

5. Operations

5.3 - *Emergency Procedures*



Structure & Formatting Reminder

This presentation is provided as a reference to help you prepare for the your exam. It seeks to go beyond memorization and provide explanation and rationale.

While this reference considers many of the points covered in the exam, given the breadth it is in no way exhaustive. It is suggested to consult a variety of resources when preparing for the exam.

Text that is marked in **YELLOW** has a high probability of being referenced directly in one of the exam's nearly 400 possible questions.

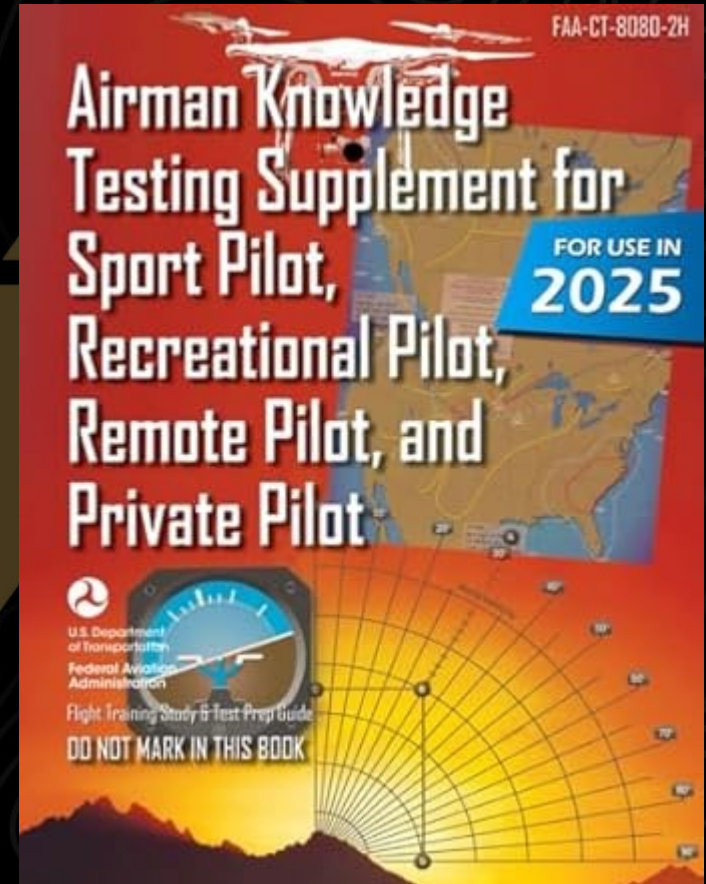
Take the quiz at the end to gauge your understanding.



Airman Knowledge Testing Supplement

Many of the points covered in the slideshow and quiz reference images and concepts found in the “Airman Knowledge Testing Supplement”.

You can download the document from the FAA [here](#). Alternatively, a hard copy can be purchased online for around \$10.





5.3 - Emergency Planning and Communication



5.3 - Emergency Planning and Communication

Success doesn't happen by luck. To fly a safe and efficient operation **you need a plan.**

Plans need to include the following:

- **Communication**
- **Legal Concerns**
- **Privacy Concerns**
- **The Weather**
- **Capabilities of your UAS**



5.3 - Emergency Planning and Communication

Standard Operation Procedure (SOP)

Establishing and instituting a SOP helps to both **prevent emergencies and minimize the extent of damage** should they occur.

A SOP might include:

- Aircraft inspections
- Site evaluations
- Limits to operating conditions
- Emergency procedures
- Contingency plans
- Responsibilities for each person
- Known or potential hazards

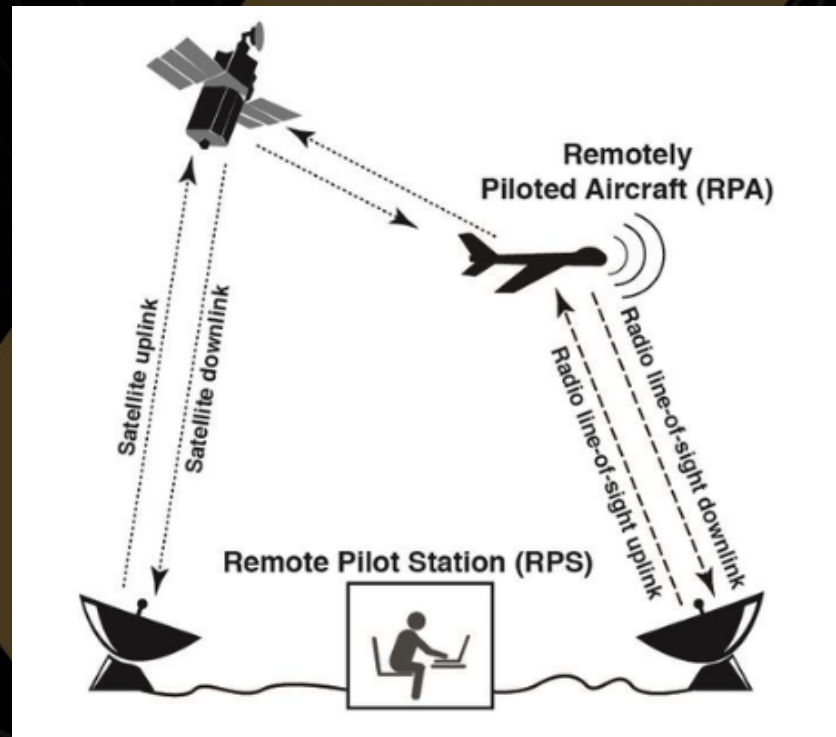


5.3 - Lost Link

A “**lost link**” is defined as the **loss of command control link** between the UAV and ground station.

There are two types:

- **Uplink**: Transmission from the ground station to the aircraft.
- **Downlink**: Transmissions of video, telemetry, and sensor data from the aircraft to the ground station.



5.3 - Lost Link

Lost Link Emergency Procedures:

- Set RTH Location (Altitude/Location)
- Maintain Visual Contact
- Restart the controller
- Fly home manually
- Establish multiple landing points
- Note last known location, altitude, and heading
- Notify ATC (only if in controlled airspace)
- Flight termination system (ex. parachute)



5.3 - Compass Errors

Compass errors can result from:

- A damaged compass module
- An improperly calibrated compass
- Interference issues resulting from Wi-Fi, high voltage lines, large metal structures, building, bridges, and railroads.

Flying in urban environments can often lead to increased interference.



5.3 - Compass Errors

Emergency Procedures

IMPORTANT: **Don't recalibrate**, if there is interference the new calibration will be referencing that interference.

- Restart the drone and controller.
- Move to a new location
- Power the drone back on.
- Try this approach multiple times
- Check in a known good area.
- If compass errors persist contact the manufacturer



5.3 - Flyaway

A **flyaway** is when the UAV **behaves in a manner that is not related to the pilots actions** with the controller.

- Reporting: **A flyway is required to be submitted to the NTSB (National Transportation Safety Board)** as it is a malfunction of the flight system.
- If the UAV can be recovered it is important to reference recorded flight data as it may reveal information about what happened.



5.3 - Flyaway

Flyaway Emergency Procedures:

- By definition there isn't much you can do in the event of a flyaway.
- Some considerations to prevent flyaways:
 - Set your RTH Point
 - Set an appropriate RTH height
 - Try to avoid compass interference
 - Keep the UAV within line of sight
 - Reset your RTH Point if you have moved.



5.3 - Collisions

- Follow and document all **pre-flight procedures**.
- Utilize all available information resources to know if other aircraft are in the area.
- Conduct a **site visit** to determine if any obstacles may pose a hazard.
- If possible, **use a VO** to help with situational awareness.
- Include your contact information on the drone.

5.3 - Collisions

Collision Emergency Procedures:

- Ensure that there are no injuries.
- **If required, report the incident to the FAA.**
- Inspect the UAV for damage and repair if possible.
- If it is beyond your ability discuss repair options with the manufacturer.
- **Conduct testing to ensure that damage has been repaired** (you are responsible for the operation even if someone else fixed it).



5.3 - Collisions

Wildlife - When to report a strike:

- If you **witness** a strike between wildlife and aircraft.
- If **evidence or damage** from a strike **has been identified** on an aircraft.
- If bird or other **remains** (whole or in part) **are found** within 250 feet of a runway centerline and within 1,000 feet of a runway end unless the reason for the animal's death is identified or suspected.



AOPA



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5.3 - Collisions

Wildlife - Which strikes to report:

- All birds
- All bats
- All terrestrial mammals **larger than 1kg** (2.2 pounds)
- Reptiles **larger than 1kg** (2.2 pounds)

While it is not explicitly required to report an animal strike most will exceed the \$500 damage threshold and specifics should be noted.



Fox News



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5.3e - Collisions

How to report a bird/wildlife strike:

- Use the **online reporting system** at the [Airport Wildlife Hazard Mitigation website](#).
- Use a printed Bird/Other **Wildlife Strike Report Form** (Form 5200-7).
- Always include as much information as possible.



Business Insider



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5.3f - Hardware and Software Issues

Hardware and software issues can result in the inability to use certain functions and unpredictable flight.

- If following a pre-flight checklist procedure most issues should reveal themselves before takeoff or immediately afterwards.
- **Many issues can be avoided by careful inspection, regular maintenance, and installing software/firmware updates on a regular basis.**



5.3f - Hardware and Software Issues

Emergency Procedures:

- If an issue is identified land the drone as soon as safely possible and recheck systems associated with the issue.
- If you are unable to drone manually institute a return to home procedure.
- **If the issue can't be resolved flight should be suspended.**



What are some general precautions/preparations that can be instituted in an attempt to avoid an emergency situation in the first place?



What are some general precautions/preparations that can be instituted in an attempt to avoid an emergency situation in the first place?

- Pre-Flight Planning & Risk Assessment
- Equipment Inspection & Maintenance
- Pilot & Crew Readiness
- Operational Best Practices
- Emergency Readiness
- Flight & Maintenance Documentation



5.3 - Lithium Batteries

Battery Depletion:

- Most drones will alert the pilot to return to home if the battery level is low.
 - The distance and altitude from the control station will typically impact that calculation.
- If battery level reaches a critical level most will initiate a forced landing procedure (wherever the drone currently is).
 - Remember: a controlled descent is better than falling out of the sky.

The general rule of thumb is to treat 20% battery as the new zero.



5.3 - Lithium Batteries

If not handled properly lithium batteries can catch fire and/or can result in a reduced ability to charge/hold a charge.

Safety Tips:

- Transport your batteries in a fire-safe container.
- Inspect your batteries before every flight.
- Never use damaged batteries.
- Ensure you follow proper manufacturer recommendation for charging.
- Don't let your batteries get too hot or too cold.



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Despite the risks associated with lithium batteries why are they still the most common way to power a UAV?



Despite the risks associated with lithium batteries why are they still the most common way to power a UAV?

Lithium batteries offer the best trade-off of power, weight, cost, and performance, despite their safety concerns.





5.4 - Frequency Spectrums



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The FCC (Federal Communications Commission) determines the frequencies used for all radio communications.

Most drones operate in the UHF band between 900 MHz and 5.8 GHz.

- 900 MHz - many remote-control only drones.
- 2.4 GHz - many camera-transmitter drones.
- 5.8 GHz - newer camera-transmitter drones (in an effort to avoid interference from wireless transmissions)



UNITED STATES FREQUENCY ALLOCATIONS

THE RADIO SPECTRUM

RADIO SERVICES COLOR LEGEND

ACTIVITY CODE

ALLOCATION USAGE DESIGNATION

SERVICE	EXAMPLE	DESCRIPTION
Primary	FSSD	Fixed Station
Secondary	MSD	Mobile Station

The radio frequency spectrum is a natural resource of the United States. It is a finite resource and its use is subject to the laws of physics. The Federal Communications Commission (FCC) is responsible for managing the radio frequency spectrum in the United States. The FCC's mission is to ensure that the radio frequency spectrum is used in a way that is in the public interest, convenience, and necessity.

U.S. DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Office of Spectrum Management

JANUARY 2016



ALL RIGHTS RESERVED. THE RADIO FREQUENCY SPECTRUM IS A NATURAL RESOURCE OF THE UNITED STATES. IT IS A FINITE RESOURCE AND ITS USE IS SUBJECT TO THE LAWS OF PHYSICS. THE FEDERAL COMMUNICATIONS COMMISSION (FCC) IS RESPONSIBLE FOR MANAGING THE RADIO FREQUENCY SPECTRUM IN THE UNITED STATES. THE FCC'S MISSION IS TO ENSURE THAT THE RADIO FREQUENCY SPECTRUM IS USED IN A WAY THAT IS IN THE PUBLIC INTEREST, CONVENIENCE, AND NECESSITY.

LLC



5.4 - Reporting an Accident



5.4 - Reporting an Accident

Certain accidents must be reported to the FAA **within 10 days**.

Reportable accidents include:

- **Serious Injury - loss of consciousness**
- **Damage - damage exceeding \$500 repair or replacement value.**



5.4 - Reporting an Accident

Information Required in Report

- Remote PIC Info - name, contact, certificate number
- Aircraft Info - registration number
- Accident Info
 - Location
 - Date & Time
 - Person Injured & Extent
 - Property Damaged & Extent
 - Description of Incident



What are some examples of accidents that **WOULD NOT** need to be reported to the FAA?



What are some examples of accidents that **WOULD NOT** need to be reported to the FAA?

- Minor drone crash with no injuries or external property damage
- UAV sustains only minor damage (e.g., broken propeller, scratched gimbal)
- Battery failure or power loss that results in a safe landing
- Flyaway with no injury or property damage
- Minor cut or scrape to pilot or crew (no serious injury or loss of consciousness)
- Drone hits the pilot's own vehicle or equipment with < \$500 in damage
- Low-speed crash into grass, bushes, or other soft terrain without damage



What are some examples of accidents that **WOULD** need to be reported to the FAA?



What are some examples of accidents that **WOULD** need to be reported to the FAA?

- Any injury that causes loss of consciousness
- Any serious injury requiring professional medical attention (deep laceration, broken bone)
- Damage to property not owned by the operator exceeding \$500 to repair or replace
- Drone crash into a car, building, or structure causing > \$500 in damage
- Drone strike causes injury to a bystander or crew member beyond minor first aid
- Battery fire that causes property damage or a safety risk to people
- Collision with another aircraft, even if minor or without injury



Unit 5 Operations – 5.3 Review Quiz

- [5.3 - Emergency Procedures – QUIZ](#)
- This quiz contains 10 questions.
 - You may take it as many times as you like.
 - The order of questions are randomized each time.
 - The large majority of the questions are worded exactly as they appear on the exam.

