

FLIGHT OPERATIONS MANUAL

2018

*Southern Illinois University / Plant & Service Operations
Operational Guidelines for Unmanned Aerial Vehicle (UAV) Operations*

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01: Introduction

01.01: General Introduction

SIU Carbondale is unique for southern Illinois in several respects. While being one of the largest employers south of Springfield (the state's capital), it is physically one of the largest organizations in southern Illinois.

There are approximately 475 buildings that are maintained over approximately ten physical locations throughout the southern Illinois area. Although most of the campus's structures are located in what could be consider the main campus area, there are many other properties and structures located throughout the southern part of the state. A substantial amount of these locations exists within the five-mile control boundary of four airports, Southern Illinois Airport (SIA) at Carbondale Illinois, Veteran's Airport at Marion Illinois, Hunter Field at Sparta Illinois, and Scott AFB / Mid-America Airport at Mascoutah (Belleville) Illinois.

In the last several years, new and evolving technologies has seen the creation of a class of remote control flying equipment known as "quad-rotors", "drones", or more formally known as an "Unmanned Aerial Vehicles (UAVs)". The complete flight hardware package and associated controlling equipment is known as small Unmanned Aerial Systems (sUAS). This classification of aircraft has been developed to a point that they are a useful tool for monitoring, photographing, and videoing various infrastructures and properties. In addition to high-resolution camera equipment for video and still photography, certain UAVs have the capability of using infrared equipment for determining the temperature(s) of the item(s) in question.

Most current UAVs are physically capable of traveling three to five miles away from its controller. This undoubtedly can pose problems, especially if this distance is three miles to five miles *straight up*. Three miles to five miles (15,000 to 25,000 feet) translates to flying in the realm of passenger, freight, and military airways.

With the recent proliferation of these drones into the consumer market, this equipment has proven a problem in coexisting around daily air traffic or what the Federal Aviation Administration (FAA) terms the National Aerospace System (NAS). The NAS is essentially *all* airspace from ground level to 60,000 feet plus. To allow UAVs to operate in the NAS environment, the FAA has created a set of regulations that commercial (and university) UAV operators must be certified in – Part 107.

The purpose of certification is to understand how to operate UAVs *safely* in the NAS. Additionally, there is the mandate of to create a set of "standard documentation" (i.e. office manuals, checklists, flying logs, maintenance logs) intended to promote safe and efficient operation of the equipment.

It cannot be over-stressed that operating this type of equipment is inherently dangerous. The FAA is an organization promoting flight safety of all types of equipment that operates in the NAS. It is everyone's responsibility that is conducting operations to follow all rules that is set forth by the FAA and rules set forth by the University.

Ultimately, safety is everyone's responsibility.

01:02: SIU General Policy

20171124_GeneralPolicy—DroneUsage--mk0203.docx currently under review...(BRET)

(Policy Documentation)

01.03: Active Documentation Purpose

To operate an UAV in a commercial (university) environment, the FAA expects a certain set of standard documentation to be maintained for every use of the UAV in question. This documentation, otherwise known as “logs”, is often referred to as maintenance logs, flight hardware logs, pilot’s logs, etc. Overall, every associated log is ultimately designed to aid the operator(s) in tracking, use, safety, and maintenance of the flight hardware in question. Another fact is that operating in the University environment adds another layer of complexity to UAV operations. For this reason, various other documents and checklists have been created to aid in tracking the particular project and aid in the actual execution of a flight.

01.04: Documentation Types

Project Application	A form that is filled out to follow each step of a request for UAV usage, including reasons for <i>Denial of Request</i> if appropriate.
Pre-Operations Check List (In-Office Planning)	A standalone checklist used to assure the UAV is prep for use and that the operating personal is familiar with what the request entails. It aids in the necessary steps needed to understand what is needed to execute the operation(s) safely – including in office briefings, site visits, etc. Also includes the steps needed to verify NOTAMs, TFR WX, etc.
Pre-flight Check List (Field Operations)	A checklist that remains with the drone. It covers site pre-flight, drone pre-flight setup, drone warmup. Additionally, contains contact names and numbers for SIAA Tower and SIU DPS. It aids in setting up the drone correctly before use.
Flight Check List (Filed Operations) and Emergency Execution (Filed Operations)	A checklist that remains with the drone. It covers the actual flight, including the steps for abnormal flight termination. Contains emergency steps to use in case of flight hardware crash / injuries.
Post-Operations Check List (Site)	A checklist that remains with the drone. It covers break down of site setup, safeing of flight hardware, and breaking the drone down for transport. Also contains a reminder to contact the Tower / DPS to inform them of operations termination.
Post-Operations Check List (Office):	A standalone checklist used to assure the drone is prepared for the next usage, including the check of removing / replacing memory cards, files downloaded, and verification the unit needs no repairs.

Some of the associated documents will come from the manufacture. Documents such as the “Owner’s Manual”, Flight Check Lists, recommended post-flight maintenance routines, etc., will be considered as part of the Flight Operation Manual, either in-part or in-whole as warranted. In addition to the actual documentation, the “Operators Manual”, the “Flight Logs”, and the “Maintenance Logs” shall be kept up-to-date at all times. Additionally, this documentation shall remain with the UAV / operators while conducting an operation. A FAA field inspector can request to see this documentation at any time, even while an operation is being conducted.

In addition to the applications and UAV check lists, various operation manuals need to be created and maintained to aid in safe operations of the flight hardware in question.

01.05: Operation Manuals and Logs

Office Operations Manual (“Flight Manual”)	Ops Manual – The UAV system shall have an operations manual that will encompasses preflight / flight / post flight operational procedures that defines the necessary action(s) that needs to be taken before / during / after flight operations to maintain compliancy with FAA mandates.
Manufacture’s Operation Manual	The UAV system shall have a flight manual that includes operating limitations, standard operating procedures, emergency procedures, assembly instructions and other pertinent operating information. Usually is the original manufacture supplied documentation.
Manufacture’s Maintenance Manual	Maintenance Manual – The UAV shall have a maintenance manual that defines actions that shall be taken to keep the UAV system in conformity with its type definition. Usually included with the original manufacture’s supplied documentation.
Maintenance Log	The document that is filled out with information about any work performed on flight hardware – either in the field or in the office. Must remain with the flight hardware at all times.
Flight Log (hardware)*	The document that is filled out with actual usage information of the flight hardware in question.
Pilot’s Log (personnel)*	The document that is filled out with actual usage information of the flight hardware in question.

**** If different people operates the flight hardware in question, the result will be a difference between the operators log and the flight hardware log. It is recommended that an UAV operator maintain a personnel log as well as maintaining a single usage log for the flight hardware in question.***

02: Abbreviations / Definitions

The following is a list of abbreviations and definitions used throughout this operations manual.

02.01: Abbreviations and Definitions

AGL	Above Ground Level.
ARP	Airport Reference Point.
ATC	Air Traffic Control.
CFR	Code of Federal Regulation.
Drone	The generic term for “Quad-Rotor”, “Flight Hardware”, “Drone”, “UAV” can and will be used interchangeably.
D-NOTAM / NOTAM	Drone-Notice to Airman / Notice to Airman.
e-CFR	Electronic Code of Federal Regulations.
FAA	Federal Aviation Administration or Administration.
FAR	Federal Aviation Regulation.
Flight Personal	Pilot, Visual Observer, Equipment Operator (if present) responsible for direct control of the operation.
Flight Hardware	The hardware (remote controllers, monitor screens, the actual UAV, batteries, related equipment) needed to conduct a flight. The term can and will be used interchangeably with sUAS / UAS.
FSDO	Flight Standards District Office.
GLONASS	Global Navigation Satellite System – the Russian satellite location system.
GPS	Global Positioning System -- the American satellite location system.
Groundspeed	The speed of any operating aerial vehicle (either manned or unmanned) if it was traveling at speed at ground level.
Guest	Any person(s) who has an interest in the Project (e.g., funding agency representative, SIU administrator, etc.) and is approved by the Project Director (PD) or Pilot-In-Charge (PIC) to observe the UAS / UAV operations, but is not considered to be a trained observer. A guest is not required to meet the qualifications of a Participant.
NAS	National Airspace System.
NM	Nautical mile.
Nonparticipating Persons	Persons not participating in flight operations.
TFR	Temporary Flight Restrictions.
NOTAM	Notice to Airman.
NTSB	Nation Transportation Safety Board.

Operator	The person or entity responsible for the overall aircraft and may include maintenance, general operations, specific procedures, selecting properly trained and certified flight crewmembers, etc. For purposes of these Operating Standards, the University is the operator of all UAS / UAV flight hardware that are flown on behalf of the University, whether flown on University or non-university property.
Part 107	The Federal Aviation Administration Regulation that governs the use of remotely controlled Small Unmanned Aircraft Systems (sUAS) – more formally known as “Title 14 (Aeronautics and Space), Chapter 1, Subchapter F, Part 107”.
Participating Person(s) / Participant(s)	Person(s) that are participating in flight operations other than the PIC and VO.
PIC / RPIC	(Remote) Pilot In Command.
Project Director (PD)	The individual responsible for the design and conduct of the entire project for which the UAS / UAV is to be used.
Project Application:	The documentation / paperwork that is filled out to record various aspects a project.
Quad-rotors (aka drones)	The “original” classification of the flight hardware more commonly refer to as “Drones” or “UAV”s.
RC	Remote Control.
SIUC / SIU	Southern Illinois University, Carbondale / Southern Illinois University.
Sortie	The word sortie is a military term related to the execution of a mission. It has migrated to civilian use in reference to a project or task involving aircraft.
sUAS / UAS / UAV	Small Unmanned Aerial Systems / Unmanned Aerial Systems / Unmanned Aerial Vehicle.
UAS Coordinator	Institutional official, or his/her designee, responsible for the administration of the University’s UAS policy and approval process.
UAS Operations	The totality of the activity for which the UAS / UAV will be used and all parameters controlling that use, including location, type of aircraft, persons involved, permits required, etc.
UAS Operator	The University is recognized as the operator for purposes of its responsibility to the FAA.
University property	Any property owned or controlled by the University or a legal affiliate of the University (e.g., leased property).
VLOS	Visual Line Of Site.
VO	Visual Observer -- A trained person who assists the unmanned aircraft pilot-in-command in the duties associated with collision avoidance. This includes, but is not limited to, avoidance of other traffic, clouds, obstructions, terrain, etc.

02.02: Future Documentation

02.03: Future Documentation

03: FAA Requirements

03.01: FAA Requirements (Part 107)

This extract is taken from the newsletter “FAA News” dated June 21st, 2016 in regards to “Summary of Small Unmanned Aircraft Rule (Part 107)”. This is a short summary in reference to Title 14 (Aeronautics and Space), Chapter 1, Subchapter F, Part 107 (more commonly referred as “Part 107”). In no relation is this to be consider the complete list of rules and regulations concerning Part 107. The most important consideration is that no one may operate a UAV for commercial (university) purposes without being formally certified in Part 107. To this end, **NO UAV OPERATIONS MAY BE CONDUCTED FOR ANY REASON BY A NON-CERTIFIED PART 107 OPERATOR WITHOUT A PART 107 OPERATOR BEING PRESENT.**

Operational Limitations	Weight between .55 lbs. and 55 lbs.
	The UAV must remain within visual line of sight (VLOS).
	The UAV may not be operated over any person that is not directly participating in the operation.
	Daylight operations only within 30 minutes of local sunrise / sunset.
	Must yield right-of-way to <i>any</i> aircraft.
	Maximum Groundspeed – 100 mph.
	Maximum Altitude – 400 feet (operational exception of 400 feet above a structure – must be within 400 feet of said structure).
	Minimum Visibility – 3 miles.
	Operations in Class B, C, D, E with ATC permission.
	Operations in Class G permitted w/o ATC permission.
	PIC / VO – only one UAS at a time.
	Preflight of UAS required by the PIC to ensure safe operations of the sUAS.
Remote Pilot in Command (PIC / RPIC) Certifications and Responsibilities	Establishes a remote pilot in command position.
	The operator of a UAV must be certified (Part 107) or directly supervised by an operator who holds a Part 107 certificate.
	Report within 10 calendar days if any operations result in serious injury, loss of consciousness, and / or property damage of \$500.

Some the operational limitations imposed by Part 107 can be bypassed by the FAA waiver process. The waiver process is designed to allow an operation in controlled airspace for a period ranging from six months to two years. The waiver process is intended to provide additional information to the FAA for site and safety analysis. The FAA is currently processing waivers (approval / denial) on an approximately 90-day period. However, processing times will vary with the complexity of the waiver request.

Some of the items that can be waived includes 107.25 – Operations from a moving vehicle, 107.29 – Daylight Operations (night flying), 107.41—Operation in certain airspace, etc.

03.02: Certification / License

(Include a copy of all active UAV pilots' certifications at this point)

Please note: *The FAA provides a pocket certification card that must be presented to a FAA field inspector upon request. It is required that this certification card be with the operator(s) while flight operations are being conducted.*

03.03: FAA Part 107 Requirements

The following is an extract of the regulations that commercial (university) operators operates under. This extract is current of the date of 2017.11.20. The most update version of the web-based documentation can be found at the electronic Code of Federal Regulations web site at <https://www.ecfr.gov>.

Please note that some sections are highlight to draw particular attention to the item in question. Although no one section is more important than another, these sections need to be view more closely and kept in mind at all times.

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Electronic Code of Federal Regulations

e-CFR data is current as of November 20, 2017

Title 14 → Chapter I → Subchapter F → Part 107

Title 14: Aeronautics and Space

PART 107—SMALL UNMANNED AIRCRAFT SYSTEMS

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AUTHORITY: 49 U.S.C. 106(f), 40101 note, 40103(b), 44701(a)(5); Sec. 333 of Pub. L. 112-95, 126 Stat. 75.

SOURCE: Docket FAA-2015-0150, Amdt. 107-1, 81 FR 42209, June 28, 2016, unless otherwise noted.

Subpart A—General

107.1 Applicability.

(a) Except as provided in paragraph (b) of this section, this part applies to the registration, airman certification, and operation of civil small unmanned aircraft systems within the United States.

(b) This part does not apply to the following:

(1) Air carrier operations;

(2) Any aircraft subject to the provisions of part 101 of this chapter; or

(3) Any operation that a remote pilot in command elects to conduct pursuant to an exemption issued under section 333 of Public Law 112-95, unless otherwise specified in the exemption.

107.3 Definitions.

The following definitions apply to this part. If there is a conflict between the definitions of this part and definitions specified in 1.1 of this chapter, the definitions in this part control for purposes of this part:

Control station means an interface used by the remote pilot to control the flight path of the small-unmanned aircraft.

Corrective lenses means spectacles or contact lenses.

Small-unmanned aircraft means an unmanned aircraft weighing less than 55 pounds on takeoff, including everything that is on board or otherwise attached to the aircraft.

Small-unmanned aircraft system (small UAS) means a small-unmanned aircraft and its associated elements (including communication links and the components that control the small unmanned aircraft) that are required for the safe and efficient operation of the small unmanned aircraft in the national airspace system.

Unmanned aircraft means an aircraft operated without the possibility of direct human intervention from within or on the aircraft.

Visual observer means a person who is designated by the remote pilot in command to assist the remote pilot in command and the person manipulating the flight controls of the small UAS to see and avoid other air traffic or objects aloft or on the ground.

107.5 Falsification, reproduction or alteration.

(a) No person may make or cause to be made—

(1) Any fraudulent or intentionally false record or report that is required to be made, kept, or used to show compliance with any requirement under this part.

(2) Any reproduction or alteration, for fraudulent purpose, of any certificate, rating, authorization, record or report under this part.

(b) The commission by any person of an act prohibited under paragraph (a) of this section is a basis for any of the following:

(1) Denial of an application for a remote pilot certificate or a certificate of waiver,

(2) Suspension or revocation of any certificate or waiver issued by the Administrator under this part and held by that person; or

(3) A civil penalty.

107.7 Inspection, testing, and demonstration of compliance.

(a) A remote pilot in command, owner, or person manipulating the flight controls of a small-unmanned aircraft system must, upon request, make available to the Administrator:

(1) The remote pilot certificate with a small UAS rating; and

(2) Any other document, record, or report required to be kept under the regulations of this chapter.

(b) The remote pilot in command, visual observer, owner, operator, or person manipulating the flight controls of a small unmanned aircraft system must, upon request, allow the Administrator to make any test or inspection of the small unmanned aircraft system, the remote pilot in command, the person manipulating the flight controls of a small unmanned aircraft system, and, if applicable, the visual observer to determine compliance with this part.

107.9 Accident reporting.

No later than 10 calendar days after an operation that meets the criteria of either paragraph (a) or (b) of this section, a remote pilot in command must report to the FAA, in a manner acceptable to the Administrator, any operation of the small unmanned aircraft involving at least:

(a) Serious injury to any person or any loss of consciousness; or

(b) Damage to any property, other than the small-unmanned aircraft, unless one of the following conditions is satisfied:

(1) The cost of repair (including materials and labor) does not exceed \$500; or

(2) The fair market value of the property does not exceed \$500 in the event of total loss.

Subpart B—Operating Rules

107.11 Applicability.

This subpart applies to the operation of all civil small-unmanned aircraft systems subject to this part.

107.12 Requirement for a remote pilot certificate with a small UAS rating.

(a) Except as provided in paragraph (c) of this section, no person may manipulate the flight controls of a small unmanned aircraft system unless:

(1) That person has a remote pilot certificate with a small UAS rating issued pursuant to subpart C of this part and satisfies the requirements of 107.65; or

(2) That person is under the direct supervision of a remote pilot in command and the remote pilot in command has the ability to immediately take direct control of the flight of the small-unmanned aircraft.

(b) Except as provided in paragraph (c) of this section, no person may act as a remote pilot in command unless that person has a remote pilot certificate with a small UAS rating issued pursuant to Subpart C of this part and satisfies the requirements of 107.65.

(c) The Administrator may, consistent with international standards, authorize an airman to operate a civil foreign-registered small unmanned aircraft without an FAA-issued remote pilot certificate with a small UAS rating.

107.13 Registration.

A person operating a civil small unmanned aircraft system for purposes of flight must comply with the provisions of 91.203(a)(2) of this chapter.

107.15 Condition for safe operation.

(a) No person may operate a civil small-unmanned aircraft system unless it is in a condition for safe operation. Prior to each flight, the remote pilot in command must check the small-unmanned aircraft system to determine whether it is in a condition for safe operation.

(b) No person may continue flight of the small unmanned aircraft when he or she knows or has reason to know that the small unmanned aircraft system is no longer in a condition for safe operation.

107.17 Medical condition.

No person may manipulate the flight controls of a small unmanned aircraft system or act as a remote pilot in command, visual observer, or direct participant in the operation of the small unmanned aircraft if he or she knows or has reason to know that he or she has a physical or mental condition that would interfere with the safe operation of the small unmanned aircraft system.

107.19 Remote pilot in command.

(a) A remote pilot in command must be designated before or during the flight of the small-unmanned aircraft.

(b) The remote pilot in command is directly responsible for and is the final authority as to the operation of the small-unmanned aircraft system.

(c) The remote pilot in command must ensure that the small-unmanned aircraft will pose no undue hazard to other people, other aircraft, or other property in the event of a loss of control of the aircraft for any reason.

(d) The remote pilot in command must ensure that the small UAS operation complies with all applicable regulations of this chapter.

(e) The remote pilot in command must have the ability to direct the small-unmanned aircraft to ensure compliance with the applicable provisions of this chapter.

107.21 In-flight emergency.

(a) In an in-flight emergency requiring immediate action, the remote pilot in command may deviate from any rule of this part to the extent necessary to meet that emergency.

(b) Each remote pilot in command who deviates from a rule under paragraph (a) of this section must, upon request of the Administrator, send a written report of that deviation to the Administrator.

107.23 Hazardous operation.

No person may:

(a) Operate a small unmanned aircraft system in a careless or reckless manner so as to endanger the life or property of another; or

(b) Allow an object to be dropped from a small-unmanned aircraft in a manner that creates an undue hazard to persons or property.

107.25 Operation from a moving vehicle or aircraft.

No person may operate a small-unmanned aircraft system—

(a) From a moving aircraft; or

(b) From a moving land or water-borne vehicle unless the small unmanned aircraft is flown over a sparsely populated area and is not transporting another person's property for compensation or hire.

107.27 Alcohol or drugs.

A person manipulating the flight controls of a small-unmanned aircraft system or acting as a remote pilot in command or visual observer must comply with the provisions of 91.17 and 91.19 of this chapter.

107.29 Daylight operation.

(a) No person may operate a small-unmanned aircraft system during night.

(b) No person may operate a small-unmanned aircraft system during periods of civil twilight unless the small-unmanned aircraft has lighted anti-collision lighting visible for at least 3 statute miles. The remote pilot in command may reduce the intensity of the anti-collision lighting if he or she determines that, because of operating conditions, it would be in the interest of safety to do so.

(c) For purposes of paragraph (b) of this section, civil twilight refers to the following:

(1) Except for Alaska, a period of time that begins 30 minutes before official sunrise and ends at official sunrise;

(2) Except for Alaska, a period of time that begins at official sunset and ends 30 minutes after official sunset; and

(3) In Alaska, the period of civil twilight as defined in the Air Almanac.

107.31 Visual line of sight aircraft operation.

(a) With vision that is unaided by any device other than corrective lenses, the remote pilot in command, the visual observer (if one is used), and the person manipulating the flight control of the small unmanned aircraft system must be able to see the unmanned aircraft throughout the entire flight in order to:

(1) Know the unmanned aircraft's location;

(2) Determine the unmanned aircraft's attitude, altitude, and direction of flight;

(3) Observe the airspace for other air traffic or hazards; and

(4) Determine that the unmanned aircraft does not endanger the life or property of another.

(b) Throughout the entire flight of the small-unmanned aircraft, the ability described in paragraph (a) of this section must be exercised by either:

(1) The remote pilot in command and the person manipulating the flight controls of the small unmanned aircraft system; or

(2) A visual observer.

107.33 Visual observer.

If a visual observer is used during the aircraft operation, all of the following requirements must be met:

(a) The remote pilot in command, the person manipulating the flight controls of the small-unmanned aircraft system, and the visual observer must maintain effective communication with each other at all times.

(b) The remote pilot in command must ensure that the visual observer is able to see the unmanned aircraft in the manner specified in 107.31.

(c) The remote pilot in command, the person manipulating the flight controls of the small-unmanned aircraft system, and the visual observer must coordinate to do the following:

(1) Scan the airspace where the small unmanned aircraft is operating for any potential collision hazard; and

(2) Maintain awareness of the position of the small-unmanned aircraft through direct visual observation.

107.35 Operation of multiple small-unmanned aircraft.

A person may not operate or act as a remote pilot in command or visual observer in the operation of more than one unmanned aircraft at the same time.

107.36 Carriage of hazardous material.

A small-unmanned aircraft may not carry hazardous material. For purposes of this section, the term hazardous material is defined in 49 CFR 171.8.

107.37 Operation near aircraft; right-of-way rules.

(a) Each small-unmanned aircraft must yield the right of way to all aircraft, airborne vehicles, and launch and reentry vehicles. Yielding the right of way means that the small unmanned aircraft must give way to the aircraft or vehicle and may not pass over, under, or ahead of it unless well clear.

(b) No person may operate a small-unmanned aircraft so close to another aircraft as to create a collision hazard.

107.39 Operation over human beings.

No person may operate a small-unmanned aircraft over a human being unless that human being is:

(a) Directly participating in the operation of the small unmanned aircraft; or

(b) Located under a covered structure or inside a stationary vehicle that can provide reasonable protection from a falling small-unmanned aircraft.

107.41 Operation in certain airspace.

No person may operate a small-unmanned aircraft in Class B, Class C, or Class D airspace or within the lateral boundaries of the surface area of Class E airspace designated for an airport unless that person has prior authorization from Air Traffic Control (ATC).

107.43 Operation in the vicinity of airports.

No person may operate a small-unmanned aircraft in a manner that interferes with operations and traffic patterns at any airport, heliport, or seaplane base.

107.45 Operation in prohibited or restricted areas.

No person may operate a small-unmanned aircraft in prohibited or restricted areas unless that person has permission from the using or controlling agency, as appropriate.

107.47 Flight restrictions in the proximity of certain areas designated by notice to airmen.

A person acting as a remote pilot in command must comply with the provisions of 91.137 through 91.145 and 99.7 of this chapter.

107.49 Preflight familiarization, inspection, and actions for aircraft operation.

Prior to flight, the remote pilot in command must:

(a) Assess the operating environment, considering risks to persons and property in the immediate vicinity both on the surface and in the air. This assessment must include:

- (1) Local weather conditions;
- (2) Local airspace and any flight restrictions;
- (3) The location of persons and property on the surface; and
- (4) Other ground hazards.

(b) Ensure that all persons directly participating in the small unmanned aircraft operation are informed about the operating conditions, emergency procedures, contingency procedures, roles and responsibilities, and potential hazards;

(c) Ensure that all control links between ground control station and the small-unmanned aircraft are working properly;

(d) If the small unmanned aircraft is powered, ensure that there is enough available power for the small unmanned aircraft system to operate for the intended operational time; and

(e) Ensure that any object attached or carried by the small-unmanned aircraft is secure and does not adversely affect the flight characteristics or controllability of the aircraft.

107.51 Operating limitations for small-unmanned aircraft.

A remote pilot in command and the person manipulating the flight controls of the small unmanned aircraft system must comply with all of the following operating limitations when operating a small unmanned aircraft system:

(a) The groundspeed of the small unmanned aircraft may not exceed 87 knots (100 miles per hour).

(b) The altitude of the small unmanned aircraft cannot be higher than 400 feet above ground level, unless the small unmanned aircraft:

(1) Is flown within a 400-foot radius of a structure; and

(2) Does not fly higher than 400 feet above the structure's immediate uppermost limit.

(c) The minimum flight visibility, as observed from the location of the control station must be no less than 3 statute miles. For purposes of this section, flight visibility means the average slant distance from the control station at which prominent unlighted objects may be seen and identified by day and prominent lighted objects may be seen and identified by night.

(d) The minimum distance of the small unmanned aircraft from clouds must be no less than:

(1) 500 feet below the cloud; and

(2) 2,000 feet horizontally from the cloud.

Subpart C—Remote Pilot Certification

107.53 Applicability.

This subpart prescribes the requirements for issuing a remote pilot certificate with a small UAS rating.

107.57 Offenses involving alcohol or drugs.

(a) A conviction for the violation of any Federal or State statute relating to the growing, processing, manufacture, sale, disposition, possession, transportation, or importation of narcotic drugs, marijuana, or depressant or stimulant drugs or substances is grounds for:

(1) Denial of an application for a remote pilot certificate with a small UAS rating for a period of up to 1 year after the date of final conviction; or

(2) Suspension or revocation of a remote pilot certificate with a small UAS rating.

(b) Committing an act prohibited by 91.17(a) or 91.19(a) of this chapter is grounds for:

(1) Denial of an application for a remote pilot certificate with a small UAS rating for a period of up to 1 year after the date of that act; or

(2) Suspension or revocation of a remote pilot certificate with a small UAS rating.

107.59 Refusal to submit to an alcohol test or to furnish test results.

A refusal to submit to a test to indicate the percentage by weight of alcohol in the blood, when requested by a law enforcement officer in accordance with 91.17(c) of this chapter, or a refusal to furnish or authorize the release of the test results requested by the Administrator in accordance with 91.17(c) or (d) of this chapter, is grounds for:

- (a) Denial of an application for a remote pilot certificate with a small UAS rating for a period of up to 1 year after the date of that refusal; or
- (b) Suspension or revocation of a remote pilot certificate with a small UAS rating.

107.61 Eligibility.

Subject to the provisions of 107.57 and 107.59, in order to be eligible for a remote pilot certificate with a small UAS rating under this subpart, a person must:

- (a) Be at least 16 years of age;
- (b) Be able to read, speak, write, and understand the English language. If the applicant is unable to meet one of these requirements due to medical reasons, the FAA may place such operating limitations on that applicant's certificate as are necessary for the safe operation of the small unmanned aircraft;
- (c) Not know or have reason to know that he or she has a physical or mental condition that would interfere with the safe operation of a small unmanned aircraft system; and
- (d) Demonstrate aeronautical knowledge by satisfying one of the following conditions:
 - (1) Pass an initial aeronautical knowledge test covering the areas of knowledge specified in 107.73(a);
or
 - (2) If a person holds a pilot certificate (other than a student pilot certificate) issued under part 61 of this chapter and meets the flight review requirements specified in 61.56, complete an initial training course covering the areas of knowledge specified in 107.74(a) in a manner acceptable to the Administrator.

107.63 Issuance of a remote pilot certificate with a small UAS rating.

An applicant for a remote pilot certificate with a small UAS rating under this subpart must make the application in a form and manner acceptable to the Administrator.

- (a) The application must include either:
 - (1) Evidence showing that the applicant passed an initial aeronautical knowledge test. If applying using a paper application, this evidence must be an airman knowledge test report showing passage of the knowledge test; or

(2) If a person holds a pilot certificate (other than a student pilot certificate) issued under part 61 of this chapter and meets the flight review requirements specified in 61.56, a certificate of completion of a part 107 initial training course.

(b) If the application is being made pursuant to paragraph (a)(2) of this section:

(1) The application must be submitted to a Flight Standards District Office, a designated pilot examiner, an airman certification representative for a pilot school, a certificated flight instructor, or other person authorized by the Administrator;

(2) The person accepting the application submission must verify the identity of the applicant in a manner acceptable to the Administrator; and

(3) The person making the application must, by logbook endorsement or other manner acceptable to the Administrator, show the applicant meets the flight review requirements specified in 61.56 of this chapter.

107.64 Temporary certificate.

(a) A temporary remote pilot certificate with a small UAS rating is issued for up to 120 calendar days, at which time a permanent certificate will be issued to a person whom the Administrator finds qualified under this part.

(b) A temporary remote pilot certificate with a small UAS rating expires:

(1) On the expiration date shown on the certificate;

(2) Upon receipt of the permanent certificate; or

(3) Upon receipt of a notice that the certificate sought is denied or revoked.

107.65 Aeronautical knowledge recency.

A person may not operate a small unmanned aircraft system unless that person has completed one of the following, within the previous 24 calendar months:

(a) Passed an initial aeronautical knowledge test covering the areas of knowledge specified in 107.73(a);

(b) Passed a recurrent aeronautical knowledge test covering the areas of knowledge specified in 107.73(b); or

(c) If a person holds a pilot certificate (other than a student pilot certificate) issued under part 61 of this chapter and meets the flight review requirements specified in 61.56, passed either an initial or recurrent training course covering the areas of knowledge specified in 107.74(a) or (b) in a manner acceptable to the Administrator.

107.67 Knowledge tests: General procedures and passing grades.

(a) Knowledge tests prescribed by or under this part are given by persons and in the manner designated by the Administrator.

(b) An applicant for a knowledge test must have proper identification at the time of application that contains the applicant's:

(1) Photograph;

(2) Signature;

(3) Date of birth, which shows the applicant meets or will meet the age requirements of this part for the certificate and rating sought before the expiration date of the airman knowledge test report; and

(4) Permanent mailing address. If the applicant's permanent mailing address is a post office box number, then the applicant must also provide a current residential address.

(c) The minimum passing grade for the knowledge test will be specified by the Administrator.

107.69 Knowledge tests: Cheating or other unauthorized conduct.

(a) An applicant for a knowledge test may not:

(1) Copy or intentionally remove any knowledge test;

(2) Give to another applicant or receive from another applicant any part or copy of a knowledge test;

(3) Give or receive assistance on a knowledge test during the period that test is being given;

(4) Take any part of a knowledge test on behalf of another person;

(5) Be represented by, or represent, another person for a knowledge test;

(6) Use any material or aid during the period that the test is being given, unless specifically authorized to do so by the Administrator; and

(7) Intentionally cause, assist, or participate in any act prohibited by this paragraph.

(b) An applicant who the Administrator finds has committed an act prohibited by paragraph (a) of this section is prohibited, for 1 year after the date of committing that act, from:

(1) Applying for any certificate, rating, or authorization issued under this chapter; and

(2) Applying for and taking any test under this chapter.

(c) Any certificate or rating held by an applicant may be suspended or revoked if the Administrator finds that person has committed an act prohibited by paragraph (a) of this section.

107.71 Retesting after failure.

An applicant for a knowledge test who fails that test may not reapply for the test for 14 calendar days after failing the test.

107.73 Initial and recurrent knowledge tests.

(a) An initial aeronautical knowledge test covers the following areas of knowledge:

- (1) Applicable regulations relating to small unmanned aircraft system rating privileges, limitations, and flight operation;
- (2) Airspace classification, operating requirements, and flight restrictions affecting small unmanned aircraft operation;
- (3) Aviation weather sources and effects of weather on small unmanned aircraft performance;
- (4) Small unmanned aircraft loading;
- (5) Emergency procedures;
- (6) Crew resource management;
- (7) Radio communication procedures;
- (8) Determining the performance of small unmanned aircraft;
- (9) Physiological effects of drugs and alcohol;
- (10) Aeronautical decision-making and judgment;
- (11) Airport operations; and
- (12) Maintenance and preflight inspection procedures.

(b) A recurrent aeronautical knowledge test covers the following areas of knowledge:

- (1) Applicable regulations relating to small unmanned aircraft system rating privileges, limitations, and flight operation;
- (2) Airspace classification and operating requirements and flight restrictions affecting small unmanned aircraft operation;
- (3) Emergency procedures;
- (4) Crew resource management;

- (5) Aeronautical decision-making and judgment;
- (6) Airport operations; and
- (7) Maintenance and preflight inspection procedures.

107.74 Initial and recurrent training courses.

(a) An initial training course covers the following areas of knowledge:

- (1) Applicable regulations relating to small unmanned aircraft system rating privileges, limitations, and flight operation;
- (2) Effects of weather on small unmanned aircraft performance;
- (3) Small unmanned aircraft loading;
- (4) Emergency procedures;
- (5) Crew resource management;
- (6) Determining the performance of small unmanned aircraft; and
- (7) Maintenance and preflight inspection procedures.

(b) A recurrent training course covers the following areas of knowledge:

- (1) Applicable regulations relating to small unmanned aircraft system rating privileges, limitations, and flight operation;
- (2) Emergency procedures;
- (3) Crew resource management; and
- (4) Maintenance and preflight inspection procedures.

107.77 Change of name or address.

(a) *Change of name.* An application to change the name on a certificate issued under this subpart must be accompanied by the applicant's:

- (1) Remote pilot certificate with small UAS rating; and
- (2) A copy of the marriage license, court order, or other document verifying the name change.

(b) The documents in paragraph (a) of this section will be returned to the applicant after inspection.

(c) *Change of address.* The holder of a remote pilot certificate with small UAS rating issued under this subpart who has made a change in permanent mailing address may not, after 30 days from that date,

exercise the privileges of the certificate unless the holder has notified the FAA of the change in address using one of the following methods:

(1) By letter to the FAA Airman Certification Branch, P.O. Box 25082, Oklahoma City, OK 73125 providing the new permanent mailing address, or if the permanent mailing address includes a post office box number, then the holder's current residential address; or

(2) By using the FAA Web site portal at *www.faa.gov* providing the new permanent mailing address, or if the permanent mailing address includes a post office box number, then the holder's current residential address.

107.79 Voluntary surrender of certificate.

(a) The holder of a certificate issued under this subpart may voluntarily surrender it for cancellation.

(b) Any request made under paragraph (a) of this section must include the following signed statement or its equivalent: "I voluntarily surrender my remote pilot certificate with a small UAS rating for cancellation. This request is made for my own reasons, with full knowledge that my certificate will not be reissued to me unless I again complete the requirements specified in 107.61 and 107.63."

Subpart D—Waivers

107.200 Waiver policy and requirements.

(a) The Administrator may issue a certificate of waiver authorizing a deviation from any regulation specified in 107.205 if the Administrator finds that a proposed small UAS operation can safely be conducted under the terms of that certificate of waiver.

(b) A request for a certificate of waiver must contain a complete description of the proposed operation and justification that establishes that the operation can safely be conducted under the terms of a certificate of waiver.

(c) The Administrator may prescribe additional limitations that the Administrator considers necessary.

(d) A person who receives a certificate of waiver issued under this section:

(1) May deviate from the regulations of this part to the extent specified in the certificate of waiver; and

(2) Must comply with any conditions or limitations that are specified in the certificate of waiver.

107.205 List of regulations subject to waiver.

A certificate of waiver issued pursuant to 107.200 may authorize a deviation from the following regulations of this part:

(a) Section 107.25—Operation from a moving vehicle or aircraft. However, no waiver of this provision will be issued to allow the carriage of property of another by aircraft for compensation or hire.

(b) Section 107.29—Daylight operation.

(c) Section 107.31—Visual line of sight aircraft operation. However, no waiver of this provision will be issued to allow the carriage of property of another by aircraft for compensation or hire.

(d) Section 107.33—Visual observer.

(e) Section 107.35—Operation of multiple small unmanned aircraft systems.

(f) Section 107.37(a)—Yielding the right of way.

(g) Section 107.39—Operation over people.

(h) Section 107.41—Operation in certain airspace.

(i) Section 107.51—Operating limitations for small unmanned aircraft.

03.04: Copy of Waivers

(Include a copy of all active waivers / certificates at this point)

Please note: The FAA provides a procedure to request either exemption(s) or waiver(s) of various UAV restrictions (see previous section 03.03 / FAA Requirements – Section 107.200 Waiver Policy and requirements). An exemption is a typical 6 months “abeyance” of the section in question. A waiver is the same request only for a longer period – typically 2 years. The primary difference in the requests is the FAA will conduct a “closer examination” for an issuance of the waiver – especially in regards to overall safety.

PSO UAV Operations has requested waivers for the following:

Section 107.205: Section 107.29—Daylight operation (also referred to night operations)

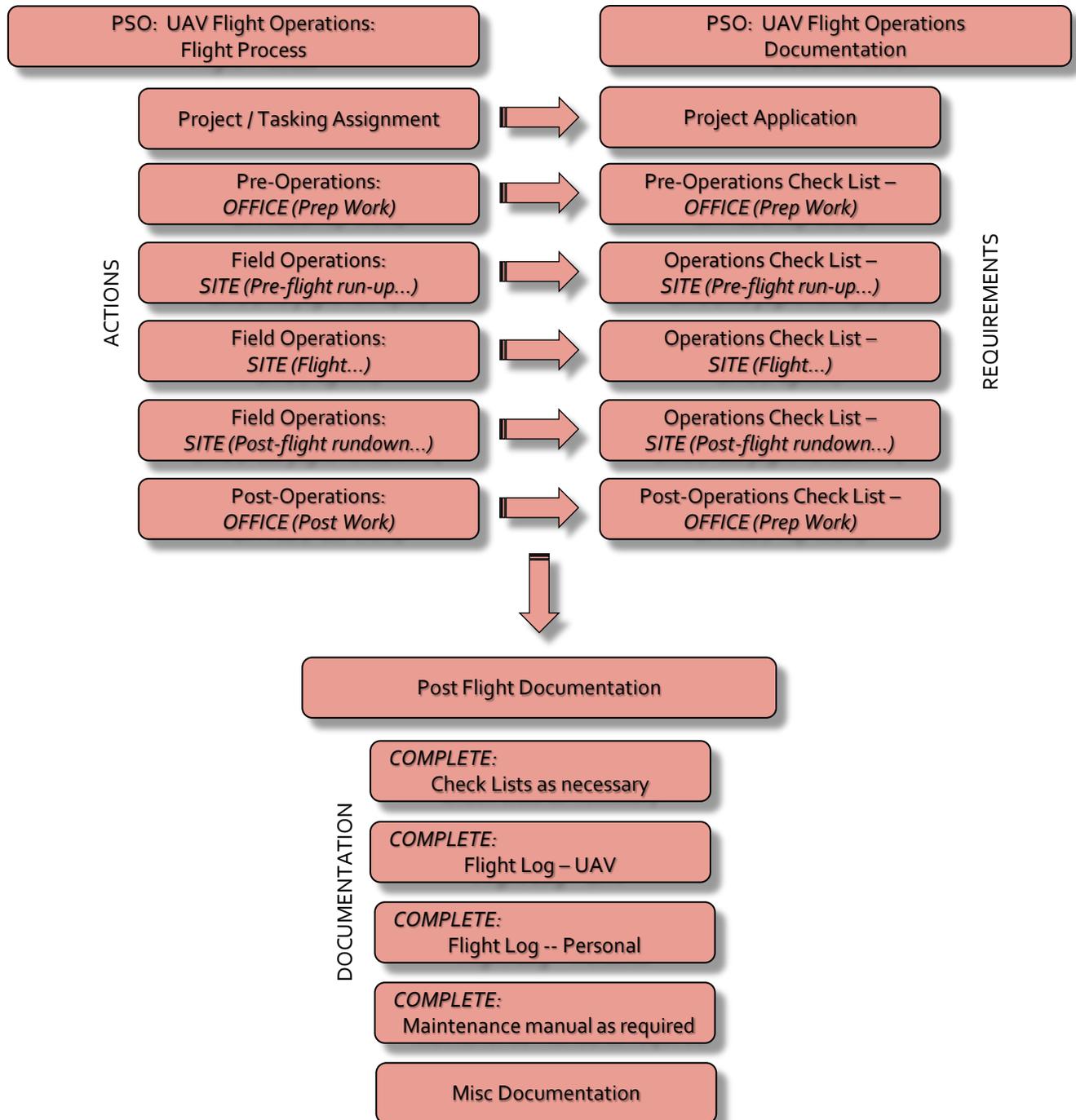
Section 107.205: Section 107.41—Operation in certain airspace (operating in the five-mile control boundary)

As conditions warrants, various exemptions / waivers will be applied for consideration to operate against the Part 107 section in question

04: Flight Operations

04.01: Operational Request

An actual flight operation commences with an accepted project or request for the use of the PSO UAV. The basic operational flow and associated documentation is as follows:



Graphic 04.01.01 – Procedure to conduct a flight operation.

04.02: Pre-Flight (In-Office Planning*)

In-office planning usually consists of tracking the project, verifying the flight hardware is ready, or needs further preparation (i.e., charged batteries, computer media, etc.). Furthermore, verifying weather, site conditions, etc. for the proposed day is necessary. Most importantly, checking with the FAA for any various operational restriction at the project site must occur every time before any flight takes place.

A pre-operation briefing should take place with all interested parties, including the university designated UAS Coordinator, designated Project Director (PD), designated remote Pilot-In-Charge (PiC), any Visual Observers (VO), Participants, and any other Guests as necessary to define the parameters of the operation in question. Although a PD may be overseeing the operation, the PiC has the final authority if the operation can be conducted safely or not.

04.02.01: INITIATE REQUEST:	Fill out Project Application / Project Tracking Sheet.
04.02.02: PREP WORK:	Prepare flight hardware per manufacture's recommendations.
04.02.03: PREP WORK:	Verify battery charge level – ensure all batteries for flight hardware, remotes, and monitors are fully charged. Charge as necessary.
04.02.04: PREP WORK:	Verify computer media as required.
04.02.05: PREP WORK:	Review proposed site to conduct safe operations: Google Earth? Site Visitation? Conduct prep work as required to ensure safe operations.
04.02.06: VERIFY:	Verify weather conditions for flight: Local Forecasts... METARs... 1 800 WX Briefs, etc...
04.02.07: VERIFY:	Verify NOTAMs / D-NOTAMs: Verify TFRs -- pilotweb.nas.faa.gov/PilotWeb/ (UAS entry)... tfr.faa.gov/ ... skyvector.com/ (map)... app.airmap.io (map)... app.classic.airmap.io (map)... dji.com/flysafe/geo-map (map)...
04.02.08: BRIEFING:	Conduct a pre-operation briefing to define operational specifics -- UAS Coordinator Project Director? Pilot-In-Charge (PiC)? Visual Observers (VO)? Participants? Site – Hazards? Camera – Sills / Videos? Discuss operation with upper management?

*** Any FAA related restrictions or notifications such as Notice to Airmen (NOTAMs) TFRs (Temporary Flight Restrictions), waiver restrictions, weather minimums, etc., will terminate any / all flying activities for the period in question. Additionally, any flight hardware faults will terminate ALL operation(s) until the fault is repaired.**

04.03: Pre-Flight (*Field Operations**)

This step is essentially similar to the previous step, except, everything should be ready. Conduct a final check before leaving for the field. There should be no questions on how the flight activities is to proceed. At this point, final verification of the flight hardware takes place, travel to site, and setup.

04.03.01: REVERIFY:	Prepare flight hardware per manufacture's recommendations.
04.03.02: REVERIFY:	Verify batteries are fully charged. Use fully charged batteries first. DO NOT use partially charged batteries <i>unless</i> it is of a short duration flight. Always keep in mind that using a partially discharged battery will mean shorter flight times.
04.03.03: REVERIFY:	Verify computer media as required. Be sure that a microSD card is available for recording and mounted in the camera.
04.03.04: REVERIFY:	Verify weather conditions for flight: Local Forecasts METARs 1 800 WX Briefs, etc.
04.03.05: REVERIFY:	Verify NOTAMs / D-NOTAMs: Verify TFRs -- pilotweb.nas.faa.gov/PilotWeb/ (UAS entry) tfr.faa.gov/ skyvector.com/ (map) app.airmap.io (map) app.classic.airmap.io (map) dji.com/flysafe/geo-map (map)
04.03.06: PACK / TRAVEL TO SITE:	(pack for travel – per manufacture's recommendations) (travel to site)
04.03.07: CONTACT:	Contact local control tower (if necessary) -- 30 minutes minimum before flight execution for clearance to proceed.
04.03.08: CONTACT:	CONTACT SIU DPS-- 30 minutes minimum before flight execution (notification).
04.03.09: REVIEW:	Verify site for necessary changes to flight plan.
04.03.10: SETUP:	Prep UAV for flight (per checklist).
04.03.11: POWER:	Power up the remote control (per manufacture's recommendations) first before powering UAV.
04.03.12: OBSERVERS / PARTICIPANTS	Place Observers / Participants as discussed.
04.03.13: POWER:	Power up UAV only after the remote control is fully powered up.
04.03.14: CONDUCT	Conduct a test of flight hardware. Assure that the controller is connected to and controlling the UAV in question.

*** Any FAA related restrictions or notifications such as Notice to Airmen (NOTAMs) TFRs (Temporary Flight Restrictions), waiver restrictions, weather minimums, etc., will terminate any / all flying activities for the period in question. Additionally, any flight hardware faults will terminate ALL operation(s) until the fault is repaired.**

04.04: Flight Execution (Field Operations)*

This step is the step that *actual flying takes place*. All participants / visual observers (VOs) should be at their assigned locations to monitor the flight. The Pilot-In-Charge (PiC) should be aware of any flight conditions / hazards and adjust accordingly.

04.04.01: EXECUTE:	Conduct flight as discussed in preflight.
04.04.02: EXECUTE -- Flight Deviations:	Be aware of any conditions that will alter the flight as discussed. Verify site for necessary changes to flight plan.
04.04.03: EXECUTE – FLIGHT:	The PiC needs to announce to all non-participants that flight operations are commencing and to stay clear of the defined operational area.
04.04.03: EXECUTE – FLIGHT:	The PiC needs to be aware of all non-participants to ensure the UAV does not stray over someone.
	The PiC must fly at speeds less than 100mph.
	The PiC must remain below the flight ceiling of 400'. The only exception is flying over tall structures – the working limitation is <i>the PiC must be w/i 400' of the structure in question and no higher than 400' above the structure's highest point.</i>
	The PiC or the designated VO must keep the UAV in site at all times.
04.04.03: TERMINATE – EMERGENCY CONDITIONS:	The PiC must give way to all aircraft to avoid a collision.
04.04.03: TERMINATE – EMERGENCY CONDITIONS:	<i>Emergency Procedures (if necessary). Refer to Section 05: Emergency Procedures, Contacts, and Reporting.</i>
04.04.04 TERMINATE (Low Batter Warning):	Land UAV back at departure point as soon as possible.
04.04.05 REPEAT (As Necessary):	To continue flight until completed:
	Wait until rotors have spun down before approaching UAV
	Power UAV down first.
	Power Remote Control down next.
04.04.05 REPEAT (As Necessary):	Replace battery(ies) as needed.
	Visually inspect blades for damage -- replace as needed.
	Visually inspect UAV for damage.
	<i>Terminate operations if UAV needs maintenance.</i>
04.04.06: REPEAT (As Necessary):	(Return to step 04.03.12 to reinitialize the flight hardware – continue from that point forward).

*** Any FAA related restrictions or notifications such as Notice to Airmen (NOTAMs) TFRs (Temporary Flight Restrictions), waiver restrictions, weather minimums, etc., will terminate any / all flying activities for the period in question. Additionally, any flight hardware faults will terminate ALL operation(s) until the fault is repaired.**

04.05: Post-Flight (Field Operations)

This step is essentially the reverse of 04.03. Instead of setting up for flight, the operation is completed and packing for return to the office. The operation could be considered “complete” if all goals are met. If further action is needed, then scheduling / adding another operation can be discussed once at the office. Refer to Section 04.06: Post-Flight (In-Office Wrap-Up).

04.05.01 TERMINATE:	Land UAV. Return to departure point if desired.
04.05.02: WAIT:	Wait until all rotors have spun down before approaching the UAV.
04.05.03: POWER:	Power down UAV first (per manufacturer’s instructions) DO NOT power down remote until UAV <i>is completely powered down</i> .
04.05.04: POWER:	Power down remote control (per manufacturer’s instructions) only after UAV is completely powered down.
04.05.05: CONTACT:	Contact Control Tower (if contacted beforehand) -- 30 minutes maximum to inform of conclusion of flight activity.
04.05.06: CONTACT:	CONTACT DPS – 30 minutes maximum to inform of conclusion of flight activity.
04.05.07: INSPECT	Inspect the UAV for any maintenance-needed items and log accordingly before packing.
04.05.08: PACK:	Break down UAV per manufacture’s recommendations.
04.05.09: PACK / TRAVEL TO OFFICE:	(pack for travel – per manufacture’s recommendations) (return to office)

04.06: Post-Flight (In-Office Wrap-Up)

Upon returning to the office, a post-flight / post-operation discussion or “debriefing” may be requested / required. This is when evaluation of how the operation was executed, places for improvement, any alterations of procedures should be discussed. Additionally, uploading of flight data should occur at this time if a UAV data service (Verizon’s Skyward, DJI’s FlightHub) is employed.

If necessary, follow-up operations can be added if all of the goals in question were not meet. However, *NO CONTINUANCE OF THE OPERATION CAN OCCUR UNTILL THE UAV IS “CLEARD” BY THE PROJECT DIRECTOR OR PILOT-In-CHARGE (PiC).*

In essence, the post-flight (office) check out is very similar to the preflight (office) (refer to section 04.02) with a few minor / additional steps. These steps include filling out of post flight logs and maintenance logs. For more information about logs and the information required, please refer to Section 06: Logs.

04.06.01: Flight Hardware Verification:	Verify battery charge level – test all batteries for flight hardware, remotes, and monitors for charge level and place on charge as necessary.
04.06.02: Computer media (micro SD card):	Remove micro SD card from camera gimbal. Place in computer and download files as desired. Prep card for next use by erasing all files from card, removing it from computer, and return it to the camera gimbal. Reformat card as necessary.
04.06.03: Fill out documentation logs:	Fill out all required fields in the UAV Flight Logbook: PSO UAV-01. (for each UAV, there should be a separate logbook / log file)
04.06.04: Fill out documentation logs:	Fill out all required fields in the UAV Maintenance Logbook: PSO UAV #01. (for each UAV, there should be a separate logbook / log file)
04.06.04: Fill out documentation logs:	Fill out all required fields in the UAV Operator's Logbook (operator’s personal logbook / log file). (for each UAV operator, there should be a separate logbook / log file)

A logbook is a record of what, where, when, and notes of the operation. In the case of the maintenance log, both “Maintenance Action Requested” and “Maintenance Action Taken” are recorded. Additionally, before the next flight, the flight log file / maintenance log file shall be printed out to keep with the UAV in question. Any documentation should be kept with the UAV in question at all times and shall be presented for inspection to a FAA inspector when requested. Refer to 107.7 Inspection, testing, and demonstration of compliance in Section 03.03 for further information.

Essentially, now is the time to examine the UAV and related components and prepare for the next flight / use. *It is highly recommended* that all actions necessary to complete the inspection (charge batteries, prepare media, etc.) is completed now so the UAV will be ready.

05: Emergency Procedures, Contacts, and Reporting

05.00: Avoidance

Unfortunately, operating a sUAS / UAV is *inherently dangerous*. It is unfortunate fact, there is very little an operator can do to recover from an incident once it starts. The best solution to operational incidents is avoidance in the first place. However, there will be a time where an incident will occur. It is the pilot-in-charge's responsibility to mitigate the incident as best as possible.

Remember: DO NOT FLY OVER NON-PARTICIPANTS

05.00.01: Avoidance	Essentially, a pilot-in-charge (PIC) is responsible for accident avoidance. To that end, the PiC can “deviate” from any of the prescribed flight rules to “the extent necessary” to avoid an accident. Afterwards, if requested by the FAA, the PiC must provide a written report of the incident. Refer to <u>107.21 In-flight emergency</u> located in section 03.03 for more details.
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05.01: Post Incident Protocol

The best possible outcome of an incident (for example a bird strike, flyaway, propeller blade breaks in mid-flight) is the UAV crashes and does not injury anyone or damages any property. The worst possible outcome is an out-of-control UAV severely injuring someone. Depending upon the severity of an incident, several actions may need to happen in short succession.

05.01.01: Terminate operations immediately	If the UAV is “flight-worthy”, the PiC can elect to return to the operational landing site, land the UAV, and examine the UAV for damage. If the UAV is not damaged, the PiC can elect to restart the project or can elect to end operations for the day.
05.01.02: Terminate operations immediately	If the UAV <i>is not “flight-worthy” but “controllable”</i> , the PiC can elect to land the UAV <i>immediately</i> , away from non-participants, buildings, etc. Most likely, the UAV is no longer flightworthy and consideration to repair or replacement must be given.
05.01.02: Terminate operations immediately	If the UAV <i>is in “uncontrollable-flight”</i> , not much can be done except for trying to steer the UAV away from non-participants, buildings, etc. Hopefully, there is enough control left to “crash” the UAV without damaging property or injuring anyone.

05.02: Post Incident Contacts

Actions that need to occur *immediately* will depend of the severity of the incident. If the UAV crashes into the ground, parking lot, lake, etc. without damaging any property, then no immediate action is necessary except contacting the university's UAV Coordinator. However, a report will need to be filed with the appropriate agencies (refer to Section 05.03: Post Incident Reporting). If someone was injured, 911, the local authorities, as well as the university must be contacted.

05.02.01: No injuries, no property damage, UAV crashes into tree – is damaged enough to require repair or replacement	Contact university officials – UAV Coordinator (SIU Legal)
05.02.02: If possible, secure and document	If possible, secure the area the UAV crashed. Record your impressions of the incident. Try to document eyewitnesses, if possible. Document (photograph) the UAV. If the UAV is unreachable, document its location, photograph as much as possible. Contact university officials – UAV Coordinator.
05.02.03: Injuries and / or property damage, UAV crashes and is damaged enough to require repair or replacement	Contact 911, request assistance. Render assistance if possible. Contact university officials – UAV Coordinator. (SIU Legal) Cooperate with officials.
05.02.04: If possible, secure and document	If possible, secure the area the UAV crashed. Record your impressions of the incident. Try to document eyewitness if possible. Document (photograph) the UAV. If the UAV is unreachable, document its location, photograph as much as possible. Contact university officials – UAV Coordinator.
05.02.05: Evidence	It is possible the local authorities will take the UAV for evidence. Cooperate and let them take it. Respectively request if you can photo document the crash area / flight hardware before authorities remove anything for your records, the university's records, the FAA, etc.

05.03: Post Incident Reporting

In addition to documenting the incident for the university and the local authorities, *the FAA and NTSB must be notified.*

Contact the NTSB immediately:

05.03.01: Contact the NTSB Response Operations Center (ROC) 844.373.9922 (24 hour)	A written report may be necessary depending upon if the NTSB chooses to follow-up with an investigation. Not all UAV incidents will be investigated.
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Contact the FAA no less than 10 days of the incident (the sooner, the better), and before any additional flights, the operator must contact the FAA (under the following conditions):

05.03.02: Contact the FAA FAA Regional Operations Center 817.222.5006 or FAA website https://faadronezone.faa.gov/ (login) or FAA Regional Office Springfield Flight Standard District Office (FSDO) 1250 North Airport Drive #1 Springfield Illinois 62707	Serious injury Loss of conscience Death Damage to any property Damage to the UAV exceeds \$500
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Although other information may be requested, the report should include the following items.

05.03.03: Report Information:	Operator / PiC/ RPiC name and contact information FAA certification number sUAS / UAV registration number (FAA registration) Location of incident Date of incident Time of incident Person injured, extent of injury (if known) Property damage, extent of damage (if known) Description of incident
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06: Logs

06.01: FAA Log(s) Requirement

The FAA *requires* various logs (documentation) to be kept on various aspect of sUAS / UAV usage and maintenance. Refer to 107.7 Inspection, testing, and demonstration of compliance in Section 03.03 for further information. In an interesting observation, *there seems to be no “standard” log design for UAV operations*. However, as a “best practice” protocol, the following information will be tracked and logged to assure compliance with FAA regulations.

For each UAV, there shall be logs kept on its operation and maintenance.

For each UAV used for any operation or at any time, information about the flight and maintenance shall be track separately.

06.02: UAV Flight Log	For operating a sUAS / UAV, the following information will be tracked: Date of operation... Operator (Pilot-in-Charge / Remote-Pilot-in-Charge)... Location (either in Latitude / Longitude, generic location address, or both)... Time of operation... Duration of operation (UAV flight time)... Weather conditions... Any pertinent notes...
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As with the flight log(s), the FAA does not present any design criteria for maintenance logs. However, the following log design seems to coincide with information tracked by most operators.

06.03: UAV Maintenance Log	For maintenance of a sUAS / UAV, the following information will be tracked: Date of applicable maintenance... Operator (Pilot-in-Charge / Remote-Pilot-in-Charge)... Maintenance Action Requested... Maintenance Action Taken... Any pertinent notes...
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In this case, tracking the work needed and the work done to a UAV is stating what maintenance is needed (for example, new propeller blades) and what maintenance was performed.

General speaking, there is very little maintenance to be performed on an UAV. Most maintenance items are related to batteries replacement, propeller blades replacement, or camera / computer media problems. Most problems related to the actual UAV itself (motors, electronic speed controllers, GPS module, remote control, etc. – the actual flight hardware) is usually unrepairable the operator. In these instances, the UAV needs to be sent to an authorized repair center, the problem and repair noted in the maintenance log.

Optionally, the operator can keep a personal “Operator Logbook” for himself / herself. In this case, the FAA does *not require* an operator to keep a personal logbook. However, the practice of keeping documentation on the flight / operation you personally perform is highly recommended. The primary reason to keep a personal flight log is you will have your own copy of what operations you have performed and what flight hardware you have used. This will come in handy if you want the information to track the number of hours you have flown, what flight hardware you have used, or documentation for job prospects. Additionally, since it is possible there will be multiple operators of the same flight hardware, it makes sense to track your own work for future reference.

As with the flight log(s), the FAA does not present any design criteria for tracking data for your personal log. However, the following design seems to coincide with most information tracked by most operators.

06.04: UAV Operator’s Log Book	For personal tracking of sUAS / UAV usage, the following information should be tracked: Date of operation... Purpose... Location (either in Latitude / Longitude, generic location address, or both)... Time of operation... Duration of operation (UAV flight time)... Weather conditions... Any pertinent notes...
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Please note: this log appears very similar to the UAV Flight Log(s) used to track the usage of each individual UAV(s). In this case, it is tracking the flight hardware and time of your operations.

06.05: Recording Media

As with the recorded information listed previously, the FAA does not recommend *any particular media or format* to use to record the information in question. It is up to the operator to choose. However, the FAA *does require immediate access* to the information at any time. This includes being able to present the information while you are in the field. It is possible that a FFA inspector could ask to see your documentation on the UAV while currently being flown. Serious consequences could occur if the documentation is not readily accessible.

06.05.01: Paper:	The most “versatile” media to use is paper. A notebook can be used to track the required information. One major advantage is the capability to design exactly the <i>layout</i> and information to be recorded. A major drawback is if the FAA “keeps” it, you do not have any records unless it is photocopied after each log entry. A possible solution to this problem is making a copy of the layout and for each entry, record it twice.
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06.05.02: Logbook	<p>The most “common” format in use.</p> <p>A logbook can be purchased and used “immediately”. Bookstores and various on-line vendors can carry various styles and designs.</p> <p>Again, as with the paper logs listed in 06.05.01, the major drawback with a book style log is if the FAA “keeps” it, you do not have any records. Again, as listed in 06.05.01, the solution is purchasing two copies of the logbook in question and recording it twice.</p>
06.05.03: Digital Media (local storage)	<p>Computer recordkeeping – either using a word processor, spreadsheet, presentation program, self-designed database or cell phone based application is rapidly growing as a solution for data entry / data management.</p> <p>The advantage of using computer media is designing the data to be tracked and inputting the data.</p> <p>The major disadvantage is similar to keeping a logbook. You will need to print out each change to physically keep the information with the UAV,</p>
06.05.04: Digital Media (Cloud based service):	<p>A “cloud” based service is, perhaps, the best solution for an enterprise level operation.</p> <p>The major advantage to using a service is all the data is readily available for data analysis.</p> <p>The major disadvantage is similar to the aforementioned disadvantages of using paper, logbooks, and locally kept data. To meet FAA requirements, a copy of the operational data and maintenance records will need to be printed out and kept for each UAV in question.</p>

07: Maintenance Procedures

There is very little “true maintenance” that is required for most battery operated UAV equipment. However, there are standard items *that must be checked* before and after each use. Any damage or flight hardware discrepancies shall be noted and remedied as soon as possible. These issues *shall be noted* in the maintenance log as action needed / action taken items.

Essentially, there are two (02) types of maintenance for UAVs – either “scheduled” or “unscheduled”.

“Scheduled maintenance”: Any required work that is performed on an UAV that is a reoccurring or is a scheduled event. Such occurrences that falls within this category can be considered preventative maintenance. Items include prop / blade replacement on a regularly scheduled basis. Additionally, regularly scheduled battery replacement falls under this category.

“Unscheduled maintenance”: Any required work on an UAV that falls outside of the scheduled maintenance routine. Such occurrences that falls within this category includes prop / blade failure in the field, battery failure, gimbal isolator replacement, or in the extreme case, hardware or motor failure. The last two being unrecoverable and would require return for repair at the appropriate service center or manufacture.

Either type of maintenance will be recorded in a “Maintenance Log”. A maintenance logbook will be kept for each drone used in operations. All preformed maintenance on a UAV will be record as an action needed / action taken. As the logbook is updated digitally, a printout will be made. At all times, an up-to-date logbook will be kept with the UAV in question.

It is possible, as the UAV “fleet” expands, that an UAV data tracking service can replace keeping of records manually. However, per FAA mandates, these records will need to be printed out and kept with the UAV in question. If a field inspector requests to see the maintenance log(s) of any / all drones on hand, it can be shown to him / her.

In this section, each drone and its associated maintenance procedures will be listed.

07.01: DJI Inspire 1 v2.0 – Maintenance Procedure

For the DJI Inspire 1 v2.0 the following actions are recommended by the manufacture --
 Every 200 flights or 50 actual flight hours, it is recommended that the UAV undergo a comprehensive inspection and maintenance routine.

07.01.01: Battery:	Check for deformities and / or swelling – do not use if the battery appears damaged.
	Verify battery contacts are “clean” -- Remove any tarnish / residue with an eraser.
	Verify the plastic housing of the battery(ies) for loose cap / damage bracket(s). Only use a battery(ies) whose housing is in good condition.
	Examine the power cables visible within the airframe. If damaged, DO NOT FLY – Contact Gresco / DJI for return to shop maintenance.
	Refer to the “ <i>Intelligent Battery Safety Guidelines</i> ” document for long-term storage procedure for of the Intelligent Flight Battery.
07.01.02: Transformation System:	Check the power cables and connectors for ware. If damaged, DO NOT FLY – Contact Gresco / DJI for return to shop maintenance.
	Check the lead screw for rust / dirt – clean with WD-40. Check the lead screw for damage, bending, binding, etc. If damaged, DO NOT FLY – Contact Gresco / DJI for return to shop maintenance.
	Listen for any irregular sounds during transformation phase. Determine source of noise and correct if possible.
	After outriggers are in flight position, check the lead screw for dirt from the unit. If dirt is found, grease bearings.
	If visible damage of lead screws (scratches, dents, particulates located underneath. If damaged, DO NOT FLY – Contact Gresco / DJI for return to shop maintenance.
07.01.03: Visual Inspection:	Verify / Tighten all accessible screws.
	Inspect for any damages that might affect flight -- particularly the location sensors located underneath the airframe. If damaged, DO NOT FLY – Contact Gresco / DJI for return to shop maintenance.
	Inspect carbon tubes for damage.
	Check dampers on landing legs for looseness. If loose, reglue the dampers (superglue).
	Verify no items are on or around the GPS Sensor module. Area must remain free of debris to assure proper functioning of the GPS module.

07.01.04: Flight Motor Inspection:	Check propeller motors are attached tightly to outriggers.
	Run-up motor without propellers attached. Listen for abnormal noise. This may be a sign of excess bearing wear. Replace motor.
	Run-up motor without propellers attached. Feel for excess vibrations. Verify that the prop shaft is rotating straight. If problems are detected, replace motor.
	Check for physical deformities between the motor's housing and motor base. If gap is uneven, replace motor.
	Inspect plastic housing around motor. If damage, replace motor housing.
	Ensure mounting screws are secured. If loose, tighten. Do not over tighten.
07.01.05: Propeller Inspection:	Visual Inspection -- Check propeller for bending, warping, cracking, nicks, etc. If damage is found, replace propeller immediately.
	Propeller Balance -- Attach propellers to the motor. Power UAV. Place on ground / solid surface. Power remote. Initiate UAV and start propellers turning. <i>DO NOT LIFT OFF – especially if indoors.</i> Inspect to see if <i>two</i> propeller lobes are visible. If two are visible, do not use the propeller in question. The blade is out-of-balance.
07.01.06: UAV Electronics Fan:	Listen for UAV fan. Listen for abnormal fan noises or vibration. Replace fan if necessary.
07.01.07: Inertial Maneuvering Unit (IMU) Inspection / Recalibration: (Infrequently -- only if check values are not <i>close to 0 or 1</i> . More likely after firmware update)	As DJI states: <i>The IMU incorporates both a 6-axis gyroscope and an accelerometer to monitor miniscule changes in tilt and movement. This allows the aircraft (UAV) to compensate and adjust immediately, holding it position at all times.</i> Recalibration: DO NOT perform recalibration on the UAV that has power already applied. Perform only on a "COLD STATE" UAV. At this point DO NOT POWER ON DRONE. Place UAV on level, secured surface, away from magnetic / electronic interference. Power UAV. In the DJI app, go to entry CAMERA / MODE / MC SETTINGS / SENSORS / CHECK IMU. Perform IMU CALIBRATION if needed. The process should take approximately 10 minutes. At completion, power everything down as normal.
07.01.08: UAV Antenna:	Check the four (04) leg mounted antennas are secure.
	Check remote control antennas for damage.

07.01.09: Camera & Gimbal Mount:	The connection point between the UAV and gimbal mount is sensitive to damage. Check the connector on the gimbal / gimbal mounting point on the UAV for damage or oxidation. Clean oxidation with an eraser. Clean contact pins as necessary. Be careful not to damage contacts. If the UAV fails to transmit a video signal, the quick-mount may be worn. Contact Gresco / DJI for return to shop maintenance.
07.01.10: Compass Calibration / Recalibration:	Refer to the Inspire 1 v2.0 user manual for further details. Calibrate the UAV compass at each new location before flight or as requested by the flight software. Follow the on-screen directions for compass calibration. Refer to the UAV Pre-flight (Field Operation) checklist for the steps to calibrate the UAV on-board compass.
07.01.11: Vision Position System (VPS): (underside of UAV)	Check the downward pointing camera lens. Clean as necessary similar to cleaning a DSLR camera lens.
	Check for and remove debris from the downward point ultrasonic transducer system.
	Ensure the DPS is attached to the UAV securely.
	To Test: Without rotor blades attached: Power UAV. Hold UAV approximately 3 to 6 feet above a richly patterned surface under good lighting conditions. Change FLIGHT MODE SWITCH (on the remote control) to "P Mode". If functioning correctly, the remote / DJI App will display an altitude reading and the app will respond "P-OPTI".
07.01.12: DJI Support Center:	www.dji.com/support www.dji.com/product/Inspire-1

08: Other Related Documentation

08:00.00: Manufacture's Documentation:

This section contains the manufacture's documentation for each UAV in question.

08:01.01.00: DJI Inspire 1 v2.0

(Include a copy of all applicable manufacture's documentation)

Please note: The DJI Inspire is on its second revision. The flight motors have been upgraded to be slightly more powerful. Additionally, a new type of rotor attachment points have been designed to assure safer attachment points for the blades. In addition, the camera isolator has been redesigned to be larger and more robust to aid in less transmitted vibration to the gimbal platform.

This flight hardware has been designated as PSO UAV #01 or "Drone 1".

08.01.01.01: Inspire 1 / Quick Start Guide

08.01.01.02: Inspire 1 /User Manual

08.01.01.03: Inspire 1 / Maintenance Manual

08.01.01.04: Inspire 1 / Safety Guidelines

08.01.01.05: Safety Guidelines and Disclaimers

08.01.01.06: Firmware Update Guide

08.01.01.07: Charging Hub

08.01.01.08: Inspire 1 TB48 Battery

08.01.01.09: Crystal Sky Monitors

08:01.02.00: (future UAV)

(Include a copy of all manufactures documentation point)

08:01.03.00: (future UAV)

(Include a copy of all manufactures documentation point)

08:01.04.00: (future UAV)

(Include a copy of all manufactures documentation point)

08:01.05.00: (future UAV)

(Include a copy of all manufactures documentation point)

08:01.06.00: (future UAV)

(Include a copy of all manufactures documentation point)

08.02 e-CFR

The Electronic Code of Federal Regulations is the digital version of the federal government's published version, Code of Federal Regulations (CFR). In this case, the most updated information for Title 14 (Aeronautics and Space), Chapter 1, Subchapter F, Part 107 (more commonly referred as "Part 107") found at:

<https://www.ecfr.gov/cgi-bin/text-idx?SID=e331c2fe611df1717386d29eee38b000&mc=true&node=pt14.2.107&rgn=div5>

08.03: (future documentation)

08.04: (future documentation)

08.05: (future documentation)

08.06: (future documentation)

09: Document Revisions

09.01: Revision Notes

Revisions – Tracking the revisions and updates to all documents is a requirement for most Operations Manuals and a good practice in general. Note the version of the document, the date of the update, and notes as to what changed for a given revision.

09.01.01: Version 01.00	2018.01	Initial document completion
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