The Flight Operations Manual (FOM)

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In this lecture you will learn:

- The content and makeup of the FOM
  - The key sections comprising a flight operations manual

7/25/20

1

What is a Flight Operations Manual?

1. Organization
2. Operational policies
3. Risk management
4. Personnel
5. Training
6. Aircraft and airworthiness
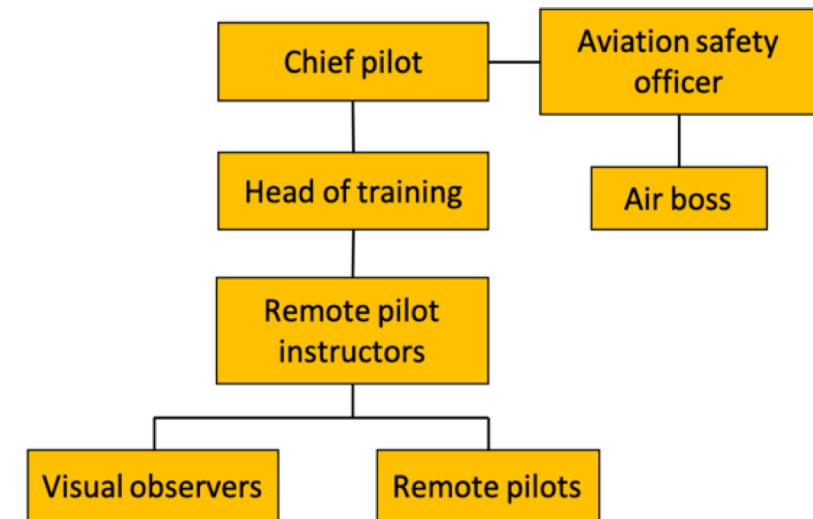7. Flight logging and document management

- The FOM serves to guide all flight operations of an organization in a safe and accountable manner

- The FOM will include the following sections:
  - Organization
  - Operational policies
  - Risk management
  - Personnel
  - Training
  - Aircraft and airworthiness
  - Flight logging and document management

Organizational/management structure

- A flight operation requires a hierarchy of oversight to ensure safe practice:
  - The **Chief Pilot** is the key accountable person for all flight operations and training
  - The **Head of Training** ensures curricular goals and objectives are met
  - The **Aviation Safety Officer (ASO)** oversees safe flight operations through reference to the Safety Management System (SMS) rulebook.

- In all cases, criteria for selection will be defined in the FOM, and this can include pilot certification, course completion, or practical experience.
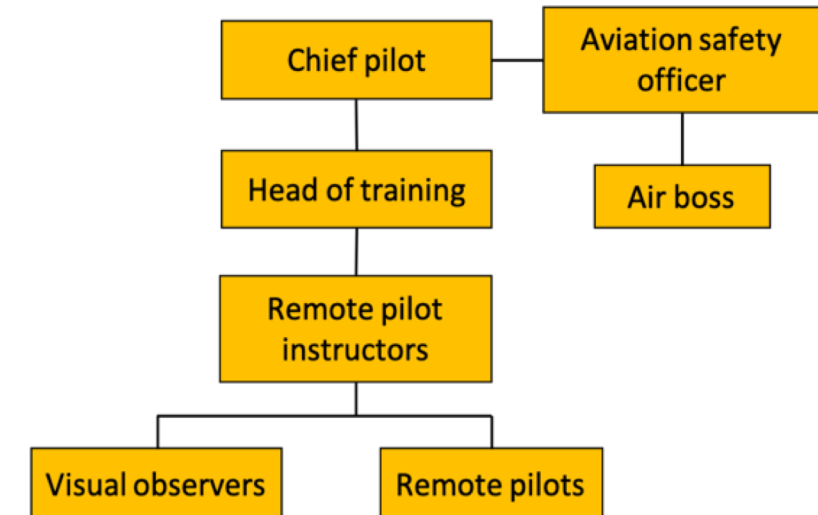
Organizational/management structure

- Other personnel are defined in the FOM:
  - The **Remote Pilot Instructor (RPI)** delivers the training curriculum and tracks student performance
  - **Remote Pilots** are either Student Pilots (SP) or Remote Pilots in Command (RPIC). The SP operate under privileges defined in the Flight Operations Manual.
  - **Visual Observers (VO)** are responsible for communicating operational hazards and air traffic conflicts during flight activities

7/25/20

4

The Responsible Person for all flight operations is the **Remote Pilot in Command (RPIC)**

- If a flight activity is occurring, there will always be a Remote Pilot in Command who is the single point responsible person for that flight

- The RPIC is responsible for:
  - Safe flight operations
  - Altering a flight operation to maintain a minimum level of safety in the event that anomalous behavior is detected
  - The RPIC is the final authority to make and/or approve of all operational decisions in a flight activity

Operational policies

- Flight organizations should have well defined standard briefing checklists to commit the flight crew to a safe operational culture.

- The UAS Pilot's Code (UASPC) provides an excellent framework for this that includes:

  - **General responsibilities of UAS pilots**
  - **Risk mitigation, to consider both manned aircraft and people on the ground**
  - **Training and proficiency, including informal methods of staying current**
  - **Security and privacy measures**

https://www.secureav.com/UAS-Listings-Page.html

Airmanship principles

- Know your aircraft, the capabilities and limitations in normal and non-normal scenarios.

- Know yourself, your limitations and personal habits that effect safety.

- Know your environment, the airspace, the weather, the operation.

- Know your team, conduct briefings, use your observers, communicate, be positive and resolve conflicts quickly and fairly.

- Know the Risks, always conduct a thorough risk assessment.

- Stay Proficient, practice and conduct 'dry runs' of complex operations, and scenario based training for emergencies.

- Have the discipline to keep up to date on the latest safety and operational knowledge, including technical information regarding your platform.

- Do this to improve your situational awareness on every operation

Operational policies

- Categories of flight operation are defined in the FOM:
  - Operational missions
  - Training
  - Recurrency
  - Demonstration flights
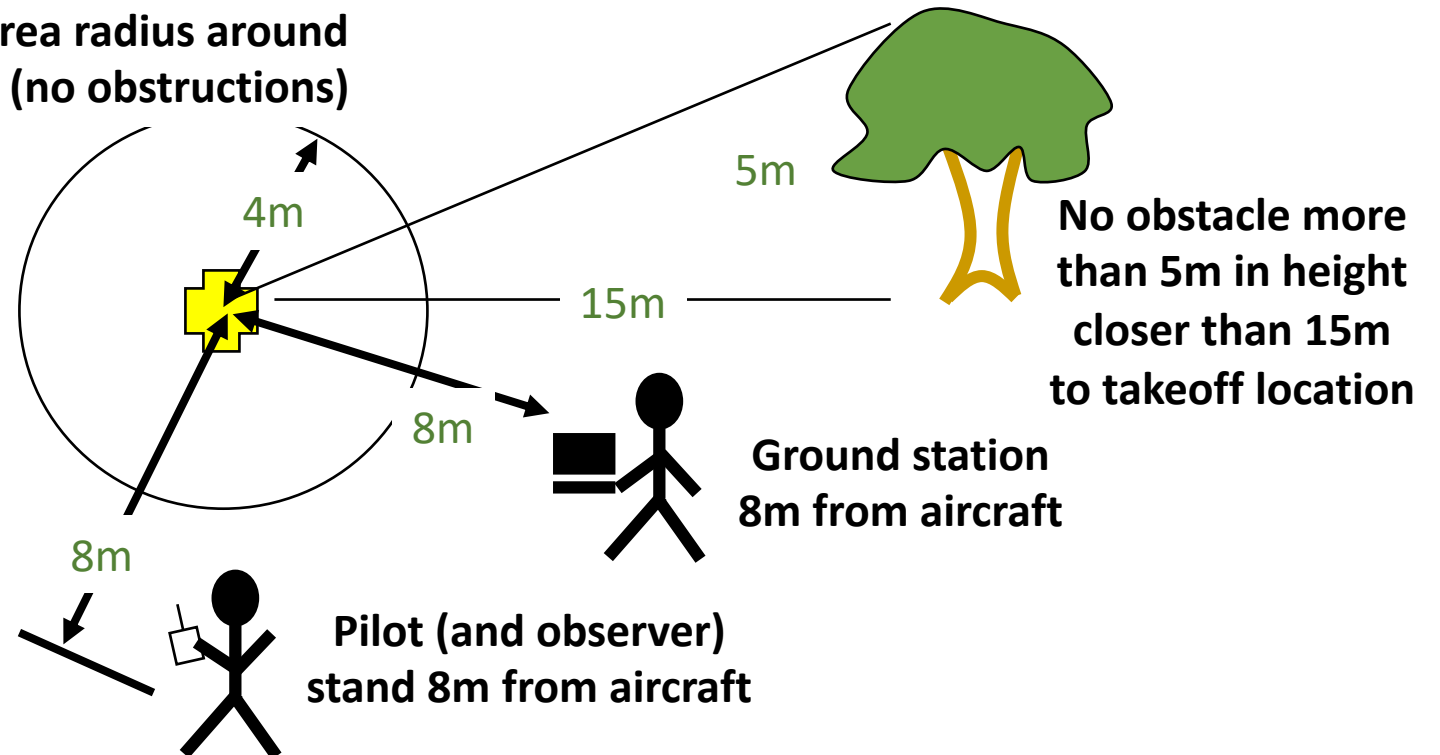 - Research / Experimental flights

Operational policies

- Flight limitations and guidelines include compliance with airspace regulations and rules for safe flight practice
  - As an example, some important regulations would include:
    - Visibility and ceiling requirements
    - Flight rules near aerodromes
    - Flight rules concerning proximity to people and structures
    - Dropping of objects
    - Right of way

Open area radius around aircraft (no obstructions)

4m

5m

15m

8m

8m

No obstacle more than 5m in height closer than 15m to takeoff location

Ground station 8m from aircraft

Pilot (and observer) stand 8m from aircraft

7/25/20

9

Operational policies

- Procedures are defined to govern a safe flight operation:
  - Document review
  - Flight plan
  - Definition of flight crew duties
  - Currency
  - Pilot restrictions (alcohol and drug use, clothing)
  - Radio usage

Operational policies

- Pre-flight activities:
  - Checklists
    - The use of checklists are critical to safe flight operation and will be reviewed multiple times in this course
  - Airspace and site survey analysis
    - Necessary to review temporary flight restrictions and evaluate the flight environment for suitability to the particular aircraft being flown
  - Weather analysis
  - Document check
  - Pilot and flight crew readiness

7/25/20

Operational policies

1. Organization
2. **Operational policies**
3. Risk management
4. Personnel
5. Training
6. Aircraft and airworthiness
7. Flight logging and document management

- Pre-flight activities:

  - Pilot and flight crew readiness - use the IMSAFE checklist or other health assessment checklist:

    - **I** *Illness,* Do I have any symptoms?
    - **M** *Medication,* Have I been taking any prescription or over-the-counter drugs that might affect my performance?
    - **S** *Stress,* Am I under psychological pressure from the job? Am I worried about financial matters, health problems, or family discord?
    - **A** *Alcohol,* Have I been drinking within the past 8 hours?
    - **F** *Fatigue,* Am I tired and not adequately rested?
    - **E** *Emotion,* Am I emotionally upset?

Operational policies

- ## In-flight activities
  - Situational awareness / crew resource management
    - Communication is limited to what is required to conduct the flight activity, and no more
      - No conversation that is not related to the flight activity
      - No picture taking or video recording outside of what is included in the mission profile
      - No cell phone use allowed accept for that required by the flight activity
    - Transfer of control - defined so there is no confusion during the flight mission
    - See and avoid

7/25/20   13
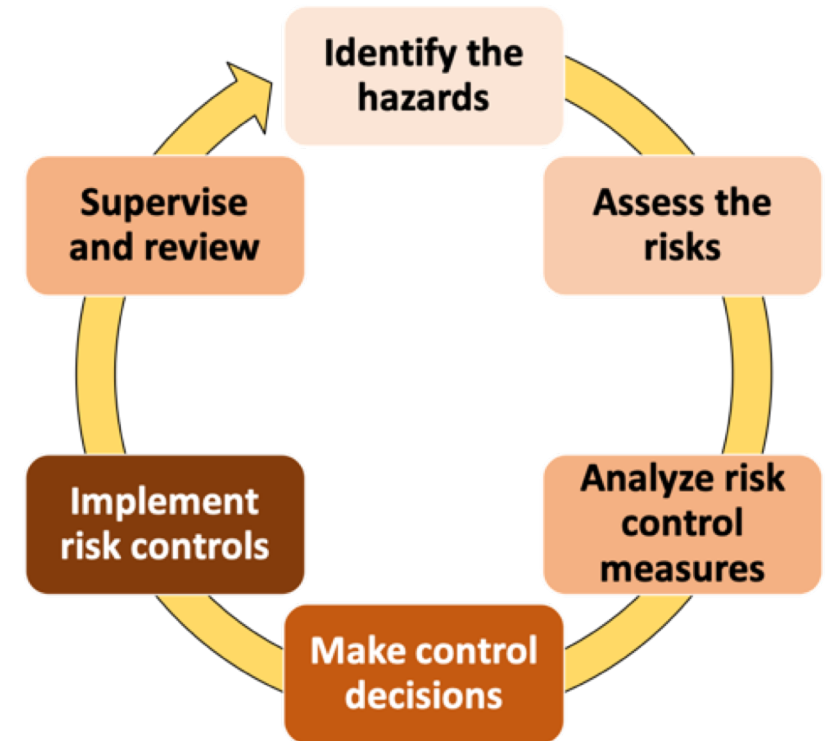
Operational policies

- Post-flight activities
  - Securing the aircraft
  - Post-flight inspection
  - Debrief the flight crew
  - Fill out logbooks
  - If there was an incident or accident, record the event and fill out any required forms

Risk management is conducted throughout a flight activity and it incorporates a **safety culture** starting with the preflight activity to post-flight debrief

- Using multiple checks throughout the flight operations process, we are able to manage risk effectively

- This means identifying risks and applying mitigations to reduce likelihood and severity

Identify the hazards

Assess the risks

Analyze risk control measures

Make control decisions

Implement risk controls

Supervise and review

Project feasibility and safety assessments

- A risk metric is computed in the flight planning process for all potential hazards

- An overall risk metric for the mission is determined (weighted scores on a 5-point scale)

- Mitigations are applied to control the risk to an acceptable level

From the SMS:

Appendix 5: Flight Risk Assessment Tool

(Implemented in Flight Request and Flight Planning Forms)

		1	2	3	4	5	Rating
Operational Factors Text Highlight Color	Type of Operation	Normal	Demo	Training/Recurrency	Initial Flight	Test Flight	
	Duration of Operation	< 1 hour	1-2 hours	2-4 hours	4-6 hours	>6 hours	
	Simultaneous Operations	1 UA		2 UAs		>2 UAs	
Crew Factors (any member)	Hours of Rest in Last 24 Hours	>8	7-8	5-6	3-5	<3 (No Fly)	
	# of Flights in Type	>20	10-20	5-10	1-5	0	
	# of Flights in Last 90 Days	>20	15-20	10-14	5-9	<5	
	Total UAS Hours	>20	10-20	5-10	1-5	0	
Environmental Factors	Current Wind or Max Gust	<8 kts	9-12 kts	13-15 kts	16-18 kts	>18 kts (No Fly)	

Project feasibility and safety assessments

- Although a 5-pt scale is the easiest to use when computing risk, a risk matrix provides a more accurate assessment of how risk can impact a mission

- The **risk matrix** considers two components: **frequency** and **severity**

	Risk Severity				
Risk Likelihood	**Catastrophic A**	**Critical B**	**Moderate C**	**Minor D**	**Negligible E**
5 – Frequent	5A	5B	5C	5D	5E
4 – Likely	4A	4B	4C	4D	4E
3 – Occasional	3A	3B	3C	3D	3E
2 – Seldom	2A	2B	2C	2D	2E
1 – Improbable	1A	1B	1C	1D	1E

Project feasibility and safety assessments

- Severity is defined as the worst thing that can result due to an individual hazard (SMS Sec 3.2)

- Likelihood is defined as the degree to which the hazard is probable to occur (SMS Sec 3.2)

Risk Sever

Risk Likelihood	Catastrophic A	Critical B	Modera C
5 – Frequent	5A	5B	5C
4 – Likely	4A	4B	4C
3 – Occasional	3A	3B	3C
2 – Seldom	2A	2B	2C
1 – Improbable	1A	1B	1C

Table 1. Safety risk severity table

Severity	Meaning	Value
Catastrophic	Equipment destroyed, death	A
Hazardous	Large reduction in safety margins, physical distress, serious injury, major equipment damage	B
Major	Significant reduction in safety margins, reduction in ability to cope with adverse conditions, serious incident, injury to persons	C
Minor	Nuisance, operating limitations, use of emergency procedures, minor incident	D
Negligible	Few consequences	E

Table 2. Safety risk probability table

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, but possible (has occurred rarely)	3
Improbable	Very unlikely to occur (not known to have occurred)	2
Extremely improbable	Almost inconceivable that the event will occur	1

Project feasibility and safety assessments

- The outcome of the assessment of risk can be summarized below:

Assessment Risk Index	Criteria	Accountability
5A, 5B, 5C, 4A, 4B, 3A	Unacceptable under existing circumstances, requires immediate action.	Program Lead, Project Manager, Aviation Safety Officer, & Head of Training
5D, 5E, 4C, 3B, 3C, 2A, 2B	Manageable under risk control & mitigation. Requires authorized decision.	Project Manager, Aviation Safety Officer, & Head of Training
4D, 4E, 3D, 2C, 1A, 1B	Acceptable after review of the operation. Requires continued tracking and recorded action plans.	Project Manager or Aviation Safety Officer
3E, 2D, 2E, 1C, 1D, 1E	Acceptable with continued data collection and trending for continuous monitoring.	RPIC

Non-normal scenarios and **emergency procedures** are just as important to the mission as are the routine operations

1. Organization
2. Operational policies
3. **Risk management**
4. Personnel
5. Training
6. Aircraft and airworthiness
7. Flight logging and document management

- Whenever there is a deviation in flight operations that is not anticipated, the pilot should have a pre-memorized procedure to follow since there will not be any time to refer to the aircraft SOPM or the user manual

- In general, the pilot should "fly the aircraft" first, and resolve the anomaly second

- A landing is to be executed as soon as practical, even if the anomaly is corrected in flight.
  - A repeat of the anomaly could happen, and the outcome may not be as good the second time as it was the first time

Non-normal scenarios and **emergency procedures** are just as important to the mission as are the routine operations

- For the S-500, the SOPM has the following recommended action for emergencies:
  - Low Endurance
    - Immediate Landing in Controlled Area
  - Loss of GCS or Radio Communications
    - Immediate RTL at Communication Regain
  - Loss of Flight Control
    - Immediate Change to Stabilize and Landing (if possible).
  - Loss of Visual Line of Sight
    - Regain LOS and Navigate Back to Home

Non-normal scenarios and emergency procedures are just as important to the mission as are the routine operations

- An Emergency Response Plan (ERP) is also available in the Safety Management System (SMS) Manual

- Emergency Procedures Quick Reference Checklist:
  - If necessary, call emergency services.
  - Render first aid as necessary.
  - Contact the ADDA Head of Training or the ADDA Project Manager via the call out list.
  - Preserve accident/incident site to ensure aircraft wreckage is not tampered with.
  - Secure the Ground Control Station.
  - Once the flight crew and scene are secure/safe take pictures and begin documentation of the incident.

Non-normal scenarios and **emergency procedures** are just as important to the mission as are the routine operations

- An Emergency Response Coordinator (ERC) is always designated (by the Aviation Safety Officer) at the site to take the lead on responding to an emergency, accident or incident

  - This person has the responsibility to prepare for emergencies by providing the following at the flying site:

    - First aid kit that includes enough supplies to handle expected injuries from drone flight

    - A phone number of the nearest emergency response unit for transportation to a hospital

    - 2l of drinking water

    - Clean patient space to administer first aid

    - A bucket of sand for putting out fires

Non-normal scenarios and emergency procedures are just as important to the mission as are the routine operations

- An Emergency Contact Tree is used to sequentially contact personnel affiliated with the ADDA to activate an emergency response:

  - First, contact the Emergency Response Coordinator (ERC) in the event of an incident or accident. This person is responsible for planning ahead for emergency situations

  - Next, the Head of Training is contacted

  - Next, contact the Project Manager if the Head of Training cannot be reached. The Project Manager also serves as the Aviation Safety Officer Both the Head of Training and the Project Manager should be on-site

  - Next, contact the Chief Pilot who may or may not be on-site

  - Next, contact the Programmatic Lead who may or may not be on-site

Non-normal scenarios and **emergency procedures** are just as important to the mission as are the routine operations

- **Mandatory Incident/Accident Reporting System:** All UAS operators are required to submit a complete and detailed incident/accident report if any of the following occur during operations:

- *Incidents*
  - Near miss with an object or person.
  - Crash with any amount of damage beyond normal wear and tear.
  - Reputation conflict.

- *Accidents*
  - Property damage of any type/cost
  - Injury of any type.

- All reports received by the ADDA will be reviewed and addressed by members of the Safety Committee.

Non-normal scenarios and **emergency procedures** are just as important to the mission as are the routine operations

The incident/accident reporting form must be filled out immediately after the event:

The Incident/Accident involved (check all that apply):

	Injury		Prop Strike/Tipover		Loss of Data Downlink
	Death		Foreign Object Damage		Airspace Violations
	Property Damage		Wildlife		Procedure Error
	Traffic Conflict in Flight		Near Midair Collision		Human Factor Error
	Fatigue		Hard Landing		Other
	Fuel/Energy Event		Loss of Command Uplink		
	Altitude Deviations		Loss of Telemetry Downlink		

Classification (check all appropriate responses):

	Damage to Aircraft (salvageable)		Injury to Person (no hospital)
	Damage to Aircraft (hull loss)		Injury to Person (hospitalized)
	Lost Aircraft (unrecoverable)		Death of Person

	Damage to Property (<$500)
	Damage to Property (>$500)

Flight personnel

- Flight personnel have specific roles defined that normally will not change
    - Student Pilots (SP) receive flight instruction from the Remote Pilot Instructor (RPI) and cannot perform flight duties unless they are operating under the direct supervision of an RPI
    - Remote Pilot Instructors (RPI) provide flight training to their students and supervise student flights
    - Remote Pilot in Command (RPIC) is the person who has direct responsibility for the safe flight of the RPA.

Training programs should be defined within the organization

1. Organization
2. Operational policies
3. Risk management
4. Personnel
5. **Training**
6. Aircraft and airworthiness
7. Flight logging and document management

- Flight training is designed to keep pilots current in the flight abilities and knowledge of rules and regulations

- Most flight training within the organization will be conducted by the head of instruction, or a designee who meets flight instructor qualifications

- Training and recurrency will be defined in a flight training and recurrency syllabus

Aircraft and airworthiness

- Most aircraft and airworthiness requirements will be compliant with the governing authority rules
  - An aircraft that is legally authorized to fly within a given airspace must meet the following requirements:
    - Registration
      - The FOM defines the policy for registering aircraft
    - Markings
      - Aircraft display markings as defined by the authority
    - Letter of Approval
      - As part of the process in gaining airworthiness for a particular aircraft, an RPA Letter of Approval (RPA) may be required

Registration number

7/25/20

29

Aircraft and airworthiness

- Maintenance is defined in the FOM to occur on a regular interval or on an as-needed basis
  - Some smaller and lower-cost aircraft do not have a specific maintenance plan defined
- Aircraft inspections include both **generic items** for a class of aircraft and **specific items** that are indicated in the OEM user manual

Registration number

Aircraft and airworthiness

- Generic maintenance classifications and procedures are outlined in the General Maintenance Manual (GMM)
  - This manual designates the authority to conduct maintenance and defines the documentation of maintenance activity

- Specific maintenance for an aircraft is described in the user manual

- In addition to airframe maintenance, **battery logbooks** and **software updates** are also included in a maintenance program

Flight logging and document management

- Logs for both pilots and aircraft are kept by the organization for purposes of determining currency and verifying operational compliance with the governing authority

- A record of pilot certifications should be kept by the organization

- Logs should be maintained for two years