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UNMANNED AERIAL SYSTEMS GUIDELINES

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HSAC UNMANNED AERIAL SYSTEMS GUIDELINES

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Foreword

An upsurge in commercial unmanned aerial vehicle (UAV) activity and an ever increasing number of manufacturers and operators has led to the establishment of these guidelines for Unmanned Aerial Systems (UAS). Since the terms Unmanned Aerial Vehicle, Unmanned Aircraft System and Remotely Piloted Aircraft (RPA) are often used synonymously, this document will use the term UAS to standardize and describe all unmanned aircraft systems. The intent of these guidelines is to consider the entire system, not just the vehicle when operating UAS. The UAS has four subsystems: aircraft, data links (control and return), ground control equipment, and the pilot/operator. In general, UAS operations can occur within visual line of sight (VLOS), extended visual line of sight (EVLOS) (within electronic line of sight of the ground control station), or beyond visual line of sight (BVLOS).

UAS may be controlled manually by a pilot or autonomously through use of programming and autopilot and can vary in size from those weighing less than a pound to some the size of a commercial jet. Regardless of the size, the basic guidelines outlined below should be considered. They are not an exhaustive list nor should they be considered the only source to reference. All UAS operators should ensure their UAS operations meet all applicable legal requirements and are consistent with industry guidance. Also, UAS operations should be incorporated into a Safety Management System (SMS) consistent with the Oil and Gas Producer's Aircraft Management Guidelines (AMG). Although many of the elements in these UAS guidelines can be incorporated directly into a Safety Management System, they do not constitute a complete SMS. The UAS operator should maintain a comprehensive SMS that seamlessly integrates UAS operations.

These guidelines are intended to provide information for personnel seeking UAS services or those desiring information to help manage service providers operating a UAS. They will be kept under review and updated and changed as necessary.

General Operating Rules

1. UAS should be operated in accordance with all applicable local, state and federal regulatory requirements, including Section 333 of the FAA Modernization and Reform Act of 2012 “Special Rules for Certain Unmanned Systems”.
    a. Offshore UAS operations in support of oil and gas should be in compliance with the above regulatory statue. Also, offshore UAS operators should comply with additional USCG, EPA and BSEE applicable requirements as well.
    b. A Notice to Airman (NOTAM) should be issued for the affected airspace of UAS operations where required by the regulatory authority. NOTAMs should be filed by the pilot in command (PIC).
    c. HSAC NOTAM guidance and other applicable Recommended Practices should be adhered to for UAS operations that could pose a potential hazard to manned aircraft operations.
    d. Operating documents: Operators should maintain documentation of system operating certification, flight operations manual and FAA pilot certifications (as required) for each operation at the point of control of the UAS operation.
    e. All UAS operations should avoid overflight of personnel not involved in the operation.
    f. In situations where manned aircraft pose a potential conflict with UAS operations, manned aircraft have the right-of way and UAS operations should be terminated until the potential conflict has passed.
2. Where UAS operations may be operated in the vicinity of facilities where explosive vapors may be present, the business line organization chartering/using the UAS will determine if the UAS will be required to be intrinsically safe (explosion proof). This issue should be included in the risk assessment.
3. CERTIFICATES OF INSURANCE: The contracting company should determine the level of insurance specified by the UAS contractor is in line with company risk management guidelines.
4. All UAS should use “sense and avoid” technology on the aircraft and a mode “S” or ADS-B capable transponder whenever practical and allowed by the FAA. Light UAVs (less than 15 pounds without fuel) operating within visual line of sight below 400 feet are exempted from this policy, but should have a designated visual observer to provide a similar level of safety to sense and avoid hazards (see paragraphs 8-12 below).
5. All UAS should be in airworthy condition and have a continuing airworthiness program to conduct flight operations in the National Airspace System (NAS). All UAS should be accepted as airworthy by the FAA. In cases where there are no applicable regulatory standard available to determine airworthiness, the operator should assert an equivalent level of safety to manned aircraft will be provided through adherence to maintenance and safety checklist usage standards prescribed in this document in addition to compliance with manufacturer guidance.
6. Essential elements of a continuing airworthiness program include a maintenance training program, unique skills or maintenance practices relating to their aircraft and a process to report applicable data relating to the maintenance of an operation.

Operations

1. All UAS operations should be controlled by a Pilot in Command (PIC). Completely autonomous UAS operations should not be conducted. A PIC may control more than one UAV, depending on the level of autonomy.
2. Where UAS operations are conducted in civil airspace utilized by manned aircraft, the PIC should be a certificated private or commercial pilot in manned aircraft.
3. A safety case should be submitted by the operator to the responsible party addressing the ratings of the PIC as it relates to the UAS operation being considered.
4. The potential to interact with manned aircraft, applicable civil aviation requirements, the size and capability of the UAS platform and the risk of the overall operation should be primary considerations in the type of certificate the PIC should hold.
5. Supplemental Pilots. Supplemental pilots are those pilots assigned UAS flight duty to augment the PIC. It is common for operators to have both an internal and an external UAS pilot. The supplemental pilot can assume either of these positions.
6. Supplemental pilots should have, at a minimum, successfully completed private pilot ground school and passed the written test or FAA-recognized equivalents.
7. Recent Pilot Experience. The operator/applicant should provide a process that ensures that pilots maintain an appropriate level of recent pilot experience for the position they are assigned in the UAS being operated.
8. Medical. Supplemental pilots should maintain, at a minimum, a valid FAA second-class medical certificate issued under part 67 or the FAA-recognized equivalent.
9. Visual Line of Sight (VLOS).
    a. Operating within Visual Line of Sight means that the PIC or visual observer is able to maintain direct, unaided (other than corrective lenses) visual contact with the unmanned aircraft, which is sufficient to monitor its flight path in relation to other aircraft, persons, vessels, vehicles and structures for the purpose of avoiding collisions. VLOS operations are normally accepted out to a maximum distance of one-half nautical mile horizontally and 400 ft. vertically from the UAS pilot.
10. Extended Visual Line of Sight (EVLOS).
    a. EVLOS operations are operations where the PIC is still able to comply with his collision avoidance responsibilities, but the need for the remote pilot to maintain direct visual contact with the unmanned aircraft is addressed via other methods or procedures. It is important to note, however, that collision avoidance is still achieved through 'visual observation' (by the PIC and/or UAS Observers.) All UAS operations should occur within VLOS, or EVLOS range. Operations beyond visual line of sight are not recommended unless an approved method of aerial separation and collision avoidance exists and the operations are in accordance with the FAA's requirements.
    b. The operator should submit a safety case including a risk assessment for the EVLOS operation. Factors taken into consideration should include:
        i. The procedures for avoiding collisions

ii. Aircraft size and configuration

iii. Aircraft color and markings

iv. Aircraft aids to observation

v. Meteorological conditions and visibility, including background conditions (cloud/blue sky)

c. The use of deployed observers

d. Operating range limits - suitable radio equipment should be fitted in order to be able to effect positive control over the unmanned aircraft at all times

e. Contingency plans for loss of link event

11. UAS operations (including night operations) should utilize one or more trained visual observers to assist the PIC with see-and-avoid responsibilities by scanning the area around the aircraft for intruder traffic and assisting the PIC with navigational awareness. The visual observer(s) should have a reliable method of instantaneous communications with the PIC such as two-way radios. Cellular phones are not considered reliable for this purpose. The PIC and visual observer(s) together should have a view of the area that is sufficient to allow enough time for the PIC to de-conflict as required.

12. Spacing multiple visual observers and/or antennae's in a linear manner ("daisy chaining") to increase operational distance beyond should generally be avoided; however, operations involving "daisy-chaining" observers/antennae may be permitted if an acceptable safety case is presented by the operator demonstrating the risks are sufficiently managed. These operations would normally fall under Extended Visual Line of Sight (EVLOS) or Beyond Visual Line of Sight (BVLOS) regulations. EVLOS operations are normally beyond a distance of 500 meters horizontally and 400 ft. vertically from the Remote Pilot.

    a. When multiple visual observers are being used, it is important for the PIC to know which visual observer(s) have direct visual contact on the aircraft.

13. Visual observers should:

    a. Be in communication with PIC either within speaking distance or with a portable radio.

    b. Be trained in areas such as aviation terminology, Visual Flight Rules (VFR), airspace requirements and applicable aviation regulatory requirements.

    c. Keep the pilot informed of possible hazards (power lines, crane/venting booms, birds, other aircraft, approaching workboats (when working underneath facility), and weather conditions;

    d. Establish an observation position having a clear view of the UAS operating area

    e. Meet any medical or physical requirements mandated by the appropriate civilian regulatory authority. (i.e. FAA class II medical exam)

    f. Be designated as such and not share in any other duties associated with the flight.

    g. Be briefed on lost communications procedures prior to the flight.

14. Weather Observation.

    a. A reliable method of determining wind speed, ceiling and visibility should be used.

    b. Weather observations should be taken near enough to the operation that it is certain that they

are valid; for example, an airport's observations can be used if the airport is within several miles and the conditions appear to be uniform.

c. Ceiling may be determined by the temperature/dew point spread.

15. Night Operations.

    a. Night operations may be considered if the operator provides a safety case and sufficient mitigation to avoid collision hazards at night. External pilots and observers should be in place 30 minutes prior to night operations to ensure dark adaptation.

16. Experience/currency: The UAS operators should provide documentation showing the pilots maintain an appropriate level of recent pilot experience in the UAS being operated or in a flight simulation training device (FSTD). At a minimum, the PIC should conduct three takeoffs (launch) and three landings (recovery) in the specific UAS within the previous 90 days, or as prescribed by the operator/applicant's recurrent training and currency program. This does not apply when the PIC is not required to be involved in the launch and recovery of the UAS operation. In addition to the training required for a pilot certificate, UAS PICs should have the following additional training (or FAA-recognized equivalent):

    a. Normal, abnormal, and emergency procedures in all specific details of the UAS being operated;

    b. Manufacturer-specific training (or an FAA accepted equivalent);

    c. Demonstrated proficiency; and

    d. Defined interval testing on the UAS being operated (i.e. semi-annual, quarterly, etc.).

17. Only the PIC should conduct radio communications. The PIC should follow the radio communications protocol appropriate to the airspace. Where communications are not specifically required by FAA regulations, such as in uncontrolled airspace (Class G), the PIC should announce on appropriate CTAF frequency prior to launch, just after launch, periodically during operations, and after landing. Announcements should include at least:

    a. Unmanned" followed by the aircraft type and registration number; e.g. "Unmanned Puma 205AV".

    b. Location of the aircraft with reference to a NAVAID, airport, or VFR reporting point.

    c. Trajectory and speed or, if remaining in a localized area, the radius of that area.

    d. Range of altitudes.

18. All operators should have a flight operations manual approved by a competent authority: at a minimum, the manual should include procedures and checklist information for pre-flight, in flight, post flight, emergency procedures, and limitations. The operations manual should also include information on aircraft systems and performance.

19. Notification to other potential users of the airspace and appropriate regulatory authorities should be issued with ample time for those operators/regulators to plan appropriately. Ensure no simultaneous operations between UAS and manned aircraft are planned in same area. The following should take place prior to operations.

    a. File NOTAMs

    b. Notify local airspace users (in addition to NOTAM). Include at least:

        i. Date and time range

ii. Precise location

iii. Altitude range

iv. Aircraft type and description (what to look for)

v. Frequencies monitored and call sign

vi. Contact information to coordinate, deconflict and exchange other information.

NOTE:
For UAS operations occurring in the vicinity of Gulf of Mexico facilities the BSEE and USCG should be notified and whether or not the helideck will be closed.

Notifying BSEE directly of UAS operations may allow the scheduling/rescheduling of inspections to avoid facilities that have ongoing UAS operations. The HSAC NOTAM guidance and other applicable Recommended Practices should be adhered to for UAS operations that could pose a potential hazard to manned aircraft operations

20. All UAS operations should include a pre-flight brief. The briefing should include at a minimum:
    a. Mission overview
    b. Hazards unique to the mission (including potential sources of interference)
    c. Check and brief applicable NOTAMs
    d. FSS/ATC notifications.
    e. Identify any special airspace and restrictions. (i.e. VFR corridors, TFRs, MOAs etc.)
    f. De-confliction plans for intruding aircraft.
    g. Weather (current and forecast ceiling, visibility and winds).
    h. Mission altitude.
    i. Lost Link, divert and flight termination procedures.
    j. Identification of any public or residential areas near flight path and privacy concerns.
    k. Flight time and fuel/battery requirements.
    l. Fuel reserves/minimum voltage requirements.
    m. Frequencies to be used.
21. Immediately prior to each launch, the PIC should:
    a. Perform a pre-flight inspection/checklist
    b. Visual inspection of airframe condition;
    c. Run system diagnostics
    d. Conduct engine run test;
    e. Check battery, sensors, etc;
    f. Verify communications with the visual observer(s) and confirm that there is no conflicting air traffic.
22. The use of cell phones and other electronic devices during flight operations should be restricted to

communications pertinent to the operational control of the UA and any required communications with Air Traffic Control. Cell phones should not be used as the primary means of communications between visual observers and pilots.

23. All UAS operations should be conducted with sterile cockpit procedures during critical phases of flight. These include: taxi and ground operations involving aircraft movement, take-off and landing, as well as all other flight operations in which safety or mission accomplishment might be compromised by distractions.
24. Lost Link Procedures.
    a. There are many acceptable approaches to satisfy lost link requirements. The intent of any lost link procedure is to ensure airborne operations remain predictable.
    b. Lost link procedures should comply with any regulatory requirements and the lost link solution will need to comply with the last Air Traffic Control (ATC) clearance if applicable.
    c. The appropriate ATC facility should be notified immediately if applicable.
    d. Lost link procedures should avoid flight over any populated areas and hazards, as well as any frequently travelled flight paths.
    e. The time and duration of each lost link event should be recorded by the operator and reported through the incident reporting process.
    f. The designated return site should be clear of any personnel and hazards in the event of an immediate lost link return to base and landing.

Maintenance

1. A maintenance program should be in place to ensure the airworthiness of any UAS being utilized. Maintenance be performed in accordance with manufacturer recommendations and only by properly trained and certified personnel. This program should comply with all governing regulations and policy. The program should, at a minimum:
    a. Have a maintenance policy and a procedures manual approved by a relevant authority.
    b. Be certified by the aircraft manufacturer.
    c. Include a pre-flight and post flight inspection of the vehicle and have an associated logbook to track inspections
    d. Include a pre-flight and post flight inspection of the ground control station.
    e. Incorporate a logbook to track flight hours and any inspection replacement times and life limited items. (i.e. batteries, rotors)
    f. Software and hardware changes should be documented as a part of the maintenance procedures.
    g. Maintain a record of malfunctions (i.e. loss of link), anomalies and damaged parts.
    h. Maintenance training and evaluation program for each operated system.
    i. A quality assurance (QA) program should be utilized as a part of the overall safety management system (SMS).

j. Include both field and depot level maintenance intervals.

2. It is highly recommended that all UAS operators provide the following information:
    a. A Continuing Airworthiness Program.
    b. A maintenance training program.
    c. Any unique skill sets or maintenance practices relating to their aircraft and/or aircraft operations that may be outside the current scope and practices of manned aviation.
    d. A process to report any applicable data relating to the operation and maintenance of the UAS.
3. A minimum essential subsystem list (MESL) or similar list should be established for the entire system. The MESLs lay the ground work for reporting the status of aircraft, ground control station and communications link availability. They list the minimum essential systems and subsystems that should work on an aircraft, ground control station and communications. The MESL should include required equipment necessary for the specific mission and can include items such as ground control stations, sensors, back-up power supplies, aircraft lighting systems, transponder, back –up antennas, etc.

Training

1. UAV pilots should meet applicable FAA licensing, training and testing requirements for each class or type of UAS they will operate. The licensing should be appropriate and as required by aircraft type certification or determination of airworthiness. UAS type or class ratings may be determined on the basis of individual type in the case of larger aircraft, or by class for smaller ones under 55 pounds.
2. All operators should have a training program to verify the air crew and observers meet the applicable requirements of the governing aviation regulator. The training program should be appropriate for each aircrew role, the environment and mission the operator is expected to perform.
3. The training program at a minimum should cover currency, evaluation, emergency procedure proficiency, systems knowledge and specialized tasks.
4. Training requirements should exist for the specific UAS on unmanned vehicles over 55 pounds maximum takeoff weight (MTOW), however training programs on UAS under 55 pounds MTOW can be designed for similar types of systems (i.e. quadcopters under five pounds).
5. All training programs should comply, or be consistent with manufacturer's recommended training programs.

Communications

1. The communications control links are essential with all UAS operations. UAS should be operated in a reliable radio frequency environment that minimizes the probability of lost link and Radio Frequency (RF) interference with nearby systems. UAS operators should have a valid communications plan that considers:
    a. Every effort is made to ensure positive control of the UAS at all times
    b. A spectrum or RAIM analysis to determine frequency strength, integrity, and areas of possible interference prior to UAS operations. The UAS should be operated in strict compliance with all provisions and conditions contained within the spectrum analysis assigned and authorized

c. At a minimum, sources of possible radio frequency (RF) interference such as microwave antennas and high voltage lines should be identified and assessed prior to commencing operations.

d. Encryption of all command and return links when possible, or when sensitive information is being collected.

e. All frequencies used to support safety-critical UAS functionality have been coordinated and licensed in accordance with the appropriate licensing regime.

f. Quick access to back-up ground control systems.

g. Immediate availability of secondary power supplies for the GCS and all antennas.

h. Safe recovery of the vehicle in the event of loss of link.

Hazard Identification and Safety

1. The UAS operator should have in place a Safety Management System (SMS) that is consistent with the SMS recommendations in the Oil & Gas Producers Aviation Management Guidelines.
2. The UAS operators should have an incident reporting system that tracks and reports all mishaps, potential mishaps, control link events, and near misses. This system should provide for analysis and improvements made as a part of the operator's Safety Management System (SMS). All mishaps, incidents and anomalies should be tracked and reported to the respective entity's aviation advisor and civilian aviation authorities when necessary.
3. Appropriate air traffic control should be immediately notified in the event of any emergency, loss of command link, loss of visual contact, or any other malfunction that would impact safety or operations.
4. All UAS operators should be equipped with any specialized equipment that may be required in the event of a mishap. For example, some composite material may require specific handling and equipment when the integrity of the composite is compromised.
5. Consideration should be given towards using UAS with redundant controls, automatic flight termination and/or flight recovery systems when operating near populated areas or sensitive infrastructure.
6. The UAS operator should have an established hazard register and hazard identification process. A hazard analysis should be completed prior to beginning flight operations in a new location, or when a new UAS is employed at an existing location. All risks should be evaluated according to a Risk Assessment Matrix (RAM), and the results of any risk controls should be evaluated through a Gap Analysis process.
7. Crew rest and crew mission day requirements, including consecutive days worked should be consistent with the Oil and Gas Producer's (OGP) Aircraft Management Guidelines (AMG) section 5.6.4 and compliant with applicable regulatory requirements. No PIC or reserve pilot should be at the controls of an UAS for more than eight (8) hours in one day to include no longer than three (3) hours in succession. UAS crews should have the opportunity of no less than twelve (12) hours of uninterrupted rest prior to flight operations.

    a. UAS service providers should have a comprehensive aircrew fatigue management program as a part of their Safety Management Systems.

Emergency Response Planning

1. A formal emergency response plan should be in place for all flight operations. An incident response checklist, approved as part of the flight operations manual, should be followed in the event of an incident or accident.

Battery Handling

1. All UAS operators should have a battery safety program that includes:
    a. Documentation with appropriate Safety Data Sheets included in the aircraft flight manual, battery tracking systems and battery log books.
    b. Battery storage plans that include storage and charging in fire proof containers.
    c. Battery inspection procedures and requirements.
    d. Procedures for thermal runaway, determination of battery pack capacity
    e. Recommended procedures for safe transportation of the batteries that are compliant with applicable regulations and work site requirements.

DEFINITIONS

The following definitions are used by the FAA's Unmanned Aircraft Systems (UAS) Integration Office and many UAS organizations to describe relevant differences between UAS operations and those of manned aircraft. Other organizations, such as the International Civil Aviation Organization (ICAO) and RTCA, Inc., have also developed acronyms and definitions which may differ from those used by the Federal Aviation Administration (FAA). Aviation safety inspectors (ASI) may wish to refer to the current version of ICAO Circular 328, Unmanned Aircraft Systems (UAS) and RTCA Guidance DO-304, Guidance Material and Considerations for Unmanned Aircraft Systems, until harmonization of terminology is achieved.

1. Aircraft. A device used or intended to be used for flight in the air, including unmanned aircraft (UA).
2. Airworthiness. A condition in which the UAS (including the aircraft, airframe, engine, propeller, accessories, appliances, and control station (CS)) conforms to its type certificate (TC), if applicable, and is in condition for safe operation.
3. Airworthiness Certification. A repeatable process that results in a documented decision that an aircraft system has been judged to be Airworthy. It is intended to verify that the aircraft system can be safely maintained and safely operated by fleet pilots within its described and documented operational envelope.
4. Airworthiness Statement. Document required from public UAS applicants during a Certificate of Waiver or Authorization (COA) application process which confirms aircraft airworthiness.
5. Certificate of Waiver or Authorization (COA). An FAA grant of approval for a specific operation. COAs may be used as an authorization, issued by the Air Traffic Organization (ATO), to a public operator for a specific UA activity. COAs for civil and commercial operations are only for aircraft that have received an airworthiness certificate from Aircraft Certification Service (AIR). Provisions or limitations may be imposed as part of the approval process to ensure the UA can operate safely with other airspace users.
6. Chase Aircraft. A manned aircraft flying in close proximity to a UA that carries a qualified observer and/or UA pilot for the purpose of seeing and avoiding other aircraft and obstacles.
7. Civil Aircraft. Aircraft other than public aircraft.
8. Congested Area. A congested area is determined on a case-by-case basis. The determination should take into consideration all circumstances, not only the size of an area and the number of homes or structures (e.g., whether the buildings are occupied or people are otherwise present, such as on roads).
9. Cooperative Aircraft. Aircraft that have an electronic means of identification (i.e., a transponder or Automatic Dependent Surveillance—Broadcast (ADS-B) transceiver) aboard in operation.

10. Crewmember (UAS). In addition to the crewmembers identified in Title 14 of the Code of Federal Regulations (14 CFR) part 1, a UAS flight crew member includes pilots, sensor/payload operators, and visual observers (VO), but may include other persons as appropriate or required to ensure safe operation of the aircraft.
11. Crew Resource Management (CRM). The effective use of all available resources including human, hardware, and information resources.
12. Daisy-Chaining. The use of multiple, successive observers to extend the flight of a UA beyond the direct visual line-of-sight of any other pilot in command (PIC) or VO.
13. Due Regard. A phase of flight wherein an aircraft commander of a State-operated aircraft assumes responsibility to separate his or her aircraft from all other aircraft.
14. Experimental Certificate. A type of Special Airworthiness Certificate issued for the purposes of research and development (R&D), crew training, exhibition, and market survey as defined in 14 CFR part 21, § 21.191(a), (c), and (f). (NOTE: According to 14 CFR part 91, § 91.319(a)(2), experimental aircraft may not be used for carrying persons or property for compensation or hire.) Commercial UAS operations cannot be conducted with an experimental certificate.
15. External Pilot. A UAS pilot who flies from outside a control station with direct visual contact with the aircraft.
16. FAA-Recognized Equivalent. An FAA recognition that a public agency may exercise its own internal processes regarding airworthiness and pilot, aircrew, and maintenance personnel certification and training; furthermore, the agency has determined that its UAS is capable of safe operation in the National Airspace System (NAS) when conducting public aircraft operations under Title 49 of the United States Code (49 U.S.C.) §§ 40102(a)(41) and 40125.
17. Flight Termination. The intentional and deliberate process of performing controlled flight into terrain (CFIT). Flight termination should be executed in the event that all other contingencies have been exhausted, and further flight of the aircraft cannot be safely achieved, or other potential hazards exist that require immediate discontinuation of flight.
18. Flyaway. An interruption or loss of the control link, or when the pilot is unable to effect control of the aircraft and, as a result, the UA is not operating in a predicable or planned manner.
19. Internal Pilot. A UAS pilot who flies from inside a control station without direct visual contact with the aircraft.
20. Lost Link. The loss of command-and-control link contact with the remotely piloted aircraft such that the remote pilot can no longer manage the aircraft's flight.
21. Non-Cooperative Aircraft. Aircraft that do not have an electronic means of identification (e.g., a transponder) aboard or that have inoperative equipment because of malfunction or deliberate action.

22. Observer. A trained person who assists a UAS pilot in the duties associated with collision avoidance and navigational awareness through electronic or visual means. Collision avoidance includes, but is not limited to, avoidance of other traffic, clouds, obstructions, terrain and navigational awareness. A visual observer (VO) is a trained person who assists the UAS pilot by visual means in the duties associated with collision avoidance. A VO includes the OPA pilot when the OPA is being operated as a UAS.
23. Off-Airport. Any location used to launch or recover aircraft that is not considered an airport (e.g., an open field).
24. Optionally Piloted Aircraft (OPA). An aircraft that is integrated with UAS technology and still retains the capability of being flown by an onboard pilot using conventional control methods (see OPA Safety Pilot, below).
25. OPA Safety Pilot. The PIC that is responsible for ensuring the safe operation of an Optionally Piloted Aircraft (OPA), whether under remote control or onboard control, for the purposes of overriding the automated control system in the case of malfunction or any other hazardous situation.
26. Pilot Duty Period. The period beginning when a flight crew member is required to report for duty with the intention of conducting a flight and ending when the aircraft is parked after the last flight. It includes the period of time before a flight or between flights that a pilot is working without an intervening rest period.
27. Pilot in Command (PIC). The person who has final authority and responsibility for the operation and safety of flight, has been designated as PIC before or during the flight, and holds the appropriate category, class, and type rating, if applicable, for the conduct of the flight. The responsibility and authority of the PIC as described by § 91.3 apply to the UA PIC. The PIC position may rotate duties as necessary with equally qualified pilots. The individual designated as PIC may change during flight. (NOTE: The PIC can only be the PIC for one aircraft at a time. For an OPA, the PIC should meet UAS guidance requirements for training, pilot licensing, and medical requirements when operating an OPA as a UAS.)
28. Safety Risk Management (SRM). A formalized, proactive approach to system safety. SRM is a methodology that ensures hazards are identified; risks are analyzed, assessed, and prioritized; and results are documented for decision-makers to transfer, eliminate, accept, or mitigate risk.
29. Scheduled Maintenance (Routine). The performance of maintenance tasks at prescribed intervals.
30. Supplemental Pilot. Pilots assigned UAS flight duties to augment the PIC. It is common for operators to have both an internal and an external UAS pilot. The supplemental pilot can assume either of these positions. The supplemental pilot may also assume duties of the PIC if the specified qualifications are met.

31. Unmanned Aircraft (UA). A device used or intended to be used for flight in the air that has no onboard pilot. This device excludes missiles, weapons, or exploding warheads, but includes all classes of airplanes, helicopters, airships, and powered-lift aircraft without an onboard pilot. UAs do not include traditional balloons (refer to 14 CFR part 101), rockets, and unpowered gliders.
32. Unmanned Aircraft System (UAS). A UA and its associated elements related to safe operations, which may include control stations (ground-, ship-, or air-based), control links, support equipment, payloads, Flight Termination Systems (FTS), and launch/recovery equipment.
33. Unscheduled Maintenance (Nonroutine). The performance of maintenance tasks when mechanical irregularities occur.
34. Visual Line of Sight (VLOS). Unaided (corrective lenses and/or sunglasses exempted) visual contact between a PIC or a VO and a UA sufficient to maintain safe operational control of the aircraft, know its location, and be able to scan the airspace in which it is operating to see and avoid other air traffic or objects aloft or on the ground

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