

Advanced Drone Piloting

Unit Plan:

Real-world applications and vocabulary integrations



Introduction

Here is a 15-day unit plan for the Advanced Drone Piloting class, with an emphasis on real-world applications and vocabulary integration.

The lessons address the standards

- **Advanced Drone Piloting - 303.01** (Understand the use of drone controls)
- **Advanced Drone Piloting - 303.02** (Demonstrate basic drone maneuvers and flight patterns in a simulated environment),
- **UAS Drone Management System Applications, such as Aloft** mission planning, pre- and post-flight checklists, or manual entry, as well as safety procedures.

Final Project:

Students will complete a final project where they design a mission from start to finish, showcasing all essential skills. The project will require them to navigate airspace, operate the drone, and follow all pre- and post-flight safety protocols.

This unit plan ensures hands-on, real-world applications while covering all essential vocabulary and standards. **UAS Drone Management System Applications**, which incorporate the Aloft mission planner and simulation tools, **are** used to engage students in meaningful UAS operations. A Manual entry option is also available.

Day 1: UAS Basics and Ground Control Station (GCS) Operations
Objective: Understand the components of a UAS and how to operate the GCS.
Vocabulary Focus: - UAS, - UA, - Ground Control Station (GCS), - Remote Pilot in Command (RPIC).
Materials: - UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms - UAS simulators, - GCS hardware.
Activity Outline: <u>Essential Question:</u> What are the main components of a UAS and their roles in flight operations? <u>Lecture:</u> Introduce UAS structure, GCS, and the role of the RPIC. <u>Hands-On:</u> Students practice connecting the UA to the GCS and configure initial settings. <u>Wrap-Up:</u> Discuss the RPIC's responsibility during a flight.
Assessment: Quiz on UAS components and RPIC roles.

Day 2: Visual Line of Sight (VLOS) and Beyond VLOS (BVLOS)
Objective: Learn the importance of maintaining VLOS and the limitations of BVLOS operations.
Vocabulary Focus: - VLOS, - BVLOS, - FPV, - Airworthiness.
Materials: - UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms - drone simulators, - FPV goggles.
Activity Outline: <u>Essential Question:</u> Why is VLOS crucial for safe UAS operations, and what risks are involved with BVLOS? <u>Lecture:</u> Review VLOS, BVLOS, and FPV operations and discuss airworthiness. <u>Hands-On:</u> Simulate VLOS flights and plan BVLOS missions in Aloft, using geofencing for safety. <u>Wrap-Up:</u> Compare the advantages and challenges of VLOS and BVLOS.

Assessment:

- Submission of BVLOS mission plans via Aloft.

Day 3: Mission Planning and Pre-Flight Procedures**Objective:**

- Develop mission planning skills and use pre-flight checklists.

Vocabulary Focus:

- Mission Planning,
- Pre-Flight Checklist,
- Geofencing,
- Payload.

Materials:

- UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms
- pre-flight
- checklist templates,
- simulators.

Activity Outline:

1. Essential Question: What are the key steps to ensure a mission is planned and executed safely?
2. Lecture: Discuss mission planning and configuring the payload for optimal performance.
3. Hands-On: Students complete a pre-flight checklist in Aloft and configure geofencing for safe operations.
4. Wrap-Up: Review the importance of pre-flight checks in ensuring airworthiness.

Assessment:

- Complete a pre-flight checklist and submit a mission plan using Aloft.

Day 4: Airspace Classification and Flight Authorization**Objective:**

- Understand how to navigate different airspace classes and request flight authorizations.

Vocabulary Focus:

- Controlled Airspace,
- Uncontrolled Airspace,
- NOTAM,
- Restricted Airspace,
- TFR,
- Airspace Classes.

Materials:

- UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms
- airspace charts.

Activity Outline: 1. <u>Essential Question:</u> How do airspace classifications impact UAS operations? 2. <u>Lecture:</u> Overview of controlled vs. uncontrolled airspace and how to interpret NOTAMs. 3. <u>Hands-On:</u> Plan a mission near restricted airspace using UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms, and simulate the process of requesting authorization for controlled airspace. 4. <u>Wrap-Up:</u> Discuss the implications of operating in restricted airspace and how to avoid violations.
Assessment: • Submission of mission plans that comply with airspace restrictions.

Day 5: Risk Assessment and Standard Operating Procedures (SOP)
Objective: • Create a risk assessment and SOP for UAS operations.
Vocabulary Focus: • Risk Assessment, • SOP, • Operational Control.
Materials: • Risk assessment templates, • UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms • simulators.
Activity Outline: 1. <u>Essential Question:</u> How can risk assessments and SOPs improve the safety and efficiency of UAS operations? 2. <u>Lecture:</u> Discuss risk management strategies and the importance of establishing SOPs. 3. <u>Hands-On:</u> Students create a risk assessment for a flight mission in UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms and draft an SOP. 4. <u>Wrap-Up:</u> Review the effectiveness of having SOPs in maintaining operational control.
Assessment: • Completed risk assessment and SOP.

Day 6: Collision Avoidance and Situational Awareness
Objective: • Develop collision avoidance techniques and improve situational awareness.

Vocabulary Focus: • Collision Avoidance, • Situational Awareness, • Redundancy.
Materials: • Drone simulators, • UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms
Activity Outline: 1. <u>Essential Question:</u> How can situational awareness and collision avoidance systems prevent UAS accidents? 2. <u>Lecture:</u> Explain the importance of collision avoidance and redundancy in UAS operations. 3. <u>Hands-On:</u> Simulate a mission in UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms, where students must navigate around obstacles while maintaining situational awareness. 4. <u>Wrap-Up:</u> Discuss the value of redundant systems in ensuring safety.
Assessment: • Submit a collision avoidance report based on simulated mission results.

Day 7: Telemetry and Command and Control Link (C2)
Objective: • Understand the role of telemetry and C2 links in drone operations.
Vocabulary Focus: • Telemetry, • Command and Control Link (C2 Link), • Lost Link, • Failsafe.
Materials: • UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms • telemetry data, • simulators.
Activity Outline: 1. <u>Essential Question:</u> How does telemetry provide critical real-time data for UAS operations? 2. <u>Lecture:</u> Overview of C2 links, telemetry, and lost link scenarios. 3. <u>Hands-On:</u> Students review telemetry data during simulated flights in UAS Drone Management System Applications, such as Aloft and/or other online application and practice recovering from lost link scenarios. 4. <u>Wrap-Up:</u> Discuss the importance of failsafe systems and how telemetry aids in maintaining control.
Assessment: • Telemetry data analysis and lost link recovery report.

Day 8: UAS Maintenance and Battery Management
Objective: Develop skills in UAS maintenance and effective battery management.
Vocabulary Focus: - UAS Maintenance, - Battery Management, - Redundancy.
Materials: - UAS kits, - battery management tools.
Activity Outline: <u>Essential Question</u>: How does regular UAS maintenance and battery management ensure reliable performance? <u>Lecture</u>: Discuss the importance of proper maintenance and battery care. <u>Hands-On</u>: Students perform maintenance checks on UAS and practice safe battery charging and storage procedures. <u>Wrap-Up</u>: Review common UAS issues due to poor maintenance and battery management.
Assessment: Complete a maintenance checklist and battery performance report.

Day 9: Incident Reporting and Data Retention Policies
Objective: Learn how to document incidents and establish data retention policies for UAS operations.
Vocabulary Focus: - Incident Reporting, - Data Retention Policy, - Return-to-Home (RTH), - Failsafe.
Materials: - Incident reporting templates, - UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms
Activity Outline: <u>Essential Question</u>: Why is proper incident reporting essential in UAS operations? <u>Lecture</u>: Discuss procedures for incident reporting and how to establish a data retention policy. <u>Hands-On</u>: Students simulate an incident in UAS Drone Management System Applications, such as Aloft and/or any online application, triggering an RTH and completing an incident report. <u>Wrap-Up</u>: Group discussion on how to maintain operational transparency through accurate documentation.

Assessment:

- Submission of incident reports and data retention policies.

Day 10: Emergency Procedures and Flight Termination Systems**Objective:**

- Learn how to respond to emergencies and use flight termination systems effectively.

Vocabulary Focus:

- Emergency Landing,
- Flight Termination System,
- Failsafe,
- Lost Link.

Materials:

- UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms
- drone simulators.

Activity Outline:

1. Essential Question: What are the key steps to take during a UAS emergency situation?
2. Lecture: Discuss emergency landing protocols, flight termination systems, and failsafe procedures.
3. Hands-On: Simulate emergency situations in UAS Drone Management System Applications, such as Aloft or any other online application, where students must execute emergency landings or initiate flight termination.
4. Wrap-Up: Discuss the importance of pre-emptively setting up failsafe systems and practicing emergency responses.

Assessment:

- Students submit a reflection on emergency procedures and their ability to safely land the drone during simulations.

Day 11: Weather Minimums and UAS Performance**Objective:**

- Understand how weather conditions impact UAS performance and flight safety.

Vocabulary Focus:

- Weather Minimums,
- Airworthiness,
- Part 107 Certification,
- Airspace Classes.

Materials:

- Weather forecast tools,
- UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms
- flight simulators.

Activity Outline: 1. <u>Essential Question</u>: How do weather conditions affect the safety and performance of UAS flights? 2. <u>Lecture</u>: Review Part 107 regulations on weather minimums and how to determine airworthiness in various weather conditions. 3. <u>Hands-On</u>: Use UAS Drone Management System Applications, such as Aloft and/or any online application to simulate flight missions under different weather conditions and analyze the impact on drone performance. 4. <u>Wrap-Up</u>: Group discussion on the challenges of operating in marginal weather and how to interpret weather data for safe flights.
Assessment: • Students submit flight logs from weather simulations and analyze how conditions affected UAS performance.

Day 12: Battery Management and Power Systems
Objective: • Deepen understanding of UAS power systems and battery management strategies.
Vocabulary Focus: • Battery Management, • Redundancy, • Return-to-Home (RTH), • Telemetry.
Materials: • Battery management tools, • drone power systems, • UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms
Activity Outline: 1. <u>Essential Question</u>: Why is proper battery management critical to successful UAS missions? 2. <u>Lecture</u>: Explain the role of battery management and how to monitor telemetry for power usage during flights. 3. <u>Hands-On</u>: Students perform power system checks in UAS Drone Management System Applications, such as Aloft and/or any online application, set up RTH for low battery scenarios, and practice safe charging and storage procedures. 4. <u>Wrap-Up</u>: Discuss the importance of redundancy and having backup power systems in the event of battery failure.
Assessment: • Students complete a battery management checklist and reflect on the telemetry data during simulated flights.

Day 13: Search and Rescue (SAR) Applications with UAS
Objective: • Apply UAS technology in search and rescue missions, focusing on thermal imaging and situational awareness.
Vocabulary Focus: • SAR (Search and Rescue), • Thermal Imaging, • Collision Avoidance, • Situational Awareness.
Materials: • UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms • drone simulators with thermal imaging capabilities.
Activity Outline: 1. <u>Essential Question</u>: How can UAS technology be effectively used in search and rescue operations? 2. <u>Lecture</u>: Introduce SAR applications and the role of thermal imaging and situational awareness. 3. <u>Hands-On</u>: Students plan and simulate SAR missions in UAS Drone Management System Applications, such as Aloft and/or any online application, using thermal imaging to locate objects in low-visibility conditions. 4. <u>Wrap-Up</u>: Review real-world examples of SAR missions and how UAS technology has been deployed to save lives.
Assessment: • Submission of SAR mission reports, detailing the use of thermal imaging and situational awareness.

Day 14: UAS Operational Control and Incident Reporting
Objective: • Understand how to maintain operational control and document incidents in a structured manner.
Vocabulary Focus: • Operational Control, • Incident Reporting, • Data Retention Policy, • Command and Control Link (C2 Link).
Materials: • UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms • incident reporting templates, • C2 link data.

Activity Outline: 1. <u>Essential Question</u>: How do you maintain operational control of a UAS in complex environments and handle incidents effectively? 2. <u>Lecture</u>: Review operational control measures, the importance of C2 links, and proper incident reporting protocols. 3. <u>Hands-On</u>: Students practice monitoring C2 links and simulate a situation requiring incident reporting and data retention. 4. <u>Wrap-Up</u>: Discuss the significance of operational control and timely incident documentation in preventing future accidents.
Assessment: • Submit incident reports and analyze the effectiveness of operational control during simulated flights.

Day 15: Final Assessment - Simulated Mission with Full Flight Plan and Post-Flight Analysis
Objective: • Demonstrate mastery of drone control, flight planning, and post-flight analysis through a comprehensive simulated mission.
Vocabulary Focus: • Mission Planning, • Pre-Flight Checklist, • Post-Flight Inspection, • Telemetry, • Flight Log.
Materials: • UAS Drone Management System Applications, such as Aloft and/or Manual entry log forms • drone simulators, • flight log templates.
Activity Outline: 1. <u>Essential Question</u>: How can you apply all learned skills to plan and execute a successful UAS mission? 2. <u>Lecture</u>: Brief recap of mission planning, safety checklists, and post-flight inspections. 3. <u>Hands-On</u>: Students conduct a full mission simulation, including pre-flight checklists, in-flight telemetry monitoring, and post-flight inspections using Aloft. 4. <u>Wrap-Up</u>: Group debrief on flight performance, safety adherence, and post-flight analysis.
Assessment: • Comprehensive mission report, including pre-flight planning, flight performance, telemetry data analysis, and post-flight inspection results.