

Oregon State University (OSU) Unmanned Systems Flight Operations manual is designed to implement the policies and procedures for the utilization and implementation of research via unmanned aircraft. This policy is based upon OSU authority under the Federal Aviation Administration regulation Title 49 U.S.C. § 40102(a)(41).

Oregon State University

UAS Operations Manual

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Record of Changes

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| --- | --- | --- | --- |
| No. | Date of Change | Change | Initials |
| Org. | 2/1/16 | N/A | - |
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|  |  |  |  |

Mark Peters

**Interim Director Research Integrity &**

**International Compliance Officer**

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Terms and Abbreviations

ATC – Air Traffic Control

OSU – Oregon State University

AV - Air Vehicle

ARTCC – Air Route Traffic Control Center

DCP – Divert / Contingency Point

GS – Ground Station

ISRB – Independent Safety Review Board

FPG – Flight Planning Guide

FRR – Flight Readiness Review

LLP – Lost Link Point

PIC – Pilot in Command - The UAS PIC is the sole and final authority for the safe operation of the UAS. The UAS PIC shall only operate one UAS at a time. The PIC is responsible for ensuring all crew members understand and can properly perform their specific roles for the flight. A PIC shall be determined and briefed prior to each flight.

OC – Operations Coordinator – The UAS Operations Coordinator is responsible for oversight of all UAS operations under any COA held by OSU. The OC is the final authority on all OSU specific policy as it pertains to UAS use. The OC will also be tasked with maintaining FAA compliance through monthly reporting, along with coordinating flights via the “Drone Complier” software. The position is currently held by the Interim Director Research Integrity Mark Peters.

PPURTC – Pan Pacific UAS Test Range Complex

ROM – Range Operations Manager

RSM – Range Safety Manager

SMS – Safety Management System

TCAS – Traffic Collision Avoidance System

UA – Unmanned Aircraft

UAS – Unmanned Aerial System

VO – Visual Observer - The UAS Observers are responsible for assuring visual separation between the UA and any other air traffic. The visual observers shall maintain direct two-way communication with the UAS PIC either through direct voice, or radio communications. A visual observer shall only be responsible for one UAS at a time.

1. General
	1. Purpose
		1. This document is to support the activities of OSU Unmanned Air System (UAS) operations, it is designed to govern the operations under the authority of OSU and the FAA. It provides the guidance and support to enable students and researchers to fulfill their requirements under the authority that is delegated to the university by the FAA as a public entity.
	2. Distribution
		1. This manual is to be assigned for any and all personnel who are utilizing unmanned aircraft for any university sponsored activity. A printed or hard copy will be maintained at the office of the OC at A312 Kerr Administration, and digital copies will be made available through OSU distribution servers and authorized cloud enabled devices.
	3. Revision Control
		1. Each revision will be approved by the OC, with final authority to approve changes and submissions to this document. Each revision will have a separate consecutive number.
		2. Each document holder will have the responsibility to ensure compliance with this document and ensure their manuals and records are kept current in accordance with the changes and policies established through this operations manual.
		3. Revision Naming - Each revision will have the following information associated with each change:
			1. Section and Page
			2. Revision Number
			3. Date
	4. Organization
		1. Org Chart
		2. Insert Org Chart
	5. Management Personnel
		1. Insert Program Personnel and Authorities/Responsibilities
2. UAS Operational Integrity
	1. Accountability
		1. Legal Compliance
		2. All UAS operations are mandated to comply with FAA regulatory and legal policies as well as any state and local policies that may affect the operations as listed in this document. This document is intended as a guidance document and may not appropriately address regional or international UAS operations legalities and it is up to the individual Pilot in Command to ensure compliance.
	2. Liability
		1. OSU maintains authority to release the FAA of any liability for UAS operations by self-declaring airworthiness for public aircraft operations. Unapproved UAS operations that occur outside of the authorized use or flight capabilities of the air vehicle will not be covered under the university liability policy.
	3. Record Retention
		1. OSU UAS operations are required to maintain and keep all records of each UAS and each flight operation for no more than 5 years.
3. Privacy
	1. General
		1. As a public institution the UAS flight operations occur under authority as a public entity. OSU is responsible for compliance with all Federal, State, and local laws as they pertain to privacy laws.
		2. Information Collection
			1. Browsing OSU web content including the “Drone Complier” software website is done so anonymously. General, non-identifying information such as IP addresses are collected to track browsing patterns and usage to better maintain our online infrastructure. OSU websites also employ the use of “cookies” to assist in site security. These cookies are discarded as soon as you close your browser or sign off. We do not collect any persistent cookies.
		3. Disclosure
			1. Oregon State University adheres to all State and Federal statutes and regulations that prohibit information disclosure for students, employees and other constituents. Oregon State University will not sell, trade, or otherwise disclose any person identifiable information in any manner that is not in conformity with applicable State or Federal statutes. Oregon State University takes appropriate steps to communicate all privacy policies and guidelines to all employees.
			2. Freedom of Information
				1. As a public university OSU complies with the Freedom of Information Act, 5 U.S.C. § 552, originally passed in 1966. Any information collected by UAS operations that falls under public domain will remain publicly accessible by request.
4. Reporting Requirements
	1. All flights conducted under any COA held by the University will be logged through the “Drone Complier” software. Flight logs will include the following relevant information will be collected for every flight and be submitted monthly to the FAA.
		1. PIC
		2. VO
		3. Aircraft N Number
		4. Date and Time
		5. Flight Duration
		6. Maintenance Issues and Status
5. UAS Test Procedures
	1. Purpose
		1. Each mission shall have the following relevant information
			1. Grant, Project, or Customer
			2. Platform approved for operation
			3. Location Identified
			4. Mission Goal Established
	2. Drone Complier
		1. Each flight will be performed in accordance with the “Drone Complier” software. This software is designed to support in lieu of a published flight planning guide. It is not a user’s manual or operations manual. For each UAS it will be the responsibility of the Pilot in Command to ensure compliance with manufacture limitations and certifications.
		2. The “Drone Complier” software will be updated with current flight plan information and is to be used to ensure compliance with OSU and FAA policy. The following documentation will be available to all PICs through the “Drone Complier” software.
			1. Aircraft specific user manuals
			2. OSU official UAS policy
			3. Flight plan details
			4. Flight logs
	3. Flight Approvals
		1. Each flight will have the following approved documents
			1. Test Plan
			2. Signed LOI for approved flight operations
			3. COA
			4. Designated Pilot in Command
6. Safety
	1. Safety Data Collection and Processing System (SDCPS)
		1. Data collection and processing will be conducted through the “Drone Complier” software. See section 5.2.
	2. Anonymous Safety Reporting Form
	3. Five Steps of Risk Management
		1. Identify the hazards
		2. Assess the hazards
		3. Develop controls and make decisions
		4. Implement controls
		5. Supervise and evaluate
	4. Risk Mitigation
		1. Safety Management System
			1. The SMS is composed of five functional components:
				1. Safety policy
				2. Procedures and Checklists
				3. Safety Risk Management
				4. Safety Assurances – ISRB / Flight Readiness Review
				5. Safety Data Collection and Reporting System (SDCRS)

Data collection and reporting will be conducted through the “Drone Complier” Software.

* 1. Safety Promotion
		1. Safety Policy – The OSU Standard Operations Procedure Manual is the source document for all operational policies and procedures. The “Drone Complier” software will provide supplementary support documentation. The Procedure Manual and all supporting documentation undergo management review, version control, and are subject to approval by the OC prior to operations.
		2. Procedures and Checklists - Shall be followed for every mission and every PIC shall be fully trained and be the only authorized operator of the air vehicle.

| Risk Probability |
| --- |
| Likelihood | Meaning | Value |
| Frequent | Likely to occur many times (has occurred frequently) | 5 |
| Occasional | Likely to occur sometimes (has occurred infrequently) | 4 |
| Remote | Unlikely to occur (has occurred rarely) | 3 |
| Improbable | Very unlikely to occur (not know to have occurred) | 2 |
| Extremely improbable | Almost inconceivable that the event will occur | 1 |

* + 1. Safety Risk Management – A comprehensive Safety Risk Management (SRM) approach shall be applied to every UAS operated by OSU. A risk analysis of every UAS shall be completed utilizing the “Drone Complier” software. The risk assessment includes guidance for the identification of risks, the creation of a hazard register for each of the identified risks. Utilizing a Risk Matrix, each risk shall be quantified and accounted for by the CO.
	1. Risk Assessment
		1. The following tables shall be used to assess mission risk.
		2. Risk Management Criteria

| Risk Probability | Risk Severity |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Catastrophic****A** | **Hazardous****B** | **Major****C** | **Minor****D** | **Negligible****E** |
| Frequent | **5** | **5A** | **5B** | **5C** | **5D** |
| Occasional | **4** | **4A** | **4B** | **4C** | **4D** |
| Remote | **3** | **3A** | **3B** | **3C** | **3D** |
| Improbable | **2** | **2A** | **2B** | **2C** | **2D** |
| Extremely improbable | **1** | **1A** | **1B** | **1C** | **1D** |

| Risk Severity |
| --- |
| Severity | **Meaning** | **Value** |
| Catastrophic |  Equipment destroyed Multiple deaths | A |
| Hazardous |  A large reduction in safety margins, physical distress or a workload that the operators cannot be relied upon to perform their tasks accurately or completely Serious injury Major equipment damage | B |
| Major |  A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of an increase in workload or as a result of conditions impairing their efficiency Serious injury Injury to persons | C |
| Minor |  Nuisance Operating limitations Use of emergency procedures Minor incident | D |
| Negligible |  Few consequences | E |

* + 1. Criteria that must be met:
			1. Hazards identified
			2. Hazards assessed
			3. Control measures and risk decisions
			4. Hazard controls

| Risk Tolerability |
| --- |
| Risk index range | Description | Recommended action |
| 5A, 5B, 5C, 4A, 4B, 3A | **High Risk** | Cease or cut back operation promptly if necessary. Perform risk mitigation to ensure that additional or enhanced preventative controls are put in place to bring down the risk index to the moderate or low range. |
| 5D, 5E, 4C, 4D, 4E, 3B, 3C, 3D, 2A, 2B, 2C, 1A | **Moderate risk** | Schedule performance of a safety assessment to bring down the risk to the low range in viable |
| 3E, 2D, 2E, 1B, 1C, 1D, 1E | **Low Risk** | Acceptable as is. No further risk mitigation required. |

| Risk Acceptance |
| --- |
| Control/Barrier | High Risk(Intolerable) | Medium Risk(Incorporate Risk Reduction Measures) | Low Risk(Manage for Continuous Improvement) |
| Threat | ***Minimum of 3*** independent, effective controls/barriers to be place for each threat | ***Minimum of 2*** independent , effective controls/barriers for each threat | ***Minimum of 1*** effective control/barrier for each threat |
| Consequence Recovery | ***Minimum of 3*** independent, effective recovery measures for each consequence | ***Minimum of 2*** independent, effective recovery measures for each consequence | ***Minimum of 1*** effective recovery measure for each consequence |
| Escalation | ***Minimum of 2*** independent, effective controls/barriers for each escalation factor | ***Minimum of 1*** effective control/barrier for each escalation factor | ***Minimum of 1*** effective control/barrier for each escalation factor |

* + - 1. Supervision
			2. Casualty expectation criteria
			3. Property damage criteria
			4. Midair collision avoidance criteria
			5. Criteria for reliability and adequacy of safeguards
	1. System Safety
		1. **Airworthiness –** The OC shall determine the airworthiness of each UAS submitted for authorization to fly.
			1. Factors to analyze for the determination of UAS airworthiness
				1. System configuration
				2. Failsafe characteristics
				3. Equipment installations
				4. Training
				5. Flight testing
				6. Flight Operations checklists
				7. Communications / data links
				8. Automation levels
				9. Handling qualities
				10. Operating limitations
				11. Conditions for flight
		2. **System Maturity –** The OC may limit the operation of the UAS based on a Maturity Level determination. As UAS flights progress, a UAS may progress to higher maturity categories through the demonstration of specific exit criteria.
			1. The Four Maturity Levels are:
				1. **Unproven –** Unproven is a UAS that has minimal if any flights. Exit criteria for this level are: 5 consecutive takeoff, approach, and landing/recovery cycles over 5 separate test periods without a safety-of-flight critical failure or serious deviation from planned parameters
				2. **Experimental -** Experimental is a UAS that is active in developmental flight testing that has demonstrated the basic abilities to conduct test flights under specific conditions and has shown the system maturity to safely stay within the flight test boundaries. Exit criteria for this level are:

30 successful takeoff and landing cycles during a minimum of 15 separate test periods.

Ability of the UAS to perform safe flight under the control of the pilot.

Ability of the UAS to perform safe and controlled semi-autonomous and autonomous flight.

Ability of the UAS to perform emergency procedures

* + - * 1. **Provisional** – Provisional is a UAS that is fine-tuning the system elements of UAS safe flight of has added subsystems that enhance safety of flight. Exit criteria for this level are:
				2. UAS has shown the ability to consistently perform normal safe flight maneuvers and consistently remain within the designated set parameters of the system design throughout the full spectrum of design conditions.
				3. UAS has shown the ability to consistently and safely perform all emergency procedures in a variety of conditions.
				4. **Mature** – Mature is a UAS that has shown the ability to consistently and safely perform all emergency procedures in a variety of conditions.
1. FLIGHTCREW QUALIFICATIONS
	1. **Training Records –** OSU UAS users shall submit training records and other supporting documents to substantiate the experience and qualifications of all flight crew members involved with flight operations under any COA held by OSU. Copies of these records shall be kept on file by the OC.
	2. **Medical Certification –** All flight crewmembers involved with flight operations shall hold at least an FAA Class 2 medical certificate. Copies of these documents shall be kept on file by the OC.
	3. **UAS Pilot in Command –** The UAS PIC shall meet the requirements of the university policies and procedures. The UAS PIC shall also hold a valid FAA Class 2 medical certificate.
		1. The UAS PIC is responsible for ensuring that the visual observers are able to see the UAS throughout the entire flight, and are able to provide the PIC with the UA's flight path, and proximity to all aviation activities and other hazards (e.g., terrain, weather, and structures).
		2. PIC Recent Flight Experience (Currency).
			1. After designation, PICs must fly at least one 1-hour mission per 60 calendar days to maintain currency. If a PIC has not flown for 60 calendar days, a 1-hour refresher mission with an instructor, and a 1-hour simulator in UAS type, is required to regain currency. Instructors may regain currency by a 1-hour simulator in UAS type.
			2. For those operations that require a certificated pilot or FAA accepted agency equivalent, based on the application, the PIC must have flight reviews 14 CFR Part 61.56, and if the pilot conducts takeoff, launch, landing or recovery the PIC must maintain recent pilot experience in manned aircraft per 14 CFR Part 61.57; Recent Flight Experience: Pilot in Command.
			3. For operations approved for night or IFR through special provisions, the PIC must maintain minimum recent pilot experience per 14 CFR Part 61.57, Recent Flight Experience: Pilot in Command, as applicable.
	4. UAS Payload Operators and Other Crewmembers
		1. **UAS Visual Observer(s) -** UAS Visual Observer(s) shall complete the Visual Observer Training. UAS Visual Observers shall also hold a valid Class 2 medical certificate when required by a COA.
			1. The visual observers must be able to clearly communicate to the UAS PIC any instructions to remain clear of any conflicting traffic, using standard phraseology as listed in the Aeronautical Information Handbook when practical.
		2. **UAS Maintenance Officer** - The UAS maintenance officer shall be qualified to repair the air vehicle in accordance with manufacturer specified training and certifications.
	5. UAS AIRWORTHINESS
		1. Configuration Management - All UAS users shall have a configuration management process in place for hardware and software changes for their UAS. This configuration management process shall include logbooks for aircraft hardware and software changes and for control station hardware and software changes. These logbooks shall be made available for inspection by range personnel during flight authorization and during any period of flight operations.
	6. Major Hardware and Software Changes - Software changes to the aircraft or control station, as well as hardware system changes, are classified as major modifications or changes by the FAA. Any major modifications or changes to the aircraft or control station shall be approved prior to any follow on flight operation. A new airworthiness statement shall be generated by the OC, and be approved prior to conducting any flight operations.
	7. System Configuration Changes - All previously flight proven systems to include payloads, may be installed or removed as required, and that activity recorded in the unmanned aircraft and ground control stations logbooks by persons authorized to conduct UAS maintenance. Additionally, all payload configurations that do not modify the aircraft in any way and stay within the payload requirements and limitations as set forth by the aircraft COA are not considered major modifications. Such modifications may include similarly proportioned and weighted payloads with identical mounting methods. Describe any payload equipment configurations in the UAS logbook that will result in a weight and balance change, electrical loads, and or flight dynamics, unless the agency has a formal process, accepted by the FAA.
	8. Maintenance Records and Airworthiness Statement - For unmanned aircraft system discrepancies, a record entry should be made by an appropriately rated person to document the finding in the logbook. No flights may be conducted following major changes, modifications or new installations unless the party responsible for certifying airworthiness has determined the system is safe to operate in the NAS and a new AWR is generated, unless the agency has a formal process, accepted by OSU. The successful completion of these tests must be recorded in the appropriate logbook, unless the agency has a formal process, accepted by OSU.
2. FREQUENCY MANAGEMENT
	1. Frequency Licensing - UAS Operators are responsible for obtaining any necessary frequency licensing and authorization from the FCC prior as part of the flight authorization process. This will be done through the Federal Communication Commission Policy found in the General University Policies Manual.
3. Mission Planning
	1. Preflight Weather
		1. The UAS PIC shall gather observed and forecast weather conditions prior to conducting flight operations. This weather data shall be part of the preflight safety briefing.
	2. Daily Flight Operations Schedule
		1. The OC shall publish a schedule of all flight operations. The schedule shall be made available through the “Drone Complier” software and app.
	3. Notice to Airmen (NOTAM)
		1. A distant (D) NOTAM shall be filed by personnel for each flight operation. The NOTAM shall be filed through the Flight Service Station at (877) 487-6867 not more than 72 hours in advance, but not less than 24 hours prior to the flight operation, unless otherwise authorized as part of a special provision. The filing personnel shall provide the following information to the FSS:
			1. Name and address of the personnel filing the NOTAM
			2. Location and altitude of the operating area
			3. Time and nature of the activity
	4. Accident / Incident Reporting
		1. Immediately after an incident or accident, and before additional flight under this COA, the proponent must provide initial notification of the following to the FAA via the UAS COA On-Line forms (Incident/Accident).
		2. All accidents/mishaps involving UAS operations where any of the following occurs:
			1. Fatal injury, where the operation of a UAS results in a death occurring within 30 days of the accident/mishap.
			2. Serious injury, where the operation of a UAS results in a hospitalization of more than 48 hours, the fracture of any bone (except for simple fractures of fingers, toes, or nose), severe hemorrhage or tissue damage, internal injuries, or second or third-degree burns
			3. Total unmanned aircraft loss
			4. Substantial damage to the unmanned aircraft system where there is damage to the airframe, power plant, or onboard systems that must be repaired prior to further flight
			5. Damage to property, other than the unmanned aircraft.
		3. Any incident/mishap that results in an unsafe/abnormal operation including but not limited to:
			1. A malfunction or failure of the unmanned aircraft’s on-board flight control system (including navigation)
			2. A malfunction or failure of ground control station flight control hardware or software (other than loss of control link)
			3. A power plant failure or malfunction
			4. An in-flight fire
			5. An aircraft collision
			6. Any in-flight failure of the unmanned aircraft’s electrical system requiring use of alternate or emergency power to complete the flight
			7. A deviation from any provision contained in the COA
			8. A deviation from an ATC clearance and/or Letter(s) of Agreement/Procedures.
			9. A lost control link event resulting in
				1. Fly-away, or
				2. Execution of a pre-planned/unplanned lost link procedure.
	5. Flight Crew Duty Time
		* 1. All UAS operations shall be conducted in accordance with the following crew rest / duty guidelines:
				1. All UAS crewmembers shall have one 30 hour continuous period of off duty time in past 7 days
				2. All UAS crewmembers shall have a 10 hour uninterrupted period of scheduled rest prior to beginning any flight operation. The time available for sleep shall not be less than 8 hours.
	6. Substance Use
		1. Alcohol use – All university standards for the consumption of alcohol must be observed by all crew members to be eligible to participate in flight operations. Additionally all PICs must follow FAR 91.17 with the amendment of a 12 hour buffer period between the last felt effects of alcohol consumption and the first flight.
		2. Drug use – Official OSU policy prohibits the use of any federally recognized drug including marijuana. All flight crew members must follow OSU’s Drug Free Workplace policy to conduct flight operations.
	7. Stop Work Authority - All personnel regardless of position and relationship have stop work authority for which they can execute a stoppage of all operations for any condition they perceive to be unsafe. This can be done without retribution or reprimand to that individual.
	8. Focused Ground Station Procedures
		1. The UAS PIC is responsible for ensuring that proper ground station procedures are maintained during all Critical Phases of Flight. Critical Phases of Flight include all ground operations to include pre-launch or pre-takeoff checks, taxi, launch/take-off and landing/recovery, and all flight operations in which safety or mission critical accomplishment might be compromised by distractions.
			1. No crewmember may perform any duties during a critical phase of flight not required for the safe operation of the aircraft
			2. The use of cell phones or other electronic devices are restricted to communications pertinent to the operational control of the UAS and any required communications with Air Traffic Control.
4. Incident Response
	1. ATC must be immediately notified in the event of any emergency, loss and subsequent restoration of command link, loss of PIC or observer visual contact, or any other malfunction or occurrence that would impact safety or operations.
	2. Local Contact Numbers
		1. Fire – 9-1-1
		2. Medical – 9-1-1
		3. Police – 9-1-1
		4. Public Safety
			1. On campus - 541-737-7000
			2. Off campus - 7-7000
	3. ATC Communications
		1. The UAS PIC shall maintain direct, two-way communication with ATC, and have the ability to maneuver the AV in response to ATC instructions.
	4. Reporting
		1. In the event of an accident or incident the OC shall immediately be notified by involved personnel. For ongoing inflight emergencies, the OC shall ensure that appropriate procedures are being followed. For post-incident response the OC shall follow the Master Emergency Management Plan set forth by OSU.
		2. Emergency Reporting
			* 1. Type of UAS
				2. Last known location, or current location if applicable
				3. Last known course, or current course if applicable
				4. Estimated fuel or battery duration remaining
				5. Any Lost Link Points, Flight Termination Points
			1. ARTCC CONTACTS
				1. Seattle Center Manager– (253) 351-3520
				2. NAS Whidbey Island Range Scheduling Office (360) 257-2877/2502
				3. Flight Service Station – (800) 992-7433
			2. LOCAL AIRPORTS
			3. Bend
				1. Airport Manager: Gary Judd 541-389-0258
				2. AWOS- 134.425 (541-382-1477)
				3. CTAF/UNICOM- 123.0
			4. Redmond
				1. Airport Manager: Jeff Tripp 541-504-3499
				2. AWOS: 119.025 (541-504-8743)
			5. Madras (S33)
				1. Airport Manager: Rob Berg 541-475- 6947
				2. AWOS: 132.425 (541-475-0494)
				3. CTAF/UNICOM: 122.8
			6. Hood River (4S2)
				1. Airport Manager: Steve Burdick 541-386-1645
			7. Prineville (S39)
				1. Airport Manager: Kelly Coffelt 541-416-0805
			8. Lake Billy Chinook State
				1. Airport Manager: Greg Summers 503-550-2400
			9. 3 Rivers (Private)
				1. Airport Manager: Steve Bangert 503-769-5291
			10. Corvallis Municipal
				1. Airport Manager: 541-766-6783