DOCUMENT 555-19

Range Commanders Council
Range Operations Group

# USER GUIDE FOR UNMANNED AIRCRAFT SYSTEM (UAS) OPERATIONS ON THE NATIONAL RANGES

**ABERDEEN TEST CENTER**
**DUGWAY PROVING GROUND**
**REAGAN TEST SITE**
**REDSTONE TEST CENTER**
**WHITE SANDS MISSILE RANGE**
**YUMA PROVING GROUND**

**NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION, PATUXENT RIVER**
**NAVAL AIR WARFARE CENTER WEAPONS DIVISION, CHINA LAKE**
**NAVAL AIR WARFARE CENTER WEAPONS DIVISION, POINT MUGU**
**NAVAL SURFACE WARFARE CENTER DAHLGREN DIVISION**
**NAVAL UNDERSEA WARFARE CENTER DIVISION KEYPORT**
**NAVAL UNDERSEA WARFARE CENTER DIVISION NEWPORT**
**PACIFIC MISSILE RANGE FACILITY**

**30TH SPACE WING**
**45TH SPACE WING**
**96TH TEST WING**
**412TH TEST WING**
**ARNOLD ENGINEERING DEVELOPMENT COMPLEX**

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION**

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**DOCUMENT 555-19**

# USER GUIDE FOR UNMANNED AIRCRAFT SYSTEM (UAS) OPERATIONS ON THE NATIONAL RANGES

**January 2019**

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**Range Operations Group**

**Published by**

**Secretariat**
**Range Commanders Council**
**U.S. Army White Sands Missile Range, New Mexico 88002-5110**

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# Preface

The Range Operations Group of the Range Commanders Council, working with the Frequency Management Group and Range Safety Group, prepared this document. It represents the collaborative effort to develop and define a common set of guidelines for unmanned aircraft system operations and to assist range users in obtaining approval to conduct UAS operations on the National Ranges. The information contained herein addresses general policy regarding operations, airspace, range safety, and frequency management.

The goal of this document is to guide the range user through the process to bring a UAS program onto a range. The operation of UAS programs on the National Ranges and their integration into day-to-day operations present many unique challenges to customers and range operators. While specific technical requirements may vary from range to range, many aspects of UAS operations are common.

Please direct any questions to:

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1510 Headquarters Avenue
White Sands Missile Range, New Mexico 88002-5110
Telephone: (575) 678-1107, DSN 258-1107
E-mail usarmy.wsmr.atec.list.rcc@mail.mil

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# Acronyms

| | |
|---|---|
| ATC | Air Traffic Control |
| COA | Certificate of Waiver or Authorization |
| DoD | Department of Defense |
| DoDD | Department of Defense Directive |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| EL-CID | Equipment Location – Certification Information Database |
| FAA | Federal Aviation Administration |
| FL | Flight Level |
| FTS | flight termination system |
| IFR | Instrument Flight Rules |
| MOA | Memorandum of Agreement |
| MRTFB | Major Range and Test Facility Base |
| NAS | National Airspace System |
| NTIA | National Telecommunications and Information Administration |
| PI | Program Introduction |
| PM | program manager |
| RCC | Range Commanders Council |
| SAA | Special Activity Airspace |
| SMO | Spectrum Management Organization |
| SUA | Special Use Airspace |
| UAS | Unmanned Aircraft System |
| UMMIPS | Uniform Materiel Movement and Issue Priority System |
| VFR | Visual Flight Rules |

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# CHAPTER 1

# Introduction

## 1.1. Purpose

This document provides a common set of guidelines and information to assist unmanned aircraft system (UAS) programs in obtaining approval to operate on the National Ranges.

## 1.2. Scope

The guidelines in this document are intended for use by customers of the Department of Defense (DoD) ranges of the Major Range and Test Facility Base (MRTFB). The guidelines provide the range customer with general information regarding national policy, Range Commanders Council (RCC) standards, and other areas of consideration related to UAS operations. It is important to remember that each range operates as an individual entity with unique processes and procedures designed for specific missions. Therefore, some of the information provided herein may not apply at all ranges.

## 1.3. Responsibilities

The DoD Directive (DoDD) 3200.11[1] assigns responsibility to the individual range commanders to manage their activity, administer the operating program, obtain reimbursements from users, provide or arrange for test support and resources, and ensure safety is consistent with operational requirements. The commanders are the final authority with regard to approval of operations on their respective ranges. In the case of programs that utilize multiple ranges, the lead range will ensure that all requirements of the lead range and all supporting ranges are met.

[1] Department of Defense. *Major Range and Test Facility Base (MRTFB)*. DoD Directive 3200.11. December 27, 2007. Change 2 incorporated October 15, 2018. May be superseded by update. Retrieved 5 November 2018. Available at http://www.esd.whs.mil/Directives/issuances/dodd/.

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# CHAPTER 2

# Range Operations

## 2.1. Requirements Definition

Early communications with a potential support range is critical to the success of a test program. Initial contact with a range is usually through informal means, such as by telephone or e-mail; however, a detailed requirements definition must be documented and submitted through the range's formal process. Although range procedures and documentation formats differ within the MRTFB, the Program Introduction (PI) document is the initial planning document submitted by a user to the supporting agency. The user should immediately submit the PI or similar document upon identification of the scope and duration of a program activity. The user should provide the best available information so that the supporting agency can initiate thorough resource and technical planning actions. This information, while sometimes fragmentary and incomplete, is of substantial value to the support agency in determining the scope of the program. For many programs, the PI can eliminate further documentation except for conducting specific operations.

| | |
|---|---|
| **NOTE**  | In all cases, the customer should contact the range to determine specific documentation requirements. |

## 2.2. Security

The UAS presents many unique challenges to the supporting ranges, including the critical challenge of security. These vehicles are equipped with a variety of sensors and systems, making it possible for them to gather large volumes of information from their environment. The ranges are unique national assets that support the research, development, test, evaluation, and training for our nation's most sophisticated and sensitive technologies. As such, it is critical that the range security team and other range customers have a full and complete understanding of UAS capabilities. While the disclosure of this information will normally be worked through the PI review process, it is recommended that a dialog with the range security team start as early as possible (initial contact). Security issues, if not properly addressed, can limit scheduling opportunities and overall access to the range.

## 2.3. Scheduling

Each MRTFB range has developed its own scheduling system and processes. These systems vary from computer-based systems capable of automated resource de-confliction and schedule distribution to person-in-the-loop operations. Along with these processes, each range has its own unique timelines for requirements submission and change management. As with security, the range user should work with range scheduling as early as possible to become familiar with the scheduling process. Programs planning to conduct multi-range operations should work through the lead range to determine what capability exists to develop an integrated schedule. All range customers planning to use the DoD MRTFB should become familiar with DoD Manual 4140.01

Volume 8.[2] The Materiel Management Regulation designates priorities based on the following two factors:

a. Force/Activity Designator reflecting essentiality of program to the overall mission of the DoD;

b. Urgency of Need Designator reflecting urgency of requisitioned item's use.

The above factors can affect the availability of the range to the customer and have a direct impact on mission success. In addition, each range has a unique process for defining range scheduling and access priorities that should be taken into account when considering program use. The RCC document 556-16[3] outlines each MRTFB's range scheduling and de-confliction guidelines.

## 2.4. Environmental Management

The environmental management of military ranges is becoming increasingly important in light of evolving regulations, facility closings, and readiness requirements for training and testing. Environmental Assessments (EAs) and Environmental Impact Statements (EISs) are prepared to identify, consider, and resolve environmental problems early in the planning stages of a program. Both the EA and EIS are developed as planning documents to integrate environmental considerations into a range's decision-making process. As with the other areas addressed in this document, UAS program personnel who are planning operations on the National Ranges must consider the impact on the environment and how their operations fit into the ranges' existing environmental plan. Early contact with the range's environmental planners will ensure the proposed operations fall within existing permits and allow sufficient time to resolve non-compliance issues. While environmental planning should be captured through the PI process, programs should be proactive in establishing communications with the range environmental management team.

[2] Department of Defense. *DoD Supply Chain Materiel Management Procedures: Materiel Data Management and Exchange*. DoDM 4140.01, Volume 8. 10 February 2014. May be superseded by update. Available at https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/414001m/414001m_vol08.pdf?ver=2017-12-12-124837-150.

[3] Range Commanders Council. *Range Scheduling Deconfliction Guidelines*. RCC 556-16. August 2016. May be superseded by update. Retrieved 6 November 2018. Available to RCC members with Private Page access at https://wsdmext.wsmr.army.mil/site/rccpri/Publications/556-16_Range_Scheduling_Deconfliction/.

# CHAPTER 3

# Range Safety Program

This section outlines the range safety goals, data requests, and flight safety system considerations for UAS operations on national ranges. It also includes a list of salient range safety documentation providing more-detailed safety guidance for UAS operation on ranges.

National ranges exist to allow potentially hazardous tests and training to take place without endangering the public. Range safety's goals are to identify risks associated with UAS testing and training and to manage risk to an acceptable level. In addition to public protection, range safety addresses the protection of people, property, and other aircraft in test and training areas.

## 3.1. Goals

The common goal of the range and range users is to operate UASs safely and effectively. The objective of the range safety program is to protect the general public, test/training personnel, high-value property, critical assets, and range resources. In general, range safety does the following.

- Compile a list of hazards associated with specific UAS test and training, weapons delivery, and use as targets events.
- Verify that the consequences of encountering those hazards can be mitigated by proven system safeguards or existing range barriers.
- Identify gaps in existing system safeguards or range barriers and propose additional hazard controls.

Range safety is concerned with:

- Consequences to people if a UAS crashes in a populated area;
- Consequences to critical property damage by a UAS impact;
- Consequences of collision with other aircraft;
- Consequences of a significant adverse impact on the mission of the range.

In the case of UAS test articles and events, range safety must ensure that system operation is above some minimally safe initial operating threshold. As the UAS program's system safety actively pursues continuous safety improvements, controls and barriers imposed by range safety can evolve and presumably be reduced over time. In the case of training and proficiency operations, range safety coordinates with the UAS program's system safety office to define commensurate range safety controls and barriers to long-term operations above some minimally safe threshold.

### 3.1.1. Risk to People and High-Value Assets

The general strategy used to minimize risk to people and critical property is to contain and mitigate risk in the following manner.

- Confine high-risk test or training operations to unpopulated areas and away from potentially vulnerable critical facilities. Where confinement is not an option, the risk will be assessed and mitigated to an acceptable level.
- Ensure test and training vehicles are healthy prior to transiting over populated areas when necessary and unavoidable.
- Plan for contingencies to avoid recoveries of unhealthy vehicles in populated areas or near potentially vulnerable critical facilities. Where avoidance of populated areas or critical facilities is not possible to accomplish mission requirements, the risk will be assessed and mitigated to an acceptable level or the mission requirements and risk decisions will be re-evaluated.

### 3.1.2. Risk to Other Aircraft

Procedures to ensure the separation of aircraft are the responsibility of the local Air Traffic Control (ATC) authority (See Chapter 4 on airspace management). The conduct of potentially hazardous UAS tests and/or training is typically separated from other aircraft by providing exclusive airspace. The typical UAS airspace safety strategy is as follows.

- Plan operations to remain inside exclusive use airspace.
- Ensure transits into and out of exclusive use airspace are coordinated with ATC.
- Ensure contingency plans exist for lost-link events and inform all stakeholders.
- Ensure unmanned aircraft with the potential to leave exclusive use airspace can be tracked by ATC. If they cannot be tracked, containment measures (back-up links, fly home routines, geo-fences, etc.) are verified before flight.

### 3.1.3. Risk to Range Mission and Access

Range safety is also concerned with the adverse impact UAS testing and training may pose to the mission of the range and will coordinate with the appropriate range stakeholders when new or unusual hazards are uncovered. These include but are not limited to the following:

- Potential of test or training vehicles or events to unexpectedly interrupt the local airspace schedule or otherwise deny airspace use to other range users;
- Radio frequency interference caused by UAS systems;
- Unusual hazardous material or environmental concerns related to UAS operations;
- Security issues, operations security concerns;
- Public perception concerns.

## 3.2. Range Safety Office Data Requests

Range safety may perform analyses and reviews to verify a new UAS or test program is safe to conduct on the range. The UAS range users can expect that data requests to support these analyses may include but are not limited to the following.

- System description
- Vehicle performance
- Vehicle safety history and reliability
- Operator qualifications
- Hazardous materials
- Test plan mission/objectives

## 3.3. Independent Flight Safety System/Certified Flight Safety System

Depending on the potential risks associated with UAS operations, the range may require the installation of an independent flight safety system on the vehicle if it does not have a certified flight safety system. Participation of the range safety office early in the planning stages of a program will reduce the possibility of costly engineering changes and/or scheduling delays, especially with respect to critical design considerations regarding the flight safety system and related flight safety controls. Coordination between the range safety office and the program manager (PM) should be established as early as possible during the planning stages. Safety personnel from at least the lead range should be notified and invited for representation at all meetings where ground and flight safety issues are addressed.

## 3.4. Range Safety Documentation

Range safety documentation is continually being developed and updated to address evolving hazards associated with UAS operations on national ranges. Appendix E contains some of the safety standards currently in use.

Range users should contact their local range safety offices to ensure the most current list of applicable documents. Contact information is located in Appendix C.

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# CHAPTER 4

# Airspace Management

## 4.1. General

Airspace is critical for UAS operations on DoD ranges. There are many types of airspace designations, each having a unique purpose. The Federal Aviation Administration (FAA) manages the National Airspace System (NAS) and provides the DoD airspace to conduct test and training. Military airspace, often defined as Special Activity Airspace (SAA), is airspace with defined dimensions within the NAS wherein limitations may be imposed upon aircraft operations, such as Restricted Areas, Prohibited Areas, Military Operations Areas, ATC Assigned Airspace, and others. The SAA consists of two common types of airspace: Special Use Airspace (SUA) and Airspace for Special Use. Current FAA and DoD doctrine suggests UAS operations be confined within SUA, specifically prohibited, restricted, or warning areas; however, there are provisions within FAA guidelines and the Memorandum of Agreement (MOA) Concerning the Operation of DoD UASs in the NAS[4] that afford UAS operations outside of prohibited, restricted, and warning areas. These operations are typically conducted under a Certificate of Waiver or Authorization (COA) from the FAA, or under a COA via Notification as outlined in the MOA.

## 4.2. Defining Airspace

When defining a section of airspace, there are four criteria to consider. These criteria are volume, proximity, time, and attributes.

a. Volume. Volume is a key concept in understanding airspace. The length and width of airspaces are depicted on two-dimensional charts, but the altitude floor and ceiling must also be defined to complete the dimensions. Altitude deconfliction enables airspace to be safely accessed by multiple users at the same time.

b. Proximity. Airspace is often associated with a geographic area, airport, airfield, or military installation. Proximity affects the utility of the airspace and its use.

c. Time. Airspace is allotted for use for a specific time period. Airspace designated for air-to-air training during a specific time may be used for air-to-ground gunnery during an alternate time period.

d. Attributes. Airspace attributes describe the physical characteristics or capabilities of the underlying surface that make certain sections of airspace unique. These attributes may be the type of terrain, instrumentation, chaff and flare approval, and target sets available.

[4] Department of Defense Board on Federal Aviation. *Memorandum of Agreement Concerning the Operation of Department of Defense Unmanned Aircraft Systems in the National Airspace System*. 16 September 2013. May be superseded by update. Available at http://www.usaasa.tradoc.army.mil/docs/br_airspace/dodfaa_moa_opsinnas_16sep2013.pdf.

## 4.3. Prohibited Areas

Prohibited areas are established under 14 CFR Part 73[5] to prohibit flight over areas on the surface in the interest of national security and welfare. Prohibited areas normally extend from the surface to a specified altitude with continuous hours of operation. No person may operate an aircraft in a prohibited area without permission of the using agency. Prohibited areas are charted on Visual Flight Rules (VFR) sectional charts, Instrument Flight Rules (IFR) en route charts, and terminal area charts. The floor and ceiling, operating hours, and control agency can be found on the charts.

## 4.4. Restricted Areas

Restricted areas are established under 14 CFR Part 73 to confine or segregate activities considered hazardous to nonparticipating aircraft. Examples of these activities include artillery firing, aerial gunnery, bomb dropping, and guided missile launches. Access to restricted areas requires specific authorization from the using or controlling agency. Restricted areas are charted on VFR sectional charts, IFR en route charts, and terminal area charts.

## 4.5. Warning Areas

Warning areas are airspaces extending from 3 to 12 nautical miles outward from the coast of the United States designated to contain activity that may be hazardous to nonparticipating traffic. Warning areas may be located over domestic waters, international waters, or both. By definition, warning areas warn nonparticipating pilots of the potential danger from activities being conducted. Warning areas are charted on VFR sectional charts, IFR en route charts, and terminal area charts

## 4.6. Classes of Airspace

Separate and apart from SAA, the FAA defines airspace by classes. Classes A through E are controlled airspaces wherein air traffic services are provided to IFR and VFR flights in accordance with the airspace classification. Class G airspace is uncontrolled and is defined as the airspace other than Classes A through E. Class A airspace extends from 18,000 feet mean sea level up to and including Flight Level (FL) 600 and is restricted to IFR flights. Classes B through D are located at towered airfields and are designed to contain published instrument procedures. Class B airspace is located around the busiest airports while Class D airspace is located around the least busy. Class E airspace includes surface area airspaces around some non-towered airfields as well as controlled airspace in areas not associated with an airfield. Class E airspace also includes the airspace above FL 600. The airfield and surrounding airspace associated with military airports that share use with civilian air traffic are known as joint-use facilities.

## 4.7. Certificate of Waiver or Authorization

In an attempt to safely afford the DoD greater access to the NAS, the MOA (DoD Board on Federal Aviation, 2013) permits operations outside of prohibited, restricted, or

[5] 14 CFR 73; Special Use Airspace

warning areas using a COA or a COA via Notification. A COA via Notification provides notice to the FAA of the DoD's intent to operate a UAS under specific circumstances. Per the MOA, a COA via Notification is used when operations will be contained within non-joint-use Class D airspace around a military airfield. The Notification is also useable for operations that transition directly from non-joint-use Class D airspace to an adjoining prohibited, restricted, or warning area. The MOA also permits use of a COA via Notification for operations in Class G airspace with certain restrictions. For all other operations outside of prohibited, restricted, or warning areas, an approved COA is required. The COA request procedures are codified in FAA Joint Order (JO) 7200.23[6].

## 4.8. Questions About Airspace

Questions about airspace at any DoD range or MRTFB can be answered by the airspace manager at the specific range. Information on airspace management offices and other contact information for RCC member and associate ranges can be found in Appendix C.

[6] Federal Aviation Administration. *Unmanned Aircraft Systems (UAS)*. FAA Joint Order 7200.23A. 1 August 2017. May be superseded by update. Retrieved 19 November 2018. Available at https://www.faa.gov/documentLibrary/media/Order/JO_7200.23A_Unmanned_Aircraft_Systems_(UAS).pdf.

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# CHAPTER 5

# Frequency Management: UAS Spectrum Utilization at DoD Test and Training Ranges

| | |
|---|---|
| NOTE  | This chapter covers the general guidelines for radio frequency spectrum management as it pertains to UAS support. For more detailed information concerning the Spectrum Management Process, please contact the local Installation Spectrum Management Office. |

## 5.1. General

There is a two-step documentation process for obtaining access to the DoD frequency spectrum. The first step refers to a Spectrum Certification, also called a Frequency Allocation. The second step, known as a Frequency Assignment, refers to the approval to radiate at specific locations.

## 5.2. System Certification

The certification/allocation process involves the comparison of the new transmitter, receiver, and antenna information with existing standards for electromagnetic interference and electromagnetic compatibility analyses to other DoD systems operating in the same portion of spectrum. The certification process is a risk reduction process that helps the PM avoid developmental delays by focusing program funding on a specific portion of the spectrum. The process of establishing spectrum-dependent equipment supportability is through an electronic process utilizing either STEPSTONE or Equipment Location – Certification Information Database (EL-CID) software programs. Applications for spectrum allocation are processed in stages. The using activity, spectrum-dependent system developer, PMO, and/or responsible acquisition activity submits either a STEPSTONE or EL-CID file for the appropriate stage as it proceeds along each milestone event or reaches an operational status. Stage 1 of the certification process, Conceptual, is not applicable for this effort. The three stages of concern for this type of system are as follows.

a. Stage 2, Experimental. Preliminary system design has been completed. Certification at this stage provides guidance for assuring spectrum support in later stages, and is needed before obtaining frequency assignments for experimental testing.

b. Stage 3, Developmental. System design has been completed. As the system design is nearly finalized, this stage provides guidelines for assuring spectrum support needed before obtaining frequency assignments for developmental testing.

c. Stage 4, Operational. System development is complete. This stage certifies availability of spectrum support and identifies operating restrictions before making operational frequency assignments.

Requestors/submitters should follow Military Department Spectrum Management Organization (SMO) policies and procedures for submitting systems for certification. Depending on the UAS system, spectrum compatibility, restrictions, and requested location, this process can take up to two or more years to complete.

## 5.3. Frequency Assignment

The purpose of the frequency assignment process is to obtain approval to radiate from the transmitter at specific locations, under specific operational conditions. Frequency assignments are specific to the equipment identified in the request and cannot be shared with other equipment regardless of their similarities. The requests for frequency assignments are created in the Standard Frequency Action Format (SFAF) and processed through a computer database management system known as Spectrum XXI (21). Frequency assignment requests must contain the system certification number (J/F-12 number) assigned to the equipment. All characteristics of the equipment, as described in its system certification, must be reflected in the radio frequency assignment. Depending on the UAS system, this process can take up to 120 days to obtain approvals for compatibility, restrictions, and requested location.

## 5.4. Experimental Assignments (XT)

For systems that have not completed the system certification process, as long as the system has been submitted for certification in Stage 2, 3, or 4, it may still be able to be supported with a radio frequency assignment. When the system is submitted for certification to the SMO, it will be issued a tracking number that allows the submitter to track the system's progress through the certification process. A frequency request should be created and submitted in Spectrum XXI with the following changes to the SFAF.

- Line 113, Station Class, should be XT, which stands for experimental.
- Line 343, Equipment Certification Identification Number, should be left blank.
- Line 520, Supplementary Details, should contain the certification tracking number of the equipment and the identity of the SMO to which it was submitted.

## 5.5. NTIA 7.11 Experimental Authority

Per the U.S. Department of Commerce, National Telecommunications and Information Administration (NTIA) Manual of Regulations and Procedures for Federal Radio Frequency Management,[7] Section 7.11, federal experimental radio stations at some ranges can be granted approval to radiate for short durations in order to complete experimental testing. Requests for these assignments should follow the SMO policies and procedures for NTIA 7.11 assignments. This process may require coordination with the responsible area frequency coordinator. This process can take up to 30 days depending on the UAS system, compatibility, duration, restrictions, and location. The use of this option is at the discretion of the spectrum management staff responsible for the location.

[7] National Telecommunications and Information Administration. *Manual of Regulations and Procedures for Federal Radio Frequency Management*. September 2017. May be superseded by update. Retrieved 27 November 2018. Available at https://www.ntia.doc.gov/files/ntia/publications/ntia_manual_september_2017_revision.pdf.

# Appendix A

# Frequency Management Checklist

The following is a combined list of common questions asked by all range frequency managers. The PM of a UAS should be prepared to answer these questions and to provide other relevant information.

| | |
|---|---|
| **NOTE**  | There are range-specific questions that are not contained in the list shown below. Unanswered questions (or unknown questions) may adversely impact the UAS test or training schedule. Therefore, the local range frequency manager should be consulted for additional information and the requirements for testing at a specific range. |

## A.1. General Contact Information

a. Is this a DoD or commercial UAS test or training program?
b. Who is the PM for this test or training?
c. What is the PM Contact Information (organizational address, telephone, and E-mail)?

## A.2. Certification Allocation Process

a. Has the UAS been granted Spectrum Certification? Please provide the assigned Systems Planning Subcommittee Spectrum Certification number and J/F-12 number.
b. Have you gathered the DD Form 1494 data information?
c. Is the information provided calculated or measured data?
d. Is the UAS in its conceptual or initial planning stage?
e. Is the UAS in its experimental or still under preliminary design?
f. Is the UAS in its development, pre-production and major design complete or testing still required?
g. Are the operational constraints and restrictions identified?
h. Are there any new modifications made to the UAS since certification was approved?

## A.3. Frequency Assignment Process

a. Do you have a Frequency Assignment?
b. What is the Agency Serial Number?
c. Has a frequency assignment proposal been submitted?
d. Has a temporary frequency proposal been submitted?
e. What are transmitters' tuning ranges?
f. What is the power in watts of each transmitter?
g. What is the bandwidth of each transmitter?
h. What is the modulation of each transmitter?

## A.4. Operational requirements/Constraints/Restrictions

a. Does your UAS require use of an FTS?
b. Are you aware your access to the spectrum is based on current range operations and will require scheduling coordination?

c. Are there any air space or altitude requirements or restrictions?
d. Are there any requirements or restrictions to Day/Night/Both operations?
e. What is the estimated total number of flights planned?
f. What is the estimated duration of each flight?
g. Are there any satellite communications required to support your UAS?
h. Are there any operational security issues?
i. Are there any weather restrictions imposed on your UAS operations?
j. Are there any new sensors, electronic attack, or weapons on board the UAS?
k. Does the UAS contain any GPS jamming or re-radiating capability?
l. Is any UAS video capability being used during the test or training?
m. Is there any on-board UAS data storage capability?

# Appendix B

# Points of Contact

## B.5. Range Operations

| RANGE | LOCATION | OFFICE | PHONE |
|---|---|---|---|
| Aberdeen Test Center | Aberdeen Proving Ground, MD | TEDT-AT-POR | 410 278-2215 |
| Dugway Proving Ground | Dugway Proving Ground, UT | TEDT-DPW-OPA | 435 831-7856 |
| Reagan Test Site | Kwajalein Atoll | SMDC-TCR-M | 256-955-2315 |
| Redstone Test Center | Huntsville, AL | TEDT-RT-MSO | 256 876-3873 |
| White Sands Missile Range | White Sands, NM | TEWS-WS-TC-RO-CE | 575 678-8613 |
| Yuma Proving Ground | Yuma, AZ | TEDT-YPY-ROT-RO | 928 328-6125 |
| 30 Space Wing | Vandenberg AFB, CA | 2 ROPS/DON | 805 606-3602 |
| 45 Space Wing | Cape Canaveral/Patrick AFB, FL | 45 RANS/DOU | 321 853-8325 |
| 96 Test Wing | Eglin AFB, FL | 96 CS/SCWF | 850 883-7535 |
| 412 Test Wing | Edwards AFB, CA | 412RANS/DO | 661 277-2727 |
| Pacific Missile Range Facility | Barking Sands, HI | PMRF N3R | 808 335-4253 |
| NAVAIR, Aircraft Division | Patuxent River, MD | Code 5.2.2.1 | 301 342-1197 |
| NAVAIR, Weapons Division | China Lake, CA | Code 52130MD | 760 939-6619 |
| NAVAIR, Weapons Division | Point Mugu, CA | Code 52330ME | 805 989-3372 |
| NASA, Wallops Flight Facility | Wallops Island, VA | Code 840 | 757 824-2717 |

## B.6. Range Safety

| RANGE | LOCATION | OFFICE | PHONE |
|---|---|---|---|
| Aberdeen Test Center | Aberdeen Proving, MD | TEDT-AT-POR | 410 278-2215 |
| Dugway Proving Ground | Dugway Proving Ground, UT | TEDT-DP-SA | 435 831-5204 |
| Reagan Test Site | Kwajalein Atoll | SMDC-TCR-S | 256-955-2744 |
| Redstone Test Center | Huntsville, AL | TEDT-RT-MSO | 256 876-3873 |
| White Sands Missile Range | White Sands, NM | TEWS-WS-TC-RO-CF | 575 678-0211 |
| Yuma Proving Ground | Yuma, AZ | TEDT-YP-TI | 928 328-6221 |
| 30 Space Wing | Vandenberg AFB, CA | 30 SW/SEL | 805 606-1129 |
| 45 Space Wing | Cape Canaveral/Patrick AFB, FL | 45 SW/SEF | 321 494-2239 |
| 96 Test Wing | Eglin AFB, FL | 96 TW/SEU | 850 882-7341 |
| 412 Test Wing | Edwards AFB, CA | 412 TW/SETR RANS/ENROR | 661 277-5297 |
| NAVAIR, Aircraft Division | Patuxent River, MD | Code 5.2.2.G | 301 342-1184 |
| NAVAIR, Weapons Division | China Lake, CA | Code 52120MD | 760 939-6810 |
| NAVAIR, Weapons Division | Point Mugu, CA | Code 52360ME | 805 989-3733 |
| Pacific Missile Range Facility | Barking Sands, HI | PMRF N3R1 | 808 335-4508 |
| NASA, Wallops Flight Facility | Wallops Island, VA | Code 803 | 757 824-1498 |

## B.7. Airspace Management

| RANGE | LOCATION | OFFICE | PHONE |
|---|---|---|---|
| Aberdeen Test Center | Aberdeen Proving, MD | TEDT-AT-POR | 410 278-2215 |
| Dugway Proving Ground | Dugway Proving Ground, UT | TEDT-DPW-OPA | 435 831-5378 |
| Reagan Test Site | Kwajalein Atoll | SMDC-TCR-S | 256-955-2744 |
| Redstone Test Center | Huntsville, AL | TEDT-RT-CSO | 256 876-4578 |
| White Sands Missile Range | White Sands, NM | TEWS-RO-CR | 575 678-4087 |
| Yuma Proving Ground | Yuma, AZ | TEDT-YPY-ROT-RO | 928 328-6125 |

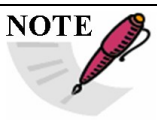
| | | | |
|---|---|---|---|
| 30 Space Wing | Vandenberg AFB, CA | 2 ROPS/DON | 805 606-3602 |
| 45 Space Wing | Cape Canaveral/Patrick AFB | 45 RANS/DOS | 321 853-5936 |
| 96 Test Wing | Eglin AFB, FL | 96 OSS/OSO | 850 882-8330 |
| 412 Test Wing | Edwards AFB, CA | 412 OSS/OSO | 661 277-2515 |
| NAVAIR, Aircraft Division | Patuxent River, MD | Code 5.2.2.1 | 301 342-1197 |
| NAVAIR, Weapons Division | China Lake, CA | Code 52310MD | 760 939-5480 |
| NAVAIR, Weapons Division | Point Mugu, CA | Code 52312ME | 760 939-0135 |
| Pacific Missile Range Facility | Barking Sands, HI | PMRF N3R1 | 808 335-4301 |
| NASA, Wallops Flight Facility | Wallops Island, VA | Code 830 | 757 824-2454 |

## B.8. Frequency Management

| RANGE | LOCATION | OFFICE | PHONE |
|---|---|---|---|
| Aberdeen Test Center | Aberdeen Proving, MD | TEDT-AT-POR | 410 278-0551 |
| Dugway Proving Ground | Dugway Proving Ground, UT | NETC-SFB-DB | 435 831-3411 |
| Reagan Test Site | Kwajalein Atoll | SMDC-TCR-M | 805-355-0063 |
| Redstone Test Center | Huntsville, AL | TEDT-RT-CSO | 256 876-6456 |
| White Sands Missile Range | White Sands, NM | ATEC CSTE-WSI-TR | 575 678-5946 |
| Yuma Proving Ground | Yuma, AZ | TEDT-YP-NEC | 928 328-7144 |
| 30 Space Wing | Vandenberg AFB, CA | 30 SCS/SCPS | 805 605-3660 |
| 45 Space Wing | Cape Canaveral/Patrick AFB | 45 SCS/SCP | 321 853-8430 |
| 96 Test Wing | Eglin AFB, FL | 96 CS/SCWF | 850 882-4202 |
| 412 Test Wing | Edwards AFB, CA | 412 CS/SCOTS | 661 277-4763 |
| NAVAIR, Aircraft Division | Patuxent River, MD | NAWCAD 52220 | 301 342-9549 |
| NAVAIR, Weapons Division | China Lake, CA | Code 52140MD/E | 760 939-6085 |
| NAVAIR, Weapons Division | Point Mugu, CA | Code 5233130D | 805 989-1003 |
| NUWC Division, Keyport | Keyport, WA | NAVSEA KP235 | 360 315-0903 |
| NUWC Division, Newport (AUTEC) | Newport, RI | Code 7031 | 561 671-2650 |
| Pacific Missile Range Facility | Barking Sands, HI | PMRF N65 | 808 335-7515 |
| NASA, Wallops Flight Facility | Wallops Island, VA | Code 565 | 757 824-1623 |

## B.9. Area Frequency Coordinators

| RANGE | LOCATION | OFFICE | PHONE |
|---|---|---|---|
| Arizona (AFC AZ) | Fort Huachuca, AZ | - | 520 538-6423 |
| Eastern (EAFC) | Cape Canaveral, FL | - | 321 853-8426 |
| Gulf (GAFC) | Eglin AFB, FL | - | 850 883-5982 |
| Mid-Atlantic (MIDLANT AFC) | Patuxent River, MD | - | 301 342-9549 |
| Nevada (NAFC) | Nellis AFB, NV | - | 702 679-0607 |
| Western (WAFC) | China Lake, CA | - | 760 939-6832 |
| White Sands Missile Range | White Sands Missile Range, NM | - | 575 678-5417 |

| | |
|---|---|
| **NOTE**  | A complete list of area frequency coordinators is maintained in Annex D of the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management, the "NTIA Redbook." The NTIA Redbook is available from the Department of Commerce, NTIA, Office of Spectrum Management at http://www.ntia.doc.gov/osmhome/redbook/redbook.html. |

# Appendix C

# Glossary

**Acceptable Risk**: A predetermined criterion or standard for a maximum risk ceiling which permits the evaluation of cost, national priority interests, and number of tests to be conducted.

**General Public**: All people not declared mission essential. This includes the public plus range personnel not essential to a mission, visitors, the press, and personnel or dependents living on the base or facility.

**Hazard**: Any real or potential condition that can cause injury, illness, or death of personnel, or damage to or loss of equipment or property.

**Hazard Area**: A geographical or geometrical surface area that is susceptible to a hazard from a planned event or unplanned malfunction.

**Individual Risk**: The risk to a single person.

**Mission Essential**: Those personnel, aircraft, and ships whose activities are directly relevant to the mission or are declared essential by the safety decision-making authority.

**Restricted Area**: Airspace designated under 14 CFR Part 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use and Instrument Flight Rules (IFR)/Visual Flight Rules (VFR) operations in the area may be authorized by the controlling ATC facility when the area is not being utilized by the using agency. Restricted areas are depicted on en route charts.
When joint use is authorized, the name of the controlling facility is also shown.

**Risk**: A measure that considers both the probability of occurrence and the consequence of a hazard. For this document, risk is expressed in terms of probability of fatality and expected fatalities.

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# Appendix D

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# Appendix E

# References

The following references are various documents and standards applied to UAS operations within the DoD, the National Ranges, and the NAS. These references define the compliance processes and procedures for which a program may be held accountable, depending on individual range policies. Each program should contact the individual range points of contact to determine applicability. The references identify applicable RCC standards, national standards, and other pertinent documents.

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