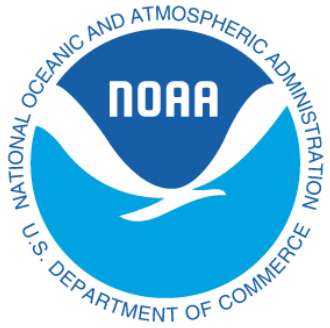

National Oceanic and Atmospheric Administration

Office of Marine and Aviation Operations

NOAA Unmanned Aircraft Systems (UAS) Handbook

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Revision Sheet

Revision	Author	Date	List of Changes
1.0 Initial Release	Philip Hall	June 19, 2017	

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1 PURPOSE

This handbook supplements NAO 216-104A: Management and Utilization of Aircraft and Aircraft Operations Center (AOC) Unmanned Aircraft Systems Policy 220-1-5 by providing additional guidance to NOAA users of Unmanned Aircraft Systems (UAS) and a framework for the safe and efficient operation of UAS operated or sponsored by NOAA. It further describes procedures for obtaining approval to procure UAS, UAS services, and operate UAS in NOAA. Aircraft Operations Center (AOC) Operations Manual Policy 220-1-5 is the governing document for NOAA UAS operations.

2 AUTHORITY

This handbook is established under the authority of NAO 216-104A: Management and Utilization of Aircraft, wherein OMAO is assigned overall responsibility for the "management and utilization of all aircraft activities within NOAA" (Section 2.01) and the Commanding Officer (CO), AOC is granted operational authority (Section 5.04). UAS is defined by statute as an aircraft that is operated without the possibility of direct human intervention from within or on the aircraft (Public Law 112-95, Section 331(8)).

This handbook does not supersede any of the regulations in 14 CFR Chapter I (Federal Aviation Regulations), Federal Management Regulation (FMR) Chapter 102 Part 33, or the Interagency Committee for Aviation Policy (ICAP) which is chaired by GSA and has determined that UAS will be included under the above FMR.

The CO, AOC is responsible for maintaining, updating and providing access to this handbook. Suggestions, corrections and comments should be addressed to the AOC UAS Section, aoc.uas@noaa.gov.

3 APPLICABILITY

This handbook provides guidance for all UAS operations within NOAA. AOC review of an operation may result in further requirements, other than those outlined in this handbook, for operational approval.

3.1 Field UAS: Line Office Owned and Operated

NAO 216-104A prescribes that NOAA Line Offices may own and operate their own UAS if they fall below the capital asset threshold and meet AOC criteria. Field UAS operations receive oversight, authority and guidance from the CO, AOC. Line Office UAS operations shall be coordinated and approved through AOC to ensure successful and safe operations. This will include the approval of operations, operational risk management, and airworthiness, as described in this Handbook. As a field UAS program increases in scope and number of platforms, AOC will also provide consultation on developing training, safety and standardization.

In addition to AOC operational and safety approval, each Line Office shall ensure that each UAS operation meets all applicable NOAA, Department of Commerce (DOC), and Federal

policy. Each Line Office will coordinate and approve their UAS Operations through the process outlined in Appendix I – Line Office Administrative Review of UAS Operations.

3.2 Acquisition of UAS and UAS Commercial Aviation Services (CAS)

OMAO and the OAR UAS Program Office (UASPO) will review all Acquisitions of UAS and UAS CAS. Acquisitions will be approved at the Line Office Executive Level. See Appendix H – UAS Pre-Acquisition Guidance for specific requirements.

3.2.1 Acquisition of UAS

OMAO is responsible for conducting a pre-acquisition review to ensure the proposed UAS will meet AOC's airworthiness and flight safety requirements. Statements of work/specifications shall be provided to OMAO **45 calendar days** prior to the planned submission of the purchase request package to the acquisition office.

3.2.2 Acquisition of UAS Commercial Aviation Services

Acquisitions for UAS commercial aviation services are defined as UAS CAS and include leased and rented aircraft.

Three steps are required prior to conducting UAS CAS operations.

Step 1. The UAS CAS pre-acquisition will be reviewed by OMAO, the UASPO, and approved at the Line Office Executive Level. See Appendix H – UAS Pre-Acquisition Guidance for specific requirements.

OMAO is responsible for conducting a pre-acquisition review to ensure that the statement of work/specifications for CAS will meet NOAA and FAA policy for pilot certification and airspace approval. The Line Office's pre-acquisition specifications and requirements shall be provided to OMAO **45 calendar days prior to the planned submission of the purchase request** package to the acquisition office. The requestor of CAS is responsible for including an OMAO clearance number on the purchase requisition as assigned by OMAO Aviation Safety Program Manager (ASPM).

Step 2. Once a contract for CAS has been awarded, each Line Office shall ensure that the specific UAS CAS operation meets all applicable NOAA, DOC, and Federal policy. Each Line Office will coordinate and approve their UAS CAS Operations through the process outlined in Appendix I – Line Office Administrative Review of UAS Operations.

Step 3. Once a contract for CAS has been awarded, OMAO is responsible for conducting a CAS operations safety and operations review to ensure that the specific operation proposed by the CAS meets NOAA and FAA policy for pilot certification and airspace approval. Operational planning information shall be submitted to the AOC UAS Section for approval of CAS operations. This package should be forwarded a minimum of **45 calendar days prior to the start of the operation** and include:

1. Airspace clearances (National airspace, special use airspace, foreign, etc.)
2. Airman certification
3. Land owner permission

4. Radio frequency clearance, if applicable
5. Risk management analysis
6. Signed contracting documents

UAS contractor operations require a NOAA Mission Commander (MC). Further information regarding the MC can be found in Section 5.2 of this document.

3.3 Other Government UAS Operations

UAS owned and operated by other government agencies can be used for NOAA operations. NAO 216-104A Section 4.4 dictates that all NOAA UAS operations will be approved by OMAO, to ensure safety and compliance with regulations and policy. Some operations may not be subject to AOC Policy 220-1-5, such as when NOAA is solely an external observer to an operation or if the operation is sponsored by a partnering government agency with an established UAS program. Details on determination of project status are contained in 220-1-5 and will be determined through consultation with the Chief of the AOC UAS Section and communicated in a written memo.

4 OVERVIEW OF GOVERNMENT UAS REQUIREMENTS

4.1 FAA Regulations Governing UAS

The FAA defines an unmanned aircraft as "an aircraft that is operated without the possibility of direct human intervention from within or on the aircraft" (Public Law 112-95, Section 331(8)). Also called drones, these unmanned aircraft do not have a human pilot onboard. All NOAA UAS operations in the National Airspace System (NAS) will follow applicable FAA policy when operating under FAA jurisdiction.

Significant FAA guidance with a brief explanation is included below:

Public Law 112-95 Section 336, special rule for model aircraft:

The Federal Aviation Administration (FAA) has determined that Section 336 of Public Law 112-95, the *FAA Modernization and Reform Act of 2012,* shall not be used as a basis of approval for commercial or government UAS operations and is applicable to recreational and hobbyists use only. All NOAA UAS operations will be categorized as a public (government) aircraft operations or civil UAS operations and may not be operated under Section 336 or AC 91-57a Model Aircraft Operating Standards.

Federal Aviation Regulation Part 107, Small Unmanned Aircraft (sUAS) Regulations:

14 CFR Part 107 governs civil and commercial UAS operations. NOAA has adopted standards, such as pilot certification, from FAR Part 107 and may use Part 107 for airspace approval depending on the operation. **Operators should have a comprehensive knowledge of FAR Part 107**.

Flight Standards Information System 8900.1 Vol 16, COA guidance:

Provides information and policy guidance regarding how civil, public and model UAS operators are authorized to conduct flight operations in a manner that complies with 14

CFR. Contains general guidelines, certification of authorization (COA) requirement guidelines and defines the exemption process for civil Section 333 exemptions. Operators should have some familiarity with this document, which may be found online.

4.2 Examples of UAS Categories, Classes, and Weights

(This list is not all-inclusive)

UAS Category	Max Gross Takeoff Weight (lb)	Normal Operating Altitude (ft)	Speed (kts)	Examples of UAS in this category (not all inclusive)
Group 1	0 - 20	<1,200 AGL	<100	Puma, MD4-1000, APH-22
Group 2	21 - 55	<3,500 AGL	<250	ScanEagle, Silver Fox, Aerosonde
Group 3	<1320	<18,000 MSL		Shadow, Integrator, Viking
Group 4	>1320		Any Airspeed	Predator A/B, Gray Eagle
Group 5		>18,000 MSL		Predator B, Global Hawk, BAMS

Table 1: Examples of UAS Categories

AGL = Above Ground Level MSL = Mean Sea Level

Source: U.S. Army Roadmap for UAS 2010-2035, pg. 12

4.3 Flights in the Domestic National Airspace System (NAS)

NOAA has multiple methods to obtain FAA airspace approval for UAS operations. The specific authorization method depends on the requirements, frequency, and spontaneity of the operation. The AOC UAS section coordinates FAA airspace approval for all NOAA UAS operations and will determine the most efficient airspace approval method that will be most beneficial for each operation.

4.3.1 FAR Part 107, Waivers, and Airspace Authorizations

NOAA may authorize UAS operations under FAR Part 107 for flights within the NAS at 400 feet AGL or lower in Class G airspace, within visual line of sight. This rule applies to small UAS that weigh 55 lbs or less.

FAR 107.205 include a list of regulations subject to waiver, such as the daylight operation requirement. A request for a certificate of waiver must contain a complete description of the proposed operation and justification that establishes that the operation can safely be conducted under the terms of a certificate of waiver.

UAS operations under Part 107 in Class B, Class C, or Class D airspace or within the lateral boundaries of the surface area of Class E airspace designated for an airport can be requested via an authorization from FAA.

AOC will coordinate all requests for Part 107 waivers and authorizations for airspace other than Class G.

4.3.2 Certificate of Authorization (COA)

Approval for flights within the NAS that do not conform to FAR Part 107 may be granted through a COA issued by the FAA and will contain specific rules and requirements. The FAA approves COA's for UAS flight operations on a case-by-case basis. The AOC UAS Section is the point of contact for FAA COA applications and is the liaison to the FAA for all UAS matters. The application includes, but is not limited to, the operations plan, airworthiness statement, airspace requirements, pilot qualifications, radio/communications frequencies, communication plan, and platform details. The application process is through a FAA online-based system. The **FAA requires a minimum of 60 business days** to process a COA application from the time it is submitted by NOAA.

4.3.3 Class G Airspace Memorandum of Agreement (MOA) and Blanket Area NOAA COA

The FAA and OMAO have entered into an agreement to allow UAS operations in Class G uncontrolled airspace. If applicable, these operations would not need to go through the formal COA application process, but would require at least 24-hour notice to the FAA before operations can occur. There are also specific limitations on this type of authorization as stipulated in AOC UAS Policy 220-1-5. The main advantage of this COA is that it provides access to altitudes up to 1200 feet. This type of clearance may not be appropriate depending on the location of the operations and the qualifications of the operators.

4.4 Flights in Special Use Airspace (SUA) - Restricted, Warning or Prohibited Areas

UAS Operations in SUA require the permission of the appropriate authority or using agency. UAS operations in these airspaces typically require exclusive planning and scheduling by the agency and may require significant lead-time depending on the agency requirements.

The FAA and DoD have a Memorandum of Agreement (MOA) to allow certain kinds of UAS flight operations over military reservations without the requirement for a COA. DoD controlling agencies can vary the terms, conditions, and lead-times for possible use of these areas, and each proposed UAS operation must be planned and evaluated on a case-by-case basis. When a UAS operation requires SUA, the AOC UAS Section will coordinate with the requestor to determine the requirements needed to operate in the desired airspace.

4.5 Flights in International/Oceanic Airspace

Generally, a country's sovereign airspace extends 12 nautical miles from the country's coastline. For most countries, airspace beyond a country's territorial limit is considered international airspace. The International Civil Aviation Organization (ICAO) may delegate responsibility for a region of international airspace to a specific country. These areas are called flight information regions (FIRs).

UAS flights conducted in active offshore warning areas require approval though that warning area's controlling agency (see section 4.4 above).

UAS flights in oceanic FIRs where the FAA is the air traffic service provider may require a COA.

UAS flights in oceanic FIRs where the air traffic service provider is a foreign government must be coordinated with that government. Additional diplomatic clearances may also be required.

Certain NOAA UAS operations in oceanic, international airspace may be conducted as a NOAA state aircraft operation under NOAA's due-regard policy. For more information see *AOC Unmanned Aircraft Systems Policy 220-1-5, Appendix A: UAS Operations in Uncontrolled (Class G) International Airspace.* FAA authorization is *not* required as long as the Pilot-in-Command (PIC) complies with this policy.

Use of contractor airframes or services in international airspace requires an appropriate agreement for aircraft services in order to declare the UAS a state aircraft. State aircraft operations are evaluated on a case-by-case basis and approved at the discretion of the CO, AOC and involve the Contracting Officer from the servicing Acquisition Division.

4.6 Flights in Foreign Airspace

UAS flights conducted within foreign countries or territories require the permission of that country's civil aviation authority. Foreign UAS flight operations require NOAA and State Department approval. Additionally, foreign UAS flight operations must meet Federal policies regarding International Traffic in Arms Regulations (ITAR) and export control.

4.7 Special Permitting

Flights over sensitive areas and/or in the vicinity of protected species or marine mammals may require a permit, authorization, or inter-agency consultation to meet environmental compliance requirements. Sensitive areas may include, but are not limited to, National Parks, National Wildlife Refuges, Waterfowl Production Areas, Wilderness Areas, and National Marine Sanctuaries Act. For flights over animals, applicable statutes may include but are not limited to: the Endangered Species Act, 16 U.S.C. § 1531 *et seq*., Marine Mammal Protection Act, 16 U.S.C. § 1361 *et seq.*, and Migratory Bird Treaty Act, 16 U.S.C. § 703 *et. seq*. These permits may contain specific mitigation measures, or other terms and conditions that will need to be met. All flights must comply with the National Environmental Policy Act, 42 U.S.C. § 4321 *et. seq*; NOAA Administrative Order 216-6A. The Principal Investigator is responsible for all environmental compliance.

5 OPERATIONAL ROLES AND RESPONSIBILITIES

5.1 NOAA Principal Investigator (PI)

The PI is the overall lead of the operation. The PI is responsible for the initial request submission (see Appendix B – UAS Flight Request Form), as well as providing any additional information required from AOC. The PI is also responsible for complying with all applicable NOAA, DOC, and Federal policy and environmental compliance requirements

5.2 NOAA Mission Commander (MC)

All UAS operations will have a Mission Commander (MC). The MC has final oversight and responsibility to ensure all applicable statutory requirements are met during all UAS operations. This includes compliance with FAA regulations, NOAA AOC 220-1-5 policy, Flight reporting requirements (SITREPS, NOTAMS, Incident/Accident reporting) and any additional requirements within the AOC Flight Authorization Memo. This person shall be a federal government employee of NOAA, or a partner federal agency.

The MC will provide federal oversight of the project and have operational authority in conjunction with the pilot in command, to include go no-go decisions based on weather, safety and operational payload status. The MC will be selected by the line office and approved by AOC UAS Section and shall have knowledge in the limitations of the platform, airspace, and clearances for approvals in the operation. In the event of an incident or accident, the MC will become the liaison with AOC to determine root causes and file any required paperwork before UAS flights are authorized by AOC to resume.

5.3 Pilot in Command (PIC)

The PIC of a UAS is directly responsible for, and is the final authority on the operation of the aircraft. Additional supporting or supplemental pilots (SP) may augment the PIC; however, the PIC retains complete and overall responsibility for safety in flight, regardless of who is piloting the aircraft.

5.4 NOAA Aircraft Operations Center (AOC)

AOC will assign an individual from the UAS Section to assist the UAS user with the review process. This individual will be familiar with proposed UAS operations and requirements and advises the UAS Flight Readiness Review Board on the proposed UAS operation but is not responsible for obtaining the required data for Appendix B – UAS Flight Request Form. The burden of completing the request and compiling the data is with the PI.

5.5 Commanding Officer, NOAA AOC

The Commanding Officer (CO), AOC will be the final approving authority for all NOAA UAS operations identified in Section 3 of this handbook.

6 AOC FLIGHT APPROVAL PROCESS AND REQUIREMENTS

NOAA programs that operate UAS shall comply with the AOC Operations Manual and AOC UAS Operations Policy 220-1-5. The following guidance for UAS operations does not supersede that policy but provides an overview of the AOC process. The process is initiated with the completion of Appendix B – UAS Flight Request Form in coordination with the checklist shown in Appendix I – Line Office Administrative Review of UAS Operations. AOC will work with the PI to complete the steps shown in Figure 1: AOC UAS Safety and Operations Approval Process.

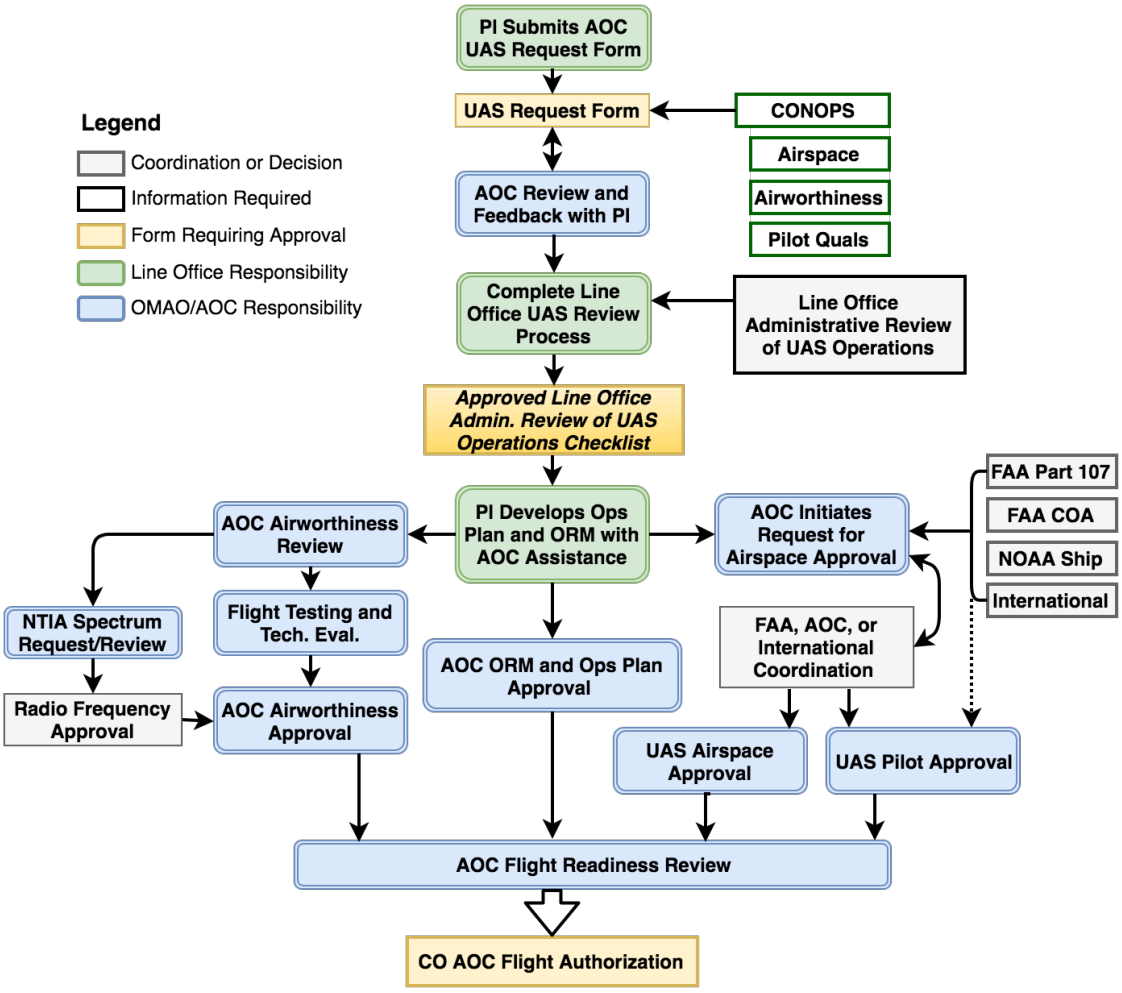


Figure 1: AOC UAS Safety and Operations Approval Process

6.1 AOC UAS Review Timeline

The minimum lead times shown in Table 2: AOC UAS Review Timeline, are required to ensure that OMAO and AOC have adequate time to ensure the operations are approved by the requested start date.

Calendar Days	Requested Service or Review	Required Items
120	Prior to Complex Operations, Including: - Operation in Foreign Airspace - Individual COA Application or FAA Exemption or Waiver Required	Completed UAS Flight Request Form (Appendix B)
90	Prior to Complex Operations when required by AOC UAS Section	Final Draft of Operations Plan
90	Prior to Operation of UAS on NOAA Ship	Final Draft of Ship Instructions
90	Prior to Operation of New UAS Model	Competed Airworthiness Questionnaire
60	Prior to Operation that Requires Full ORM	Completed UAS Flight Request Form
30-60	Prior to Operations of a UAS utilizing a licensed frequency	Submitted NTIA Application
45	Prior to Operation with Previously Approved ORM	Completed UAS Flight Request Form
45	Review Required Prior to Submission of Purchase Request Package to Acquisition Office for UAS Acquisition or UAS Commercial Aviation Service (CAS)	UAS statement of work/specification requirements
45	Prior to UAS Contractor Operations	Specified in Handbook Sec. 3.2
15-30	Prior to FRR - UAS Section Review	FRR Review Package
15	Prior to Flight Authorization	AOC CO Authorization

Table 2: AOC UAS Review Timeline

6.2 Emergency Response

When a mission is being considered for emergency response, the operation shall be coordinated ahead of time through the UAS Flight Request Form to the greatest extent possible. This will enable OMAO/AOC to adequately review the operation, pre-coordinate airspace and emergency COAs, and potentially pre-authorize the response mission. Emergency response missions that cannot meet the above lead times will be requested directly through the Line Office Representative to the Fleet Council.

6.3 NOAA UAS Flight Request Form

The objective of the form is to provide an accurate understanding of the UAS platform, operations, project risks and mitigations. The information in the form is directly used for airspace requests such as the FAA COA process. For follow-on projects in the same flight

region, a flight request form may not be required. Depending on operational requirements, an abridged flight request form could be requested.

The PI should complete Appendix B – UAS Flight Request Form and attachments and submit to the AOC UAS Section (aoc.uas@noaa.gov) at least **120 calendar days prior** to the proposed project start date if a new COA application or foreign airspace will be required. Projects not requiring a COA or foreign airspace access must be submitted to AOC **45 or 60 days prior** to the proposed project start date depending on the type of project and ORM required (see 6.5). The request will also go through the NOAA Marine Operations Center (MOC) when shipboard operations are requested. AOC will assist the NOAA PI with the form, required information and attachments.

6.4 AOC Cost Estimate

An AOC Cost Estimate is needed when AOC personnel are directly supporting a project in the field. If funds are to be transferred to AOC for support, a cost estimate will be required. The PI should submit the request to the AOC UAS Section. The AOC UAS Section then generates a cost estimate. Funds are to be transferred and in place prior to commencing operations.

6.5 Operational Risk Management (ORM)

6.5.1 ORM Process

ORM is a deliberate process of identifying, assessing and managing risks. AOC requires an ORM be completed for all aviation and UAS operations. The steps required in an ORM are: 1) Identify hazards, 2) Assess hazards, 3) Make risk decisions, 4) Implement controls, and 5) Supervise. Identifying and implementing control measures reduces the likelihood and/or severity of operational hazards to an acceptable level. To ensure approval for the requested project start date an ORM document needs to be submitted **60 calendar days prior** to project start date. See Appendix C - Sample Operational Risk Management (ORM) Assessment. If requested, AOC can provide training on how to conduct an ORM. The ORM requires signatures from relevant AOC Branch Chiefs.

Long term, consistent UAS operations may qualify for a Wide Area ORM, permitting operations in a larger geographical area with a single approval (see 6.5.3).

6.5.2 ORM Addendum

If the project and the personnel are similar to a previous project that has a current signed ORM an ORM addendum can be used. See Appendix D - Example ORM Addendum.

6.5.3 Wide Area ORM

The Wide Area ORM allows select organizations to operate throughout a wide geographic area with approval of a Notice of Intent to Fly Form. Complexity of UAS operations and demonstrated safety record are two factors that will be assessed to determine if UAS operations can operate under a Wide Area ORM. It is the discretion of the CO of AOC to determine if UAS operations qualify for a Wide Area ORM.

The Notice of Intent to Fly (NIF) Form is used by the AOC UAS Section to evaluate and determine if the proposed UAS operations are permissible within the scope of a Wide Area ORM, NOAA and FAA regulations. The NIF Form is to be submitted to the UAS Section at least **two business days prior** to the intended day of operations. The AOC UAS Section will review the operational area for compliance; an approved and signed NIF Form, by the AOC UAS Section, is required prior to UAS flight operations. Additional risks that are not identified within the Wide Area ORM will require approval of an ORM addendum.

6.6 UAS Operations (Ops) Plan

For most projects, the Ops Plan details are contained within the ORM or ORM Addendum and a separate document is not required. A separate Ops plan is required for very complex operations where the details and scope exceed the format of the ORM process. The requirement for an Ops plan is determined with consultation with AOC UAS Section. **Depending on the complexity of the operation, a detailed Ops plan may be required at least 90 calendar days prior** to operations. An Ops plan is a detailed description of the proposed operations and may include, but is not limited to the following:

1. Concept of operations (CONOPS) – When, where, why, and how.
2. Aircraft system description
3. Sensor package
4. Communication links
5. Electromagnetic interference testing (EMI)
6. Aircrew requirements and responsibilities
7. Launch procedures
8. Flight operations
9. Recovery procedures
10. Flight restrictions
11. Operational risk management or hazard analysis
12. Emergency procedures
13. Method of sense-and-avoid with other aircraft
14. Method of air traffic control (ATC) communications
15. UAS airworthiness and previous testing/flights
16. Any required mitigation measures, best management practices, monitoring, terms and conditions, or other environmental compliance requirements.

6.7 Airspace Coordination

6.7.1 NOAA UAS Operations that utilize FAR Part 107

FAR Part 107 enables flights to take place in Class G airspace 400 feet AGL or lower. AOC will review the items under 6.6 to ensure compliance with the requirements needed to operate under this authority.

6.7.2 NOAA UAS Operations that utilize a COA

Applications for a COA are submitted using an online system where the request describes the UAS and operation being conducted.

The COA application includes, but is not limited to the operational plan, risk management, airworthiness statement, airspace requirements, pilot qualifications, radio/communications frequencies, and communication plan.

AOC is responsible for submitting and assisting in the development of COA applications for NOAA UAS operations. The PI is responsible for providing all the required supporting materials and documents.

Once AOC has received all project planning documents, AOC UAS Section personnel will coordinate all the COA application requirements with the PI. The FAA requires a **minimum of 60 business days** from receiving a validated COA application to approval for new COAs. Operations that include complex airspace or larger areas will require a longer review time. FAA review can be much more extensive and take longer than 60 business days; close coordination with the AOC UAS Section is recommended to tailor operations to areas that will expedite the FAA review process.

6.7.3 NOAA UAS Operations that utilize the Class G MOA

The FAA and NOAA have entered into an agreement to allow UAS operations in Class G uncontrolled airspace, under certain circumstances. If applicable, these operations would not need to go through the formal COA application process, but would require at least 24-hour advance notice to the FAA before operations can occur. There are also specific limitations on this type of authorization as stipulated in AOC UAS Policy 220-1-5. This type of clearance may not be appropriate depending on the location of the operations and the qualifications of the operators. AOC UAS Section will advise when this method is applicable.

6.7.4 Public / State Aircraft Status

In certain circumstances, UAS flown in support of NOAA may be classified as Public or State aircraft. This status is dependent on several factors including the intended use, ownership, and contract status. In international airspace, which is greater than 12 nautical miles from land, a NOAA UAS may be designated a State aircraft and may be operated without a COA. In all circumstances, the MC must exercise due regard for the safe navigation of other aircraft. Mitigation strategies will be agreed to prior to operations in conjunction with the AOC UAS Section. Public and State aircraft status can be extended to contract aircraft so long as an appropriate lease for aircraft services is in place and operations are conducted for the government. AOC will provide specific guidance for all contracted UAS operations. Designation of non-NOAA owned UAS as state or public aircraft is at the discretion of the CO, AOC.

6.8 Pilot Qualifications and Certification

6.8.1 Medical

There are no medical requirements for piloting UAS at or below 400 feet AGL; above 400 feet AGL a third class medical certificate will be required. This applies to both the Pilot In Command and Supplemental Pilot.

6.8.2 Pilot in Command (PIC)

The PIC is required to have a Remote Pilot Airman Certificate with a UAS rating issued from the FAA. This is expected to accommodate the majority of UAS operations; however operations in airspace other than Class G or altitudes above 400 feet may require further certifications such as a Private Pilot's license. This will be determined on a case-by-case basis. The PIC is also required to have a PIC Designation Letter in the platform being operated. The PIC Designation Letter consists of an AOC UAS Section review of a pilot's Original Equipment Manufacturers (OEM) training, FAA certifications and medical records. The CO of AOC will sign approved PIC letters for NOAA employees. Contractor pilots operating UAS for NOAA must have a written PIC designation from their contracting agency.

6.8.3 Supplemental Pilot (SP)

For operations that require a supplemental or external pilot, the SP is only required to receive OEM training on the platform to be able to operate the UAS. The PIC must be present at all times to take direct control of the UAS.

6.8.4 Mission Systems Operator (MSO)

Ancillary personnel such as MSO's must be thoroughly familiar and possess operational experience with the equipment being utilized.

6.8.5 Visual Observer (VO)

The VO must be able to maintain visual contact with the UAS at all times. For operations that extend beyond ½ mile the VO must have a verified vision test (corrected to 20/20) within the past 24 months.

6.9 Ship Project Instructions

Signed Ship Project Instructions are required for UAS operations on NOAA ships. Project Instructions are intended to inform the CO of the ship the nature of the UAS operations that are to take place. The Project Instructions are to be used for de-confliction with other ship missions/operations. Project Instructions are to be submitted to and signed by the CO of the ship and then forwarded to AOC UAS Section.

Submission of Project Instructions is due **90 days prior** to start date of the project.

6.10 UAS Airworthiness

An approved Airworthiness Statement is required prior to commencing any NOAA UAS operation. AOC will make the final determination of whether or not the UAS has sufficient

airworthiness substantiation and will be responsible for generating the Airworthiness Statement. The UAS must be shown to be airworthy for the specific operation being conducted. Unlike manned aircraft, the airworthiness requirements for UAS are dependent on the operational requirements of the mission. For example, operations of UAS in remote areas or special use airspace could have different airworthiness standards than those in the National Airspace or in populated areas.

New UAS platforms will require test flights in a controlled environment or Special Use Airspace in order to demonstrate the platform's capabilities such as reliability, endurance and/or lost link procedures. At a minimum, UAS Airworthiness Statement will include the date when the document becomes effective, warnings, and limitations. The information that will be required for a new airworthiness statement can be found in Appendix E - UAS Airworthiness Form and Appendix F – Risk Based Airworthiness.

Submit documents for AOC airworthiness and any maintenance requirements, as applicable, **90 calendar days prior** to start date of the project.

6.10.1 Standard Operating Procedure (SOP) for UAS field Units

Line Offices that own and operate field UAS should develop SOPs for their platforms. This document will describe specific procedures to follow for NOAA's intended use of the UAS, regardless of the location or type of operation. These procedures would not necessarily be covered in the manufacturer's operating manual. This would include best practices, maintenance checks, proficiency requirements, re-currency training, and unique safety procedures. Development of this document should be in collaboration with the AOC UAS Section to ensure completeness.

6.10.2 Maintenance and Continued Airworthiness

All NOAA UAS operators will follow AOC Maintenance instructions as outlined in AOC Policy 220-1-5, Section 5 and the specific UAS manufacturer's maintenance guidelines. Public or State aircraft status shall not change any maintenance practices or requirements as stipulated by the manufacturer without AOC approval.

6.11 Frequency Spectrum Approval

Each UAS operation must have appropriate approval for radio spectrum usage through NOAA's Office of Radio Frequency Management and DOC's National Telecommunications and Information Administration (NTIA). This process will be initiated by the AOC UAS Section and may take from 30-60 calendar days depending on the mission location and UAS frequency allocation requirements. ISM unlicensed radio bands (i.e. 902-928MHz, 2.4GHz, 5.8GHz) may receive an expedited review.

6.12 UAS Flight Readiness Review (FRR) Board and Approval

It is the discretion of the Chief of the AOC UAS Section to determine if an FRR Board is necessary. UAS Flights will be approved for a specific flight envelope. This may include restrictions on weather, daylight, airframe, location or other operational restrictions. Changes to the flight approval may require an updated Ops plan, ORM document and other materials as

appropriate. A follow up FRR Board may be necessary to review changes to the Ops plan and reissue a recommendation to the CO of AOC on how the mission will proceed. An FRR Board is usually convened **15 to 20 calendar days prior** to an operational flight approval.

The FRR Board should include at a minimum the project's PI, MC, personnel providing direct operational support, and the AOC UAS Section. The Chief UAS Section, AOC, will designate a chairman for the FRR Board and ensure the PI is appropriately prepared.

The project's PI will provide a briefing to the FRR Board (in person or via telephone conference). Copies of the briefing material should be made available to the board three business days prior to the scheduled Board date. The FRR Board will then review the UAS flight request and make a recommendation to the CO of AOC on whether or not to execute the mission as proposed.

The FRR Board will focus on, but is not limited to, the following areas:

a. Concept of operations (CONOPS) – When, where, why, and how.
b. Operation risk management (ORM) / hazard analysis and mitigations.
c. Operations plans, cruise plans (if required) and Airspace / Safety Plans.
d. Emergency procedures (to include incident procedures and notification checklist).
e. COA provisions.
f. Aircraft system description
g. Sensor package
h. Communication links
i. Electromagnetic interference testing (EMI) if applicable
j. Launch / flight / recovery procedures
k. UAS Airworthiness and previous testing/flights
l. Procedures for incidents and accidents
m. Recovery plan for downed/lost UAS

6.13 CO Flight Authorization Memo (FAM)

This is a signed memo from the CO of AOC authorizing the UAS operation.

6.14 Minimum Operational Requirements

The following requirements must be met prior to any NOAA UAS flight operation commencing:

a. Flight Authorization Memorandum from CO, AOC.
b. For flights in the NAS, an approved FAA airspace authorization.
c. For flights in SUA, an approval from the controlling agency.
d. For flights in non-U.S. airspace, written approval from the foreign aviation regulatory agency, diplomatic clearance through the U.S. State Department, and compliance with all ITAR and foreign export requirements.
e. Meet AOC PIC requirements.
f. Meet AOC airworthiness and maintenance requirements, as applicable.

g. AOC approved ORM.
h. NTIA frequency clearances.
i. Ops plan (required for complex operations, see 6.6)
j. Meet all applicable environmental compliance requirements.
k. Approved checklist from Appendix I – Line Office Administrative Review of UAS Operations.

6.15 UAS Reporting Requirements

UAS shall follow AOC requirements for aviation asset reporting and utilization. Once an operation has been approved, the MC shall provide daily flight information in accordance with normal AOC aircraft and project reporting requirements (i.e. NOTAMS, SITREPS, Incident/Accident, flight logs, maintenance discrepancies, etc.).

6.15.1 Notice to Airman (NOTAMS)

NOTAMs are notices containing information utilized for situational awareness by manned aircraft operators. Missions that are operating under certain FAA authority (i.e. Class G MOA, COA's, etc.) require a NOTAM to be issued prior to flight operations. AOC will provide guidance on issuing a NOTAM upon request.

6.15.2 Situational Report (SITREP)

SITREPs provide the means for various parties within NOAA to stay abreast of the status of UAS operations occurring within NOAA. AOC also uses the information contained within a SITREP for tracking metrics needed for a variety of different reporting requirements. SITREPs are required upon completion of flights at the end of each operational day unless other arrangements have been made. The AOC UAS Section will guide the user through the requirements within the SITREP during the approval process.

6.15.3 Incident/Accident Reporting

The initial action required for all incidents/accidents is to immediately establish communications with the Operations Officer of AOC. This can be accomplished via the personnel in the AOC UAS Section starting with the Chief, AOC UAS Section. The MC will be provided the contact information needed for reporting requirements. All UAS operations will be halted until positive clearance is given from the Chief, UAS Section or their designee. The AOC UAS Section will guide you through the information and steps required. The information that typically will be required can be found in Appendix G – UAS Incident/Accident Form.

7 OWNERSHIP OF UAS

The following information describes the different types of ownership of UAS's within NOAA.

7.1 Corporate UAS (Capitalized Assets)

UAS that exceed the capital asset threshold of $200,000 original acquisition cost are corporate aircraft and subject to additional federal regulation and reporting. In most cases, corporate UAS will be fully resourced by AOC staff and their services available for use by all Line Offices. Corporate UAS will be subject to the same allocation process as manned aircraft and included in the annual Aircraft Allocation Plan that is approved by the Fleet Council. Corporate UAS will be owned and operated by AOC, unless otherwise approved by AOC.

7.2 Field UAS (Non-Capitalized Assets)

NOAA Line Offices may own and operate UAS for their own requirements, with their own qualified staff as a field UAS. Field UAS do not exceed the capital asset threshold of $200,000 acquisition cost and do not require highly specialized training to operate. All UAS operations will be approved by AOC in accordance with this handbook, NAO 216-104 and AOC Policy 220-1-5. For routine field UAS operations an approved SOP is recommend.

Appendix A – Acronyms and Abbreviations

AGL	Above Ground Level
AOC	Aircraft Operations Center
ASPM	Aviation Safety Program Manager
ATC	Air Traffic Control
CAS	Commercial Aviation Services
CO	Commanding Officer
COA	Certificate of Authorization
CONOPS	Concept of Operations
CPA	Closest Point of Approach
DOC	Department of Commerce
DOD	Department of Defense
EMI	Electromagnetic Interference Testing
FAA	Federal Aviation Administration
FAM	Flight Authorization Memo
FAR	Federal Aviation Regulations
FIR	Flight Information Region
FRR	Flight Readiness Review
GPS	Global Positioning System
ICAO	International Civil Aviation Organization
ICAP	Interagency Committee for Aviation Policy
ITAR	International Traffic in Arms Regulations
LIPO	Lithium Polymer Battery
MC	Mission Commander
MOA	Memorandum of Agreement
MOC	Marine Operations Center
MSO	Mission System Operator
NAO	NOAA Administrative Order
NAS	National Airspace System
NIF	Notice of intent to Fly
NOTAM	Notice to Airman
NTIA	National Telecommunications and Information Administration
OEM	Original Equipment Manufacturer
OMAO	Office of Marine and Aviation Operations
OPS	Operations / Operations Officer
ORM	Operational Risk Management
PI	Principal Investigator
PIC	Pilot in Command

PPE	Personal Protective Equipment
SEB	Science and Engineering Branch
SITREP	Situation Report
SOP	Standard Operating Procedures
SP	Supplemental Pilot
SUA	Special Use Airspace
sUAS	Small Unmanned Aircraft System
UAS	Unmanned Aircraft System
UASPO	Unmanned Aircraft Systems Program Office
USCG	United States Coast Guard
VTOL	Vertical Take Off and Landing
VO	Visual Observer

Appendix B – UAS Flight Request Form

Please fill out the following information to the best of your ability and email to **aoc.uas@noaa.gov**. This form is the beginning of the flight planning process, leading to airspace request submission, Operational Risk Management (ORM) development, airworthiness evaluation, and Flight Readiness Review (FRR) preparation. For definition of terms in this form please consult AOC Policy 220-1-5.

1. **Contact information for the project point of contact (name, email, phone). If known, please include names of UAS Pilot in Command (PIC) and Mission Commander (MC).**

2. **Please describe the members of your team, their affiliations, and their experience with UAS development or operations.**

3. **Is the UAS owned by NOAA? Will the UAS be operated by NOAA personnel? Will the UAS be deployed from a NOAA Ship or Aircraft? Will NOAA personnel have direct operational control over the execution of the project? Note that if all four answers are no, generally the project is considered UAS Commercial aviation service (CAS).**

4. **Please describe the project and the NOAA objective of the UAS operation (healthy oceans, weather-ready nation, climate adaptation and mitigation, resilient coastal communities).**

5. **Description of your UAS:**
    a. Type of Air Vehicle (Fixed wing, quad-rotor, hex-rotor, tethered, etc.)
    b. Propulsion description (Electric, gas).
    c. Weights (Empty, payload, fuel, maximum).
    d. Autopilot (Pixhawk, Piccolo, DJI, etc.).
    e. Mission planning and Command & Control system.
    f. Describe the maturity of your system in its current configuration (not flown, number of flight hours, product flown on manned aircraft, etc.).
    g. Has your system (in its current configuration) flown under any FAA authorizations (FAR Part 107, COA, 333 exemption, Special Airworthiness Certificate)?
    h. Is your UAS (or any subsystem) restricted under ITAR?
    i. Describe any hazardous materials related to the operation of your product (LiPo batteries, fuel, hydraulic fluid, etc.)
    j. Has your UAS undergone an airworthiness evaluation? If so, please describe the process and provide documentation from the reviewing authority.

6. **Description of Requested Operations:**
    a. What is the purpose of your system or mission?

b. What is your desired timeline for operations? Please note that **minimum** lead times as described within the UAS Handbook. Unique airspace or airworthiness considerations can extend planning lead times significantly.

c. Where do you want to launch, recover, and operate the UAS? What types of airspace are included (NAS, International/High Seas, Special Use, Foreign, etc.)? Please include a shapefile overlaid on an aeronautical chart if possible in attachment, as well as the COA document if applicable.

d. Do you have FAA airspace authorization for the area? Do you have landowner permission for launch/recovery sites? Please include attachments with any applicable supporting documents. Please note for CAS these must be provided by the contracted company. For NOAA operations the AOC UAS Section will coordinate with the PI.

e. What altitudes and distances from launch point are required for your mission?

f. Does your mission require any special terrain features (water, hills, etc.)? Shipboard or small boat operations? If applicable, are shipboard SOPs available from the OEM?

g. What spectrum does the UAS operate on? If CAS operation, does the company have a license with the FCC to operate within the required spectrum?

h. Have you completed or are in the process of completing all relevant environmental compliance requirements?

7. Piloting the UAS:

a. Do you have an FAA certified pilot who will operate the UAS as Pilot in Command (PIC)? If an FAA certified pilot is not required, please describe the level of training required for operation of the UAS.

b. Is the UAS PIC current per FAR Part 91 or Part 107 requirements?

c. If required, does the UAS PIC have a current FAA medical exam?

Appendix C - Sample Operational Risk Management (ORM) Assessment

Hexacopter Field Program

NMFS Southeast Fisheries Science Center

National Marine Mammal Laboratory

ORM TEAM:

(List names)

ORM Background

SWFSC/NMML UAS Program for the APH-22 Hexacopter

Program Goal: Develop and deploy a safe, simple, and relatively inexpensive UAS system that will allow field scientists to take high-resolution vertical aerial photographs to:

1. Improve the accuracy and precision of counts for animals in large groups,
2. Identify uniquely marked individuals,
3. Investigate changes in nutritive and reproductive condition of marine mammals based on their size and shape,
4. Extend sampling efforts to areas that are unsafe to access from the ground or sea.

Project Goal: Collect aerial images and breath samples from marine mammals to examine the relationship between population health and body condition.

Project Description: The objective of these studies is to assess the body condition and nutritional status of marine mammals based on measurements of length and width from vertical aerial photographs collected using an unmanned aerial system (UAS). Some projects will include linking these measures to respiratory health determined from breath samples.

Areas of projects include the Orca Whale surveys in Northwest US/Canada, Beaked Whale surveys in Bahamas, Humpback whale assessments in Cape Cod, Grey Whale surveys at the Piedras Blancas Light Station, and Steller Sea Lion surveys in the Pribilof and Aleutian Islands.

Aircraft Operations: The aircraft will be operated by a team of at least two individuals on all flights. One individual will act as Pilot in Command (PIC) of the platform and this person will be in command of the operation, operate the RC unit, and maintain visual contact with the aircraft. The second individual will act as Visual Observer (VO) and will observe the UAS and surrounding airspace throughout each flight and provide the PIC information on the UAS's flight path and proximity to all aviation hazards necessary to prevent collision. The VO will also monitor altitude and orientation relative to the PIC.

Flights will be conducted from a small boat or shore-based and the aircraft will be launched and retrieved by hand. This is the same technique we have used in all previous vessel based ops with the APH-22. Landing on the ground in the vicinity of the operator will be considered if local conditions permit.

These experiments and surveys will be conducted in National Airspace, Special Use Airspace, or International Airspace as dictated by project requirements and airspace clearance availability.

Flights will be conducted in the following conditions:

1. Daylight hours
2. Visibility 3 statute miles or greater
3. UAS able to operate at least 500 feet below the cloud ceiling
4. Wind less than 25 knots
5. Rain less than 0.25 inches per hour

The APH-22 air vehicle will operate within 0.5 nautical miles from the Ground Control Station and operate below 400 feet AGL for all operations beyond 5 nautical miles from civil airports. The APH-22 air vehicle will operate within 0.25 nautical miles from the Ground Control Station and operate below 200 feet AGL for all operations between 2 and 5 nautical miles of a civil airport. Each flight operation will be preceded and followed by using the appropriate checklists.

UAS Description: The APH-22 hexacopter is designed and built by Aerial Imaging Solutions. The APH-22 is a small vertical takeoff and landing (VTOL) UAS that will be used to collect digital photographs with its Canon EOS M camera payload. The aircraft is powered by a 4 cell Lithium polymer battery that drives 6 brushless electric motors. It weighs approximately 4 pounds and measures 32 inches from propeller to propeller. Depending on payload and environmental conditions the aircraft can achieve flight durations of up to 35 minutes. The UAS's attitude, altitude, and heading are stabilized by an electronic control system that incorporates 3 gyros, 3 accelerometers, a magnetic compass, a barometric pressure sensor, a GPS receiver, and 8 microprocessors. The radial arms and core of the aircraft are aluminum, the electronic support chassis and landing struts are carbon fiber, and the landing support struts are ABS. Foam landing pads are attached to the skids to dampen the impact of landing and increase surface area in contact with the ground. These landing pads also provide floatation to the UAS in the unlikely event of a water landing.

Figure 1. APH-22 in the Aleutians before flight, June 2014.

Operational Risk Management Assessment

This section outlines and assesses hazards specific to APH-22 operations (see Risk Assessment Code chart for quick reference) and how such hazards will be mitigated or managed should they occur.

1. Laceration injuries caused by VTOL propellers:

Risk assessment prior to mitigation: **II-C. Moderate**

Mitigation

- PIC will be skilled and proficient in piloting the hexacopter and the VO will be trained in hand launch and recovery.
- Only allow the flight team within vicinity of the aircraft during operations.
- Only allow VO to launch and recover aircraft.
- VO will wear PPE including long sleeves, Kevlar gloves, glasses, and hat during launch and recovery. The VO will wear a helmet during ship or small-boat based launch and recovery.

Risk Assessment following mitigation: **II-D. Minor**

2. Impact injuries caused by falling object / VTOL:

Risk assessment prior to mitigation: **II-C. Moderate**

Mitigation

- Alert all personnel in vicinity of UAS operations prior to commencing and immediately following each flight.
- PIC and VO will ensure that the UAS stays well clear of all personnel (VO excepted

during launch and recovery) and under no circumstances directly overflies personnel.
- Ensure there is a means to notify personnel if necessary to prevent potential injury following UAS malfunction. Brief personnel on potential hazards and the need for situational awareness during UAS operations.

Risk Assessment following mitigation: **II-D. Minor**

3. Impact with buildings, vessels, or ground:

Risk assessment prior to mitigation: **III-C. Minor**

Mitigation

- The PIC will not operate the UAS in the vicinity of other vessels other than small research boats used for launch and recovery.
- PIC will terminate flight operations if another boat approaches within a CPA (closest point of approach) of 200 meters of the launch/recovery vessel.
- UAS Operations will only occur over water or sparsely populated areas, never directly overflying buildings or non-participating marine vessels.

4. Impact with aerial objects:

Risk assessment prior to mitigation: **II-C. Moderate**

Mitigation

- VTOL flights will not exceed 400’ AGL and 0.5nm lateral distance beyond 5nm from civil airports.
- VTOL flights will not exceed 200’ AGL and 0.25nm lateral distance from the GCS when operating between 2nm and 5nm from civil airports.
- When operating between 2nm and 5nm from civil airports, flight crew will have a dedicated aviation band radio tuned to local CTAF, monitoring for any conflicting traffic.
- The visual observer will maintain a constant lookout for aircraft in the airspace surrounding the VTOL and notify the PIC of any aircraft in the vicinity.
- If an aircraft appears in the operation area the PIC will reduce UAS altitude to 50’ AGL, return the VTOL to home, and land.

Risk Assessment following mitigation: **III-D. Negligible**

5. Fly Away:

Risk assessment prior to mitigation: **III-C. Minor**

Mitigation

- If link is lost for 10 seconds, UAS is programmed to return to home (the point from which was launched) using GPS and altimeter.
- If GPS is lost following loss of link, the UAS will hover in place for 60 seconds and proceed to land if link or GPS in not regained.
- If UAS begins to perform abnormally and becomes unresponsive to commands due to motor loss, motor failure, or propeller damage the PIC will immediately land, if possible. If it is not possible to land the UAS at its current location, the PIC shall command ‘return

to home' and then land as soon as possible.

Risk Assessment following mitigation: **III-D. Negligible**

6. Loss of UAS following impact with water / terrain (unable to recover UAS):

Risk assessment prior to mitigation: **II-C. Moderate**

Mitigation

- The VTOLs are equipped with high visibility / high floatation landing skids. It should remain highly visible whether on shore or in water and will float if it impacts water.
- All attempts will be made to recover the aircraft via the small boat. If the UAS is on the surface of the water it will be recovered by a small boat team.
- Operations will not be conducted in situations where there is no means to recover the downed UAS.
- Personnel shall not enter the water from shore or boat to recover the UAS.

7. Battery Fire:

Risk assessment prior to mitigation: **II-C. Moderate**

Mitigation

- Caution will be exercised with batteries - batteries will be stored and charged in LiPo bags constructed to suppress any possible fire. Batteries will be transported in bubble wrap and dedicated containers.
- Any LiPo fire will be suppressed and contained with water. As per USCG regulations, the Research Vessel will have a dry chemical extinguisher (ABC type) readily available for any resulting fires of other types.
- Personnel shall be kept well clear of any smoke or fumes from the fire.

Risk Assessment following mitigation: **III-D. Negligible**

8. Skiff and Beach Landing Hazards:

Risk assessment prior to mitigation: **II-C. Moderate**

Mitigation

- Personnel will wear appropriate personal flotation devices and exposure gear for all small boat operations and during any transfers of gear between ship and small boat or between small boat and shore.
- Weather conditions will be assessed by the crew of the research vessel and immediately discontinued if there any doubt to a safe landing.
- A full weather and sea conditions safety briefing shall be held prior to shore landings. A go/no-go decision will be made by the ship's crew and landing party.
- No equipment will be hand-carried by personnel while transiting between the small boat and shore. All equipment will be handed between personnel, allowing free hands while disembarking any vessel.

Risk Assessment following mitigation: **III-D. Negligible**

ASSESSMENT:

The intent of this ORM is to identify additional hazards that exist for APH-22 operations involved in field missions in 2016. The most serious of these hazards identified by the team includes laceration injuries caused by the propellers and potential impact injuries from a falling object. These hazards were identified based on the experience of the personnel involved in this ORM process. By implementing risk control measures, the hazards pose a reduced level of risk. With control measures in place, the level of risk is determined by the ORM team to be acceptable for the flight testing and operational testing to accomplish the project. Effectiveness of control measures should be continuously evaluated.

It is the recommendation of the ORM Team to the Commanding Officer that the mitigated risk level is acceptable for the missions to be successful and that the benefits outweigh the risks.

RAC Chart

Risk Assessment Code (RAC) Chart for APH-22

Step 1. Identify Hazards			Step 2. Assess Hazards	Step 3. Make Risk Decisions		Step 4. Implement Controls	Step 5. Supervise
Operation Phases	**Hazards**	**Causes**	**Initial RAC**	**DevelopControls**	**Residual RAC**	**How to Implement**	**How to Supervise**
Flight phase, Launch and Recovery phase	(1)Laceration injuries	Impact to personnel from AV	II-C - Moderate	Only allow flight team in vicinity of launch/recovery. PPE including Kevlar gloves, glasses, and helmet	II-D - Minor	Ensure controls are completed and carried out.	PIC will ensure compliance.
Flight phase, Launch and Recovery phase	(2) Impact injuries caused by falling object	Loss of propulsion, improper control inputs	II-C - Moderate	Alert personnel in vicinity of launch/recovery ops.	II-D – Minor	Ensure that only essential crew will be present at launch or landing location.	PIC will ensure compliance.
Flight phase	(3) Impact with vessels	Multiple non-participating surface vessels	III-C - Minor	Lookout maintained for vessels. Terminate flight if vessels	III-D - Negligible	VO will alert PIC if surface vessels are near.	PIC will ensure compliance.
Flight phase	(4) Impact with aerial objects	Normal Operations	II-C - Moderate	Vigilant watch will be maintained, ops will not exceed 200/400 feet. If non- participating aircraft detected flight ops will be terminated.	III-D - Negligible	VO will alert PIC if aircraft are near. PIC will maintain good comms with VO.	PIC will ensure compliance.
Flight phase	(5) UAS Flyaway	Normal Operations	III-C - Minor	AV programmed to return home after loss of link. After abnormal operations detected, PIC will initiate "come home" command.	III-D- Negligible	VO will alert PIC to any abnormal operations. Operations conducted in remote area.	PIC will ensure compliance.

RAC Chart

Step 1. Identify Hazards			Step 2. Assess Hazards	Step 3. Make Risk Decisions		Step 4. Implement Controls	Step 5. Supervise
Operation Phases	**Hazards**	**Causes**	**Initial RAC**	**DevelopControls**	**Residual RAC**	**How to Implement**	**How to Supervise**
Flight phase	(6) Loss of UAS after impact with water	Normal Operations	II-C - Moderate	Flotation skids, no recovery without small boat, no personnel will enter water.	III-D – Negligible	PIC will ensure flotation skids are in place prior to takeoff.	PIC will ensure compliance.
All phases	(7) Battery fire	Normal Operations	II-C – Moderate	Water and Dry Chem extinguisher available. Batteries stored in purpose built LiPo bags.	III-D - Negligible	PIC will ensure proper extinguishers and bags available.	PIC will ensure compliance.
Personnel Transfer	(8) Beach Landing	High sea state during beach landing	II-C Moderate	Safety brief, PFD's, Constant Weather Eval, safely pass gear ashore after personnel transfer.	III-D – Negligible	PIC will ensure safety brief is held and all gear is safely passed to shore.	PIC will ensure compliance

Example of ORM Identification, Characterization, and Quantification of Risks

		PROBABILITY			
		A	B	C	D
SEVERITY	I	1	1	2	3
	II	1	2	3	4
	III	2	3	4	5
	IV	3	4	5	5

Table 1. Risk Assessment Code (RAC) Summary –

Beginning Severity/Probability Codes in Blue, Ending in Red

Hazard Severity:

1. Category I –
   Catastrophic impact: The hazard may cause death, loss of facility, major environmental impact, or negative national news coverage.
2. Category II –
   Serious impact: The hazard may cause severe injury, significant localized environmental damage, major damage to or loss of aircraft or property, or damage to reputation making local news.
3. Category III –
   Minor impact: The hazard may cause minor injury, minor environmental effect, minor damage, or limited effect on reputation.
4. Category IV –
   Minimal impact: The hazard presents a minimal threat to personnel safety or property, minimal environmental impact, or minimal effect on reputation.

Mishap Probability:

1. Subcategory A –
   Likely to occur immediately or within a short period of time. Expected to occur frequently to a person or an individual item or continuously to a group of people or inventory.
2. Subcategory B –
   Probably will occur in time. Expected to occur several times to a person or individual item or frequently to a group of people or inventory.
3. Subcategory C –
   May occur in time. Can reasonably be expected to occur sometime to a person or individual item or several times to a group of people or inventory.
4. Subcategory D –
   Unlikely to occur.

Appendix D - Example ORM Addendum

2016 Atlantic Menhaden Addendum to the APH-22 Field Operations ORM

What and Who: The Northeast Fisheries Science Center (NEFSC) is collaborating with the Southeast Fisheries Science Center (SEFSC) and the University of New Hampshire to develop aerial and underwater acoustical methods that will improve fisheries-independent estimates of Atlantic Menhaden abundance and biomass on the East Coast. The project is being funded through NOAA-Fisheries Office of Science and Technology (S&T). Operations will consist of launching and recovering an APH-22 Hexacopter and Puma AE from a small boat.

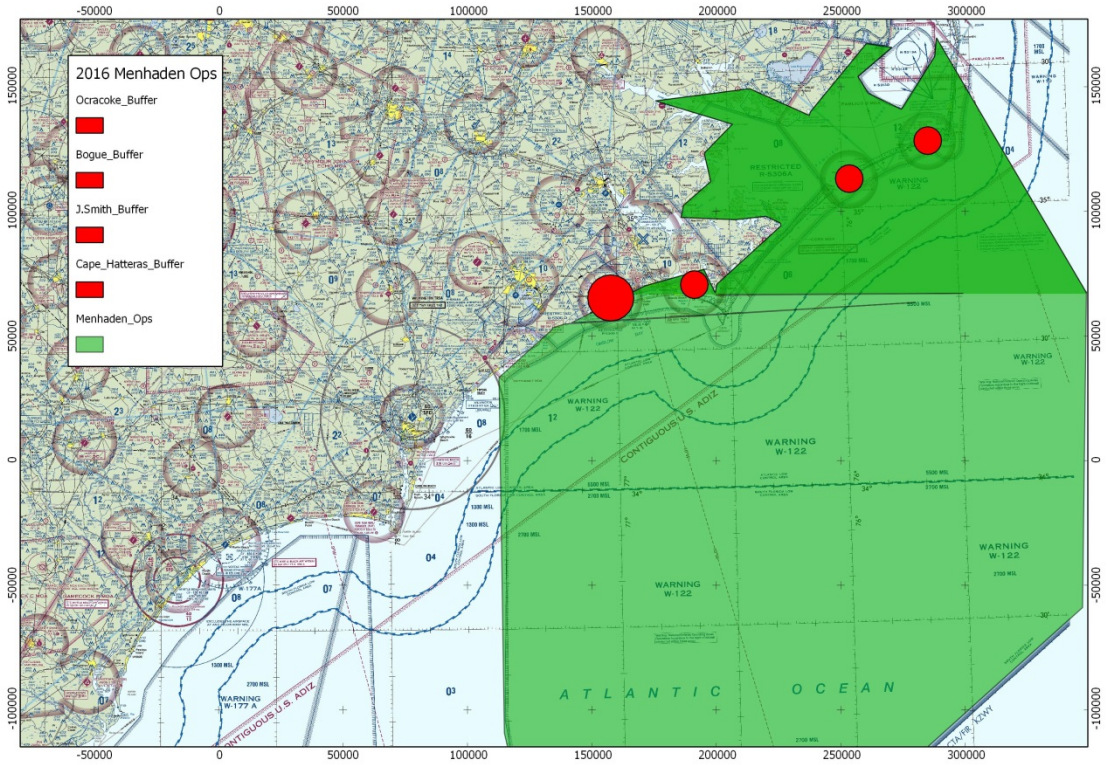
Where: Primarily around the inlet of Beaufort, NC. See figure 1.

When: 21 November – 1 January 2016.

General Plan: Each UAS will be operated by a team of two individuals (one PIC, one Visual Observer), conducting flights from a contracted small boat. Flights will be conducted within 0.5 nautical miles laterally and 400 feet vertically from the ground control station. The APH-22 Hexacopter will be operated by a pair of scientist. The Puma AE will be operated by a pair of UAS pilots provided by NOAA's Aircraft Operations Center (AOC). There will be no concurrent UAS flights at any time.

Flights will be conducted within 0.5 nautical miles laterally and 400 feet vertically from the ground control station.

Figure 1.



In green is the proposed area of UAS operations over marine waters of North Carolina State. Within this area we will adhere to the requirements of NOAA's Class G MOA with the FAA by flying only in Class G airspace and not within 5nm of any civil airports (or 3nm of civil airports with a UAS pilot holding a private pilot license). All Warning zones off of Cherry Point Marine Corps Air Station will be contacted and cleared for UAS ops. Red areas signify 5nm range around airports.

After reviewing the APH-22 2016 Field Operations ORM, there are no additional hazards that need to be addressed for the Atlantic Menhaden Survey.

Appendix E - UAS Airworthiness Form

UAS Airworthiness

Introduction:

NOAA policy dictates the requirement for UAS's to have an airworthiness document associated with each UAS operation. Policy 220-1-5 Section 5.3 states "The UAS must be shown to be airworthy for the specific operation being conducted. Unlike manned aircraft, the airworthiness requirements for UAS are dependent on the operational requirements of the UAS (for example, to gather particular data, certain unmanned aircraft may purposefully terminate flight in a way that does not harm persons or property)."

The following questionnaire will enable applicable personnel to determine the airworthiness for each specific operation.

sUAS / UAS Classification:

This airworthiness document only takes into consideration category 1 UAS's.

Category	I	II	III
Weight (lb)	≤ 55	55-330	> 330
Airspeed (kt)	≤ 70	≤ 200	> 200
Type	sUAS	sUAS	UAS

UAS Questionnaire:

Please respond to each item in the questionnaire. If an item does not apply or is yet to be determined, indicate so with "Not Applicable (N/A)" or "To Be Determined (TBD)".

Please provide a separate questionnaire for each UAS type.

Please provide a new or updated questionnaire for major changes to the UAS.

1 REQUIRED DOCUMENTATION

Please provide copies of documentation for the items listed below:

- **A.** Copy of current Airworthiness Certificate (both sides) with limitations (if available)
- **B.** Copy of log book page containing entry of total aircraft time (if available)
- **C.** Most recent weight and balance form with equipment list (if available)
- **D.** UAS manufacturer's weight and balance envelope graph/chart (if available)
- **E.** Copy of last UAS inspection (if applicable)
- **F.** Forward, aft, right and left side looking pictures of the UAS and/or 3-view drawing
- **G.** Pictures of the experimenter port/protrusion to be used (internal and external)
- **H.** Pictures of installations attached to the UAS that are not part of the standard operation of the UAS (ie. experimenter equipment, flight test data systems, etc.)
- **I.** Copy of log book entry of last altimeter and static pressure system inspection (if available)
- **J.** All 8110-3, 337, STC or UAS modification documentation, used for experimenter/instrument purposes (if applicable)
- **K.** Copy of frequency management plan (if available)
- **L.** Copy of flight manual (if available)
- **M.** Fault Tree Analysis (if performed)
- **N.** Copy of Flight Test Plan (if available)
- **O.** Copy of Training Plan (if available)

2 AIRCRAFT INFORMATION

Points of Contact:

Name of UAS owner/company:

Address:

Phone:

Fax:

E-mail:

Location of the UAS:

Contact name at this location:

Address:

Phone:

Fax:

Email:

A. Aircraft Description:

1. Overall vehicle description including material composition:
2. Overall dimensions (length, wing span, tail height, etc.):
3. Maximum gross takeoff weight:
4. Maximum zero fuel weight:
5. Payload capacity:
6. Ground clearance:
7. Location of minimum ground clearance:
8. Systems unique design characteristics (i.e. hydraulic systems, parachute, brakes, etc.):
9. What is the UAS estimated reliability (MTBF)?
10. Describe the operational history of the UAS. Including the following:
11. Total number of flight and flight hours on the UAS
12. Any system failures, incidents, accidents, or emergencies, and the resultant system modifications or corrective actions.
13. Any major repairs, modifications, and/or alterations.

B. Performance Characteristics

1. Maximum altitude:
2. Maximum and cruise airspeeds:
3. Maximum endurance:
4. Maximum range:
5. Maximum range of Control link:
6. Maximum range of Data link:
7. Rate of climb:
8. Rate of descent:
9. Maximum glide slope:
10. Does the UAS have a high visibility paint scheme that enables other pilots to see and avoid the UAS and enables the observer(s) to obtain and track the UAS?
11. Performance limitations (i.e. wind shear, gusts, visibility, icing, lighting, etc.):
12. What indications, if any, does the system provide the UAS pilot concerning the existence of icing conditions?
13. Does the UAS intend to operate in known icing conditions?
14. Describe any icing protection capability of the UAS.
15. Is there an operational manual for the UAS?
16. Does the manual have a section with all the aircraft limitations in one location?
17. Does the operating manual have bolded or underlined procedures for emergencies for memory item steps?
18. Is there an operational checklist for all phases of the operation?
19. Are there separate checklist items for normal, abnormal, and emergency procedures?

C. Propulsion System

1. Fuel-power propulsion systems
   a. Engine type and manufacturer:
   b. Fuel capacity:
   c. Describe the failure modes and abnormal conditions. How does the system respond, and what safeguards are in place to lower risk of loss of engine power for each of the following?
   d. Fuel starvation
   e. Fuel contamination
   f. Failed signal input from the control station
   g. Can the pilot restart the engine in flight?
   h. Are there safeguards to preclude inadvertent engine starts that could cause injury to ground personnel?
2. Electric-powered propulsion systems
   a. What type of motor is used?
   b. What is the power output of the motor?
   c. What current draw range does the motor have?
   d. Does the system have a separate electrical source? If not, how is the UAS power managed?

D. Avionics

Provide an overall system diagram of the avionics architecture, including detailed descriptions of the following:

1. UAS architecture, including functional flow and subsystem performance
2. Control station architecture, including functional flow and subsystem performance
3. Communication system architecture, including function flow and subsystem performance

E. Navigation

1. How does the UAS determine where it is?
2. How does it navigate to its intended destination?
3. What are the causes and effects of loss of heading or altitude?
4. Does the UAS have anti-collision lights?
5. Describe the procedures to test the altimeter system (14 CFR 91.411, Altimeter system and altitude reporting equipment test and inspection)

3 COMMAND, CONTROL, COMMUNICATION

A. Control Station

1. Describe or diagram the control station configuration.
2. How is the control station powered?
3. What procedures are in place should the control station lose primary and secondary power?
4. Does the pilot have a standardized screen set up at the initiation of each phase of flight?
5. Are any other programs running on the ground control computer?
6. What are the possible conditions that would cause a control position lock-up? Are any of the primary flight controls based on the Microsoft Windows operating system?
7. What alarms or warnings does the system provide to the pilot (for example, low fuel or battery, failure of critical systems, departure from operational boundary)?
8. How accurately can the pilot determine the attitude and position of the UAS?
9. What kind of inadvertent input could the pilot enter to cause an undesirable outcome (for example, accidentally engaging the kill engine command in flight)?
10. What is the lag time between command input and execution by the vehicle?

B. UAS Control

1. Describe the overall flight control system used by the UAS (mechanical linkage, hydraulic, fly by wire, servos, types of control surfaces, etc.). Provide a diagram showing the location of the servos and control surfaces, and power to the servos.
2. Description, location and drive mechanism of primary flight control surfaces (i.e. single conventional rudder, vertical stabilizer, servo driven):
3. Description, location and drive mechanism of secondary flight control surfaces (i.e. segmented slotted flaps, inboard wing trailing edge, servo driven):
4. Describe automated flight control system and software used (if applicable):
5. Describe any automated secondary control systems (yaw damp, airspeed driven flap system etc.):
6. Provide a description of failure modes and conditions along with mitigations of each mode.
7. How does the system respond to a servo failure?
8. What indications alert the pilot that a servo is stuck?
9. Describe how the control surfaces respond to commands from the flight control computer. Describe how the pilot provides input to the control surfaces (for example, through an external box, waypoint, stick and rudder pedals).
10. Provide a description of the procedures in place to prevent failures due to weather or icing.
11. Does the flight control computer interface with auxiliary controls that might cause unintended action?

12. Describe the systems the flight control computer interfaces with to determine flight status and to issue appropriate commands

C. Autopilot

1. Is the autopilot a commercial off-the-self product? If so, name the type/manufacturer.
2. Describe the procedures you use to install the autopilot. How is correct installation verified? Reference any documents or procedures provided by the manufacturer and/or developed by your company.
3. Does the autopilot employ input parameters to keep the aircraft within structural limits? If so, provide a table of these limits. How were these limits validated?
4. Where do the autopilot commands reside once they are input by the pilot?
5. What type of software-in-the-loop (SIL) and hardware-in-the-loop (HIL) simulations have been performed? What was the outcome of the simulations?
6. Will auto-pilot system change-outs occur on any flights during this operation? If so, what is the reliability of each system?
7. Describe the method for switching between pilot controlled (manual) and autonomous flight modes. At what point during the flight will this happen?
8. What indication does the pilot have that he/she is in control of the UAS?
9. How are changes made to the flight plan during flight?

D. Communications

1. List all the frequencies that are available and/or used by the UAS.
2. How do you limit the likelihood of unplanned loss of communications between the pilot and the UAS due to the following?
3. Radio frequency or other interference
4. Flight beyond communication range
5. Antenna masking during turns and pitch angles
6. Loss of control station functionality
7. Loss of UAS functionality
8. Atmospheric attenuation
9. Loss of link
10. Loss of visual contact with the UAS
11. What are the potential sources of radio frequency interference within the proposed operating area and how are they monitored, managed, and/or mitigated?
12. What spectrum will be used for the communications? How has the use of this spectrum been coordinated? If not required, under what regulation is the use of the frequency authorized?
13. What type of signal processing and/or link security is employed?

14. For satellite links, estimate the system communications latencies associated with using the satellite link for aircraft control and for ATC communications?
15. What is the data link margin in terms of the overall link budget at the maximum anticipated distance from the control station? How was it determined?
16. Does the system employ redundant communications links? If so, how dissimilar are they?
17. Is there a radio signal strength and/or health indicator or similar display to the pilot? How are the signal strength and health value determined, and what are the threshold values that represent a critically degraded signal?
18. Is the UAS equipped with an operable Mode-C or Mode-S transponder?
19. Can the pilot operate the transponder?
20. Is there an intercommunication system that allows for communication between the pilot(s), ground support personnel, and observers?
21. What procedures have been established in the event of intercom failure?

E. Emergency and flight recovery

1. Describe the emergency recovery system, if any.
2. How do you know the emergency recovery system is operational?
3. Under what conditions is the return home mode both manually and automatically activated?
4. What is the return home point? How is this point selected? How is this point entered?
5. How does the UAS navigate when in the return home mode?
6. Describe the flight recovery system (FRS), if any?
7. Under what conditions is an FRS manually and automatically activated?
8. What happens to the aircraft when the FRS is activated? For example, does the engine run temporarily? Does the UAS glide or become unstable?
9. How do you know the FRS is operational?
10. Provide a fault tree diagram, starting with the initial condition of normal flight that shows the conditions that will trigger the FRS.
11. If activated, can the FRS be turned off/shut down if no longer needed?
12. If FRS fails, is there a backup or secondary FRS to ensure no additional hazards are introduced to the operational area?
13. Describe how the aircraft will react during takeoff, climb, cruise, descent, and landing in the event of a loss link.
14. Describe the operational procedures in the event of a lost link.

F. Flight Termination System and Ground Abort

1. Does the UAS contain a flight termination system? If so, explain.
2. Is there a procedure for ground aborts? If so, explain.

G. Failure Modes and Effects Analysis

What are the Failure Modes and Effects of the UAS, and what is the mitigating actions or controls for each vehicle and system. At a minimum address the below failures and events:

1. Loss of manual remote control link?
2. Loss of autonomous flight control system communications?
3. Loss of GPS or INS in autonomous mode
4. Loss of UAS battery power
5. Loss of ground power
6. Loss of ground station
7. Loss of line-of-sight
8. Loss of communications and GPS
9. Flights through the Operational Area Limit

H. Ground Support Equipment

1. Describe all the support equipment used on the ground. Include any launch or recovery systems, ground data terminals, generators, and power supplies.
2. Provide a description of system equipment required for takeoff/launch. Identify unique system performance and procedures.
3. Provide a description of system equipment required for landing/recovery. Identify unique system performance and procedures.

4 EXPERIMENT SUPPORT INFORMATION

A. Sensor Characteristics

1. Number of existing and intended sensors:
2. Fuselage location of each sensor:
3. Sensor type (camera, ir, multispectral, etc):
4. Sensor size:
5. Sensor power requirements:

B. Power Specifications

1. Type of power available to experimenters (115VAC, 28VDC, etc.):
2. Maximum amount of power available for experimenter use:
3. Type of circuit protection provided between UAS power and experiments:

5 CONFIGURATION AND SOFTWARE MANAGEMENT

A. Configuration Management

1. What procedures are in place to manage change configuration? Are they documented?
2. Describe the procedure used for controlled drawings, test procedures, and engineering changes?
3. Describe the quality assurance system, including methods and procedures used and structure within the organization.

B. Software Management

1. In high-level terms, how much of the software was designed by the UAS operator? Identify which areas of the system contain vendor software.
2. What software development processes have been used in the development of software components for the aircraft and control station, and what software lifecycle data is available for review?
3. How will updates to system software (including commercial off-the-self software) be implemented?
4. Provide a description of the software requirements and the functional allocation between hardware and software.
5. How is software verified, validated, and tested for the system?
6. How is vendor software development overseen?
7. How is software load control implemented for the system to ensure the correct software components are loaded onto the system?
8. What software quality assurance processes are used in the development of the system software? If software is vendor-provided, vendor control must be addressed.
9. What procedures are in place to manage change configuration? How are these documented?

6 MAINTENANCE INFORMATION

A. Inspection Program

Describe the inspection and maintenance program that will be used to maintain the aircraft and related systems, including the ground station and/or other support systems.

B. Airworthiness Directives

Is the UAS maintained in accordance with all applicable FAA airworthiness directives?

C. Weight and Balance

What weight and balance methods are being used?

D. Maintenance Records

What maintenance records are being kept?

E. Maintenance Manuals

Is the UAS maintained in accordance with factory approved and current maintenance manuals?

Appendix F – Risk Based Airworthiness

Risk Based Airworthiness for Small Unmanned Aircraft Systems 55 lbs or Less

Categories:

Category 1 - Operations conducted in a controlled environment with regard to testing and evaluation of a new aircraft.

1. Meets visual inspection for typical standards including construction, electrical, fuel, etc.)
2. Show proposed controllability for Takeoff, Landing and Mission
3. Show proposed Operational procedures, Emergency procedures and Checklists.
4. Show proposed Standard Operating Procedures for (Firmware/Software Version control, FCF requirements, etc.)

Category 2 - Operations conducted in International Waters, SUA and/or remote locations where population or sensitive areas are out of the range of the UAS.

1. Comply and demonstrate requirements in Category 1
2. Mitigation method in the advent the UAS experiences a loss of link event.
3. Mitigation method for preventing loss of power (low battery, fuel starvation, etc.)

Category 3 - Operations conducted within the NAS 10nm or closer to airports and/or population (not to directly overfly.

1. Comply and demonstrate requirements in Category 1 and 2.
2. Mitigation for horizontal and vertical boundary excursions (geo-fence)

Category4 - Operations conducted over populated areas and people.

1. Comply and demonstrate requirements in Category 1,2 and 3
2. TBD

Sub-Categories:

Sub Category A - Flights flown from ships/small boats

1. Demonstrated ability to initialize platform in high magnetic interference areas as well as pitch and roll variations. To include Standard Operating Procedures.

Sub Category B - SUAS weighing greater than 20 pounds but less than 55 pounds or SUAS with range greater than 50nm or with a ground speed greater than 87 Knots (100 mph)

1. Repeated flight testing in controlled environment to include a minimum of 5 flight hours, 10 takeoffs/landings, 5 loss of link events and 5 geo-fence events
2. TBD

Sub Category C- Other than electrical propulsion

1. TBD

Sub Category D- Hazardous Materials onboard

1. TBD

Appendix G – UAS Incident/Accident Form

UAS INCIDENT / ACCIDENT REPORT	Case: Date Received: Organization:

NOTE: TO BE USED IN CONJUNCTION WITH AOC POLICY 220-1-4 NOTIFICATION REQUIREMENTS
TO BE COMPLETED BY EMPLOYEE

• Field Office: • Mission: • Person Initiating Report:
• Time of Incident / Accident: (hh:mm AM/PM) Local/Zulu • Date of Incident / Accident: (mm/dd/yyyy)
• Flight Crew Information: (crew positions involved)
• Type of Aircraft: (Make / Model / Tail #) • Aircraft Location at time of Incident / Accident: • Ground Control Station Location at time of Incident / Accident: • Weather Conditions at time of Incident / Accident:

• Description of Incident / Accident:
• Damages and or Injuries:
• Additional Information / Comments:

TO BE COMPLETED BY INVESTIGATOR

• Investigation Findings:
• Corrective Actions:
• Comments:

• Investigator: • Date:

TO BE COMPLETED BY OPERATIONS OFFICER

• Released for Continued Operations:
• Comments:
• Signature / Date:

TO BE COMPLETED BY SAFETY

• Hazrep Required:
• Comments:
• Signature / Date:

Appendix H – UAS Pre-Acquisition Guidance

Instructions

The following process will be utilized for acquisitions of Unmanned Aircraft Systems (UAS) and Commercial Aviation Services (CAS) that include UAS operations to ensure compliance with NOAA, Department of Commerce (DOC), and Federal policy. UAS Acquisitions and CAS will be reviewed by OMAO, UASPO, and approved at the Line Office Executive Level.

Applicability

The *Unmanned Aircraft Systems (UAS) Pre-Acquisition Approval Checklist* shall be completed and approved prior to submission of the Purchase Requisition package to the servicing Acquisition Division for UAS acquisitions and UAS CAS.

Approval via this form is not required:

1) When the contract is for a data product and not for aviation services, provided the Federal involvement does not include close Government monitoring of the contractor's day-to-day operations.
2) For Federal Grants[1]

Responsibilities

Line Offices

1) Each line office is responsible for ensuring that a proposed acquisition of UAS or CAS meets Line Office requirements, NOAA, DOC, and Federal policies.
2) The requestor of UAS CAS or a UAS acquisition is responsible for initiating the process through their Line Office point of contact for UAS.
3) Each Line Office will develop an internal procedure to coordinate and approve the pre-acquisitions statement of work/specifications. Approval is through their DAA or executive level designee(s).
4) As part of market research conducted for each acquisition, Line Offices shall consult with the AOC UAS Office and the OAR UAS Program Office as they are continually evaluating the market and have knowledge of UAS known to meet NOAA's airworthiness requirements. Any requirement anticipated to be a "sole source" or "brand name" acquisition would require an appropriate justification.
5) Line Offices are encouraged to include UASPO and OMAO when a technical evaluation of proposals is needed.
6) Initiate early involvement with the Contracting Officer from the servicing Acquisition Division.

[1] Recipients of grant funding must meet NOAA's UAS Privacy Policy. NOAA Grantors are highly encouraged to consult with OMAO and UASPO when drafting Federal funding opportunity announcements and award documentation associated with UAS services. For more information see Appendix I – Line Office Administrative Review of UAS Operations.

UAS Program Office (UASPO)

The UAS Program Office provides guidance on latest technologies to meet mission needs.

Aircraft Operations Center (AOC)

AOC is responsible for approving UAS airworthiness and operations and will evaluate pre-solicitation specifications to ensure that the UAS acquired will meet AOC's airworthiness and operational requirements. The AOC UAS Office maintains a list of UAS that have previously met NOAA's airworthiness requirements. However, this may not guarantee that a UAS approved for one operation will be approved for a different application.

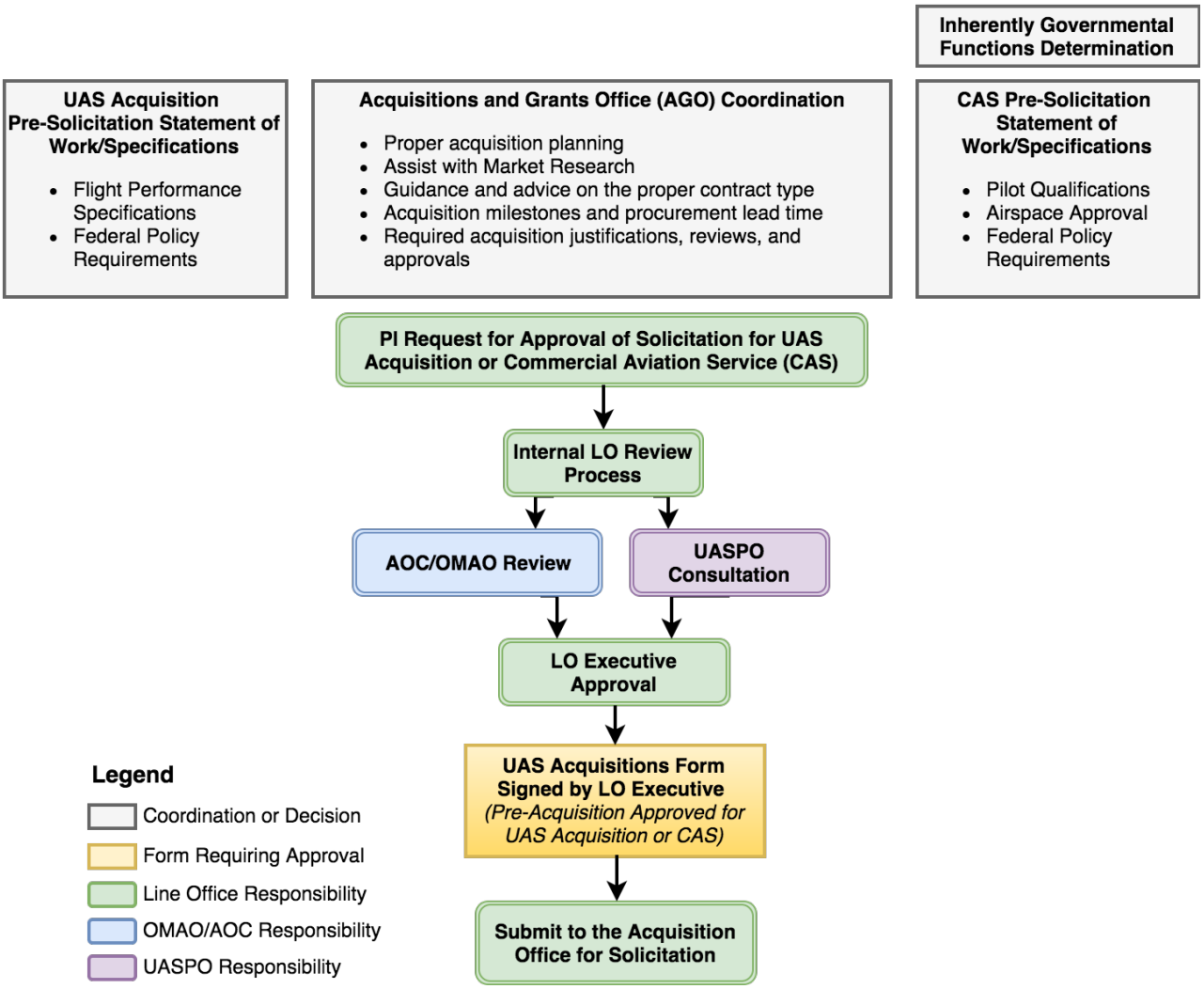
Office of Marine and Aviation Operations (OMAO)

OMAO is responsible for ensuring that the pre-solicitation specifications for CAS will meet NOAA and FAA policy for pilot certification and airspace approval. Acquisition offices shall ensure requests for CAS include an OMAO-assigned clearance number.

Acquisitions and Grants Office (AGO)

AGO assists in the Line Office to accomplish:

1) Proper acquisition planning
2) Assist with Market Research
3) Guidance and advice on the proper contract type
4) Acquisition milestones and procurement lead time
5) Required acquisition justifications, reviews, and approvals



Pre-Acquisition Approved Process

This flow chart shows the general process to get your pre-acquisition statement of work/specifications or requirements approved. Contact your Line Office UAS coordinator to initiate this process. Each Line Office has developed their internal review process. Complete this process prior to submission to Acquisition Division.

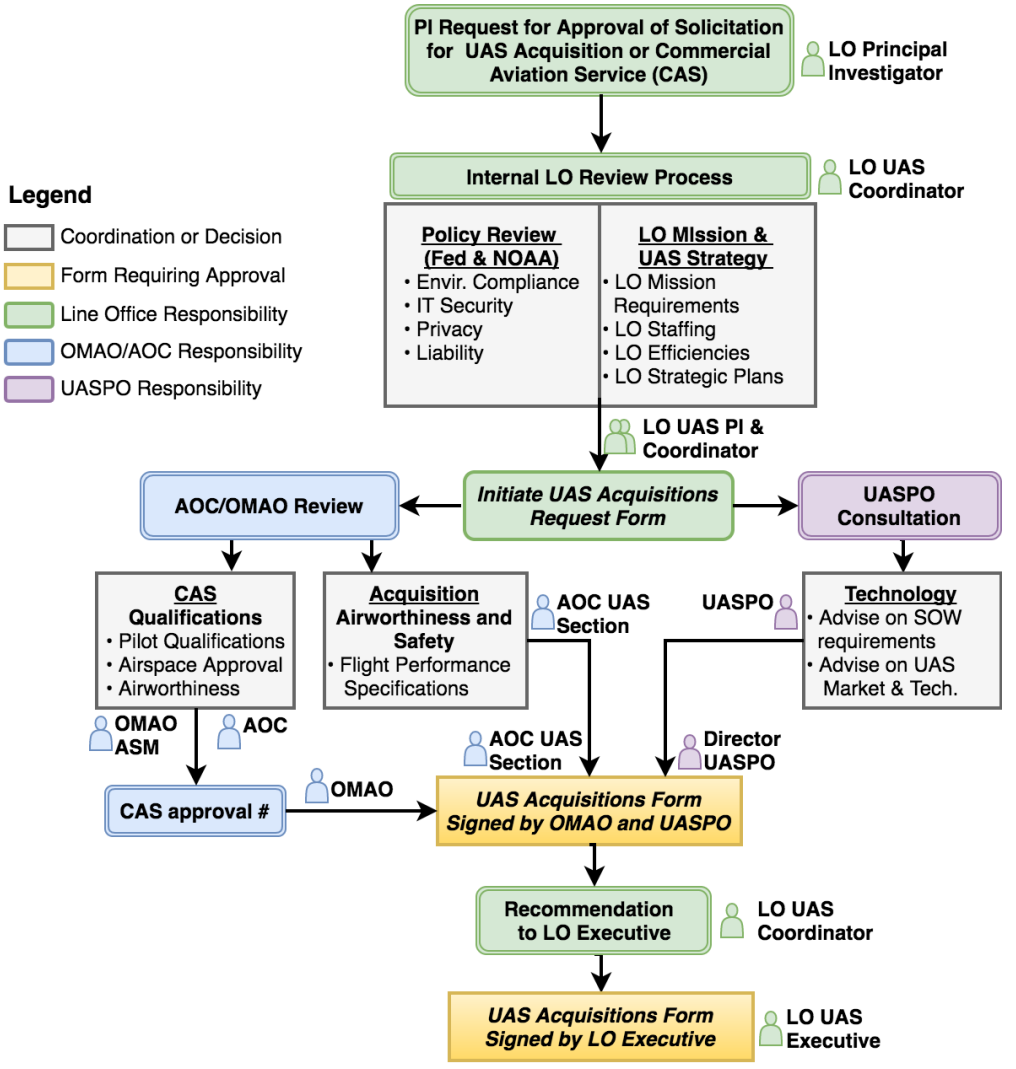
Inherently Governmental Functions Determination

FAR 7.503(e) and Commerce Acquisition Regulation (CAR) at 1307.503 requires that all procurement request packages submitted by program offices to initiate a procurement action for services shall contain a written determination by the designated requirements official that affirms that none of the functions to be performed in the statement of work are inherently governmental.

Line Office Internal Review	
45 Days OMAO Review	14 Days UASPO Concurrence
Final Line Office Approval	

Review Timelines

Outside of the internal Line Office process, the reviews will be completed within 45 calendar days. Once the Line Office completes internal review of the requests, both OMAO and UASPO processes begin.



Detailed UAS Pre-Acquisition Approval Process

This flow chart shows the detail process for pre-acquisition approval, including the responsibilities at each stage.

Definitions and Policy References

1) AOC Policy 220-1-5 Unmanned Aircraft Systems (UAS) Operations

a. Provides guidance specific to the operation and management of UAS where differences may exist from the utilization and management of manned aircraft.

b. Pilot in Command (PIC)/Second in Command (SIC): NOAA will designate a PIC for federal employees. Contractors will provide their own PIC designation. For operations where NOAA employees and contractors are in a PIC/SIC relationship, NOAA employees are not permitted to be SIC where the contractor is PIC. For more information see AOC Policy 220-1-5 UAS Operations.

2) Buy American Statute, Trade Agreements and Impacts on Acquisition of Foreign Made UAS & Aircraft

Seek guidance from your contracting officer regarding the Buy American statute in all acquisitions for UAS supplies or UAS services. UAS are classified as aircraft with respect to the Buy American statute requirements.

The Buy American statute restricts the purchase of supplies that are not domestic end products. The Buy American Act (FAR Subpart 25.1) applies to the purchase of supplies acquired for use in the United States if (1) the supply contract exceeds the micro-purchase threshold of $3500 or (2) the supply portion of a contract for services that involves the furnishing of supplies (e.g., lease) exceeds the micro purchase threshold of $3500. As such, the Buy America statute does not apply to a contract for UAS services unless it includes UAS supplies exceeding $3500.

There are five exceptions to Buy American listed at FAR 25.103. One exception to Buy American that could *not* be cited is the one applicable to the purchase of commercial information technology as FAA has classified UAS as aircraft and Buy American applies to civil aircraft (defined at FAR 25.003).

In addition, the trade agreement on civil aircraft at FAR 25.103 waives the Buy American statute for the purchase of "civil aircraft and related articles" (defined at FAR 25.003) from countries that are parties to the agreement for acquisitions less than the dollar value specified at FAR 25.1101(d). NOAA has determined that aircraft in this context applies to UAS.

3) NAO 2016-104A

NOAA Administrative Order (NAO) 216-104A mandates that the NOAA Aircraft Operations Center (AOC) manage all aircraft operated by NOAA. Acquisition related sections:

a. "Corporate UAS" are UAS that can be classified as NOAA capital assets that are operated for all of NOAA by AOC, owned by AOC, and allocated through the Fleet Council. "Field UAS" fall below the capital asset threshold of $200,000 original acquisition cost and meet AOC criteria for being owned and operated by individual line offices in compliance with AOC policy.
b. 4.04 Line offices will coordinate all acquisitions of UAS with OMAO to ensure that the system being procured meet safety and regulatory requirements and that NOAA complies with federal UAS policy and reporting requirements.
c. 5.09 Acquisition offices shall ensure requests for Commercial Aviation Services (CAS) and UAS include an OMAO-assigned clearance number. As awards are made, acquisition offices should provide ASPM with a copy of each obligating document.

4) NOAA UAS Handbook

This handbook supplements NAO 216-104A: Management and Utilization of Aircraft and AOC Policy 220-1-5 UAS Operations by providing additional guidance to NOAA users of UAS and a framework for the safe and efficient operation of UAS operated or sponsored by NOAA.

5) NOAA UAS Privacy Policy

Outlines the collection, use, retention, and dissemination of information obtained by UAS operation. NOAA will apply this policy to ensure that, in carrying out the Agency's mission, any UAS operation operated by NOAA, on behalf of NOAA (e.g., by contractors), or with NOAA sponsorship (e.g., by grantees), will not violate the privacy rights of the of the individuals whose Personally Identifiable Information (PII) may be collected or observed through NOAA's UAS activities.

6) UAS: Unmanned Aircraft System.

The FAA defines an unmanned aircraft as "an aircraft that is operated without the possibility of direct human intervention from within or on the aircraft" (Public Law 112-95, Section 331(8)). Also called drones, these unmanned aircraft do not have a human pilot onboard.

UAS Pre-Acquisition Approval Checklist

The Line Office shall certify that proposed UAS acquisition or Commercial Aircraft Service (CAS) meets Line Office requirements, NOAA, DOC, and other applicable federal policies by addressing each checklist item and completing all signatures prior to contract solicitation. Completion of this checklist applies to the processing of all UAS acquisitions, regardless of dollar value or previous AOC UAS airworthiness determinations. The applicability of each checklist item for acquisitions of UAS and/or CAS is indicated.

Reference: NOAA UAS Handbook, Appendix H – UAS Pre-Acquisition Guidance.

Federal Policy Checklist

____ Inherently Governmental Functions Determination (CAS)

For services, determination that none of the functions being performed are inherently governmental (FAR 7.503(e)) and CAR 1307.503)

____ Statement of Work Requirements (CAS)

This statement of work includes specific tasks to be performed and the deliverables to be provided.

For a service contract, the UAS operational tasks and a surveillance plan must be provided. These documents must be submitted with the purchase requisition and requisition package submission to AGO.

____ Liability Insurance Requirements (CAS)

This statement of work includes liability insurance requirements.

Contracted UAS operations expose NOAA to additional liability risk. Line Offices shall include liability insurance requirements for inclusion in solicitations for services.

____ NOAA UAS Privacy Policy (CAS)

This statement of work addresses NOAA's UAS Privacy Policy and does not change or remove any existing obligation of law or policy regarding privacy.

NOAA's UAS Privacy Policy outlines the collection, use, retention, and dissemination of information obtained by UAS operation and use to ensure that, in carrying out NOAA's mission, any UAS operation by NOAA, on behalf of NOAA (e.g., by contractors), or with NOAA sponsorship (e.g., by grantees), will not violate the privacy rights of the of the individuals whose Personally Identifiable Information (PII) may be collected or observed through NOAA's UAS activities.

____ Federal Cyber Policy (UAS Acquisitions and CAS)

This statement of work addresses Federal Cyber Security and Information Technology Policies.

This includes, but is not limited to Sec. 205 of the Cyber Security Information Sharing Act of 2015, OMB Circular A-130, NIST SP 800-37, and NAO 212-13 NOAA Information Technology Security Policy.

____ Environmental Compliance (UAS Acquisitions and CAS)

The Line Office has completed all applicable environmental compliance reviews, consultations, and permitting requirements, including, but not limited to, the National Environmental Policy Act, 42 U.S.C. § 4321 *et. seq*; NOAA Administrative Order 216-6A; Endangered Species Act, 16 U.S.C. § 1531 *et seq*., and Marine Mammal Protection Act, 16 U.S.C. § 1361 *et seq*. If applicable, the statement of work addresses any required mitigation measures, best management practices, monitoring, terms and conditions, or other environmental compliance requirements.

Approval

_____UASPO Director (Acquisitions and CAS)

UASPO has been consulted regarding this pre-solicitation. *(sign and date)*

_____OMAO UAS Advisor (CAS)

OMAO has reviewed the pre-solicitation specifications provided to ensure they include NOAA and FAA operational requirements. *(sign and date)*

☐ OMAO-assigned clearance number.

_____AOC UAS Section Chief (UAS acquisition)

The AOC UAS Section has reviewed this pre-solicitation specifications provided to ensure the UAS acquired will meet NOAA airworthiness and operational requirements. *(sign and date)*

_____Line Office Executive Level Approval *(sign and date)*

The _____*(Line Office)* has reviewed this pre-solicitation form and supporting documents. Approval to proceed with this acquisition is granted.

Appendix I – Line Office Administrative Review of UAS Operations

Instructions

Line Offices will utilize the following process for the approval of UAS operations to ensure compliance with NOAA, Department of Commerce (DOC), and Federal policy. Each Line Office shall certify that each UAS operation meets applicable policy. OMAO will ensure that all UAS Operations meet safety requirements and are in compliance with aviation regulations and AOC Policy 220-1-5, UAS Operations.

Applicability

The *Line Office Administrative Review of UAS Operations Checklist* shall be completed prior to all UAS operations.

Approval via this form is not required:

1) When the operation is a contract for a data product and not for aviation services, provided the Federal involvement does not include close Government monitoring of the contractor's day-to-day operations.
2) For Federal Grants

Responsibilities

Line Offices

1) Each Line Offices is responsible for ensuring that Field UAS operations meet a Line Office requirement, NOAA, DOC, and other applicable federal policies that are outside the scope of OMAO's safety and operations review, including all applicable environmental compliance requirements.
2) The requestor of UAS operations is responsible for initiating the process through their Line Office point of contact for UAS.
3) Each Line Office will coordinate and endorse UAS Operations through their Line Office Unmanned Systems (UxS) Executive Oversight Board member or designee.

OAR UAS Program Office (UASPO)

1) The UASPO provides guidance on latest technologies to meet mission needs and to provide technical advice to assist Line Offices throughout the process.

Office of Marine and Aviation Operations (OMAO) and Aircraft Operations Center (AOC)

1) Management and operational control of all aircraft, including UAS are functions and responsibilities of OMAO.
2) AOC is responsible for evaluating and approving UAS operations to ensure safety and compliance with aviation regulations and policy.

Definitions and Policy References

1) Acquisition of a Data Product

When the operation is a contract for a data product and not for aviation services, provided the Federal involvement does not include close Government monitoring of the contractor's day-to-day operations, the government's liability exposure is unlikely.

2) AOC Policy 220-1-5 Unmanned Aircraft Systems (UAS) Operations

Provides guidance specific to the operation and management of UAS where differences may exist from the utilization and management of manned aircraft.

3) Federal Grants (Line Office administrative review not required)

A grant is a transfer of money, property, services or anything of value to a recipient whenever the principal purpose is to accomplish a public purpose of support or stimulation that is authorized by Federal Statute. The Department of Commerce cannot make a grant unless Congress provides to an agency both legislative authority and funding to conduct a program or perform delineated activities.

As a condition of receiving Federal financial assistance, successful applicants must agree to comply with NOAA's UAS Privacy Policy. To this end, NOAA Grantors are highly encouraged to consult with OMAO and UASPO when drafting Federal funding opportunity announcements and award documentation associated with UAS services.

In addition, all UAS service awards must include a special award condition stating that UAS operations must be in compliance with all applicable Federal government and Federal Aviation Administration regulations.

4) Liability Guidance for UAS

Negligence of a Government employee or contractor in UAS operations *may* open up liability to the Government. *Contact the Dept. of Commence General Litigation Division* to understand what liability government and contractor UAS Operations may exist under the Federal Tort Claims Act (FTCA) for domestic operations and Admiralty Law for operations conducted from deployed vessels. Seek their assistance when needed in looking for ways to decrease or limit liability where possible.

Contact the DOC Contract Law Division to address contract liability issues.

Contact the DOC Federal Assistance Law Division to address Grants or Cooperative Agreement matters.

5) NAO 2016-104A

NOAA Administrative Order (NAO) 216-104A mandates that the NOAA Aircraft Operations Center (AOC) manage all aircraft operated by NOAA.

6) NOAA UAS Handbook

This handbook supplements NAO 216-104A: Management and Utilization of Aircraft and AOC Policy 220-1-5 UAS Operations by providing additional guidance to NOAA users of UAS and a framework for the safe and efficient operation of UAS operated or sponsored by NOAA.

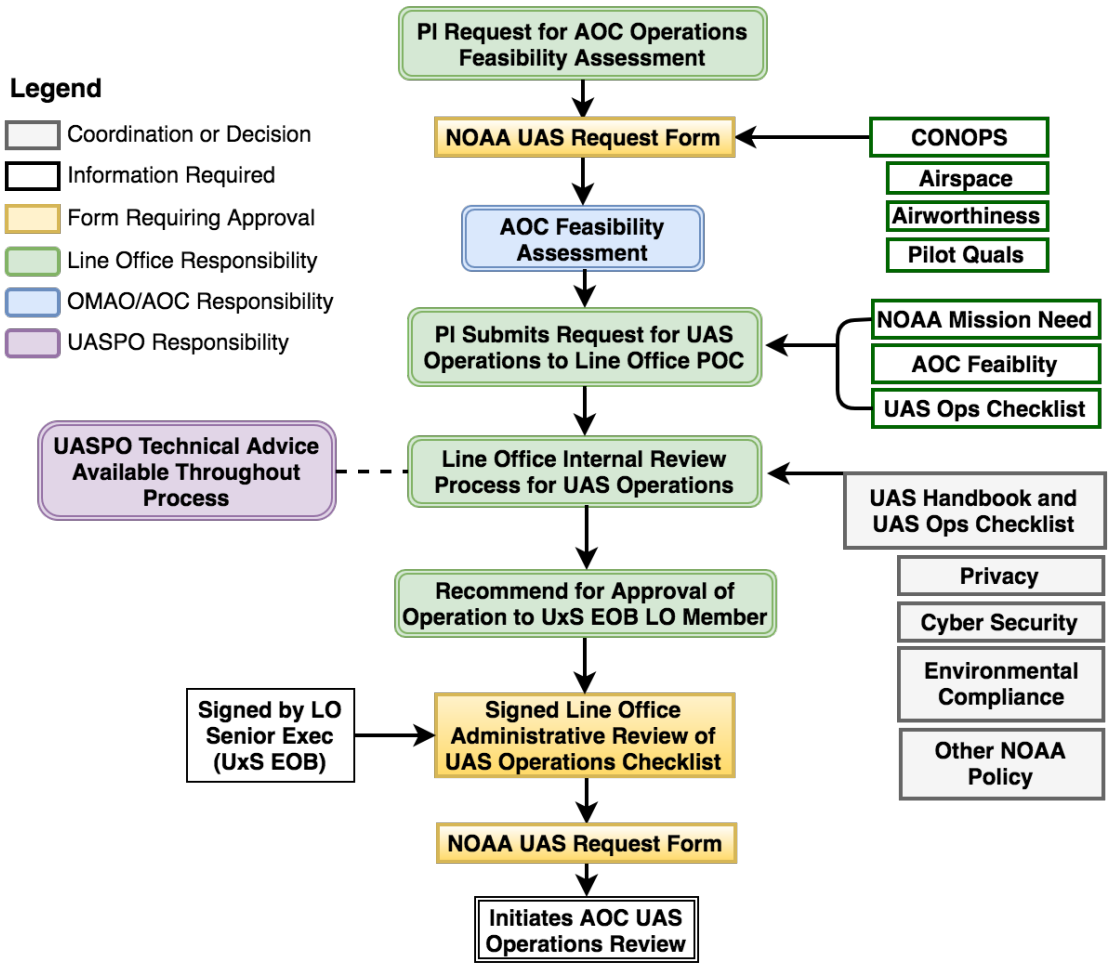
7) NOAA UAS Privacy Policy

This policy outlines the collection, use, retention, and dissemination of information obtained by UAS operation. NOAA will apply this policy to ensure that, in carrying out the Agency's mission, any UAS operation operated by NOAA, on behalf of NOAA (e.g., by contractors), or with NOAA sponsorship (e.g., by grantees), will not violate the privacy rights of the individuals whose Personally Identifiable Information (PII) may be collected or observed through NOAA's UAS activities.

The Privacy Policy requires that NOAA cooperative institutes, academic institutions, State, local, tribal, and territorial governments that are recipients of Federal grant funding for the purchase or use of UAS for their own operations have in place policies and procedures to safeguard individuals' privacy, civil rights, and civil liberties prior to expending such funds. All UAS service applications and subsequent awards must include the manner in which the successful applicant will meet the mandates of this policy. For more information see Appendix J – UAS Privacy Policy Summary.

8) UAS: Unmanned Aircraft System.

The FAA defines an unmanned aircraft as "an aircraft that is operated without the possibility of direct human intervention from within or on the aircraft" (Public Law 112-95, Section 331(8)). Also called drones, these unmanned aircraft do not have a human pilot onboard.



Line Office Administrative Review of UAS Operations Flow Chart

Submitting the AOC NOAA UAS Request Form to AOC initiates this process. AOC is available to assist in the completion of this form. AOC will assign the UAS request a tracking number and provide an operational feasibility statement to the requestor and the Line Office UAS coordinator. The Line Office UxS EOB member will review the *Line Office Administrative Review of UAS Operations Checklist*.

A signed *Line Office Administrative Review of UAS Operations Checklist* will initiate the AOC UAS flight approval process as specified in the NOAA UAS Handbook. UAS operations will be approved with the issuance of a Commanding Officer Flight Authorization Memo.

Line Office Administrative Review of UAS Operations Checklist

The Line Office shall certify that the proposed UAS operation meets Line Office requirements, NOAA, DOC, and other applicable federal policies.

Reference: NOAA Small UAS Handbook, Appendix I – Line Office Administrative Review of UAS Operations.

Federal Policy Checklist

____ NOAA UAS Privacy Policy

The proposed UAS operation addresses NOAA's UAS Privacy Policy and does not change or remove any existing obligation of law or policy regarding privacy.

____ Federal Cyber Policy

The proposed UAS operation addresses Federal Cyber Security and Information Technology Policies. This includes, but is not limited to Sec. 205 of the Cyber Security Information Sharing Act of 2015, OMB Circular A-130, NIST SP 800-37, and NAO 212-13 NOAA Information Technology Security Policy.

____ Environmental Compliance

The Line Office has completed all applicable environmental compliance reviews, consultations, and permitting requirements, including, but not limited to, the National Environmental Policy Act, 42 U.S.C. § 4321 *et. seq*; NOAA Administrative Order 216-6A; Endangered Species Act, 16 U.S.C. § 1531 *et seq*., and Marine Mammal Protection Act, 16 U.S.C. § 1361 *et seq.* If applicable, the statement of work addresses any required mitigation measures, best management practices, monitoring, terms and conditions, or other environmental compliance requirements.

Approval

_____ Unmanned Systems Executive Oversight

(sign and date) Board (UxS EOB) Line Office Representative

_____ has reviewed this UAS operation and approval to

(line office name) proceed with this operation is granted.

Appendix J – UAS Privacy Policy Summary

Summary

In carrying out its scientific mission and in protecting citizens' life and safety, NOAA utilizes many technologies, including UAS. Because NOAA's use of UAS may unintentionally collect Personally Identifiable Information (PII), the protections of NOAA's UAS Privacy Policy are necessary. This policy serves as an application of existing law and policy, and also includes new constraints unique to UAS operations contained in a February 15, 2015 Presidential Memorandum, for example, limitations on UAS-gathered data storage durations. NOAA users must ensure that all UAS activities adhere to the existing laws and policies regarding PII collection, use, storage, and transmission, as well as to verify that the additional duties outlined in the Presidential Memorandum which have been set forth in this policy, are effectuated.

The UAS Privacy Policy will be updated as required and can be found at the following link:

http://www.cio.noaa.gov/itmanagement/pdfs/Signed_UAS_PrivacyPolicy.pdf

Appendix K – UAS with AOC Airworthiness Releases

The following UAS associated with a contract delivery or performance have completed the AOC Airworthiness review process and have been granted UAS Airworthiness Releases as of May 5, 2017. This list will be updated on a regular basis.

Aerial Imaging Solutions APO-42

Aerial Imaging Solutions APH-17

Aerial Imaging Solutions APH-22

Raytheon Coyote

SenseFly eBee

Microdrones MD4-1000

AeroVironment Puma

DJI-S1000