MANAGING THE UAS DEPLOYMENT: MISSIONS, DATA AND INTEGRATION

Governor’s Hurricane Conference 2019 // TS39

Wednesday, 15 May

Merrick, Broder, Hart, and McDaniel
Module 1 - Introductions and Administration

TS39. Managing the UAS Deployment
About Us

- The Center for Disaster Risk Policy (CDRP) is an applied research center in the College of Social Science and Public Policy.
- The Emergency Management and Homeland Security Program (EMHS) is our academic arm, and teaches 21 different EM, homeland security, intelligence studies, and UAS courses.
- Provides support to local, state and Federal entities on a variety of EM-related issues.
- Conducts research on the applicability of UAS in a variety of EM scenarios, including recon, damage assessment, US&R, and wide area search.
  - Researching UAS in EM since 2012. Operates under nationwide public COA as well as 14 CFR Part 107 and formerly under a Section 333 Exemption.
  - Has deployable UAS resources to assist agencies and organizations.
- Member of the Center for Robot-Assisted Search and Rescue (CRASAR) Roboticists Without Borders (RWB) program.
Module 2 - UAS in EM / Missions and Aircraft

TS39. Managing the UAS Deployment
Unmanned Aircraft Types

- A couple of classifications:
  - Small Unmanned Aircraft System (sUAS) - Per the FAA, any UAS (any configuration) that weighs less than 55lbs at takeoff, including payload, fuel, batteries, etc.
  - “Group 1” UAS - DoD classification of a UAS weighing up to 20 lbs, with a nominal operating altitude of less than 1,200’ AGL, with a speed of 100 knots or less.
  - “Group 2” UAS - DoD classification of a UAS weighing between 20 lbs. and 55lbs., with a nominal operating altitude of less than 3,500’ AGL, with a speed of 250 knots or less.
  - Commercial Off-the-Shelf (COTS) - A system (UAS or otherwise) that is commercially available and adaptable to a specific use without customization or development.
sUAS Types

- **Fixed-Wing** - UAS configured like an airplane, with traditional lift-generating surfaces such as wings, lifting bodies, etc. These UAS fly and maneuver like airplanes, and require significant launch and landing areas or equipment.
  - Pros: Efficiency increases flight time, airspeed
  - Cons: Launch/recovery area requirement, lack of hover capability

- **Multirotor** - UAS configured with four, six, or eight (other configurations are possible) fixed pitch propellers, each driven by an individual motor. These UAS are vertical take off and landing (VTOL) capable and can hover.
  - Pros: Easy to maneuver, VTOL, hover
  - Cons: Flight time is short

- **Hybrid/VTOL** - UAS configured to VTOL like a multirotor then transition to fixed-wing flight.
  - Pros: VTOL, increased flight time
  - Cons: Wind resistance, system complexity
Sample EM UAS Missions
What is Intelligence, Surveillance, and Reconnaissance (ISR)?

- **Intelligence**: to process collected data and information into a product (the intelligence) that usable by decision makers or planners.
- **Surveillance**: to provide observation about a situation or incident, particularly to increase situational awareness.
- **Reconnaissance**: to provide observation of an area, incident, or situation with focus on locating specific features, subjects, or resources. This includes Search and Rescue.
What is ISR?

- In the context of the small unmanned aircraft system (sUAS) in emergency management, an ISR mission:
  - Provides real-time or near real-time information to decision makers about the incident, disaster, or emergency.
  - Supports ongoing missions being performed by other resources.
  - Requires organic (internal to the UAS team) analysis of data captured by the UAS.
Small UAS, particularly in the civilian arena (including emergency management) are best employed as tactical resources.

Small UAS and ISR are most useful when supporting existing teams/resources/missions.
<table>
<thead>
<tr>
<th>Mission</th>
<th>UAS Task</th>
<th>ISR Aspect</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damage assessment</td>
<td>Assess housing damage</td>
<td>Recon -&gt; Intel</td>
<td>RGB Video/Images</td>
</tr>
<tr>
<td>Damage assessment</td>
<td>Route clearance</td>
<td>Recon</td>
<td>RGB Video</td>
</tr>
<tr>
<td>SAR</td>
<td>Hasty search</td>
<td>Recon -&gt; Intel</td>
<td>RGB/IR Video/Images</td>
</tr>
<tr>
<td>Situational Awareness</td>
<td>Initial assessment</td>
<td>Surveillance</td>
<td>RGB Video</td>
</tr>
</tbody>
</table>

*Sample EM missions mapped to ISR aspects*
Missions vs. Sorties

- A **mission** is an assignment or a specific deliverable/objective to a resource (or resources) to complete.
- A **sortie** is a single flight of an aircraft, from takeoff to landing.
- A mission may be completed by a single resource in a single sortie, or it may take multiple resources and/or sorties to complete.
Sample Mission Types: 
Reconnaissance/Situational Awareness

- Appropriate aircraft:
  - Any. Fixed wing may provide faster recon and longer flight times (coverage)
- Specialized team requirements [Low/Medium/High]:
  - Low
- Preplanning [Low/Medium/High]:
  - Low
- Execution time [Low/Medium/High]:
  - Low
- Post-processing:
  - Low
Sample Mission Types:
Search and Rescue

- Appropriate aircraft:
  - Any. Fixed wing may provide faster longer flight times (coverage)
- Specialized team requirements [Low/Medium/High]:
  - Medium
- Preplanning [Low/Medium/High]:
  - High
- Execution time [Low/Medium/High]:
  - Medium
- Post-processing:
  - Low
Sample Mission Types: Damage Assessment

- Appropriate aircraft:
  - Multi-rotor
- Specialized team requirements [Low/Medium/High]:
  - Low
- Preplanning [Low/Medium/High]:
  - Medium
- Execution time [Low/Medium/High]:
  - Low
- Post-processing:
  - Low
Sample Mission Types: Mapping

- Appropriate aircraft:
  - Any. Fixed wing may provide faster longer flight times (coverage)

- Specialized team requirements [Low/Medium/High]:
  - Medium (sensors and stabilization)

- Preplanning [Low/Medium/High]:
  - Medium

- Execution time [Low/Medium/High]:
  - Medium

- Post-processing:
  - High
Sample Mission Types:

3D Modeling

- Appropriate aircraft:
  - Any. Fixed wing may provide faster longer flight times (coverage)
- Specialized team requirements [Low/Medium/High]:
  - Medium (sensors and stabilization)
- Preplanning [Low/Medium/High]:
  - Medium
- Execution time [Low/Medium/High]:
  - Medium
- Post-processing:
  - High
Sample Mission Types:
Sampling/Monitoring

- Appropriate aircraft:
  - Multi-rotor
- Specialized team requirements [Low/Medium/High]:
  - Medium (sensors)
- Preplanning [Low/Medium/High]:
  - Medium
- Execution time [Low/Medium/High]:
  - Low
- Post-processing:
  - Low
Defining/Verifying Capability

- It’s important to ensure that your UAS teams are capable of completing the assigned mission.
- Press them. In an aviation safety culture, everyone must be able to say ‘unable’ without ridicule or negative consequences.
- I’d rather a team tell me the assigned mission is beyond their capabilities than have them go out and suffer an incident because they were pressured into accepting a task.
Module 3 - The Regulatory Framework

TS39. Managing the UAS Deployment
Categories of UAS Operations

- The FAA has defined three categories of UAS user:
  - **Recreational User** - A recreational user is someone that flies UAS or model aircraft for hobbyist or recreational purposes.
  - **Civil User** - A civil user flies UAS for any commercial or professional purpose.
  - **Public User** - A governmental public entity, such as governmental agencies including police and fire departments, planning departments, publicly funded universities, public schools (K-12), etc. utilizing the UAS for a governmental purpose.
14 CFR Part 107 - Civil User

**Pilot Requirements**
- Must be 16 years old
- Must possess a Remote Pilot Certificate
- Must pass an initial aeronautical knowledge test at an FAA-approved knowledge testing center.
- Must be vetted by the TSA

**Aircraft Requirements**
- Weigh less than 55lbs.
- Must be registered
14 CFR Part 107 - Civil User
Default Conditions

- Aircraft must be operated within unassisted line of sight of the pilot.
- Aircraft may not exceed 100mph/88knots.
- Aircraft may only be operated in Class G airspace.
- Aircraft may not be operated at night.
- Aircraft will not exceed 400’ AGL, unless within 400’ laterally of a tower or structure.
- Aircraft may not be operated over people or moving vehicles not involved in the flight operation.
14 CFR Part 107 - Civil User
Default Rules

- Aircraft must be operated within unassisted line of sight of the pilot.
- Aircraft may not exceed 100mph/88knots.
- Aircraft may only be operated in Class G airspace.
- Aircraft may not be operated at night.
- Aircraft will not exceed 400’ AGL, unless within 400’ laterally of a tower or structure.
- Aircraft may not be operated over people or moving vehicles not involved in the flight operation.
- Aircraft must yield to manned aviation.

FAA Summary: https://www.faa.gov/uas/media/Part_107_Summary.pdf
14 CFR Part 107 - Civil User
Waivers Available

- Daylight operation (107.29)
- Operation from a moving vehicle (107.25)
- Visual line of sight operation (107.31)
- Operation of multiple unmanned aircraft systems (107.35)
- Operation over people (107.39)
- Operation in certain airspace (107.41)
  - LAANC simplifies this in some areas.
  - **Low Altitude Authorization and Notification Capability** - automated airspace waivers compliant with 107.41.
- Operating limitations for small UAS (107.51)
### Part 107 Waivers & Authorizations

<table>
<thead>
<tr>
<th>TITLE</th>
<th>DATE</th>
<th>APPLICANT</th>
<th>TYPE</th>
<th>STATUS</th>
<th>REFERENCE ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>107.29 Daytime Operation...</td>
<td>12/18/2018</td>
<td>David Merrick</td>
<td>Operational Waiver</td>
<td>Approved</td>
<td>107W-2018-17412</td>
</tr>
</tbody>
</table>
Certificates of Authorization (COA) - Public User

Public users of UAS - government organizations - may apply for a Certificate of Authorization or COA.

These are also referred to as Certificates of Waiver.

The FAA has created an online application process for public organizations, and the process can usually be completed in less than 60 working days.
COA Pilot Certifications

Unlike Part 107 operations, Public COAs do not have mandated pilot requirements.

The FAA has limited oversight of Public Aircraft operations - they fall outside of the majority of the FAA’s jurisdiction.

Public aircraft operators can specify their own pilot certification requirements.
  
  DoD aviators are not required to hold FAA pilot certificates to fly in the National Airspace System. DoD specifies an equivalent or higher standard and maintains those pilot records.

However, many public agencies simply require their pilots hold FAA pilot certificates. This eliminates the need for an agency to develop and maintain standards and records.

It is therefore possible for a COA to require a UAS pilot hold a Part 107 Remote Pilot Certificate from the FAA.

For higher risk operations (over people, controlled airspace, etc.) a manned aviation (Part 61) pilot certificate may be advisable. This demonstrates to the FAA the PIC will meet a high standard of professionalism and safety.
Some COA Restrictions

- A public entity cannot get a COA to conduct UAS operations that are not in the public good. For example, a university can obtain a COA for research regarding UAS design or operations. However, the same university cannot get a COA to film video for a recruiting or promotional video - that is viewed as a commercial purpose and would require operations under Part 107.

- COAs are only valid when the aircraft is operating as a Public Aircraft.

- Simply being owned or leased by the government does not grant Public Aircraft status. (See handout)

- COAs are only valid when the UAS is operated by employees of the requesting organization.
COA Advantages

- COAs are low cost (free to apply).
- Automatic inclusion of nighttime operations (no further waivers required)
- Flights over people allowed in life safety situations.
Know Your State and Local Laws

- In Florida, read 934.50 and understand the implications.
- Understand state/local limitations on surveying and mapping.
Plan for Data Retention, Public Information Requests, Etc.

Data collected from a UAS is just like any other government data. Discuss retention and release policies in advance.
Each rule set offers advantages and disadvantages. Having both available gives the mission manager/UAS team flexibility in how they accomplish the mission.

[Best Practice]
Have 107 and COA Available
Module 4 - ICS and Integration

TS39. Managing the UAS Deployment
The Air Operations Branch is responsible for the coordination of all aviation resources on an incident - *including UAS*.

The AOBD is supported by two key positions: the **Air Support Group Supervisor** (ASGS) and the **Air Tactical Group Supervisor** (ATGS).

Remember, these positions are established only when needed.
Air Operations Branch

Under the ATGS, alongside the Helicopter Coordinator and the Fixed-Wing Coordinator, we add the UAS Coordinator.

This is unofficial, but mimics the intent of the existing AOB structure.
What is Flight Coordination?

- It’s not Air Traffic Control (ATC). AOB very seldom gives command and control orders to aircraft (one exception is Air Attack in wildland firefighting).

- Primary goals:
  - Airspace deconfliction
  - Efficient use of resources
  - Permissions/authorizations
  - Tracking of resources/expenses
Local // Tactical

The vast majority of coordination burden occurs at this level - with the UAS team on the ground. No one is going to do it for you, you have to force this issue.

Local coordination resources may include:

- Other UAS teams
- Local aircraft (LE, air ambulance, etc.)
- Incident Command Post
- City/County Emergency Operations Center

*Local coordination occurs in the immediate vicinity of the mission areas.*
Local // Tactical

Local coordination activities may include:

- Airspace management (often informal)
  - “I’ll be below 200 feet, you stay above 240 feet.” - This is ‘vertical separation’.
- Reducing duplication of effort.
- Working with units/resources to establish goals and objectives (such as an IMT or ICP).
- Integration with higher levels of coordination.
- There may not be a dedicated position (in the ICP) for coordination.
Local // Tactical

Airspace Management Plan (informal at the tactical level)

- Use altitude (vertical separation)
- Use ground references (horizontal separation)
  - I.e. “I’m north of sixth street, you stay south”
- Rotate aircraft/crews (time separation)
- Use the minimum number of aircraft required to complete the mission
- Make sure everyone understands who is going to be where and when
State Air Operations Branch (AOB)

State coordination activities may include:

- Development of an Airspace Management Plan (AMP)
- Coordination of SAR aircraft
- Develop and distribute pilot kneeboards (coordination info) - often referred to as SPINS (Special Instructions)
- Develop and request TFR’s
- Provide aviation resource management support
- Coordinate overhead C2 (command and control) aircraft. This is typically a Federal resource that is chopped to the State.
<table>
<thead>
<tr>
<th>Altitude Zone</th>
<th>Mission Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,000' AGL (up to but not including)</td>
<td>NON - SAR FIXED-WING/VIP/MEDIA</td>
</tr>
<tr>
<td>2,500' AGL (up to but not including)</td>
<td>BUFFER ZONE</td>
</tr>
<tr>
<td>1,500' AGL (up to but not including)</td>
<td>NON-SAR R-W</td>
</tr>
<tr>
<td>1,000' AGL (up to but not including)</td>
<td>SMALL FIXED-WING SAR OPERATIONS</td>
</tr>
<tr>
<td>500' AGL (up to but not including)</td>
<td>R-W MED EVAC/RESCUE PERSONNEL</td>
</tr>
<tr>
<td>400' AGL (up to but not including)</td>
<td>ROTARY WING (R-W) SAR/MED EVAC &amp; SLING LOAD OPERATIONS</td>
</tr>
<tr>
<td>SFC</td>
<td>SMALL UAS</td>
</tr>
</tbody>
</table>
State // State Air Operations Branch (AOB)

State level aviation coordination only occurs for large scale disasters. It rarely occurs for typical emergencies or incidents.

The focus at the State level is on manned aviation resources, though Florida leads on integration of UAS at the state level.

State Air Operations Branch is part of the State Operations section, and coordinates all aviation resources assigned to a disaster.
State // State Air Operations Branch (AOB)

Issues at the State AOB level:

- Title 10 DoD assets
  - Communications failures
  - Difficult to publish a Comm Plan that everyone has seen/utilizes
- No centralized coordination of airborne imagery requests

In reality... all deconfliction will depend on the UAS operator.
“A TFR is not a force field.” The FAA does not like TFRs... and you may not get one, even if you ask for it.

Federal/FAA concerns are not your concerns. It is important to understand that.

The FAA mission is to ensure the safety and efficiency of the National Airspace System. They will help you, but only when they can meet their primary mission.

The FAA will (often before you ask) publish an ACA - Airspace Coordination Area. This is a notification/advisory area that provides additional information to pilots, but it does not limit or restrict flights. An ACA can provide useful coordination information to pilots, including radio frequencies, etc.
FEMA Air Operations fulfills the same mission at the Federal level that State AOB fulfills at the state level.

It serves as a resource coordination entity - **FEMA has no aircraft, including UAS.**

FEMA can help coordinate imagery collection, including manned assets such as NOAA and CAP.
Federal // Other Agencies

- **Civil Air Patrol (CAP)**
  - CAP flies post-impact recon with Cessna 172s and 182s.
  - CAP is developing sUAS / Group 1 UAS capability.

- **Customs and Border Protection (CBP)**
  - CBP provides P-3 Orion C2 aircraft over major disasters, callsign Orion.
  - CBP rotary-wing aircraft will be over the incident.
Establish a local/tactical UAS Coordinator when necessary to reduce pilot load and maintain safety of personnel on the ground.

Example situations include:

- Multiple UAS will be operating at the same time
- UAS will be operating in a mixed manned/unmanned environment

The UAS Coordinator will:

- Assign tasks to UAS crews
- Develop and maintain the airspace management plan.
- Log actions in an [ICS Form 214](#) for all UAS resources/units.
All UAS resources in an operational area should have a common radio frequency to assist in deconflicting traffic. In many situations, UAS teams may find themselves operating in the same airspace as other UAS team without prior coordination.

By using a UAS CTAF (“Common Traffic Advisory Frequency”) all UAS pilots can announce their flights and communicate with other teams as necessary.

The FCC will not license the use of aviation band VHF radios for this purpose - CDRP is recommending the use of GMRS/FRS radios as a cheap, ubiquitous solution.

GMRS/FRS Channel 6 (462.6875) with no tone squelch (CTCSS or DCS) is the common UAS CTAF. This UHF frequency (with a handheld portable radio) will be limited to approximately 1 mile on the ground.
Before launching: “CITY NAME traffic, multirotor UAS CALLSIGN launching and operating to two zero zero feet. CITY NAME traffic.”

On landing: “CITY NAME traffic, multirotor UAS CALLSIGN landing at this time. CITY NAME traffic.”

Changing operating altitudes: “CITY NAME traffic, multirotor UAS CALLSIGN climbing to four zero zero feet. CITY NAME traffic.”

Example: “West Palm Beach traffic, multirotor UAS Dirt Zero One is launching and operating to two zero zero feet. West Palm Beach traffic.”

CTAF can be used to communicate pilot to pilot even among non-standardized crews.
Understand that in a disaster UAS crews in the field may not be able to communicate to the State AOB. Pre-plan as much as possible and don’t depend on internet or telephone based communications.

Have TFRs and Airspace Coordination Areas (ACAs) in place before impact, if possible.

[Best Practice]
Anticipate a Loss of Communication
State AOB should publish a SPINS document daily, and include this in updates to the FAA for inclusion in NOTAM systems. SPINS will contain the communications plan, as well as methods to contact the AOB.

**Corollary:** UAS Teams should look for the SPINS daily.
Module 5 - Waivers, Authorizations, TFRs and the SOSC

TS39. Managing the UAS Deployment
Airspace Over a Disaster Area

- During or after an emergency or disaster, local or state authorities may request the Federal Aviation Administration (FAA) restrict air traffic in the airspace over or near the disaster impact area. This is called a Temporary Flight Restriction (TFR).

- This request can be made for a variety of reasons, including:
  - To protect persons and property on the surface or in the air from existing or imminent hazard associated with an incident on the surface when the presence of low flying aircraft would magnify, alter, spread or compound that hazard.
  - Provide a safe environment for the operations of disaster relief aircraft.
  - Prevent unsafe congestion of sightseeing and other aircraft above an incident or event that may generate a high degree of public interest.
Airspace Over a Disaster Area

- The FAA will have a presence in the State AOB before/during a disaster.
- They will help establish a TFR if necessary.
TFRs

- The TFR will define the geographic boundaries as well as the effective altitude of the restrictions. The TFR also includes the effective date/times of the restriction.

**Airspace Definition:**
- **Center:** On the HIBBING VOR/DME (HIB) 313 degree radial at 12.9 nautical miles. (Latitude: 47°27'17"N, Longitude: 92°55'38"W)
- **Radius:** 3 nautical miles
- **Altitude:** From the surface up to and including 4500 feet MSL

**Effective Date(s):**
- From February 24, 2015 at 1630 UTC
- To February 24, 2015 at 1730 UTC
TFRs and DJI

- DJI aircraft can detect active TFRs and will limit/restrict flight inside the defined area.
- If you are a public safety agency, you must request an unlock for your aircraft so it can operate inside a TFR.
  - [https://www.dji.com/flysafe](https://www.dji.com/flysafe)
UAS Operations in an Emergency

- During an emergency or disaster, some of the limitations applied to COA-based operations can be waived by the FAA.
- The “emergency COA”/”amended COA”/”SGI” process can be completed quickly and can allow:
  - Flights beyond visual range (maybe)
  - Flights in controlled airspace
  - Reduced pilot certification requirements
- As part of the emergency COA process, mitigating factors will be taken into account.
SGI / Emergency COA Requirements

- The emergency COA adapts an existing COA to a new geographic area for a specific (limited) duration.
  - Part 107 operators are eligible as well (since 2017)
- The proposed UAS operations must be directly related to response/recovery from an emergency or disaster.
  - A letter specifying the request from a response organization is required for third parties requesting an emergency COA.
- The aircraft and airspace must be defined.
- A TFR (Temporary Flight Restriction) after a major disaster can simplify the emergency COA process.
The SOSC can help agencies get emergency clearance to fly in controlled airspace (Class E, D, C or B), at night, or waive other restrictions. Call them - not local ATC or other FAA officials.
Recommended Process

- When you know you will need permission to fly in airspace that you cannot normally access:
  - Develop location information using DMS (Degree Minutes Seconds) format. Keep this location as simple as possible: a single point with a radius or a polygon with four points, etc.
  - Determine range/bearing from closest airport (probably the one that generates the controlled airspace)
  - Gather your COA or Part 107 information.
  - Call the SOSC with this info, provide your contact information.
  - Complete the checklist they will send you via email.
  - Send completed checklist to SOSC.
  - Call the SOSC to notify them that your paperwork is in their inbox.
  - Wait.
Notes on the “Checklist”

- The SOSC will provide you with a form to complete.
  - Keep dates/times tight (no multi-day operations)
  - Use Zulu time
  - Coordinates must be in degree, minutes, seconds format. Nothing else.
    - 29:38:01N/81:12:38W
When in doubt in an incident or emergency, call them. If the State AOB is activated, you can call the FAA there.
You aren’t going to get one whenever you ask. If the FAA gives you a TFR, expect them to revoke it early. It’s best to not plan for them.
Get your 107.41 (Airspace) and 107.29 (Daylight) waivers in place as part of your program startup. Don’t wait until an incident occurs.
If you don’t have unlocks complete, you may not be able to operate.
Keep a non-DJI bird available for emergencies.
Module 6 - Mission Management

TS39. Managing the UAS Deployment
The UAS Crew Members

- Flight Crew (Required)
  - Remote Pilot-in-Command (RPIC)
  - Visual Observer (VO)

- Additional Crew
  - Sensor Operator
  - Data Specialist
    - WHY? Having a person dedicated to this position allows the flight crew to immediately re-launch the aircraft and leave post-processing to the Data Specialist.
  - Logistics Specialist
    - The Logistics Specialist can again relieve the flight crew from having to deal with equipment maintenance, battery and power managements, etc.
Mission Management Cycle

Five Phases

- Request
- Planning
- Collection
- Analysis
- Distribution

Who Requests What and When?

- Remember, there is no set way to accomplish a request for UAS resources.
- Most requestors do not have a firm understanding of what UAS can and cannot accomplish.
- Requests will be vague, inaccurate, and based on faulty assumptions.
- In a scenario when multiple UAS teams are working, the UAS Coordinator (either State or local, as appropriate) should filter and refine requests, as well as choose appropriate available resources to match to requests.
- FEMA Resource Typing will not help here.
Mission Management // Request Phase

- Mission request details are provided to the UAS Coordinator, and include, at a minimum:
  - Location/area to be covered
  - Date/time of request
  - Type of information/data to be gathered
  - Suspense date/time
  - Coordinating instructions and point of contact
  - Special instructions
Mission Management // Planning Phase - Assignment

- Once the request is received, it moves to the Planning phase.
- The UAS Coordinator assigns the request to a UAS team for planning development (an eventual movement to Collection).
  - Assignment should be made based on factors including:
    - Available resources
    - UAS team capabilities versus request requirements
    - Logistical capabilities and limitations
    - Duty day limits (if applied)
Mission Management // Planning Phase - Development

- **Mission -> Payload -> Airframe -> Crew Considerations**
  - What payload is required to meet the parameters? What airframe is required to support that payload? What airframe is required by the location? Is there room for a fixed-wing? What crew requirements exist to support the airframe and payload?
The assigned UAS crew will expand the information in the request into a working Mission/Sortie Plan. In addition to refined information from the request, the Mission/Sortie Plan will include:

- Mission location specifics refined to accurate coordinates (Lat/Long or USNG as required)
- Flight/sortie profiles
  - Including operating altitudes (driven by mission/sensor requirements)
- Personnel assigned
- Equipment to be utilized
- Communications plan
- Logistics plan
- Safety plan
Mission Management // Planning Phase - Development

- When planning, be certain to select appropriate altitudes for the sensor being used. Many times flights are planned at altitudes too high.

- There are four steps or functions in remote sensing. Each requires increased resolution.
  - **Surveillance**
    - Wide area observation of a scene, incident, etc. General awareness
  - **Detection**
    - Distinguish an object from background information. Recognition that this is potentially of interest (color, FLIR image, etc.)
  - **Classification**
    - Determine the type of object (person, deer, car, truck, motorcycle)
  - **Identification**
    - Fix an exact identification on an object (Ford Mustang, human male, Bell 407, etc.)
Mission Management // Planning Phase - Development

- At a lower altitude:
  - The higher the resolution from any given optical or IR sensor
  - Aircraft speed may be limited to reduce motion blur
  - Coverage will be smaller - more sorties will be required to cover the same area
  - Terrain masking is increased
### Sample worksheet on sweep width and GSD

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Image Size (pixels)</strong></td>
<td><strong>AOV (deg)</strong></td>
<td><strong>Calculate Sweep Width by Altitude</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Camera</strong></td>
<td>Width</td>
<td>Height</td>
<td>Width</td>
<td>Height</td>
<td><strong>Altitude (m)</strong></td>
<td><strong>Sweep Width (m)</strong></td>
<td><strong>GSD (cm)</strong></td>
</tr>
<tr>
<td>3</td>
<td>DJI X4S</td>
<td>5472</td>
<td>3078</td>
<td>73</td>
<td>53</td>
<td>60.0</td>
<td>84</td>
<td>1.54</td>
</tr>
<tr>
<td>4</td>
<td>DJI Z30 (Wide)</td>
<td>1920</td>
<td>1080</td>
<td>53</td>
<td>40</td>
<td>57</td>
<td>57</td>
<td>2.96</td>
</tr>
<tr>
<td>5</td>
<td>DJI X3</td>
<td>4000</td>
<td>3000</td>
<td>81</td>
<td>65</td>
<td>97</td>
<td>97</td>
<td>2.43</td>
</tr>
<tr>
<td>6</td>
<td>DJI Mavic Pro</td>
<td>4000</td>
<td>3000</td>
<td>66</td>
<td>51</td>
<td>74</td>
<td>74</td>
<td>1.85</td>
</tr>
<tr>
<td>7</td>
<td>DJI XT (9mm)</td>
<td>640</td>
<td>512</td>
<td>69</td>
<td>56</td>
<td>78</td>
<td>78</td>
<td>12.24</td>
</tr>
<tr>
<td>8</td>
<td>DJI XT (13mm)</td>
<td>640</td>
<td>512</td>
<td>45</td>
<td>37</td>
<td>47</td>
<td>47</td>
<td>7.38</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>114</td>
<td></td>
</tr>
</tbody>
</table>
Mission Management // Planning Phase - Development

- Preplan flight routes in GCS software whenever possible
  - DroneDeploy, Ground Station Pro, MapsMadeEasy, Autopilot, etc.
- The use of automation decreases pilot workload which increases safety.
- Preplanning also ensures good coverage of a mission area (reduces the possibility of gaps)
Mission Management // Collection Phase

During the collection phase, the UAS team(s) will execute as many sorties (individual flights) as needed to accomplish the mission. Actions in the Collection phase include:

- Deploy crew and equipment. Move crews and equipment to the area of operations.
- Monitor logistics. Adjust as needed.
- Sortie risk assessment. Perform a risk assessment prior to each individual sortie; monitor weather conditions, crew and equipment conditions, etc.
- Post-sortie data management. Logging, data download, etc.
Once data is collected by the aircraft, it must be converted into a deliverable intelligence product. This involves:

- **Data validation.** Did the UAS team capture the expected data on the sortie? Is the quality of that data sufficient?
- **Generate products.** May include processing still images to maps or 3D models, cleaning up video, etc.
- **Quality assurance.** Does the generated product meet the expected quality standards?
Mission Management // Analysis Phase - Retasking

- In some cases, the collected data may not meet the minimum standards for the intended product.
  - Example: 20% of the images are blurry or out of focus.
- Further, the generated product may not meet the needs of the mission.
- In these cases, the UAS team may be retasked to go back and collect data again.
Mission Management // Dissemination Phase

- The final UAS product(s) must get from the UAS team to the people that need the information.
  - Delivery. May include network distribution (email, etc.) or physical distribution (USB drive, etc.)
  - Support. There will always, always, always be questions about the products. The UAS team must support those quickly.
Establish internal typing of UAS resources.

FEMA UAS Team Typing:

For DJI users performing mapping, survey or search missions, recommend DJI *Ground Station Pro* software for mission planning and sortie assignments. Allows distribution of assigned flight areas to multiple crews.

[Best Practice] Use Mission Planning Software
Alternatives to DJI Ground Station Pro include:

- Drone Deploy
- CAPE
- DroneSense
Throughout the process, log significant activity on ICS form 214. Including:

- Mission requests
- Mission planning
- Flight information
- Significant information collected
Capture and store flight logs from each sortie. With DJI aircraft, this will require an internet connection and a third party service such as AirData or DroneLogBook.
Module 7 - Data Management

TS39. Managing the UAS Deployment
Problems With Data (Historical)

- Data gets lost
  - Totally lost - the SD card disappears
  - Exists but can’t be found - duplicate file names, files put in strange locations, ...
  - Exists but folders and files are named in a way that no one can connect to the right area or mission
- Data gets overwritten when an SD card is reused
- Data Specialist can’t keep up with the influx of data from teams
- There is no single repository for data
- Incident Command does not get information quickly
- UAS Coordinator has no idea of how missions have been flown and what the results are
The IC Perspective

- Incident Command will need specific data products; the data product depends on the mission objectives.
- Actionable data is not the same as ALL the data.
- During the incident...
  - They will not want to watch 20 minutes of video for 90 seconds of key content or sort through img001, img002,... to find the one picture they need.
  - They will not have training or software to run photogrammetrics; UAS teams will not have time to monitor or notice a program has finished.
- After the incident, they may need the data for documentation, analysis, or legal reasons.
- Incident Command owns the data; they do not expect it to be released or used without their explicit permission (especially on anything that smacks of self-promoting social media or press releases).
- Incident Command expects a chain-of-custody of the data.
The Bare Minimum Information

This information MUST be captured by the UAS Team flying the sortie/mission.

- Mission name/number
- UAS Team name and personnel
- Area associated with the mission. May have to annotate if not explicitly in the name (e.g., Echo means “section 31, 35”)
- Mission type
- Mission objectives
- Platform/Aircraft/Sensors
- Any notes as to findings or highlights
Data Management In the Five Phases

- Data management occurs during the Collection, Analysis and Dissemination phases.
- Data management is the responsibility of every member of the UAS Team(s).
- Lost data may be irreplaceable - the time spent to collect that data is gone.
- Information is perishable, so time is of the essence.
UAS Team Responsibilities for Data Management

- Use 1 SD card per sortie to make it easier to differentiate between the sorties.
- Put data into the right folders and subfolder for the Data Specialist, subject to availability of time and invulnerability to car sickness.
- Remember to take screenshot plus context views of LZ, or interesting events/people/scenes! And to give it to the Data Specialist.
- Log every flight
Data Specialist Responsibilities in Data Management

- Make sure you know the mission information, team, and area *before* the UAS team walks out the door (and disappears).
- Get the data in the right folders - do not let the UAS Team just give data and walk away. If they have not QA’d the data, then they need to stay and make sure the data is correct and filed properly.
- Backup all data immediately - never lose data or the chain of custody
- There should always be a copy and the original on SEPARATE storage devices. Never edit or rename the original files - always work on copies.
Data Specialist Responsibilities in Data Management

- Get the right data to the right person in Incident Command - in the format they want/need.
- Perform post-processing (computer vision, photogrammetry, etc.)
  - Monitor the processes. Inform everyone when complete.
- Be able to provide at any time the most up-to-date information about the flights, e.g., “at this time, have flown 34 flights for 25 missions” “3 of the 25 missions were mapping, the rest were FPV for reconnaissance” “where is the data for section 41 where they found the person?”
- Fill in the Excel (.xlsx) data log.
Examples of Data Repository Structure

- **Folder: Date - Incident**
  - **Subfolder: Team Name**
    - mmdyyyy_location_city_mission_team
      - subfolder: Sortie 1, 2, 3,..., n
        - subfolders:
          - Images
          - Videos
          - map.png
        - if further postprocessing or snippets, subfolder: “Products”
        - if any photos from phone or other sources, then subfolder: “Context Source”
    - Date_summary.pptx
<table>
<thead>
<tr>
<th>A</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>mission_name</td>
<td>mission_type</td>
<td>primary_objective</td>
<td>sortie_id</td>
<td>#pictures</td>
<td>#videos</td>
<td>platform</td>
<td>platform_type</td>
<td>control</td>
<td>mission_flight_time</td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_2</td>
<td>0</td>
<td>1</td>
<td>Disco</td>
<td>Fixed-Wing</td>
<td>FPV</td>
<td>0:27:27</td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_3</td>
<td>0</td>
<td>2</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_4</td>
<td>490</td>
<td>0</td>
<td>Disco</td>
<td>Fixed-Wing</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_5</td>
<td>0</td>
<td>1</td>
<td>Disco</td>
<td>Fixed-Wing</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_6</td>
<td>328</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_7</td>
<td>194</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_8</td>
<td>110</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_9</td>
<td>255</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_10</td>
<td>19</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_11</td>
<td>12</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_12</td>
<td>6</td>
<td>2</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_13</td>
<td>12</td>
<td>3</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_14</td>
<td>17</td>
<td>1</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_15</td>
<td>43</td>
<td>1</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_16</td>
<td>40</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_17</td>
<td>29</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_18</td>
<td>20</td>
<td>1</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_19</td>
<td>13</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_20</td>
<td>0</td>
<td>1</td>
<td>Disco</td>
<td>Fixed-Wing</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_21</td>
<td>0</td>
<td>3</td>
<td>Inspire</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10122018_Bayside_PanamaCity</td>
<td>strategic SA/recon/survey</td>
<td>visual assessment</td>
<td>10122018_Bayside_PanamaCity_22</td>
<td>17</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>ground search</td>
<td>missing person</td>
<td>10132018_MexicoBeach_1</td>
<td>0</td>
<td>1</td>
<td>Inspire</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>ground search</td>
<td>missing person</td>
<td>10132018_MexicoBeach_2</td>
<td>0</td>
<td>1</td>
<td>Inspire</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>ground search</td>
<td>missing person</td>
<td>10132018_MexicoBeach_3</td>
<td>0</td>
<td>3</td>
<td>Inspire</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>ground search</td>
<td>missing person</td>
<td>10132018_MexicoBeach_4</td>
<td>0</td>
<td>4</td>
<td>Inspire</td>
<td>Rotorcraft</td>
<td>FPV</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_1</td>
<td>220</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_2</td>
<td>70</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_3</td>
<td>379</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_4</td>
<td>94</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_5</td>
<td>198</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_6</td>
<td>244</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_7</td>
<td>115</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_8</td>
<td>342</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_9</td>
<td>362</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_10</td>
<td>118</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_11</td>
<td>193</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_12</td>
<td>144</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_13</td>
<td>374</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_14</td>
<td>254</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_15</td>
<td>78</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_16</td>
<td>39</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td>10132018_MexicoBeach</td>
<td>debris/damage/assessment</td>
<td>mapping</td>
<td>10132018_MexicoBeach_17</td>
<td>260</td>
<td>0</td>
<td>Mavic</td>
<td>Rotorcraft</td>
<td>PP</td>
<td></td>
</tr>
</tbody>
</table>
At least one Data Specialist should be available when UAS Teams are operating.

This position can be part of the UAS Coordinator’s role if workload permits.

The Data Specialist performs all post-processing on the collected data.
Have at least one high speed USB 3.1 standard external HDD for data backups.

Have several USB 3.1 thumb drives available for disseminating data.
Make UAS Teams responsible for their data.

They are going to want to sleep/eat/etc. when they come in from the field. Stress to them that the data they collected is the entire reason the teams are deployed.

[Best Practice]
Have a lot of USB drives
Module 8 - Logistics

TS39. Managing the UAS Deployment
The Logistics Model

- Here is an operational UAS team supporting an EM mission.
The Logistics Model

- The underlying logistics structure allows the UAS team to support and accomplish the mission.
- Without the proper logistics, the mission will fail.
Logistics Needs

- To utilize a UAS in a specific mission, particularly one in emergency management, there is a lot more than simply picking up a UAS and crew and going flying.
- That approach works for a Saturday of flying for fun, but it invites failure in a professional environment.
- Failure here is defined as more than just having an accident... failure is not achieving the goals of the assigned mission. A UAS team can fly successfully for days and still fail at the mission - particularly without the required logistics planning.
Two is one, one is none.

- The first and foremost rule for planning a UAS mission is this phrase: **Two is one and one is none.**
- If you need an item to complete the mission, you need two of that item. At least. Things break, they get lost, their batteries die.
- When planning a UAS mission away from easy access to support and supplies, bring two (at least) completely operational UAS to accomplish the mission. Otherwise a loss of one aircraft (or even minor damage) could result in a failure to complete the mission.
Logistics Supporting UAS Operations

- There are a lot of factors that may go into the logistics plan for a UAS Team. These include:
  - Training
  - Spares and Repair
  - Operational Support
    - Transportation
    - Housing
    - Safety and Security
    - Information Technology
    - Telecommunications
    - Power and Infrastructure
Training

- Training of UAS crew is a function of logistics, including both primary training and refresher training. This may also include training requirements for a specific mission.

- Ordinarily, training is not mission specific and is completed and up to date prior to creating a logistics plan for a specific mission. However, mission specific payloads may require training prior to the execution of the mission. This must be reflected in the logistics planning.
Spares and Repair

- If you are flying a UAS, you need spare parts and the ability to conduct repairs.
- The first spare you should always have is... a second UAS. Remember: Two is one and one is none.
- Other examples include: propellers, landing gear, batteries, antennas, etc.
- The UAS team should also have the necessary tools and supplies to conduct repairs in the field.
- The exact items required will vary from mission to mission and aircraft to aircraft.
The largest aspect of the mission logistics plan is typically the operational support items. What will the UAS team need from the moment they leave home or office to the moment they return? The operational support section seeks to answer questions such as:
Operational Support

- Transportation
  - What types of transport will be required? How much? Where is that transportation sourced?

- Housing
  - If the mission (including travel) will last multiple days, where will the crew be housed overnight?
Operational Support

- Meals and drinking water
  - Source? Availability? Cost?

- Safety and Security
  - If the crew requires medical assistance, what hospitals, clinics, etc. are available? What first aid equipment should be brought along? Who is trained to use it?
  - Are vaccinations required (such as for Yellow Fever or Typhoid)?
  - Are there other security considerations or actions that need to be taken?
Operational Support

- **Information Technology**
  - Outside of the UAS itself (including the GCS), what IT resources will be required for the mission?

- **Telecommunications**
  - What telecommunications support will be required? Is there cellular coverage? Wifi?
  - What is required and can it be obtained?
Operational Support

- Power and Infrastructure
  - Is there power available in the mission area? What voltage? Is it reliable?
    - Charging batteries requires a source of power
  - Can power equipment (solar, generators, etc.) be carried by the UAS team?
  - Are roads passable? Is it possible to get to the mission area?
  - Is four wheel drive required or recommended? Do vehicles need snorkels (for crossing small rivers)?
Internal Factors Impacting Logistics

- There are a variety of internal factors (resulting from mission requirements or decisions) that will change the logistics plan. These may include:
  - Policies and procedures
  - Mission complexity
  - Mission timeline
  - Crew training/experience
  - Crew size
  - Payload requirements
  - Aircraft requirements
External Factors Impacting Logistics

- There are a variety of external factors (outside of the mission design and requirements) that will change the logistics plan. These may include:
  - Weather
  - Terrain
  - Timeline
  - Available Infrastructure
  - Transportation Limitations
  - Social/Political Situation
  - Legal/Regulatory Frameworks
  - Financial Support
Work backward from the target! You know the mission request and parameters - that’s the fixed point (the target).

Using that as a destination, work backward (we’ve done this before) and determine everything that will be required to put the crew at the right place to accomplish the mission.
If it is mission critical, have two of them.

[Best Practice]
Two is One, One is None
- Pack and store equipment in ready to deploy packages or kits.
- Kits should be inventoried regularly, and maintenance performed and logged.