two structures (metal observation tower and wood frame observation platform) located within the project area will be removed. The area comprising the base and clearing limits of the airstrip will be cleared of all vegetation. Vegetation alongside the length (out to 30 m [100 ft] on each side) of the airstrip will be cleared. Trees will be cut to ground level; digging below ground to remove stumps and roots is not anticipated since the area for the airstrip will be elevated with up to 1 m (3 ft) with fill in most areas. The site will then be filled, compacted, and graded to design specifications prior to application of the asphalt.

Construction of the UAS airstrip will affect approximately 5.3 hectares (13 acres) of vegetated areas from clearing and approximately 1.2 hectares (3 acres) of jurisdictional wetlands from fill activities. The appropriate permits for construction in a wetland area will be obtained prior to commencement of construction activities. Additionally, WFF will submit an infiltration trench design plan to Virginia Department of Environmental Quality (VDEQ) and U.S. Army Corps of Engineers (USACE) for review and approval.

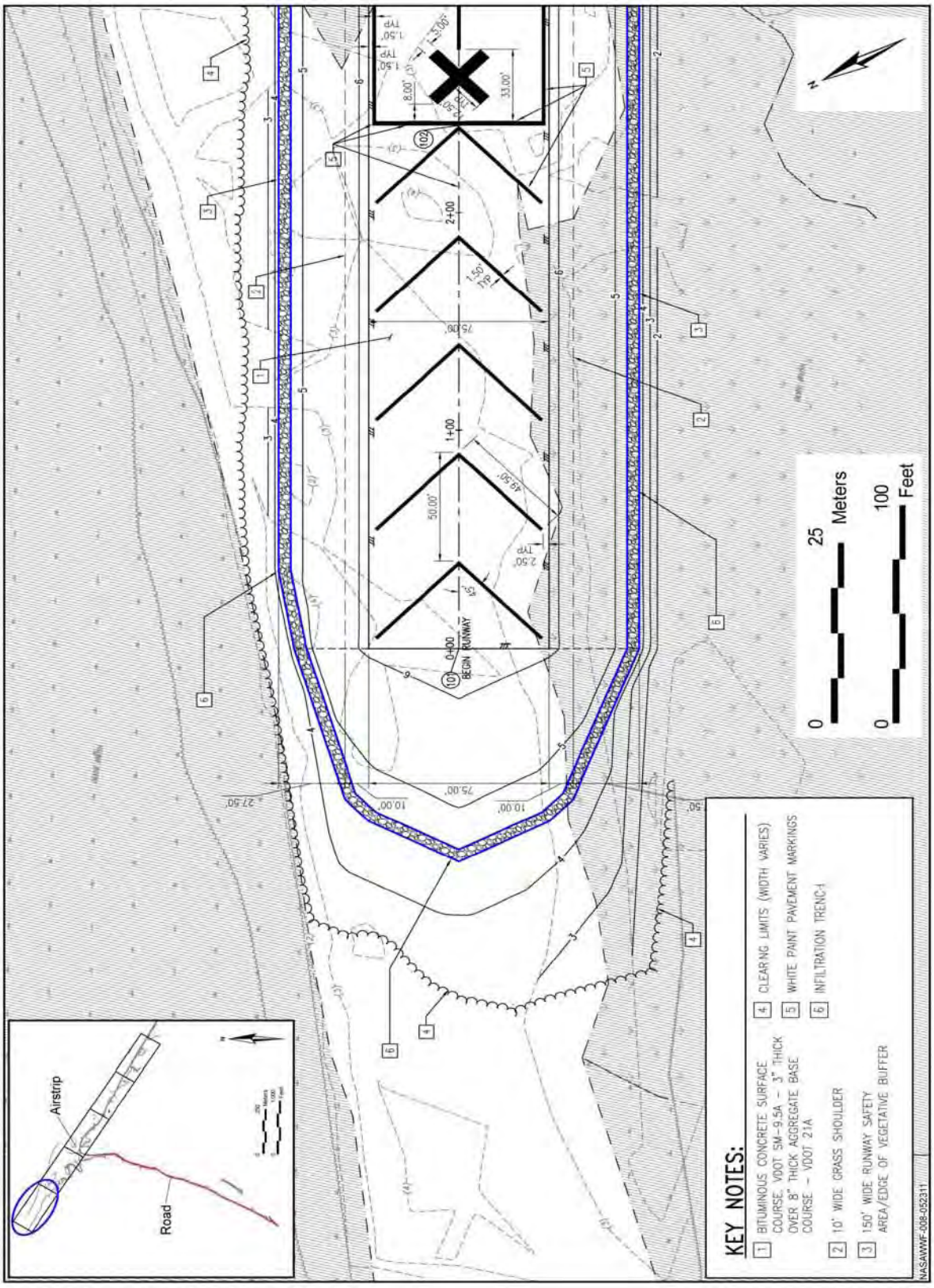

Figure 7. Representative View of the Proposed UAS Airstrip

The UAS airstrip will need to be elevated approximately 1 m (3 ft) above the existing ground surface to ensure sufficient surface water runoff for UAS operations. An infiltration trench will be constructed to capture the surface water runoff; the trench will incorporate low impact development techniques and will be constructed in accordance with Virginia stormwater management regulations and VDEQ standards for pre- and post-development stormwater discharge rates.

A staging pad for aircraft and support vehicles (i.e., government vehicles, fire truck, mobile command station, and road sweeper) in preparation for and during flight operations will be located just below the point where the access road meets the airstrip. Crushed gravel will be used to improve the existing dirt access road that provides service to the northernmost end of Wallops Island. Infrastructure improvements to provide electrical and telecommunication service will be implemented.

WFF anticipates construction of the UAS airstrip will begin in fiscal year 2013 and require approximately 9 months to complete. Construction activities will occur during daylight hours.

Maintenance

UAS operators require a clear line of sight during take-offs and landings; therefore, vegetation alongside the length (out to 30 m [100 ft] on each side with some variations) of the airstrip will be maintained via mowing and simple mechanical tools, as needed, throughout the year. Beyond the ends of the airstrip, the vegetation height will also be maintained in order to provide the necessary line of sight for UAS operators. Clearing around the known archaeological site will be done in accordance with a plan approved by the Virginia Department of Historic Resources.

Operations

UAS and UAS-based operations will be conducted year round during NASA's normal Air Traffic Control tower hours (Monday through Friday, 7 AM to 5 PM). From 2007 to 2009, annual UAS operations varied between 70 and 130 sorties[1] (personal communication, Justis 2010). Under this proposal, WFF intends to conduct on average, four UAS sorties each day. A maximum of 1,040 UAS sortie operations[2] will occur each year. This total will include the transition of UAS flight operations from the south Wallops Island airstrip. The number and frequency of operations will be dictated by the type of UAS test and UAS-based research being conducted in a given year.

Night operations are probable and will take place under special circumstances (e.g., hurricane monitoring). The airstrip will have no permanent lighting; should lighting be required for the rare nighttime operation, the lighting will be provided via mobile vehicle source at the minimum intensity necessary for task performance.

UAS will operate within the existing NASA controlled/restricted airspace (R-6604A/B) and within the Virginia Capes Operating Area (VACAPES OPREA), the Navy's offshore training area (Figure 2). UAS from WFF will not operate over Chincoteague Island, Assateague Island National Seashore, or over any populated areas. Aside from takeoff and landing, the minimum operating altitude for UAS operating near the airstrip will be approximately 150 m (500 ft).

[1] A sortie consists of a single UAS flight operation from takeoff through landing.
[2] A sortie operation applies to flight activities outside of the airfield/airstrip space environment.

UAS Community Operational Noise Levels

Of the UAS currently operating and proposed for operations at the new UAS airstrip, the Viking 300 has been determined to be the loudest of the unmanned systems. The noise level[3] of the Viking 300 is 70 dB at 300 m (1,000 ft) flight altitude at 100 km per hour (56 knots) (this is maximum level (L_{max}) occurring during the flyover). For aircraft flyovers at these speeds, the Sound Exposure Level (SEL)[4] is approximately 10 decibels (dB) greater than the maximum level, which would give an estimated SEL value of 80 dB for a 300 m (1,000 ft) flyover. A 150 m (500 ft) minimum cruise altitude near the airstrip is proposed. The reduction of the altitude by a factor of 2 would increase the SEL by 3 dB[5]. Thus, the estimated SEL underneath the flight track near the airstrip at 150 m (500 ft) would be approximately 83 dB.

Under the Proposed Action, it is projected that the average operational day would consist of no more than four UAS sorties, which means eight operations per day (one sortie equals one departure and one arrival). UAS sorties would occur during daylight hours, with the potential for an occasional nighttime operation taking place under special circumstances (e.g., hurricane monitoring). Therefore, an estimated maximum Day-Night Average Sound Level (DNL)[6] value underneath the flight track is calculated using the following formula:

$$DNL = SEL^{*} + 10*\log(\text{Number of passes}) - 49.4$$

Using this formula, a maximum DNL for UAS operations under this proposal would be:

$$DNL = 83 \text{ dB SEL} + 10*\log(8) - 49.4 = DNL\ 43 \text{ dB}$$

This level is very low and is actually 10 dB below the ambient levels of DNL 52.5 dB (Downing 2011). These calculations indicate that UAS operations at the new airstrip would not create significant noise levels in the surrounding areas, assuming operational parameters remain as projected.

[3] Sound Level is the amplitude (level) of the sound that occurs at any given time. When an aircraft flies by, the level changes continuously, starting at the ambient (background) level, increasing to a maximum as the aircraft passes closest to the receiver, then decreases to ambient as the aircraft flies into the distance. Sound levels occur on a logarithmic decibel scale; a sound level that is 10 dB louder than another will be perceived as twice as loud.

[4] SEL accounts for both the maximum sound level and the length of time a sound lasts. SEL does not directly represent the sound level heard at any given time, but rather provides a measure of the total sound exposure for an entire event.

[5] SEL values are analogous to a line source which has a distance variation of 3 dB per doubling, whereas L_{max} variation with distance follows a point source which is 6 dB per doubling of distance.

[6] DNL is a noise metric combining the levels and durations of noise events, and the number of events over a 24-hour time period. It is a cumulative average, computed over a given time period like a year, to represent total noise exposure.

UAS Proposed for Operations

A representative list of UAS that currently operate and are proposed for operations has been provided (refer to Table 1). The Viking 400 would be the largest UAS authorized to operate from the proposed airstrip. The Viking 400 has a 6 m (20 ft) wingspan, is 4.5 m (14.7 ft) in length, and has a maximum weight of 240 kilograms (530 pounds). The minimum length for takeoff and landing the Viking 400 is 760 m (2,500 ft).

UAS Operators

UAS operators are and will remain responsible for transporting their respective aircraft to and from WFF; operators are not provided storage or maintenance space while on the installation. On average, a UAS operations team will consist of three people who will remain in the local area for up to two weeks. Additionally, WFF range safety personnel, consisting of up to three persons will remain on site during UAS operations. If the UAS airstrip will be used as a base for NASA scientific instrumentation, up to two NASA science personnel will also be present to monitor the instrument's functionality. UAS will be controlled by the operator via a truck mounted mobile command center or a hand-held control switch, depending on the type of UAS being operated. Operators will be required to maintain a clear line of sight for UAS take-offs and landings. WFF will not permit UAS to be remotely controlled unless prior approval by WFF Range Safety Office was provided. With the exception of the Aerosonde listed above, UAS operating from the airstrip will be fueled with a common jet propellant (JP). JP-5 is the most frequently used fuel for turbine engines. This fuel will not be stored on site; each UAS operator will be responsible for transporting and dispensing fuel for each day's use. The average UAS operating from WFF will hold approximately 11 liters (3 gallons) of JP-5 fuel.

1.5 GENERAL CONSERVATION MEASURES

Provided below is a summary of considerations and mitigation measures for sensitive biological resources that WFF has incorporated into the planning, design, and operation of the new UAS airstrip. These more general conservation measures help to avoid and minimize impacts to all species being covered by this biological assessment; species-specific conservation measures are discussed separately for each species in Chapter 3.

1. In 2009, WFF proposed to construct a 1,600 m (5,200 ft) long by 25 m (75 ft) wide UAS airstrip in the north end of Wallops Island at the location currently proposed. Coordination letters were sent to Federal and state agencies providing a brief description of the proposal. After careful consideration, WFF determined that a smaller UAS airstrip will meet their overall need. As such, the original proposed airstrip has been reduced by 42% in length, placing it further inland away from the coastal dunes and beaches, and thus lessening potential impacts on species using those habitats.
2. WFF has chosen to construct the shortest airstrip possible necessary to accommodate all UAS types. The Viking 400 will be the largest UAS that would be authorized to operate from the new airstrip.
3. The proposed airstrip is now sited to minimize encroachment of the existing bald eagle nest. The eastern end of the airstrip is now approximately 215 m (700 ft) from the recently active nest, and

the clear zones that will be annually maintained now only encroach tangentially on the previously required 200 m (660-ft) nest site buffer.

4. Prior to the start of construction activity, silt fencing and other approved measures to control erosion and sedimentation will be installed. After completion of construction, all barren and exposed soil surfaces will be revegetated using native grass seed mixtures following a site-specific Sediment and Erosion Control Plan that WFF will design and oversee its implementation.

5. In accordance with State of Virginia stormwater management standards for pre- and post-development stormwater discharge rates, an infiltration trench will be constructed to capture the surface water runoff from the airstrip and all other developed, impervious surfaces; low impact development methods will be incorporated into the trench allowing stormwater to infiltrate directly from the trench. .

6. Clear zones on either side of the airstrip (out to 30 m [100 ft] on each side with some variations) and at either ends are required to maintain clear lines-of-sight per safety standards. Vegetation within clear zones will be maintained in a minimally intrusive manner via mowing and simple mechanical tools, as needed, throughout the year.

7. UAS operating from the airstrip would be fueled with a common JP. JP-5 is the most frequently used fuel for turbine engines. In order to minimize any potential spills of hazardous materials, jet fuel will not be stored on site; instead, each UAS operator will be responsible for transporting fuel to the site, dispensing fuel for each day's use, and then transporting fuel offsite. All personnel involved in transporting and dispensing fuel will be trained on how to implement WFF's Integrated Contingency Plan prior to handling fuel onsite.

8. There will be no permanent lighting at the new airstrip. Any temporary lighting that may be necessary during UAS operations will be of the minimum intensity necessary to perform the required function and will be designed so that it is shielded and/or cast downwards. Because nighttime UAS operations will be very infrequent, and any light that is needed will be shielded and downward cast, the potential impact from nighttime safety lighting at the airstrip will be negligible.

9. Besides being infrequent, nighttime operations of UAS will not result in impacts from aircraft safety lighting potentially illuminating beachfront areas. UAS will be operating within the existing NASA controlled/restricted airspace (R-6604A/B) and within the Navy's VACAPES OPAREA, both of which are restricted airspace so standard FAA aircraft safety lighting requirements do not apply.

10. A minimum cruise altitude will be mandated as UAS fly over the beach areas, and maximum angles of ascent and descent will be used for UAS takeoffs and landings. Although, minimum cruise altitudes over the airstrip and beach/land areas may be as low as 150 m (500 ft) above ground level, UAS operators will be instructed to maintain an altitude of 305 m (1,000 feet) over protected species. Trajectories will be included in each UAS flight profile/plan.

11. UAS operators will be instructed not to use flight paths that run parallel to the beaches.

12. The existing threatened and endangered species monitoring/reporting program will continue. A summary of the program's objectives, methodologies, and reporting forms for the coming year

> (2011) can be found in Appendix A – *"Wallops Island Protected Species Monitoring Plan, February 2011."* Per the program's protocols, should listed species (e.g., piping plovers, red knot, sea turtles) or their nests be found on the beach directly under the primary UAS flight paths, UAS operators will be directed to use alternate flight paths, or to temporarily shut down flight operations.

1.6 CONSULTATION HISTORY

NASA is the proponent for the North Wallops Island airstrip and is the lead agency for preparation of the corresponding Environmental Assessment. The USACE is a cooperating agency. As defined in 40 CFR §1508.5, a cooperating agency….

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

USACE is a cooperating agency because they possess regulatory authority and specialized expertise pertaining to the location of the Proposed Action. Under Section 404 of the Clean Water Act, the USACE has jurisdiction over the disposal of dredged and fill material in Waters of the U.S.

Because of the project's potential to affect federally listed species under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS), WFF sent a project scoping letter to the USFWS Virginia Field Office on July 14, 2010, requesting any early project-related comments and potential concerns. Informal USFWS consultation began with a teleconference held on January 26, 2011, which was attended by Mr. Mike Drummond of the USFWS Virginia Field Office. Mr. Drummond requested that he be provided with a more focused project description, as well as a list of any avoidance and minimization measures that may have already been incorporated into the project design and operational phases. Mr. Drummond also requested that, in addition to the species list he was provided, that the biological assessment also consider potential impacts to red knot (*Calidris canutus*), nesting loggerhead sea turtles (*Caretta caretta*), and evaluate the potential for Delmarva fox squirrel (*Sciurus niger cinereus*) and tiger beetle (*Tetracha virginica*) to be present on Wallops Island.

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CHAPTER 2 EXISTING CONDITIONS

2.1 ACTION AREA

The action area is the geographic area in which project effects could be experienced by listed species. The area of effect for the construction of the new UAS airstrip includes the airstrip footprint, access road upgrade, and areas underlying the approach and takeoff zones at either end of the airstrip. The coastal communities over which UAS will traverse during takeoffs and on approach during landings are included because of potential indirect effects of visual and noise disturbance produced by overflying UAS. There are four distinct ecological communities included within the action area: 1) uplands, 2) non-tidal emergent and scrub-shrub wetlands, 3) estuarine intertidal emergent wetlands, and 4) coastal habitats (i.e., dunes, inter-dune swales, beaches, and nearshore waters). Due to varying degrees of human disturbance and the influence of invasive species within the project area, the quality of these habitats varies significantly throughout the site.

2.2 ECOLOGICAL CLASSIFICATION OF NORTH WALLOPS ISLAND

The western portion of the project area, identified as the area to the west of North Seawall Road, is dominated by tidal marsh which transition into smaller areas of palustrine emergent and scrub-shrub wetlands. Scrub-shrub uplands are located between the tidal and non-tidal wetland complexes located to the north and south. The eastern portion of the project area contains a larger percentage of forested and scrub-shrub uplands than the western portion. Palustrine emergent wetlands are more prevalent to the north of North Seawall Road while palustrine scrub-shrub wetlands are prevalent to the south of the road. The following descriptions generally depict the habitats encountered while transiting from the drier, more central portions of the island seaward to the inshore waters of the Atlantic Ocean.

Forested Uplands

The majority of the forested upland areas located within the subject project area are characterized as mature pine with mixed hardwoods. Dominant species within these areas include loblolly pine (*Pinus taeda),* black cherry (*Prunus serotina),* American Holly (*Ilex opaca),* and eastern red cedar (*Juniperus virginiana*). Dominant species within the scrub-shrub upland areas include wax myrtle (*Myrica cerifera),* poison ivy (*Toxicodendron radiicans*), common greenbrier (*Smilax rotundifolia*), black cherry, American holly, eastern red cedar, and Sassafras (*Sassafras albidium).* Upland soils typically have a fine sand texture with a very dark grayish brown (10YR 3/2) color with no mottles in the upper 2.5 to 10 centimeters (cm) (1 to 4 inches [in]) and underlain with a light olive brown (2.5Y 5/3) color.

Common mammal species that occupy the maritime forest include white tail deer (*Odocoileus virginianus*), gray fox, and opossum. Songbirds frequently seen in the woodlands and adjoining tidal wetlands include saltmarsh sharp-tailed sparrow (*Ammodramus caudacutus*), swamp sparrow (*Melospiza georgiana*), common yellowthroat (*Geothlypis trichas*), white-eyed vireo (*Vireo griseus*), and white-breasted nuthatch (*Sitta canadensis*). The inland areas and tidal marshes on Wallops Island also support a variety of raptor species, including turkey vulture (*Cathartes aura*), black vulture (*Coragyps atratus*), sharp-shinned hawk (*Accipiter striatus*), red-tailed hawk (*Buteo jamaicensis*), Cooper's hawk (*Accipiter cooperii*), red-shouldered hawk (*Buteo lineatus*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), barn owl (*Tyto alba*), bald eagle, and peregrine falcon.

Palustrine Scrub-Shrub

Palustrine scrub-shrub wetland communities are dominated by wax myrtle, poison ivy, common greenbrier, and groundsel bush (*Baccharis halimifolia).* Palustrine emergent wetlands are mainly dominated by common reed (*Phragmites australis*) with a low persistence of soft rush (*Juncus effuses)* in some areas. Soils within the non-tidal wetlands vary but typically have a sand texture with a black color in the upper 2.5 to 10 cm (1 to 4 in) and a grayish brown color beneath. Evidence of organic streaking was also noted to exist below the A layer.

Tidal Marsh

The tidal marsh complexes are dominated by species typically occurring in these communities. These species, transitioning from upper tidal marsh to lower tidal marsh, include common reed, salt bush (*Iva frutecens)*, seashore mallow (*Kosteletzkya virginica*), marsh mallow (*Althaea officinalis*), seaside goldenrod (*Solidago sempervirens*), common glasswort (*Salicornea europaea*), salt meadow hay (*Spartina patens*), salt grass (*Distichlis spicata*), and salt marsh bulrush (*Scirpus robustus*). Typical lower tidal communities include salt meadow hay and smooth cordgrass (*Spartina alternifolia*). Non-vegetated tidal mud flats and tidal drainage patterns are present within the low marsh habitat along the southeastern boundary of the project area. Comacca soils within the tidal areas exhibit a fine sandy texture with a dark grayish brown color (10YR 4/2) in the top 15 cm (6 in), and underlain with a very dark gray color (10YR 3/1). Chincoteague soils exhibited a black (2.5Y 2.5/1) silt loam in the upper 15 cm (6 in) of soil, and underlain with a dark grey (2.5Y 4/1) loamy sand.

The tidal marshes on Wallops Island represent important stop-over habitat for waterfowl and shorebirds during spring and fall migration. Some of the species frequently observed in large numbers on Wallops Island include Canada goose (*Branta canadensis*), gadwall (*Anas strepera*), least sandpiper (*Calidris minutilla*), short-billed dowitcher (*Limnodromus griseus*), least tern (*Sterna antillarum*), osprey (*Pandion haliaetus*), double-crested cormorant (*Phalacrocorax auritus*), and horned grebe (*Podiceps auritus*).

The bays and tidal marshes adjacent to Wallops Island support a wide variety of breeding, wintering, and migrating waterfowl. Species frequently observed in large numbers during winter include common loon (*Gavia immer*), American black duck (*Anas rubripes)*, blue-winged teal (*Anas discors*), bufflehead (*Bucephala albeola*), common goldeneye (*Bucephala clangula*), canvasback (*Aythya valisineria*), lesser scaup (*Aythya affinis*), common merganser (*Mergus merganser*), hooded merganser (*Lophodytes cucullatus*), and red-breasted merganser (*Mergus serrator*).

Dunes and Maritime Grasslands

The maritime grasslands, which occur on the foredunes and secondary sand dunes, are characterized by American beachgrass (*Ammophila breviligulata*), saltmeadow cordgrass, beach panic grass (*Panicum amarum*), and seaside goldenrod (*Solidago sempervirens*). Relatively pristine occurrences of this habitat type can be found at the northern end of Wallops Island.

Inter-dune Swales

Inter-dune swales ("sea swales") are seasonally to semipermanently flooded, maritime herbaceous wetlands occupying deep inter-dune basins and swales. These swales occur chiefly in the northern and north central parts of the island. Common threesquare (*Schoenoplectus pungens = Scirpus pungens*), other Cyperaceae, grasses such as switchgrass (*Panicum virgatum*), and saltmeadow cordgrass, rushes (*Juncus*

spp.), sea pink (*Sabatia stellaris*), saltmarsh fimbristylis (*Fimbristylis spadicea*), seaside goldenrod, and other herbaceous species are present.

Mammal species routinely observed in the inter-dune areas include white-tailed deer, meadow vole (*Microtus pennsylvanicus*), and cottontail rabbit (*Sylvilagus floridanus*), while typical amphibians and reptiles include Fowler's toad (*Bufo fowleri*), green tree frog (*Hyla cinerea*), black rat snake (*Elaphe obsoleta obsoleta*), eastern hognose snake (*Heterodon platirhinos*), fence lizard (*Sceloporus undulatus*), box turtle (*Terrapene carolina*), and diamondback terrapin (*Malaclemys terrapin*).

Beaches

The beach systems include upper beaches and over-wash flats, which are situated just above the mean high tide limit, but are flooded by high spring tides and storm surges. They are generally sparsely vegetated with American searocket (*Cakile edentula*), seabeach orach (*Atriplex arenaria*), and Russian thistle (*Salsola kali*), a common invasive non-native beach species.

Mammalian species frequently observed in the upper beach and intertidal zones include red fox and raccoon. Shorebirds and wading birds species that routinely use the marshes and shoreline areas of Wallops Island include piping plover (*Charadrius melodus*), red knot (*Calidris canutus)*, great-black backed gull (*Larus marinus*), American oystercatcher (*Haematopus palliatus*), willet (*Catoptrophorus semipalmatus*), glossy ibis (*Plegadis alcinellus*), ring-billed gull (*Larus delawarensis*), great blue heron (*Ardea herodias*), snowy egret (*Egretta thula*), and green heron (*Butorides striatus*).

Inshore Marine System

The marine system consists of the open ocean overlying the continental shelf and its associated high-energy coastline. Salinities exceed 30 parts per thousand with little or no dilution except outside the mouths of estuaries. Marine systems are divided into two subsystems, subtidal and intertidal. In subtidal subsystems the substrate is continuously submerged, whereas in intertidal subsystems the substrate is exposed and flooded by tides. Substrates may consist of rock bottom, unconsolidated bottom, aquatic bed, reef, rocky shore, and unconsolidated shore. The beaches at Wallops Island are classified as intertidal with an unconsolidated sand bottom and the adjacent waters are classified as subtidal with an unconsolidated bottom. Shoreline erosion and accretion constantly change the character of the shoreline. Currently, the widest beaches occur on the northern and southern portions of the east shore, with the central portion of the island being nearly devoid of beaches and protected by a seawall.

Nearshore state jurisdictional waters extend 5.5 km (3 nautical miles) offshore of the Wallops Island coast. Water depth in state waters ranges up to approximately 12 m (40 ft). This zone is located on the inner portion of the outer continental shelf and extends to about 130 to 160 km (80 to 100 miles) off the mid-Atlantic Coast. Numerous invertebrate species are present in the unconsolidated substrate and open waters of the nearshore zone. Common species include annelid worms, bivalves, crabs, sand dollars, gastropods, comb jellies, and jellyfish. Many of these organisms are an important food source for fish, birds, and sea turtles.

Common fish in the waters near WFF include the sandbar shark (*Carcharhinus plumbeus*), sand shark (*Carcharisa taurus*), northern pipefish (*Syngnathus fuscus*), dusky pipefish (*Syngnathus floridae*), bay anchovy (*Anchoa mitchilli*), smooth dogfish (*Mustelus canis*), smooth butterfly ray (*Gymnura micrura*), bluefish (*Pomatomidae saltatrix*), spot (*Leiostomus xanthurus*), and summer flounder (*Paralichthys dentatus*).

CHAPTER 3 LISTED SPECIES THAT MAY BE AFFECTED BY THE PROPOSED ACTION

3.1 LISTED SPECIES OVERVIEW

The federal Endangered Species Act (ESA) provides for the protection of federally listed threatened and endangered species of plants and animals, as well as designation of critical habitat for animal species. The ESA establishes federal policy that federal agencies, in exercise of their authorities, shall seek to conserve and protect endangered and threatened species. It also establishes a consultation process through which federal agencies, such as NASA and USFWS, can facilitate avoidance of agency actions that would adversely affect, or result in "take," of federally listed species or critical habitat. The taking prohibition includes any harm or harassment, and applies within the U.S. and on the high seas.

Table 2 includes a list of federally threatened and endangered species that are known to occur, or may potentially occur, within the action area. Note that this BA, and the table below, is an analysis of federally listed species that are terrestrial, but also includes marine species that may come ashore and nest on the nearby beaches of north Wallops Island. In general, this includes listed species that may be occupying habitats directly impacted by construction of the new UAS airstrip and associated facilities, as well as species that may be indirectly affected from lights, overflight UAS noise, and the visual disturbance from UAS suddenly appearing over the beach. As a federal agency, NASA does not have an obligation to protect state-listed only species, but often consults with Virginia Department of Game and Inland Fisheries (VDGIF) on species that are dually listed under the federal ESA and state ESA. As the Proposed Action will not affect nearshore or subtidal habitats, impacts to marine mammals, fish, and sea turtle species in the nearshore open water environment will not occur.

As a responsible federal agency and steward of the land under its jurisdiction and management, NASA WFF environmental program staff have been monitoring threatened and endangered species use of Wallops Island for many years now, either solely or through partnerships with other agencies, institutions, or research groups. In 2010, WFF staff organized its various monitoring efforts into a single Protected Species Monitoring Program, the results of which were published in December 2010 (NASA WFF 2010b). Data for loggerhead sea turtle nests, piping plover nests, and red knot flock sighting locations are presented in Figure 8, as are the locations of the Proposed Action (new UAS airstrip, hangar, and clear zones). A summary of the objectives, methodologies, and procedures that will be used in the 2011 monitoring program is provided in Appendix A.

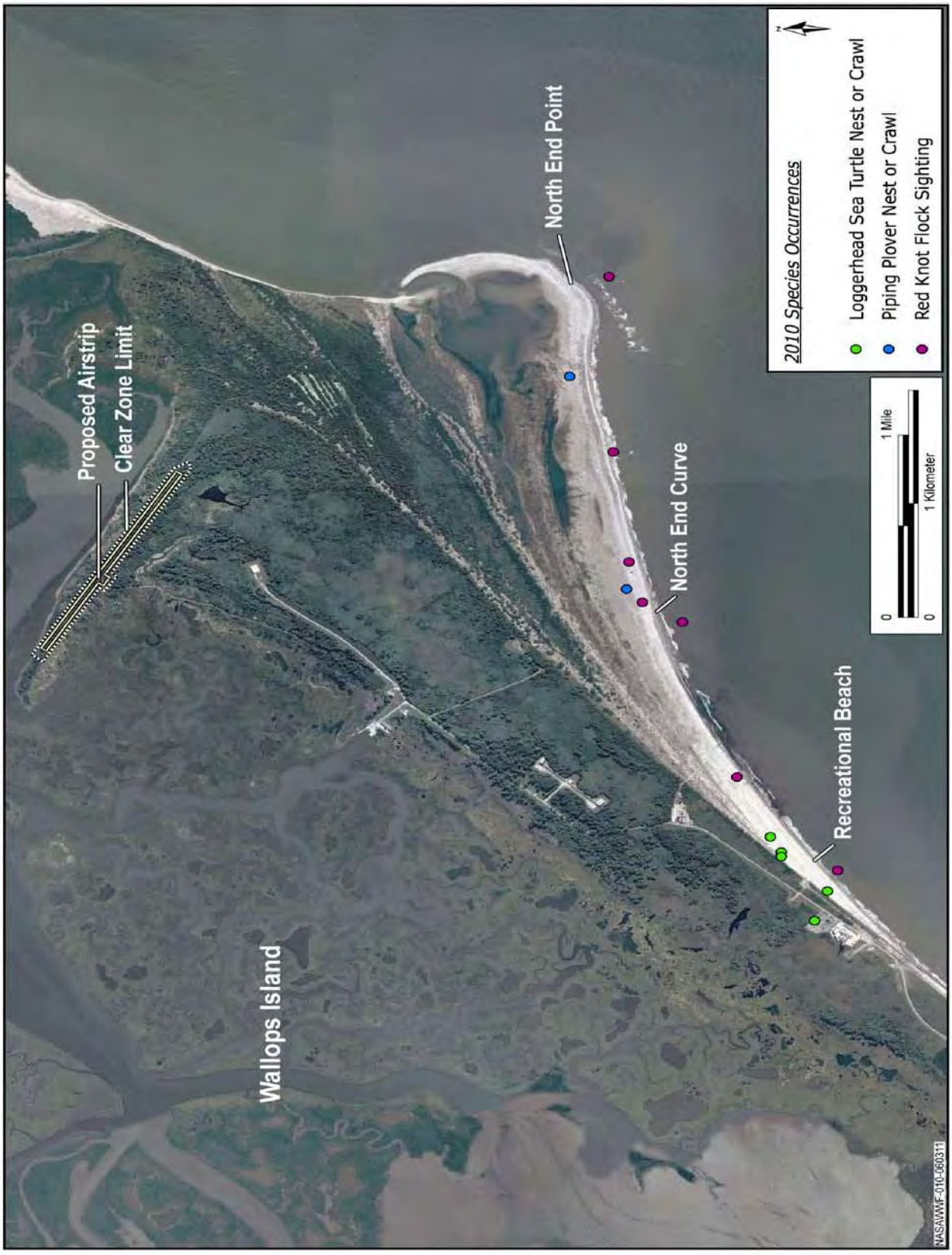

Figure 8. Nest and Sighting Locations on Wallops Island

Table 2. Federally Listed Threatened and Endangered Species Known to Occur in the Region					
Common Name	***Scientific Name***	***Federal Listing Status***	***Likelihood of Occurrence***	***Seasonality of Occurrence***	***Required Habitat & Potential to Occur Onsite***
Plants					
Seabeach Amaranth	*Amaranthus pumilus*	Threatened	Slight	Year-round	Restricted to open sandy portions of ocean beaches between the high tide line and the toe of the primary dune. Nearest known location in Virginia is Hog Island. Not known to occur on Wallops.
Invertebrates					
Northeast Beach Tiger Beetle	*Cicindela d. dorsalis*	Threatened	Remote	Year-round	Present historically, from Cape Cod south through the Chesapeake Bay shorelines, but now believed extirpated from nearly this entire region. Normally occurs from about the fore-dune to the high tide line on ocean and bay beaches. Not known to occur on Wallops.
Reptiles					
Loggerhead Sea Turtle	*Caretta caretta*	Threatened	Known to Occur	Maturation & Migration May-November Nesting April-September	The only sea turtle that nests as far north as Virginia. Nests in small numbers on sandy beaches along Virginia's coast late spring through summer, and found in Virginia's offshore coastal waters during winter and migration. Last nested on Wallops Island in 2010.
Birds					
Red Knot	*Calidris canutus*	Candidate	Known to Occur	Primarily late May	A locally common to abundant transient in late spring and early fall, and does not breed in Accomack County. Preferred habitats include tidal flats and sandy or pebbly beaches. Numbers declining, but several hundred observed in 2010 at North End Curve and North End Point on Wallops Island's ocean beaches.

Table 2. Federally Listed Threatened and Endangered Species Known to Occur in the Region					
Common Name	***Scientific Name***	***Federal Listing Status***	***Likelihood of Occurrence***	***Seasonality of Occurrence***	***Required Habitat & Potential to Occur Onsite***
Piping Plover	*Charadrius melodus*	Threatened	Known to Occur	late April-late July	Known to nest on Virginia's coastal beaches, dunes, and wash-over areas in late spring to mid-summer, with one brood raised per year. They feed on small invertebrates in intertidal surf zones, mud flats, tidal pool edges, barrier flats, and sand flats and along the ocean and barrier bays. Suitable nesting habitat occurs on the extreme southern and northern ends of Wallops Island., with three nesting events at north end in 2010, and one on south end in 2011.
Mammals					
Delmarva Peninsula Fox Squirrel	*Sciurus niger cinereus*	Endangered	None	Year-round	Prefers mature forest of both hardwood and pine trees with minimal understory and ground cover. Feeds primarily on nuts from oak, hickory, sweet gum, walnut and loblolly pine. While within the historic range of the species, the only known location for it in Virginia is a trans-located population at Chincoteague National Wildlife Refuge. This species does not occur on Wallops Island.

Sources: Virginia Department of Game and Inland Fisheries (VDGIF 2009); NASA INRMP (2008b); USFWS (2011); and National Marine Fisheries Service (NMFS [2011]).
Note: The bald eagle, formerly listed as endangered, now de-listed and considered recovered; is provided protection under the federal Bald and Golden Eagle Protection Act. An active bald eagle nest is known to occur about 200 m (700 ft) east of the eastern portion of the proposed airstrip. WFF will continue to monitor activity at the nest during breeding season and during the operational phase of the UAS airstrip.

3.2 SEABEACH AMARANTH

The threatened seabeach amaranth (*Amaranthus pumilus*) is an herbaceous plant, which colonizes and stabilizes the areas seaward of the primary dunes, growing closer to the high tide line than any other coastal plant. An annual plant and fugitive species, seabeach amaranth appears to need extensive beach and inlet areas that function in a relatively natural and dynamic manner. It often grows in the same areas selected for nesting by shorebirds such as plovers, terns, and skimmers. It emerges on sand dunes, inlets, and over-wash flats in summer and early fall. Its distribution varies from year to year,

influenced by seed dispersal and locally favorable conditions for germination, growth, and flowering. Flowering begins as soon as plants are mature, sometimes as early as June, but more typically beginning in July and continuing into late fall. Seed production begins in July or August and peaks in September.

Seabeach amaranth occurs on barrier islands and beaches, where its primary habitat consists of over-wash flats at the accreting ends of islands, and the lower foredunes and upper strands of non-eroding beaches. This species appears to be intolerant of competition, and does well on sites with low vegetative cover. Seabeach amaranth requires extensive areas of barrier island beaches and inlet areas, and is most successful at colonizing un-altered beach landscapes which are inherently dynamic. These characteristics allow it to "move around" in the landscape as a fugitive species, occupying suitable habitat as it becomes available.

While seabeach amaranth has been documented as occurring along coastal Virginia in areas of suitable habitat, it has yet to be located on Wallops Island. Surveys in 2010 failed to locate any seabeach amaranth on Wallops Island (NASA WFF 2010b). Because seabeach amaranth is not known to occur on Wallops Island, and beach dune habitats will not be disturbed by construction, implementation of the Proposed Action would have **No Effect** on this plant species, and it will not be discussed further in this BA.

3.3 NORTHEAST BEACH TIGER BEETLE

Northeast beach tiger beetle (*Cicindela dorsalis dorsalis*) is a whitish tiger beetle with variable dark maculation that is found only along saltwater beaches. The northeast beach tiger beetle only occurs from about the fore-dune to the high tide line on some ocean and bay beaches. Adults actively hunt while larvae live in burrows in the sand where they sit and wait for passing prey. Tiger beetle larvae seal off their burrow and hibernate in early fall. The life cycle spans two or three years. The northeastern beach tiger beetle spends its entire two-year life cycle on sandy beaches. Eggs are laid in the sand, and the larvae live in burrows below the high tide line. The adults are about 1 cm (0.5 in) long and are active along the intertidal zone (between high and low tide) during the day and rest under the sand along the back beach at night. The larvae inhabit vertical burrows within the intertidal zone, capturing food items washed ashore by waves.

The northeastern beach tiger beetle has a historic range from New Jersey to Cape Cod and along much of the eastern and western shorelines of the Chesapeake Bay, from southern Maryland to Virginia. Although the northeastern beach tiger beetle was present historically on the Atlantic coast beaches, especially in the northeast, it is extirpated from nearly this entire region. It is believed that this species only inhabits portions of the Delmarva Peninsula fronting the Chesapeake Bay, not the Atlantic Ocean (NASA WFF 2009b). Because it is highly unlikely that this species occurs in the Action Area, implementation of the Proposed Action would have **No Effect** on northeast beach tiger beetle, and they will be excluded from further discussion in this BA.

3.4 LOGGERHEAD SEA TURTLE

Although the loggerhead sea turtle (*Caretta caretta*) is the most abundant sea turtle in U.S. waters, it is still listed as threatened under the ESA. Loggerhead sea turtles are a reddish-brown sea turtle that inhabit the open sea to more than 800 km (500 miles) from shore, mostly over the continental shelf, as well as

bays, estuaries, lagoons, creeks, and river mouths. Nesting occurs on open high-energy sandy beaches above the high-tide mark, seaward of well-developed dunes. Hatchlings drift in convergence zones in floating patches of kelp (*Sargassum* spp.) (USFWS and NMFS 1993). As juveniles, they begin occupying the waters of the continental shelf, edge and slope from 200 m (656 ft) depth all the way into coastal waters and estuaries (Hopkins-Murphy et al. 2003). These waters comprise an important developmental habitat for this species. Juveniles and adults feed mostly on benthic invertebrates. Loggerheads do not venture into the Gulf Stream in the fall, probably to avoid being swept into the colder northern waters (Epperly et al. 1995). Loggerheads prefer steeply sloped beaches with gradual offshore approaches and are sensitive to beachfront lighting.

Based on data from the Wallops Island protected species monitoring program (NASA WFF 2010b), a total of four loggerhead sea turtle nests were found on Wallops Island's beaches in 2010 (during June and July), with the number of eggs in each ranging from 99 to 175. All four nests were located south of the existing south Wallops Island UAS airstrip, approximately 2.5 km (1.6 miles) southwest of the proposed new north Wallops Island airstrip (see Figure 8). Each nest was marked with protective signage and covered with a protective cage, with one egg being retained for eventual genetic analyses. No sea turtle nests or false crawls were found on Wallops Island's beaches in 2009, and in 2008 one nest was laid late in the season but was flooded and froze during late October storms (Mitchell 2011a).

3.5 RED KNOT

The red knot (*Calidris canutus*), a Candidate species for federal listing, is a medium sized sandpiper that is one of the longest-distance migrants known in the world (USFWS 2005). These small birds have wingspans of approximately 50 cm (20 in) and fly more than 1,500 km (930 miles) from south to north each spring and in reverse each autumn. These are relatively short birds with short legs, and their heads and breasts are rusty colored during the breeding season and grey the rest of the year. Red knots migrate in large flocks and frequent the same stopping areas each year. Their long migration periods cause physiological changes such as increases in fat mass and flight muscle and decreases in leg muscle mass, stomach mass, and gizzard mass (USFWS 2005). Red knots survive on small mussels and other mollusks for a large percentage of the year and horseshoe crab eggs during migration (USFWS 2005). In 2006, USFWS reviewed the candidacy status of red knot, but determined that its protection under the federal ESA remains warranted but precluded by other, higher priority activities. Currently it is still a Candidate species.

Based on survey data from the mid-1990s, 8,000 to 10,000 red knots would migrate through the barrier islands of Virginia each year (NASA WFF 2009b). However, survey data throughout 2009 indicated much lower numbers of individuals. On May 8, 2009, there was a flock of approximately 1,300 individuals seen on north Wallops Island; but, later that same month, flock size dropped to about 20 to 200 individuals (NASA WFF 2009b). In 2010, red knot flocks were sighted between May 14 and May 28 at numerous locations along Wallops Island's beaches, with flock size ranging from 2 to 230, and flocks

averaging 56 individuals. A number of these sightings occurred at "North End Curve" and "North End Point," which are both about 1.5 km (1 mile) south-southeast from the eastern end of the proposed airstrip, and generally near what will eventually be some of the UAS departure and approach flight paths over the beach (see Figure 8).

3.6 PIPING PLOVER

The Atlantic coast population of piping plover (*Charadrius meolodus*) breeds on coastal beaches in the north from Newfoundland and southeastern Quebec and south to North Carolina and Florida. Some plovers migrate as far south as the West Indies and Bahamas. Plovers are small, beige and white shorebirds with a black band across their breast and forehead. They typically feed on invertebrates such as marine worms, beetles, fly larvae, crustaceans, and mollusks. Habitat generally consists of ocean beaches, sand, or algal flats in protected bays, while breeding occurs mainly on gently sloping foredunes or blow-out areas behind dunes (NASA WFF 2009b). In late March or early April, after they have established territories and conducted courtship rituals, plover pairs form shallow depressions in the sand for nests where they lay their eggs. Nests can be found above the high tide line on coastal beaches, sandflats at the end of spits and barrier islands, gently sloping foredunes, blowout areas behind dunes, and over-wash areas between dunes. These nests consist of a range of substrate material from fine grained sands up to shells and cobbles. Generally, nests are found in areas with little or no vegetation, however, occasionally nests have been found under beachgrass and other vegetation (NASA WFF 2009b).

Piping plovers have been monitored on Wallops Island since 1986 and nesting habitat has been delineated in the dune and over-wash areas. Plovers are observed annually foraging and resting on the beaches of Wallops Island, and nesting is routinely documented on the northern beaches; however, no nesting plovers have been observed on the southern portion of the island since 2000. In 2008, two pairs of piping plovers began nesting attempts at the north end of Wallops Island, but no eggs were laid (NASA WFF 2010b). In 2009, three pairs nested successfully on the northern beaches; and in 2010, there were three nesting attempts, including one nest that was washed out by the tide, one nest with eggs that did not hatch, and one nest with 4 eggs that fledged 4 young (NASA WFF 2010b; Mitchell 2011b). Of the three 2010 piping plover nests, the one nearest to the project site was at "North End Point," about 1.5 km (0.9 miles) to the south-southeast from the eastern end of the proposed airstrip (see Figure 8). In May 2011, one piping plover nest was observed on the south end of Wallops Island. At the request of USFWS, NASA has designated piping plover nesting habitat at the extreme northern and southern ends of Wallops Island, and these areas are recognized as sensitive resource areas by WFF requiring special protective measures.

3.7 DELMARVA PENINSULA FOX SQUIRREL

Delmarva Peninsula fox squirrel (*Sciurus niger cinereus*) is a large tree squirrel that is a well-marked and distinct subspecies restricted in range to the Delmarva Peninsula (Delaware, Maryland, Virginia). There are about 180 Delmarva Peninsula fox squirrels in the Chincoteague National Wildlife Refuge. Habitat for the Delmarva Peninsula fox squirrel includes mature, open park-like stands of deciduous or mixed

deciduous-pine forest, especially near farmland; this species prefers ecotones where forest grades into scrub or grasslands. It is found in both upland and bottomland locations, but most often among loblolly pines. It is restricted to larger groves along streams, bays, or salt marshes and is found in relatively small woodlots on occasion. The squirrels prefer dens in hollow trees, but also construct nests of twigs and leaves in tree crotches, in tangles of vines in trees, or toward the ends of larger branches, 10-15 m (30 to 50 ft) above ground. Delmarva Peninsula fox squirrels are more terrestrial than gray squirrels and often forage on the ground. Diet includes acorns and nuts; the seeds of hickory, beech, walnut, and loblolly pine; buds and flowers of trees; and fungi, insects, fruit, and an occasional bird egg. When available in abundance, they can feed almost exclusively on green pine cones.

Though it occurs on nearby Assateague Island, the Delmarva Peninsula fox squirrel does not occur on those portions of the peninsula fronting the Atlantic Ocean, so it would not occur in the Action Area, and it has never been found on any part of Wallops Island (NASA WFF 2009b). As such, implementation of the Proposed Action would have **No Effect** on the Delmarva Peninsula fox squirrel, and it will be excluded from further discussion in this BA.

CHAPTER 4 ANALYSIS OF EFFECTS TO LISTED SPECIES

4.1 APPROACH TO ANALYSIS

This chapter presents an analysis of potential direct, indirect, temporary, and permanent effects on listed species that would result from construction, operation, and periodic maintenance of the proposed new UAS airstrip on north Wallops Island. Direct effects are considered to be the immediate result of the Proposed Action, whereas indirect effects are caused by the Proposed Action but occur later in time and are reasonably certain to occur. Potential project effects on protected species are further classified and evaluated based on their anticipated longevity as temporary or permanent effects. All project effects are summarized as they would occur after the General Conservation Measures (avoidance and minimization measures) described in Subchapter 1.5 are implemented. Any additional conservation measures being considered and implemented that are specific to certain species protection are described below.

4.2 EFFECTS TO LISTED SPECIES

Based on the scope of the proposed new UAS airstrip construction and operational parameters, as described in Chapter 1, potential effects to nesting loggerhead sea turtles, red knots, and piping plovers could occur with implementation of the Proposed Action. As discussed below, some impacts may occur from construction noise, but more likely from operational lighting with regard to sea turtles, or UAS overflight noise or visual disturbance with regard to red knots and piping plovers. The benefits that will be derived from implementing the project's General Conservation Measures, as well as any remaining potential effects, are described below for each of these three species.

4.3 LOGGERHEAD SEA TURTLE

Loggerhead sea turtles are often seen in the channels and inlets of Virginia's barrier islands. It has only been in more recent years that loggerhead sea turtle nests have been periodically found on Wallops Island beaches. Four loggerhead sea turtle nests were found on Wallops Island in 2010 (during June and July), but all four nests were located north of the existing south Wallops Island UAS airstrip, and approximately 2.6 km (1.6 miles) southwest of the proposed new north Wallops Island airstrip (see Figure 8). However, direct impacts to this species from the Proposed Action are not anticipated, because the project has been intentionally designed and sited to avoid disturbance to any dune or beach habitats. Nighttime lighting could disorient nesting females and emerging hatchlings; however, this type of indirect impact is also not anticipated, because: (1) UAS will only be operating infrequently at night; (2) any safety lighting at the airstrip will be of minimal intensity and downward-shielded; and (3) overflying UAS will not be using running lights. Finally, as directed by the WFF Threatened and Endangered Species Monitoring Program protocols, should WFF monitoring staff identify sea turtle nesting activity under UAS flight paths on the beach, UAS flights will be redirected or suspended until nesting activity has ceased or nestlings have completed their emergence. Given that direct impacts to sea turtle nesting habitat will be avoided, and that numerous measures will be implemented to avoid lighting and UAS overflight noise disturbances, it is concluded that implementation of the Proposed Action will have **No Effect** on loggerhead sea turtles.

4.4 RED KNOT

Red knots, a candidate species for federal listing, are a locally common to abundant transient from May 10th through June 5th and from July 20th through September 25th along the coast of Accomack County, Virginia. Red knots are rare west of the Chesapeake Bay and an uncommon to rare visitor in the winter and summer. Red knots do not breed in the vicinity of Accomack County, although they have been appearing regularly during spring migration on Wallops Island, mostly during the second half of May. In 2010 on the northern beaches of Wallops Island, numbers of red knots grew steadily from a low of 50 individuals or so in mid-May, to a large flock of 230 birds that was observed on May 28. No red knots were observed on the northern beaches after the end of May, and none were ever observed on the southern beaches. Many of the 2010 north beach sightings of red knots were at "North End Curve" and "North End Point" (see Figure 8), which are both about 1.6 km (1 mile) south-southeast from the eastern end of the proposed airstrip, and generally near what will eventually be some of the UAS departure and approach flight paths over the beach. However, direct impacts to this species' habitat from the Proposed Action are not anticipated because the project has been intentionally designed and sited to avoid all sensitive intertidal and over-wash habitats seaward of the dunes.

It is possible that red knots occurring within the flight path of UAS overflying the beach could experience deleterious startle responses from the sudden appearance and sound generated by UAS. The effects of overflying aircraft on waterfowl and shorebirds have been well-studied in the past 20 years, with researchers reporting varying results and conclusions. A review of the literature indicates that at least some level of temporary startle response can be expected and anticipated, particularly in non-nesting birds. Komenda-Zehnder *et al*. (2003), for example, focused on determining the minimum altitude above ground level (AGL) needed to minimize the stressful startle response of ducks in the Swiss lowlands to overflying aircraft and helicopters; they found that found that, depending on aircraft type, between 60 and 78 percent of waterfowl exhibited "stressed" behaviors (alarm posture, swimming away, taking immediate flight) with fixed-wing aircraft flying at approximately 150 m (500 ft) AGL and generating 66-68 dB noise, while helicopters at the same altitude caused a 82-89 percent startle response rate at 75-79 dB. Waterfowl returned to a relaxed posture after 5 minutes or so, although they did not appear to habituate or acclimate to the overflights. Smit and Visser (1993), in summarizing many Dutch studies, believe that large groups of waterfowl can habituate to overflights that occur daily, but mass startle responses can be elicited when a new type of aircraft suddenly appears, particularly at low altitudes (less than 300 m [about 1,000 ft] AGL).

It is sufficient to conclude that at least some level of shorebird startle response may be elicited, particularly early on in UAS operations, and if UAS fly below 150 m (500 ft) over the beach and intertidal zone, although some eventual habituation to UAS overflights is possible. However: (1) UAS will only be overflying the beach eight times per day, at most; (2) UAS operators will be instructed to maintain a flight path both 305 m (1,000 feet) vertically and horizontally away from red knots; and (3) with sound levels generated by the loudest UAS type actually being nearly 10dB below ambient levels measured onsite - it is unlikely that red knots would experience any significant short or long-term effects from UAS sound or visual disturbances. Therefore, given that direct impacts to dune habitats and maritime habitats seaward of the dunes will be avoided, and that numerous measures will be implemented to minimize visual and sound disturbances, it is concluded that implementation of the Proposed Action **will not substantially affect** local populations of red knots.

4.5 PIPING PLOVER

The piping plover is an uncommon transient and summer resident of the lower Chesapeake Bay and is known to inhabit the coastal habitats of the nearby Chincoteague National Wildlife Refuge. It was first identified on northeast Wallops Island in a survey in June 28, 1995. Piping plovers are known to periodically use the sandy beaches and tidal flats along the coast of Wallops Island; piping plover nesting has been documented in recent years on Wallops Island. In 2008, two pairs of piping plovers began nesting attempts at the north end of Wallops Island, but no eggs were laid (NASA WFF 2010b). In 2009, three pairs nested successfully on the northern beaches; and in 2010, there were three nesting attempts, including one nest with 4 eggs that fledged 4 young (NASA WFF 2010b). Of the three 2010 piping plover nests, the one nearest to the project site was at "North End Point," about 1.5 km (0.9 miles) to the south-southeast from the eastern end of the proposed airstrip (see Figure 8).

Direct impacts to this species' habitat from the Proposed Action are not anticipated because the project has been intentionally designed and sited to avoid all sensitive intertidal and over-wash habitats seaward of the dunes. Indirect impacts on piping plovers from UAS noise and visual disturbances is possible, but unlikely. Similar precautions will be taken to avoid startle responses in nesting piping plovers from overflying UAS, including: (1) UAS overflights of the beach will be infrequent (eight times per day, at most) and (2) UAS operators will be instructed to maintain a flight path both 305 m (1,000 feet) vertically and horizontally away from piping plovers. And, with sound levels generated by the loudest UAS type actually being nearly 10dB below ambient levels measured onsite, startle responses resulting in piping plover nest abandonment are also not anticipated. Given that direct impacts to dune habitats and other maritime habitats seaward of the dunes will be avoided, and that numerous measures will be implemented to minimize visual and sound disturbances, it is concluded that implementation of the Proposed Action **may affect, but is not likely to adversely affect,** piping plovers.

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CHAPTER 5 CUMULATIVE IMPACTS

"Cumulative effects" under the ESA are those effects of *future* State, municipal, or private activities, *not* involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation (50 Code of Federal Regulations 402.02). No future State, municipal, or private projects have been identified in the action area. Therefore, the Proposed Action, in conjunction with other past, present, or reasonably foreseeable projects, would not be expected to result in major adverse cumulative impacts to any listed threatened or endangered species.

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CHAPTER 6 CONCLUSION

Based on the evaluation presented above, NASA has made the following determination of effects on listed species and critical habitat from implementation of the Proposed Action within the action area (Table 3).

Table 3. Summary of Findings for Federally Listed Threatened and Endangered Species under the Jurisdiction of the USFWS

Species	*ESA Status*	*Effects Determination*
Sea Turtles (nesting only)		
Loggerhead Sea Turtle	Threatened	No effect.
Birds		
Red Knot	Candidate	Not likely to substantially affect.
Piping Plover	Threatened	May affect, not likely to adversely affect.

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APPENDIX A
WALLOPS ISLAND PROTECTED SPECIES MONITORING PLAN

This document is available online at
http://sites.wff.nasa.gov/code250/docs/2011WFFProtectedSpeciesMonitoringPlan.pdf

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
6669 Short Lane
Gloucester, Virginia 23061

SEP 22 2011

Mr. Josh Bundick
NASA Wallops Flight Facility
Code 250.W
Wallops Island, Virginia 23337

Re: Wallops Flight Facility – Unmanned Aerial Systems Airstrip, Accomack County, Virginia, Project # 2010-I-0642

Dear Mr. Bundick:

This document transmits the U.S. Fish and Wildlife Service's (Service) the results of our review of the National Aeronautics and Space Administration's (NASA) referenced proposed project at the Wallops Flight Facility (WFF), in Accomack County, Virginia and its effects on the federally listed endangered green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), and Delmarva fox squirrel (*Sciurus niger cinereus*), and the threatened Atlantic coast population of the piping plover (*Charadrius melodius*), loggerhead turtle (*Caretta caretta*), seabeach amaranth (*Amaranthus pumilius*), and northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) in accordance with section 7 of the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA).

Since 2003, unmanned aerial systems (UAS) have been operating from an airstrip on a then remote portion of south Wallops Island. In 2005, the airstrip was expanded to accommodate larger classes of UAS. The airstrip was lengthened to 1,500 feet (ft); two staging pads were also added. While this airstrip met an immediate and emerging need, the location has proven to be unsatisfactory for continued UAS flight operations. Storm events often inundate the runway with surf and sand, and the east/west orientation makes it susceptible to cross winds.

WFF has determined that a new airstrip is needed to provide an adequately-sized facility that will be capable of supporting the testing and deployment of existing and future UAS and UAS-based scientific instruments at WFF. UAS tests and UAS-based research opportunities form an important objective of NASA Goddard Space Flight Center's Suborbital and Special Orbital Projects Directorate and as such, this type of mission need requires an unencumbered operating environment. The new airstrip will have an asphalt surface and will measure approximately 3,000 ft long (2,500 ft plus an additional 500 ft clear zone) by 75 ft wide located at the northern portion of the island with an east-west orientation.

The federally listed species found on WFF inhabit the coastal beach zone of the island. The proposed runway site lies within the upland and marsh section of the island, well behind the coastal dune and shoreline side of the island. The Service agrees with NASA's determination that the proposed construction of the facility will have "no effect" on any of the federally listed species because construction activities will be limited to areas outside habitat that supports the listed species. However, the subsequent use of the runway and operation of UAS over the coastal zone associated with the construction of the runway as proposed has the potential to impact the federally listed species found within.

The candidate species red knot (*Calidris canutus rufa*) was included in NASA's June, 2011 biological assessment (BA). This species has not yet been proposed for listing and therefore will not be addressed further in this document; however, we appreciate NASA's consideration of this species and any conservation measures implemented to minimize or avoid threats to this species will contribute to its conservation. The Service would like to work with NASA to develop a candidate conservation agreement for the red knot.

The Service concurs with the NASA's determination that the proposed action will have "no effect" on the seabeach amaranth, Delmarva fox squirrel, and northeastern beach tiger beetle because these species are not found on Wallops Island.

The Service does not concur with NASA's determination of "no effect" on nesting sea turtles for the proposed project. NASA has proposed the following steps to reduce and minimize potential impacts to nesting sea turtles: (1) limit night flights for special circumstances like hurricane monitoring, (2) any safety lighting at the airstrip will be minimal intensity and downward-shielded, (3) over flying UAS will not use running lights, and (4) as directed by the WFF Threatened and Endangered Species Monitoring Program protocols, should WFF monitoring staff identify sea turtle nesting activity under UAS flight paths on the beach, UAS flights will be redirected or suspended until nesting activity has ceased or nestlings have completed their emergence. The avoidance and minimization measures proposed by NASA will be sufficient to prevent possible impacts to nesting sea turtles during normal UAS operations. However, during special circumstances (e.g., hurricane data collection missions) there may be a potential to affect nesting turtles. Based on the low number of nests at this site annually (between 1-4 nests per year), the low probability of hurricanes occurring during the nesting period here in Virginia, and the even lower probability that an emergency UAS flight would occur at night while turtles were nesting, the likelihood of disturbance resulting from UAS operations is low. Additionally, UAS operations and clearances from beach habitats will minimize the potential that UAS operations will affect sea turtles even if they do occur during nesting, and any effects are expected to be limited to temporary changes in behavior that will not reduce the likelihood of nesting. Consequently, these minor disturbances are considered to be insignificant and discountable, and the project as proposed, "may affect, but is not likely to adversely affect" nesting sea turtles.

The Service concurs with NASA's determination that the proposed action "may affect, but is not likely to adversely affect" piping plovers with the addition of avoidance and monitoring measures that NASA and the Service agreed to during a 19 August 2011 conference call. The

UAS flights may have the potential to disturb nesting plovers. NASA has proposed the following precautions to avoid and minimize disturbance of plovers: (1) UAS over-flights of the beach will be on average only four sorties each day (1,040 sorties maximum per year) and (2) UAS operators will be instructed to maintain a flight path both 1,000 ft vertically and horizontally away from nesting piping plovers. The Service has some concern regarding the 1,000 ft vertical and horizontal buffer proposed for UAS over flights adjacent to nesting piping plovers because this distance may not avoid all effects. Based on our review of available information on the effects of aircraft overflights on shorebirds, consultation with species experts, and past Service consultations on the effects of aircraft on nesting plovers, we recognized that the specific information on effects of aircraft is either limited to specific to situations and/or aircraft types and no information was available that would allow evaluation of effects of small aircraft similar to those proposed. Current research that is being done is focusing primarily on larger and faster military aircraft types like the F-18 and the Osprey, and not the type of aircraft involved in this proposed action. Early results have shown that nesting plovers after such aircraft have flown over, are fast to return to normal behavior and there appears to be no adverse effects (Dr. Jim Fraser, Virginia Tech, pers. comm.).

The Service believes that conducting monitoring of the effects of UAS aircraft on plovers, in conjunction with an adaptive management type of approach, would be appropriate to ensure that any possible effects of these types of aircraft is addressed. On August 19, 2011, NASA and the Service held a conference call to discuss our concerns regarding what would be considered an appropriate buffer distance. NASA has agreed to work with the Service and other species experts to develop an approach to UAS operation and monitoring that would be compatible with NASA's needs and provide information on potential effects on shorebirds. NASA has agreed to monitor nesting plover behavior, through observation, video-recording, or even UAS-mounted cameras during aircraft operation to determine if plovers are affected. NASA may also attempt to establish disturbance thresholds and evaluate effects of other variables on likelihood of disturbance, including aircraft propulsion type, flight path relative to plovers, and others. The Service is confident that the monitoring program would provide good information on the response of plovers to UAS over-flights, and allow NASA to adopt appropriate modifications to avoidance buffers and flight paths if needed, and to reinitiate consultation under section 7 if necessary. Based on the best currently available data, the Service believes that with the conservation measures and the 1,000 foot horizontal and vertical buffers, disturbances to nesting plovers are unlikely to occur, and will be limited to temporary changes in behavior that are similar to responses to potential predators in the vicinity of nesting plovers and are unlikely to result in flushing from nests. The Service believes that the level of disturbance will be insignificant and discountable, and birds will return to normal activities quickly following disturbance, and the proposed action is not likely adversely affect piping plovers. In addition, the proposed monitoring in conjunction with UAS operation has the potential to significantly improve future conservation efforts for plovers and other shorebirds.

The proposed airstrip location was modified to minimize encroachment on an existing bald eagle nest. The project is outside the 660 ft buffer required to protect active nests, and there are no

identified eagle concentration areas, thus the proposed action is not likely to disturb bald eagles, and consequently, no eagle act permit is required.

Should project plans change or if additional information on the distribution of listed species or critical habitat becomes available, this determination may be reconsidered. If you have any questions, please contact Mike Drummond of this office at (804) 693-6694, extension 122, or via email at mike_drummond@fws.gov.

Sincerely,

for Cindy Schulz, Acting Supervisor

Cindy Schulz
Supervisor
Virginia Field Office

cc: Chincoteague NWR, Chincoteague, VA (Lou Hinds)
VDACS, Richmond, VA (Keith Tignor)
VDCR, DNH, Richmond, VA (René Hypes)
VDGIF, Richmond, VA (Amy Ewing)