Basic Drone Pilot (DP01)

Curriculum Guide – Track B

STEM / Programming Integration Pathway



DronePilotsForUS

BLUE RIDGE MOUNTAIN DRONES EDUCATION

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"Making High School Students Drone Pilots"

Basic Drone Pilot (DP01)

Course Introduction

The Basic Drone Pilot (DP01) Curriculum is designed to introduce high school students to the foundational knowledge and skills required for safe and effective drone operation within the broader field of aviation.

This course provides a structured, aviation-first pathway that develops student understanding of drone systems, flight principles, airspace awareness, safety procedures, and real-world applications. Students engage in hands-on learning experiences that reinforce core aviation concepts while building confidence in operating unmanned aircraft systems (UAS).

Emphasis is placed on **safety, responsibility, and industry relevance**, ensuring students are prepared for advanced coursework and future certification pathways, including FAA Part 107.

Course Purpose

The purpose of this course is to:
- Introduce students to aviation concepts and drone technology
- Develop foundational knowledge of flight, airspace, and drone systems
- Promote safe, responsible, and professional drone operation
- Build awareness of career pathways in the drone and aviation industries
- Prepare students for advanced drone training and FAA certification pathways
- Provide hands-on learning experiences that connect theory to real-world application

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Course Structure

This course is organized into **18 weeks of instruction** using a structured and flexible instructional model.

Instructional Model
This course is built as an **80-day instructional sequence delivered within a 90-day semester**.

The remaining 10 days are intentionally reserved for assessment, application, and instructional flexibility.

Each instructional day is designed for approximately **80 minutes of class time**, including:
- Direct instruction
- Guided discussion
- Hands-on drone flight activities
- Skill development and practice
- Assessment and reflection

The curriculum progresses from **foundational aviation knowledge to applied operational skills**, ensuring students build both conceptual understanding and practical proficiency.

Assessment & Flex Day Integration (10 Days)

To support pacing flexibility and mastery-based learning, the following structure is recommended:
• Week 4 – Unit Assessment (1 day)
• Week 7 – Unit Assessment (1 day)
• Week 9 – Midterm Exam (1 day)
• Week 12 – Unit Assessment (1 day)
• Week 15 – Unit Assessment (1 day)
• Week 18 – Final Exam (1 day)
• Remaining 4 days – Flight Labs / Skill Reinforcement / Weather Buffer

These flex days ensure teachers can adapt instruction while maintaining course integrity and student success.

Standards Alignment

The DP01 course is aligned to a structured set of **100-series standards**, ensuring consistency, progression, and alignment with aviation education expectations:
• **101.00 – Foundational Aviation Concepts and UAS Introduction**
• **102.00 – UAS Systems and Component Functionality**
• **103.00 – Airspace and Chart Interpretation**
• **104.00 – Mission Planning and Operational Decision-Making**
• **105.00 – Safety Procedures and Regulatory Requirements**
• **106.00 – Manual Flight Operations and Control**
• **107.00 – Programming and Autonomous Flight (Track B only – final unit)**

Standard 106 (Flight Operations) is embedded throughout the course and reinforced through hands-on flight activities, simulations, and performance-based assessments.

Standard 107 is introduced **only at the end of the course in Track B**, serving as a capstone application of previously learned concepts.

Instructional Approach

This curriculum uses a blended instructional model that includes:
• Direct instruction for foundational knowledge
• Guided practice for concept development
• Hands-on activities for real-world skill application
• Performance-based assessments for mastery
• Reflection and revision for continuous improvement

Each lesson is designed for an **80-minute class period**, ensuring appropriate pacing, engagement, and instructional depth.

Student Outcomes

By the end of this course, students will be able to:
• Explain foundational aviation concepts and drone operations
• Identify drone components and describe system functionality
• Interpret basic airspace and operational constraints
• Apply safety procedures and preflight planning techniques
• Demonstrate controlled drone flight maneuvers
• Evaluate flight conditions and make safe operational decisions
• Exhibit responsible and professional drone operation behavior

Track B students will additionally be able to:
• Apply basic programming concepts to autonomous drone movement
• Execute simple programmed flight paths using a drone platform

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Teacher Implementation Notes

• Each lesson is self-contained and designed for daily instruction
• Hands-on activities are included whenever possible
• Safety should be reinforced in every lesson
• Flight activities may be conducted using real drones or simulators
• Teachers should adapt pacing based on student needs
• Flex days should be used strategically for assessment and skill development

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TRACK DESCRIPTIONS

Track A – Aviation & Part 107 Preparation Pathway
Track A is designed to build a strong foundation in aviation knowledge, drone operations, and airspace awareness to prepare students for the Remote Drone Pilot course and eventual FAA Part 107 certification.

Students develop essential skills in:
• Flight safety
• Airspace understanding
• Mission planning
• Regulatory awareness

This track emphasizes **real-world aviation application** and serves as the primary pathway for students pursuing certification and careers in drone operations.

Track B – Aviation with Programming Capstone Pathway
Track B includes all core aviation and drone operation concepts found in Track A, while adding a **structured introduction to programming and autonomous flight at the end of the course**.

Basic Drone Pilot (DP01)

Students first develop a strong aviation foundation before applying programming concepts such as:
• Sequencing
• Loops
• Command execution

Using platforms such as Tello EDU or CoDrone, students design and execute simple autonomous flight paths as a capstone experience.

This track maintains a primary focus on aviation while providing exposure to STEM applications and emerging technology pathways.

Track A (80 Days)

Standard	%	Days
101.00	15%	12
102.00	15%	12
103.00	20%	16
104.00	15%	12
105.00	20%	16
106.00	15%	Embedded

Track B (80 Days)

Standard	%	Days
101.00	15%	12
102.00	15%	12
103.00	20%	16
104.00	15%	12
105.00	15%	12
106.00	10%	Embedded
107.00	**15%**	**Final 12 days ONLY**

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DP01 Standards Track B – STEM / Programming Track (Total = 100%)

Week 1 – Foundations of Aviation and Drone Industry

Week 2 – Aerodynamics and Flight Principles

Week 3 – Safety, Risk, and Procedures

Week 4 – Airspace Fundamentals and Chart Introduction

Week 5 – Mission Planning & Pre-Flight Considerations

Week 6 – Introduction to Mission Planning and Risk Assessment

Week 7 – Expanding Mission Planning and Risk Management

Week 8: Applying Mission Planning to Flight Operations

Week 9: Safety Procedures and Regulatory Foundations

Week 10 – Safety & Regulatory Operations

Week 11 Precision Flight and Stability Control

Week 12 – Advanced Flight Control and Maneuver Precision

Week 13 – Mission-Based Flight Operations and Risk Management

Week 14 – Introduction to Drone Programming and Autonomous Flight Concepts

Week 15 – Advanced Autonomous Mission Development and Execution

Week 16 – Applying and Improving Autonomous Drone Missions

Week 17 – Final Autonomous Mission Mastery and Performance

Week 18 – Final Assessment and Course Closure

DP01 Basic Drone Pilot Course – Master Standards Table (Two-Track Model)

DP01 Standards Track B – STEM / Programming Track (Total = 100%)

Standard Number	Description	RBT Level	% of Course
101.00	Explain foundational aviation concepts and their impact on drone operations.	B2	15%
101.01	Identify historical developments in aviation and UAS evolution.	A1	
101.02	Describe aerodynamic forces affecting drone flight.	B2	
101.03	Identify career pathways and industry applications in UAS and aviation.	A1	
102.00	Explain UAS components and system functionality.	B2	15%
102.01	Identify drone components and their functions.	A1	
102.02	Compare drone types and configurations for different missions.	B2	
102.03	Explain how drone systems function together during operation	B2	
103.00	Interpret aeronautical charts and airspace for safe drone operations.	C3	20%
103.01	Identify chart symbols, airspace classifications, and restrictions.	A1	
103.02	Interpret sectional charts for flight planning decisions.	B2	
103.03	Apply chart data to determine safe and legal flight locations.	C3	
104.00	Apply mission planning and operational decision-making for drone operations.	C3	15%
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3	
104.02	Evaluate environmental and airspace factors for mission approval.	B2	

105.00	Apply safety procedures and regulatory requirements for drone operations.	C3	15%
105.01	Explain FAA rules, TRUST certification, and introductory Part 107 concepts.	B2	
105.02	Apply safety procedures and risk mitigation strategies.	C3	
105.03	Demonstrate safe and responsible drone flight operations.	C3	
106.00	Perform manual drone flight operations using controlled maneuvers.	C3	10%
106.01	Execute basic drone flight maneuvers including hover, yaw, and directional control.	C3	
106.02	Demonstrate controlled takeoff, navigation, and landing procedures.	C3	
107.00	Apply programming concepts to autonomous drone flight operations.	C3	10%
107.01	Explain programming logic including sequence, loops, and commands.	B2	
107.02	Develop a programmed flight path using a drone platform.	C3	
107.03	Execute an autonomous drone mission based on programmed instructions.	C3	
107.04	Evaluate and troubleshoot autonomous flight performance.	B2	

Week 1 – Foundations of Aviation and Drone Industry

Week Overview
This week introduces students to the world of aviation and drones, focusing on the **history, evolution, and career opportunities** within the industry. Students will explore how drone technology developed from early aviation and how it is used in modern industries.

Emphasis is placed on **career awareness (NCDPI requirement)** and understanding the role drones play across multiple fields. This foundation prepares students for deeper technical and operational learning in future weeks.

Week 1 – Day 1: Introduction to Drones, Aviation, and Course Expectations

Standard	Description	RBT Level
101.00	Explain foundational aviation concepts and their impact on drone operations.	B2
101.01	Identify historical developments in aviation and UAS evolution.	A1
101.03	Identify career pathways and industry applications in UAS and aviation.	B2

Objective
Students will identify the purpose of drones, describe their role in aviation, and recognize career opportunities in the drone industry.

Essential Question
How have drones become an important part of modern aviation and careers?

Key Concepts
• Definition of drones (UAS)
• Aviation vs drone aviation
• Real-world drone applications
• Career pathways in UAS
• Course expectations and structure

Vocabulary
• UAS (Unmanned Aircraft System) – Aircraft operated without a pilot onboard
• UAV (Unmanned Aerial Vehicle) – The drone itself
• Aviation – The operation of aircraft
• Payload – Equipment carried by a drone
• Operator – Person controlling the drone

Materials Needed
- PowerPoint Presentation (Week 1 Day 1 – Introduction to Drones, Aviation, and Course Expectations)
- Course syllabus
- Whiteboard/markers
- Student notebooks

Bellringer
Prompt:
Where have you seen drones used in real life? List at least two examples.

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • What they already know about drones
   • Places where they have seen drones used
   • General ideas about aviation and aircraft

   Discuss:
   • Where have you seen drones used in real life?
   • Why do people use drones instead of other tools?

   Bridge to lesson:
   - Drones are now used in many industries and are part of the larger field of aviation
   - This course will help students understand how drones work, how they are used, and how to operate them responsibly

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2. **Core Concept Introduction**
   • A drone is part of an Unmanned Aircraft System (UAS)
   • A UAS includes the aircraft, the controller, and the operator
   • Drones are used for more than recreation and are becoming an important part of modern aviation

   Key Teaching Point:
   Drones are aviation tools that require both technical understanding and responsible operation.

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3. **Concept Development**
   A. **Understanding What a Drone Is**
      - A drone is an aircraft operated without a pilot onboard
      - Many drones are controlled remotely by a pilot using a controller or tablet
      - The full system includes the drone, the controller, and the person operating it
      - Drones are part of aviation because they operate in the air and must follow safety expectations

   B. **Exploring the Growth of Drone Technology**
      • Early drone use was largely military
      • Over time, technology improved and drone use expanded into civilian industries
      • Drones are now smaller, more affordable, and easier to use than earlier systems
      • Modern drones are used in schools, businesses, and public service operations

C. Identifying Modern Uses of Drones
- Photography and videography
- Agriculture and crop monitoring
- Public safety and emergency response
- Construction and mapping
- Inspection of buildings, towers, and infrastructure
- Delivery and other emerging technology applications

D. Connecting Drones to Careers
- Drone pilots work in many industries
- Careers may include inspection, photography, mapping, agriculture, and public safety support
- Students who learn drone skills may prepare for advanced training and industry certifications later
- Understanding drone careers helps students connect classroom learning to real-world opportunities

E. Introducing the Course Purpose and Expectations
- This course is designed to introduce students to foundational aviation and drone concepts
- Students will study safety, flight, airspace, mission planning, and drone operations
- Hands-on learning will be an important part of the course
- Responsible behavior, attention to safety, and participation are important expectations for success

Key Teaching Point:
Drone education connects aviation knowledge, technical skill, safety awareness, and career readiness.

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4. Application to Drone Flight
Students connect drone missions to real-world purposes by comparing their uses, such as taking photos, inspecting a roof, or supporting agriculture. Students recognize that drone flights are planned around a specific task or goal.

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5. Guided Examples / Demonstration
Instructor presents several examples of drone use, such as:
- Taking aerial photos of a football field
- Inspecting a roof for damage
- Monitoring crops in a field
- Assisting with search operations in a public safety setting

For each example, students identify:
- The purpose of the flight
- The industry connected to the flight
- A possible career related to that drone use

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6. **Real-World Connection**
   Drones are used every day in industries that students recognize, including media, agriculture, construction, and emergency services. Learning about drones helps students see how aviation knowledge can connect to real jobs, technical skills, and future certification pathways.

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7. **Key Reinforcement Summary**
   • Drones are part of modern aviation
   • Drones are used in many industries for specific missions
   • Drone technology is connected to real careers and technical opportunities
   • This course introduces students to safe, responsible, and professional drone operation

   Key Teaching Point:
   Drone piloting is both a technical skill and a professional responsibility.

Course Overview and Expectations
• Overview of course structure
• Hands-on learning expectations
• Safety expectations
• Introduction to future topics:
• Flight
• Airspace
• Safety
• Programming (end of course only)

Key point:
• This is an aviation-first course with real-world application

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Formative Questions for Use in This Lesson
• What makes a drone different from other aircraft?
• Why are drones considered part of aviation?
• What industries use drones the most?
• Why are drone careers growing?

Hands-On Activity
Activity Title: Drone Applications Brainstorm
Objective:
Students will identify and categorize real-world drone uses and connect them to careers.

Activity Procedure
1. Divide students into small groups
2. Assign each group an industry (agriculture, construction, public safety, media)
3. Students list how drones are used in that industry
4. Identify at least one related career
5. Groups present findings to class
6. Instructor records responses on board
7. Class discusses similarities and differences

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Industry Understanding	Clear and detailed	Mostly clear	Limited	Incorrect
Career Connection	Strong connection	Adequate	Limited	Missing
Participation	Fully engaged	Mostly engaged	Some participation	Minimal
Presentation	Clear and confident	Mostly clear	Some difficulty	Unclear

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Assessment Items

1. What does UAS stand for?
   A. Unmanned Aircraft System
   B. United Aviation System
   C. Universal Air System
   D. Uncontrolled Aircraft System
2. What is a UAV?
   A. The controller
   B. The drone itself
   C. The battery
   D. The pilot
3. Which industry uses drones?
   A. Agriculture
   B. Construction
   C. Public safety
   D. All of the above
4. What is aviation?
   A. Driving vehicles
   B. Operation of aircraft
   C. Building drones
   D. Repairing equipment
5. Why are drone careers growing?
   A. Less technology
   B. Increased demand for drone services
   C. Fewer applications
   D. Reduced use

Answer Key

1. A
2. B
3. D
4. B
5. B

Closure
Drones are an important part of modern aviation and are used across many industries, creating growing career opportunities.

Exit Ticket
Name one industry that uses drones and explain how they are used.

Teacher Notes
• Emphasize career connections early
• Keep discussion interactive and student-driven
• Reinforce aviation-first mindset
• Set expectations for hands-on learning
• This lesson sets the foundation for the entire course

Week 1 – Day 2: History of Aviation and Evolution of Drone Technology

Standard	Description	RBT Level
101.00	Explain foundational aviation concepts and their impact on drone operations.	B2
101.02	Describe aerodynamic forces affecting drone flight.	B2

Objective
Students will identify key developments in aviation history and explain how these advancements led to modern drone technology.

Essential Question
How has aviation history influenced the development of modern drones?

Key Concepts
• Evolution of aviation
• Timeline of flight development
• Transition from manned to unmanned aircraft
• Technological advancements
• Influence of aviation on drones

Vocabulary
• Aviation – Operation of aircraft
• Innovation – Introduction of new ideas or technology
• Manned Aircraft – Aircraft with a human pilot onboard
• Unmanned Aircraft – Aircraft operated without a pilot onboard
• Evolution – Gradual development over time

Materials Needed
• PowerPoint Presentation (Week 1 Day 2 – History of Aviation and Drone Evolution)
• Whiteboard/markers
• Student notebooks
• Timeline handout (teacher-created or printed)

Bellringer
Prompt:
What do you think was the most important invention that made modern flight possible? Explain your answer.

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   - In the previous lesson, Students learned what drones are and how they are used
   - Today, they will begin learning how drones actually move through the air

   Ask students:
   - What makes something fly?
   - Why do some objects stay in the air longer than others?

   Emphasize that:
   - Flight is not random—it is controlled by specific forces
   - Understanding these forces is essential for safe and effective drone operation

   Bridge to lesson:
   - All aircraft, including drones, rely on the same basic principles of flight

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2. **Core Concept Introduction**
   - There are four main forces that affect flight
   - These forces determine whether an object rises, falls, speeds up, or slows down

   Introduce the four forces:
   - Lift
   - Weight
   - Thrust
   - Drag

   Key Teaching Point:
   All flight is controlled by the interaction of four forces

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3. **Concept Development**
   - **A. Understanding Lift**
     - Lift is the force that pushes an aircraft upward
     - In drones, lift is created by spinning propellers
     - Faster spinning propellers generate more lift

     Emphasize that:
     - Without lift, the drone cannot leave the ground

   - **B. Understanding Weight**
     - Weight is the force pulling the drone downward due to gravity
     - Every drone has weight based on its size and components

     Emphasize that:
     - Lift must overcome weight for the drone to rise

   - **C. Understanding Thrust**
     - Thrust is the force that moves the drone in a direction
     - It allows the drone to move forward, backward, or sideways

     Emphasize that:
     - Thrust is controlled by adjusting the drone’s motors

D. Understanding Drag
- Drag is the resistance that slows the drone down
- It is caused by air pushing against the drone as it moves

Emphasize that:
- Drag always works against thrust

E. How Forces Work Together
- All four forces act at the same time during flight
- The balance between these forces determines motion

Provide examples:
- Lift = Weight → Drone hovers
- Lift > Weight → Drone rises
- Thrust > Drag → Drone moves forward
- Drag increases → Drone slows down

Emphasize that:
- Pilots must understand how forces interact to control flight

4. Application to Drone Flight
- Every movement of a drone is caused by changes in these forces
- Pilots adjust controls to increase or decrease these forces

Students should understand:
- Takeoff requires lift to exceed weight
- Movement requires thrust to overcome drag
- Stable flight requires balance between forces

5. Guided Examples / Demonstration
- Consider what happens when a drone takes off
- The motors spin faster, increasing lift

Provide additional examples:
- A drone slowing down → drag increases or thrust decreases
- A drone rising quickly → lift is much greater than weight

Ask students to identify:
- Which force is changing in each situation

6. Real-World Connection
- All aircraft—from airplanes to helicopters to drones—use these same four forces
- Drone pilots must understand these forces to operate safely and effectively

Emphasize that:
- Understanding flight principles helps prevent crashes and improves control

7. **Key Reinforcement Summary**
   - Flight is controlled by four forces: lift, weight, thrust, and drag
   - These forces always act together
   - The balance of forces determines how a drone moves
   - Pilots must understand these forces to control flight safely

   Key Teaching Point:
   Drone flight is the result of balancing and adjusting the four forces of flight

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Formative Questions for Use in This Lesson
- What made powered flight possible?
- Why did aviation technology improve over time?
- What advantages do unmanned aircraft provide?
- How are drones connected to traditional aviation?

Hands-On Activity
Activity Title: Aviation Timeline Construction
Objective:
Students will create a visual timeline showing key developments in aviation and drone evolution.

Activity Procedure
1. Provide students with timeline materials or blank paper
2. Students identify major aviation milestones discussed in class
3. Place events in chronological order
4. Add short descriptions for each milestone
5. Highlight transition to drone technology
6. Share timelines with a partner or small group
7. Discuss similarities and differences
8. Review as a class

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Accuracy of Timeline	All events correct	Most correct	Some errors	Incorrect
Understanding of Evolution	Clear connections made	Mostly clear	Limited	Minimal
Organization	Well organized	Mostly organized	Some confusion	Disorganized
Participation	Fully engaged	Mostly engaged	Some participation	Minimal

Activity Title: The effects of design on an aircraft discussion.
Objective: Students discuss how design can affect the aerodynamics of flight
Scenario
A student builds a paper aircraft, but it immediately drops straight to the ground after launch.

- What force is not being properly generated?
- What design change might improve flight?

Assessment Items

1. What was a key limitation of early flight attempts?
   A. Too much power
   B. Lack of sustained powered flight
   C. Too many pilots
   D. Excessive speed
2. What made powered flight possible?
   A. Batteries
   B. Combination of lift and thrust
   C. GPS
   D. Sensors
3. Why were unmanned aircraft developed?
   A. Entertainment only
   B. To replace airplanes
   C. For safety and efficiency
   D. To reduce technology
4. What technology helps modern drones navigate?
   A. Fuel
   B. GPS
   C. Wings
   D. Paint
5. How are drones related to aviation?
   A. They are separate systems
   B. They are based on aviation principles
   C. They do not use flight principles
   D. They replace aviation entirely

Answer Key

1. B
2. B
3. C
4. B
5. B

Closure

Modern drones are the result of continuous advancements in aviation, building on foundational flight principles developed over time.

Exit Ticket

Explain one major development in aviation history and how it contributed to modern drone technology.

Teacher Notes

- Emphasize progression and connection between events
- Use visuals to support timeline understanding
- Reinforce vocabulary throughout lesson
- Encourage students to think about cause-and-effect relationships
- Prepare students for deeper exploration of flight principles in upcoming lessons

Week 1 – Day 3: Introduction to the Forces of Flight

Standard	Description	RBT Level
101.00	Explain foundational aviation concepts and their impact on drone operations.	B2
101.02	Describe aerodynamic forces affecting drone flight.	B2

Objective
Students will identify the four forces of flight and explain how they interact to allow a drone to fly.

Essential Question
What forces act on a drone during flight, and how do they work together?

Key Concepts
• Four forces of flight
• Lift, thrust, drag, weight
• Balance of forces
• Flight stability
• Interaction of forces

Vocabulary
• Lift – Upward force that opposes weight
• Thrust – Forward/upward force produced by motors/propellers
• Drag – Resistance force opposing motion
• Weight – Downward force caused by gravity
• Balance – Equal forces resulting in stable flight

Materials Needed
• PowerPoint Presentation (Week 1 Day 3 – Forces of Flight)
• Whiteboard/markers
• Student notebooks
• Simple visual diagram of forces (teacher-created or printed)

Bellringer
Prompt:
What do you think keeps a drone in the air instead of falling to the ground?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   - In the previous lesson, they learned about the four forces of flight: lift, weight, thrust, and drag
   - These forces explain why a drone can rise, fall, or move

Ask students:
• What happens if one force becomes stronger than the others?
• Can a drone move if all forces are balanced?

Emphasize that:
• Flight is controlled by how these forces interact—not by a single force acting alone

Bridge to lesson:
• Today, students will learn how these forces work together during real drone movement

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2. Core Concept Introduction
• The four forces of flight are always acting at the same time
• Drone movement happens when the balance between these forces changes

Key Teaching Point:
Drone movement is created by changing the balance between forces

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3. Concept Development

A. **Forces Are Always Acting Together**
• Lift, weight, thrust, and drag are always present during flight
• A drone cannot move unless one or more of these forces changes

Emphasize that:
• Flight is the result of interaction—not isolated forces

B. **Balanced Forces and Hovering**
• When lift equals weight, the drone hovers
• When thrust equals drag, the drone maintains its position

Provide example:
• A drone staying still in the air has balanced forces

Emphasize that:
• Balanced forces create stable flight

C. **Unbalanced Forces and Movement**
• When one force becomes greater than another, movement occurs

Provide examples:
• Lift greater than weight → drone rises
• Lift less than weight → drone descends
• Thrust greater than drag → drone moves forward
• Increased drag → drone slows down

Emphasize that:
• All drone movement is caused by unbalanced forces

D. **Directional Movement and Force Changes**
• Drones change direction by adjusting how forces are applied
• Tilting the drone changes how thrust is directed

Provide example:
• When a drone tilts forward, thrust moves it forward instead of just upward

Emphasize that:
• Directional movement requires controlled imbalance of forces

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E. **Stability and Control**
• Pilots must constantly adjust forces to maintain control
• Small changes in force can significantly affect movement

Emphasize that:
• Smooth adjustments help maintain stable flight
• Sudden changes can cause instability

Key Teaching Point:
Drone pilots control movement by managing balanced and unbalanced forces

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4. Application to Drone Flight
• Every drone movement—hovering, rising, turning, or slowing—is caused by changes in force balance

Students should understand:
• Hovering requires balanced forces
• Movement requires unbalanced forces
• Pilots adjust controls to manage these changes

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5. Guided Examples / Demonstration
• Consider what happens during different flight situations

Provide examples:
• A drone rising quickly → lift is greater than weight
• A drone slowing down → drag is increasing
• A drone drifting sideways → forces are unbalanced

Ask students to identify:
• Which forces are changing
• How the pilot should respond

Sample Scenario
A drone begins drifting sideways during flight without the pilot changing controls.

• Which force is most likely affecting the drone?
• What should the pilot monitor?

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6. Real-World Connection
• Drone pilots must constantly adjust forces during real flights
• Environmental factors like wind can change force balance

Emphasize that:
• Understanding force interaction helps pilots maintain control and avoid accidents

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7. **Key Reinforcement Summary**
   • All four forces act at the same time
   • Balanced forces create stable flight
   • Unbalanced forces create movement
   • Pilots control drones by adjusting force balance

   Key Teaching Point:
   Drone flight is controlled by managing how forces interact and change

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Formative Questions for Use in This Lesson
• What force allows a drone to rise?
• What force is always pulling the drone downward?
• How does thrust affect movement?
• What happens when lift equals weight?

Hands-On Activity
Activity Title: Forces of Flight Demonstration
Objective:
Students will observe and model how forces of flight interact to create movement.

Activity Procedure

1. Instructor demonstrates vertical movement using hand motions or model
2. Students mimic lift vs weight using hands
3. Demonstrate forward motion (thrust vs drag)
4. Students describe what happens when forces change
5. Students draw a simple diagram of forces on a drone
6. Label all four forces
7. Share diagrams with a partner
8. Review as a class

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Understanding of Forces	Clear and complete	Mostly clear	Limited	Minimal
Diagram Accuracy	All forces labeled correctly	Mostly correct	Some errors	Incorrect
Participation	Fully engaged	Mostly engaged	Some participation	Minimal
Explanation	Clear explanation	Mostly clear	Limited	Unclear

Assessment Items

1. What force lifts a drone into the air?
   A. Drag
   B. Weight
   C. Lift
   D. Gravity
2. What force pulls the drone downward?
   A. Lift
   B. Weight
   C. Thrust
   D. Drag
3. What creates thrust in a drone?
   A. Battery
   B. Motors and propellers
   C. Frame
   D. Sensors
4. What is drag?
   A. Upward force
   B. Resistance to movement
   C. Gravity
   D. Lift
5. What happens when lift equals weight?
   A. Drone falls
   B. Drone rises
   C. Drone hovers
   D. Drone stops

Answer Key

1. C
2. B
3. B
4. B
5. C

Closure

The four forces of flight—lift, weight, thrust, and drag—work together to determine how a drone moves and stays in the air.

Exit Ticket

Explain what happens when lift is greater than weight and how that affects a drone.

Teacher Notes

- Use clear visual examples to reinforce understanding
- Connect forces to real drone movement
- Keep explanations simple and consistent
- Reinforce vocabulary throughout lesson
- This lesson builds foundation for control and flight lessons

Week 1 – Day 4: Applying Forces of Flight to Drone Controls

Standard	Description	RBT Level
101.00	Explain foundational aviation concepts and their impact on drone operations.	B2
101.02	Describe aerodynamic forces affecting drone flight.	B2

Objective
Students will explain how pilot controls affect the forces of flight and influence drone movement.

Essential Question
How do drone controls change the forces of flight to create movement?

Key Concepts
• Control inputs and flight response
• Relationship between controls and forces
• Directional movement
• Stability and balance
• Cause-and-effect in flight

Vocabulary
• Throttle – Controls lift (up/down movement)
• Yaw – Rotational movement left/right
• Pitch – Forward/backward tilt and movement
• Roll – Side-to-side tilt and movement
• Control Input – Action taken by the pilot

Materials Needed
• PowerPoint Presentation (Week 1 Day 4 – Forces of Flight and Drone Controls)
• Whiteboard/markers
• Student notebooks
• Drone controller (if available for demonstration)

Bellringer
Prompt:
If you push a drone forward, what do you think happens to the forces acting on it?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

Students recall:
- The four forces of flight (lift, weight, thrust, drag)
- How forces affect motion and stability
- Basic drone movement from previous lessons

Discuss:
- What happens if one force becomes stronger or weaker during flight?
- How do forces work together to control a drone?

Bridge to lesson:
- Drone flight is controlled by managing the balance between forces
- Today we will focus on how forces interact during real drone movement

---

2. **Core Concept Introduction**
- Drone movement is the result of forces working together, not independently
- Pilots must understand how forces interact to maintain control

Key Teaching Point:
Drone flight depends on balancing forces to control movement and stability

---

3. **Concept Development**

A. Understanding Force Interaction
- Lift, weight, thrust, and drag do not act alone
- All four forces are always acting on the drone at the same time
- Changes in one force affect the others

B. Lift vs Weight in Drone Flight
- Lift pushes the drone upward
- Weight pulls the drone downward
- When lift equals weight → the drone hovers
- When lift is greater than weight → the drone rises
- When lift is less than weight → the drone descends

C. Thrust vs Drag in Drone Movement
- Thrust moves the drone forward or in a direction
- Drag resists that motion
- When thrust is greater than drag → the drone accelerates
- When drag increases → movement slows

D. Force Balance and Stability
- Stable flight requires balanced forces
- Uneven forces can cause drifting, tilting, or loss of control
- Pilots must make small adjustments to maintain balance

E. Pilot Control and Force Adjustment
- Pilots adjust controls to change forces
- Increasing throttle increases lift
- Directional inputs adjust thrust and balance
- Smooth control inputs help maintain stable flight

Key Teaching Point:
Drone pilots control movement by adjusting how forces interact during flight

---

4. Application to Drone Flight
Students analyze how changes in force balance affect drone movement, such as rising, descending, speeding up, or slowing down.

---

5. Guided Examples / Demonstration
Instructor demonstrates or explains scenarios such as:
- A drone rising too quickly
- A drone slowing down during forward movement
- A drone drifting due to imbalance

Students identify:
- Which forces are changing
- How the pilot should respond

---

6. Real-World Connection
- Drone pilots must constantly manage forces during real flights to maintain control, avoid obstacles, and complete missions safely.
- Understanding how forces interact helps pilots make better decisions during operation.

---

7. Key Reinforcement Summary
- All four forces act together during flight
- Balanced forces create stable flight
- Changes in one force affect overall movement
- Pilots must adjust controls to maintain balance

Key Teaching Point:
Successful drone flight depends on managing the interaction of all four forces

---

Formative Questions for Use in This Lesson
- What control increases lift?
- What happens when you use pitch forward?
- How does roll affect movement?
- What is the purpose of yaw?

Hands-On Activity
Activity Title: Control and Movement Simulation
Objective:
Students will model how control inputs affect drone movement and forces.

Activity Procedure

1. Instructor demonstrates each control using hand motions or controller
2. Students mimic throttle, yaw, pitch, and roll using body movement
3. Instructor calls out control inputs
4. Students respond with correct movement
5. Students explain which force is being affected
6. Pair students to quiz each other on controls
7. Review as a class

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Understanding of Controls	Clear and accurate	Mostly correct	Some confusion	Incorrect
Force Connection	Strong connection made	Mostly clear	Limited	Minimal
Participation	Fully engaged	Mostly engaged	Some participation	Minimal
Explanation	Clear and detailed	Mostly clear	Limited	Unclear

Assessment Items

1. What control increases lift?
   A. Yaw
   B. Roll
   C. Throttle
   D. Pitch
2. What does pitch control?
   A. Rotation
   B. Up and down
   C. Forward and backward movement
   D. Speed only
3. What does roll control?
   A. Up and down
   B. Left and right movement
   C. Rotation
   D. Lift
4. What does yaw control?
   A. Forward movement
   B. Side movement
   C. Rotation
   D. Lift

5. What happens when multiple controls are used together?
   A. No movement
   B. Combined movement
   C. Drone stops
   D. Forces disappear

Answer Key

1. C
2. C
3. B
4. C
5. B

Closure

Drone movement is controlled by pilot inputs that adjust the forces of flight, allowing precise and controlled operation.

Exit Ticket

Explain how one control input affects a force and changes drone movement.

Teacher Notes

• Reinforce connection between controls and forces
• Use physical movement to support understanding
• Keep explanations consistent and simple
• Prepare students for hands-on flight introduction
• This lesson bridges theory to practical application

Week 1 – Day 5: Flight Readiness, Safety, and Pre-Flight Introduction

Standard	Description	RBT Level
101.02	Describe aerodynamic forces affecting drone flight.	B2
106.00	Perform manual drone flight operations using controlled maneuvers	C3

Objective
Students will apply their understanding of the four forces of flight to describe and perform basic drone movements.

Essential Question
How do the four forces of flight work together to control drone movement?

Key Concepts
• All four forces act at the same time during flight
• Changes in force balance create movement
• Drone movement is controlled through adjustments in forces
• Smooth control leads to stable and efficient flight

Vocabulary
• **Lift** – The upward force created by propellers that allows the drone to rise
• **Gravity (Weight)** – The downward force pulling the drone toward the Earth
• **Thrust** – The force that moves the drone forward
• **Drag** – The air resistance that slows the drone down
• **Force Balance** – The relationship between forces that determines motion
• **Maneuver** – A controlled movement of the drone

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Open flight space
• Cones or markers
• Whiteboard or presentation display

Bellringer
What happens to a drone when lift becomes greater than gravity?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   - Lift and gravity control vertical motion
   - Thrust and drag control horizontal motion

   Discussion connects individual forces to combined movement

---

2. **Core Concept Introduction**
   All four forces operate simultaneously during flight
   Movement occurs when forces become unbalanced

   Key Teaching Point:
   Drone movement is the result of changing force balance.

---

3. **Concept Development**
   - **A. Hover**
     - Lift equals gravity
     - Minimal thrust and drag
     - Drone maintains position

   - **B. Ascend and Descend**
     - Lift greater than gravity results in upward movement
     - Gravity greater than lift results in descent

   - **C. Forward Movement**
     - Thrust greater than drag
     - Drone tilts forward to move

   - **D. Turning**
     Movement changes direction through coordinated control inputs

---

4. **Application to Drone Flight**
   Students connect:
   - Throttle to lift
   - Pitch to thrust
   - Controlled inputs to stable movement

   Small adjustments result in controlled flight

---

5. **Guided Examples / Demonstration**
   Students use hand motions to model:
   - Hover
   - Ascend
   - Forward movement

   Optional demonstration with drone showing controlled movement

---

6. Real-World Connection

Controlled movement is required in:

- Photography
- Inspection
- Navigation missions

---

7. Key Reinforcement Summary

• All flight movement is based on force interaction
• Balance creates stability
• Imbalance creates movement

Key Teaching Point:
Skilled pilots control movement by managing multiple forces at once.

Formative Questions for Use in This Lesson

• What happens when lift equals gravity?
• What causes a drone to move forward?
• How do pilots control movement?
• Why is force balance important?
• What happens when forces are not controlled?

Hands-On Activity: Force Application Simulation
Activity Procedure

1. Students simulate drone movement using body motion
2. Identify which forces change during each movement
3. Discuss how force changes impact motion
4. Repeat with multiple movement scenarios

Flight Engagement Activity
Students:
• Perform controlled takeoff
• Maintain hover
• Move forward and return
• Perform controlled landing

Scenario

A student attempts to hover a drone, but it slowly rotates in place.

• Which control is being affected?
• What adjustment should the pilot make?

Performance Rubric

Criteria	4 - Advance	3 - Proficient	2 - Developing	1 - Beginning
Understanding of Forces	Clearly explains all force interactions	Mostly accurate	Partial understanding	Minimal understanding
Application to Movement	Accurately connects forces to movement	Some errors	Limited connection	Incorrect understanding
Flight Control	Smooth and controlled	Mostly stable	Some instability	Uncontrolled
Participation	Fully engaged	Participates well	Limited engagement	Not engaged

Assessment Items

1. What happens when lift equals gravity?
   A. The drone moves forward
   B. The drone hovers
   C. The drone falls
   D. The drone turns
2. What force must be greater than drag for forward movement?
   A. Lift
   B. Gravity
   C. Thrust
   D. Weight
3. What causes a drone to descend?
   A. Lift increases
   B. Gravity becomes greater than lift
   C. Thrust increases
   D. Drag decreases
4. How do pilots control drone movement?
   A. Changing weather
   B. Adjusting forces through controls
   C. Increasing weight
   D. Reducing gravity
5. Why is force balance important?
   A. It increases speed
   B. It creates stability
   C. It reduces control
   D. It increases drag

Answer Key

1. B
2. C
3. B
4. B
5. B

Closure
How do changes in force balance affect drone movement?

Teacher Notes
• Reinforce connection between forces and controls
• Emphasize smooth, controlled inputs
• Prepare students for Week 2 flight control lessons

Week 2 – Aerodynamics and Flight Principles

Week Overview
This week builds on the foundational understanding of flight by expanding student knowledge of **aerodynamics and how forces interact during drone operation**. Students will move beyond identification of the four forces and begin analyzing how these forces influence stability, control, and performance.

Instruction focuses on how adjustments in force affect drone behavior, preparing students for upcoming lessons in drone systems and flight operations. Emphasis is placed on **cause-and-effect relationships in flight**, reinforcing the connection between pilot inputs and aircraft response.

Week 2 – Day 1: Force Interaction and Flight Stability

Standard	Description	RBT Level
101.02	Describe aerodynamic forces affecting drone flight.	B2
106.00	Perform manual drone flight operations using controlled maneuvers.	C3

Objective
Students will explain how the forces of flight interact to maintain stability and control during drone operation.

Essential Question
How do the forces of flight work together to create stable drone flight?

Key Concepts
• Force interaction
• Stability in flight
• Balanced vs unbalanced forces
• Control through force adjustment
• Flight behavior

Vocabulary
• Stability – Ability to maintain controlled flight
• Equilibrium – Balanced forces
• Imbalance – Unequal forces causing movement
• Control – Ability to manage flight behavior
• Adjustment – Change made to control forces

Materials Needed
• PowerPoint Presentation (Week 2 Day 1 – Force Interaction and Stability)
• Whiteboard/markers
• Student notebooks
• Simple drone or model (if available)

Bellringer
Prompt:
What do you think happens if one force acting on a drone becomes stronger than the others?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • How drones move using forces and controls
   • Basic understanding of safe operation from prior lessons

   Ask students:
   • What could happen if a drone is flown without checking it first?
   • Why is preparation important before using any equipment?

   Emphasize that:
   • Many drone accidents occur due to lack of preparation
   • Safe operation begins before the drone leaves the ground

   Bridge to lesson:
   • Drone pilots must prepare before every flight by checking themselves, their equipment, and their environment

---

2. **Core Concept Introduction**
   • Drone safety begins before powering on the aircraft
   • A pre-flight check ensures that all systems are ready for safe operation

   Introduce the concept of pre-flight readiness:
   • Pilot readiness
   • Equipment inspection
   • Environmental awareness

   Key Teaching Point:
   Safe drone operations begin with proper pre-flight preparation

---

3. **Concept Development**
   A. Understanding Pilot Readiness
   • The pilot must be physically and mentally prepared to fly
   • Distraction, fatigue, or lack of focus increases risk

   Emphasize that:
   • The pilot is responsible for all flight decisions
   • Good judgment is essential for safe operation

B. Equipment Inspection (Pre-Flight Check)

• All drone components must be checked before flight

Key inspection areas:
• Propellers – secure and undamaged
• Battery – charged and properly connected
• Frame – no cracks or visible damage
• Controller – functioning and connected

Emphasize that:
• Small issues can lead to major failures during flight

C. Environmental Awareness

• The surrounding environment directly impacts flight safety

Key factors to evaluate:
• Obstacles (trees, buildings, power lines)
• People nearby
• Weather conditions (wind, visibility)

Emphasize that:
• Pilots must be aware of all surroundings before takeoff

D. Identifying Potential Risks

• A risk is any condition that could cause a problem during flight

Examples include:
• Damaged equipment
• Strong winds
• Crowded areas

Emphasize that:
• Identifying risks early helps prevent accidents

E. Making a Go/No-Go Decision

• Pilots must determine whether it is safe to fly

Define:
• Go decision → Conditions are safe
• No-Go decision → Conditions are unsafe

Emphasize that:
• Choosing not to fly is often the safest decision

Key Teaching Point:
Safe drone pilots evaluate readiness and make informed decisions before every flight

---

4. **Application to Drone Flight**
   • Pilots complete a pre-flight check before every operation
   • This includes evaluating the pilot, equipment, and environment

   Students should understand:
   • Flight should only occur when all conditions are safe

---

5. **Guided Examples / Demonstration**
   Present scenarios such as:
   • A drone with a damaged propeller
   • Flying in strong wind conditions

   Students identify:
   • The risk present
   • Whether the flight should proceed
   • What action should be taken

---

6. **Real-World Connection**
   • Professional drone pilots perform pre-flight checks before every mission
   • These checks help prevent accidents and ensure safe operations

   Emphasize that:
   • Pre-flight preparation is standard practice in aviation

---

7. **Key Reinforcement Summary**
   • Safe flight begins before takeoff
   • Pilots must check themselves, equipment, and environment
   • Risks must be identified before flying
   • Responsible pilots make go/no-go decisions

   Key Teaching Point:
   Preparation and decision-making are essential for safe drone operations

---

Formative Questions for Use in This Lesson
• What happens when forces are balanced?
• What causes a drone to move?
• How do pilots maintain stability?
• What factors can affect stability?

Hands-On Activity
Activity Title: Stability and Force Balance Simulation
Objective:
Students will demonstrate and explain how force balance affects drone stability.

Activity Procedure
1. Instructor demonstrates balanced vs unbalanced forces using examples
2. Students simulate force changes using hand motions
3. Instructor presents different flight scenarios
4. Students identify which forces are changing

5. Students explain resulting movement
6. Work in pairs to create scenarios
7. Share responses with class
8. Review key concepts

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Understanding of Stability	Clear and complete	Mostly clear	Limited	Minimal
Force Identification	Accurate and consistent	Mostly correct	Some errors	Incorrect
Participation	Fully engaged	Mostly engaged	Some participation	Minimal
Explanation	Clear and detailed	Mostly clear	Limited	Unclear

Sample Scenario

A student is preparing for flight and notices one propeller has a small crack.

• Should the drone be flown?
• What safety concern is present?

Assessment Items

1. What happens when forces are balanced?
   A. Drone moves
   B. Drone crashes
   C. Drone remains stable
   D. Drone speeds up

2. What causes drone movement?
   A. Balanced forces
   B. Unbalanced forces
   C. Equal forces
   D. No forces

3. What does throttle primarily affect?
   A. Drag
   B. Lift
   C. Weight
   D. Yaw

4. What happens when thrust is greater than drag?
   A. Drone slows
   B. Drone moves forward
   C. Drone stops
   D. Drone descends

5. What can affect drone stability?
   A. Wind
   B. Weight
   C. Battery
   D. All of the above

Answer Key

1. C
2. B
3. B
4. B
5. D

Closure

Drone stability depends on the balance of forces, and movement occurs when those forces are adjusted by the pilot.

Exit Ticket

Explain what happens when lift and weight are not equal and how it affects flight.

Teacher Notes

• Reinforce cause-and-effect relationships
• Use real-world examples when possible
• Encourage students to think through scenarios
• Keep connections to controls clear
• This lesson prepares students for deeper aerodynamic concepts

Week 2 – Day 2: Drag, Thrust, and Efficiency in Flight

Standard	Description	RBT Level
101.02	Describe aerodynamic forces affecting drone flight.	B2
106.00	Perform manual drone flight operations using controlled maneuvers.	C3

Objective
Students will describe how thrust and drag affect drone movement and demonstrate controlled flight that improves efficiency.

Essential Question
How do thrust and drag work together to impact drone efficiency and control?

Key Concepts
• Thrust moves the drone forward
• Drag resists motion and slows the drone
• Efficient flight balances thrust and drag
• Smooth control reduces unnecessary drag
• Poor control increases resistance and instability

Vocabulary
• **Thrust** – The forward force that propels the drone through the air
• **Drag** – The resistance force that opposes motion through the air
• **Efficiency** – Using the least amount of energy to achieve controlled movement
• **Resistance** – Forces that oppose motion
• **Control Input** – Movements made by the pilot to control the drone

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Cones or markers
• Open flight space
• Whiteboard or presentation display

Bellringer
What happens when a drone uses too much thrust during flight?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   - Lift and gravity control vertical movement
   - Thrust and drag control horizontal movement

   Discussion connects forward motion to resistance

2. Core Concept Introduction

- Thrust creates movement while drag resists it
- Efficient flight requires managing both forces together

Key Teaching Point:
Efficient pilots control thrust to minimize drag and maintain stability.

---

3. Concept Development

A. Thrust in Flight

- Thrust moves the drone forward
- Increased thrust increases speed
- Excess thrust reduces control

B. Drag in Flight

- Drag increases with speed and movement
- Irregular movement increases resistance
- Stable movement reduces drag

C. Relationship Between Thrust and Drag

- Higher thrust leads to increased drag
- Balance creates controlled motion
- Unbalanced forces create instability

D. Efficiency in Drone Flight

Efficient flight uses:
• Smooth inputs
• Controlled speed
• Minimal corrections

Inefficient flight includes:
• Sudden movements
• Overcorrection
• Excessive thrust

---

4. Application to Drone Flight

Students connect:

- Smooth control → reduced drag
- Controlled thrust → stable movement

Focus on maintaining steady forward motion

---

5. Guided Examples / Demonstration

Teacher demonstrates:

- Smooth forward flight
- Over-controlled flight

Students identify differences in efficiency

---

6. **Real-World Connection**
   Efficient flight is critical in:
   - Battery management
   - Long-duration missions
   - Professional drone operations

---

7. **Key Reinforcement Summary**
   • Thrust creates movement
   • Drag resists movement
   • Efficiency comes from control

   Key Teaching Point:
   Smooth, controlled flight reduces drag and improves performance.

Formative Questions for Use in This Lesson
• What is thrust?
• What is drag?
• How does drag affect movement?
• Why is efficiency important?
• How can a pilot reduce drag?

Hands-On Activity: Efficiency Comparison
Activity Procedure
1. Students perform two flight attempts:
   - Smooth controlled flight
   - Rapid, over-controlled flight
2. Observe differences in:
   - Stability
   - Control
   - Efficiency
3. Discuss which method was more effective

Flight Engagement Activity
Students:
• Perform forward flight
• Maintain steady speed
• Focus on smooth control
• Return and land

Performance Rubric

Criteria	4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
Understanding of Thrust & Drag	Clearly describes both forces and relationship	Mostly accurate	Partial understanding	Minimal understanding
Application to Flight	Demonstrates efficient control	Minor inconsistencies	Frequent errors	Poor control
Flight Stability	Smooth and controlled	Mostly stable	Some instability	Uncontrolled
Participation	Fully engaged	Participates well	Limited engagement	Not engaged

Assessment Items

1. What force moves a drone forward?
   A. Lift
   B. Gravity
   C. Thrust
   D. Drag
2. What force resists forward motion?
   A. Lift
   B. Thrust
   C. Gravity
   D. Drag
3. What happens when thrust increases?
   A. Drag decreases
   B. Speed increases
   C. Lift stops
   D. Gravity increases
4. What improves flight efficiency?
   A. Sudden movements
   B. Smooth control inputs
   C. Increasing drag
   D. Reducing lift
5. Why is drag important?
   A. It increases speed
   B. It resists motion
   C. It replaces thrust
   D. It controls lift

Answer Key

1. C
2. D
3. B
4. B
5. B

Closure
How does controlling thrust help reduce drag and improve flight efficiency?

Teacher Notes
• Emphasize smooth control over speed
• Reinforce relationship between thrust and drag
• Prepare students for continued flight control practice

Week 2 – Day 3: Connecting All Four Forces in Flight Maneuvers

Standard	Description	RBT Level
101.02	Describe aerodynamic forces affecting drone flight.	B2
106.00	Perform manual drone flight operations using controlled maneuvers.	C3

Objective
Students will demonstrate precise control of a drone by applying smooth and intentional inputs to maintain stable flight.

Essential Question
How does precise control improve drone stability and flight performance?

Key Concepts
• Precision control requires small, intentional inputs
• Smooth movements improve stability
• Overcorrection leads to instability
• Controlled flight improves efficiency and safety
• Skilled pilots anticipate movement rather than react to it

Vocabulary
• **Precision** – The ability to make accurate and controlled movements
• **Stability** – Maintaining steady and balanced flight
• **Overcorrection** – Excessive control input that disrupts stability
• **Control Input** – Movement of controls used to direct the drone
• **Adjustment** – A small change made to maintain control

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Cones or floor markers
• Open flight space
• Whiteboard or presentation display

Bellringer
Why do sudden control movements make a drone harder to fly?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   - Thrust and drag relationship
   - Efficient vs inefficient flight

   Discussion connects efficiency to control precision

2. Core Concept Introduction

- Precise control results from small, deliberate inputs
- Drone stability depends on how inputs are applied

Key Teaching Point:
Smooth, controlled inputs create stable flight.

---

3. Concept Development

A. Small Inputs vs Large Inputs

Small inputs:
• Maintain stability
• Allow controlled movement

Large inputs:
• Create instability
• Increase need for correction

B. Overcorrection

Occurs when inputs are too large or too frequent
Results in:
• Oscillation
• Loss of control

C. Maintaining Stability

Stable flight requires:
• Balanced forces
• Consistent inputs
• Awareness of movement

D. Anticipation in Flight

- Pilots observe movement and adjust early
- Reduces need for large corrections

---

4. Application to Drone Flight

Students focus on:
• Smooth takeoff
• Stable hover
• Controlled directional movement

Inputs remain small and consistent

---

5. Guided Examples / Demonstration

Teacher demonstrates:
• Stable hover using small inputs
• Unstable hover using large inputs

Students identify differences

---

6. **Real-World Connection**
   Precision control is required in:
   • Inspection work
   • Indoor flight
   • Obstacle navigation

---

7. **Key Reinforcement Summary**
   • Precision improves stability
   • Stability improves control
   • Control improves safety

   Key Teaching Point:
   Good pilots make small adjustments, not large corrections.

Formative Questions for Use in This Lesson
• What is precision control?
• What causes overcorrection?
• Why are small inputs important?
• How does precision improve stability?
• What happens when inputs are too large?

Hands-On Activity: Precision Hover Challenge
Activity Procedure
1. Students take off and establish hover
2. Maintain position within a marked area
3. Use small adjustments to stay stable
4. Hold position for a set time
5. Repeat and improve control

Flight Engagement Activity
Students:
• Perform takeoff
• Maintain hover
• Execute controlled forward movement
• Return and land

Sample Scenario
A student begins takeoff without checking surroundings and nearly flies into a nearby tree.

• What step was missed?
• How could this situation have been prevented?

Performance Rubric

Criteria	4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
Precision Control	Consistently uses small, accurate inputs	Mostly controlled	Some overcorrection	Frequent instability
Flight Stability	Maintains steady hover and movement	Minor instability	Frequent corrections	Unstable flight
Application of Concepts	Clearly applies precision principles	Partial application	Limited understanding	Incorrect application
Participation	Fully engaged	Participates well	Limited engagement	Not engaged

Assessment Items

1. What is precision control?
   A. Using large movements
   B. Making small, accurate adjustments
   C. Flying quickly
   D. Ignoring movement
2. What causes overcorrection?
   A. Small inputs
   B. Balanced forces
   C. Large or repeated inputs
   D. Slow movement
3. What improves drone stability?
   A. Sudden movement
   B. Large inputs
   C. Smooth control
   D. Increased drag
4. Why is anticipation important in flight?
   A. It increases speed
   B. It reduces control
   C. It prevents large corrections
   D. It increases drag
5. What happens when control inputs are too large?
   A. Stability improves
   B. Movement slows
   C. Instability increases
   D. Drag decreases

Answer Key

1. B
2. C
3. C
4. C
5. C

Closure
How do small control inputs improve drone stability?

Teacher Notes
• Emphasize control over speed
• Reinforce importance of small adjustments
• Prepare students for maneuver execution (Day 4)

Week 2 – Day 4: Introduction to Drone Controls (Throttle, Yaw, Pitch, Roll)

Standard	Description	RBT Level
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.01	Execute basic drone flight maneuvers including hover, yaw, and directional control.	C3
102.01	Identify drone components and their functions.	A1

Objective
Students will execute controlled yaw and directional maneuvers while maintaining stable flight.

Essential Question
How do pilots control direction and orientation during drone flight?

Key Concepts
• Yaw controls rotation of the drone
• Directional control allows movement in multiple directions
• Controlled maneuvers require coordination of inputs
• Stability must be maintained during movement
• Orientation affects how controls respond

Vocabulary
• **Yaw** – Rotation of the drone left or right around its vertical axis
• **Orientation** – The direction the drone is facing
• **Directional Control** – Moving the drone forward, backward, left, or right
• **Coordination** – Using multiple controls together smoothly
• **Rotation** – Turning movement around a central point

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Cones or markers
• Open flight space
• Whiteboard or presentation display

Bellringer
What happens to control inputs when the drone is facing a different direction?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   - Precision control
   - Stable hover
   - Small input adjustments

   Discussion connects stability to controlled movement

---

2. **Core Concept Introduction**
   - Directional movement requires coordinated control inputs
   - Yaw changes the orientation of the drone, which affects movement direction

   Key Teaching Point:
   Pilots must understand orientation to control direction accurately.

---

3. **Concept Development**
   A. Yaw Control
   - Yaw rotates the drone left or right
   - Does not move the drone forward or backward
   - Changes the direction the drone is facing

   B. Directional Movement
   Drone moves:
   • Forward and backward
   • Left and right

   Movement depends on orientation

   C. Orientation Awareness
   - Controls respond differently based on drone direction
   - Forward input changes when drone is rotated

   D. Coordinated Movement
   Combining:
   • Yaw
   • Directional movement

   Creates controlled navigation

---

4. **Application to Drone Flight**
   Students focus on:
   • Controlled yaw movements
   • Maintaining hover while rotating
   • Moving in controlled directions

---

5. **Guided Examples / Demonstration**
   Teacher demonstrates:
   • Yaw in place
   • Forward movement before and after rotation

   Students observe control differences

---

6. **Real-World Connection**
   Directional control is critical in:
   • Navigation through obstacles
   • Indoor flight
   • Precision operations

---

7. **Key Reinforcement Summary**
   • Yaw controls direction
   • Orientation changes movement response
   • Coordination improves control

   Key Teaching Point:
   Understanding orientation is essential for controlled flight.

Formative Questions for Use in This Lesson
• What does yaw control?
• Does yaw move the drone forward?
• How does orientation affect movement?
• Why is coordination important?
• What happens if orientation is ignored?

Hands-On Activity: Yaw and Direction Drill
Activity Procedure
1. Students take off and hover
2. Perform controlled yaw left and right
3. Stop and stabilize after each rotation
4. Move forward in current orientation
5. Repeat sequence multiple times

Flight Engagement Activity
Students:
• Perform takeoff
• Hover
• Execute yaw rotation
• Move in controlled directions
• Return and land

Performance Rubric

Criteria	4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
Yaw Control	Smooth and precise rotation	Mostly controlled	Some instability	Poor control
Directional Movement	Accurate and controlled	Minor errors	Frequent errors	Uncontrolled
Coordination	Smooth combination of inputs	Mostly coordinated	Limited coordination	Disorganized
Stability	Maintains stable flight	Minor instability	Frequent corrections	Unstable

---

Assessment Items

1. What does yaw control?
   A. Forward movement
   B. Rotation
   C. Lift
   D. Speed
2. Does yaw cause forward movement?
   A. Yes
   B. No
   C. Sometimes
   D. Only in wind
3. What affects how a drone responds to controls?
   A. Color
   B. Orientation
   C. Size
   D. Battery
4. What is directional control?
   A. Rotating only
   B. Moving in different directions
   C. Increasing speed
   D. Changing altitude
5. Why is coordination important?
   A. It reduces movement
   B. It improves control
   C. It increases drag
   D. It stops rotation

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

How does orientation affect the way a drone moves?

Teacher Notes

• Reinforce orientation awareness
• Encourage slow, controlled inputs
• Prepare students for full maneuver sequences (Day 5)

Week 2 – Day 5: Basic Flight Maneuvers and Control Practice

Standard	Description	RBT Level
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.01	Execute basic drone flight maneuvers including hover, yaw, and directional control.	C3

Objective
Students will perform a complete flight sequence including takeoff, controlled navigation, and safe landing.

Essential Question
How do pilots safely complete a full drone flight from takeoff to landing?

Key Concepts
• Safe flight begins with controlled takeoff
• Navigation requires coordination of multiple inputs
• Landing must be slow and controlled
• Consistent procedures improve safety and performance
• Full flight sequences require planning and awareness

Vocabulary
• **Takeoff** – The controlled process of lifting the drone into the air
• **Navigation** – Directing the drone along a planned path
• **Landing** – Bringing the drone safely back to the ground
• **Flight Path** – The route the drone follows during flight
• **Control Sequence** – A series of movements performed in order

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Cones or markers for course layout
• Open flight space
• Whiteboard or presentation display

Bellringer
What is the most important part of a safe drone landing?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   - Precision control
   - Yaw and directional movement
   - Stable hover

   Discussion connects individual skills into a full flight sequence

---

2. **Core Concept Introduction**
   A complete flight includes:
   • Takeoff
   • Navigation
   • Landing

   Each phase requires control and attention

   Key Teaching Point:
   Safe pilots follow a consistent flight sequence every time.

---

3. **Concept Development**
   A. **Controlled Takeoff**
      - Gradual increase in lift
      - Drone rises smoothly
      - Immediate stabilization after takeoff

   B. **Navigation**
      - Movement along a planned path
      - Use of:
        - Forward/backward movement
        - Yaw for direction
        - Small adjustments for control

   C. **Flight Path Awareness**
      Students maintain awareness of:
      • Position
      • Direction
      • Obstacles

   D. **Controlled Landing**
      - Slow descent
      - Minimal movement
      - Gentle contact with ground

---

4. **Application to Drone Flight**
   Students perform:
   • Takeoff
   • Hover stabilization
   • Controlled navigation
   • Return and landing

   Focus remains on smooth, consistent control

---

5. **Guided Examples / Demonstration**
   Teacher demonstrates:
   • Proper takeoff
   • Controlled navigation path
   • Smooth landing

   Students observe sequence and timing

---

6. **Real-World Connection**
   Full flight procedures are used in:
   • Commercial operations
   • Inspection missions
   • Public safety applications

---

7. **Key Reinforcement Summary**
   • Every flight follows a sequence
   • Control is required at each stage
   • Smooth operation improves safety

   Key Teaching Point:
   Consistent procedures lead to safe and successful flights.

Formative Questions for Use in This Lesson
• What is the first step in a flight sequence?
• Why is controlled takeoff important?
• What is navigation?
• How should a drone land?
• Why is consistency important in flight?

Hands-On Activity: Full Flight Sequence Practice
Activity Procedure
1. Students plan a simple flight path
2. Perform controlled takeoff
3. Navigate through marked course
4. Maintain stable flight
5. Return and perform controlled landing

Flight Engagement Activity
Students:
• Execute full flight sequence
• Demonstrate control at each phase
• Maintain awareness throughout flight

Performance Rubric

Criteria	4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
Takeoff Control	Smooth and controlled	Minor instability	Inconsistent	Poor control
Navigation	Accurate and controlled path	Minor errors	Frequent corrections	Uncontrolled
Landing	Smooth and precise	Slightly rough	Inconsistent	Hard landing
Overall Control	Consistent and stable	Mostly controlled	Some instability	Unstable

C3 Scenario (End-of-Week Application)
Sample Scenario

A student plans to fly a drone on a school field where there are light winds, nearby buildings, and several people walking in the area.

• What risks are present?
• Is this flight safe to perform?
• What changes should be made before flying?

Assessment Items

1. What is the first step in a flight sequence?
   A. Landing
   B. Takeoff
   C. Navigation
   D. Turning
2. What is navigation?
   A. Taking off
   B. Landing
   C. Moving along a planned path
   D. Stopping movement
3. What is important during landing?
   A. Speed
   B. Sudden movement
   C. Slow, controlled descent
   D. Increased thrust

4. Why is takeoff important?
   A. It determines flight color
   B. It sets the tone for control
   C. It increases drag
   D. It reduces lift
5. What improves overall flight performance?
   A. Random movement
   B. Consistent procedures
   C. Increased speed
   D. Ignoring controls

Answer Key

1. B
2. C
3. C
4. B
5. B

Closure

What is the most important part of completing a safe flight?

Teacher Notes

• Reinforce full flight sequence
• Emphasize smooth transitions between phases
• Prepare students for safety unit (Week 3)

Week 3 – Safety, Risk, and Procedures

Week Overview
This week introduces students to essential drone safety principles and risk awareness. Students will learn how to identify hazards, apply safety procedures, and develop responsible pilot behavior. Emphasis is placed on preventing accidents, protecting people and property, and building a safety-first mindset that supports all future drone operations. Students will begin applying structured safety procedures and risk mitigation strategies that prepare them for safe and controlled drone flight.

Week 3 – Day 1: Introduction to Drone Safety and Risk Awareness

Standard	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.02	Apply safety procedures and risk mitigation strategies.	C3

Objective
Students will identify hazards and apply basic safety procedures and risk mitigation strategies used to support safe drone operations.

Essential Question
Why is safety the most important responsibility of a drone pilot?

Key Concepts
• Safety is the foundation of all drone operations
• Hazards can exist in the environment, equipment, and pilot behavior
• Risk is the likelihood that a hazard will cause harm
• Risk mitigation reduces danger before and during flight
• Safe pilots follow procedures consistently

Vocabulary
• **Safety** – Protection from harm or danger
• **Hazard** – Anything that can cause harm or damage
• **Risk** – The chance that a hazard will cause harm
• **Risk Mitigation** – Actions taken to reduce or control risk
• **Situational Awareness** – Awareness of surroundings during operations
• **Procedure –** A step-by-step method for completing a task safely
• **Responsibility** – The duty to act safely and make good decisions

---

Materials Needed
• Classroom drone (demonstration only)
• Whiteboard or presentation display
• Hazard scenario cards
• Images of safe/unsafe drone operations
• Student notebooks

Bellringer
What could go wrong if a drone is flown without checking the area first?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall prior learning about drone movement, control, and flight operations.
   Discuss:
   • What makes a drone flight successful?
   • What could cause a flight to fail?

   Bridge to lesson:
   • Even a well-controlled drone can become unsafe if hazards are ignored
   • Safe flight begins before takeoff

---

2. **Core Concept Introduction**
   Introduce the concept of safety in drone operations.

   Explain:
   • Drones are aircraft and must be operated responsibly
   • Safety is the pilot's first priority

   Key Teaching Point:
   Safe drone pilots prevent problems instead of reacting to them.

---

3. **Concept Development**
   A. **Understanding Hazards**
      • Hazards are anything that can cause harm

      Types of hazards:
      • Environmental – obstacles, weather, people
      • Equipment – low battery, damaged propellers
      • Human – distraction, poor decisions

   B. **Understanding Risk**
      • Risk is the likelihood that a hazard will cause harm

      Example:
      • Tree = hazard
      • Flying close to it = increased risk

C. Risk Mitigation

• Pilots reduce risk through planning and action

Examples:
• Moving takeoff location
• Clearing the area
• Inspecting equipment
• Delaying flight

Key Teaching Point:
Pilots control risk through decisions.

D. Safety Procedures

• Safety procedures are consistent steps used before and during flight

Examples:
• Inspect drone
• Check surroundings
• Establish flight boundaries
• Maintain awareness

---

4. Application to Drone Flight

Students connect safety to real flight situations.

Scenario:
A pilot prepares to launch but notices people near the flight area.
Ask:
• What is the hazard?
• What is the risk?
• What action should be taken?

---

5. Guided Examples / Demonstration

Teacher presents scenarios or images of drone operations.

Students identify:
• Hazards
• Risks
• Safe actions

Optional:
Teacher demonstrates a mock flight area and points out hazards.

---

6. Real-World Connection

Discuss:
• Drone pilots in real industries must operate safely
• Unsafe operation can cause:
  - Injury
  - Property damage
  - Legal consequences

Examples:
• Public safety
• Inspection
• Media production

---

7. Key Reinforcement Summary

• Safety is the pilot's responsibility
• Hazards exist in every flight environment
• Risk can be reduced through planning
• Procedures improve safety
• Good decisions prevent accidents

Key Teaching Point:
Safe pilots think before they fly.

Formative Questions for Use in This Lesson

• What is a hazard?
• What is risk?
• What is the difference between hazard and risk?
• How can a pilot reduce risk?
• Why are safety procedures important?

Hands-On Activity

Activity Title: Hazard Identification Exercise

Objective:

Students will identify hazards and apply risk mitigation strategies in drone scenarios.

Activity Procedure

1. Divide students into small groups
2. Provide each group with a scenario or image
3. Students identify hazards
4. Students explain the risk
5. Students propose a mitigation strategy
6. Groups present findings
7. Class discusses best safety decisions

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Hazard Identification	Identifies all hazards clearly	Identifies most hazards	Identifies some hazards	Identifies few hazards
Risk Understanding	Clearly explains risk	Mostly accurate	Partial understanding	Minimal understanding
Mitigation Strategy	Strong and practical solutions	Appropriate solutions	Limited solutions	Weak or missing
Participation	Fully engaged	Participates well	Limited participation	Minimal participation

Sample Scenario

A student is preparing to fly a drone and notices the controller is not responding correctly to inputs.

- What system component might be causing the issue?
- What should the student check before attempting flight?

Assessment Items

1. What is a hazard?
   A. A safe condition
   B. Something that can cause harm
   C. A type of drone
   D. A control input
2. What is risk?
   A. A checklist
   B. The chance that harm may occur
   C. A flight control
   D. A battery
3. Which is an example of risk mitigation?
   A. Ignoring obstacles
   B. Flying faster
   C. Moving away from hazards
   D. Skipping inspection
4. Which is a hazard?
   A. Low battery
   B. Trees
   C. Distraction
   D. All of the above
5. Why are safety procedures important?
   A. They increase speed
   B. They reduce risk
   C. They replace training
   D. They control weather

Answer Key

1. B
2. B
3. C
4. D
5. B

Closure

What is one safety habit every drone pilot should follow before every flight?

Teacher Notes

• Emphasize safety as the foundation for all flight operations
• Use real-world examples to reinforce importance
• Encourage discussion and student participation
• Reinforce hazard vs risk distinction clearly
• This lesson sets expectations for all future flight activities

Week 3 – Day 2: Pre-Flight Planning and Risk Assessment

Standard	Description	RBT Level
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3
105.01	Explain FAA rules, TRUST certification, and introductory Part 107 concepts.	B2
105.02	Apply safety procedures and risk mitigation strategies.	C3

Objective
Students will apply pre-flight planning procedures and use risk assessment strategies to evaluate and prepare for safe drone operations.

Essential Question
How does proper pre-flight planning reduce risk in drone operations?

Key Concepts
• Pre-flight planning is required before every drone operation
• Risk assessment helps identify potential hazards before flight
• Safe pilots evaluate the environment, equipment, and mission
• Planning reduces the chance of accidents and errors
• Consistent procedures improve safety and performance

Vocabulary
• **Pre-Flight Planning** – The process of preparing for a drone operation before takeoff
• **Risk Assessment** – Evaluating potential hazards and determining their impact
• **Flight Area** – The location where the drone will operate
• **Authorization** – Permission to fly in controlled or restricted areas
• **Inspection** – Checking equipment and conditions before use
• **Mitigation** – Actions taken to reduce risk
• **Checklist** – A structured list of steps used to ensure safety

---

Materials Needed
• Classroom drone
• Pre-flight checklist handout
• Whiteboard or presentation display
• Scenario cards
• Open space or mock flight area
• Student notebooks

Bellringer
What steps should a pilot take before launching a drone to ensure a safe flight?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Hazards and risks from Day 1
   • Importance of safety procedures

   Discuss:
   • What happens if hazards are not identified before flight?

   Bridge to lesson:
   • Today we focus on how planning helps prevent those risks

---

2. **Core Concept Introduction**
   - Introduction to FAA Rules & TRUST"
     - Recreational vs commercial use
     - TRUST certification purpose
     - Basic FAA expectations:
       - Visual line of sight
       - No flying over people
       - Airspace awareness (high-level only)
   - Introduce pre-flight planning as a required part of all drone operations.
     - Safe flights begin before takeoff
     - Planning allows pilots to identify and reduce risk

   Key Teaching Point:
   A safe flight starts with a strong plan and basic Flight Safety.

---

3. **Concept Development**

   A. Purpose of Pre-Flight Planning
   • Helps pilots prepare for safe operations
   • Identifies hazards before they become problems

   B. Risk Assessment Process

   Introduce a simple process:
   • Identify hazards
   • Evaluate the level of risk
   • Take action to reduce risk

   Examples:
   • Wind conditions
   • Obstacles
   • People in the area

C. Flight Area Evaluation
Pilots must evaluate the environment before flight

Check for:
• Obstacles (trees, buildings, wires)
• Surface conditions
• Space for takeoff and landing
• Presence of people

D. Equipment Readiness
Equipment must be inspected before flight

Check for:
• Battery level
• Propeller condition
• Drone frame condition
• Controller connection

E. Use of Checklists
• Checklists ensure steps are not missed
• Professional pilots rely on checklists

Key Teaching Point:
Never rely on memory—use a checklist.

---

4. Application to Drone Flight
Scenario:
A pilot prepares to fly but notices strong wind and people nearby.
Ask:
• What hazards are present?
• What is the level of risk?
• What actions should be taken?

Students determine whether to proceed, adjust, or cancel the flight.

---

5. Guided Examples / Demonstration
Teacher demonstrates a basic pre-flight planning process:
• Inspect drone
• Evaluate environment
• Identify hazards
• Apply mitigation strategies

Students observe and identify each step.

6. **Real-World Connection**
   Discuss:
   • Professional drone pilots must complete pre-flight planning every time
   • Used in industries such as:
     - Public safety
     - Inspection
     - Agriculture
     - Media production

   Explain:
   • Failure to plan can result in accidents or mission failure

---

7. **Key Reinforcement Summary**
   • Pre-flight planning reduces risk
   • Risk assessment helps identify hazards early
   • Pilots must evaluate environment and equipment
   • Checklists improve consistency and safety
   • Good planning leads to successful operations

   Key Teaching Point:
   Planning prevents problems before they happen.

Formative Questions for Use in This Lesson
• What is pre-flight planning?
• Why is risk assessment important?
• What should a pilot check before flight?
• How does a checklist improve safety?
• What should a pilot do if risk is too high?

Hands-On Activity
Activity Title: Pre-Flight Planning Simulation
Objective:
Students will apply a structured pre-flight planning process to evaluate a drone operation.

Activity Procedure
1. Divide students into small groups
2. Provide each group with a flight scenario
3. Students identify hazards in the scenario
4. Evaluate the level of risk
5. Develop a pre-flight plan
6. Decide whether the flight is safe to proceed
7. Present decisions and reasoning to the class

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Hazard Identification	Identifies all hazards clearly	Identifies most hazards	Identifies some hazards	Identifies few hazards
Risk Assessment	Accurately evaluates risk level	Mostly accurate	Partial understanding	Minimal understanding
Planning Process	Clear and structured plan	Mostly organized	Some organization	Disorganized
Participation	Fully engaged	Participates well	Limited participation	Minimal participation

Assessment Items

1. What is the purpose of pre-flight planning?
   A. To increase speed
   B. To prepare for safe operation
   C. To avoid using controls
   D. To reduce battery usage
2. What is risk assessment?
   A. Charging batteries
   B. Evaluating potential hazards
   C. Controlling altitude
   D. Flying faster
3. What should a pilot check before flight?
   A. Only the drone
   B. Only the environment
   C. Equipment, environment, and conditions
   D. Nothing
4. Why are checklists important?
   A. They slow down flight
   B. They replace training
   C. They ensure all steps are completed
   D. They increase speed
5. What should a pilot do if risk is too high?
   A. Fly anyway
   B. Ignore the risk
   C. Reduce risk or cancel the flight
   D. Increase altitude

Answer Key

1. B
2. B
3. C
4. C
5. C

Closure
What is one step in pre-flight planning that you believe is most important and why?

Teacher Notes
• Reinforce that planning happens before every flight
• Emphasize checklist use as a required habit
• Use real-world scenarios to build understanding
• Connect planning to safety and decision-making
• This lesson builds directly into pre-flight inspection procedures

Week 3 – Day 3: Pre-Flight Inspection and Safety Procedures

Standard	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.02	Apply safety procedures and risk mitigation strategies.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will apply safety procedures and demonstrate proper pre-flight inspection techniques to ensure safe and responsible drone operations.

Essential Question
How does a pre-flight inspection reduce risk and support safe drone operations?

Key Concepts
• Pre-flight inspection is required before every flight
• Safety procedures reduce preventable accidents
• Equipment and environmental checks are essential
• Consistent inspection improves reliability and safety
• Responsible pilots follow procedures every time

Vocabulary
• **Pre-Flight Inspection** – A systematic check of the drone and environment before flight
• **Procedure** – A step-by-step method for completing a task safely
• **Equipment Check** – Inspection of drone components before use
• **Environmental Check** – Evaluation of surroundings for hazards
• **Readiness** – Confirmation that all conditions are safe for flight
• **Malfunction** – Equipment not operating correctly
• **Safety Boundary** – A defined area for safe drone operation

Materials Needed
• Classroom drone (DJI Tello or similar)
• Controllers or tablets
• Printed pre-flight checklist
• Cones or markers for flight area
• Whiteboard or presentation display
• Student notebooks

Bellringer
What could happen if a drone is flown without checking the equipment first?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Hazard identification and risk mitigation (Day 1)
   • Pre-flight planning and risk assessment (Day 2)

   Discuss:
   • What is the next step before actually flying?

   Bridge to lesson:
   • Today we focus on physically checking the drone and environment before flight

---

2. **Core Concept Introduction**
   Introduce pre-flight inspection as a critical safety procedure.
   • Even a well-planned flight can fail if equipment is not checked
   • Inspection ensures the drone is ready for safe operation

   Key Teaching Point:
   A safe flight begins with a complete and careful inspection.

---

3. **Concept Development**
   A. **Purpose of Pre-Flight Inspection**
      • Identifies problems before takeoff
      • Prevents equipment failure and unsafe conditions

   B. **Equipment Inspection**
      Explain that the drone must be checked carefully

      Check for:
      • Propellers (secure and undamaged)
      • Battery (charged and properly connected)
      • Frame (no cracks or damage)
      • Motors (clear and unobstructed)
      • Controller connection

   C. **Environmental Inspection**
      Explain that the flight area must be safe

      Check for:
      • Obstacles (trees, walls, wires, desks)
      • People in the area
      • Surface conditions
      • Adequate space for takeoff and landing

D. Safety Boundaries

• Pilots must define a safe operating area

Examples:
• Marking takeoff zone
• Keeping people outside flight area
• Maintaining visual line of sight

E. Importance of Consistency

• Inspection must be done every time
• Skipping steps increases risk

Key Teaching Point:
Consistency creates safe habits.

---

4. Application to Drone Flight

Scenario:
A drone has a loose propeller and people are standing close to the launch area.
Ask:
• What are the hazards?
• What should the pilot do before flight?

Students determine required corrections before launch.

---

5. Guided Examples / Demonstration

Teacher demonstrates a full pre-flight inspection:
• Equipment check
• Environmental check
• Establishing safety boundaries

Students observe and identify each step.

Sample Scenario
A drone's camera feed is working, but the drone does not respond to movement commands.

• Which system components are functioning correctly?
• Which component may be failing?

---

6. Real-World Connection

Discuss:
• Professional drone pilots must complete inspections before every mission
• Used in:
  - Public safety operations
  - Infrastructure inspection
  - Commercial drone services

Explain:
• Failure to inspect can result in equipment damage, injury, or mission failure

---

7. **Key Reinforcement Summary**
   • Pre-flight inspection prevents accidents
   • Equipment and environment must be checked
   • Safety boundaries protect people and property
   • Consistency improves safety
   • Responsible pilots follow procedures every time

   Key Teaching Point:
   Inspection is a required step for every safe flight.

Formative Questions for Use in This Lesson
• What is a pre-flight inspection?
• Why is equipment inspection important?
• What should be checked in the environment?
• Why should pilots establish safety boundaries?
• What happens if inspection steps are skipped?

Hands-On Activity
Activity Title: Guided Pre-Flight Inspection Practice
Objective:
Students will perform a structured pre-flight inspection using a checklist.

Activity Procedure
1. Divide students into small groups
2. Provide each group with a drone and checklist
3. Students perform equipment inspection
4. Students inspect the flight area
5. Identify any hazards present
6. Determine if the drone is ready for flight
7. Repeat process to reinforce consistency

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Inspection Accuracy	Completes all steps correctly	Minor errors	Some missing steps	Incomplete
Hazard Identification	Identifies all hazards	Identifies most hazards	Identifies some hazards	Few identified
Procedure Use	Follows checklist consistently	Mostly consistent	Some inconsistency	Does not follow
Maintains awareness of surroundings	Completes all steps correctly	Mostly consistent	Some inconsistency	Does not follow
Follows safety procedures	Completes all steps correctly	Mostly consistent	Some inconsistency	Does not follow
Demonstrates responsible operation	Completes all steps correctly	Mostly consistent	Some inconsistency	Does not follow
Participation	Fully engaged	Participates well	Limited participation	Minimal participation

---

Assessment Items

1. What is the purpose of a pre-flight inspection?
   A. To increase speed
   B. To identify problems before flight
   C. To control direction
   D. To reduce altitude

2. What should be checked on the drone?
   A. Only the battery
   B. Only the controller
   C. All components including propellers and frame
   D. Nothing

3. What is part of an environmental check?
   A. Checking the battery
   B. Checking obstacles and surroundings
   C. Checking the controller
   D. Checking speed

4. Why are safety boundaries important?
   A. They increase speed
   B. They protect people and property
   C. They reduce battery use
   D. They control altitude

5. What happens if inspection steps are skipped?
   A. Nothing changes
   B. Safety increases
   C. Risk increases
   D. Flight improves

Answer Key

1. B
2. C
3. B
4. B
5. C

Closure

What is one step in a pre-flight inspection that you will always perform before flying?

Teacher Notes

• Emphasize checklist use as a required habit
• Reinforce consistency in every inspection
• Allow students to physically practice procedures
• Connect inspection to previous lessons on risk and planning
• This lesson prepares students for full operational safety application

Week 3 – Day 4: In-Flight Safety and Operational Decision-Making

Standard	Description	RBT Level
105.02	Apply safety procedures and risk mitigation strategies.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will apply safety procedures and make responsible in-flight decisions to maintain safe drone operations.

Essential Question
How do pilot decisions during flight impact safety?

Key Concepts
• Safety procedures must continue during flight
• Pilots must maintain situational awareness at all times
• Conditions can change during flight and require quick decisions
• Responsible pilots adjust actions to maintain safety
• Good decision-making prevents accidents

Vocabulary
• **In-Flight** – The period when the drone is actively flying
• **Situational Awareness** – Understanding what is happening during flight
• **Decision-Making** – Choosing actions based on current conditions
• **Adjustment** – Changing actions to maintain control and safety
• **Emergency Response** – Actions taken when something goes wrong
• **Visual Line of Sight (VLOS)** – Keeping the drone visible to the pilot
• **Control Input** – Commands given to the drone

Materials Needed
• Classroom drone
• Controllers or tablets
• Cones or markers for flight boundaries
• Scenario cards
• Whiteboard or presentation display
• Student notebooks

Bellringer
What should a pilot do if something unexpected happens while the drone is in the air?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Hazard identification and risk mitigation (Day 1)
   • Pre-flight planning (Day 2)
   • Pre-flight inspection (Day 3)

   Discuss:
   • Are safety procedures only important before flight?

   Bridge to lesson:
   • Safety continues throughout the entire flight

---

2. **Core Concept Introduction**

   Introduce in-flight safety as active decision-making during operation.
   • Conditions can change while flying
   • Pilots must continuously monitor and adjust

   Key Teaching Point:
   Safe pilots stay aware and make decisions during flight—not after problems occur.

---

3. **Concept Development**

   A. **Situational Awareness**
   • Pilots monitor the drone, environment, and surroundings

   Examples:
   • Watching for obstacles
   • Monitoring people entering the area
   • Observing drone behavior

   B. **Maintaining Visual Line of Sight**
   • Pilots must always keep the drone visible

   Importance:
   • Avoid obstacles
   • Maintain control
   • Support safe navigation

   C. **Responding to Changing Conditions**
   • Conditions may change during flight

   Examples:
   • Wind increases
   • People enter the flight area
   • Drone begins drifting

   Pilot actions:
   • Adjust position
   • Reduce speed
   • Land if necessary

D. Safe Control and Movement

• Smooth and controlled inputs improve safety

Avoid:
• Sudden movements
• Overcorrection
• Excessive speed

E. Emergency Decision-Making

• Pilots must be prepared to respond immediately

Examples:
• Loss of control
• Low battery warning
• Unexpected obstacle

Key Teaching Point:
When safety is at risk, the correct decision is to land immediately.

4. Application to Drone Flight

Scenario:
During flight, a person walks into the flight area.
Ask:
• What is the hazard?
• What action should be taken?

Students determine safe responses such as hovering, repositioning, or landing.

5. Guided Examples / Demonstration

Teacher demonstrates controlled flight:
• Maintaining awareness
• Adjusting to simulated hazards
• Executing a safe landing

Students identify appropriate decisions during the demonstration.

6. Real-World Connection

• Drone pilots in professional environments must make decisions during flight
• Used in:
  - Public safety operations
  - Inspection missions
  - Media production
• In-flight decisions directly impact safety and mission success

7. **Key Reinforcement Summary**
   • Safety continues during flight
   • Situational awareness is critical
   • Pilots respond to changing conditions
   • Controlled movements improve safety
   • Good decisions prevent accidents

   Key Teaching Point:
   Safe flight depends on awareness and decision-making.

Formative Questions for Use in This Lesson
• What is situational awareness?
• Why must pilots maintain visual line of sight?
• What should a pilot do if conditions change?
• Why are smooth control inputs important?
• When should a pilot land immediately?

Hands-On Activity
Activity Title: Controlled Flight and Decision-Making Practice
Objective:
Students will demonstrate safe in-flight behavior and decision-making during drone operation.

Activity Procedure
1. Set up a defined flight area
2. Assign students roles (pilot and observer)
3. Pilot performs basic flight maneuvers
4. Introduce simulated changes (obstacle, person, condition)
5. Pilot responds appropriately
6. Rotate roles
7. Discuss decisions made during activity

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Situational Awareness	Constant awareness	Mostly aware	Limited awareness	Minimal awareness
Decision-Making	Strong and timely decisions	Appropriate decisions	Delayed decisions	Poor decisions
Flight Control	Smooth and controlled	Mostly controlled	Some instability	Poor control
Safety Response	Immediate and correct	Mostly correct	Delayed response	Unsafe response

---

Assessment Items

1. What is situational awareness?
   A. Flying faster
   B. Understanding surroundings during flight
   C. Increasing altitude
   D. Controlling speed
2. Why must pilots maintain visual line of sight?
   A. To increase speed
   B. To keep the drone visible for safe operation
   C. To reduce battery use
   D. To avoid using controls
3. What should a pilot do if a person enters the flight area?
   A. Ignore the person
   B. Fly closer
   C. Adjust or land immediately
   D. Increase speed
4. Why are smooth control inputs important?
   A. They increase speed
   B. They improve safety and control
   C. They reduce battery use
   D. They eliminate hazards
5. When should a pilot land immediately?
   A. When conditions become unsafe
   B. When the drone is stable
   C. When nothing is wrong
   D. When flying smoothly

Answer Key

1. B
2. B
3. C
4. B
5. A

Closure

What is one decision a pilot can make during flight that improves safety?

Teacher Notes

• Emphasize real-time decision-making during flight
• Reinforce importance of visual line of sight
• Encourage calm and controlled responses
• Provide guided practice opportunities
• This lesson prepares students for full operational safety application

Week 3 – Day 5: Integrated Safety Procedures and Responsible Drone Operations

Standard	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.02	Apply safety procedures and risk mitigation strategies.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will apply safety procedures, risk mitigation strategies, and responsible flight practices to demonstrate safe drone operations.

Essential Question
How do safety procedures, risk awareness, and decision-making work together to ensure safe drone operations?

Key Concepts
• Safe drone operation requires planning, inspection, and in-flight awareness
• Risk mitigation must be applied before and during flight
• Responsible pilots follow procedures consistently
• Decision-making impacts safety at every stage of flight
• Safe operations protect people, equipment, and the environment

---

Vocabulary
• **Operational Safety** – Safe practices used throughout all phases of flight
• **Risk Mitigation** – Actions taken to reduce or control hazards
• **Procedure Compliance** – Following established safety steps consistently
• **Responsible Operation** – Making safe and ethical decisions during flight
• **Flight Readiness** – Confirmation that all conditions are safe for operation
• **Hazard Awareness** – Recognizing potential dangers in the environment
• **Decision-Making** – Choosing safe actions based on conditions

---

Materials Needed
• Classroom drones
• Controllers or tablets
• Pre-flight checklists
• Cones or markers for flight area
• Scenario cards
• Whiteboard or presentation display
• Student notebooks

Bellringer
What are the most important steps a pilot should take to ensure a safe drone flight from start to finish?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Hazard identification and risk mitigation (Day 1)
   • Pre-flight planning (Day 2)
   • Pre-flight inspection (Day 3)
   • In-flight decision-making (Day 4)

   Discuss:
   • How do all of these steps connect to safe drone operations?

   Bridge to lesson:
   • Today integrates all safety concepts into complete flight operations

---

2. **Core Concept Introduction**
   Introduce integrated safety as the combination of all procedures and decisions used during drone operations.
   • Safe operations require consistency across all phases
   • Pilots must apply knowledge before, during, and after flight

   Key Teaching Point:
   Safe drone operation is a complete process, not a single step.

---

3. **Concept Development**
   A. **Full Safety Process**
      • Pre-flight planning
      • Risk assessment
      • Equipment inspection
      • Environmental evaluation
      • In-flight awareness
      • Safe landing

   B. **Risk Mitigation Across All Phases**
      • Before flight – identify and reduce hazards
      • During flight – adjust to changing conditions
      • After flight – evaluate performance and safety

   C. Procedure Compliance
      • Follow checklists and safety steps every time
      • Avoid skipping steps
      • Maintain consistency

D. Responsible Drone Operation
- Protect people and property
- Maintain control at all times
- Make safe decisions
- Follow rules and expectations

E. Decision-Making and Safety
- Every action affects safety
- Good decisions reduce risk
- Unsafe decisions increase danger

Key Teaching Point:
Safe pilots consistently make responsible decisions throughout the entire operation.

---

4. Application to Drone Flight

Scenario:
A pilot completes pre-flight planning and inspection but notices changing conditions during flight.
Ask:
- What actions should the pilot take?
- How should safety procedures be applied?

Students determine how to adjust and maintain safe operation.

---

5. Guided Examples / Demonstration

Teacher demonstrates a complete safe flight process:
- Pre-flight planning
- Inspection
- Controlled flight
- Safe landing

Students identify safety procedures used at each stage.

---

6. Real-World Connection
- Professional drone pilots follow complete safety procedures for every mission
- Used in:
  - Public safety
  - Infrastructure inspection
  - Agriculture
  - Media production
- Safe operations build trust and ensure mission success

---

7. **Key Reinforcement Summary**
   • Safety procedures apply to all phases of flight
   • Risk mitigation is ongoing
   • Responsible pilots follow procedures consistently
   • Decision-making impacts safety
   • Safe operations require preparation, awareness, and control

   Key Teaching Point:
   Safe drone pilots apply all safety principles every time they fly.

Formative Questions for Use in This Lesson
• What are the steps in a complete safe flight process?
• How is risk mitigation applied during flight?
• Why is procedure compliance important?
• What makes a drone operation responsible?
• How does decision-making impact safety?

Hands-On Activity
Activity Title: Full Safety Flight Simulation
Objective:
Students will apply all safety procedures to complete a full drone operation.

Activity Procedure
1. Set up a defined flight area
2. Assign students roles (pilot and observer)
3. Students complete pre-flight planning
4. Perform pre-flight inspection
5. Conduct controlled flight
6. Respond to simulated changes or hazards
7. Execute a safe landing
8. Rotate roles and repeat

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Safety Procedures	Follows all procedures consistently	Minor errors	Some missing steps	Incomplete
Risk Mitigation	Identifies and reduces risk effectively	Mostly effective	Limited effectiveness	Minimal effort
Flight Control	Smooth and controlled	Mostly controlled	Some instability	Poor control
Decision-Making	Strong and timely decisions	Appropriate decisions	Delayed decisions	Poor decisions

C3 Scenario

A student attempts to fly a drone, but the drone lifts briefly and then immediately lands unexpectedly.

• What components could be causing this issue?
• What should be checked before the next flight attempt?

Assessment Items

1. What is operational safety?
   A. Flying faster
   B. Safe practices used throughout flight
   C. Increasing altitude
   D. Controlling speed
2. When should risk mitigation occur?
   A. Only before flight
   B. Only during flight
   C. Only after flight
   D. Throughout all phases of flight
3. What is procedure compliance?
   A. Ignoring steps
   B. Following safety steps consistently
   C. Increasing speed
   D. Skipping inspection
4. What is responsible drone operation?
   A. Flying quickly
   B. Making safe and controlled decisions
   C. Ignoring hazards
   D. Flying without planning
5. Why is decision-making important in drone operations?
   A. It increases speed
   B. It reduces battery use
   C. It impacts safety
   D. It controls altitude

Answer Key

1. B
2. D
3. B
4. B
5. C

Closure

What is one safety procedure you will always follow before, during, or after every flight?

Teacher Notes

- Reinforce that safety is a complete process
- Emphasize consistency across all lessons
- Allow students to demonstrate full understanding
- Use this lesson as a transition to more advanced flight operations
- Ensure all students can connect planning, inspection, and flight behavior

Week 4 – Airspace Fundamentals and Chart Introduction

Week Overview
This week introduces students to aeronautical charts and airspace systems used to support safe and legal drone operations. Students will learn to identify chart symbols, understand airspace classifications, and interpret sectional charts for flight planning. Emphasis is placed on using chart data to make informed decisions about where drones can be flown safely and legally.

Week 4 – Day 1: Introduction to Aeronautical Charts and Airspace

Standard	Description	RBT Level
103.00	Interpret aeronautical charts and airspace for safe drone operations.	C3
103.01	Identify chart symbols, airspace classifications, and restrictions.	A1

Objective
Students will identify the purpose of airspace and explain why it is essential for safe drone operations.

Essential Question
Why must drone pilots understand airspace before flying?

Key Concepts
• Airspace regulates where drones can fly
• Airspace is designed to protect aircraft and people
• Drone pilots must evaluate airspace before flight
• Restrictions exist to prevent unsafe operations

Vocabulary
• **Airspace** – The area above Earth regulated for aircraft operations
• **Controlled Airspace** – Airspace with specific rules and restrictions
• **Uncontrolled Airspace** – Airspace with fewer restrictions
• **Restriction** – A limitation placed on flight operations

Materials Needed
• PowerPoint Presentation (Week 4 Day 1 – Airspace Introduction)
• Whiteboard and markers
• Sample airspace visuals/images
• Student notebooks

Bellringer
Why might some locations be unsafe or illegal for drone flight?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Safety procedures and risk awareness from Week 3
   • The importance of evaluating conditions before flight
   • Basic understanding of responsible drone operation

   Discuss:
   • What could happen if a drone pilot flies without checking surroundings or conditions?

   Bridge to lesson:
   • Safe drone pilots do not just consider safety—they must also understand the airspace where they are flying

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2. **Core Concept Introduction**
   • Airspace is a system used to organize and control aircraft operations

   Key Teaching Point:
   Airspace helps ensure that drones and aircraft operate safely without interfering with each other

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3. **Concept Development**
   A. Understanding Airspace
   • Airspace is the area above the ground where aircraft operate
   • It is structured to maintain safe distances between aircraft

   B. Identifying Types of Airspace
   • Controlled airspace includes restrictions and regulations
   • Uncontrolled airspace has fewer limitations but still requires awareness

   C. Recognizing the Purpose of Airspace
   • Prevent collisions
   • Protect people and property
   • Organize flight operations

   D. Connecting Airspace to Drone Operations
   • Drone pilots must be aware of where they are flying
   • Airspace determines whether flight is allowed

   E. Introducing Airspace Awareness
   • Pilots evaluate their location before flight
   • Awareness helps prevent unsafe or illegal operations

   Key Teaching Point:
   Drone pilots must understand airspace before every flight to ensure safe and legal operation

---

4. **Application to Drone Flight**
   Students evaluate different locations and determine potential airspace concerns before flight.

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5. **Guided Examples / Demonstration**
   Instructor presents sample locations and models how to identify possible airspace concerns.

6. **Real-World Connection**
   Drone pilots must evaluate airspace before every flight to comply with regulations and maintain safety.

7. **Key Reinforcement Summary**
   Airspace awareness is a critical step in every safe drone operation.

Formative Questions for Use in This Lesson
• What is airspace?
• Why is airspace regulated?
• What is the difference between controlled and uncontrolled airspace?
• Why must drone pilots check airspace before flying?

Hands-On Activity
Activity Title: Safe vs. Unsafe Flight Locations

Activity Procedure
1. Instructor presents images of different flight locations
2. Students analyze each location
3. Students identify possible airspace concerns
4. Students determine whether the location appears safe or unsafe
5. Class discussion of decisions and reasoning

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Airspace Understanding	Accurate and thorough identification of concerns	Mostly accurate identification	Some understanding shown	Minimal understanding
Reasoning	Clear and well-supported explanations	Adequate explanations	Limited explanation	No clear reasoning
Participation	Fully engaged and contributes consistently	Participates appropriately	Limited participation	Minimal engagement

Assessment Items
1. What is airspace?
   A. Ground area
   B. Air above Earth
   C. Water area
   D. Building space

2. Why is airspace regulated?
   A. To increase speed
   B. To ensure safety
   C. To change weather
   D. To control noise
3. What is controlled airspace?
   A. Airspace with no rules
   B. Airspace with restrictions
   C. Airspace used only for drones
   D. Airspace without aircraft
4. What must drone pilots do before flying?
   A. Ignore rules
   B. Check airspace
   C. Increase speed
   D. Reduce battery use
5. What does airspace help protect?
   A. Trees only
   B. Buildings only
   C. Aircraft and people
   D. Roads only

Answer Key

1. B
2. B
3. B
4. B
5. C

Closure

Airspace awareness is the foundation of safe and responsible drone operations. Every flight begins with understanding where you are allowed to fly.

Teacher Notes

• Emphasize the connection between safety (Week 3) and airspace (Week 4)
• Keep explanations simple and foundational
• Focus on awareness, not deep technical detail yet
• Prepare students for airspace classifications in Day 2

Week 4 – Day 2: Airspace Classifications

Standard	Description	RBT Level
103.00	Interpret aeronautical charts and airspace for safe drone operations.	C3
103.01	Identify chart symbols, airspace classifications, and restrictions.	A1

Objective
Students will identify airspace classifications and describe how they impact drone operations.

Essential Question
How do different airspace classifications affect where drones can fly?

Key Concepts
• Airspace is divided into classifications
• Each classification has different restrictions
• Airspace near airports is more controlled
• Drone pilots must understand classifications before flight

Vocabulary
• **Class B Airspace** – Highly controlled airspace around major airports
• **Class C Airspace** – Moderately controlled airspace around medium airports
• **Class D Airspace** – Controlled airspace around smaller airports
• **Class E Airspace** – Controlled airspace not classified as B, C, or D
• **Class G Airspace** – Uncontrolled airspace

Materials Needed
• PowerPoint Presentation (Week 4 Day 2 – Airspace Classifications)
• Airspace classification visuals/diagrams
• Whiteboard and markers
• Student notebooks

Bellringer
Why are areas near airports more restricted than open fields?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Airspace purpose and structure from Day 1
   • The importance of evaluating flight locations
   • Safety considerations from previous weeks

   Discuss:
   • Why might some areas require more control than others?

   Bridge to lesson:
   • Airspace is divided into classifications to manage different levels of air traffic and risk

2. **Core Concept Introduction**
   • Airspace is divided into classifications based on traffic, location, and level of control

   Key Teaching Point:
   Different airspace classifications determine how and where drones can operate

3. **Concept Development**
   A. Understanding Airspace Classifications
   • Airspace is divided into Class B, C, D, E, and G
   • Each class represents a different level of control

   B. Identifying Controlled Airspace
   • Class B, C, D, and E are controlled airspace
   • These areas often exist near airports

   C. Identifying Uncontrolled Airspace
   • Class G is uncontrolled airspace
   • Fewer restrictions but still requires safe operation

   D. Recognizing Operational Impact
   • Restrictions vary depending on classification
   • Pilots must understand rules before flying

   E. Connecting Classifications to Flight Decisions
   • Airspace classification helps determine whether a flight is allowed
   • Pilots use this information before takeoff

   Key Teaching Point:
   Airspace classifications guide drone pilots in making safe and legal flight decisions

4. **Application to Drone Flight**
   Students identify how airspace classifications affect where they can safely operate a drone.

5. **Guided Examples / Demonstration**
   Instructor presents diagrams of airspace classes and explains how to recognize them.

6. **Real-World Connection**
   Drone pilots must understand airspace classifications to avoid restricted areas and ensure compliance.

7. **Key Reinforcement Summary**
   Airspace classifications determine where and how drones can safely fly.

Formative Questions for Use in This Lesson
• What are the five airspace classifications?
• Which airspace is most restrictive?
• Which airspace is least restrictive?
• Why are airports surrounded by controlled airspace?

Hands-On Activity
Activity Title: Airspace Classification Matching

Activity Procedure

1. Students are given descriptions of different airspace types
2. Students match each description to the correct classification
3. Students explain their reasoning
4. Instructor reviews answers with the class

C3 Scenario (Decision-Based Application)
Students are given a location near an airport and must determine:
• What airspace classification is likely present
• Whether it is safe to fly
• What concerns or restrictions may apply

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Airspace Identification	Accurately identifies all classifications	Mostly accurate	Some correct	Limited understanding
Reasoning	Clear and well-supported explanations	Adequate explanations	Limited reasoning	No clear reasoning
Participation	Fully engaged and contributes consistently	Participates appropriately	Limited participation	Minimal engagement

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Assessment Items

1. Which airspace is most restrictive?
   A. Class G
   B. Class E
   C. Class B
   D. Class D
2. Which airspace is considered uncontrolled?
   A. Class B
   B. Class C
   C. Class D
   D. Class G
3. Why is airspace near airports more controlled?
   A. Less traffic
   B. More aircraft activity
   C. Fewer people
   D. Lower altitude

4. What must drone pilots understand before flying?
   A. Battery size
   B. Airspace classification
   C. Drone color
   D. Speed only
5. Which airspace has the least restrictions?
   A. Class B
   B. Class C
   C. Class D
   D. Class G

Answer Key

1. C
2. D
3. B
4. B
5. D

Closure

Understanding airspace classifications helps drone pilots determine where they can safely and legally operate.

Teacher Notes

• Use visuals to reinforce understanding
• Keep explanations clear and simple
• Emphasize differences between airspace types
• Prepare students for chart symbols in Day 3

Week 4 – Day 3: Applying Sectional Charts to Flight Planning Decisions

Standard	Description	RBT Level
103.00	Interpret aeronautical charts and airspace for safe drone operations.	C3
103.01	Identify chart symbols, airspace classifications, and restrictions.	A1
103.02	Interpret sectional charts for flight planning decisions.	B2

Objective
Students will identify common aeronautical chart symbols and explain how they are used to understand airspace.

Essential Question
How do chart symbols help drone pilots understand where they can safely fly?

Key Concepts
• Aeronautical charts use symbols to represent real-world features
• Symbols communicate airspace classifications and restrictions
• Charts are tools used for safe flight planning
• Understanding symbols is the first step in chart interpretation

Vocabulary
• **Sectional Chart** – A map used by pilots to show airspace and features
• **Symbol** – A visual representation of a real-world object or condition
• **Legend** – A guide that explains chart symbols
• **Restricted Area** – Airspace where flight is limited or prohibited
• **Airport Symbol** – A chart symbol representing an airport location

Materials Needed
• PowerPoint Presentation (Week 4 Day 3 – Chart Symbols)
• Sample sectional chart images
• Printed chart excerpts (optional)
• Whiteboard and markers
• Student notebooks

Bellringer
Why would pilots use symbols instead of words on a map?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Airspace classifications from Day 2
   • The importance of identifying restrictions
   • Basic chart exposure from previous lessons

Discuss:
• How can pilots quickly understand complex information about a flight area?

Bridge to lesson:
• Pilots use charts with symbols to quickly interpret airspace information

---

2. **Core Concept Introduction**
   • Aeronautical charts use symbols to represent airspace and features

Key Teaching Point:
Chart symbols allow pilots to quickly understand important flight information

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3. **Concept Development**
   A. Understanding Chart Symbols
   • Symbols represent airports, airspace, and hazards
   • Each symbol communicates specific information

   B. Using the Chart Legend
   • The legend explains the meaning of symbols
   • Pilots reference the legend when needed

   C. Identifying Airspace Indicators
   • Symbols show classifications and restrictions
   • These indicators guide pilot decisions

   D. Recognizing Hazards and Restrictions
   • Some symbols represent obstacles or restricted areas
   • Pilots must identify these before flight

   E. Connecting Symbols to Flight Planning
   • Symbols help determine safe and unsafe flight areas
   • Pilots use symbol information to plan flights

   Key Teaching Point:
   Understanding chart symbols allows pilots to interpret airspace and prepare for safe operations

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4. **Application to Drone Flight**
   Students use chart symbols to identify restrictions and hazards in a flight area.

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5. **Guided Examples / Demonstration**
   Instructor walks through a chart and models symbol interpretation.

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6. **Real-World Connection**
   Pilots rely on charts to identify hazards and ensure safe operations.

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7. **Key Reinforcement Summary**
   Chart symbols are essential tools for understanding airspace.

Formative Questions for Use in This Lesson
• What is a sectional chart?
• What is the purpose of a legend?
• What do chart symbols represent?
• Why are symbols used instead of text?

Hands-On Activity
Activity Title: Chart Symbol Identification

Activity Procedure
1. Students are provided with a sample chart or image
2. Students identify selected symbols
3. Students match symbols to their meanings
4. Students explain what each symbol represents
5. Instructor reviews answers with the class

C3 Scenario (Decision-Based Application)
Students are given a simple chart with a marked location and must determine:
• What symbols are present
• What those symbols indicate
• Whether the location appears safe for drone flight

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Symbol Identification	Accurately identifies all symbols	Mostly accurate	Some correct	Limited understanding
Interpretation	Clear and correct explanations	Adequate explanations	Limited interpretation	Minimal understanding
Participation	Fully engaged and contributes consistently	Participates appropriately	Limited participation	Minimal engagement

Assessment Items
1. What is a sectional chart used for?
   A. Drawing pictures
   B. Showing airspace and features
   C. Storing data
   D. Controlling drones
2. What does a legend do?
   A. Controls flight
   B. Explains symbols
   C. Measures speed
   D. Shows weather

3. What is a symbol on a chart?
   A. A word
   B. A number
   C. A visual representation
   D. A direction
4. Why are symbols used on charts?
   A. To confuse pilots
   B. To simplify information
   C. To replace rules
   D. To increase speed
5. What might a restricted area symbol indicate?
   A. Safe flight zone
   B. No restrictions
   C. Limited or no flight allowed
   D. Landing zone

Answer Key

1. B
2. B
3. C
4. B
5. C

Closure

Chart symbols help drone pilots quickly understand important airspace information needed for safe flight.

Teacher Notes

• Use clear visuals—this lesson is highly visual
• Reinforce connection between symbols and real-world meaning
• Keep interpretation simple—deeper analysis comes in Day 4
• Prepare students for full chart interpretation next lesson

Week 4 – Day 4: Scenario-Based Chart Analysis and Flight Decision-Making

Standard	Description	RBT Level
103.00	Interpret aeronautical charts and airspace for safe drone operations.	C3
103.02	Interpret sectional charts for flight planning decisions.	B2

Objective
Students will interpret aeronautical chart information to determine safe and appropriate drone flight locations.

Essential Question
How do drone pilots use charts to determine where they can safely fly?

Key Concepts
• Charts provide detailed airspace information
• Airspace boundaries define where flight is allowed or restricted
• Chart interpretation supports safe decision-making
• Pilots must analyze charts before flying

Vocabulary
• **Boundary** – A line that defines the limits of an airspace area
• **Airspace Classification** – A category of regulated airspace
• **Chart Interpretation** – The process of analyzing map data to make decisions
• **Flight Planning** – The process of preparing for a safe drone operation

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Materials Needed
• PowerPoint Presentation (Week 4 Day 4 – Chart Interpretation)
• Sectional chart examples (simplified)
• Whiteboard and markers
• Student worksheets (chart interpretation practice)
• Student notebooks

Bellringer
What information would you need before deciding to fly a drone in a new location?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Chart symbols and classifications
   • How symbols represent real-world features

   Discuss:
   • Why is recognizing symbols not enough for safe flight?

Bridge to lesson:
• Pilots must interpret chart information to make decisions

---

2. **Core Concept Introduction**
   • Chart interpretation is the process of analyzing chart information to make flight decisions

   Key Teaching Point:
   Pilots must interpret—not just identify—chart information

---

3. **Concept Development**
   A. Understanding Chart Interpretation
   • Interpretation involves analyzing multiple elements together
   • Pilots must look beyond individual symbols

   B. Identifying Airspace Boundaries
   • Boundaries define where restrictions apply
   • Pilots must recognize these limits

   C. Evaluating Airspace Conditions
   • Different areas have different levels of restriction
   • Conditions vary by location

   D. Connecting Charts to Real Locations
   • Charts represent actual flight environments
   • Pilots must relate chart data to real-world locations

   E. Applying Interpretation to Decisions
   • Pilots determine whether flight is safe
   • Decisions are based on chart information

   Key Teaching Point:
   Chart interpretation allows pilots to make informed flight decisions

---

4. **Application to Drone Flight**
   Students interpret chart information to determine safe flight areas.

---

5. **Guided Examples / Demonstration**
   Instructor models step-by-step chart interpretation and decision-making.

---

6. **Real-World Connection**
   Drone pilots use chart interpretation to ensure safe and legal flight operations.

---

7. **Key Reinforcement Summary**
   Interpreting charts is essential for safe and responsible drone operation.

Formative Questions for Use in This Lesson
• What does a chart boundary represent?
• How can you identify restricted areas on a chart?
• Why is chart interpretation important for drone pilots?
• What decisions must a pilot make using chart information?

Hands-On Activity
Activity Title: Chart Interpretation Exercise

Activity Procedure

1. Students are given a simplified chart
2. Students identify airspace classifications and boundaries
3. Students determine which areas are safe or restricted
4. Students explain their reasoning
5. Instructor reviews answers with the class

C3 Scenario (Decision-Based Application)
Students are given a chart with a marked flight location and must:
• Identify the airspace classification
• Determine if flight is allowed
• Explain their decision based on chart information

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Chart Interpretation	Accurate and complete analysis	Mostly accurate	Partial understanding	Limited understanding
Decision-Making	Clear and well-supported decisions	Adequate reasoning	Limited reasoning	No clear reasoning
Participation	Fully engaged and contributes consistently	Participates appropriately	Limited participation	Minimal engagement

Assessment Items

1. What does a boundary on a chart represent?
   A. A road
   B. A limit of airspace
   C. A building
   D. A weather pattern
2. Why do pilots interpret charts?
   A. To draw maps
   B. To make flight decisions
   C. To measure speed
   D. To control drones
3. What should a pilot identify on a chart?
   A. Colors only
   B. Airspace and restrictions
   C. Weather only
   D. Battery life

4. What does chart interpretation help determine?
   A. Drone color
   B. Safe flight locations
   C. Flight speed
   D. Camera angle
5. What must a pilot do before flying?
   A. Guess
   B. Interpret chart information
   C. Ignore airspace
   D. Increase altitude

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Interpreting aeronautical charts allows drone pilots to make safe and informed decisions before flight.

Teacher Notes

• Emphasize step-by-step interpretation
• Encourage students to explain their reasoning
• Focus on decision-making, not memorization
• Prepare students for full scenario application in Day 5

Week 4 – Day 5: Integrated Airspace and Chart-Based Flight Planning

Standard	Description	RBT Level
103.00	Interpret aeronautical charts and airspace for safe drone operations.	C3
103.02	Interpret sectional charts for flight planning decisions.	B2
103.03	Apply chart data to determine safe and legal flight locations.	C3
105.02	Apply safety procedures and risk mitigation strategies	C3

Objective
Students will apply airspace knowledge and safety procedures to make informed drone flight decisions.

Essential Question
How do airspace knowledge and safety considerations work together to determine whether a drone flight should occur?

Key Concepts
• Safe drone flight requires both airspace knowledge and safety awareness
• Pilots must evaluate risks before flying
• Not all locations are safe or legal for flight
• Decision-making is a critical pilot responsibility

Vocabulary
• **Risk Assessment** – The process of identifying potential hazards before flight
• **Mitigation** – Actions taken to reduce risk
• **Flight Decision** – The determination of whether to proceed with a flight
• **Hazard** – A potential source of danger

Materials Needed
• PowerPoint Presentation (Week 4 Day 5 – Decision Making)
• Scenario worksheets (flight locations with charts)
• Whiteboard and markers
• Student notebooks

Bellringer
What factors should a drone pilot consider before deciding to fly?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Chart symbols and interpretation
   • Airspace classifications
   • Safety procedures from previous lessons

Discuss:
• What happens if a pilot ignores airspace and safety considerations?

Bridge to lesson:
• Safe flight requires both understanding and decision-making

---

2. **Core Concept Introduction**
   • Decision-making is the process of determining whether a flight should occur

   Key Teaching Point:
   Pilots must evaluate all factors before deciding to fly

---

3. **Concept Development**
   A. Understanding Decision-Making
   • Pilots must decide whether conditions are safe
   • Not all locations are appropriate for flight

   B. Identifying Airspace Factors
   • Airspace classification affects flight legality
   • Restrictions must be considered

   C. Recognizing Safety Risks
   • Hazards such as obstacles and people
   • Environmental conditions

   D. Evaluating Flight Conditions
   • Pilots consider multiple factors together
   • Conditions determine flight readiness

   E. Making Flight Decisions
   • Pilots decide to proceed or not
   • Decisions must be justified

   Key Teaching Point:
   Safe drone pilots evaluate airspace and risks before every flight

---

4. **Application to Drone Flight**
   Students apply airspace and safety knowledge to determine whether a flight should occur.

---

5. **Guided Examples / Demonstration**
   Instructor models a full flight decision scenario.

---

6. **Real-World Connection**
   Drone pilots must make informed decisions before every flight to ensure safety and compliance.

---

7. **Key Reinforcement Summary**
   Safe flight depends on informed decision-making.

Formative Questions for Use in This Lesson
• What is risk assessment?
• What hazards might affect a drone flight?
• Why is decision-making important for pilots?
• What should a pilot do if a location is unsafe?

Hands-On Activity
Activity Title: Mission Scenario Analysis

Activity Procedure
1. Students are given a flight scenario with a location and chart
2. Students identify airspace classification
3. Students identify hazards and risks
4. Students determine whether the flight should proceed
5. Students justify their decision
6. Class discussion and review

C3 Scenario (REPLACE ONLY THIS SECTION)
Students are given a sectional chart with a marked flight location and must:
• Identify the airspace classification
• Identify any restrictions or hazards present
• Determine whether the flight is **safe and legal**
• Justify their decision using chart data and safety considerations

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Airspace Interpretation	Accurate and complete analysis	Mostly accurate	Partial understanding	Limited understanding
Risk Assessment	Thorough identification of hazards	Adequate identification	Limited identification	Minimal understanding
Decision-Making	Clear, well-supported decision	Adequate reasoning	Limited reasoning	No clear reasoning
Participation	Fully engaged and contributes consistently	Participates appropriately	Limited participation	Minimal engagement

Assessment Items
1. What is risk assessment?
   A. Ignoring hazards
   B. Identifying potential dangers
   C. Increasing speed
   D. Charging batteries

2. What is a hazard?
   A. A safe area
   B. A type of drone
   C. A potential danger
   D. A flight path
3. What should a pilot do before flying?
   A. Guess
   B. Evaluate risks and airspace
   C. Ignore restrictions
   D. Fly immediately
4. What does mitigation mean?
   A. Increasing risk
   B. Reducing risk
   C. Ignoring problems
   D. Ending flight
5. What is the final step in flight planning?
   A. Charging batteries
   B. Decision-making
   C. Increasing altitude
   D. Changing location

Answer Key

1. B
2. C
3. B
4. B
5. B

Closure

Safe drone pilots evaluate airspace and risks before every flight and make informed decisions to ensure safe and legal operations.

Teacher Notes

• Emphasize that choosing NOT to fly is sometimes the correct decision
• Encourage students to justify decisions clearly
• Reinforce connection between airspace and safety
• This lesson serves as a transition into more advanced planning

Week 5 – Mission Planning & Pre-Flight Considerations

Week Overview
This week introduces students to the basic concepts of mission planning and pre-flight preparation for drone operations. Students will explore how drone pilots prepare for flight by identifying environmental conditions, airspace considerations, and overall readiness. The focus is on building an understanding of the factors that influence flight, allowing students to recognize what should be reviewed before flying and explain how these elements support safe and responsible drone operations.

Week 5 – Day 1: Introduction to Mission Planning Concepts

Standard	Description	RBT Level
104.00	Apply mission planning and operational decision-making for drone operations.	C3
104.01	Evaluate environmental and airspace factors for mission approval.	B2

Objective
Students will identify key components of mission planning and describe factors that should be considered before a drone flight.

Essential Question
What information should a drone pilot review before flying?

Key Concepts
• Mission planning supports safe drone operations
• Environmental conditions affect flight
• Airspace considerations impact where drones can fly
• Preparation helps reduce risk
• Multiple factors influence flight readiness

Vocabulary
• **Mission Planning** – Preparing for a drone operation before flight
• **Pre-Flight Planning** – Steps taken before flying to ensure readiness
• **Environmental Factors** – Weather and surroundings that affect flight
• **Airspace Considerations** – Rules and classifications that affect where drones can fly
• **Risk Awareness** – Recognizing potential hazards before flight
• **Flight Readiness** – Being prepared for a safe drone operation

---

Materials Needed
• Scenario worksheets
• Pre-flight planning checklist
• Whiteboard or presentation display
• Student notebooks

Bellringer
What are some things you would check before flying a drone for the first time in a new location?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Safety concepts from previous weeks
   • Basic understanding of drone operation
   • Awareness of environmental conditions

   Discuss:
   • What could go wrong if a pilot does not prepare before flying?

   Bridge to lesson:
   • Pilots do not just take off—they prepare before every flight

---

2. **Core Concept Introduction**
   • Mission planning is the process of preparing for a drone flight

   Key Teaching Point:
   Preparation helps pilots understand conditions before flying

---

3. **Concept Development**
   A. **Understanding Mission Planning**
      • Mission planning includes thinking about where, when, and how a drone will fly
      • It helps pilots prepare for different conditions

   B. **Identifying Environmental Factors**
      • Weather conditions (wind, rain, visibility)
      • Surroundings (trees, buildings, people)
      • These factors can affect flight safety

   C. **Recognizing Airspace Considerations**
      • Some locations have restrictions
      • Airspace determines where drones can operate
      • Pilots review airspace before flying

   D. **Introducing Risk Awareness**
      • Risks are conditions that could cause problems
      • Identifying risks helps pilots prepare

   E. **Understanding Flight Readiness**
      • Pilots consider multiple factors before flying
      • Preparation helps determine if conditions are appropriate

   Key Teaching Point:
   Drone pilots review important information before flying to help ensure safe operations

---

4. **Application to Drone Flight**
   • Students review a simple scenario
   • Identify environmental and airspace factors
   • Describe what should be considered before flying

---

5. **Guided Examples / Demonstration**
   • Teacher presents a basic flight scenario
   • Students identify important factors
   • Discuss how conditions might affect flight

---

6. **Real-World Connection**
   • Drone pilots prepare before every flight
   • Planning helps prevent accidents
   • Preparation is used in industries such as photography, inspection, and public safety

---

7. **Key Reinforcement Summary**
   • Mission planning helps prepare for flight
   • Environmental and airspace factors affect operations
   • Risks can be identified before flying
   • Preparation supports safe drone use

   Key Teaching Point:
   Preparation is an important step before any drone flight

Formative Questions for Use in This Lesson
• What is mission planning?
• What environmental factors affect flight?
• Why is airspace important?
• What is a risk?
• Why should pilots prepare before flying?

Hands-On Activity
Activity Title: Mission Planning Exploration
Objective:
Students will identify factors that should be considered before a drone flight

---

Activity Procedure
1. Divide students into groups
2. Provide each group with a simple flight scenario
3. Identify environmental conditions
4. Identify airspace considerations
5. Describe possible risks
6. Discuss whether the location appears appropriate for flight
7. Explain reasoning
8. Share findings

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Factor Identification	All factors identified	Most identified	Some identified	Few identified
Understanding	Clear explanation	Adequate explanation	Limited explanation	Minimal explanation
Application	Strong connection to scenario	Appropriate connection	Basic connection	Minimal connection
Participation	Fully engaged	Participates well	Limited participation	Minimal participation

Assessment Items

1. What is mission planning?
   A. Flying quickly
   B. Preparing for a drone flight
   C. Charging batteries
   D. Controlling speed
2. What is an environmental factor?
   A. Drone color
   B. Weather and surroundings
   C. Controller type
   D. Battery level
3. Why is airspace important?
   A. It determines speed
   B. It affects where drones can fly
   C. It controls battery life
   D. It changes direction
4. What is risk awareness?
   A. Ignoring hazards
   B. Recognizing potential problems
   C. Flying faster
   D. Avoiding planning
5. Why should pilots prepare before flying?
   A. To increase speed
   B. To ensure safe operation
   C. To reduce cost
   D. To change equipment

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure
What is one factor you would always check before flying a drone?

Teacher Notes
• Keep focus on introduction and exploration
• Avoid high-level decision-making expectations
• Encourage students to explain their thinking
• Reinforce preparation as a key part of safe operations
• This lesson sets the foundation for deeper planning concepts later in the week

Week 5 – Day 2: Identifying Environmental Factors in Mission Planning

Standard	Description	RBT Level
104.00	Apply mission planning and operational decision-making for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will identify environmental factors that affect drone flight and describe how these factors influence flight conditions.

Essential Question
How do environmental conditions affect drone flight?

Key Concepts
• Environmental conditions impact drone operations
• Weather plays a major role in flight safety
• Physical surroundings affect maneuverability
• Visibility influences pilot awareness
• Identifying conditions supports safer flight preparation

Vocabulary
• **Environmental Factors** – Conditions in the environment that affect drone flight
• **Wind Speed** – The movement of air that can impact drone stability
• **Visibility** – How clearly a pilot can see surroundings
• **Obstacles** – Objects that may interfere with flight (trees, buildings, power lines)
• **Weather Conditions** – Atmospheric elements such as wind, rain, and temperature
• **Flight Conditions** – The overall environment in which a drone operates

Materials Needed
• Scenario worksheets (weather-based)
• Pre-flight checklist
• Whiteboard or presentation display
• Images of different weather conditions

Bellringer
What types of weather conditions might make flying a drone more difficult?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Mission planning basics from Day 1
   • Importance of preparation before flight

   Discuss:
   • What environmental conditions could affect a drone?

Bridge to lesson:
• Today we focus on how the environment affects flight

---

2. Core Concept Introduction
• Environmental factors are conditions that influence how a drone flies

Key Teaching Point:
Understanding environmental conditions helps pilots prepare for flight

---

3. Concept Development

A. Understanding Weather Conditions
• Wind can affect drone stability and control
• Rain can damage drone components
• Temperature can affect battery performance

B. Recognizing Wind Impact
• Strong winds can push a drone off course
• Gusts can make control more difficult

C. Understanding Visibility
• Clear visibility allows better control
• Fog, rain, or darkness reduce visibility

D. Identifying Physical Obstacles
• Trees, buildings, and power lines can interfere with flight
• Obstacles require careful navigation

E. Recognizing Changing Conditions
• Environmental conditions can change during flight
• Pilots monitor conditions continuously

Key Teaching Point:
Environmental conditions play a major role in how safely a drone can operate

---

4. Application to Drone Flight
• Students review different environmental scenarios
• Identify conditions present
• Describe how those conditions might affect flight

---

5. Guided Examples / Demonstration
• Teacher presents weather and environment images
• Students identify environmental factors
• Discuss how each factor could impact flight

---

6. **Real-World Connection**
   - Drone pilots check weather before flying
   - Environmental awareness helps prevent accidents
   - Industries rely on safe conditions for drone operations

---

7. **Key Reinforcement Summary**
   - Environmental factors affect drone performance
   - Weather and surroundings impact safety
   - Visibility and obstacles influence control
   - Identifying conditions supports better preparation

   Key Teaching Point:
   Understanding environmental conditions helps support safe drone flight

---

Formative Questions for Use in This Lesson

- What are environmental factors?
- How does wind affect drone flight?
- Why is visibility important?
- What are obstacles?
- Why should pilots check conditions before flying?

Hands-On Activity
Activity Title: Environmental Scenario Exploration
Objective:
Students will identify environmental conditions and describe how they affect drone flight

---

Activity Procedure

1. Divide students into groups
2. Provide each group with a different environmental scenario
3. Identify weather conditions
4. Identify obstacles
5. Describe visibility conditions
6. Discuss how these factors might affect flight
7. Explain reasoning
8. Share responses with class

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Identification	All factors identified	Most identified	Some identified	Few identified
Understanding	Clear explanation	Adequate explanation	Limited explanation	Minimal explanation
Application	Strong connection to flight	Appropriate connection	Basic connection	Minimal connection
Participation	Fully engaged	Participates well	Limited participation	Minimal participation

Assessment Items

1. What is an environmental factor?
   A. Drone color
   B. Conditions that affect flight
   C. Controller type
   D. Battery level
2. How does wind affect a drone?
   A. Improves battery
   B. Pushes the drone off course
   C. Changes color
   D. Reduces size
3. Why is visibility important?
   A. It controls speed
   B. It helps the pilot see surroundings
   C. It increases battery life
   D. It changes direction
4. What is an obstacle?
   A. A type of drone
   B. An object that interferes with flight
   C. A battery component
   D. A control setting
5. Why should pilots check weather before flying?
   A. To change color
   B. To ensure safe flight conditions
   C. To increase speed
   D. To reduce cost

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Name one environmental factor that could affect your drone flight.

Teacher Notes

• Keep discussion at an introductory level
• Focus on identification and understanding—not evaluation
• Encourage students to explain observations
• Reinforce that conditions affect flight safety
• Connect learning to real-world flying situations

Week 5 – Day 3: Airspace Considerations in Mission Planning

Standard	Description	RBT Level
103.00	**Interpret aeronautical charts and airspace for safe drone operations.**	**C3**
103.02	**Interpret sectional charts for flight planning decisions.**	**B2**
103.03	**Apply chart data to determine safe and legal flight locations.**	**C3**

Objective
Students will identify basic airspace considerations and describe how airspace affects where drones can be flown.

Essential Question
How does airspace affect where you can fly a drone?

Key Concepts
• Airspace determines where drones can operate
• Some areas have more restrictions than others
• Airspace awareness supports safe flight preparation
• Location impacts flight planning
• Pilots review airspace before flying

Vocabulary
• **Airspace** – The space above the ground where aircraft operate
• **Controlled Airspace** – Airspace with specific rules and restrictions
• **Uncontrolled Airspace** – Airspace with fewer restrictions
• **Authorization** – Permission to fly in certain areas
• **Restricted Area** – Airspace with limitations on flight
• **Prohibited Area** – Airspace where flight is not allowed

Materials Needed
• Airspace visuals or diagrams
• Scenario worksheets (location-based)
• Whiteboard or presentation display
• Student notebooks

Bellringer
Why do you think some areas might have more restrictions for drone flight than others?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Environmental factors from Day 2
   • Mission planning concepts from Day 1

   Discuss:
   • Besides weather, what else might affect where you can fly?

   Bridge to lesson:
   • Today we focus on how location and airspace affect drone flight

---

2. **Core Concept Introduction**
   • Airspace refers to the space where aircraft, including drones, operate

   Key Teaching Point:
   Different areas have different rules that affect drone flight

---

3. **Concept Development**
   - **A. Understanding Airspace Basics**
     • Airspace is organized into different types
     • Each type has different levels of restriction
   - **B. Recognizing Controlled Airspace**
     • Controlled airspace has more rules
     • Authorization may be required to fly
   - **C. Recognizing Uncontrolled Airspace**
     • Uncontrolled airspace has fewer restrictions
     • Drones can often fly more freely
   - **D. Identifying Restricted and Prohibited Areas**
     • Some areas limit or prevent drone flight
     • These areas exist for safety and security
   - **E. Connecting Airspace to Mission Planning**
     • Pilots review airspace before flying
     • Location impacts where drones can operate

   Key Teaching Point:
   Understanding airspace helps pilots prepare for safe drone operations

---

4. **Application to Drone Flight**
   • Students review different location scenarios
   • Identify possible airspace considerations
   • Describe how location might affect flight

---

5. **Guided Examples / Demonstration**
   • Teacher presents maps or visuals of different locations
   • Students identify possible airspace types
   • Discuss how airspace might influence flight

6. Real-World Connection

- Drone pilots review airspace before flying
- Airspace rules help keep aircraft separated
- Many industries must follow airspace guidelines

7. Key Reinforcement Summary

- Airspace affects where drones can fly
- Some areas have more restrictions than others
- Authorization may be needed in certain locations
- Understanding airspace supports safe flight preparation

Key Teaching Point:
Location plays an important role in drone flight planning

Formative Questions for Use in This Lesson

- What is airspace?
- What is controlled airspace?
- What is uncontrolled airspace?
- Why might some areas have restrictions?
- Why do pilots review airspace before flying?

Hands-On Activity
Activity Title: Airspace Scenario Exploration
Objective:
Students will identify airspace considerations and describe how they affect drone flight

Activity Procedure

1. Divide students into groups
2. Provide each group with a location scenario
3. Identify possible airspace considerations
4. Discuss whether the area may have restrictions
5. Describe how location could affect flight
6. Explain reasoning
7. Share responses with class

C3 Scenario

Students are given a sectional chart and environmental conditions and must:

- Analyze the chart data
- Identify airspace classification and restrictions
- Determine whether the flight is **safe and legal**
- Justify their decision using chart evidence

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Identification	All factors identified	Most identified	Some identified	Few identified
Understanding	Clear explanation	Adequate explanation	Limited explanation	Minimal explanation
Application	Strong connection to scenario	Appropriate connection	Basic connection	Minimal connection
Participation	Fully engaged	Participates well	Limited participation	Minimal participation

Assessment Items

1. What is airspace?
   A. The ground area for drones
   B. The space where aircraft operate
   C. The drone battery system
   D. The controller system
2. What is controlled airspace?
   A. Airspace with no rules
   B. Airspace with specific rules and restrictions
   C. Airspace only for drones
   D. Airspace without aircraft
3. What is uncontrolled airspace?
   A. Airspace with fewer restrictions
   B. Airspace with strict rules
   C. Airspace for airplanes only
   D. Airspace with no visibility
4. What is a prohibited area?
   A. An area for training
   B. An area where flight is not allowed
   C. An area with no obstacles
   D. An area for beginners
5. Why do pilots review airspace before flying?
   A. To increase speed
   B. To ensure safe and appropriate flight location
   C. To change battery life
   D. To adjust controls

Answer Key

1. B
2. B
3. A
4. B
5. B

Closure
What is one thing you should check about airspace before flying?

Teacher Notes
• Keep instruction at an introductory level
• Focus on understanding, not detailed regulation
• Avoid deep FAA classification complexity
• Encourage discussion and observation
• Reinforce that this is a foundation for future airspace learning

Week 5 – Day 4: Risk Awareness in Mission Planning

Standard	Description	RBT Level
103.00	**Interpret aeronautical charts and airspace for safe drone operations.**	**C3**
103.02	**Interpret sectional charts for flight planning decisions.**	**B2**
103.03	**Apply chart data to determine safe and legal flight locations.**	**C3**

Objective
Students will identify potential risks in a drone mission and describe how those risks can affect flight.

Essential Question
What types of risks should be considered before flying a drone?

Key Concepts
• Risks are conditions that may affect safe flight
• Environmental, location, and equipment factors can create risks
• Identifying risks helps pilots prepare for flight
• Awareness of risk supports safer operations
• Planning includes recognizing possible challenges before flight

Vocabulary
• **Risk** – A condition that could cause problems during flight
• **Hazard** – A specific danger that may affect safety
• **Risk Awareness** – Recognizing potential issues before flight
• **Obstacle** – An object that may interfere with drone movement
• **Flight Safety** – Operating a drone in a way that reduces danger
• **Pre-Flight Check** – A review of conditions before flying

Materials Needed
• Scenario worksheets (risk-based scenarios)
• Pre-flight checklist
• Whiteboard or presentation display
• Images of different flight environments

Bellringer
What is something that could go wrong during a drone flight?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Environmental factors from Day 2
   • Airspace considerations from Day 3

Discuss:
• How could these factors create problems during a flight?

Bridge to lesson:
• Today we focus on identifying risks before flying

---

2. Core Concept Introduction
• Risk refers to anything that could affect safe drone operation

Key Teaching Point:
Recognizing risks before flight helps pilots prepare for safer operations

---

3. Concept Development

A. Understanding Risk in Drone Operations
• Risks are conditions that could lead to problems
• Risks can come from different sources

B. Identifying Environmental Risks
• Strong wind, rain, or poor visibility
• Changing weather conditions

C. Identifying Location-Based Risks
• Buildings, trees, and power lines
• People or crowded areas

D. Identifying Equipment-Related Risks
• Low battery levels
• Damaged propellers
• Poor signal connection

E. Applying Interpretation to Flight Planning Decisions
• Pilots use chart data to determine if a flight is safe and legal
• Decisions must consider both airspace restrictions and safety risks
• Pilots must justify flight decisions using chart evidence

Key Teaching Point:
Drone pilots use chart data to determine safe and legal flight operations before takeoff

---

4. Application to Drone Flight
• Students review flight scenarios
• Identify possible risks
• Describe how risks could affect flight

---

5. Guided Examples / Demonstration
• Teacher presents different flight situations
• Students identify risks in each situation
• Discuss how those risks might affect flight

---

6. **Real-World Connection**
   • Drone pilots identify risks before every flight
   • Risk awareness helps prevent accidents
   • Safe operations depend on preparation

---

7. **Key Reinforcement Summary**
   • Risks can come from environment, location, or equipment
   • Identifying risks helps prepare for flight
   • Awareness supports safer operations
   • Preparation reduces potential problems

   Key Teaching Point:
   Understanding risks helps support safe drone flight

Formative Questions for Use in This Lesson
• What is a risk?
• What is a hazard?
• What environmental risks can affect flight?
• What location risks can affect flight?
• Why is it important to identify risks before flying?

Hands-On Activity
Activity Title: Risk Identification Exploration
Objective:
Students will identify risks in flight scenarios and describe how they affect drone operations

---

Activity Procedure
1. Divide students into groups
2. Provide each group with a flight scenario
3. Identify environmental risks
4. Identify location-based risks
5. Identify equipment-related risks
6. Describe how these risks might affect flight
7. Explain reasoning
8. Share responses with class

C3 Scenar
Students create a flight plan and must:
• Identify airspace classification
• Evaluate restrictions and hazards
• Determine if the mission is **safe and legal**
• Justify their decision using chart data

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Identification	All risks identified	Most identified	Some identified	Few identified
Understanding	Clear explanation	Adequate explanation	Limited explanation	Minimal explanation
Application	Strong connection to scenario	Appropriate connection	Basic connection	Minimal connection
Participation	Fully engaged	Participates well	Limited participation	Minimal participation

Assessment Items

1. What is a risk?
   A. A type of drone
   B. A condition that could cause problems
   C. A flight control
   D. A battery setting
2. What is a hazard?
   A. A safety tool
   B. A specific danger that affects safety
   C. A controller type
   D. A flight mode
3. Which is an environmental risk?
   A. Low battery
   B. Strong wind
   C. Controller signal
   D. Drone color
4. Which is a location-based risk?
   A. Rain
   B. Buildings and power lines
   C. Battery level
   D. Temperature
5. Why is risk awareness important?
   A. To increase speed
   B. To prepare for safer flight
   C. To change equipment
   D. To reduce cost

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure
Name one type of risk you should check before flying a drone.

Teacher Notes
• Keep focus on identification and understanding of risks
• Avoid high-level evaluation or decision-making language
• Encourage students to explain their observations
• Reinforce connection between risk awareness and safe flight
• Build confidence in recognizing conditions before flying

Week 5 – Day 5: Applying Mission Planning Concepts

Standard	Description	RBT Level
103.00	Interpret aeronautical charts and airspace for safe drone operations.	C3
103.02	Interpret sectional charts for flight planning decisions.	B2
103.03	Apply chart data to determine safe and legal flight locations.	C3
105.02	Apply safety procedures and risk mitigation strategies.	C3

Objective
Students will identify mission planning factors and describe how those factors influence whether a drone flight should take place.

Essential Question
What factors should be considered when deciding whether to fly a drone?

Key Concepts
• Multiple factors influence drone flight
• Environmental, airspace, and risk factors work together
• Planning helps prepare for safe drone operations
• Conditions should be reviewed before flight
• Understanding factors supports better flight decisions

Vocabulary
• **Mission Planning** – Preparing for a drone flight by reviewing conditions
• **Environmental Factors** – Weather and surroundings that affect flight
• **Airspace Considerations** – Rules and restrictions for where drones can fly
• **Risk Awareness** – Recognizing potential problems before flight
• **Flight Conditions** – The overall situation in which a drone operates
• **Flight Readiness** – Being prepared for a safe drone operation

Materials Needed
• Comprehensive scenario worksheets
• Pre-flight planning checklist
• Whiteboard or presentation display
• Student notebooks

Bellringer
What are the most important things you would check before deciding to fly a drone?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Mission planning concepts (Day 1)
   • Environmental factors (Day 2)
   • Airspace considerations (Day 3)
   • Risk awareness (Day 4)

   Discuss:
   • How do all these factors work together before a flight?

   Bridge to lesson:
   • Today we bring all planning concepts together

---

2. **Core Concept Introduction**

   • Drone pilots review multiple factors before flying

   Key Teaching Point:
   Looking at all conditions together helps support safe flight preparation

---

3. **Concept Development**

   A. Reviewing Mission Planning Factors
   • Environmental conditions
   • Airspace considerations
   • Risk awareness

   B. Understanding How Factors Work Together
   • Conditions do not exist independently
   • Multiple factors affect flight at the same time

   C. Recognizing Safe vs Challenging Conditions
   • Some conditions support easier flight
   • Some conditions make flight more difficult

   D. Describing Flight Readiness
   • Pilots consider whether conditions appear appropriate
   • Preparation helps identify concerns before flight

   E. Making Flight Decisions Using Chart Data
   • Pilots determine whether a flight should proceed based on chart data
   • Decisions must evaluate legality and safety
   • Pilots must justify decisions using airspace and risk information

   Key Teaching Point:
   Drone pilots must determine whether a flight is safe and legal using chart data before operating

---

4. **Application to Drone Flight**

   • Students review full mission scenarios
   • Identify environmental, airspace, and risk factors
   • Describe how these factors influence flight

5. **Guided Examples / Demonstration**
   • Teacher presents a complete flight scenario
   • Students identify all planning factors
   • Discuss whether the situation appears appropriate for flight

6. **Real-World Connection**
   • Drone pilots review multiple conditions before flying
   • Planning helps prevent unsafe or illegal situations
   • Many industries rely on careful preparation

7. **Key Reinforcement Summary**
   • Multiple factors influence drone flight
   • Environmental, airspace, and risk factors are connected
   • Planning helps identify concerns before flying
   • Preparation supports safe and legal drone operations

   Key Teaching Point:
   Looking at all conditions together helps support safe, legal, and responsible drone use

Formative Questions for Use in This Lesson
• What factors affect drone flight?
• Why should multiple factors be considered together?
• What are environmental factors?
• What are airspace considerations?
• Why is preparation important before flying?

Hands-On Activity
Activity Title: Mission Planning Scenario Exploration
Objective:
Students will identify mission planning factors and describe how they influence flight decisions

Activity Procedure
1. Divide students into groups
2. Provide each group with a detailed mission scenario
3. Identify environmental conditions
4. Identify airspace considerations
5. Identify potential risks
6. Discuss whether the situation appears appropriate for flight
7. Explain reasoning
8. Share responses with class

C3 Scenario

Students are given a full mission scenario including location and chart data and must:

- Identify airspace classification
- Identify all restrictions and hazards
- Determine whether the flight is **safe and legal**
- Provide a complete justification using chart data and safety considerations

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Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Identification	All factors identified	Most identified	Some identified	Few identified
Understanding	Clear explanation	Adequate explanation	Limited explanation	Minimal explanation
Application	Strong connection to scenario	Appropriate connection	Basic connection	Minimal connection
Participation	Fully engaged	Participates well	Limited participation	Minimal participation

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Assessment Items

1. What is mission planning?
   A. Flying quickly
   B. Preparing for a drone flight
   C. Charging batteries
   D. Changing direction
2. What is an environmental factor?
   A. Drone color
   B. Weather and surroundings
   C. Controller type
   D. Battery size
3. Why is airspace important?
   A. It changes speed
   B. It affects where drones can fly
   C. It increases battery life
   D. It changes direction
4. What is risk awareness?
   A. Ignoring hazards
   B. Recognizing potential problems
   C. Flying faster
   D. Avoiding planning

5. Why should multiple factors be considered before flying?
   A. To increase speed
   B. To support safe flight preparation
   C. To reduce cost
   D. To change equipment

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

What is one factor you would always consider before flying a drone?

Teacher Notes

• Keep focus on combining concepts, not high-level decision-making
• Avoid “Go/No-Go” or legal determination language
• Encourage students to explain their thinking
• Reinforce this as a foundational application lesson
• Build confidence in recognizing conditions before flight

Week 6 – Introduction to Mission Planning and Risk Assessment

This week introduces mission planning, shifting students from interpreting airspace to actively preparing for drone operations. Students will apply knowledge of airspace, environmental conditions, and safety considerations to evaluate and plan drone flights. Emphasis is placed on identifying risks, assessing flight conditions, and determining whether a mission is safe and legal before takeoff. This transition builds critical decision-making skills required for real-world drone operations and prepares students for more advanced planning and flight execution in upcoming weeks.

Week 6 – Day 1: Introduction to Mission Planning

Standard	Description	RBT Level
104.00	Apply mission planning principles for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will understand the purpose of mission planning and begin applying basic pre-flight planning considerations.

Essential Question
Why is mission planning necessary before operating a drone?

Key Concepts
• Mission planning prepares pilots for safe and effective flight
• Environmental, airspace, and safety factors must be evaluated before flight
• Planning helps determine whether a flight should occur

Vocabulary
• **Mission Planning** – The process of preparing for a drone flight
• **Pre-Flight Check** – Steps taken before flight to ensure readiness
• **Risk Assessment** – Evaluating potential hazards before flight
• **Flight Environment** – The conditions surrounding a flight location

---

Materials Needed
• PowerPoint Presentation (Week 6 Day 1 – Mission Planning Introduction)
• Sample flight scenarios
• Whiteboard and markers
• Student notebooks

Bellringer
What could happen if a drone pilot skips planning before a flight?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Airspace interpretation from Week 5
   • How to determine if a flight is safe and legal
   • The importance of decision-making before flight

   Discuss:
   • What information did you need in Week 5 to decide if a flight was safe and legal?

   Bridge to lesson:
   • Pilots do not just evaluate charts—they use that information to plan a complete flight

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2. **Core Concept Introduction**

   • Mission planning is the structured process of preparing for a drone operation

   Key Teaching Point:
   Mission planning allows pilots to evaluate all conditions before flight to ensure safety and compliance

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3. **Concept Development**

   A. Understanding Mission Planning
   • Mission planning includes evaluating where, when, and how a drone will fly
   • It is the first step before any drone operation

   B. Identifying Environmental Factors
   • Weather conditions (wind, visibility, precipitation)
   • Physical surroundings (buildings, trees, people)
   • Environmental factors directly impact flight safety

   C. Recognizing Airspace Considerations
   • Airspace classification determines where drones can operate
   • Pilots must review airspace before planning a mission
   • Restrictions identified in Week 5 are now used in planning

   D. Introducing Risk Assessment
   • Risks are conditions that could negatively affect flight
   • Pilots identify hazards before flight begins
   • Risk assessment is part of every mission plan

   E. Determining Flight Readiness
   • Pilots evaluate all conditions together
   • A mission may be approved, modified, or canceled
   • Decisions must be based on safety and legality

   Key Teaching Point:
   Drone pilots apply mission planning and risk assessment to determine whether a flight should occur

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4. **Application to Drone Flight**
   Students are given a basic flight scenario and identify environmental, airspace, and risk factors that must be considered before flight.

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5. **Guided Examples / Demonstration**
   Instructor presents a sample mission and models:
   • Identifying key planning factors
   • Evaluating risks
   • Determining if the mission should proceed

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6. **Real-World Connection**
   Professional drone pilots use mission planning before every operation to ensure safe, legal, and effective flight.

---

7. **Key Reinforcement Summary**
   Mission planning is a critical process that helps pilots determine if a drone flight is safe and appropriate.

Formative Questions for Use in This Lesson
• What is mission planning?
• Why is planning necessary before flight?
• What factors must be considered before flying?
• How does risk assessment affect flight decisions?

Hands-On Activity
Activity Title: Introduction to Mission Planning

Activity Procedure
1. Students are given a simple flight scenario
2. Students identify environmental conditions
3. Students identify airspace considerations
4. Students identify potential risks
5. Students determine whether the mission should proceed and explain why

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Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Factor Identification	Complete and accurate	Mostly accurate	Partial	Limited
Risk Recognition	Clear and thorough	Adequate	Limited	Minimal
Decision-Making	Strong justification	Adequate reasoning	Limited	Minimal
Participation	Fully engaged	Participates	Limited	Minimal

C3 Scenario (Decision-Based Application)
Students are given a mission scenario and must:
• Identify environmental and airspace factors
• Identify risks
• Determine whether the mission is **safe and legal**
• Justify their decision

Assessment Items

1. What is mission planning?
   A. Flying a drone
   B. Preparing for a drone flight
   C. Charging a battery
   D. Landing a drone
2. Why is mission planning important?
   A. To increase speed
   B. To ensure safety and readiness
   C. To change weather
   D. To reduce battery size
3. What is a risk in drone operations?
   A. A benefit
   B. A hazard
   C. A speed increase
   D. A battery type
4. What must pilots evaluate before flight?
   A. Only speed
   B. Only altitude
   C. Environmental and airspace factors
   D. Only battery level
5. What is the result of mission planning?
   A. Faster drones
   B. Better colors
   C. A decision to proceed or not
   D. Larger propellers

Answer Key

1. B
2. B
3. B
4. C
5. C

Closure
Mission planning ensures that every drone flight begins with preparation, safety, and informed decision-making.

Teacher Notes

- Emphasize connection to Week 5 (charts → planning)
- Reinforce decision-making language (safe AND legal)
- Prepare students for deeper planning tools in Day 2

Week 6 – Day 2: Mission Planning Tools and Structured Pre-Flight Process

Standard	Description	RBT Level
104.00	Apply mission planning principles for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will apply a structured pre-flight planning process using mission planning tools to evaluate drone operations.

Essential Question
How do drone pilots use structured planning tools to prepare for safe and legal flights?

Key Concepts
• Mission planning follows a structured process
• Planning tools help organize decision-making
• Risk assessment is part of every pre-flight plan

Vocabulary
• **Pre-Flight Procedure** – A step-by-step process used before flight
• **Checklist** – A tool used to ensure all steps are completed
• **Risk Factor** – A condition that could impact flight safety
• **Flight Plan** – A prepared outline of a drone mission

Materials Needed
• PowerPoint Presentation (Week 6 Day 2 – Planning Tools)
• Pre-flight checklist handout
• Sample mission scenarios
• Whiteboard and markers
• Student notebooks

Bellringer
Why might a checklist be important before flying a drone?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Mission planning concepts from Day 1
   • Environmental, airspace, and risk factors
   • The need to determine if a flight is safe and legal

   Discuss:
   • What steps did you use yesterday to decide if a mission should proceed?

   Bridge to lesson:
   • Pilots do not rely on memory—they use structured tools to ensure every step is completed

2. Core Concept Introduction

• Mission planning uses structured tools such as checklists and planning steps

Key Teaching Point:
Planning tools help pilots consistently evaluate all necessary factors before flight

3. Concept Development

A. Understanding Pre-Flight Procedures

• Pre-flight procedures are step-by-step actions completed before flight
• These procedures ensure readiness and safety

B. Using Checklists in Mission Planning

• Checklists help pilots verify that all planning steps are completed
• They reduce the chance of missing important details

C. Identifying Key Planning Components

• Environmental conditions
• Airspace considerations
• Equipment readiness
• Safety risks

D. Applying Risk Assessment Tools

• Pilots identify and evaluate risk factors before flight
• Risks must be considered before making a flight decision

E. Following a Structured Planning Process

• Pilots follow a consistent process every time
• Planning leads to a clear decision: proceed, modify, or cancel

Key Teaching Point:
Drone pilots use structured planning tools and procedures to ensure safe and legal flight operations

4. Application to Drone Flight

Students apply a pre-flight checklist to evaluate a sample drone mission.

5. Guided Examples / Demonstration

Instructor models using a checklist to evaluate a mission scenario:
• Walk through each step
• Identify risks
• Make a decision

6. Real-World Connection

Professional drone pilots use standardized checklists and procedures to ensure consistency and safety in every mission.

7. Key Reinforcement Summary

Structured planning tools help pilots make consistent, safe, and legal flight decisions.

Formative Questions for Use in This Lesson
• What is a pre-flight procedure?
• Why are checklists important?
• What factors must be included in planning?
• How do planning tools support decision-making?

Hands-On Activity
Activity Title: Pre-Flight Planning Checklist Application

Activity Procedure
1. Students are given a mission scenario
2. Students use a checklist to evaluate conditions
3. Students identify environmental and airspace factors
4. Students identify risks
5. Students determine whether the mission should proceed and explain why

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Checklist Use	Complete and accurate	Mostly accurate	Partial	Limited
Risk Identification	Clear and thorough	Adequate	Limited	Minimal
Decision-Making	Strong justification	Adequate reasoning	Limited	Minimal
Participation	Fully engaged	Participates	Limited	Minimal

C3 Scenario (Decision-Based Application)
Students are given a mission scenario and must:
• Apply a structured checklist
• Identify all relevant factors
• Evaluate risks
• Determine whether the mission is **safe and legal**
• Justify their decision

Assessment Items
1. What is a pre-flight procedure?
   A. A flight path
   B. Steps completed before flight
   C. A landing method
   D. A drone type
2. Why are checklists used in mission planning?
   A. To increase speed
   B. To organize and ensure steps are completed
   C. To change weather
   D. To reduce battery use

3. What is a risk factor?
   A. A benefit
   B. A hazard
   C. A speed setting
   D. A drone feature
4. What is the purpose of a flight plan?
   A. Decoration
   B. To guide a mission
   C. To charge batteries
   D. To store drones
5. What decision results from mission planning?
   A. Drone color
   B. Flight speed
   C. Proceed, modify, or cancel
   D. Battery size

Answer Key

1. B
2. B
3. B
4. B
5. C

Closure

Using structured planning tools ensures that drone pilots consistently prepare for safe and legal operations.

Teacher Notes

• Emphasize consistency in using planning tools
• Reinforce that planning is a repeatable process
• Prepare students for deeper scenario evaluation in Day 3

Week 6 – Day 3: Step-by-Step Mission Planning and Risk Evaluation

Standard	Description	RBT Level
104.00	Apply mission planning principles for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will apply a structured step-by-step mission planning process to evaluate drone operations and determine flight readiness.

Essential Question
How do drone pilots follow a structured process to plan and evaluate a mission?

Key Concepts
• Mission planning follows a repeatable step-by-step process
• Each step builds toward a flight decision
• Risk evaluation is integrated throughout the planning process

Vocabulary
• **Mission Evaluation** – The process of reviewing all factors before flight
• **Flight Readiness** – Determining if conditions support safe operation
• **Risk Mitigation** – Reducing or managing identified risks
• **Go/No-Go Decision** – Determining whether to proceed with a flight

Materials Needed
• PowerPoint Presentation (Week 6 Day 3 – Planning Process)
• Pre-flight checklist (from Day 2)
• Structured mission planning worksheet
• Sample mission scenarios
• Whiteboard and markers
• Student notebooks

Bellringer
What steps should a drone pilot follow before deciding to fly?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Mission planning concepts from Day 1
   • Use of checklists and planning tools from Day 2
   • The importance of determining if a flight is safe and legal

   Discuss:
   • How did the checklist help organize your decision-making yesterday?

Bridge to lesson:
- Pilots not only use tools, they follow a structured process to ensure every step is completed correctly

---

2. Core Concept Introduction

• Mission planning is completed through a structured, step-by-step process

Key Teaching Point:
Following a structured planning process ensures that all critical factors are evaluated before flight

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3. Concept Development

A. Step 1 – Define the Mission Objective
- Identify the purpose of the flight
- Determine what the drone is expected to accomplish
- Mission purpose guides planning decisions

B. Step 2 – Evaluate Environmental Conditions
- Assess weather conditions (wind, visibility, precipitation)
- Identify physical surroundings (obstacles, people, structures)
- Environmental factors directly impact safety

C. Step 3 – Analyze Airspace and Location
- Identify airspace classification
- Determine restrictions or limitations
- Apply chart interpretation skills from previous weeks

D. Step 4 – Identify and Mitigate Risks
- Identify potential hazards
- Consider ways to reduce or manage risks
- Some risks may require modifying the mission

E. Step 5 – Make a Go/No-Go Decision
- Evaluate all factors together
- Determine whether the mission is safe and legal
- Justify the decision using planning data

Key Teaching Point:
Drone pilots follow a structured planning process to evaluate conditions and determine whether a mission should proceed

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4. Application to Drone Flight

Students apply the full step-by-step mission planning process to evaluate a flight scenario.

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5. Guided Examples / Demonstration

Instructor models a complete mission planning process:
- Defines mission objective
- Evaluates environment and airspace
- Identifies risks
- Makes and explains a go/no-go decision

6. **Real-World Connection**
   Professional drone pilots follow structured planning processes before every flight to ensure safe and compliant operations.

7. **Key Reinforcement Summary**
   A structured planning process helps pilots evaluate all factors and make informed flight decisions.

Formative Questions for Use in This Lesson
• What is the first step in mission planning?
• Why is environmental evaluation important?
• How does airspace affect planning?
• What is a go/no-go decision?

Hands-On Activity
Activity Title: Full Mission Planning Process

Activity Procedure
1. Students are given a mission scenario
2. Students define the mission objective
3. Students evaluate environmental conditions
4. Students analyze airspace
5. Students identify risks and mitigation strategies
6. Students make a go/no-go decision and justify their answer

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Process Completion	Complete and accurate	Mostly complete	Partial	Limited
Risk Identification	Clear and thorough	Adequate	Limited	Minimal
Decision-Making	Strong justification	Adequate reasoning	Limited	Minimal
Participation	Fully engaged	Participates	Limited	Minimal

C3 Scenario (Decision-Based Application)
Students are given a mission scenario and must:
• Follow all planning steps
• Evaluate environmental and airspace factors
• Identify risks and mitigation strategies
• Determine whether the mission is **safe and legal**
• Justify their decision using planning data

Assessment Items

1. What is the first step in mission planning?
   A. Fly the drone
   B. Define the mission objective
   C. Charge batteries
   D. Land the drone
2. What must be evaluated during planning?
   A. Only speed
   B. Only altitude
   C. Environmental and airspace factors
   D. Only battery size
3. What is risk mitigation?
   A. Ignoring risks
   B. Increasing risks
   C. Reducing or managing risks
   D. Avoiding planning
4. What is a go/no-go decision?
   A. Choosing a drone color
   B. Deciding whether to fly
   C. Increasing speed
   D. Changing altitude
5. What must a pilot use to make a decision?
   A. Guessing
   B. Planning data
   C. Random choice
   D. Speed settings

Answer Key

1. B
2. C
3. C
4. B
5. B

Closure

Following a structured mission planning process ensures that drone pilots make safe, informed, and legal decisions before flight.

Teacher Notes

• Emphasize sequence of steps (order matters)
• Reinforce decision-making using evidence
• Prepare students for more complex mission scenarios in Day 4

Week 6 – Day 4: System Functionality Across Drone Configurations

Standard	Description	RBT Level
104.00	Apply mission planning principles for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will evaluate complex mission scenarios and modify flight plans to ensure safe and legal drone operations.

Essential Question
How can a drone pilot modify a mission to reduce risk and ensure safe and legal flight?

Key Concepts
• Not all missions should proceed as originally planned
• Pilots can modify missions to reduce risk
• Risk evaluation leads to safer and more effective operations

Vocabulary
• **Mission Modification** – Adjusting a flight plan to improve safety or compliance
• **Risk Level** – The severity of potential hazards
• **Mitigation Strategy** – An action taken to reduce risk
• **Operational Adjustment** – A change made to improve flight conditions

Materials Needed
• PowerPoint Presentation (Week 6 Day 4 – Mission Modification)
• Mission planning worksheet
• Sample complex mission scenarios
• Whiteboard and markers
• Student notebooks

Bellringer
What could a drone pilot change if a mission is not safe as planned?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Step-by-step mission planning process from Day 3
   • How to identify risks and make go/no-go decisions
   • The importance of safe and legal flight operations

   Discuss:
   • What happens if a mission is not safe, but could be adjusted instead of canceled?

   Bridge to lesson:
   • Pilots do not always cancel missions—they adjust plans to reduce risk and improve safety

2. Core Concept Introduction

• Mission modification is the process of adjusting a flight plan to address risks

Key Teaching Point:
Pilots can modify mission plans to reduce risk and create safer flight conditions

3. Concept Development

A. Identifying When Modification is Needed

• Some missions are not safe in their original form
• Risks may be reduced instead of canceling the mission
• Pilots must recognize when adjustments are appropriate

B. Evaluating Risk Levels

• Risks vary in severity
• Some risks can be managed, while others require cancellation
• Pilots must evaluate how serious each risk is

C. Applying Mitigation Strategies

• Adjust flight location
• Change altitude or flight path
• Delay flight due to environmental conditions
• Limit operational area

D. Adjusting Mission Plans

• Pilots revise plans based on identified risks
• Adjustments must improve safety and compliance
• Planning is flexible, not fixed

E. Re-Evaluating Mission Decisions

• After modification, pilots must reassess the mission
• Determine whether the mission is now safe and legal
• Justify the final decision using planning data

Key Teaching Point:
Drone pilots modify mission plans to reduce risk and ensure safe and legal operations

4. Application to Drone Flight

Students evaluate a complex mission scenario and identify possible modifications to improve safety.

5. Guided Examples / Demonstration

Instructor presents a mission with multiple risks and models:
• Identifying risks
• Applying mitigation strategies
• Modifying the mission
• Re-evaluating the decision

6. **Real-World Connection**
   Drone pilots frequently adjust missions due to weather, airspace restrictions, or unexpected hazards to maintain safe operations.

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7. **Key Reinforcement Summary**
   Mission modification allows pilots to reduce risk and improve safety before flight.

Formative Questions for Use in This Lesson
• When should a mission be modified instead of canceled?
• What are examples of mitigation strategies?
• How do pilots evaluate risk levels?
• Why must a mission be re-evaluated after modification?

Hands-On Activity
Activity Title: Mission Modification Challenge

Activity Procedure
1. Students are given a complex mission scenario
2. Students identify all risks present
3. Students determine if the mission is safe as planned
4. Students propose modifications to reduce risk
5. Students re-evaluate the mission after changes
6. Students determine if the mission is now safe and legal and justify their decision

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Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Risk Identification	Complete and accurate	Mostly accurate	Partial	Limited
Mitigation Strategy	Strong and effective	Adequate	Limited	Minimal
Decision-Making	Strong justification	Adequate reasoning	Limited	Minimal
Participation	Fully engaged	Participates	Limited	Minimal

C3 Scenario (Decision-Based Application)
Students are given a complex mission scenario and must:
• Identify risks
• Apply mitigation strategies
• Modify the mission plan
• Determine whether the mission is **safe and legal** after modification
• Justify their decision using planning data

Assessment Items
1. What is mission modification?
   A. Ending a flight
   B. Adjusting a flight plan
   C. Increasing speed
   D. Charging batteries

2. Why do pilots modify missions?
   A. To make flights longer
   B. To reduce risk and improve safety
   C. To increase altitude
   D. To change colors
3. What is a mitigation strategy?
   A. Ignoring risk
   B. Increasing risk
   C. Reducing risk
   D. Avoiding planning
4. What must pilots do after modifying a mission?
   A. Fly immediately
   B. Re-evaluate the mission
   C. Increase speed
   D. Change battery
5. What determines if a mission can proceed?
   A. Pilot preference
   B. Risk evaluation and planning
   C. Drone color
   D. Speed settings

Answer Key

1. B
2. B
3. C
4. B
5. B

Closure

Mission modification allows drone pilots to adjust plans and improve safety, ensuring responsible and effective flight operations.

Teacher Notes

• Emphasize flexibility in planning
• Reinforce that not all risks require cancellation
• Prepare students for full independent planning in Day 5

Week 6 – Day 5: Mission Planning Capstone – Independent Flight Decision-Making

Standard	Description	RBT Level
104.00	Apply mission planning principles for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will independently apply the mission planning process to evaluate a drone operation and determine whether a mission is safe and legal.

Essential Question
How can a drone pilot independently plan and evaluate a mission to ensure safe and legal flight?

Key Concepts
• Mission planning is a complete process that leads to a decision
• All planning factors must be evaluated together
• Safe and legal flight depends on informed decision-making

Vocabulary
• **Mission Plan** – A complete outline of a drone operation
• **Flight Decision** – The final determination to proceed, modify, or cancel
• **Risk Evaluation** – The process of analyzing hazards
• **Operational Judgment** – Making decisions based on planning data

Materials Needed
• PowerPoint Presentation (Week 6 Day 5 – Capstone Planning)
• Mission planning worksheet (full process)
• Scenario cards (moderate complexity)
• Whiteboard and markers
• Student notebooks

Bellringer
What is the most important factor when deciding whether to fly a drone?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Mission planning fundamentals (Day 1)
   • Use of planning tools and checklists (Day 2)
   • Step-by-step planning process (Day 3)
   • Mission modification strategies (Day 4)

   Discuss:
   • What steps must a pilot follow before making a flight decision?

Bridge to lesson:
• Today, you will apply the entire mission planning process independently to make a final flight decision

---

2. Core Concept Introduction
• Mission planning is a complete process that results in a final flight decision

Key Teaching Point:
Drone pilots must independently evaluate all planning factors to determine whether a mission is safe and legal

---

3. Concept Development

A. Reviewing the Full Mission Planning Process
- Define mission objective
- Evaluate environmental conditions
- Analyze airspace
- Identify risks and mitigation strategies
- Make a go/no-go decision

B. Integrating Planning Factors
- All factors must be considered together
- No single factor determines the decision alone

C. Applying Risk Evaluation
- Identify hazards
- Determine if risks can be reduced
- Decide if modification is appropriate

D. Making Independent Decisions
- Students must rely on their planning process
- Decisions must be based on evidence, not guessing

E. Justifying Flight Decisions
- Students must explain why a mission is safe and legal
- Justification must include planning factors and risk evaluation

Key Teaching Point:
Drone pilots use a complete planning process to independently determine whether a mission should proceed

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4. Application to Drone Flight
Students independently apply the full mission planning process to evaluate a drone mission scenario.

---

5. Guided Examples / Demonstration
Instructor provides a brief example, then releases responsibility to students for independent work.

---

6. **Real-World Connection**
   Drone pilots are responsible for independently planning and evaluating each mission before flight.

---

7. **Key Reinforcement Summary**
   Independent mission planning allows pilots to make safe, legal, and responsible flight decisions.

Formative Questions for Use in This Lesson
• What steps are included in mission planning?
• Why must all factors be considered together?
• How do pilots justify a flight decision?
• What determines if a mission should proceed?

Hands-On Activity
Activity Title: Independent Mission Planning Capstone

Activity Procedure
1. Students are given a mission scenario (moderate complexity)
2. Students define the mission objective
3. Students evaluate environmental conditions
4. Students analyze airspace
5. Students identify risks and possible mitigation strategies
6. Students determine whether to proceed, modify, or cancel
7. Students justify their decision using planning data

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Process Completion	Complete and accurate	Mostly complete	Partial	Limited
Risk Evaluation	Clear and thorough	Adequate	Limited	Minimal
Decision-Making	Strong justification	Adequate reasoning	Limited	Minimal
Independence	Fully independent	Minimal support	Needs support	Unable

---

C3 Scenario (Decision-Based Application)
Students are given a mission scenario and must independently:
• Apply the full mission planning process
• Evaluate environmental and airspace factors
• Identify risks and mitigation strategies
• Determine whether the mission is **safe and legal**
• Provide a complete justification using planning data

Assessment Items

1. What is the final step in mission planning?
   A. Charging batteries
   B. Making a flight decision
   C. Selecting a drone
   D. Changing altitude
2. What must be considered during planning?
   A. Only weather
   B. Only airspace
   C. All planning factors together
   D. Only battery level
3. What is risk evaluation?
   A. Ignoring hazards
   B. Identifying and analyzing hazards
   C. Increasing speed
   D. Changing direction
4. What must support a flight decision?
   A. Guessing
   B. Planning data
   C. Drone color
   D. Speed settings
5. What are the possible outcomes of mission planning?
   A. Faster flight
   B. Higher altitude
   C. Proceed, modify, or cancel
   D. Larger drone

Answer Key

1. B
2. C
3. B
4. B
5. C

Closure

Mission planning allows drone pilots to independently evaluate conditions and make safe, informed, and legal flight decisions.

Teacher Notes

• Allow students to work independently—this is a performance lesson
• Focus on justification, not just answers
• Use this as a checkpoint for student readiness before moving forward

Week 7 – Expanding Mission Planning and Risk Management

This week builds on mission planning fundamentals by expanding students' ability to evaluate more complex flight scenarios and apply risk management strategies. Students will refine their ability to assess environmental conditions, airspace considerations, and operational risks while making informed decisions about drone operations. Emphasis is placed on improving decision-making, applying mitigation strategies, and justifying whether a mission is safe and legal. This progression strengthens students' confidence and prepares them for real-world drone planning situations.

Week 7 – Day 1: Advanced Risk Identification in Mission Planning

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Standards	Description	RBT Level
104.00	Apply mission planning and operational decision-making for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will identify multiple risk factors in more complex mission scenarios and evaluate their impact on drone operations.

Essential Question
How do drone pilots identify and evaluate multiple risks in a mission?

Key Concepts
• Missions often include multiple risk factors
• Risks vary in type and severity
• Identifying risks is the first step in managing them

Vocabulary
• **Multiple Risk Factors** – More than one hazard affecting a mission
• **Environmental Risk** – Weather or surroundings that impact flight
• **Operational Risk** – Risks related to how the drone is used
• **Risk Severity** – The level of impact a risk may have

Materials Needed
• PowerPoint Presentation (Week 7 Day 1 – Advanced Risk Identification)
• Mission scenarios (moderate complexity)
• Whiteboard and markers
• Student notebooks

Bellringer
What types of risks could affect a drone flight at the same time?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Mission planning process from Week 6
   • Risk identification and mitigation strategies
   • Making safe and legal flight decisions

   Discuss:
   • What risks did you identify in previous mission scenarios?

   Bridge to lesson:
   • In real-world operations, pilots must evaluate multiple risks at the same time—not just one

---

2. **Core Concept Introduction**

   • Drone missions often involve multiple risks that must be evaluated together

   Key Teaching Point:
   Pilots must identify and evaluate multiple risks to make informed flight decisions

---

3. **Concept Development**

   A. Identifying Multiple Risk Factors
   • Missions may include environmental, airspace, and operational risks
   • Risks often occur at the same time
   • Pilots must identify all relevant risks

   B. Categorizing Types of Risk
   • Environmental risks (weather, obstacles)
   • Airspace risks (restrictions, proximity to airports)
   • Operational risks (pilot skill, mission complexity)

   C. Evaluating Risk Severity
   • Some risks are minor, others are significant
   • Severity affects whether a mission can proceed
   • Pilots must determine how serious each risk is

   D. Understanding Combined Risk Impact
   • Multiple small risks can create a larger problem
   • Risks must be evaluated together, not individually
   • Combined risk affects overall mission safety

   E. Connecting Risk Identification to Decision-Making
   • Identifying risks leads to better planning decisions
   • Pilots must determine whether a mission is safe and legal
   • Risk identification is the foundation for mitigation

   Key Teaching Point:
   Drone pilots must identify and evaluate multiple risks to determine whether a mission is safe and legal

---

4. **Application to Drone Flight**
   Students analyze a mission scenario and identify all potential risk factors.

---

5. **Guided Examples / Demonstration**
   Instructor presents a scenario with multiple risks and models:
   • Identifying each risk
   • Categorizing risk types
   • Discussing severity

---

6. **Real-World Connection**
   Drone pilots often face multiple risks during real operations and must evaluate all of them before flight.

---

7. **Key Reinforcement Summary**
   Identifying multiple risks is essential for safe and effective mission planning.

Formative Questions for Use in This Lesson
• What are examples of different types of risk?
• Why must risks be evaluated together?
• What is risk severity?
• How does risk identification affect decision-making?

Hands-On Activity
Activity Title: Multi-Risk Scenario Analysis

Activity Procedure

1. Students are given a mission scenario with multiple risks
2. Students identify all risk factors
3. Students categorize risks (environmental, airspace, operational)
4. Students evaluate risk severity
5. Students determine whether the mission is **safe and legal** and justify their answer

---

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Risk Identification	Complete and accurate	Mostly accurate	Partial	Limited
Risk Categorization	Clear and correct	Adequate	Limited	Minimal
Risk Evaluation	Strong reasoning	Adequate	Limited	Minimal
Participation	Fully engaged	Participates	Limited	Minimal

C3 Scenario (Decision-Based Application)

Students are given a mission scenario and must:

- Identify multiple risks
- Categorize risk types
- Evaluate severity
- Determine whether the mission is **safe and legal**
- Justify their decision

Assessment Items

1. What are multiple risk factors?
   A. One hazard
   B. Several hazards affecting a mission
   C. A flight path
   D. A drone type
2. What is environmental risk?
   A. Battery level
   B. Weather or surroundings
   C. Drone color
   D. Speed setting
3. What is risk severity?
   A. Speed
   B. Size of drone
   C. Level of impact of a risk
   D. Flight time
4. Why must risks be evaluated together?
   A. To increase speed
   B. To reduce battery use
   C. Because combined risks affect safety
   D. To change altitude
5. What is the result of risk evaluation?
   A. Drone color
   B. Flight decision
   C. Battery type
   D. Speed setting

Answer Key

1. B
2. B
3. C
4. C
5. B

Closure

Drone pilots must identify and evaluate multiple risks to ensure safe and legal flight operations.

Teacher Notes
• Emphasize that multiple risks are common in real-world scenarios
• Reinforce categorization of risks
• Prepare students for applying mitigation strategies in Day 2

Week 7 – Day 2: Prioritizing Risks and Decision Impact

Standards	Description	RBT Level
104.00	Apply mission planning and operational decision-making for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will evaluate multiple risk factors and prioritize them to determine their impact on mission planning decisions.

Essential Question
How do drone pilots determine which risks have the greatest impact on a flight decision?

Key Concepts
• Not all risks have the same level of impact
• Pilots must prioritize risks before making decisions
• High-impact risks influence whether a mission can proceed

Vocabulary
• **Risk Priority** – The importance level of a risk
• **High-Impact Risk** – A risk that significantly affects safety or legality
• **Low-Impact Risk** – A risk with minimal effect on operations
• **Decision Impact** – How a risk influences the final flight decision

Materials Needed
• PowerPoint Presentation (Week 7 Day 2 – Risk Prioritization)
• Mission scenarios (multiple risk factors)
• Whiteboard and markers
• Student notebooks

Bellringer
If a drone flight has several risks, how would you decide which ones matter most?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Identifying multiple risks from Day 1
   • Types of risks (environmental, airspace, operational)
   • Determining whether a mission is safe and legal

   Discuss:
   • Are all risks equally important when deciding whether to fly? Why or why not?

Bridge to lesson:
• Pilots must not only identify risks—they must determine which risks have the greatest impact on the decision

---

2. Core Concept Introduction
• Risk prioritization is the process of determining which risks matter most

Key Teaching Point:
Drone pilots prioritize risks to focus on the most critical factors affecting safety and legality

---

3. Concept Development

A. Understanding Risk Priority
• Risks vary in importance
• Some risks directly affect safety or legality
• Others may have minimal impact

B. Identifying High-Impact Risks
• Risks that could cause unsafe or illegal flight
• Examples: restricted airspace, strong winds, crowded environments

C. Recognizing Low-Impact Risks
• Risks that do not significantly affect the mission
• May still require awareness but not major changes

D. Evaluating Risk Influence on Decisions
• High-impact risks often determine go/no-go decisions
• Multiple moderate risks may combine to increase impact
• Pilots must evaluate how risks affect the mission outcome

E. Applying Risk Prioritization to Planning Decisions
• Pilots focus on the most critical risks first
• Decisions must reflect the highest-priority concerns
• Final decisions must ensure the mission is safe and legal

Key Teaching Point:
Drone pilots prioritize risks to make informed, safe, and legal flight decisions

---

4. Application to Drone Flight
Students analyze a mission scenario and rank risks based on their level of impact.

---

5. Guided Examples / Demonstration
Instructor presents a scenario and models:
• Identifying risks
• Ranking risks (high → low impact)
• Explaining how priority affects the final decision

---

6. Real-World Connection
Drone pilots must quickly determine which risks are most critical to ensure safe and compliant operations.

---

7. **Key Reinforcement Summary**
   Prioritizing risks allows pilots to focus on what matters most when making flight decisions.

Formative Questions for Use in This Lesson
• What is risk priority?
• What makes a risk high-impact?
• How do multiple risks affect decisions?
• Why is prioritization important in mission planning?

Hands-On Activity
Activity Title: Risk Prioritization Exercise

Activity Procedure
1. Students are given a mission scenario with multiple risks
2. Students identify all risks present
3. Students rank risks from highest to lowest impact
4. Students explain why each risk was ranked
5. Students determine whether the mission is **safe and legal** and justify their decision

---

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Risk Identification	Complete and accurate	Mostly accurate	Partial	Limited
Risk Prioritization	Clear and logical	Adequate	Limited	Minimal
Decision-Making	Strong justification	Adequate reasoning	Limited	Minimal
Participation	Fully engaged	Participates	Limited	Minimal

C3 Scenario (Decision-Based Application)
Students are given a mission scenario and must:
• Identify multiple risks
• Rank risks by priority
• Evaluate how each risk affects the mission
• Determine whether the mission is **safe and legal**
• Justify their decision using prioritized risk analysis

Assessment Items
1. What is risk priority?
   A. Speed of flight
   B. Importance level of a risk
   C. Drone size
   D. Battery level

2. What is a high-impact risk?
   A. A minor issue
   B. A risk that affects safety or legality
   C. A color choice
   D. A flight path
3. Why must risks be prioritized?
   A. To increase speed
   B. To focus on the most important factors
   C. To reduce battery use
   D. To change altitude
4. What can multiple moderate risks create?
   A. No effect
   B. A larger combined risk
   C. Faster flight
   D. Better control
5. What determines the final flight decision?
   A. Drone color
   B. Risk prioritization and evaluation
   C. Battery size
   D. Speed settings

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Drone pilots must prioritize risks to focus on the most critical factors and make safe and legal flight decisions.

Teacher Notes

• Emphasize that not all risks are equal
• Reinforce logical reasoning behind prioritization
• Prepare students for applying mitigation strategies based on priority in Day 3

Week 7 – Day 3: Understanding Direction and Orientation on Maps

Standards	Description	RBT Level
104.00	Apply mission planning and operational decision-making for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will apply mitigation strategies to prioritized risks to improve mission safety and determine appropriate flight decisions.

Essential Question
How do drone pilots apply mitigation strategies to reduce risk and improve flight safety?

Key Concepts
• Mitigation strategies are applied based on risk priority
• Not all risks require the same response
• Effective mitigation improves mission safety and feasibility

---

Vocabulary
• **Mitigation Strategy** – An action taken to reduce or manage risk
• **Risk Response** – The action chosen to address a risk
• **Operational Adjustment** – A change made to improve safety
• **Residual Risk** – Risk that remains after mitigation

Materials Needed
• PowerPoint Presentation (Week 7 Day 3 – Mitigation Strategies)
• Mission scenarios (prioritized risks)
• Mission planning worksheet
• Whiteboard and markers
• Student notebooks

Bellringer
If a risk is identified, what can a pilot do instead of canceling the mission?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Identifying multiple risks (Day 1)
   • Prioritizing risks based on impact (Day 2)
   • Determining whether a mission is safe and legal

   Discuss:
   • Once a high-priority risk is identified, what should a pilot do next?

Bridge to lesson:
• Pilots do not stop at identifying risks—they take action to reduce or manage them

---

2. Core Concept Introduction
• Mitigation strategies are used to reduce the impact of identified risks

Key Teaching Point:
Drone pilots apply mitigation strategies based on risk priority to improve mission safety

---

3. Concept Development

A. Understanding Risk Response Options
• Proceed as planned (if risk is low)
• Modify the mission (if risk can be reduced)
• Cancel the mission (if risk is too high)

B. Matching Mitigation Strategies to Risk Priority
• High-priority risks require strong mitigation or cancellation
• Moderate risks may be reduced through adjustments
• Low risks may require minimal action

C. Common Mitigation Strategies
• Adjust flight location
• Change altitude or flight path
• Delay flight due to weather
• Reduce flight area or duration

D. Evaluating Residual Risk
• After mitigation, some risk may remain
• Pilots must determine if remaining risk is acceptable
• Decision must still ensure safe and legal flight

E. Connecting Mitigation to Final Decisions
• Mitigation affects whether a mission proceeds
• Decisions must reflect improved safety conditions
• Final outcome: proceed, modify, or cancel

Key Teaching Point:
Drone pilots apply mitigation strategies and evaluate remaining risk to determine safe and legal flight decisions

---

4. Application to Drone Flight
Students apply mitigation strategies to a prioritized risk scenario and re-evaluate mission safety.

---

5. Guided Examples / Demonstration
Instructor models:
• Selecting mitigation strategies based on risk priority
• Applying adjustments to the mission
• Evaluating residual risk
• Making a final decision

6. **Real-World Connection**
   Drone pilots regularly adjust missions based on risk conditions to maintain safe and compliant operations.

7. **Key Reinforcement Summary**
   Applying mitigation strategies allows pilots to reduce risk and make informed flight decisions.

Formative Questions for Use in This Lesson
• What is a mitigation strategy?
• How does risk priority affect mitigation decisions?
• What is residual risk?
• When should a mission be canceled instead of modified?

Hands-On Activity
Activity Title: Risk Mitigation Planning Exercise

Activity Procedure
1. Students are given a mission scenario with prioritized risks
2. Students identify the highest-priority risks
3. Students select appropriate mitigation strategies
4. Students modify the mission plan
5. Students evaluate residual risk
6. Students determine whether the mission is **safe and legal** and justify their decision

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Risk Identification	Complete and accurate	Mostly accurate	Partial	Limited
Mitigation Strategy	Effective and appropriate	Adequate	Limited	Minimal
Residual Risk Evaluation	Clear and logical	Adequate	Limited	Minimal
Decision-Making	Strong justification	Adequate reasoning	Limited	Minimal

C3 Scenario (Decision-Based Application)
Students are given a mission scenario and must:
• Identify prioritized risks
• Apply appropriate mitigation strategies
• Modify the mission plan
• Evaluate residual risk
• Determine whether the mission is **safe and legal**
• Justify their decision using planning data

Assessment Items

1. What is a mitigation strategy?
   A. Ignoring risks
   B. Increasing risks
   C. Reducing or managing risk
   D. Avoiding planning
2. What should be done with high-priority risks?
   A. Ignore them
   B. Address them with strong mitigation or cancel
   C. Increase them
   D. Avoid planning
3. What is residual risk?
   A. Risk before planning
   B. Risk after mitigation
   C. No risk
   D. Increased risk
4. What are possible responses to risk?
   A. Increase, ignore, speed
   B. Proceed, modify, cancel
   C. Fly faster, fly higher, fly longer
   D. Charge, land, store
5. What must be evaluated after mitigation?
   A. Drone color
   B. Battery size
   C. Remaining risk
   D. Speed settings

Answer Key

1. C
2. B
3. B
4. B
5. C

Closure

Applying mitigation strategies allows drone pilots to reduce risk and make safe and legal flight decisions.

Teacher Notes

• Emphasize matching mitigation to risk priority
• Reinforce that not all risks can be reduced
• Prepare students for full mission planning integration in Day 4

Week 7 – Day 4: Integrated Risk Management and Mission Planning

Standards	Description	RBT Level
104.00	Apply mission planning and operational decision-making for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will integrate risk identification, prioritization, and mitigation strategies to evaluate and modify a drone mission for safe and legal operation.

Essential Question
How do drone pilots combine risk identification, prioritization, and mitigation to plan a safe and legal mission?

Key Concepts
• Mission planning requires multiple steps working together
• Risk identification, prioritization, and mitigation are interconnected
• Effective planning results in informed flight decisions

Vocabulary
• **Integrated Planning** – Combining multiple planning steps into one process
• **Risk Interaction** – How multiple risks affect each other
• **Mitigation Plan** – A structured approach to reducing risk
• **Flight Feasibility** – Whether a mission can be safely and legally completed

Materials Needed
• PowerPoint Presentation (Week 7 Day 4 – Integrated Planning)
• Mission planning worksheet (full process)
• Complex mission scenarios
• Whiteboard and markers
• Student notebooks

Bellringer
Why is it important to evaluate all risks together instead of separately?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Identifying multiple risks (Day 1)
   • Prioritizing risks (Day 2)
   • Applying mitigation strategies (Day 3)

   Discuss:
   • How do these steps work together when planning a mission?

Bridge to lesson:
- Pilots do not perform these steps separately—they combine them into one complete planning process

---

2. Core Concept Introduction

• Integrated mission planning combines all risk management steps into a single process

Key Teaching Point:
Drone pilots must combine risk identification, prioritization, and mitigation to make effective planning decisions

---

3. Concept Development

A. Combining Planning Steps into One Process
- Identify risks
- Prioritize risks
- Apply mitigation strategies
- Evaluate final mission conditions

B. Understanding Risk Interaction
- Risks can influence each other
- Multiple moderate risks can create a higher overall risk
- Pilots must evaluate combined effects

C. Developing a Mitigation Plan
- Multiple risks may require multiple adjustments
- Mitigation must address the most critical risks first
- Planning must remain flexible

D. Evaluating Flight Feasibility
- After mitigation, pilots determine if the mission is possible
- Must ensure the mission is safe and legal
- Decisions must reflect all planning factors

E. Making Final Integrated Decisions
- Combine all planning data
- Determine whether to proceed, modify, or cancel
- Provide clear justification

Key Teaching Point:
Drone pilots use integrated planning to evaluate all risks and determine safe and legal flight decisions

---

4. Application to Drone Flight

Students apply full integrated planning to a complex mission scenario.

---

5. **Guided Examples / Demonstration**
   Instructor models a full integrated planning process:
   • Identify and prioritize risks
   • Apply mitigation strategies
   • Evaluate combined effects
   • Make a final decision

---

6. **Real-World Connection**
   Drone pilots must manage multiple risks simultaneously and adjust plans to ensure safe and compliant operations.

---

7. **Key Reinforcement Summary**
   Integrated planning allows pilots to evaluate all risks together and make informed flight decisions.

Formative Questions for Use in This Lesson
• What is integrated planning?
• How do risks interact with each other?
• Why must mitigation address high-priority risks first?
• What determines if a mission is feasible?

Hands-On Activity
Activity Title: Integrated Mission Planning Challenge

Activity Procedure
1. Students are given a complex mission scenario
2. Students identify all risks
3. Students prioritize risks based on impact
4. Students apply mitigation strategies
5. Students evaluate combined risk and flight feasibility
6. Students determine whether the mission is **safe and legal** and justify their decision

---

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Risk Identification	Complete and accurate	Mostly accurate	Partial	Limited
Risk Prioritization	Clear and logical	Adequate	Limited	Minimal
Mitigation Strategy	Effective and appropriate	Adequate	Limited	Minimal
Decision-Making	Strong justification	Adequate reasoning	Limited	Minimal

---

C3 Scenario (Decision-Based Application)
Students are given a complex mission scenario and must:
• Identify and prioritize risks
• Apply mitigation strategies
• Evaluate combined risk impact
• Determine whether the mission is **safe and legal**
• Justify their decision using integrated planning

Assessment Items

1. What is integrated planning?
   A. Ignoring risks
   B. Combining planning steps into one process
   C. Increasing speed
   D. Changing altitude
2. What is risk interaction?
   A. One risk only
   B. How risks affect each other
   C. Drone color
   D. Battery level
3. What is a mitigation plan?
   A. Ignoring risks
   B. A plan to reduce risk
   C. Increasing speed
   D. Avoiding planning
4. What determines flight feasibility?
   A. Drone color
   B. Battery size
   C. Safety and legality after planning
   D. Speed settings
5. What are possible final decisions?
   A. Faster, higher, longer
   B. Proceed, modify, cancel
   C. Charge, land, store
   D. Fly, stop, turn

Answer Key

1. B
2. B
3. B
4. C
5. B

Closure
Integrated mission planning allows drone pilots to evaluate all risks and make safe and legal flight decisions.

Teacher Notes

- Emphasize that planning is a complete system, not separate steps
- Reinforce combined risk thinking
- Prepare students for independent capstone application in Day 5

Week 7 – Day 5: Applying Map and Visual Awareness Skills to Flight Planning

Standards	Description	RBT Level
104.00	Apply mission planning and operational decision-making for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will independently apply integrated mission planning, including risk identification, prioritization, and mitigation, to determine whether a drone mission is safe and legal.

Essential Question
How can a drone pilot independently apply advanced risk management to make safe and legal flight decisions?

Key Concepts
• Mission planning requires integration of all planning steps
• Multiple risks must be evaluated together
• Effective mitigation leads to informed decisions

Vocabulary
• **Integrated Risk Management** – Combining all risk evaluation steps into one process
• **Planning Justification** – Explaining decisions using planning data
• **Operational Decision-Making** – Choosing actions based on evaluated conditions
• **Mission Outcome** – Final result of planning (proceed, modify, cancel)

Materials Needed
• PowerPoint Presentation (Week 7 Day 5 – Capstone)
• Full mission planning worksheet
• Scenario cards (moderate to complex)
• Whiteboard and markers
• Student notebooks

Bellringer
What is the most important step in mission planning when making a final flight decision?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Mission planning process from Week 6
   • Risk identification (Day 1)
   • Risk prioritization (Day 2)
   • Mitigation strategies (Day 3)
   • Integrated planning (Day 4)

Discuss:
• How do all these steps work together to support a final decision?

Bridge to lesson:
• Today, you will apply the full mission planning and risk management process independently

---

2. Core Concept Introduction

- Advanced mission planning integrates all risk management steps into independent decision-making

Key Teaching Point:
Drone pilots must independently apply all planning steps to determine whether a mission is safe and legal

---

3. Concept Development

A. Reviewing the Integrated Planning Process
- Identify risks
- Prioritize risks
- Apply mitigation strategies
- Evaluate combined risk
- Make a final decision

B. Applying Advanced Risk Thinking
- Consider multiple interacting risks
- Evaluate overall mission conditions
- Focus on the most critical safety factors

C. Making Independent Planning Decisions
- Students must rely on their own evaluation
- Decisions must be based on planning data

D. Justifying Mission Outcomes
- Explain why a mission should proceed, be modified, or be canceled
- Use evidence from planning steps

E. Ensuring Safe and Legal Operations
- All decisions must reflect safety and regulatory awareness
- Final determination must be clearly supported

Key Teaching Point:
Drone pilots use integrated risk management to independently make safe and legal flight decisions

---

4. Application to Drone Flight

Students independently apply the full integrated mission planning process to a complex scenario.

---

5. Guided Examples / Demonstration

Instructor provides a brief example, then transitions to independent student performance.

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6. **Real-World Connection**
   Drone pilots must independently evaluate and plan each mission, often under changing conditions, to ensure safe operations.

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7. **Key Reinforcement Summary**
   Integrated mission planning allows pilots to independently evaluate risks and make informed flight decisions.

Formative Questions for Use in This Lesson
• What steps are included in integrated mission planning?
• Why must decisions be based on planning data?
• How do multiple risks affect decision-making?
• What determines the final mission outcome?

Hands-On Activity
Activity Title: Advanced Mission Planning Capstone

Activity Procedure
1. Students are given a complex mission scenario
2. Students identify all risks
3. Students prioritize risks
4. Students apply mitigation strategies
5. Students evaluate combined and residual risk
6. Students determine whether to proceed, modify, or cancel
7. Students justify their decision using planning data

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Risk Identification	Complete and accurate	Mostly accurate	Partial	Limited
Risk Prioritization	Clear and logical	Adequate	Limited	Minimal
Mitigation Strategy	Effective and appropriate	Adequate	Limited	Minimal
Decision-Making	Strong justification	Adequate reasoning	Limited	Minimal
Independence	Fully independent	Minimal support	Needs support	Unable

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C3 Scenario (Decision-Based Application)
Students are given a complex mission scenario and must independently:
• Identify and prioritize risks
• Apply mitigation strategies
• Evaluate combined and residual risk
• Determine whether the mission is **safe and legal**
• Provide a complete justification using planning data

Assessment Items

1. What is integrated risk management?
   A. Ignoring risks
   B. Combining all risk evaluation steps
   C. Increasing speed
   D. Avoiding planning
2. What must be used to justify a decision?
   A. Guessing
   B. Planning data
   C. Drone color
   D. Speed settings
3. What are possible mission outcomes?
   A. Faster, higher, longer
   B. Proceed, modify, cancel
   C. Charge, land, store
   D. Fly, stop, turn
4. What is the purpose of mitigation strategies?
   A. Increase risk
   B. Reduce or manage risk
   C. Avoid planning
   D. Change color
5. What determines if a mission is safe and legal?
   A. Pilot preference
   B. Integrated planning and risk evaluation
   C. Battery size
   D. Speed settings

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Drone pilots use integrated mission planning and risk management to independently make safe and legal flight decisions.

Teacher Notes

• This is a performance-based lesson—minimize direct instruction
• Focus on student reasoning and justification
• Use this lesson to assess readiness for continued course progression

Week 8: Applying Mission Planning to Flight Operations

Week 8 Overview
This week transitions students from mission planning into real-time flight application. Students will apply risk identification, prioritization, and mitigation strategies to guide safe drone operation during flight. Emphasis is placed on operational awareness, in-flight decision-making, and adjusting flight behavior based on changing conditions. Students will learn that mission planning is not a one-time task but a continuous process that supports safe and effective drone operations. This week strengthens the connection between planning and execution, preparing students for hands-on flight performance in upcoming units.

Week 8 – Day 1: Connecting Mission Planning to Flight Execution

Standards	Description	RBT Level
104.00	Apply mission planning and operational decision-making for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will explain how mission planning decisions guide drone flight execution and safe operation.

Essential Question
How does mission planning influence real-time drone flight operations?

Key Concepts
• Planning decisions directly affect flight behavior
• Safe operations require continuous awareness
• Pilots must apply planning during flight

Vocabulary
• **Flight Execution** – Operating a drone during a mission
• **Operational Awareness** – Staying aware of conditions during flight
• **In-Flight Adjustment** – Changes made during flight to maintain safety
• **Planning-to-Action Connection** – How planning guides flight behavior

Materials Needed
• PowerPoint Presentation (Week 8 Day 1 – Planning to Execution)
• Mission scenarios (from Week 7)
• Whiteboard and markers
• Student notebooks

Bellringer
How could a decision made before flight change what a pilot does during flight?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Mission planning process (Weeks 6–7)
   • Risk identification, prioritization, and mitigation
   • Safe and legal decision-making

   Discuss:
   • What decisions did you make during mission planning last week?

   Bridge to lesson:
   • Planning does not stop at takeoff—it continues during flight

2. **Core Concept Introduction**

   • Mission planning guides how a drone is operated during flight

   Key Teaching Point:
   Drone pilots use planning decisions to guide safe and effective flight execution

3. **Concept Development**

   A. Understanding the Planning-to-Flight Connection
   • Planning determines flight path, altitude, and behavior
   • Decisions made before flight influence actions during flight

   B. Applying Planning Decisions During Flight
   • Avoid obstacles identified during planning
   • Maintain safe altitude based on environment
   • Follow operational limits

   C. Maintaining Operational Awareness
   • Pilots must monitor surroundings continuously
   • Conditions may change during flight
   • Awareness supports safe operation

   D. Making In-Flight Adjustments
   • Adjustments may be required due to conditions
   • Adjustments must align with safety and planning decisions
   • Safety remains the priority

   E. Connecting Planning to Safe Operations
   • Planning reduces uncertainty
   • Well-planned missions improve execution
   • Decisions must remain safe and legal

   Key Teaching Point:
   Drone pilots apply planning decisions during flight to maintain safe and controlled operations

4. **Application to Drone Flight**

   Students analyze how a mission plan affects specific flight actions.

5. **Guided Examples / Demonstration**
   Instructor models a mission plan and demonstrates how it affects:
   • Flight path
   • Altitude
   • Adjustments

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6. **Real-World Connection**
   Drone pilots apply planning decisions continuously during real-world operations.

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7. **Key Reinforcement Summary**
   Mission planning guides flight execution and supports safe drone operation.

Formative Questions for Use in This Lesson
• How does planning affect flight behavior?
• What is operational awareness?
• When should adjustments be made?
• Why is planning important during flight?

Hands-On Activity
Activity Title: Planning-to-Flight Analysis

Activity Procedure
1. Students review a mission plan
2. Identify key planning decisions
3. Explain how each affects flight behavior
4. Identify possible in-flight adjustments
5. Explain how safety is maintained

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Planning Analysis	Complete and accurate	Mostly accurate	Partial	Limited
Flight Connection	Clear and logical	Adequate	Limited	Minimal
Adjustment Identification	Strong and relevant	Adequate	Limited	Minimal
Participation	Fully engaged	Participates	Limited	Minimal

C3 Scenario (Decision-Based Application)
Students are given a mission plan and must:
• Identify planning decisions
• Explain how they affect flight
• Describe adjustments
• Explain how the mission remains **safe and legal**

Assessment Items

1. What is flight execution?
   A. Planning
   B. Operating a drone during a mission
   C. Charging batteries
   D. Storing equipment
2. How does planning affect flight?
   A. No effect
   B. Guides operation
   C. Changes color
   D. Increases speed
3. What is operational awareness?
   A. Ignoring surroundings
   B. Awareness during flight
   C. Flying faster
   D. Landing quickly
4. When should a pilot adjust?
   A. Never
   B. When needed for safety
   C. Only before flight
   D. Only after landing
5. What is the purpose of planning?
   A. Speed
   B. Safe operation
   C. Appearance
   D. Battery life

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Mission planning directly supports safe and effective drone flight operations.

Teacher Notes

• Emphasize that planning continues during flight
• Reinforce awareness and adjustment
• Prepare students for real-time decision-making

Week 8 – Day 2: Real-Time Decision-Making During Flight Operations

Standards	Description	RBT Level
104.00	Apply mission planning and operational decision-making for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will apply mission planning knowledge to make real-time decisions during drone flight based on changing conditions.

Essential Question
How do drone pilots make safe decisions when conditions change during flight?

Key Concepts
• Flight conditions can change during operations
• Pilots must make decisions in real time
• Safe decisions are based on planning and awareness

Vocabulary
• **Real-Time Decision-Making** – Making decisions during flight
• **Changing Conditions** – Environmental or operational changes during flight
• **Flight Adjustment** – Modifying flight behavior to maintain safety
• **Situational Awareness** – Understanding what is happening during flight

Materials Needed
• PowerPoint Presentation (Week 8 Day 2 – Real-Time Decisions)
• Scenario cards (changing conditions)
• Whiteboard and markers
• Student notebooks

Bellringer
What would you do if conditions changed while you were flying a drone?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Mission planning and execution connection (Day 1)
   • Risk identification and mitigation (Week 7)
   • Safe and legal decision-making

   Discuss:
   • What happens if conditions during flight are different than planned?

   Bridge to lesson:
   • Pilots must adjust and make decisions during flight, not just before it

2. Core Concept Introduction

• Real-time decision-making is required when conditions change during flight

Key Teaching Point:
Drone pilots must use planning knowledge and awareness to make safe decisions during flight

3. Concept Development

A. Understanding Changing Flight Conditions
- Weather may shift (wind, visibility)
- New obstacles or hazards may appear
- Operational conditions may differ from the plan

B. Maintaining Situational Awareness
- Pilots must continuously observe surroundings
- Awareness helps detect problems early
- Awareness supports safe decision-making

C. Identifying When Adjustments Are Needed
- Unsafe conditions require immediate response
- Pilots must recognize warning signs
- Decisions must prioritize safety

D. Applying Real-Time Adjustments
- Change altitude or position
- Adjust flight path
- Slow down or reposition
- Prepare to return or land

E. Connecting Decisions to Safety and Planning
- Adjustments should reflect mission planning
- Decisions must maintain safe and legal operation
- Final outcome: continue, modify, or end the mission

Key Teaching Point:
Drone pilots must recognize changes and apply safe adjustments during flight

4. Application to Drone Flight

Students analyze scenarios where conditions change and determine appropriate in-flight responses.

5. Guided Examples / Demonstration

Instructor presents scenarios such as:
- Increasing wind
- Unexpected obstacle
- Loss of visibility

Models appropriate responses and decision-making.

6. **Real-World Connection**
   Drone pilots frequently encounter changing conditions and must adjust quickly to maintain safe operations.

---

7. **Key Reinforcement Summary**
   Real-time decision-making ensures safe and controlled drone flight when conditions change.

Formative Questions for Use in This Lesson
• What are examples of changing conditions?
• What is situational awareness?
• When should a pilot adjust during flight?
• Why are real-time decisions important?

Hands-On Activity
Activity Title: Real-Time Decision Simulation

Activity Procedure
1. Students are given a flight scenario
2. Instructor introduces a change in conditions
3. Students identify the issue
4. Students determine appropriate adjustments
5. Students explain how safety is maintained
6. Students determine whether to continue, modify, or end the mission

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Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Situation Recognition	Immediate and accurate	Mostly accurate	Partial	Limited
Decision-Making	Strong and logical	Adequate	Limited	Minimal
Adjustment Strategy	Effective and safe	Adequate	Limited	Minimal
Participation	Fully engaged	Participates	Limited	Minimal

C3 Scenario (Decision-Based Application)
Students are given a changing-condition scenario and must:
• Identify the change
• Determine appropriate adjustments
• Explain how safety is maintained
• Decide whether to continue, modify, or end the mission

Assessment Items
1. What is real-time decision-making?
   A. Planning before flight
   B. Making decisions during flight
   C. Charging batteries
   D. Landing only

2. What are changing conditions?
   A. Drone color
   B. Changes during flight
   C. Battery size
   D. Speed setting
3. What is situational awareness?
   A. Ignoring surroundings
   B. Awareness during flight
   C. Flying faster
   D. Landing quickly
4. When should a pilot adjust?
   A. Never
   B. When conditions change
   C. Only before flight
   D. Only after landing
5. What is the safest response to dangerous conditions?
   A. Ignore
   B. Continue flying
   C. Adjust or end the mission
   D. Increase speed

Answer Key

1. B
2. B
3. B
4. B
5. C

Closure

Drone pilots must make real-time decisions and adjust flight operations to maintain safety.

Teacher Notes

• Emphasize quick but thoughtful decision-making
• Reinforce safety as the top priority
• Prepare students for more complex multi-variable scenarios in Day 3

Week 8 – Day 3: Managing Multiple Changing Conditions During Flight

Standards	Description	RBT Level
104.00	Apply mission planning and operational decision-making for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will apply real-time decision-making skills to manage multiple changing conditions during drone flight operations.

Essential Question
How do drone pilots safely respond when multiple conditions change during flight?

Key Concepts
• Multiple conditions can change at the same time
• Pilots must evaluate combined effects
• Safe decisions require prioritization and awareness

Vocabulary
• **Simultaneous Conditions** – Multiple changes occurring at the same time
• **Priority Response** – Addressing the most critical issue first
• **Combined Risk** – The effect of multiple risks together
• **Operational Control** – Maintaining safe control of the drone

Materials Needed
• PowerPoint Presentation (Week 8 Day 3 – Multiple Conditions)
• Multi-condition scenario cards
• Whiteboard and markers
• Student notebooks

Bellringer
What would be more difficult: handling one problem during flight or multiple problems at the same time? Why?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Planning-to-flight connection (Day 1)
   • Real-time decision-making (Day 2)
   • Situational awareness and adjustments

   Discuss:
   • What happens if more than one issue occurs during flight?

Bridge to lesson:
• Pilots often face multiple changes at once and must respond effectively

---

2. Core Concept Introduction
• Multiple changing conditions increase complexity during flight

Key Teaching Point:
Drone pilots must prioritize and respond to multiple conditions to maintain safe operations

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3. Concept Development

A. Understanding Simultaneous Conditions
• Weather changes and obstacles may occur together
• Visibility, wind, and environment can all shift
• Pilots must evaluate all conditions

B. Evaluating Combined Risk
• Multiple moderate risks can create a higher overall risk
• Risks must be considered together
• Combined risk affects decision-making

C. Prioritizing Responses
• Address the most dangerous condition first
• Maintain control of the drone at all times
• Focus on safety over task completion

D. Applying Multiple Adjustments
• Adjust altitude and position
• Modify flight path
• Slow or stabilize movement
• Prepare for landing if needed

E. Maintaining Operational Control and Safety
• Keep the drone stable and controlled
• Ensure all actions reflect safety and legality
• Determine if the mission should continue, be modified, or end

Key Teaching Point:
Drone pilots must prioritize and manage multiple risks to maintain safe and controlled flight

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4. Application to Drone Flight
Students evaluate scenarios involving multiple changing conditions and determine appropriate responses.

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5. Guided Examples / Demonstration
Instructor presents a scenario with multiple changes (e.g., wind increase + obstacle + reduced visibility) and models:
• Identifying all issues
• Prioritizing response
• Applying adjustments
• Making a final decision

6. **Real-World Connection**
   Drone pilots frequently encounter multiple changing conditions and must respond quickly to maintain safe operations.

7. **Key Reinforcement Summary**
   Managing multiple conditions requires prioritization, awareness, and safe decision-making.

Formative Questions for Use in This Lesson
• What are simultaneous conditions?
• Why must risks be evaluated together?
• How do pilots decide what to address first?
• What is the most important priority during flight?

Hands-On Activity
Activity Title: Multi-Condition Flight Decision Challenge

Activity Procedure
1. Students are given a scenario with multiple changing conditions
2. Students identify all conditions
3. Students evaluate combined risk
4. Students prioritize which issue to address first
5. Students determine appropriate adjustments
6. Students decide whether to continue, modify, or end the mission
7. Students justify their decision

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Condition Identification	Complete and accurate	Mostly accurate	Partial	Limited
Risk Evaluation	Clear and logical	Adequate	Limited	Minimal
Priority Decision	Strong and justified	Adequate	Limited	Minimal
Adjustment Strategy	Effective and safe	Adequate	Limited	Minimal

C3 Scenario (Decision-Based Application)
Students are given a multi-condition scenario and must:
• Identify all changing conditions
• Evaluate combined risk
• Prioritize responses
• Apply adjustments
• Determine whether the mission is **safe and legal**
• Justify their decision

Assessment Items

1. What are simultaneous conditions?
   A. One condition only
   B. Multiple changes during flight
   C. Battery levels
   D. Drone color
2. What is combined risk?
   A. One risk
   B. Multiple risks together
   C. No risk
   D. Battery level
3. What should be addressed first?
   A. Least important issue
   B. Most dangerous condition
   C. Drone color
   D. Speed setting
4. What is operational control?
   A. Losing control
   B. Maintaining safe control of the drone
   C. Flying faster
   D. Changing direction only
5. What is the priority during flight?
   A. Speed
   B. Task completion
   C. Safety
   D. Appearance

Answer Key

1. B
2. B
3. B
4. B
5. C

Closure

Drone pilots must manage multiple changing conditions by prioritizing risks and maintaining safe control of the drone.

Teacher Notes

• Emphasize prioritization under pressure
• Reinforce that safety overrides mission goals
• Prepare students for full operational application in Day 4

Week 8 – Day 4: Integrated Flight Operations and Real-Time Risk Management

Standards	Description	RBT Level
104.00	Apply mission planning and operational decision-making for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will apply mission planning and real-time decision-making to manage complex flight scenarios and maintain safe and legal drone operations.

Essential Question
How do drone pilots integrate planning and real-time decisions to safely manage complex flight operations?

Key Concepts
• Flight operations require both planning and real-time decision-making
• Multiple risks must be managed simultaneously
• Safe operations depend on continuous evaluation and adjustment

Vocabulary
• **Integrated Flight Operations** – Combining planning and real-time flight decisions
• **Operational Decision-Making** – Making choices during flight to maintain safety
• **Dynamic Conditions** – Conditions that change during flight
• **Flight Feasibility** – Whether a mission can continue safely

Materials Needed
• PowerPoint Presentation (Week 8 Day 4 – Integrated Operations)
• Complex mission scenarios
• Mission planning worksheet
• Whiteboard and markers
• Student notebooks

Bellringer
Why is it important to combine planning and real-time decisions during flight?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Planning-to-flight connection (Day 1)
   • Real-time decision-making (Day 2)
   • Managing multiple conditions (Day 3)

Discuss:
• How do all these skills work together during a real flight?

Bridge to lesson:
• Pilots must combine all skills to manage real-world flight operations

---

2. Core Concept Introduction
• Integrated flight operations combine planning and real-time decision-making

Key Teaching Point:
Drone pilots must apply planning and real-time decision-making together to manage safe flight operations

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3. Concept Development

A. Combining Planning and Real-Time Decisions
- Planning provides the foundation
- Real-time decisions adjust for changing conditions
- Both must work together during flight

B. Understanding Dynamic Flight Conditions
- Conditions may change during operation
- Pilots must adapt to new information
- Continuous evaluation is required

C. Managing Multiple Risks During Flight
- Identify all current risks
- Evaluate combined impact
- Prioritize responses

D. Applying Integrated Adjustments
- Modify flight path, altitude, or speed
- Adjust based on environmental conditions
- Prepare for landing if necessary

E. Determining Flight Feasibility
- Evaluate whether the mission should continue
- Ensure operations remain safe and legal
- Decide to continue, modify, or end the mission

Key Teaching Point:
Drone pilots must continuously evaluate and adjust flight operations to maintain safety and legality

---

4. Application to Drone Flight
Students apply integrated planning and real-time decision-making to a complex flight scenario.

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5. **Guided Examples / Demonstration**
   Instructor presents a full scenario and models:
   • Reviewing the mission plan
   • Identifying changes during flight
   • Applying adjustments
   • Making a final decision

---

6. **Real-World Connection**
   Drone pilots must continuously combine planning and real-time decisions to safely manage flight operations in dynamic environments.

---

7. **Key Reinforcement Summary**
   Integrated flight operations require continuous evaluation, adjustment, and safe decision-making.

Formative Questions for Use in This Lesson
• How do planning and real-time decisions work together?
• What are dynamic conditions?
• How do pilots manage multiple risks during flight?
• What determines if a mission should continue?

Hands-On Activity
Activity Title: Integrated Flight Operations Challenge

Activity Procedure
1. Students are given a complex mission scenario
2. Students review the mission plan
3. Instructor introduces changing conditions
4. Students identify all risks
5. Students prioritize responses
6. Students apply integrated adjustments
7. Students determine whether to continue, modify, or end the mission
8. Students justify their decision

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Risk Identification	Complete and accurate	Mostly accurate	Partial	Limited
Decision-Making	Strong and logical	Adequate	Limited	Minimal
Adjustment Strategy	Effective and safe	Adequate	Limited	Minimal
Justification	Clear and supported	Adequate	Limited	Minimal

C3 Scenario (Decision-Based Application)
Students are given a complex scenario and must:
• Identify risks
• Apply planning and real-time decision-making
• Manage multiple conditions
• Determine whether the mission is **safe and legal**
• Justify their decision

Assessment Items

1. What are integrated flight operations?
   A. Planning only
   B. Combining planning and real-time decisions
   C. Flying faster
   D. Charging batteries
2. What are dynamic conditions?
   A. Conditions that stay the same
   B. Changing conditions during flight
   C. Battery level
   D. Drone color
3. What must pilots do during flight?
   A. Ignore changes
   B. Continuously evaluate conditions
   C. Increase speed
   D. Change color
4. What determines flight feasibility?
   A. Drone appearance
   B. Safety and legality
   C. Speed
   D. Battery color
5. What are possible mission outcomes?
   A. Faster, higher, longer
   B. Continue, modify, end
   C. Charge, land, store
   D. Fly, stop, turn

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure
Drone pilots must integrate planning and real-time decision-making to safely manage flight operations.

Teacher Notes
• Emphasize continuous evaluation and adjustment
• Reinforce integration of all learned skills
• Prepare students for full independent application in Day 5

Week 8 – Day 5: Mission Planning and Flight Operations Capstone

Standards	Description	RBT Level
104.00	Apply mission planning and operational decision-making for drone operations.	C3
104.01	Apply pre-flight planning procedures and risk assessment tools.	C3

Objective
Students will apply mission planning, risk assessment, and real-time decision-making to complete a full flight scenario while maintaining safe and legal drone operations.

Essential Question
How do drone pilots apply mission planning and decision-making to safely complete a full flight operation?

Key Concepts
• Mission planning guides all flight operations
• Real-time decisions are required during flight
• Safe operations depend on continuous evaluation

Vocabulary
• **Mission Execution** – Completing a planned drone operation
• **Operational Decision-Making** – Making safe choices during flight
• **Flight Outcome** – The result of a mission (continue, modify, or end)
• **Safety Validation** – Ensuring operations remain safe and legal

Materials Needed
• PowerPoint Presentation (Week 8 Day 5 – Capstone)
• Full mission scenario packets
• Mission planning worksheet
• Whiteboard and markers
• Student notebooks

Bellringer
What is the most important factor when completing a drone mission?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Mission planning (Week 6)
   • Risk identification and prioritization (Week 7)
   • Real-time decision-making and integrated operations (Week 8)

   Discuss:
   • What skills are required to complete a full drone mission safely?

Bridge to lesson:
• Today you will apply all learned skills to complete a full mission scenario

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2. Core Concept Introduction
• Capstone application of mission planning and flight operations

Key Teaching Point:
Drone pilots must apply planning, awareness, and decision-making together to complete safe and effective missions

---

3. Concept Development

A. Reviewing the Mission Planning Process
• Identify mission objectives
• Assess environmental conditions
• Evaluate airspace and surroundings
• Identify risks

B. Applying Risk Assessment and Prioritization
• Determine risk level
• Prioritize hazards
• Apply mitigation strategies

C. Executing the Mission Plan
• Follow planned flight path and procedures
• Maintain control and awareness
• Apply operational limits

D. Applying Real-Time Decision-Making
• Recognize changing conditions
• Adjust flight behavior
• Maintain safety and legality

E. Determining Final Flight Outcome
• Evaluate if the mission remains safe
• Decide to continue, modify, or end
• Justify decisions based on safety

Key Teaching Point:
Drone pilots must integrate planning, risk management, and real-time decisions to safely complete missions

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4. Application to Drone Flight
Students complete a full mission scenario from planning through final decision-making.

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5. Guided Examples / Demonstration
Instructor models a complete mission walkthrough:
• Planning → Risk → Execution → Adjustment → Outcome

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6. **Real-World Connection**
   Drone pilots must apply all operational skills together to safely complete real-world missions.

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7. **Key Reinforcement Summary**
   Successful drone missions require planning, awareness, and safe decision-making throughout the entire operation.

Formative Questions for Use in This Lesson
• What are the steps of mission planning?
• How do pilots manage risks during flight?
• When should a mission be modified or ended?
• What ensures a mission is safe and legal?

Hands-On Activity
Activity Title: Full Mission Capstone Challenge

Activity Procedure
1. Students are given a complete mission scenario
2. Students complete mission planning steps
3. Students identify and prioritize risks
4. Instructor introduces changing conditions
5. Students apply real-time adjustments
6. Students determine final mission outcome
7. Students present and justify decisions

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Mission Planning	Complete and accurate	Mostly accurate	Partial	Limited
Risk Assessment	Strong and logical	Adequate	Limited	Minimal
Decision-Making	Effective and justified	Adequate	Limited	Minimal
Final Outcome Justification	Clear and supported	Adequate	Limited	Minimal

---

C3 Scenario (Decision-Based Application)
Students are given a full mission scenario and must:
• Plan the mission
• Identify and prioritize risks
• Apply real-time decision-making
• Determine whether the mission is **safe and legal**
• Justify their final decision

Assessment Items

1. What is mission execution?
   A. Planning only
   B. Completing a drone mission
   C. Charging batteries
   D. Landing only
2. What must pilots do during flight?
   A. Ignore conditions
   B. Maintain awareness and adjust
   C. Increase speed
   D. Change color
3. What is the purpose of risk assessment?
   A. Increase speed
   B. Identify and manage hazards
   C. Improve appearance
   D. Reduce battery use
4. What are possible mission outcomes?
   A. Fly faster
   B. Continue, modify, or end
   C. Charge battery
   D. Land only
5. What ensures safe operations?
   A. Speed
   B. Appearance
   C. Planning and decision-making
   D. Battery size

Answer Key

1. B
2. B
3. B
4. B
5. C

Closure

Safe drone operations require full integration of mission planning, risk management, and real-time decision-making.

Teacher Notes

• This is a performance-based lesson—focus on student thinking
• Allow students to justify decisions
• Reinforce that safety overrides mission goals
• This completes Standard 104 mastery

Week 9: Safety Procedures and Regulatory Foundations

This week introduces students to essential safety procedures and regulatory requirements that govern drone operations. Students will learn the importance of following rules, understanding operational limitations, and applying safe practices during flight. Emphasis is placed on developing responsible pilot behavior, recognizing legal requirements, and applying safety procedures in real-world scenarios. This unit begins building the foundation for understanding FAA regulations and prepares students for more advanced regulatory concepts in later weeks.

Week 9 – Day 1: Introduction to Drone Safety and Responsible Operations

Standards	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.01	Explain FAA rules, TRUST certification, and introductory Part 107 concepts.	B2

Objective
Students will explain the importance of safety procedures and responsible behavior in drone operations.

Essential Question
Why are safety procedures and rules important in drone operations?

Key Concepts
• Safety is the foundation of all drone operations
• Drone pilots must follow rules and procedures
• Responsible behavior ensures safe and legal flight

Vocabulary
• **Safety Procedures** – Steps taken to ensure safe drone operations
• **Responsible Operation** – Following rules and making safe decisions
• **FAA** – Federal Aviation Administration, the agency that regulates aviation
• **Regulations** – Rules that must be followed during drone operations

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Materials Needed
• PowerPoint Presentation (Week 9 Day 1 – Drone Safety Basics)
• Whiteboard and markers
• Student notebooks

Bellringer
Why do you think rules are important when flying a drone?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Mission planning and risk management (Weeks 6–8)
   • Making safe decisions during flight
   • Understanding environmental and operational risks

   Discuss:
   • What could happen if a drone pilot ignores safety procedures?

   Bridge to lesson:
   • Planning helps prevent problems, but rules ensure safe operations

---

2. **Core Concept Introduction**

   • Drone operations must follow safety procedures and regulations

   Key Teaching Point:
   Drone pilots are responsible for operating safely and following all rules

---

3. **Concept Development**

   A. Understanding the Importance of Safety
   • Safety protects people, property, and the pilot
   • Unsafe operations can lead to accidents or damage
   • Safety is the top priority in all drone flights

   B. Defining Responsible Drone Operation
   • Pilots must make safe and informed decisions
   • Responsible pilots follow procedures and rules
   • Safety decisions must be made before and during flight

   C. Introduction to FAA Oversight
   • The FAA regulates drone operations in the United States
   • Rules exist to ensure safe use of airspace
   • Pilots must understand and follow these rules

   D. Understanding the Role of Regulations
   • Regulations provide structure and safety guidelines
   • Rules apply to where, when, and how drones can fly
   • Following regulations helps prevent accidents

   E. Connecting Safety to Flight Operations
   • Safety procedures must be applied at all times
   • Pilots must follow rules before, during, and after flight
   • Responsible operation ensures safe and legal outcomes

   Key Teaching Point:
   Safe drone operations depend on following procedures and regulations at all times

---

4. **Application to Drone Flight**

   Students analyze how safety procedures influence flight decisions and outcomes.

---

5. **Guided Examples / Demonstration**
   Instructor presents scenarios showing:
   • Safe vs unsafe drone operation
   • Following vs ignoring rules
   • Consequences of unsafe behavior

---

6. **Real-World Connection**
   Drone pilots must follow safety procedures and regulations to operate legally and responsibly in real-world environments.

---

7. **Key Reinforcement Summary**
   Safety and responsibility are essential for all drone operations.

Formative Questions for Use in This Lesson
• Why is safety important in drone operations?
• What is responsible operation?
• What is the role of the FAA?
• Why must pilots follow regulations?

Hands-On Activity
Activity Title: Safe vs Unsafe Operation Analysis

Activity Procedure
1. Students are given example scenarios
2. Students identify safe and unsafe behaviors
3. Students explain why actions are safe or unsafe
4. Students suggest improvements for unsafe scenarios
5. Students connect decisions to safety and regulations

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Safety Identification	Complete and accurate	Mostly accurate	Partial	Limited
Reasoning	Strong and logical	Adequate	Limited	Minimal
Improvement Suggestions	Effective and realistic	Adequate	Limited	Minimal
Participation	Fully engaged	Participates	Limited	Minimal

C3 Scenario (Decision-Based Application)
Students are given a flight scenario and must:
• Identify unsafe behaviors
• Explain why they are unsafe
• Apply appropriate safety procedures
• Determine how the operation can become **safe and legal**

Assessment Items

1. What is the purpose of safety procedures?
   A. Increase speed
   B. Ensure safe operations
   C. Improve appearance
   D. Reduce battery use
2. What is responsible operation?
   A. Ignoring rules
   B. Following rules and making safe decisions
   C. Flying faster
   D. Changing altitude only
3. What does the FAA do?
   A. Builds drones
   B. Regulates aviation
   C. Sells equipment
   D. Repairs drones
4. Why are regulations important?
   A. They slow pilots down
   B. They ensure safe operations
   C. They change drone color
   D. They increase speed
5. What is the most important priority in drone operations?
   A. Speed
   B. Appearance
   C. Safety
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. C

Closure

Safe drone operations require responsible behavior and adherence to regulations.

Teacher Notes

• Emphasize safety as the top priority
• Reinforce responsibility and accountability
• Prepare students for specific FAA rules in Day 2

Week 9 – Day 2: Introduction to FAA Rules and TRUST Certification

Standards	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.01	Explain FAA rules, TRUST certification, and introductory Part 107 concepts.	B2

Objective
Students will identify key FAA rules for drone operation and explain the purpose of the TRUST certification.

Essential Question
What rules must drone pilots follow, and why is TRUST certification important?

Key Concepts
• FAA rules govern drone operations
• TRUST certification is required for recreational drone pilots
• Rules help ensure safe and legal flight

Vocabulary
• **FAA Regulations** – Rules established by the FAA for drone operations
• **TRUST Certification** – The Recreational UAS Safety Test required for recreational pilots
• **Recreational Flight** – Flying a drone for fun, not for business
• **Operational Limits** – Restrictions on how drones can be flown

---

Materials Needed
• PowerPoint Presentation (Week 9 Day 2 – FAA Rules & TRUST)
• FAA rule summary handout
• Whiteboard and markers
• Student notebooks

Bellringer
What rules do you think exist for flying a drone?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Importance of safety procedures (Day 1)
   • Responsible drone operation
   • Role of the FAA

   Discuss:
   • Why would the FAA create rules for drone pilots?

   Bridge to lesson:
   • Safety is supported by rules that all pilots must follow

2. Core Concept Introduction

• FAA rules define how drones can be safely operated

Key Teaching Point:
Drone pilots must understand and follow FAA rules to operate legally

3. Concept Development

A. Overview of FAA Drone Rules

• FAA establishes rules for drone safety
• Rules apply to all drone pilots
• Rules help prevent accidents and protect airspace

B. Key FAA Rules for Drone Operation

• Fly below 400 feet
• Keep the drone within visual line of sight
• Do not fly over people (unless allowed)
• Do not interfere with manned aircraft
• Follow airspace restrictions

C. Understanding Operational Limits

• Limits define safe operating conditions
• Pilots must stay within allowed boundaries
• Limits help prevent unsafe situations

D. Introduction to TRUST Certification

• TRUST is required for recreational drone pilots
• It ensures basic understanding of safety rules
• Certification must be completed before flying recreationally

E. Connecting Rules to Safe Operations

• Following rules ensures safe and legal flight
• Rules support responsible pilot behavior
• Safety and regulations work together

Key Teaching Point:
Drone pilots must follow FAA rules and complete required certifications to operate safely

4. Application to Drone Flight

Students evaluate flight scenarios to determine if FAA rules are being followed.

5. Guided Examples / Demonstration

Instructor presents scenarios such as:
• Flying above 400 feet
• Flying near an airport
• Flying beyond visual line of sight
Students identify rule violations and correct actions.

6. **Real-World Connection**
   All drone pilots must follow FAA rules and complete TRUST certification to fly legally in real-world environments.

---

7. **Key Reinforcement Summary**
   FAA rules and TRUST certification ensure safe and responsible drone operations.

Formative Questions for Use in This Lesson
• What are some key FAA rules?
• What is TRUST certification?
• Why are operational limits important?
• What happens if rules are not followed?

Hands-On Activity
Activity Title: FAA Rule Application Challenge

Activity Procedure
1. Students are given flight scenarios
2. Students identify which FAA rules apply
3. Students determine if the scenario is compliant or not
4. Students explain why
5. Students suggest how to correct violations

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Rule Identification	Complete and accurate	Mostly accurate	Partial	Limited
Compliance Evaluation	Clear and correct	Adequate	Limited	Minimal
Explanation	Strong and logical	Adequate	Limited	Minimal
Participation	Fully engaged	Participates	Limited	Minimal

C3 Scenario (Decision-Based Application)
Students are given a flight scenario and must:
• Identify applicable FAA rules
• Determine if the flight is legal
• Explain violations (if any)
• Provide corrective actions to ensure the flight is **safe and legal**

Assessment Items
1. What is the FAA?
   A. Drone manufacturer
   B. Aviation regulatory agency
   C. Repair service
   D. Training company

2. What is the maximum typical altitude for drone flight?
   A. 100 feet
   B. 200 feet
   C. 400 feet
   D. 1000 feet
3. What is visual line of sight?
   A. Using a camera
   B. Seeing the drone with your eyes
   C. Using GPS
   D. Flying at night
4. What is TRUST certification?
   A. A drone license
   B. A recreational safety test
   C. A repair program
   D. A training drone
5. Why are FAA rules important?
   A. Increase speed
   B. Ensure safe and legal operation
   C. Change drone color
   D. Improve battery life

Answer Key

1. B
2. C
3. B
4. B
5. B

Closure

Drone pilots must understand and follow FAA rules and complete TRUST certification to operate safely and legally.

Teacher Notes

• Keep rule explanations simple and clear
• Reinforce real-world application
• Prepare students for deeper regulatory understanding (Part 107 intro in upcoming lessons)

Week 9 – Day 3: Introduction to Part 107 and Types of Drone Operations

Standards	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.01	Explain FAA rules, TRUST certification, and introductory Part 107 concepts.	B2

Objective
Students will explain the difference between recreational and commercial drone operations and identify the purpose of Part 107 certification.

Essential Question
What is the difference between recreational and commercial drone operations?

Key Concepts
• Drone operations are classified as recreational or commercial
• Part 107 certification is required for commercial drone operations
• Rules vary depending on how the drone is used

Vocabulary
• **Part 107** – FAA certification required for commercial drone operations
• **Commercial Operation** – Flying a drone for business or work purposes
• **Recreational Operation** – Flying a drone for personal enjoyment
• **Certification** – Official approval to operate under specific rules

Materials Needed
• PowerPoint Presentation (Week 9 Day 3 – Part 107 Basics)
• Comparison chart (Recreational vs Commercial)
• Whiteboard and markers
• Student notebooks

Bellringer
Why might different rules apply depending on how a drone is used?

Instructional Content
1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • FAA rules and operational limits (Day 2)
   • TRUST certification for recreational pilots
   • Importance of following regulations

   Discuss:
   • Are all drone pilots using drones for the same purpose?

   Bridge to lesson:
   • Different types of drone use require different rules and certifications

2. Core Concept Introduction

• Drone operations fall into two main categories: recreational and commercial

Key Teaching Point:
Drone pilots must follow different rules depending on how the drone is used

3. Concept Development

A. Understanding Recreational Drone Operations
- Flying for fun or personal enjoyment
- Requires TRUST certification
- Must follow FAA safety rules

B. Understanding Commercial Drone Operations
- Flying for business or work purposes
- Examples: photography, inspections, mapping
- Requires Part 107 certification

C. Introduction to Part 107 Certification
- FAA certification for commercial drone pilots
- Requires passing a knowledge test
- Demonstrates understanding of aviation rules and safety

D. Comparing Recreational vs Commercial Rules
- Both must follow safety rules
- Commercial operations have additional requirements
- Certification requirements differ

E. Connecting Certification to Safe Operations
- Certification ensures pilots understand rules
- Proper certification supports safe and legal flight
- Pilots must know which rules apply to their operation

Key Teaching Point:
Drone pilots must understand the type of operation they are performing and follow the appropriate rules

4. Application to Drone Flight

Students classify flight scenarios as recreational or commercial and determine required certifications.

5. Guided Examples / Demonstration

Instructor presents scenarios such as:
- Flying for fun in a park
- Taking photos for a business
- Inspecting a building

Students determine:
- Type of operation
- Required certification

6. **Real-World Connection**
   Drone pilots must understand whether they are flying recreationally or commercially to follow the correct rules and operate legally.

7. **Key Reinforcement Summary**
   Different types of drone operations require different rules and certifications.

Formative Questions for Use in This Lesson
• What is Part 107?
• What is the difference between recreational and commercial use?
• Why is certification important?
• How do rules change based on drone use?

Hands-On Activity
Activity Title: Operation Type Classification Challenge

Activity Procedure
1. Students are given various flight scenarios
2. Students classify each as recreational or commercial
3. Students identify required certification (TRUST or Part 107)
4. Students explain their reasoning
5. Students discuss why rules differ

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Classification Accuracy	Complete and correct	Mostly correct	Partial	Limited
Certification Identification	Accurate and justified	Adequate	Limited	Minimal
Reasoning	Strong and logical	Adequate	Limited	Minimal
Participation	Fully engaged	Participates	Limited	Minimal

C3 Scenario (Decision-Based Application)
Students are given a flight scenario and must:
• Identify whether the operation is recreational or commercial
• Determine required certification
• Explain why
• Describe how to ensure the operation is **safe and legal**

Assessment Items
1. What is Part 107?
   A. A drone model
   B. FAA certification for commercial pilots
   C. A repair tool
   D. A training drone

2. What is recreational drone use?
   A. Flying for business
   B. Flying for fun
   C. Flying for inspection
   D. Flying for delivery
3. What type of operation requires Part 107?
   A. Recreational
   B. Commercial
   C. Practice
   D. Indoor
4. What certification is required for recreational pilots?
   A. Part 107
   B. TRUST
   C. FAA license
   D. None
5. Why is certification important?
   A. To increase speed
   B. To ensure safe and legal operation
   C. To improve battery life
   D. To change drone color

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Drone pilots must understand the type of operation they are performing and follow the appropriate certification and rules.

Teacher Notes

• Keep Part 107 introduction high-level (no deep dive yet)
• Reinforce differences between recreational and commercial use
• Prepare students for applying rules in more complex scenarios in Day 4

Week 9 – Day 4: Applying Control Inputs for Basic Flight Maneuvers

Standards	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.01	Explain FAA rules, TRUST certification, and introductory Part 107 concepts.	B2

Objective
Students will apply FAA rules and certification requirements to evaluate and make decisions about drone flight scenarios.

Essential Question
How do drone pilots determine if a flight is safe and legal?

Key Concepts
• Drone operations must follow FAA rules
• Certification requirements depend on flight purpose
• Pilots must evaluate safety and legality before and during flight

---

Vocabulary
• **Regulatory Compliance** – Following FAA rules and requirements
• **Legal Operation** – Flying within all required rules and guidelines
• **Violation** – Breaking a rule or regulation
• **Corrective Action** – Steps taken to fix a violation

Materials Needed
• PowerPoint Presentation (Week 9 Day 4 – Regulatory Application)
• Scenario cards (rule + certification combinations)
• Whiteboard and markers
• Student notebooks

Bellringer
What makes a drone flight illegal?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • FAA rules and operational limits (Day 2)
   • TRUST certification requirements
   • Part 107 and types of operations (Day 3)

   Discuss:
   • What factors must a pilot consider before flying legally?

Bridge to lesson:
• Pilots must apply rules and certifications together to determine if a flight is safe and legal

---

2. Core Concept Introduction
• Safe drone operations require both rule compliance and correct certification

Key Teaching Point:
Drone pilots must evaluate both safety and legality before and during flight

---

3. Concept Development

A. Understanding Regulatory Compliance
• All flights must follow FAA rules
• Compliance ensures safe use of airspace
• Pilots are responsible for following all requirements

B. Identifying Legal vs Illegal Operations
• Legal operations follow rules and certification requirements
• Illegal operations violate FAA regulations
• Violations can result in unsafe conditions

C. Evaluating Certification Requirements
• Recreational → TRUST certification
• Commercial → Part 107 certification
• Pilots must match certification to operation type

D. Identifying Violations and Risks
• Flying too high or beyond line of sight
• Flying without proper certification
• Ignoring airspace restrictions
• Unsafe flight conditions

E. Applying Corrective Actions
• Adjust flight plan
• Follow proper certification requirements
• Modify or cancel flight
• Ensure compliance before continuing

Key Teaching Point:
Drone pilots must identify violations and take corrective action to maintain safe and legal operations

---

4. Application to Drone Flight
Students evaluate scenarios to determine legality and apply corrective actions.

---

5. Guided Examples / Demonstration
Instructor presents scenarios such as:
• Commercial flight without Part 107
• Flying beyond visual line of sight
• Flying in restricted airspace

Students identify:
• Violations
• Required corrections

---

6. Real-World Connection
Drone pilots must evaluate every flight for compliance with FAA rules and certification requirements to operate legally.

---

7. Key Reinforcement Summary
Safe and legal drone operations require understanding and applying both rules and certification requirements.

Formative Questions for Use in This Lesson
• What is regulatory compliance?
• What makes a flight illegal?
• How do certification requirements affect operations?
• What should a pilot do if a rule is violated?

Hands-On Activity
Activity Title: Legal or Illegal Flight Challenge

Activity Procedure
1. Students are given flight scenarios
2. Students determine if each scenario is legal or illegal
3. Students identify specific violations
4. Students determine required certification
5. Students propose corrective actions
6. Students explain how the flight becomes safe and legal

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Violation Identification	Complete and accurate	Mostly accurate	Partial	Limited
Certification Matching	Accurate and justified	Adequate	Limited	Minimal
Corrective Actions	Effective and realistic	Adequate	Limited	Minimal
Reasoning	Strong and logical	Adequate	Limited	Minimal

C3 Scenario (Decision-Based Application)
Students are given a flight scenario and must:
• Identify violations
• Determine correct certification
• Apply FAA rules
• Provide corrective actions
• Explain how the flight becomes **safe and legal**

Assessment Items

1. What is regulatory compliance?
   A. Ignoring rules
   B. Following FAA rules
   C. Flying faster
   D. Charging batteries
2. What makes a flight illegal?
   A. Following rules
   B. Breaking FAA regulations
   C. Flying safely
   D. Staying below 400 feet
3. What certification is required for commercial operations?
   A. TRUST
   B. Part 107
   C. None
   D. FAA permit
4. What is a violation?
   A. Following rules
   B. Breaking a rule
   C. Flying safely
   D. Landing correctly
5. What should a pilot do if a rule is broken?
   A. Ignore it
   B. Continue flying
   C. Take corrective action
   D. Increase speed

Answer Key

1. B
2. B
3. B
4. B
5. C

Closure

Drone pilots must evaluate every flight for compliance and take corrective action to ensure safe and legal operations.

Teacher Notes

• Emphasize decision-making responsibility
• Reinforce legal consequences and safety importance
• Prepare students for full regulatory application in Day 5

Week 9 – Day 5: Culminating Maneuver Application and Practice

Standards	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.01	Explain FAA rules, TRUST certification, and introductory Part 107 concepts.	B2

Objective
Students will apply FAA rules, safety procedures, and certification requirements to evaluate and complete full flight scenarios that ensure safe and legal drone operations.

Essential Question
How do drone pilots ensure every flight is both safe and legal?

Key Concepts
• Safe operations require following FAA rules
• Certification must match the type of operation
• Pilots must evaluate and adjust to maintain compliance

Vocabulary
• **Compliance Evaluation** – Determining if a flight follows all rules
• **Operational Legality** – Whether a flight meets FAA requirements
• **Risk and Regulation Alignment** – Ensuring safety decisions match legal requirements
• **Flight Authorization (Conceptual)** – Permission or approval required for certain operations

Materials Needed
• PowerPoint Presentation (Week 9 Day 5 – Compliance Capstone)
• Full scenario packets (safety + rules + certification)
• Whiteboard and markers
• Student notebooks

Bellringer
What must a pilot check before flying to ensure the flight is legal?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Safety procedures and responsibility (Day 1)
   • FAA rules and operational limits (Day 2)
   • Recreational vs commercial operations (Day 3)
   • Regulatory compliance and corrective actions (Day 4)

   Discuss:
   • What steps must a pilot take to ensure a flight is safe and legal?

Bridge to lesson:
• Today you will apply all safety and regulatory knowledge to complete full flight scenarios

---

2. Core Concept Introduction
• Safe and legal flight requires combining safety procedures, rules, and certification

Key Teaching Point:
Drone pilots must evaluate all aspects of a flight to ensure full compliance and safety

---

3. Concept Development

A. Reviewing Safety Procedures and Responsibilities
• Safety is the top priority in all operations
• Pilots are responsible for safe decisions
• Safety must be maintained before and during flight

B. Applying FAA Rules and Operational Limits
• Follow altitude, airspace, and visibility rules
• Avoid restricted or unsafe areas
• Maintain proper flight behavior

C. Matching Certification to Operation Type
• Recreational → TRUST
• Commercial → Part 107
• Certification must match flight purpose

D. Identifying Violations and Risk Factors
• Recognize unsafe or illegal conditions
• Identify incorrect certification use
• Evaluate environmental and operational risks

E. Applying Full Compliance Decision-Making
• Determine if the mission is safe and legal
• Apply corrective actions if needed
• Decide to continue, modify, or cancel the mission

Key Teaching Point:
Drone pilots must combine safety, rules, and certification to ensure compliant operations

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4. Application to Drone Flight
Students complete a full compliance evaluation of a drone mission scenario.

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5. Guided Examples / Demonstration
Instructor models a full scenario:
• Identify rules and certification
• Evaluate safety conditions
• Identify violations
• Apply corrective actions
• Determine final outcome

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6. **Real-World Connection**
   Drone pilots must ensure every flight meets safety and regulatory requirements before and during real-world operations.

---

7. **Key Reinforcement Summary**
   Safe and legal drone operations require full compliance with safety procedures, FAA rules, and certification requirements.

Formative Questions for Use in This Lesson
• What must be checked before flight?
• How do rules and certification work together?
• What makes a flight unsafe or illegal?
• What should a pilot do if a violation is identified?

Hands-On Activity
Activity Title: Full Compliance Capstone Challenge

Activity Procedure
1. Students are given a complete flight scenario
2. Students identify applicable FAA rules
3. Students determine operation type (recreational or commercial)
4. Students identify required certification
5. Students evaluate safety conditions
6. Students identify violations (if any)
7. Students apply corrective actions
8. Students determine final outcome (continue, modify, cancel)
9. Students justify their decisions

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Rule Identification	Complete and accurate	Mostly accurate	Partial	Limited
Certification Matching	Accurate and justified	Adequate	Limited	Minimal
Risk Evaluation	Strong and logical	Adequate	Limited	Minimal
Decision-Making	Effective and justified	Adequate	Limited	Minimal

---

C3 Scenario (Decision-Based Application)
Students are given a full mission scenario and must:
• Apply FAA rules
• Identify certification requirements
• Evaluate safety risks
• Identify violations
• Apply corrective actions
• Determine whether the mission is **safe and legal**
• Justify their final decision

Assessment Items

1. What is compliance evaluation?
   A. Ignoring rules
   B. Checking if rules are followed
   C. Flying faster
   D. Charging batteries
2. What determines if a flight is legal?
   A. Speed
   B. Following FAA rules
   C. Drone color
   D. Battery size
3. What certification is required for commercial operations?
   A. TRUST
   B. Part 107
   C. None
   D. FAA permit
4. What should a pilot do if a violation is found?
   A. Ignore it
   B. Continue flying
   C. Apply corrective action
   D. Increase speed
5. What is the most important priority in flight operations?
   A. Speed
   B. Appearance
   C. Safety
   D. Distance

Answer Key

1. B
2. B
3. B
4. C
5. C

Closure

Drone pilots must ensure every flight is safe and legal by applying safety procedures, FAA rules, and proper certification.

Teacher Notes

• This is a performance-based lesson—focus on student reasoning
• Reinforce full compliance thinking
• Emphasize safety over mission completion
• This completes initial Standard 105 application

Week 10 – Safety & Regulatory Operations

Week Overview
This week deepens student understanding of drone safety, legal requirements, and responsible operation. Students move beyond basic awareness into structured knowledge of FAA rules, TRUST certification concepts, and operational decision-making. Emphasis is placed on understanding regulations, applying safety procedures, and evaluating real-world flight scenarios. By the end of the week, students will be able to identify legal requirements and apply safe operational practices in preparation for more advanced flight decision-making.

Week 10 – Day 1: FAA Rules, TRUST, and Responsible Drone Operations

Standards	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.01	Explain FAA rules, TRUST certification, and introductory Part 107 concepts.	B2

Objective
Students will identify the role of the FAA, distinguish between recreational and commercial drone operations, and recognize the purpose of TRUST certification and introductory Part 107 requirements.

Essential Question
Why are FAA regulations important for safe and legal drone operations?

Key Concepts
• FAA authority over airspace
• Recreational vs commercial drone use
• TRUST certification
• Introductory Part 107 concepts
• Purpose of drone regulations
• Safe and legal operations

Vocabulary
- **FAA (Federal Aviation Administration)** – The agency that regulates aviation in the United States
- **Regulation** – A rule that must be followed during drone operations
- **Recreational Flight** – Flying a drone for fun or personal enjoyment
- **Commercial Flight** – Flying a drone for work, business, or compensation
- **TRUST Certification** – The Recreational UAS Safety Test required for recreational drone pilots
- **Part 107** – FAA rules governing commercial small drone operations

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Materials Needed
• PowerPoint presentation (FAA rules overview)
• Whiteboard / projector
• FAA rule summary handout
• Scenario cards
• Student notebooks

Bellringer
• List two rules you think drone pilots should follow
• Why are rules important in aviation?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Safety concepts from previous lessons
   • The importance of preparation before flight
   • That drone pilots are responsible for safe operation

   Ask students:
   • What could happen if drones were flown without rules?
   • Why do systems like roads and schools have rules?

   Emphasize that:
   • Rules reduce risk and create safe environments
   • Drone pilots operate in shared airspace and must follow regulations

   Bridge to lesson:
   • Drone flight is regulated to ensure safe operation for all airspace users

---

2. **Core Concept Introduction**
   • The FAA manages airspace in the United States
   • Drone pilots must follow FAA rules
   • Regulations ensure safe and legal operations

   Emphasize that:
   • Drones are classified as aircraft
   • Drone pilots are responsible for knowing and following rules

   Key Teaching Point:
   Drone pilots must follow FAA regulations to operate safely and legally

---

3. **Concept Development**
   A. **FAA Authority Over Airspace**
      • The FAA regulates all airspace in the United States
      • Drones operate within this system

      Emphasize that:
      • Drone pilots are part of the aviation system
      • Drones are considered aircraft under FAA authority

B. Recreational vs Commercial Drone Use

- Recreational: flying for personal enjoyment
- Commercial: flying for work or compensation

Examples:

- Flying at a park = recreational
- Taking photos for a business = commercial

Emphasize that:

- The purpose of the flight determines the rules

C. TRUST Certification

- Required for recreational drone pilots
- Proof of completion must be available
- Ensures understanding of safety rules

Emphasize that:

- TRUST must be completed before recreational flight

D. Basic FAA Drone Rules

Introduce key rules:

- Fly below 400 feet
- Maintain visual line of sight
- Do not fly over people
- Do not fly near emergency operations
- Follow airspace restrictions

Emphasize:

- These rules apply to all drone operations

E. Responsible Drone Operation

- Safe pilots follow rules at all times
- Responsibility includes:
  - awareness
  - decision-making
  - respect for others

Emphasize:

- Responsible operation prevents accidents

F. Introductory Part 107 Concepts

- Applies to commercial drone operations
- Requires passing an FAA knowledge test

Emphasize that:

- This course builds foundational knowledge for future certification

---

G. Purpose of Regulations

- Reduce accidents
- Protect people and property
- Organize airspace

Emphasize that:

- Following regulations is part of responsible operation

Key Teaching Point:
FAA regulations guide safe and responsible drone operations

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4. Application to Drone Flight

Students connect:

- FAA rules → safe flight decisions
- TRUST knowledge → responsible operation

Students recognize:

- Every flight must follow regulations

---

5. Guided Examples / Demonstration

Instructor presents scenarios:

- Flying near a crowd
- Flying above 400 feet
- Flying near emergency responders

Students identify:

- Which rule applies
- Whether the flight is legal

Examples:

- Flying a drone for fun at home
- Taking aerial photos for a business
- Recording a school event

Students identify:

- Recreational or commercial use
- Required certification

Sample Scenario
A student wants to use a drone to take photos for a friend's lawn care business.

- Is this recreational or commercial use?
- What certification is required?
- What rules apply before flight?

---

6. Real-World Connection

- All drone pilots must follow FAA regulations
- Required in:
  - recreational flying
  - professional operations
  - public safety

Emphasize:
• Regulations protect people and airspace

---

7. **Key Reinforcement Summary**
   • FAA regulates drone operations
   • TRUST certification is required
   • Rules apply to all pilots
   • Responsible operation is essential

   Key Teaching Point:
   Following FAA regulations ensures safe and legal drone operation.

Formative Questions for Use in This Lesson
• What is the role of the FAA?
• What is TRUST certification?
• Why must pilots follow regulations?
• What is one FAA rule for drone flight?
• How does responsible operation improve safety?

Hands-On Activity: Flight Classification Exercise
Students classify drone flight scenarios and determine required certifications.

Activity Procedure
1. Students are given flight scenarios
2. Identify applicable FAA rule
3. Determine if the flight is safe and legal
4. Explain reasoning
5. Share responses with class
6. Instructor reviews correct application

Performance Rubric

Criteria	4 – Advanced	3 – Proficient	2 – Developing	1 – Beginning
Classification Accuracy	All correct	Most correct	Some correct	Few correct
Certification Identification	All correct	Most correct	Some correct	Few correct
Reasoning	Clear and accurate	Mostly accurate	Limited clarity	Minimal understanding
Participation	Fully engaged	Mostly engaged	Some participation	Limited participation

---

Assessment Items

1. What organization regulates drone operations in the United States?
   A. NASA
   B. FAA
   C. TSA
   D. DOT
2. What type of drone flight is for personal enjoyment?
   A. Commercial
   B. Recreational
   C. Industrial
   D. Government
3. What is required for recreational drone pilots?
   A. Pilot license
   B. TRUST certification
   C. No requirement
   D. Registration only
4. What does Part 107 apply to?
   A. Recreational flying
   B. Commercial operations
   C. Drone repair
   D. Air traffic control
5. Why are FAA regulations important?
   A. Increase speed
   B. Reduce cost
   C. Ensure safety
   D. Simplify flying

Answer Key

1. B
2. B
3. B
4. B
5. C

Closure

Students summarize why FAA rules are necessary and identify one difference between recreational and commercial drone operations.

Teacher Notes

• Reinforce classification of flight purpose
• Keep explanations practical and clear
• Use relatable examples
• Prepare students for deeper regulatory application in upcoming lessons

Week 10 – Day 2: Risk Assessment and Operational Decision-Making

Standards	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.02	Apply safety procedures and risk mitigation strategies.	C3

Objective
Students will evaluate flight scenarios and apply risk mitigation strategies to determine safe drone operations.

Essential Question
How do drone pilots evaluate risk and make safe operational decisions?

Key Concepts
• Risk is present in every drone operation
• Safe flight requires identifying and reducing risk
• Environmental, equipment, and human factors affect safety
• Go/No-Go decisions are critical in drone operations
• Risk mitigation improves safe outcomes

Vocabulary
• **Risk** – The possibility of danger or failure during flight
• **Mitigation** – Actions taken to reduce risk
• **Hazard** – A condition that could cause harm or failure
• **Go/No-Go Decision** – Determining whether it is safe to fly
• **Operational Awareness** – Understanding conditions that affect flight

Materials Needed
• PowerPoint Presentation (Week 10 Day 2 – Risk Assessment and Decision-Making)
• Scenario cards or printed examples
• Whiteboard/markers
• Student notebooks

Bellringer
Prompt:
List three factors that could make flying a drone unsafe.

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Pre-flight checks include pilot, equipment, and environment
   • Safety procedures must be followed before every flight
   • Not all conditions are safe for flight

Discuss:
• What could happen if a pilot ignores a safety concern?
• Why is preparation important before flying?

Bridge to lesson:
• Safe drone pilots do more than check equipment—they evaluate risk and make decisions

---

2. Core Concept Introduction
• Every drone flight involves risk
• Pilots must identify and manage risk before takeoff

Key Teaching Point:
Safe drone operation requires evaluating conditions and making informed decisions before flight.

---

3. Concept Development

A. Identifying Risks
• Risks may come from:
  - environment (wind, obstacles)
  - equipment (damage, battery issues)
  - human factors (distraction, inexperience)

Emphasize:
• Risks must be identified before flight begins

B. Understanding Hazards
• A hazard is anything that could cause a problem

Examples:
• Trees, buildings, power lines
• People in the flight area
• Poor weather conditions

Emphasize:
• Hazards increase the likelihood of risk

C. Risk Mitigation Strategies
• Mitigation reduces or eliminates risk

Examples:
• Changing flight location
• Waiting for better weather
• Replacing damaged equipment
• Adjusting flight path

Emphasize:
• Pilots must take action to reduce risk

D. Go/No-Go Decision
Final decision before flight

Define:
• **Go** → Conditions are safe
• **No-Go** → Conditions are unsafe

Emphasize:
• Choosing not to fly is a responsible decision

E. Continuous Risk Evaluation
Risk assessment does not stop after takeoff
• Pilots must monitor conditions throughout flight

Emphasize:
• Conditions can change quickly

---

4. Application to Drone Flight
Students connect:
• Risk identification → safer planning
• Mitigation → safer execution
• Decision-making → safer outcomes

Students recognize:
• Every professional flight includes risk evaluation

---

5. Guided Examples / Demonstration
Instructor presents scenarios:
• Wind increasing during flight
• Low battery warning
• Unexpected people entering flight area

Students identify:
• Risk present
• Mitigation strategy
• Go/No-Go decision

---

6. Real-World Connection
• Professional drone pilots use risk assessment on every mission
• Required in industries such as:
  - public safety
  - construction
  - inspection

Emphasize:
• Safety decisions protect people, property, and equipment

---

7. **Key Reinforcement Summary**
   • Every flight has risk
   • Pilots must identify hazards
   • Mitigation reduces risk
   • Go/No-Go decisions ensure safety

   Key Teaching Point:
   Safe pilots make informed decisions before and during every flight.

Formative Questions for Use in This Lesson
• What is risk in drone operations?
• What is a hazard?
• How can risk be reduced?
• What is a Go/No-Go decision?
• Why is it important to evaluate conditions continuously?

Hands-On Activity
Activity Title: Risk Assessment Scenario Analysis
Objective:
Students will evaluate flight scenarios and determine safe operational decisions.

Activity Procedure
1. Students are given a flight scenario
2. Identify hazards in the scenario
3. Determine level of risk
4. Propose mitigation strategies
5. Make a Go/No-Go decision
6. Justify decision
7. Share responses with class

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Hazard Identification	All hazards identified	Most identified	Some identified	Few identified
Risk Evaluation	Accurate and detailed	Mostly accurate	Limited	Incorrect
Mitigation Strategy	Effective and realistic	Mostly effective	Limited	Missing
Decision Justification	Clear and logical	Mostly clear	Limited	Unclear

---

Scenario (C3 Application)
A student plans to fly a drone in a school field. Wind is increasing, and several people are walking nearby.
• What hazards are present?
• What risks do these hazards create?
• Should the pilot proceed with the flight? Why or why not?

Assessment Items

1. What is risk?
   A. A type of drone
   B. The possibility of danger
   C. A flight path
   D. A controller
2. What is a hazard?
   A. A safe condition
   B. A condition that could cause harm
   C. A type of battery
   D. A flight control
3. What is mitigation?
   A. Increasing speed
   B. Reducing risk
   C. Avoiding control
   D. Ignoring hazards
4. What is a Go/No-Go decision?
   A. Choosing flight speed
   B. Choosing flight direction
   C. Deciding whether to fly
   D. Choosing battery level
5. Why is risk evaluation important?
   A. To increase speed
   B. To improve safety
   C. To reduce flight time
   D. To avoid programming

Answer Key

1. B
2. B
3. B
4. C
5. B

Closure

Safe drone operation depends on identifying risks, applying mitigation strategies, and making responsible decisions.

Teacher Notes

• Reinforce decision-making as a critical pilot skill
• Encourage thoughtful analysis of scenarios
• Emphasize that safety decisions are part of professional operation
• Prepare students for continued application of safety concepts

Week 10 – Day 3: Applying Safety Procedures During Drone Operations

Standards	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.02	Apply safety procedures and risk mitigation strategies.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will apply safety procedures during simulated or real drone operations and demonstrate safe decision-making throughout flight activities.

Essential Question
How do drone pilots apply safety procedures during actual flight operations?

Key Concepts
• Safety procedures must be followed before, during, and after flight
• Pilot awareness is critical during drone operation
• Conditions can change during flight
• Safe pilots continuously evaluate and adjust
• Responsible operation prevents accidents

Vocabulary
• **Operational Safety** – Safe practices during active flight
• **Situational Awareness** – Understanding surroundings and conditions during flight
• **Flight Monitoring** – Observing drone performance and environment
• **Adjustment** – Changes made to maintain safe operation
• **Responsibility** – Accountability for safe drone use

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Flight area with defined boundaries
• Cones or markers
• Whiteboard or presentation display

Bellringer
Prompt:
What should a pilot do if conditions change while a drone is in flight?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Pre-flight checks ensure readiness
   • FAA rules must be followed
   • Risk must be evaluated before flight

   Discuss:
   • Is safety only important before takeoff?
   • What happens if conditions change during flight?

   Bridge to lesson:
   • Safety does not stop after takeoff—pilots must actively manage safety during flight

---

2. **Core Concept Introduction**

   • Safe operation requires continuous awareness
   • Pilots must monitor conditions and respond appropriately

   Key Teaching Point:
   Safe drone pilots continuously evaluate and adjust during flight to maintain safe operation.

---

3. **Concept Development**

   A. Situational Awareness During Flight

   • Pilots must monitor:
     - surroundings
     - obstacles
     - people
     - weather conditions

   Emphasize:
   • Conditions can change quickly during flight

   B. Monitoring Drone Performance

   • Pilots observe:
     - stability
     - responsiveness
     - battery level

   Emphasize:
   • Early detection of issues prevents accidents

   C. Responding to Changing Conditions

   Examples:
   • Wind increases
   • People enter flight area
   • Drone becomes unstable

Appropriate responses:
• Adjust flight path
• Reduce altitude
• Land if necessary

Emphasize:
• Quick, controlled decisions improve safety

D. Maintaining Safe Flight Behavior
• Smooth control inputs
• Avoid aggressive movement
• Maintain safe distance from hazards

Emphasize:
• Controlled flight reduces risk

E. Responsibility During Operation
• Pilot is responsible for:
  - safety of others
  - equipment
  - flight decisions

Emphasize:
• Responsibility continues throughout the entire flight

---

4. Application to Drone Flight
Students apply:
• Continuous monitoring
• Real-time decision-making
• Safe adjustments during flight

Students recognize:
• Safety is an active process, not a one-time step

---

5. Guided Examples / Demonstration
Instructor demonstrates scenarios:
• Wind affecting drone stability
• Low battery warning
• Obstacle appearing in flight path

Students identify:
• What is happening
• What action should be taken
• Why the action improves safety

---

6. **Real-World Connection**
   • Professional pilots monitor conditions throughout flight
   • Required in:
     - inspection operations
     - public safety missions
     - commercial drone work

   Emphasize:
   • Continuous safety awareness is a professional expectation

---

7. **Key Reinforcement Summary**
   • Safety continues during flight
   • Pilots must monitor conditions
   • Adjustments maintain safe operation
   • Responsibility remains with the pilot

   Key Teaching Point:
   Safe drone operation requires constant awareness and timely adjustments.

Formative Questions for Use in This Lesson
• What is situational awareness?
• Why must pilots monitor conditions during flight?
• What should a pilot do if conditions change?
• How can a pilot maintain safe flight behavior?
• Why is responsibility important during flight?

Hands-On Activity
Activity Title: In-Flight Safety Response Practice
Objective:
Students will demonstrate safe flight adjustments in response to changing conditions.

Activity Procedure

1. Students perform controlled takeoff
2. Maintain stable hover
3. Instructor introduces simulated changes:
   - obstacle
   - wind condition (verbal cue)
   - restricted area
4. Students adjust flight accordingly
5. Demonstrate controlled landing
6. Reflect on decisions made

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Situational Awareness	Consistently aware and responsive	Mostly aware	Limited awareness	Unaware
Response to Conditions	Immediate and correct	Mostly correct	Delayed response	Incorrect
Flight Control	Smooth and controlled	Mostly stable	Some instability	Uncontrolled
Safety Behavior	Consistently safe	Mostly safe	Some unsafe actions	Unsafe

---

Scenario (C3 Application)
A student is flying a drone when wind suddenly increases and the drone begins drifting toward a group of people.

• What immediate action should the pilot take?
• What safety procedure is being applied?
• Why is this response important?

Assessment Items

1. What is situational awareness?
   A. Flying fast
   B. Understanding surroundings during flight
   C. Increasing altitude
   D. Ignoring conditions

2. What should a pilot monitor during flight?
   A. Only the drone
   B. Only the controller
   C. Drone and surroundings
   D. Only the weather

3. What should a pilot do if wind increases?
   A. Ignore it
   B. Fly faster
   C. Adjust or land
   D. Increase altitude

4. Why is monitoring battery important?
   A. To increase speed
   B. To prevent loss of control
   C. To improve the signal
   D. To reduce drag

5. Who is responsible for safe operation?
   A. The instructor
   B. The drone
   C. The pilot
   D. The manufacturer

Answer Key

1. B
2. C
3. C
4. B
5. C

Closure

Safe drone pilots continuously monitor conditions and make adjustments to maintain safe operation throughout flight.

Teacher Notes

• Reinforce real-time decision-making
• Emphasize safety as an ongoing process
• Encourage controlled and thoughtful responses
• Prepare students for final safety application and transition

Week 10 – Day 4: Demonstrating Safe and Responsible Drone Operations

Standards	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.02	Apply safety procedures and risk mitigation strategies.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will demonstrate safe drone operation by applying pre-flight, in-flight, and post-flight safety procedures during a structured flight activity.

Essential Question
What does safe and responsible drone operation look like during a complete flight?

Key Concepts
• Safe operation includes all phases of flight
• Pre-flight, in-flight, and post-flight procedures are connected
• Responsible pilots follow safety practices consistently
• Situational awareness is required throughout the flight
• Safe behavior prevents accidents and improves outcomes

Vocabulary
• **Pre-Flight** – Actions taken before flight to ensure safety
• **In-Flight** – Actions taken during active drone operation
• **Post-Flight** – Actions taken after landing
• **Safe Operation** – Conducting flight without risk to people or property
• **Procedure** – A set of steps followed to complete a task

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Designated flight area
• Cones or markers
• Pre-flight checklist (if available)
• Whiteboard or presentation display

Bellringer
Prompt:
Why is it important to follow the same safety steps every time you fly?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Pre-flight checks ensure readiness
   • Risk must be evaluated before flight
   • Pilots must monitor conditions during operation

   Discuss:
   • What steps are required before flying?
   • What should a pilot do during flight to stay safe?

   Bridge to lesson:
   • Safe drone operation requires following procedures before, during, and after every flight

---

2. **Core Concept Introduction**

   • Safe operation is a complete process, not a single step
   • All phases of flight must follow safety procedures

   Key Teaching Point:
   Safe and responsible drone pilots follow structured procedures throughout the entire flight process.

---

3. **Concept Development**

   A. Pre-Flight Procedures

   • Check:
     - pilot readiness
     - equipment condition
     - environment

   Emphasize:
   • Safe flights begin before takeoff

   B. In-Flight Procedures

   • Maintain:
     - situational awareness
     - control of the drone
     - safe distance from hazards

   Emphasize:
   • Continuous monitoring ensures safety

   C. Post-Flight Procedures

   • After landing:
     - power down safely
     - inspect equipment
     - evaluate flight performance

   Emphasize:
   • Post-flight actions prepare for future flights

D. Consistency in Safety Procedures
- Safe pilots follow the same steps every time
- Consistency reduces errors

Emphasize:
- Repetition builds safe habits

E. Responsibility in Drone Operation
- Pilots are responsible for:
  - safety of people
  - equipment
  - compliance with rules

Emphasize:
- Responsibility applies at all times

---

4. Application to Drone Flight

Students apply:
- Complete flight procedure:
  - pre-flight
  - flight
  - post-flight

Students recognize:
- Safe operation requires attention at every stage

---

5. Guided Examples / Demonstration

Instructor demonstrates:
- Pre-flight check
- Controlled takeoff and hover
- Safe navigation
- Controlled landing
- Post-flight inspection

Students identify:
- Safety steps at each stage

---

6. Real-World Connection
- Professional drone pilots follow structured procedures
- Used in:
  - commercial operations
  - public safety
  - inspection missions

Emphasize:
- Consistent procedures are industry standard

---

7. **Key Reinforcement Summary**
   - Safe operation includes all phases of flight
   - Procedures must be followed consistently
   - Awareness and responsibility are essential
   - Safe habits prevent accidents

   Key Teaching Point:
   Safe drone operation is a complete process that requires consistency and responsibility.

Formative Questions for Use in This Lesson

- What are the three phases of drone operation?
- Why are pre-flight procedures important?
- What must a pilot do during flight?
- What happens after landing?
- Why is consistency important?

Hands-On Activity
Activity Title: Complete Safe Flight Procedure
Objective:
Students will perform a full flight sequence while demonstrating all safety procedures.

Activity Procedure

1. Students complete pre-flight check
2. Perform controlled takeoff
3. Maintain stable hover
4. Navigate within flight area
5. Demonstrate situational awareness
6. Perform controlled landing
7. Conduct post-flight check

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Pre-Flight Procedures	Complete and accurate	Mostly complete	Some steps missing	Incomplete
In-Flight Control	Smooth and controlled	Mostly stable	Some instability	Uncontrolled
Situational Awareness	Consistently aware	Mostly aware	Limited awareness	Unaware
Post-Flight Procedures	Complete and accurate	Mostly complete	Some steps missing	Incomplete

---

Scenario (C3 Application)
A student completes a flight but immediately turns off the controller without checking the drone or surrounding area.

• What step was missed?
• Why is this important?
• What should the student do after every flight?

Assessment Items

1. What is pre-flight?
   A. Flying the drone
   B. Actions before flight
   C. Actions after landing
   D. Emergency response
2. What must a pilot do during flight?
   A. Ignore surroundings
   B. Maintain awareness
   C. Increase speed
   D. Change settings randomly
3. What is post-flight?
   A. Pre-flight check
   B. During flight
   C. After landing procedures
   D. Emergency procedures
4. Why are procedures important?
   A. To increase speed
   B. To reduce control
   C. To improve safety
   D. To avoid rules
5. What is the pilot responsible for?
   A. Only the drone
   B. Only the controller
   C. Safety and operation
   D. Only speed

Answer Key

1. B
2. B
3. C
4. C
5. C

Closure
Safe drone pilots follow consistent procedures before, during, and after every flight to ensure safe and responsible operation.

Teacher Notes
• Reinforce full-flight safety process
• Emphasize consistency and habit-building
• Encourage careful and controlled flight behavior
• Prepare students for final application and transition

Week 10 – Day 5: Comprehensive Safety Evaluation and Flight Decision-Making

Standards	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.02	Apply safety procedures and risk mitigation strategies.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will evaluate complete flight scenarios, apply safety procedures, and justify Go/No-Go decisions based on risk assessment and operational conditions.

Essential Question
How do drone pilots make safe and responsible decisions before and during flight operations?

Key Concepts
• Safe flight requires evaluation of all conditions
• Risk assessment guides decision-making
• Go/No-Go decisions determine flight safety
• Safety procedures must be applied consistently
• Responsible pilots justify their decisions

Vocabulary
• **Risk Assessment** – The process of evaluating potential hazards before and during flight
• **Decision-Making** – Choosing appropriate actions based on conditions
• **Go Decision** – Determining that conditions are safe for flight
• **No-Go Decision** – Determining that conditions are unsafe for flight
• **Evaluation** – Judging conditions to make informed decisions

Materials Needed
• Scenario cards or printed flight scenarios
• Classroom drones (optional for demonstration)
• Whiteboard/markers
• Student notebooks

Bellringer
Prompt:
What is the most important factor to consider before deciding to fly a drone?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • FAA rules must be followed
   • Pre-flight checks identify risks
   • Safety procedures apply during flight
   • Safe operation includes all phases of flight

   Discuss:
   • What steps are required before flying?
   • What factors determine if a flight is safe?

   Bridge to lesson:
   • Safe pilots use all of these concepts together to make informed decisions

---

2. **Core Concept Introduction**
   • Safe drone operation depends on decision-making
   • Pilots must evaluate all conditions before and during flight

   Key Teaching Point:
   Safe drone pilots combine knowledge, awareness, and judgment to make responsible flight decisions.

---

3. **Concept Development**

   A. Reviewing Safety Procedures
   • Pre-flight:
     - pilot readiness
     - equipment check
     - environment evaluation

   • In-flight:
     - monitoring conditions
     - maintaining control

   • Post-flight:
     - inspection
     - evaluation

   Emphasize:
   • All phases contribute to safe operation

   B. Comprehensive Risk Assessment
   • Evaluate:
     - environment
     - equipment
     - people
     - airspace

   Emphasize:
   • Multiple factors affect safety

C. Making Go/No-Go Decisions

- Based on:
  - risk level
  - ability to mitigate hazards

Define:

- Go → safe to proceed
- No-Go → unsafe conditions

Emphasize:

- Choosing not to fly is a correct decision when risk is high

D. Justifying Decisions

- Pilots must explain:
  - identified risks
  - mitigation strategies
  - final decision

Emphasize:

- Clear reasoning improves safety

E. Applying Safety in Real Scenarios

- Combine:
  - rules
  - procedures
  - awareness
  - judgment

Emphasize:

- Safe operation requires all elements working together

4. Application to Drone Flight

Students apply:

- Full safety process
- Risk evaluation
- Decision-making

Students recognize:

- Safe operation is based on informed judgment

5. Guided Examples / Demonstration

Instructor presents multiple scenarios:

- Crowded area
- Changing weather
- Equipment concern

Students identify:
• Hazards
• Risk level
• Mitigation
• Go/No-Go decision

---

6. Real-World Connection
• Professional drone pilots must evaluate risk before every mission
• Required in:
  - public safety
  - inspections
  - commercial operations

Emphasize:
• Decision-making is a critical professional skill

---

7. Key Reinforcement Summary
• Safe flight requires evaluation
• Risk must be assessed
• Decisions must be justified
• Responsible pilots prioritize safety

Key Teaching Point:
Safe drone pilots make informed decisions based on risk, conditions, and responsibility.

Formative Questions for Use in This Lesson
• What is risk assessment?
• What factors must be evaluated before flight?
• What is a Go/No-Go decision?
• Why must decisions be justified?
• How do safety procedures support decision-making?

Hands-On Activity
Activity Title: Comprehensive Flight Scenario Evaluation
Objective:
Students will evaluate scenarios and make justified flight decisions.

Activity Procedure
1. Students are given a detailed flight scenario
2. Identify hazards
3. Evaluate risk level
4. Propose mitigation strategies
5. Make Go/No-Go decision
6. Justify decision
7. Present findings to class

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Hazard Identification	All hazards identified	Most identified	Some identified	Few identified
Risk Evaluation	Accurate and detailed	Mostly accurate	Limited	Incorrect
Decision-Making	Logical and justified	Mostly logical	Limited reasoning	Unclear
Participation	Fully engaged	Mostly engaged	Some participation	Minimal

---

Scenario (C3 Application)

A student plans to fly a drone near a construction site. There are cranes, workers in the area, and moderate wind conditions.

• What hazards are present?
• What risks do these hazards create?
• What mitigation strategies could be applied?
• Should the pilot proceed with the flight? Why or why not?

Assessment Items

1. What is risk assessment?
   A. Increasing speed
   B. Evaluating potential hazards
   C. Flying higher
   D. Ignoring conditions

2. What does a Go decision mean?
   A. Stop flying
   B. Conditions are safe
   C. Increase speed
   D. Change direction

3. What should a pilot do if risk is too high?
   A. Continue flight
   B. Ignore conditions
   C. Make a No-Go decision
   D. Increase altitude

4. Why must decisions be justified?
   A. To increase speed
   B. To improve safety reasoning
   C. To reduce battery use
   D. To avoid rules

5. What is a key responsibility of a drone pilot?
   A. Flying fast
   B. Ignoring hazards
   C. Making safe decisions
   D. Avoiding control

Answer Key

1. B
2. B
3. C
4. B
5. C

Closure

Safe drone operation requires evaluating risks, applying safety procedures, and making responsible decisions before and during every flight.

Teacher Notes

• Emphasize critical thinking and justification
• Encourage discussion of multiple perspectives
• Reinforce safety as the top priority
• Prepare students for transition to next unit

Week 11 Precision Flight and Stability Control

Week 11 Overview
Week 11 transitions students into advanced flight performance with a focus on precision control and stability. Students move beyond basic maneuvering to develop consistent, repeatable flight skills through controlled hover, directional accuracy, and smooth input management. Emphasis is placed on minimizing overcorrection, maintaining stability under varying conditions, and refining pilot response. These skills establish the foundation for mission-based flight and advanced operational applications in the weeks ahead.

Week 11 – Day 1: Precision Hover and Stability Control

Standards	Description	RBT Level
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.01	Execute basic drone flight maneuvers including hover, yaw, and directional control.	B2

Objective
Students will demonstrate precision hover by maintaining a stable drone position using small, controlled inputs.

Essential Question
How do precise control inputs improve drone stability during hover?

Key Concepts
• Precision hover requires balanced forces
• Small control inputs maintain stability
• Overcorrection causes instability
• Consistent control improves performance
• Stability is the foundation of all drone movement

Vocabulary
• **Hover** – Maintaining a fixed position in the air
• **Stability** – Maintaining controlled and steady flight
• **Precision** – Accurate and controlled movement
• **Overcorrection** – Excessive control input that causes instability
• **Control Input** – Movement of controls used to direct the drone

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Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Marked hover zones (floor markers or cones)
• Open flight space
• Whiteboard or presentation display

Bellringer
Prompt:
Why is it harder to keep a drone still than to move it?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Basic flight maneuvers (takeoff, hover, landing)
   • Precision control and small inputs
   • Effects of overcorrection on stability

   Discuss:
   • What happens when control inputs are too large?
   • Why does a drone drift during hover?

   Bridge to lesson:
   • Stable hover is the foundation for all advanced drone maneuvers

---

2. **Core Concept Introduction**
   • Hovering requires balanced forces and continuous adjustment
   • Stability depends on precise control inputs

   Key Teaching Point:
   Precision hover is achieved through small, consistent adjustments that maintain balance.

---

3. **Concept Development**
   A. Understanding Precision Hover
   - A stable hover maintains position:
     - vertically
     - horizontally
   - Emphasize:
     • Perfect stillness is not required—control is the goal

   B. Small Control Inputs
   - Small adjustments:
     - prevent drift
     - maintain balance
   - Large inputs:
     - cause instability
     - require correction
   - Emphasize:
     Precision comes from minimal movement

   C. Causes of Drift
   - Environmental factors:
     - airflow
     - uneven surfaces

- Pilot factors:
  - delayed reaction
  - excessive input
- Emphasize:
  - Drift is normal—control corrects it

D. Managing Overcorrection

- Overcorrection creates:
  - oscillation
  - loss of stability
- Emphasize:
  - Controlled inputs reduce correction cycles

E. Building Consistency

- Repetition improves:
  - control
  - reaction time
  - stability
- Emphasize:
  - Consistency leads to mastery

4. Application to Drone Flight

Students apply:
- Controlled takeoff
- Stable hover within a defined area
- Small adjustments to maintain position

Students recognize:
- Hover control is required before advanced movement

---

5. Guided Examples / Demonstration

Instructor demonstrates:
- Stable hover using small inputs
- Unstable hover using large inputs

Students identify:
- Differences in control
- Impact of input size on stability

---

6. Real-World Connection

- Precision hover is required in:
  - inspection
  - photography
  - confined space operations

Emphasize:
- Stability ensures accuracy and safety

---

7. **Key Reinforcement Summary**
   • Hover requires balanced forces
   • Small inputs maintain stability
   • Overcorrection reduces control
   • Practice improves precision

   Key Teaching Point:
   Precision hover is the foundation for all controlled drone flight.

Formative Questions for Use in This Lesson
• What is a hover?
• Why are small inputs important?
• What causes drift?
• What is overcorrection?
• How can a pilot improve stability?

Hands-On Activity
Activity Title: Precision Hover Challenge
Objective:
Students will maintain a stable hover within a defined boundary using precise control inputs.

Activity Procedure

1. Students perform controlled takeoff
2. Establish hover within marked zone
3. Maintain position for a set time (e.g., 10–15 seconds)
4. Use small inputs to correct drift
5. Repeat multiple attempts to improve performance
6. Reflect on control improvements

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Hover Stability	Maintains precise position consistently	Mostly stable	Some drift	Unstable
Control Input	Small and controlled	Mostly controlled	Some overcorrection	Excessive input
Consistency	Repeats performance reliably	Mostly consistent	Inconsistent	Unpredictable
Focus & Participation	Fully engaged	Mostly engaged	Some participation	Minimal

---

Scenario (C3 Application)
A student attempts to hover but the drone continuously drifts and oscillates due to large control inputs.

• What is causing the instability?
• What adjustment should the pilot make?
• How can the pilot improve hover control?

Assessment Items

1. What is a hover?
   A. Moving forward
   B. Maintaining position in the air
   C. Landing
   D. Rotating
2. What type of inputs improve stability?
   A. Large inputs
   B. Sudden inputs
   C. Small, controlled inputs
   D. No inputs
3. What is overcorrection?
   A. Balanced control
   B. Excessive input causing instability
   C. Stable flight
   D. Slow movement
4. What causes drift?
   A. Balanced forces
   B. Environmental and control factors
   C. Increased lift only
   D. Reduced drag
5. How does practice improve hover?
   A. Reduces effort
   B. Improves consistency and control
   C. Increases speed
   D. Eliminates movement

Answer Key

1. B
2. C
3. B
4. B
5. B

Closure
Precision hover is achieved through small, controlled inputs that maintain stability and prepare pilots for advanced maneuvers.

Teacher Notes
• Emphasize repetition and patience
• Encourage small adjustments over large corrections
• Reinforce stability before movement
• Prepare students for directional precision (Day 2)

Week 11 – Day 2: Directional Control and Positional Accuracy

Standard	Description	RBT Level
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.01	Execute basic drone flight maneuvers including hover, yaw, and directional control.	C3

Objective
Students will demonstrate directional control by moving the drone accurately along defined paths while maintaining stability.

Essential Question
How does directional control improve positional accuracy during drone flight?

Key Concepts
• Directional control requires precision and timing
• Accurate movement depends on controlled inputs
• Smooth transitions improve flight stability
• Orientation affects control decisions
• Positional accuracy requires consistency

Vocabulary
• **Directional Control** – The ability to move a drone accurately in a specific direction
• **Orientation** – The direction the drone is facing
• **Positional Accuracy** – The ability to reach and maintain a specific location
• **Transition** – Movement from one position to another
• **Alignment** – Maintaining correct direction during movement

---

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Floor markers or cones (to create paths)
• Open flight area
• Whiteboard or presentation display

Bellringer
Prompt:
Why is it more difficult to fly in a straight line than to hover in one place?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Precision hover requires small control inputs
   • Stability is maintained through consistent adjustments
   • Overcorrection causes instability

Discuss:
• What happens when a drone drifts during movement?
• How does hover control support movement?

Bridge to lesson:
• Controlled movement builds on stable hover and requires precise directional inputs

---

2. Core Concept Introduction
• Directional control allows the drone to move accurately along a path
• Positional accuracy depends on control, timing, and orientation

Key Teaching Point:
Accurate drone movement requires controlled inputs, proper orientation, and consistent correction.

---

3. Concept Development

A. Directional Movement Fundamentals
• Movement directions include:
  ○ forward
  ○ backward
  ○ left
  ○ right
• Each direction requires:
  ○ controlled input
  ○ stable hover before movement

Emphasize:
• Movement begins from a stable position

B. Maintaining Straight-Line Flight
• Straight-line movement requires:
  ○ consistent input
  ○ minimal correction
• Common issues:
  ○ drifting off path
  ○ uneven input

Emphasize:
• Small corrections maintain alignment

C. Role of Orientation
• Drone direction affects control:
  ○ forward changes based on orientation
  ○ pilot perspective may shift

Emphasize:
• Understanding orientation improves control accuracy

D. Smooth Transitions Between Movements

- Transitions require:
  - controlled stopping
  - gradual input changes
- Abrupt changes cause:
  - instability
  - loss of accuracy

Emphasize:

- Smooth movement improves control

E. Building Positional Accuracy

- Accuracy improves with:
  - repetition
  - controlled inputs
  - awareness of position

Emphasize:

- Precision movement leads to repeatable results

---

4. Application to Drone Flight

Students apply:

- Controlled takeoff and hover
- Straight-line movement between markers
- Controlled stopping at target points

Students recognize:

- Accurate movement requires planning and control

---

5. Guided Examples / Demonstration

Instructor demonstrates:

- Straight-line movement between two points
- Controlled stop at target location
- Incorrect movement with drift

Students identify:

- Differences in control
- Causes of positional error

---

6. Real-World Connection

- Directional accuracy is required in:
  - inspections
  - mapping
  - obstacle navigation

Emphasize:

- Precision movement improves mission success

---

7. **Key Reinforcement Summary**
   • Directional control improves accuracy
   • Orientation affects movement
   • Smooth transitions improve stability
   • Practice builds consistency

   Key Teaching Point:
   Accurate drone movement depends on controlled inputs, orientation awareness, and smooth transitions.

Formative Questions for Use in This Lesson
• What is directional control?
• Why is straight-line movement difficult?
• How does orientation affect control?
• What causes drift during movement?
• How can positional accuracy be improved?

Hands-On Activity
Activity Title: Straight-Line Flight Challenge
Objective:
Students will demonstrate positional accuracy by flying along a defined path and stopping at target points.

Activity Procedure

1. Students perform controlled takeoff
2. Establish stable hover
3. Fly forward along marked path
4. Stop at designated point
5. Maintain position briefly
6. Repeat movement in different directions
7. Reflect on accuracy and control

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Directional Accuracy	Precise path maintained	Mostly accurate	Some deviation	Off path
Control Input	Smooth and controlled	Mostly controlled	Some overcorrection	Uncontrolled
Stopping Accuracy	Stops precisely at target	Close to target	Some error	Misses target
Consistency	Repeats accurately	Mostly consistent	Inconsistent	Unpredictable

---

Scenario (C3 Application)
A student attempts to fly in a straight line but the drone drifts to the side and misses the target position.

• What is causing the drift?
• What adjustment should the pilot make?
• How can the pilot improve directional accuracy?

Assessment Items

1. What is directional control?
   A. Hovering in place
   B. Moving accurately in a direction
   C. Increasing speed
   D. Landing
2. What helps maintain a straight path?
   A. Large inputs
   B. Sudden movements
   C. Small corrections
   D. No control
3. What affects directional control?
   A. Battery only
   B. Orientation
   C. Color of drone
   D. Speed only
4. What improves positional accuracy?
   A. Random movement
   B. Repetition and control
   C. Increasing speed
   D. Ignoring drift
5. What causes deviation from path?
   A. Balanced control
   B. Controlled input
   C. Drift and overcorrection
   D. Stable hover

Answer Key

1. B
2. C
3. B
4. B
5. C

Closure
Directional control and positional accuracy are achieved through controlled inputs, proper orientation, and consistent practice.

Teacher Notes
• Reinforce smooth and controlled movement
• Emphasize importance of orientation
• Encourage repetition for improvement
• Prepare students for multi-directional patterns (Day 3)

Week 11 – Day 3: Multi-Directional Movement and Flight Path Control

Standard	Description	RBT Level
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.01	Execute basic drone flight maneuvers including hover, yaw, and directional control.	C3

Objective
Students will demonstrate controlled multi-directional movement by navigating a defined flight path using smooth transitions and precise inputs.

Essential Question
How do smooth transitions and directional control improve multi-directional flight accuracy?

Key Concepts
• Multi-directional movement requires coordination of controls
• Smooth transitions maintain stability
• Flight paths require planning and control
• Sudden inputs reduce accuracy
• Consistency improves performance

Vocabulary
• **Flight Path** – The route a drone follows during movement
• **Transition** – Movement from one direction to another
• **Coordination** – Using multiple controls together effectively
• **Path Control** – Maintaining movement along a defined route
• **Adjustment** – Small corrections made during flight

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Floor markers or cones (to create flight patterns)
• Open flight space
• Whiteboard or presentation display

Bellringer
Prompt:
Why is changing direction more difficult than flying in a straight line?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Stable hover supports controlled movement
   • Directional control improves accuracy
   • Small inputs reduce drift

Discuss:
• What happens when a drone changes direction too quickly?
• Why are transitions important during flight?

Bridge to lesson:
• Multi-directional movement builds on directional control and requires smooth transitions

---

2. Core Concept Introduction
• Flight paths require movement in multiple directions
• Smooth transitions maintain control and accuracy

Key Teaching Point:
Controlled multi-directional flight depends on smooth transitions and coordinated inputs.

---

3. Concept Development

A. Understanding Multi-Directional Movement
• Movement includes combinations of:
  - forward and backward
  - left and right
  - turning (yaw)
• Requires coordination of multiple inputs

Emphasize:
• Movement is not isolated—controls work together

B. Planning a Flight Path
• A flight path includes:
  - starting position
  - movement sequence
  - stopping points

• Examples:
  - square pattern
  - rectangle
  - simple course

Emphasize:
• Planning improves accuracy

C. Smooth Transitions Between Directions
• Transitions require:
  - controlled stopping
  - gradual change in input

• Poor transitions cause:
  - drift
  - instability

Emphasize:
• Smooth changes maintain control

D. Coordinating Controls

• Effective movement requires:
  - timing
  - balance of inputs

• Overuse of one control:
  - reduces accuracy

Emphasize:
• Coordination improves efficiency

E. Maintaining Path Accuracy

• Accuracy requires:
  - consistent speed
  - controlled input
  - continuous correction

Emphasize:
• Small adjustments keep the drone on path

4. Application to Drone Flight

Students apply:
• Controlled takeoff and hover
• Navigate a multi-directional path (e.g., square pattern)
• Maintain control during transitions
• Stop at defined points

Students recognize:
• Path control requires planning and coordination

5. Guided Examples / Demonstration

Instructor demonstrates:
• Square flight pattern with smooth transitions
• Same pattern with abrupt changes

Students identify:
• Differences in control and accuracy
• Effects of transitions on stability

6. Real-World Connection

• Multi-directional flight is used in:
  - inspections
  - obstacle navigation
  - search operations

Emphasize:
• Accurate path control is essential for mission success

7. **Key Reinforcement Summary**
   • Multi-directional movement requires coordination
   • Smooth transitions maintain stability
   • Flight paths improve control
   • Practice increases accuracy

   Key Teaching Point:
   Effective drone movement requires coordinated control and smooth transitions between directions.

Formative Questions for Use in This Lesson
• What is a flight path?
• Why are transitions important?
• How does coordination affect control?
• What causes instability during direction changes?
• How can path accuracy be improved?

Hands-On Activity
Activity Title: Square Flight Path Challenge
Objective:
Students will navigate a square flight path using controlled multi-directional movement.

Activity Procedure

1. Students perform controlled takeoff
2. Establish stable hover
3. Fly forward to first marker
4. Stop and transition to next direction
5. Continue pattern to complete square
6. Maintain control at each corner
7. Repeat to improve accuracy

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Path Accuracy	Precise and consistent	Mostly accurate	Some deviation	Off path
Transitions	Smooth and controlled	Mostly smooth	Some abrupt changes	Uncontrolled
Control Coordination	Highly coordinated	Mostly coordinated	Some difficulty	Poor coordination
Consistency	Repeats accurately	Mostly consistent	Inconsistent	Unpredictable

---

Scenario (C3 Application)
A student is flying a square pattern but overshoots each corner and struggles to change direction smoothly.

- What is causing the overshooting?
- What adjustment should the pilot make?
- How can the pilot improve transition control?

Assessment Items

1. What is a flight path?
   A. Hover position
   B. Route a drone follows
   C. Speed setting
   D. Landing zone
2. What improves multi-directional control?
   A. Large inputs
   B. Smooth transitions
   C. Sudden movement
   D. Increased speed
3. What happens with poor transitions?
   A. Improved stability
   B. Reduced movement
   C. Drift and instability
   D. Faster control
4. What is coordination?
   A. Using one control
   B. Ignoring inputs
   C. Using controls together effectively
   D. Increasing altitude
5. How is path accuracy maintained?
   A. No correction
   B. Large inputs
   C. Small adjustments
   D. Increased speed

Answer Key

1. B
2. B
3. C
4. C
5. C

Closure
Multi-directional flight requires coordinated control, smooth transitions, and consistent adjustments to maintain an accurate flight path.

Teacher Notes
• Reinforce smooth transitions over speed
• Emphasize stopping before direction change
• Encourage repetition for consistency
• Prepare students for precision pattern refinement (Day 4)

Week 11 – Day 4: Precision Pattern Execution and Control Consistency

Standard	Description	RBT Level
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.01	Execute basic drone flight maneuvers including hover, yaw, and directional control.	C3
106.02	Demonstrate controlled takeoff, navigation, and landing procedures.	C3

Objective
Students will demonstrate consistent control by executing repeated flight patterns with precision and minimal deviation.

Essential Question
How does consistency improve precision and control during repeated drone maneuvers?

Key Concepts
• Consistency improves flight accuracy
• Repetition builds control and confidence
• Precision patterns require planning and execution
• Smooth control inputs reduce error
• Controlled navigation improves performance

Vocabulary
• **Consistency** – Performing actions the same way repeatedly
• **Pattern Execution** – Following a planned flight path accurately
• **Deviation** – Movement away from the intended path
• **Repetition** – Repeating an action to improve performance
• **Control Precision** – Accurate and controlled movement

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Floor markers or cones (pattern layout)
• Open flight area
• Whiteboard or presentation display

Bellringer
Prompt:
Why is repeating the same movement important for improving performance?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Directional control improves accuracy
   • Smooth transitions maintain stability
   • Multi-directional movement requires coordination

   Discuss:
   • What happens when movements are inconsistent?
   • Why is repetition important for skill development?

   Bridge to lesson:
   • Consistent execution of flight patterns improves control and prepares pilots for real-world operations

---

2. **Core Concept Introduction**

   • Precision improves through consistent execution
   • Repeating flight patterns builds control and reduces error

   Key Teaching Point:
   Consistent execution of controlled flight patterns leads to improved precision and reliable performance.

---

3. **Concept Development**

   A. **Importance of Consistency in Flight**

      • Consistency allows:
        - predictable movement
        - reduced errors
        - improved control

      • Inconsistent control causes:
        - deviation
        - instability

      Emphasize:
      • Repetition builds reliable performance

   B. **Understanding Flight Patterns**

      • Patterns include:
        - square
        - rectangle
        - linear routes

      • Each pattern requires:
        - defined path
        - controlled transitions

      Emphasize:
      • Patterns provide structure for practice

C. Reducing Deviation

• Deviation occurs when:
  - inputs are too large
  - transitions are abrupt

• Controlled inputs:
  - maintain path accuracy

Emphasize:
• Small corrections keep the drone on course

D. Repetition and Skill Development

• Repetition improves:
  - reaction time
  - control accuracy
  - confidence

Emphasize:
• Practice leads to consistency

E. Full Pattern Execution

• Requires:
  - takeoff
  - navigation
  - stopping control
  - landing

Emphasize:
• All phases must be controlled and consistent

---

4. Application to Drone Flight

Students apply:
• Execute a defined flight pattern
• Repeat pattern multiple times
• Maintain accuracy and consistency

Students recognize:
• Consistent performance improves control

---

5. Guided Examples / Demonstration

Instructor demonstrates:
• Accurate repeated pattern execution
• Inconsistent pattern with deviation

Students identify:
• Differences in control and consistency
• Impact of repetition on performance

---

6. **Real-World Connection**
   • Consistent flight patterns are used in:
     - inspections
     - mapping operations
     - repeated flight missions

   Emphasize:
   • Reliability is critical in professional drone operations

---

7. **Key Reinforcement Summary**
   • Consistency improves precision
   • Repetition builds control
   • Patterns develop accuracy
   • Controlled inputs reduce deviation

   Key Teaching Point:
   Consistent execution of flight patterns leads to reliable and accurate drone control.

Formative Questions for Use in This Lesson
• Why is consistency important?
• What is deviation?
• How does repetition improve performance?
• What causes inconsistent movement?
• How can a pilot reduce error?

Hands-On Activity
Activity Title: Repeated Pattern Precision Challenge
Objective:
Students will execute and repeat a flight pattern while maintaining consistent accuracy.

Activity Procedure
1. Students perform controlled takeoff
2. Establish stable hover
3. Execute a square or rectangular pattern
4. Land safely
5. Repeat the same pattern multiple times
6. Compare performance across attempts
7. Reflect on improvements

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Pattern Accuracy	Highly precise and consistent	Mostly accurate	Some deviation	Inaccurate
Consistency	Repeats pattern reliably	Mostly consistent	Some variation	Inconsistent
Control Precision	Smooth and controlled	Mostly controlled	Some instability	Uncontrolled
Completion	Fully completes all phases	Mostly complete	Partial completion	Incomplete

---

Scenario (C3 Application)
A student completes a flight pattern but each attempt looks different, with varying path accuracy and stopping points.

• What is causing the inconsistency?
• What should the pilot focus on improving?
• How can repetition improve performance?

Assessment Items

1. What does consistency mean?
   A. Random movement
   B. Repeating actions the same way
   C. Increasing speed
   D. Changing direction

2. What is deviation?
   A. Staying on path
   B. Movement away from intended path
   C. Hovering
   D. Landing

3. What improves consistency?
   A. Random inputs
   B. Repetition
   C. Large movements
   D. Ignoring errors

4. What causes inconsistent flight?
   A. Controlled inputs
   B. Smooth transitions
   C. Uneven control inputs
   D. Stable hover

5. What is the benefit of repeating patterns?
   A. Reduces control
   B. Improves accuracy and performance
   C. Increases speed
   D. Eliminates need for control

Answer Key

1. B
2. B
3. B
4. C
5. B

Closure

Consistent execution of flight patterns improves precision, control, and overall drone performance.

Teacher Notes

• Emphasize repetition and consistency
• Encourage reflection between attempts
• Reinforce smooth, controlled inputs
• Prepare students for full maneuver integration (Day 5)

Week 11 – Day 5: Integrated Flight Maneuver Performance and Evaluation

Standard	Description	RBT Level
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.01	Execute basic drone flight maneuvers including hover, yaw, and directional control.	C3
106.02	Demonstrate controlled takeoff, navigation, and landing procedures.	C3

Objective
Students will demonstrate mastery of flight control by performing a complete sequence of maneuvers with precision, stability, and consistency.

Essential Question
How do precision, consistency, and control work together during complete drone flight operations?

Key Concepts
• Flight performance requires integration of all control skills
• Precision and consistency improve maneuver execution
• Controlled transitions maintain stability
• Full flight sequences require planning and execution
• Performance improves through practice and evaluation

Vocabulary
• **Maneuver** – A controlled movement of the drone
• **Integration** – Combining multiple skills into one performance
• **Flight Sequence** – A series of planned maneuvers
• **Execution** – Performing a task as planned
• **Performance** – The quality of flight control

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Defined flight course (cones/markers)
• Open flight area
• Whiteboard or presentation display

Bellringer
Prompt:
What is the most important skill needed to perform a complete and controlled drone flight?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

Students recall:
• Precision hover improves stability
• Directional control improves accuracy
• Smooth transitions maintain control
• Consistency improves performance

Discuss:
• What skills are needed for complete flight control?
• How do individual skills work together?

Bridge to lesson:
• All flight skills must now be combined into a complete, controlled performance

---

2. **Core Concept Introduction**

• Flight performance requires combining all learned skills
• Successful execution depends on precision, consistency, and control

Key Teaching Point:
Effective drone flight requires integrating all control skills into a smooth, consistent performance.

---

3. **Concept Development**

A. Integrating Flight Skills

• Skills combined include:
  - takeoff
  - hover
  - directional movement
  - transitions
  - landing

• Each skill must:
  - connect smoothly
  - support overall control

Emphasize:
• Integration creates complete performance

B. Executing a Flight Sequence

• A sequence includes:
  - planned movements
  - defined path
  - controlled stopping points

• Requires:
  - timing
  - coordination
  - awareness

Emphasize:
• Execution must follow the planned sequence

C. Maintaining Precision and Stability

• Precision requires:
  - small inputs
  - consistent control

• Stability requires:
  - smooth transitions
  - controlled movement

Emphasize:
• Precision and stability work together

D. Evaluating Flight Performance

• Evaluation includes:
  - accuracy
  - consistency
  - control

• Identify:
  - strengths
  - areas for improvement

Emphasize:
• Evaluation improves future performance

E. Building Confidence Through Performance

• Confidence develops through:
  - repetition
  - successful execution
  - controlled performance

Emphasize:
• Confidence supports improved control

---

4. Application to Drone Flight

Students apply:
• Complete flight sequence:
  - takeoff
  - hover
  - multi-directional movement
  - pattern execution
  - landing

Students recognize:
• All skills must work together for successful performance

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Complete flight sequence with smooth transitions
   • Incomplete or inconsistent sequence

   Students identify:
   • Differences in control and performance
   • Impact of consistency on execution

---

6. **Real-World Connection**
   • Integrated flight performance is required in:
     - inspections
     - mapping
     - public safety operations

   Emphasize:
   • Professional drone pilots must demonstrate consistent performance

---

7. **Key Reinforcement Summary**
   • Flight performance requires integration
   • Precision and consistency improve execution
   • Smooth transitions maintain control
   • Evaluation supports improvement

   Key Teaching Point:
   Complete drone flight performance depends on integrating all control skills into a consistent and precise sequence.

Formative Questions for Use in This Lesson
• What skills are included in a flight sequence?
• Why is integration important?
• How does consistency improve performance?
• What should be evaluated after a flight?
• How does practice improve confidence?

Hands-On Activity
Activity Title: Full Flight Sequence Performance
Objective:
Students will perform a complete flight sequence demonstrating precision, control, and consistency.

Activity Procedure
1. Students review flight sequence plan
2. Perform controlled takeoff
3. Maintain stable hover
4. Execute multi-directional pattern
5. Perform controlled transitions
6. Complete accurate landing

7. Evaluate performance and repeat

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Sequence Completion	Fully complete and precise	Mostly complete	Partial completion	Incomplete
Control Precision	Smooth and controlled	Mostly controlled	Some instability	Uncontrolled
Consistency	Highly consistent	Mostly consistent	Some variation	Inconsistent
Overall Performance	Strong and reliable	Adequate	Needs improvement	Poor

---

Scenario (C3 Application)
A student performs a full flight sequence but struggles with transitions between movements, causing instability and inconsistent performance.

• What is causing the instability?
• What should the pilot focus on improving?
• How can smoother transitions improve performance?

Assessment Items

1. What is a flight sequence?
   A. Hover only
   B. A series of planned maneuvers
   C. Landing only
   D. Speed control

2. What does integration mean in flight?
   A. Using one skill
   B. Combining multiple skills
   C. Increasing speed
   D. Ignoring movement

3. What improves flight performance?
   A. Large inputs
   B. Random movement
   C. Precision and consistency
   D. Ignoring errors

4. What should be evaluated after flight?
   A. Speed only
   B. Color of drone
   C. Performance and accuracy
   D. Battery only

5. What improves confidence?
   A. Avoiding practice
   B. Repetition and success
   C. Increasing speed
   D. Ignoring mistakes

Answer Key

1. B
2. B
3. C
4. C
5. B

Closure

Complete flight performance requires integrating all control skills into a smooth, consistent, and precise sequence.

Teacher Notes

• Emphasize full integration of skills
• Encourage reflection and improvement
• Reinforce smooth transitions and control
• Prepare students for advanced maneuver refinement (Week 12)

Week 12 – Advanced Flight Control and Maneuver Precision

Week 12 Overview
Week 12 advances students from consistent flight control to refined maneuver precision and efficiency. Students focus on improving accuracy during complex movement patterns, controlling speed and timing, and executing maneuvers with minimal deviation. Emphasis is placed on smooth directional changes, controlled yaw integration, and maintaining positional accuracy throughout multi-step flight paths. These skills prepare students for mission-based flight applications where precision and efficiency are critical to success.

Week 12 – Day 1: Yaw Control and Orientation Mastery

Standard	Description	RBT Level
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.01	Execute basic drone flight maneuvers including hover, yaw, and directional control.	C3

Objective
Students will demonstrate controlled yaw movements and maintain orientation awareness during flight operations.

Essential Question
How does yaw control affect drone orientation and directional accuracy?

Key Concepts
• Yaw controls drone rotation
• Orientation affects movement direction
• Controlled yaw improves accuracy
• Rapid rotation reduces control
• Orientation awareness improves decision-making

Vocabulary
• **Yaw** – Rotation of the drone left or right around its vertical axis
• **Orientation** – The direction the drone is facing
• **Rotation Control** – Managing turning movement
• **Heading** – The direction the drone is pointed
• **Alignment** – Maintaining correct directional positioning

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Marked flight area
• Floor markers or cones
• Whiteboard or presentation display

Bellringer
Prompt:
Why does changing the direction a drone is facing affect how it moves?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Directional control depends on orientation
   • Multi-directional movement requires coordination
   • Smooth transitions improve control

   Discuss:
   • What happens when a drone turns but movement inputs stay the same?
   • Why is orientation important for accuracy?

   Bridge to lesson:
   • Controlling yaw allows pilots to manage orientation and improve directional accuracy

2. **Core Concept Introduction**
   • Yaw changes the direction the drone is facing
   • Orientation determines how movement inputs affect flight

   Key Teaching Point:
   Effective drone control requires understanding and managing orientation through controlled yaw movements.

3. **Concept Development**
   A. **Understanding Yaw Movement**
      • Yaw rotates the drone:
        - left
        - right
      • Does not move the drone forward or backward

      Emphasize:
      • Yaw changes direction, not position

   B. **Relationship Between Yaw and Orientation**
      • Orientation determines:
        - forward direction
        - lateral movement
      • Same control input produces different results based on orientation

      Emphasize:
      • Pilots must adjust based on drone heading

C. Controlled Rotation

• Controlled yaw requires:
  - small inputs
  - gradual rotation

• Rapid rotation causes:
  - loss of control
  - disorientation

Emphasize:
• Smooth rotation improves accuracy

D. Maintaining Alignment During Rotation

• Pilots must:
  - track direction
  - maintain awareness

• Losing orientation leads to:
  - incorrect movement
  - path deviation

Emphasize:
• Orientation awareness is critical

E. Integrating Yaw with Movement

• Yaw combined with movement:
  - improves maneuver precision
  - allows directional adjustments

Emphasize:
• Yaw enhances control when used correctly

---

4. Application to Drone Flight

Students apply:
• Controlled takeoff and hover
• Perform gradual yaw rotations
• Maintain position during rotation
• Re-align orientation before movement

Students recognize:
• Yaw control improves directional accuracy

---

5. Guided Examples / Demonstration

Instructor demonstrates:
• Controlled yaw with stable hover
• Rapid yaw causing instability

Students identify:
• Differences in control
• Impact of rotation speed

6. **Real-World Connection**
   • Yaw control is essential in:
     - camera alignment
     - inspections
     - navigation

   Emphasize:
   • Orientation control is critical for precision work

7. **Key Reinforcement Summary**
   • Yaw controls rotation
   • Orientation affects movement
   • Smooth rotation improves control
   • Awareness prevents errors

   Key Teaching Point:
   Yaw control allows pilots to manage orientation and improve flight accuracy.

Formative Questions for Use in This Lesson
• What is yaw?
• How does orientation affect movement?
• Why is controlled rotation important?
• What happens with rapid yaw?
• How can a pilot maintain alignment?

Hands-On Activity
Activity Title: Yaw Control and Orientation Challenge
Objective:
Students will demonstrate controlled yaw while maintaining position and orientation awareness.

Activity Procedure
1. Students perform controlled takeoff
2. Establish stable hover
3. Rotate drone slowly using yaw
4. Stop at designated headings
5. Maintain position during rotation
6. Repeat for accuracy
7. Reflect on orientation control

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Yaw Control	Smooth and precise	Mostly controlled	Some instability	Uncontrolled
Orientation Awareness	Consistently accurate	Mostly accurate	Some confusion	Disoriented
Stability During Rotation	Maintains position	Mostly stable	Some drift	Unstable
Consistency	Repeats accurately	Mostly consistent	Inconsistent	Unpredictable

---

Scenario (C3 Application)
A student rotates the drone but becomes confused about its direction, causing incorrect movement during the next maneuver.

- What caused the confusion?
- What should the pilot focus on improving?
- How can orientation awareness be maintained?

Assessment Items

1. What is yaw?
   A. Forward movement
   B. Rotation left or right
   C. Landing
   D. Hover
2. What does orientation determine?
   A. Speed
   B. Direction of movement
   C. Battery level
   D. Altitude
3. What happens with rapid yaw?
   A. Improved control
   B. Increased stability
   C. Loss of control
   D. Faster movement
4. What improves yaw control?
   A. Large inputs
   B. Sudden movement
   C. Small, controlled inputs
   D. No control

5. Why is orientation awareness important?
   A. To increase speed
   B. To maintain accuracy
   C. To reduce battery use
   D. To avoid hovering

Answer Key

1. B
2. B
3. C
4. C
5. B

Closure

Controlled yaw and orientation awareness are essential for accurate and precise drone flight.

Teacher Notes

• Emphasize slow, controlled rotation
• Reinforce orientation awareness
• Encourage visual tracking of drone heading
• Prepare students for combined yaw and movement (Day 2)

Week 12 – Day 2: Combining Yaw with Directional Movement

Standard	Description	RBT Level
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.01	Execute basic drone flight maneuvers including hover, yaw, and directional control.	C3
106.02	Demonstrate controlled takeoff, navigation, and landing procedures.	C3

Objective
Students will demonstrate coordinated control by combining yaw and directional movement to maintain accurate flight paths.

Essential Question
How does combining yaw with directional movement improve flight accuracy and control?

Key Concepts
• Yaw and movement must be coordinated
• Orientation changes affect directional inputs
• Smooth control improves accuracy
• Combined movements require timing and precision
• Coordination reduces drift and error

Vocabulary
• **Coordinated Movement** – Using multiple controls together smoothly
• **Combined Control** – Simultaneous use of yaw and directional inputs
• **Flight Alignment** – Maintaining correct direction during movement
• **Control Timing** – Applying inputs at the correct moment
• **Adjustment** – Small corrections during movement

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Floor markers or cones (pattern setup)
• Open flight area
• Whiteboard or presentation display

Bellringer
Prompt:
What happens if a drone turns but the pilot continues to move it in the same direction without adjusting controls?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Yaw changes orientation
   • Directional control depends on orientation
   • Smooth transitions improve stability

   Discuss:
   • What happens when orientation changes but inputs do not?
   • Why must pilots adjust movement after turning?

   Bridge to lesson:
   • Combining yaw with movement requires coordination and timing to maintain control

---

2. **Core Concept Introduction**

   • Yaw and directional movement must work together
   • Pilots must adjust inputs based on orientation

   Key Teaching Point:
   Accurate drone flight requires coordinating yaw and movement through controlled, well-timed inputs.

---

3. **Concept Development**

   A. Understanding Combined Movement

   • Combined movement includes:
     - yaw + forward movement
     - yaw + lateral movement

   • Requires:
     - coordination
     - control awareness

   Emphasize:
   • Controls must work together, not independently

   B. Adjusting Movement Based on Orientation

   • After yaw:
     - forward direction changes
     - lateral control shifts

   • Pilot must:
     - recognize orientation
     - adjust inputs accordingly

   Emphasize:
   • Orientation determines movement outcome

C. Timing of Control Inputs

• Effective control requires:
  - correct timing
  - smooth transitions

• Poor timing causes:
  - drift
  - loss of alignment

Emphasize:
• Timing improves coordination

D. Maintaining Flight Alignment

• Alignment requires:
  - awareness of path
  - controlled adjustments

• Misalignment leads to:
  - deviation
  - inefficient movement

Emphasize:
• Continuous correction maintains path

E. Improving Coordination Through Practice

• Practice improves:
  - control timing
  - orientation awareness
  - movement accuracy

Emphasize:
• Coordination develops with repetition

---

4. Application to Drone Flight

Students apply:
• Controlled takeoff and hover
• Perform yaw and then move in correct direction
• Maintain alignment along defined path
• Adjust movement based on orientation

Students recognize:
• Combined control improves maneuver precision

---

5. Guided Examples / Demonstration

Instructor demonstrates:
• Yaw followed by correct directional movement
• Yaw followed by incorrect movement (no adjustment)

Students identify:
• Differences in control and outcome
• Impact of coordination on accuracy

---

6. **Real-World Connection**
   • Combined control is required in:
     - inspections
     - obstacle navigation
     - camera positioning

   Emphasize:
   • Professional operations require coordinated movement

---

7. **Key Reinforcement Summary**
   • Yaw and movement must be coordinated
   • Orientation affects control
   • Timing improves accuracy
   • Practice builds coordination

   Key Teaching Point:
   Coordinating yaw and directional movement improves accuracy, efficiency, and overall flight control.

Formative Questions for Use in This Lesson
• What is combined control?
• Why must movement adjust after yaw?
• How does timing affect control?
• What causes misalignment?
• How can coordination be improved?

Hands-On Activity
Activity Title: Yaw and Movement Coordination Challenge
Objective:
Students will demonstrate coordinated control by combining yaw and directional movement along a defined path.

Activity Procedure
1. Students perform controlled takeoff
2. Establish stable hover
3. Perform yaw to a new heading
4. Move forward based on new orientation
5. Navigate between markers
6. Maintain alignment during movement
7. Repeat for improved coordination

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Coordination	Highly coordinated	Mostly coordinated	Some difficulty	Poor coordination
Alignment Accuracy	Precise and consistent	Mostly accurate	Some deviation	Off path
Control Timing	Smooth and well-timed	Mostly controlled	Some delay	Poor timing
Stability	Maintains control	Mostly stable	Some instability	Unstable

---

Scenario (C3 Application)
A student rotates the drone using yaw but continues to move forward based on the original direction, causing the drone to move off course.

• What mistake was made?
• What adjustment should the pilot make?
• How can the pilot improve coordination?

Assessment Items

1. What is combined control?
   A. Using one control
   B. Using multiple controls together
   C. Increasing speed
   D. Hovering
2. What changes after yaw?
   A. Battery level
   B. Drone color
   C. Direction of movement
   D. Altitude
3. What causes misalignment?
   A. Controlled input
   B. Smooth transitions
   C. Poor coordination
   D. Stable hover
4. What improves coordination?
   A. Random inputs
   B. Practice
   C. Increased speed
   D. Ignoring orientation

5. Why is timing important?
   A. To increase speed
   B. To improve control accuracy
   C. To reduce battery
   D. To avoid movement

Answer Key

1. B
2. C
3. C
4. B
5. B

Closure

Combining yaw with directional movement improves control, accuracy, and overall flight performance.

Teacher Notes

• Emphasize orientation awareness during movement
• Reinforce timing and smooth transitions
• Encourage repetition for coordination improvement
• Prepare students for complex maneuver sequences (Day 3)

Week 12 – Day 3: Complex Flight Patterns with Yaw Integration

Standard	Description	RBT Level
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.01	Execute basic drone flight maneuvers including hover, yaw, and directional control.	C3
106.02	Demonstrate controlled takeoff, navigation, and landing procedures.	C3

Objective
Students will demonstrate advanced control by executing complex flight patterns that integrate yaw and directional movement with precision.

Essential Question
How does integrating yaw into complex flight patterns improve maneuver precision and control?

Key Concepts
• Complex patterns require coordinated control
• Yaw integration improves maneuver accuracy
• Smooth transitions maintain stability
• Orientation must be maintained throughout flight
• Precision improves with planning and execution

Vocabulary
• **Complex Pattern** – A multi-step flight path with directional changes
• **Yaw Integration** – Using rotation as part of movement
• **Maneuver Precision** – Accurate execution of flight movements
• **Control Coordination** – Using multiple inputs together effectively
• **Flight Accuracy** – Maintaining the intended path and position

---

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Floor markers or cones (pattern setup)
• Open flight area
• Whiteboard or presentation display

Bellringer
Prompt:
Why is it more difficult to control a drone when both direction and orientation are changing?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

Students recall:
- Yaw affects orientation
- Directional movement depends on orientation
- Coordination improves control
- Smooth transitions maintain stability

Discuss:
- What challenges occur when combining yaw and movement?
- Why is coordination important for complex patterns?

Bridge to lesson:
- Complex flight patterns require integrating yaw and directional control to maintain accuracy

---

2. **Core Concept Introduction**

- Complex flight patterns combine multiple movements
- Yaw must be integrated smoothly into movement

Key Teaching Point:
Precise drone control requires integrating yaw and movement into coordinated, accurate flight patterns.

---

3. **Concept Development**

A. Understanding Complex Flight Patterns

- Patterns include:
  - squares with rotation
  - figure-eight paths
  - multi-step routes
- Require:
  - planning
  - coordination

Emphasize:
- Patterns increase in complexity with added movements

B. Integrating Yaw into Movement

- Yaw can be used:
  - before movement
  - during movement
- Proper use:
  - improves alignment
  - maintains direction

Emphasize:
- Yaw must support movement, not disrupt it

C. Maintaining Orientation Throughout Patterns

• Pilots must:
  - track drone heading
  - adjust controls based on orientation

• Loss of orientation causes:
  - incorrect movement
  - deviation from path

Emphasize:
• Orientation awareness is critical for accuracy

D. Coordinating Multiple Inputs

• Requires:
  - timing
  - balance of controls

• Poor coordination leads to:
  - instability
  - inefficient movement

Emphasize:
• Coordination improves maneuver precision

E. Improving Precision Through Planning and Practice

• Planning includes:
  - path design
  - movement sequence

• Practice improves:
  - accuracy
  - consistency

Emphasize:
• Preparation leads to better performance

---

4. Application to Drone Flight

Students apply:
• Controlled takeoff and hover
• Execute complex pattern with yaw integration
• Maintain alignment and control
• Perform controlled landing

Students recognize:
• Complex patterns require coordination and precision

---

5. Guided Examples / Demonstration

Instructor demonstrates:
• Complex pattern with smooth yaw integration
• Same pattern with poor coordination

Students identify:
• Differences in accuracy and control
• Impact of yaw integration

---

6. Real-World Connection
• Complex maneuvering is required in:
  - inspections
  - search operations
  - confined space navigation

Emphasize:
• Precision and coordination are essential in professional operations

---

7. Key Reinforcement Summary
• Complex patterns require coordination
• Yaw improves maneuver accuracy
• Orientation must be maintained
• Practice improves precision

Key Teaching Point:
Integrating yaw into complex flight patterns improves control, accuracy, and overall performance.

Formative Questions for Use in This Lesson
• What is a complex flight pattern?
• How does yaw improve accuracy?
• Why is orientation important?
• What causes loss of control in complex patterns?
• How can precision be improved?

Hands-On Activity
Activity Title: Complex Pattern Navigation Challenge
Objective:
Students will execute a complex flight pattern using coordinated yaw and directional movement.

Activity Procedure
1. Students perform controlled takeoff
2. Establish stable hover
3. Execute a complex pattern (e.g., figure-eight or square with rotation)
4. Maintain alignment during movement
5. Use yaw to adjust orientation
6. Complete pattern and land safely
7. Reflect and repeat for improvement

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Pattern Accuracy	Highly precise	Mostly accurate	Some deviation	Off path
Yaw Integration	Smooth and effective	Mostly controlled	Some difficulty	Poor use
Coordination	Highly coordinated	Mostly coordinated	Some issues	Poor coordination
Stability	Maintains control	Mostly stable	Some instability	Unstable

---

Scenario (C3 Application)
A student attempts a complex flight pattern but loses orientation during yaw movements, causing incorrect path navigation.

• What caused the loss of control?
• What should the pilot focus on improving?
• How can orientation awareness be maintained during complex movement?

Assessment Items

1. What is a complex pattern?
   A. Hover only
   B. Multi-step flight path
   C. Landing only
   D. Speed control
2. What does yaw integration improve?
   A. Speed
   B. Accuracy
   C. Battery life
   D. Altitude
3. What causes deviation in complex patterns?
   A. Smooth control
   B. Coordination
   C. Loss of orientation
   D. Stable hover
4. What improves precision?
   A. Random movement
   B. Practice and planning
   C. Increased speed
   D. Ignoring errors
5. Why is coordination important?
   A. To increase speed
   B. To reduce control
   C. To improve maneuver accuracy
   D. To avoid hovering

Answer Key

1. B
2. B
3. C
4. B
5. C

Closure

Executing complex flight patterns with yaw integration improves coordination, precision, and overall drone control.

Teacher Notes

• Reinforce orientation awareness throughout movement
• Encourage smooth integration of yaw
• Emphasize planning before execution
• Prepare students for speed and timing control (Day 4)

Week 12 – Day 4: Speed Control and Timing in Precision Flight

Standard	Description	RBT Level
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.01	Execute basic drone flight maneuvers including hover, yaw, and directional control.	C3
106.02	Demonstrate controlled takeoff, navigation, and landing procedures.	C3

Objective
Students will demonstrate controlled speed and proper timing during flight maneuvers to improve precision and reduce deviation.

Essential Question
How do speed and timing affect precision and control during drone flight?

Key Concepts
• Speed affects control and stability
• Timing determines accuracy of movement
• Faster movement increases difficulty of control
• Controlled speed improves precision
• Proper timing reduces error and deviation

Vocabulary
• **Speed Control** – Managing how fast the drone moves
• **Timing** – Applying control inputs at the correct moment
• **Deceleration** – Slowing down movement
• **Acceleration** – Increasing speed
• **Control Precision** – Accurate and controlled flight movement

---

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Flight pattern markers or cones
• Open flight space
• Whiteboard or presentation display

Bellringer
Prompt:
Why is it harder to control a drone when it is moving faster?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Precision movement requires small control inputs
   • Smooth transitions improve stability
   • Complex patterns require coordination

   Discuss:
   • What happens when a drone moves too quickly?
   • How does speed affect control accuracy?

   Bridge to lesson:
   • Controlling speed and timing improves precision and reduces errors during flight

---

2. **Core Concept Introduction**

   • Speed and timing directly affect flight accuracy
   • Controlled movement improves precision

   Key Teaching Point:
   Effective drone control requires managing speed and applying inputs at the correct time.

---

3. **Concept Development**

   A. **Understanding Speed in Drone Flight**

   • Speed affects:
   - control difficulty
   - stopping distance
   - accuracy

   • Higher speed:
   - reduces precision
   - increases error

   Emphasize:
   • Controlled speed improves performance

   B. **Importance of Timing**

   • Timing involves:
   - when to start movement
   - when to stop movement
   - when to adjust inputs

   • Poor timing leads to:
   - overshooting
   - delayed correction

   Emphasize:
   • Correct timing improves accuracy

C. Acceleration and Deceleration Control

• Acceleration:
  - must be gradual

• Deceleration:
  - must occur before target point

• Poor control results in:
  - overshooting
  - instability

Emphasize:
• Smooth speed changes improve control

D. Balancing Speed and Precision

• Fast movement:
  - reduces control

• Slow movement:
  - improves accuracy

• Pilots must:
  - adjust speed based on task

Emphasize:
• Balance is key to performance

E. Improving Timing Through Practice

• Practice improves:
  - reaction time
  - control accuracy
  - consistency

Emphasize:
• Repetition develops timing awareness

---

4. Application to Drone Flight

Students apply:
• Controlled takeoff and hover
• Navigate pattern at controlled speed
• Adjust speed before stopping points
• Maintain accuracy during movement

Students recognize:
• Speed and timing affect performance

---

5. Guided Examples / Demonstration

Instructor demonstrates:
• Controlled movement with proper timing
• Fast movement with poor timing

Students identify:
• Differences in accuracy and control
• Impact of speed on precision

---

6. Real-World Connection

• Speed control is critical in:
  - inspections
  - confined space navigation
  - precise positioning tasks

Emphasize:
• Professional pilots adjust speed based on conditions

---

7. Key Reinforcement Summary

• Speed affects control
• Timing affects accuracy
• Controlled movement improves precision
• Practice improves timing

Key Teaching Point:
Managing speed and timing improves drone control, accuracy, and overall flight performance.

Formative Questions for Use in This Lesson

• How does speed affect control?
• Why is timing important?
• What causes overshooting?
• How can speed be controlled?
• How does practice improve timing?

Hands-On Activity
Activity Title: Speed and Timing Precision Challenge
Objective:
Students will demonstrate controlled speed and timing while navigating a defined flight path.

Activity Procedure

1. Students perform controlled takeoff
2. Establish stable hover
3. Navigate pattern at controlled speed
4. Adjust speed before each stopping point
5. Maintain accuracy during movement
6. Complete pattern and land safely
7. Reflect on speed and timing performance

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Speed Control	Smooth and consistent	Mostly controlled	Some inconsistency	Uncontrolled
Timing Accuracy	Precise timing	Mostly accurate	Some delay	Poor timing
Path Accuracy	Highly accurate	Mostly accurate	Some deviation	Off path
Stability	Maintains control	Mostly stable	Some instability	Unstable

---

Scenario (C3 Application)

A student flies too quickly during a pattern and consistently overshoots stopping points, causing loss of control and deviation.

• What is causing the overshooting?
• What adjustment should the pilot make?
• How can better timing improve performance?

Assessment Items

1. What does speed affect in drone flight?
   A. Color
   B. Control and accuracy
   C. Battery type
   D. Size
2. What is timing?
   A. Speed only
   B. Applying inputs at the correct moment
   C. Hovering
   D. Landing
3. What causes overshooting?
   A. Slow movement
   B. Controlled input
   C. Poor timing and high speed
   D. Stable hover
4. What improves precision?
   A. Faster speed
   B. Controlled speed
   C. Random movement
   D. Ignoring timing
5. How can timing be improved?
   A. Avoid practice
   B. Increase speed
   C. Practice and repetition
   D. Ignore errors

Answer Key

1. B
2. B
3. C
4. B
5. C

Closure

Managing speed and timing allows drone pilots to improve accuracy, control, and overall flight performance.

Teacher Notes

• Emphasize slow, controlled movement
• Reinforce importance of timing before stopping points
• Encourage repetition for improvement
• Prepare students for full advanced pattern integration (Day 5)

Week 12 – Day 5: Advanced Flight Precision Performance and Evaluation

Standard	Description	RBT Level
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.01	Execute basic drone flight maneuvers including hover, yaw, and directional control.	C3
106.02	Demonstrate controlled takeoff, navigation, and landing procedures.	C3

Objective
Students will demonstrate advanced flight precision by executing a complex maneuver sequence using coordinated yaw, directional control, speed management, and timing.

Essential Question
How do coordination, speed, timing, and precision work together to produce advanced drone flight performance?

Key Concepts
• Advanced performance requires integration of multiple control skills
• Precision improves through coordination and timing
• Controlled speed enhances accuracy
• Smooth transitions maintain stability
• Evaluation improves future performance

Vocabulary
• **Advanced Precision** – High level of accuracy and control during flight
• **Maneuver Sequence** – A planned series of coordinated movements
• **Control Integration** – Combining multiple flight skills
• **Flight Efficiency** – Completing movements with minimal error
• **Performance Evaluation** – Assessing flight quality and accuracy

---

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Complex flight course (cones/markers)
• Open flight area
• Whiteboard or presentation display

Bellringer
Prompt:
What skill is most important for achieving high-level drone flight precision?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Yaw control affects orientation
   • Combined movement improves coordination
   • Complex patterns require precision
   • Speed and timing affect accuracy

   Discuss:
   • How do these skills work together during flight?
   • What happens when one skill is not controlled properly?

   Bridge to lesson:
   • Advanced drone performance requires combining all control skills into a single, coordinated sequence

---

2. **Core Concept Introduction**

   • Advanced flight requires integration of all learned skills
   • Performance improves through coordination and control

   Key Teaching Point:
   Advanced drone precision is achieved by integrating control, timing, speed, and coordination into a smooth and accurate flight sequence.

---

3. **Concept Development**

   A. **Integrating Advanced Flight Skills**

      • Skills include:
        - yaw control
        - directional movement
        - speed management
        - timing
        - pattern execution

      • Must be:
        - coordinated
        - consistent

      Emphasize:
      • Integration produces advanced performance

   B. **Executing Complex Maneuver Sequences**

      • Requires:
        - planning
        - control awareness
        - smooth transitions

      • Includes:
        - multi-directional movement
        - orientation adjustments

Emphasize:
• Execution must follow the planned sequence

C. Maintaining Precision and Efficiency

• Precision requires:
- small inputs
- accurate timing

• Efficiency requires:
- minimal deviation
- controlled movement

Emphasize:
• Efficient movement improves performance

D. Managing Speed and Timing

• Speed must be:
- controlled
- adjusted based on movement

• Timing must be:
- accurate
- consistent

Emphasize:
• Speed and timing directly affect accuracy

E. Evaluating and Improving Performance

• Evaluation includes:
- accuracy
- consistency
- control

• Improvement requires:
- reflection
- repetition

Emphasize:
• Evaluation leads to better performance

---

4. Application to Drone Flight

Students apply:
• Complete advanced maneuver sequence:
- takeoff
- hover
- yaw integration
- complex pattern navigation
- controlled landing

Students recognize:
• Advanced performance requires full skill integration

5. Guided Examples / Demonstration

Instructor demonstrates:
- Advanced sequence with high precision
- Same sequence with poor coordination

Students identify:
- Differences in performance
- Impact of control and timing

6. Real-World Connection

- Advanced precision is required in:
  - professional inspections
  - aerial mapping
  - public safety operations

Emphasize:
- High-level control is essential in professional drone work

7. Key Reinforcement Summary

- Advanced performance requires integration
- Precision improves with coordination
- Speed and timing affect accuracy
- Evaluation improves results

Key Teaching Point:
Advanced drone flight precision depends on integrating all control skills into a consistent, accurate, and efficient performance.

Formative Questions for Use in This Lesson

- What skills are required for advanced precision?
- How does coordination improve performance?
- Why are speed and timing important?
- What should be evaluated after flight?
- How can performance be improved?

Hands-On Activity

Activity Title: Advanced Precision Flight Challenge

Objective:

Students will execute a complex maneuver sequence demonstrating precision, coordination, and control.

Activity Procedure

1. Students review advanced flight sequence
2. Perform controlled takeoff
3. Maintain stable hover
4. Execute complex pattern with yaw integration
5. Manage speed and timing throughout sequence

6. Perform controlled landing
7. Evaluate performance and repeat

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Sequence Execution	Highly precise and complete	Mostly accurate	Some errors	Incomplete
Coordination	Highly coordinated	Mostly coordinated	Some difficulty	Poor coordination
Speed & Timing	Controlled and accurate	Mostly controlled	Some inconsistency	Poor control
Overall Performance	Strong and efficient	Adequate	Needs improvement	Poor

---

Scenario (C3 Application)

A student completes a complex maneuver sequence but shows inconsistent speed and poor timing, resulting in inaccurate movement and deviation from the flight path.

• What is causing the performance issues?
• What should the pilot focus on improving?
• How can better coordination improve the outcome?

Assessment Items

1. What is advanced precision?
   A. Fast movement
   B. High level of accuracy and control
   C. Random movement
   D. Hover only
2. What is a maneuver sequence?
   A. Single movement
   B. Planned series of movements
   C. Landing only
   D. Speed control
3. What improves flight efficiency?
   A. Large inputs
   B. Controlled movement
   C. Random control
   D. Increased speed
4. What affects flight accuracy?
   A. Color of drone
   B. Speed and timing
   C. Battery type
   D. Altitude only

5. What improves performance?
   A. Avoiding practice
   B. Ignoring errors
   C. Evaluation and repetition
   D. Increasing speed

Answer Key

1. B
2. B
3. B
4. B
5. C

Closure

Advanced drone flight precision is achieved by integrating all control skills into a smooth, accurate, and consistent performance.

Teacher Notes

• Reinforce full skill integration
• Encourage reflection after each attempt
• Emphasize precision over speed
• Prepare students for mission-based flight applications (Week 13)

Week 13 – Mission-Based Flight Operations and Risk Management

Week 13 Overview
Week 13 transitions students from controlled flight execution into mission-based drone operations. Students begin applying previously learned skills within structured operational scenarios that require planning, safety awareness, and decision-making. Emphasis is placed on risk management, operational awareness, and maintaining compliance with safety procedures during real-world style flight tasks. Students will analyze operational environments, identify potential hazards, and apply appropriate mitigation strategies while performing controlled flight missions.

Week 13 – Day 1: Introduction to Mission-Based Flight and Operational Awareness

Standard	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.02	Apply safety procedures and risk mitigation strategies.	C3
106.00	Perform manual drone flight operations using controlled maneuvers.	C3

Objective
Students will identify mission objectives and apply operational awareness to maintain safe and controlled drone flight.

Essential Question
How does operational awareness improve safety and success during drone missions?

Key Concepts
• Mission-based flight requires planning and awareness
• Operational awareness improves safety
• Risk identification is critical before flight
• Safe operations depend on environment and decision-making
• Flight performance must align with mission objectives

Vocabulary
• **Mission-Based Flight** – Drone operations performed to complete a specific task
• **Operational Awareness** – Understanding the environment and conditions during flight
• **Mission Objective** – The goal of a drone operation
• **Hazard** – A potential source of danger
• **Risk Mitigation** – Actions taken to reduce potential hazards

Basic Drone Pilot (DP01)

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Mission scenario cards or prompts
• Flight area with designated zones
• Whiteboard or presentation display

Bellringer
Prompt:
What should a drone pilot think about before starting a flight mission?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Safe flight requires controlled movement
   • Regulations and safety procedures guide operations
   • Precision and coordination improve performance

   Discuss:
   • What happens if a pilot flies without planning?
   • Why is safety important before flight begins?

   Bridge to lesson:
   • Mission-based flight requires planning, awareness, and safe decision-making

---

2. **Core Concept Introduction**
   • Drone missions require a defined purpose
   • Pilots must assess conditions before flight

   Key Teaching Point:
   Successful drone operations depend on understanding mission objectives and maintaining awareness of the environment.

---

3. **Concept Development**
   A. **Understanding Mission-Based Flight**
      • A mission includes:
        ○ a defined goal
        ○ a planned flight path
        ○ expected outcomes

      • Examples include:
        ○ inspection
        ○ observation
        ○ navigation tasks

      Emphasize:
      • Flight must match the mission objective

B. Identifying Mission Objectives

- Objectives define:
  - where to fly
  - how to fly
  - what to accomplish
- Clear objectives:
  - improve efficiency
  - reduce errors

Emphasize:

- A clear goal guides all flight decisions

C. Recognizing Environmental Factors

- Factors include:
  - obstacles
  - space limitations
  - surrounding conditions
- These affect:
  - safety
  - control

Emphasize:

- Environment directly impacts flight performance

D. Identifying Hazards

- Hazards may include:
  - obstacles
  - interference
  - restricted areas
- Failure to identify hazards leads to:
  - unsafe operations
  - mission failure

Emphasize:

- Hazard awareness is critical before flight

E. Applying Risk Mitigation Strategies

- Strategies include:
  - adjusting flight path
  - controlling speed
  - maintaining safe distance
- Mitigation reduces:
  - risk
  - potential errors

Emphasize:

- Safe planning leads to successful missions

4. **Application to Drone Flight**
   Students apply:
   • Review a mission scenario
   • Identify objective and hazards
   • Plan safe flight approach
   • Execute controlled mission flight

   Students recognize:
   • Planning and awareness improve mission success

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Mission planning with hazard identification
   • Flight with and without proper planning

   Students identify:
   • Differences in safety and success
   • Impact of operational awareness

6. **Real-World Connection**
   • Mission-based flight is used in:
     - inspections
     - public safety
     - aerial observation

   Emphasize:
   • Real-world operations require planning and safety awareness

7. **Key Reinforcement Summary**
   • Missions require clear objectives
   • Operational awareness improves safety
   • Hazard identification is critical
   • Risk mitigation reduces danger

   Key Teaching Point:
   Mission success depends on planning, awareness, and safe decision-making.

Formative Questions for Use in This Lesson
• What is a mission-based flight?
• Why are mission objectives important?
• What are environmental factors?
• How can hazards be identified?
• What is risk mitigation?

Hands-On Activity
Activity Title: Mission Planning and Awareness Challenge
Objective:
Students will plan and execute a simple mission while identifying hazards and applying safety strategies.

Activity Procedure

1. Students receive mission scenario
2. Identify mission objective
3. Identify potential hazards
4. Plan safe flight path
5. Perform controlled takeoff
6. Execute mission flight
7. Land safely and evaluate performance

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Mission Planning	Clear and effective	Mostly clear	Some gaps	Unclear
Hazard Identification	Identifies all hazards	Most hazards identified	Some hazards missed	Few identified
Flight Safety	Fully safe operation	Mostly safe	Some risk	Unsafe
Execution	Accurate and controlled	Mostly accurate	Some errors	Incomplete

---

Scenario (C3 Application)
A student begins a mission without identifying obstacles in the flight area and nearly collides with an object during flight.

• What mistake was made?
• What should have been done before flight?
• How could risk mitigation improve the outcome?

Assessment Items

1. What is a mission-based flight?
   A. Random flying
   B. Flight with a specific purpose
   C. Hover only
   D. Speed control
2. What is a mission objective?
   A. Battery level
   B. Flight goal
   C. Drone color
   D. Altitude

3. What is a hazard?
   A. Safe area
   B. Potential danger
   C. Landing zone
   D. Flight path
4. What improves mission safety?
   A. Ignoring environment
   B. Operational awareness
   C. Faster speed
   D. Random movement
5. What is risk mitigation?
   A. Increasing speed
   B. Avoiding planning
   C. Reducing potential hazards
   D. Ignoring hazards

Answer Key

1. B
2. B
3. B
4. B
5. C

Closure

Mission-based drone operations require clear objectives, environmental awareness, and safe decision-making.

Teacher Notes

• Emphasize planning before flight
• Reinforce hazard identification
• Encourage thoughtful decision-making
• Prepare students for deeper risk assessment (Day 2)

Week 13 – Day 2: Risk Assessment and Pre-Flight Decision-Making

Standard	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.02	Apply safety procedures and risk mitigation strategies.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3
106.00	Perform manual drone flight operations using controlled maneuvers.	C3

Objective
Students will conduct a pre-flight risk assessment and make informed decisions to ensure safe drone operations.

Essential Question
How does risk assessment influence safe and effective drone flight decisions?

Key Concepts
• Risk assessment is required before flight
• Identifying hazards improves safety
• Decision-making affects mission success
• Pre-flight planning reduces errors
• Safe operations depend on informed choices

Vocabulary
• **Risk Assessment** – The process of identifying and evaluating potential hazards
• **Pre-Flight Check** – Steps taken before flight to ensure safety
• **Decision-Making** – Choosing actions based on available information
• **Operational Risk** – Potential danger during flight operations
• **Mitigation Strategy** – Actions taken to reduce risk

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Pre-flight checklist handouts
• Scenario cards
• Flight area with designated zones
• Whiteboard or presentation display

Bellringer
Prompt:
What could happen if a pilot skips a pre-flight check?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Mission planning requires identifying hazards
   • Operational awareness improves safety
   • Controlled flight requires preparation

   Discuss:
   • Why must a pilot assess conditions before flight?
   • What happens when risks are not identified?

   Bridge to lesson:
   • Safe drone operations depend on evaluating risks before flight begins

---

2. **Core Concept Introduction**

   • Risk assessment is a critical pre-flight step
   • Decisions made before flight affect safety and success

   Key Teaching Point:
   Effective drone operations require identifying risks and making informed decisions before flight begins.

---

3. **Concept Development**

   A. Understanding Risk Assessment

   • Risk assessment involves:
     - identifying hazards
     - evaluating potential impact

   • Helps determine:
     - whether to proceed
     - how to adjust operations

   Emphasize:
   • Risk assessment must occur before flight

   B. Identifying Operational Risks

   • Risks may include:
     - obstacles
     - environmental conditions
     - restricted areas

   • Risks vary by:
     - location
     - mission type

   Emphasize:
   • Each flight has unique risks

C. Evaluating Risk Severity

• Risks must be evaluated based on:
  - likelihood
  - impact

• High-risk situations:
  - require adjustment
  - may prevent flight

Emphasize:
• Not all risks are equal

D. Making Pre-Flight Decisions

• Decisions include:
  - proceed with flight
  - modify flight plan
  - delay or cancel mission

• Based on:
  - identified risks
  - safety considerations

Emphasize:
• Safe decisions prioritize risk reduction

E. Applying Mitigation Strategies

• Strategies include:
  - adjusting flight path
  - reducing speed
  - maintaining safe distance

• Goal:
  - minimize risk
  - maintain control

Emphasize:
• Mitigation improves safety and success

---

4. Application to Drone Flight

Students apply:
• Conduct pre-flight risk assessment
• Identify hazards in flight area
• Evaluate risk level
• Adjust flight plan as needed
• Execute safe mission flight

Students recognize:
• Risk assessment improves decision-making

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Pre-flight risk assessment process
   • Flight with proper vs. improper preparation

   Students identify:
   • Differences in safety outcomes
   • Impact of decision-making

---

6. **Real-World Connection**
   • Risk assessment is required in:
   - commercial drone operations
   - public safety missions
   - inspections

   Emphasize:
   • Professional pilots must evaluate risk before every flight

---

7. **Key Reinforcement Summary**
   • Risk assessment improves safety
   • Identifying hazards prevents accidents
   • Decision-making affects outcomes
   • Mitigation reduces risk

   Key Teaching Point:
   Pre-flight risk assessment ensures safe, controlled, and successful drone operations.

Formative Questions for Use in This Lesson
• What is risk assessment?
• Why is it important before flight?
• What factors influence risk?
• What decisions can a pilot make?
• How does mitigation improve safety?

Hands-On Activity
Activity Title: Pre-Flight Risk Assessment Simulation
Objective:
Students will perform a pre-flight risk assessment and make safe operational decisions.

Activity Procedure
1. Students receive flight scenario
2. Identify hazards in the environment
3. Evaluate risk severity
4. Determine appropriate action (proceed, adjust, or delay)
5. Plan safe flight approach
6. Execute mission with mitigation strategies
7. Reflect on decision-making

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Risk Identification	Identifies all risks	Most risks identified	Some risks missed	Few identified
Decision-Making	Strong and appropriate	Mostly appropriate	Some errors	Poor decisions
Mitigation Application	Effective strategies used	Mostly effective	Limited use	Not applied
Flight Safety	Fully safe operation	Mostly safe	Some risk present	Unsafe

---

Scenario (C3 Application)
A student identifies hazards before flight but decides to proceed without adjusting the flight plan, resulting in unsafe conditions during the mission.

• What mistake was made?
• What decision should have been made?
• How could mitigation improve safety?

Assessment Items

1. What is risk assessment?
   A. Ignoring hazards
   B. Identifying and evaluating risks
   C. Increasing speed
   D. Hovering

2. What should a pilot do before flight?
   A. Start immediately
   B. Perform risk assessment
   C. Increase speed
   D. Ignore environment

3. What influences risk level?
   A. Drone color
   B. Environment and conditions
   C. Battery type
   D. Altitude only

4. What is a mitigation strategy?
   A. Ignoring hazards
   B. Reducing risk
   C. Increasing speed
   D. Avoiding planning

5. What is a safe decision?
   A. Ignoring risks
   B. Proceeding without planning
   C. Adjusting based on risk
   D. Increasing speed

Answer Key

1. B
2. B
3. B
4. B
5. C

Closure

Pre-flight risk assessment and informed decision-making are essential for safe and successful drone operations.

Teacher Notes

• Reinforce importance of pre-flight planning
• Encourage thoughtful decision-making
• Emphasize that safety decisions come before flight
• Prepare students for in-flight risk management (Day 3)

Week 13 – Day 3: In-Flight Risk Management and Decision Adjustment

Standard	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.02	Apply safety procedures and risk mitigation strategies.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3
106.00	Perform manual drone flight operations using controlled maneuvers.	C3

Objective
Students will identify and respond to risks during flight by making real-time adjustments to maintain safe drone operations.

Essential Question
How does a pilot make safe decisions when unexpected risks occur during flight?

Key Concepts
• Risks can occur during flight
• Pilots must continuously assess conditions
• Real-time decisions affect safety
• Adjustments reduce potential hazards
• Safe operations require constant awareness

Vocabulary
• **In-Flight Risk** – A hazard that occurs during drone operation
• **Real-Time Decision-Making** – Making immediate decisions based on current conditions
• **Adjustment** – A change made to improve safety or control
• **Situational Awareness** – Understanding what is happening during flight
• **Corrective Action** – Steps taken to fix a problem

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Scenario cards with in-flight challenges
• Flight area with designated zones and obstacles
• Whiteboard or presentation display

Bellringer
Prompt:
What should a pilot do if something unexpected happens during flight?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

Students recall:
- Risk assessment occurs before flight
- Hazard identification improves safety
- Mitigation strategies reduce risk

Discuss:
- What happens if a new risk appears during flight?
- Can all risks be predicted before flight?

Bridge to lesson:
- Pilots must continue assessing risk and making decisions during flight

---

2. **Core Concept Introduction**

- Not all risks can be identified before flight
- Pilots must respond to changing conditions

Key Teaching Point:
Safe drone operations require continuous awareness and the ability to make real-time adjustments during flight.

---

3. **Concept Development**

A. Understanding In-Flight Risks

- Risks may include:
  - unexpected obstacles
  - changes in environment
  - loss of control
- These risks:
  - occur suddenly
  - require immediate response

Emphasize:
- Pilots must remain alert at all times

B. Maintaining Situational Awareness

- Pilots must:
  - monitor surroundings
  - track drone position
  - observe changes in conditions
- Loss of awareness leads to:
  - delayed reactions
  - increased risk

Emphasize:
- Awareness is continuous, not one-time

C. Making Real-Time Decisions

• Decisions must be:
  - quick
  - informed
  - safe

• Options include:
  - adjusting movement
  - stopping flight
  - landing immediately

Emphasize:
• Safety is the priority in all decisions

D. Applying Corrective Actions

• Corrective actions include:
  - reducing speed
  - changing direction
  - increasing distance from hazards

• Purpose:
  - restore control
  - reduce risk

Emphasize:
• Quick corrections prevent escalation

E. Evaluating Decisions During Flight

• Pilots must:
  - monitor results of adjustments
  - continue assessing conditions

• Ongoing evaluation:
  - improves safety
  - supports better decisions

Emphasize:
• Decision-making is continuous

---

4. Application to Drone Flight

Students apply:
• Perform controlled takeoff
• Execute mission flight
• Respond to simulated in-flight risks
• Apply corrective actions
• Maintain safe control and complete flight

Students recognize:
• Continuous awareness improves safety

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Flight with proper in-flight adjustments
   • Flight without response to risks

   Students identify:
   • Differences in safety and control
   • Impact of decision-making

---

6. **Real-World Connection**
   • In-flight decision-making is required in:
     - inspections
     - emergency response
     - complex environments

   Emphasize:
   • Professional pilots must respond to changing conditions

---

7. **Key Reinforcement Summary**
   • Risks can occur during flight
   • Situational awareness is critical
   • Real-time decisions improve safety
   • Corrective actions reduce hazards

   Key Teaching Point:
   Safe drone operation requires continuous awareness and the ability to make immediate, effective decisions during flight.

Formative Questions for Use in This Lesson
• What is an in-flight risk?
• Why is situational awareness important?
• What decisions can a pilot make during flight?
• What are corrective actions?
• How can risks be reduced during flight?

Hands-On Activity
Activity Title: In-Flight Risk Response Challenge
Objective:
Students will respond to simulated in-flight risks by making real-time adjustments to maintain safe flight.

Activity Procedure
1. Students perform controlled takeoff
2. Begin mission flight
3. Instructor introduces simulated risk scenario
4. Students identify the risk
5. Apply corrective action
6. Maintain control and complete flight

7. Reflect on decisions and outcomes

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Risk Recognition	Immediate and accurate	Mostly accurate	Some delay	Missed risks
Decision-Making	Quick and appropriate	Mostly appropriate	Some errors	Poor decisions
Corrective Action	Effective and controlled	Mostly effective	Limited effectiveness	Ineffective
Flight Safety	Fully safe operation	Mostly safe	Some risk present	Unsafe

---

Scenario (C3 Application)
During a mission flight, a student notices an unexpected obstacle but delays taking action, resulting in loss of control and unsafe movement.

• What caused the unsafe situation?
• What should the pilot have done immediately?
• How could situational awareness improve the outcome?

Assessment Items

1. What is an in-flight risk?
   A. A planned movement
   B. A hazard that occurs during flight
   C. A landing procedure
   D. A speed change

2. What is situational awareness?
   A. Ignoring surroundings
   B. Understanding conditions during flight
   C. Increasing speed
   D. Hovering

3. What is a corrective action?
   A. Ignoring a problem
   B. A step taken to fix a problem
   C. Increasing speed
   D. Landing immediately

4. What improves safety during flight?
   A. Delayed decisions
   B. Real-time decision-making
   C. Ignoring risks
   D. Faster movement

5. What should a pilot do when a risk appears?
   A. Ignore it
   B. Continue without change
   C. Make adjustments immediately
   D. Increase speed

Answer Key

1. B
2. B
3. B
4. B
5. C

Closure

Safe drone operations require continuous awareness and the ability to respond quickly and effectively to in-flight risks.

Teacher Notes

• Emphasize continuous situational awareness
• Reinforce quick, safe decision-making
• Encourage reflection after each scenario
• Prepare students for full mission execution with integrated risk management (Day 4)

Week 13 – Day 4: Mission Execution with Integrated Risk Management

Standard	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.02	Apply safety procedures and risk mitigation strategies.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.02	Demonstrate controlled takeoff, navigation, and landing procedures.	C3

Objective
Students will execute a complete mission while applying pre-flight planning, in-flight risk management, and controlled flight operations.

Essential Question
How do planning, awareness, and control work together during full mission execution?

Key Concepts
• Mission execution requires planning and control
• Risk management must occur before and during flight
• Controlled maneuvers ensure safe operations
• Decision-making impacts mission success
• Integrated skills improve performance

Vocabulary
• **Mission Execution** – Performing a planned drone operation
• **Operational Control** – Maintaining control throughout the mission
• **Integrated Skills** – Combining multiple abilities during flight
• **Flight Path** – The route the drone follows
• **Safe Operation** – Conducting flight without risk or hazard

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Mission scenario cards
• Flight course with obstacles and zones
• Pre-flight checklist
• Whiteboard or presentation display

Bellringer
Prompt:
What steps must a pilot take to successfully complete a drone mission from start to finish?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

Students recall:
- Mission planning defines objectives and hazards
- Risk assessment occurs before flight
- In-flight decisions maintain safety
- Controlled maneuvers ensure stability

Discuss:
- What happens if one part of the process is ignored?
- Why must all steps be connected?

Bridge to lesson:
- Mission success depends on integrating planning, control, and risk management

---

2. **Core Concept Introduction**

- Mission execution requires combining all learned skills
- Safety and control must be maintained throughout

Key Teaching Point:
Successful drone missions require integrating planning, risk management, and controlled flight into one continuous process.

---

3. **Concept Development**

A. Preparing for Mission Execution

- Preparation includes:
  - defining mission objective
  - identifying hazards
  - planning flight path
- Preparation ensures:
  - safety
  - efficiency

Emphasize:
- Strong preparation leads to successful execution

B. Executing the Planned Flight Path

- Requires:
  - controlled takeoff
  - accurate navigation
  - maintaining alignment
- Must follow:
  - planned route
  - mission objective

Emphasize:
- Execution must match the plan

C. Applying Risk Management During Flight

• Includes:
  - monitoring environment
  - identifying new risks
  - making adjustments

• Requires:
  - situational awareness
  - decision-making

Emphasize:
• Risk management continues during flight

D. Maintaining Control and Stability

• Control requires:
  - smooth inputs
  - consistent movement

• Stability prevents:
  - drift
  - loss of accuracy

Emphasize:
• Control ensures safe operation

E. Completing the Mission Safely

• Includes:
  - controlled landing
  - reviewing performance

• Success depends on:
  - completing objective
  - maintaining safety

Emphasize:
• Safe completion is the goal

---

4. Application to Drone Flight

Students apply:
• Conduct pre-flight planning
• Execute mission flight
• Apply in-flight risk management
• Maintain control and alignment
• Complete mission with safe landing

Students recognize:
• Integration of skills leads to successful mission execution

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Full mission execution with integrated skills
   • Mission with poor planning or control

   Students identify:
   • Differences in safety and success
   • Impact of integration

---

6. **Real-World Connection**
   • Mission execution is required in:
   - inspections
   - aerial mapping
   - public safety operations

   Emphasize:
   • Professional operations require full integration of skills

---

7. **Key Reinforcement Summary**
   • Missions require planning and control
   • Risk management occurs throughout flight
   • Integrated skills improve performance
   • Safe execution is the goal

   Key Teaching Point:
   Mission success depends on integrating planning, risk management, and controlled flight operations.

Formative Questions for Use in This Lesson
• What steps are required before a mission?
• How is risk managed during flight?
• Why is control important during execution?
• What defines mission success?
• How do skills work together during flight?

Hands-On Activity
Activity Title: Full Mission Execution Challenge
Objective:
Students will execute a complete mission using planning, control, and risk management strategies.

Activity Procedure
1. Students receive mission scenario
2. Identify objective and hazards
3. Plan flight path
4. Perform controlled takeoff
5. Execute mission with adjustments as needed
6. Complete controlled landing

7. Evaluate mission performance

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Mission Planning	Clear and detailed	Mostly clear	Some gaps	Unclear
Execution Accuracy	Highly accurate	Mostly accurate	Some deviation	Off path
Risk Management	Consistent and effective	Mostly effective	Limited	Not applied
Flight Control	Smooth and stable	Mostly controlled	Some instability	Uncontrolled

---

Scenario (C3 Application)
A student plans a mission but fails to adjust during flight when new risks appear, resulting in loss of control and incomplete mission execution.

• What mistake was made?
• What should have been done during flight?
• How does integrated risk management improve success?

Assessment Items

1. What is mission execution?
   A. Random flight
   B. Performing a planned operation
   C. Hovering
   D. Speed control
2. What is required before flight?
   A. Ignoring hazards
   B. Planning and risk assessment
   C. Increasing speed
   D. Immediate takeoff
3. What must occur during flight?
   A. No adjustments
   B. Risk management
   C. Ignoring environment
   D. Faster movement
4. What ensures safe operation?
   A. Random movement
   B. Controlled flight
   C. Increased speed
   D. Ignoring planning
5. What defines mission success?
   A. Speed
   B. Completion with safety
   C. Battery use
   D. Altitude

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Successful mission execution requires planning, control, and continuous risk management throughout flight.

Teacher Notes

• Reinforce full integration of skills
• Emphasize continuous risk awareness
• Encourage reflection on performance
• Prepare students for performance evaluation and optimization (Day 5)

Week 13 – Day 5: Mission Performance Evaluation and Operational Improvement

Standard	Description	RBT Level
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
105.02	Apply safety procedures and risk mitigation strategies.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.02	Demonstrate controlled takeoff, navigation, and landing procedures.	C3

Objective
Students will evaluate mission performance and identify improvements to enhance safety, efficiency, and flight control.

Essential Question
How does evaluating mission performance improve future drone operations?

Key Concepts
• Evaluation improves performance
• Identifying strengths and weaknesses supports growth
• Safety must remain the top priority
• Reflection leads to better decision-making
• Continuous improvement enhances mission success

Vocabulary
• **Performance Evaluation** – Assessing the quality of flight and mission execution
• **Operational Improvement** – Making changes to improve performance
• **Strength** – A successful aspect of performance
• **Weakness** – An area needing improvement
• **Reflection** – Thinking about actions to improve future performance

Materials Needed
• Classroom drones (DJI Tello or similar)
• Controllers or tablets
• Mission performance checklist or rubric
• Scenario prompts
• Flight area with designated course
• Whiteboard or presentation display

Bellringer
Prompt:
Why is it important to review performance after completing a task?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

Students recall:
- Mission planning requires hazard identification
- Risk assessment improves safety
- In-flight adjustments maintain control
- Mission execution requires integration of skills

Discuss:
- What makes a mission successful?
- How can performance be improved after a mission?

Bridge to lesson:
- Evaluating performance helps pilots improve future mission success

---

2. **Core Concept Introduction**

- Evaluation identifies strengths and areas for improvement
- Reflection improves future performance

Key Teaching Point:
Continuous evaluation and reflection lead to safer, more efficient, and more accurate drone operations.

---

3. **Concept Development**

A. Understanding Performance Evaluation

- Evaluation includes:
  - accuracy
  - safety
  - control
  - mission completion
- Helps determine:
  - what worked well
  - what needs improvement

Emphasize:
- Evaluation is essential after every mission

B. Identifying Strengths

- Strengths may include:
  - precise control
  - strong planning
  - effective risk management
- Recognizing strengths:
  - builds confidence
  - reinforces correct behavior

Emphasize:
- Strengths should be repeated

C. Identifying Areas for Improvement

• Weaknesses may include:
  - poor timing
  - loss of control
  - missed hazards

• Improvement requires:
  - awareness
  - corrective action

Emphasize:
• Improvement is part of learning

D. Applying Operational Improvements

• Improvements include:
  - adjusting flight plan
  - improving control techniques
  - enhancing decision-making

• Goal:
  - improve safety and efficiency

Emphasize:
• Changes should be applied in future flights

E. Continuous Improvement Cycle

• Process includes:
  - perform mission
  - evaluate performance
  - apply improvements

• Leads to:
  - better outcomes
  - increased safety

Emphasize:
• Improvement is ongoing

4. Application to Drone Flight

Students apply:
• Execute mission flight
• Evaluate performance using rubric
• Identify strengths and weaknesses
• Apply improvements in repeated flight

Students recognize:
• Evaluation improves performance

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Mission with evaluation and improvement
   • Mission without evaluation

   Students identify:
   • Differences in performance over time
   • Impact of reflection

---

6. **Real-World Connection**
   • Performance evaluation is used in:
   - commercial drone operations
   - public safety missions
   - professional aviation

   Emphasize:
   • Professionals continuously improve performance

---

7. **Key Reinforcement Summary**
   • Evaluation improves performance
   • Reflection supports growth
   • Strengths should be repeated
   • Improvements enhance safety

   Key Teaching Point:
   Continuous evaluation and improvement lead to safer and more effective drone operations.

Formative Questions for Use in This Lesson
• What is performance evaluation?
• Why is reflection important?
• What are strengths and weaknesses?
• How can performance be improved?
• What is continuous improvement?

Hands-On Activity
Activity Title: Mission Evaluation and Improvement Challenge
Objective:
Students will evaluate mission performance and apply improvements to enhance future operations.

Activity Procedure
1. Students perform mission flight
2. Evaluate performance using rubric
3. Identify strengths and weaknesses
4. Plan improvements
5. Repeat mission with adjustments
6. Compare performance results
7. Reflect on improvement

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Evaluation Accuracy	Thorough and insightful	Mostly accurate	Some gaps	Limited
Identification of Strengths	Clearly identified	Mostly identified	Some missed	Not identified
Identification of Weaknesses	Clearly identified	Mostly identified	Some missed	Not identified
Improvement Application	Effective and applied	Mostly applied	Limited application	Not applied

Scenario (C3 Application)

A student completes a mission but does not evaluate performance or apply improvements, resulting in repeated mistakes during future flights.

• What mistake was made?
• What should the pilot have done after the mission?
• How does evaluation improve future performance?

Assessment Items

1. What is performance evaluation?
   A. Ignoring results
   B. Assessing performance
   C. Increasing speed
   D. Hovering
2. What is a strength?
   A. A mistake
   B. A successful part of performance
   C. A hazard
   D. A delay
3. What is a weakness?
   A. A success
   B. An area needing improvement
   C. A flight path
   D. A landing
4. What improves future performance?
   A. Ignoring results
   B. Reflection and improvement
   C. Increasing speed
   D. Avoiding practice

5. What is continuous improvement?
   A. One-time change
   B. Ongoing evaluation and adjustment
   C. Ignoring errors
   D. Random movement

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Evaluating mission performance and applying improvements leads to safer, more efficient, and more successful drone operations.

Teacher Notes

• Encourage honest self-evaluation
• Reinforce importance of reflection
• Emphasize applying improvements
• Prepare students for transition into advanced applications and programming (Week 14)

Week 14 – Introduction to Drone Programming and Autonomous Flight Concepts

Week 14 Overview
Week 14 introduces students to the fundamentals of drone programming and autonomous flight operations. Students transition from manual control to understanding how programmed instructions can guide drone behavior. Emphasis is placed on sequencing commands, understanding cause-and-effect relationships, and maintaining safe operational practices while using automated flight features. Students will explore how programming enhances mission efficiency while still requiring pilot awareness and safety oversight. This week establishes the foundation for applying programming concepts to real-world drone operations.

Week 14 – Day 1: Introduction to Programming Concepts and Logic

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.01	Explain programming logic, including sequence, loops, and commands.	B2
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3

Objective
Students will identify basic programming concepts and understand how command logic controls drone operations.

Essential Question
How do programmed commands control drone behavior?

Key Concepts
• Programming uses commands to control actions
• Commands must follow a sequence
• Logic determines how drones respond
• Cause-and-effect relationships drive outcomes
• Safety remains essential during automated operations

Vocabulary
• **Programming** – Creating a set of instructions for a system to follow
• **Command** – A specific instruction given to a drone
• **Sequence** – The order in which commands are executed
• **Logic** – The reasoning behind how commands function
• **Automation** – Performing tasks without manual control

Basic Drone Pilot (DP01)

Materials Needed
• Classroom drones (DJI Tello EDU or similar with programming capability)
• Tablets or computers with programming interface (block-based preferred)
• Visual command cards (forward, backward, turn, hover)
• Whiteboard or presentation display
• Flight demonstration area

Bellringer
Prompt:
What happens if instructions are given in the wrong order?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Manual flight requires control and decision-making
   • Mission execution requires planning and sequencing
   • Risk management ensures safe operations

   Discuss:
   • How do pilots decide what to do first during a mission?
   • What happens if steps are performed out of order?

   Bridge to lesson:
   • Programming uses the same idea—steps must be in the correct order to achieve a result

---

2. **Core Concept Introduction**
   • Programming allows drones to follow instructions automatically
   • Commands must be structured in a logical order

   Key Teaching Point:
   Programming uses structured commands and logical sequences to control drone behavior.

---

3. **Concept Development**
   A. **Understanding Programming Concepts**
      • Programming involves:
        - giving instructions
        - controlling actions
        - achieving a specific outcome

      • Programming is used to:
        - automate tasks
        - improve efficiency

      Emphasize:
      • Programming replaces manual control with planned instructions

---

B. Understanding Commands

• Commands are:
- individual instructions
- specific actions

• Examples include:
- move forward
- turn
- hover

Emphasize:
• Each command controls a specific movement

C. Understanding Sequence

• Sequence determines:
- order of actions
- final outcome

• Incorrect sequence results in:
- incorrect movement
- mission failure

Emphasize:
• Order matters in programming

D. Understanding Logic

• Logic determines:
- how commands interact
- expected results

• Logical thinking helps:
- predict outcomes
- avoid errors

Emphasize:
• Programming requires logical thinking

E. Connecting Programming to Drone Operations

• Programming can:
- control movement
- guide flight paths

• Pilots must still:
- monitor safety
- maintain awareness

Emphasize:
• Automation does not replace responsibility

---

4. **Application to Drone Flight**
   Students apply:
   • Arrange command cards into correct sequence
   • Predict drone movement based on commands
   • Observe demonstration of programmed sequence

   Students recognize:
   • Sequence and logic determine outcomes

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Correct sequence producing intended movement
   • Incorrect sequence producing unintended results

   Students identify:
   • Differences in outcomes
   • Importance of correct logic

---

6. **Real-World Connection**
   • Programming is used in:
     - automated drone missions
     - inspections
     - mapping

   Emphasize:
   • Automation improves efficiency but requires oversight

---

7. **Key Reinforcement Summary**
   • Programming uses commands
   • Commands must follow sequence
   • Logic determines outcomes
   • Safety remains essential

   Key Teaching Point:
   Programming allows drones to perform tasks automatically, but success depends on correct logic and sequencing.

Formative Questions for Use in This Lesson
• What is programming?
• What is a command?
• Why is sequence important?
• What is logic?
• How does programming control drones?

Hands-On Activity
Activity Title: Command Sequence Challenge
Objective:
Students will arrange and test command sequences to control simulated drone movement.

Activity Procedure

1. Students receive command cards
2. Arrange commands into a sequence
3. Predict drone movement
4. Observe demonstration or simulate result
5. Adjust sequence if incorrect
6. Repeat until correct outcome is achieved

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Sequence Accuracy	Fully correct	Mostly correct	Some errors	Incorrect
Logical Reasoning	Strong reasoning	Mostly logical	Some gaps	Limited
Prediction Accuracy	Accurate predictions	Mostly accurate	Some errors	Inaccurate
Engagement	Fully engaged	Mostly engaged	Some engagement	Minimal

---

Scenario (C3 Application)
A student creates a sequence of commands but places a turn command before moving forward, causing the drone to move in an unintended direction.

• What caused the incorrect movement?
• How should the sequence be corrected?
• Why is order important in programming?

Assessment Items

1. What is programming?
   A. Manual flight
   B. Giving instructions to control actions
   C. Random movement
   D. Hovering

2. What is a command?
   A. A battery
   B. An instruction
   C. A drone part
   D. A signal

3. What is sequence?
   A. Speed
   B. Order of actions
   C. Height
   D. Direction

4. What happens if sequence is incorrect?
   A. Correct movement
   B. Incorrect outcome
   C. Faster flight
   D. Better control
5. What is logic?
   A. Random thinking
   B. Reasoning behind actions
   C. Speed control
   D. Battery use

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Programming allows drones to follow structured instructions, and success depends on correct sequencing and logical thinking.

Teacher Notes

• Keep programming conceptual (no heavy coding yet)
• Emphasize sequence and logic over syntax
• Reinforce safety responsibility during automation
• Prepare students for command sequencing application (Day 2)

Week 14 – Day 2: Command Sequences and Logical Flow in Drone Programming

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.01	Explain programming logic, including sequence, loops, and commands.	B2
107.02	Develop a programmed flight path using a drone platform.	C3
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3

Objective
Students will construct and evaluate command sequences to control drone movement using logical flow.

Essential Question
How does the order of commands affect drone movement and mission success?

Key Concepts
• Command sequences control drone behavior
• Logical flow determines movement accuracy
• Order of commands impacts outcomes
• Predicting outcomes improves programming accuracy
• Safety must be maintained during automated operations

Vocabulary
• **Command Sequence** – A series of instructions executed in order
• **Logical Flow** – The correct order of operations
• **Execution** – Carrying out programmed commands
• **Outcome** – The result of a sequence
• **Error** – A mistake in sequence or logic

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with block-based programming interface
• Command cards or programming blocks
• Whiteboard or presentation display
• Flight demonstration area

Bellringer
Prompt:
Why is the order of steps important when following directions?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Programming uses commands and sequence
   • Incorrect sequence leads to incorrect results
   • Logic determines outcomes
   • Safe operations must be maintained

   Discuss:
   • What happens if steps are skipped or out of order?
   • How can we predict what a drone will do?

   Bridge to lesson:
   • Today's lesson focuses on building and analyzing command sequences for accurate outcomes

---

2. **Core Concept Introduction**
   • Command sequences must follow a logical order
   • Each command affects the next action

   Key Teaching Point:
   The accuracy of drone movement depends on the correct sequence and logical flow of commands.

---

3. **Concept Development**

   A. **Understanding Command Sequences**
   - A sequence includes:
     - multiple commands
     - a defined order
   - Sequences control:
     - movement
     - direction
     - timing

   Emphasize:
   • Commands must work together in order

   B. **Understanding Logical Flow**
   - Logical flow ensures:
     - commands make sense
     - actions follow correctly
   - Poor logic leads to:
     - incorrect movement
     - mission failure

   Emphasize:
   • Logical thinking improves accuracy

C. Predicting Outcomes

• Before execution, pilots should:
  - review sequence
  - predict movement

• Prediction helps:
  - identify errors
  - improve results

Emphasize:
• Thinking ahead prevents mistakes

D. Identifying Errors in Sequences

• Errors may include:
  - incorrect order
  - missing steps
  - unnecessary commands

• Errors cause:
  - unintended movement
  - loss of control

Emphasize:
• Errors must be identified before execution

E. Correcting Command Sequences

• Corrections include:
  - rearranging commands
  - removing errors
  - improving logic

• Goal:
  - achieve desired outcome

Emphasize:
• Adjustments improve performance

---

4. Application to Drone Flight

Students apply:
• Build command sequences using blocks or cards
• Predict drone movement
• Execute sequence (simulated or actual)
• Identify and correct errors

Students recognize:
• Logical sequencing improves outcomes

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Correct command sequence
   • Sequence with errors

   Students identify:
   • Differences in movement
   • Impact of logical flow

---

6. **Real-World Connection**
   • Command sequencing is used in:
   - automated inspections
   - drone mapping
   - programmed flight missions

   Emphasize:
   • Programming improves efficiency but requires accuracy

---

7. **Key Reinforcement Summary**
   • Command sequences control movement
   • Logical flow ensures correct outcomes
   • Prediction improves accuracy
   • Errors must be identified and corrected

   Key Teaching Point:
   Correct sequencing and logical flow are essential for accurate and safe drone programming.

Formative Questions for Use in This Lesson
• What is a command sequence?
• Why is logical flow important?
• How can outcomes be predicted?
• What causes errors in programming?
• How can sequences be corrected?

Hands-On Activity
Activity Title: Command Sequence Build and Test
Objective:
Students will create, test, and refine command sequences to control drone movement.

Activity Procedure
1. Students receive a movement task
2. Build a command sequence
3. Predict the outcome
4. Execute sequence (simulation or drone)
5. Observe results
6. Identify errors
7. Adjust and retest sequence

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Sequence Accuracy	Fully correct	Mostly correct	Some errors	Incorrect
Logical Flow	Strong and consistent	Mostly logical	Some gaps	Weak logic
Error Identification	Quickly identifies errors	Identifies most errors	Some missed	Few identified
Correction Application	Effective corrections	Mostly effective	Limited	Not applied

---

Scenario (C3 Application)

A student creates a command sequence but forgets to include a forward movement before turning, causing the drone to rotate in place instead of moving as intended.

- What caused the incorrect outcome?
- What should be added to the sequence?
- How does logical flow affect the result?

Assessment Items

1. What is a command sequence?
   A. A single instruction
   B. A series of instructions in order
   C. A drone part
   D. A battery
2. What is logical flow?
   A. Random order
   B. Correct order of operations
   C. Speed increase
   D. Hovering
3. Why is prediction important?
   A. To increase speed
   B. To identify errors before execution
   C. To avoid planning
   D. To reduce battery
4. What is an error in programming?
   A. Correct sequence
   B. Mistake in logic or order
   C. Faster movement
   D. Hover
5. How can errors be corrected?
   A. Ignore them
   B. Rearrange and adjust commands
   C. Increase speed
   D. Stop programming

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Accurate command sequencing and logical flow are essential for successful and safe drone programming.

Teacher Notes

• Reinforce prediction before execution
• Encourage students to identify errors independently
• Emphasize logical thinking over speed
• Prepare students for applying sequences to actual drone movement (Day 3)

Week 14 – Day 3: Applying Simple Programming Sequences to Drone Movement

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.02	Develop a programmed flight path using a drone platform.	C3
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3

Objective
Students will create and execute simple programming sequences to control drone movement while maintaining safe operations.

Essential Question
How can programmed sequences control drone movement accurately and safely?

Key Concepts
• Programming sequences control movement
• Commands must be accurate and ordered
• Execution produces predictable outcomes
• Manual control supports programming understanding
• Safety must be maintained during automated flight

Vocabulary
• **Program Execution** – Running a set of programmed commands
• **Movement Command** – Instruction controlling direction or motion
• **Input** – The command given to the system
• **Output** – The result of the command
• **Automation Control** – Managing drone behavior through programming

---

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with block-based programming interface
• Programming platform (Tello EDU app or equivalent)
• Flight area with marked boundaries
• Whiteboard or presentation display

Bellringer
Prompt:
How can a series of commands replace manual control during flight?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Programming uses commands and sequences
   • Logical flow determines outcomes
   • Errors affect results
   • Safe operations must always be maintained

   Discuss:
   • How do we move from planning commands to executing them?
   • What happens when commands are applied to real movement?

   Bridge to lesson:
   • Today's lesson focuses on applying programming sequences to actual drone movement

---

2. **Core Concept Introduction**

   • Programming allows commands to control real drone movement
   • Execution produces observable outcomes

   Key Teaching Point:
   Simple programming sequences can control drone movement when commands are accurate and logically structured.

---

3. **Concept Development**

   A. **Understanding Program Execution**

   • Execution means:
   - running commands
   - observing results

   • Execution requires:
   - correct sequence
   - clear logic

   Emphasize:
   • Commands must be correct before execution

   B. **Connecting Commands to Movement**

   • Commands control:
   - direction
   - distance
   - rotation

   • Movement reflects:
   - programmed instructions

   Emphasize:
   • Each command produces a specific action

C. Building Simple Movement Sequences

• Sequences may include:
- takeoff
- forward movement
- turns
- landing

• Sequence must:
- follow logical order
- match intended path

Emphasize:
• Structure determines success

D. Monitoring Execution Results

• Students must:
- observe movement
- compare expected vs actual

• Monitoring helps:
- identify errors
- improve accuracy

Emphasize:
• Observation is critical

E. Maintaining Safety During Programming

• Safety requires:
- controlled environment
- awareness during execution
- readiness to stop operation

• Pilots must:
- remain responsible
- monitor drone at all times

Emphasize:
• Automation does not eliminate responsibility

---

4. Application to Drone Flight

Students apply:
• Build simple program sequence
• Execute sequence using drone
• Observe movement outcome
• Adjust commands as needed
• Repeat for accuracy

Students recognize:
• Programming directly controls movement

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Correct programmed movement sequence
   • Sequence with errors

   Students identify:
   • Differences in outcomes
   • Importance of accuracy

---

6. **Real-World Connection**
   • Programmed flight is used in:
   - inspections
   - mapping
   - repetitive missions

   Emphasize:
   • Automation improves efficiency but requires accuracy

---

7. **Key Reinforcement Summary**
   • Programming controls movement
   • Execution produces results
   • Observation improves accuracy
   • Safety must be maintained

   Key Teaching Point:
   Accurate programming sequences allow drones to perform controlled movements safely and effectively.

Formative Questions for Use in This Lesson
• What is program execution?
• How do commands control movement?
• Why is sequence important?
• How can errors be identified?
• Why must safety be maintained during programming?

Hands-On Activity
Activity Title: Simple Programming Flight Challenge
Objective:
Students will create and execute a simple programmed flight sequence.

Activity Procedure
1. Students design a simple flight sequence
2. Input commands into programming interface
3. Predict movement outcome
4. Execute program
5. Observe results
6. Identify errors
7. Adjust and re-execute program

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Sequence Accuracy	Fully correct	Mostly correct	Some errors	Incorrect
Execution Control	Smooth and accurate	Mostly controlled	Some issues	Uncontrolled
Error Identification	Immediate and accurate	Mostly accurate	Some delay	Missed errors
Safety Awareness	Fully maintained	Mostly maintained	Some lapses	Unsafe

Scenario (C3 Application)

A student programs a drone to move forward and then land but forgets to include a takeoff command, resulting in no movement.

• What caused the failure?
• What command is missing?
• How can the sequence be corrected?

Assessment Items

1. What is program execution?
   A. Planning commands
   B. Running programmed commands
   C. Manual flight
   D. Hovering
2. What controls drone movement in programming?
   A. Battery
   B. Commands
   C. Speed
   D. Height
3. What happens when commands are incorrect?
   A. Correct movement
   B. Incorrect outcome
   C. Faster speed
   D. Better control
4. What helps identify errors?
   A. Ignoring results
   B. Observing outcomes
   C. Increasing speed
   D. Skipping steps
5. What must always be maintained during programming?
   A. Speed
   B. Safety
   C. Altitude
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Programming sequences allow drones to perform controlled movements, but accuracy and safety must always be maintained.

Teacher Notes

• Reinforce connection between commands and movement
• Encourage careful observation of results
• Emphasize safety during execution
• Prepare students for autonomous flight comparison (Day 4)

Week 14 – Day 4: Autonomous Flight Execution and Manual vs Programmed Control

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.02	Develop a programmed flight path using a drone platform.	C3
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
106.02	Demonstrate controlled takeoff, navigation, and landing procedures.	C3
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3

Objective
Students will execute autonomous drone flight sequences and compare programmed control to manual flight operations.

Essential Question
How does autonomous flight compare to manual control in terms of accuracy, safety, and efficiency?

Key Concepts
• Autonomous flight follows programmed commands
• Manual control relies on pilot input
• Both methods require accuracy and safety
• Programming improves consistency
• Pilots remain responsible for safety

Vocabulary
• **Autonomous Flight** – Drone operation controlled by programmed instructions
• **Manual Control** – Drone operation controlled by a pilot
• **Execution Accuracy** – How closely the outcome matches the intended result
• **Consistency** – Repeating the same result reliably
• **Override** – Taking manual control during automated operation

---

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with programming interface
• Pre-built or student-created programming sequences
• Flight area with marked path or course
• Whiteboard or presentation display

Bellringer
Prompt:
Which do you think is more reliable—manual control or programmed flight? Why?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

Students recall:
- Programming uses sequences to control movement
- Execution produces predictable outcomes
- Errors can be identified and corrected
- Safety must always be maintained

Discuss:
- How does programmed flight differ from manual flight?
- What advantages does programming provide?

Bridge to lesson:
- Today's lesson focuses on executing programmed flight and comparing it to manual control

---

2. **Core Concept Introduction**

- Autonomous flight follows programmed commands
- Manual control requires real-time decision-making

Key Teaching Point:
Both programmed and manual flight have advantages, but safety and control must be maintained in all operations.

---

3. **Concept Development**

A. Understanding Autonomous Flight

- Autonomous flight involves:
  - programmed commands
  - automated execution
- Provides:
  - consistency
  - repeatability

Emphasize:
- Automation follows instructions exactly

B. Understanding Manual Control

- Manual control involves:
  - pilot input
  - real-time adjustments
- Provides:
  - flexibility
  - adaptability

Emphasize:
- Manual control responds to changing conditions

C. Comparing Accuracy and Consistency

• Programmed flight:
  - consistent
  - repeatable

• Manual flight:
  - varies by pilot
  - adaptable

Emphasize:
• Each method has strengths

D. Identifying Safety Considerations

• Both methods require:
  - awareness
  - monitoring

• Risks include:
  - incorrect programming
  - pilot error

Emphasize:
• Safety responsibility remains with the pilot

E. Applying Manual Override

• Override allows:
  - stopping automated flight
  - taking control

• Used when:
  - risks occur
  - errors are detected

Emphasize:
• Pilots must be ready to intervene

---

4. Application to Drone Flight

Students apply:
• Execute programmed flight sequence
• Perform same flight manually
• Compare accuracy and consistency
• Identify differences in performance

Students recognize:
• Programming improves consistency, manual control improves flexibility

---

5. Guided Examples / Demonstration

Instructor demonstrates:
• Autonomous flight sequence
• Manual flight of same path

Students identify:
• Differences in accuracy and control
• Strengths of each method

---

6. **Real-World Connection**
   • Both methods are used in:
   - inspections
   - mapping
   - automated missions

   Emphasize:
   • Professional pilots use both manual and automated control

---

7. **Key Reinforcement Summary**
   • Autonomous flight is consistent
   • Manual control is flexible
   • Both require safety awareness
   • Pilots must be ready to intervene

   Key Teaching Point:
   Understanding both programmed and manual control improves overall drone operation and safety.

Formative Questions for Use in This Lesson
• What is autonomous flight?
• How does manual control differ?
• What are advantages of programming?
• What are advantages of manual control?
• When should override be used?

Hands-On Activity
Activity Title: Autonomous vs Manual Flight Comparison
Objective:
Students will compare programmed flight to manual flight to evaluate accuracy and control.

Activity Procedure
1. Students execute programmed flight sequence
2. Observe accuracy and consistency
3. Perform same flight manually
4. Compare results
5. Identify strengths and weaknesses
6. Discuss safety considerations
7. Reflect on preferred method

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Execution Accuracy	Highly accurate	Mostly accurate	Some deviation	Inaccurate
Comparison Analysis	Clear and detailed	Mostly clear	Some gaps	Limited
Safety Awareness	Fully maintained	Mostly maintained	Some lapses	Unsafe
Engagement	Fully engaged	Mostly engaged	Some engagement	Minimal

---

Scenario (C3 Application)
A student runs a programmed flight but notices the drone is heading toward an obstacle and does not intervene, resulting in unsafe operation.

• What mistake was made?
• What should the pilot have done?
• Why is manual override important?

Assessment Items

1. What is autonomous flight?
   A. Manual control
   B. Programmed flight
   C. Random movement
   D. Hovering
2. What is manual control?
   A. Programming
   B. Pilot-controlled flight
   C. Automated flight
   D. Pre-planned flight
3. What is an advantage of programming?
   A. Flexibility
   B. Consistency
   C. Random movement
   D. Delay
4. What is an advantage of manual control?
   A. Consistency
   B. Flexibility
   C. Automation
   D. Repetition
5. What is override?
   A. Ignoring commands
   B. Taking control during automation
   C. Increasing speed
   D. Hovering

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Both programmed and manual flight methods are valuable, but safe operation requires awareness, control, and readiness to intervene.

Teacher Notes

• Reinforce importance of pilot responsibility
• Emphasize when to use override
• Encourage comparison discussion
• Prepare students for programming evaluation and refinement (Day 5)

Week 14 – Day 5: Autonomous Flight Evaluation and Troubleshooting

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
107.04	Evaluate and troubleshoot autonomous flight performance.	B2
105.03	Demonstrate safe and responsible drone flight operations.	C3
106.00	Perform manual drone flight operations using controlled maneuvers.	C3

Objective
Students will execute an autonomous drone mission and evaluate performance to identify errors and apply troubleshooting strategies for improvement.

Essential Question
How can evaluating and troubleshooting autonomous flight improve performance and safety?

Key Concepts
• Autonomous missions require accurate execution
• Evaluation identifies performance issues
• Troubleshooting improves outcomes
• Errors must be analyzed and corrected
• Safety must be maintained throughout all operations

Vocabulary
• **Troubleshooting** – Identifying and correcting problems
• **Autonomous Mission** – A programmed flight performed without manual control
• **Performance Analysis** – Evaluating results against expectations
• **Flight Deviation** – Difference between expected and actual movement
• **Correction Strategy** – Method used to fix errors

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with programming interface
• Student-developed programmed flight paths
• Flight area with defined course or objective
• Evaluation checklist or rubric
• Whiteboard or presentation display

Bellringer
Prompt:
Why is it important to identify and fix mistakes after completing a task?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Programming sequences control drone movement
   • Execution produces measurable results
   • Autonomous and manual control differ
   • Safety must always be maintained

   Discuss:
   • What happens when a programmed flight does not perform as expected?
   • How can performance improve over time?

   Bridge to lesson:
   • Today's lesson focuses on executing autonomous missions and improving them through evaluation and troubleshooting

---

2. **Core Concept Introduction**

   • Autonomous missions must be evaluated after execution
   • Troubleshooting improves performance and accuracy

   Key Teaching Point:
   Successful drone programming requires executing missions, analyzing performance, and applying corrections to improve results.

---

3. **Concept Development**

   A. **Understanding Autonomous Mission Execution**

   • Execution involves:
   - running programmed flight
   - observing results

   • Requires:
   - accurate programming
   - safe environment

   Emphasize:
   • Execution must match intended outcome

   B. **Understanding Performance Evaluation**

   • Evaluation includes:
   - comparing expected vs actual results
   - identifying deviations

   • Helps determine:
   - accuracy
   - efficiency

   Emphasize:
   • Evaluation reveals areas for improvement

C. Identifying Flight Deviations

• Deviations may include:
- incorrect direction
- incomplete movement
- timing errors

• Causes include:
- sequence errors
- logic mistakes

Emphasize:
• Deviations indicate problems in programming

D. Applying Troubleshooting Strategies

• Troubleshooting includes:
- reviewing command sequence
- identifying incorrect steps
- adjusting commands

• Goal:
- correct errors
- improve performance

Emphasize:
• Troubleshooting leads to better outcomes

E. Maintaining Safety During Troubleshooting

• Safety requires:
- monitoring flight
- controlling environment
- readiness to intervene

• Pilots must:
- remain alert
- ensure safe operations

Emphasize:
• Safety is always the priority

---

4. Application to Drone Flight

Students apply:
• Execute autonomous mission
• Observe performance outcome
• Identify deviations
• Apply troubleshooting corrections
• Re-execute mission
• Compare results

Students recognize:
• Troubleshooting improves performance

5. Guided Examples / Demonstration

Instructor demonstrates:
- Programmed mission with errors
- Corrected mission

Students identify:
- Differences in performance
- Effectiveness of troubleshooting

6. Real-World Connection

- Troubleshooting is used in:
  - inspections
  - mapping missions
  - automated operations

Emphasize:
- Professionals continuously evaluate and improve flight performance

7. Key Reinforcement Summary

- Autonomous missions must be evaluated
- Deviations indicate errors
- Troubleshooting improves performance
- Safety must always be maintained

Key Teaching Point:
Evaluating and troubleshooting autonomous flight ensures accurate, efficient, and safe drone operations.

Formative Questions for Use in This Lesson

- What is troubleshooting?
- What is an autonomous mission?
- What is a flight deviation?
- How can errors be corrected?
- Why must safety be maintained during troubleshooting?

Hands-On Activity

Activity Title: Autonomous Mission Troubleshooting Challenge

Objective:

Students will execute, evaluate, and troubleshoot a programmed drone mission.

Activity Procedure

1. Students execute programmed flight mission
2. Observe and record results
3. Identify deviations from expected outcome
4. Analyze cause of errors
5. Modify command sequence
6. Re-execute mission

7. Compare results and improvements

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Execution Accuracy	Highly accurate	Mostly accurate	Some deviation	Inaccurate
Evaluation Quality	Thorough and precise	Mostly accurate	Some gaps	Limited
Troubleshooting Effectiveness	Highly effective	Mostly effective	Limited	Ineffective
Safety Awareness	Fully maintained	Mostly maintained	Some lapses	Unsafe

---

Scenario (C3 Application)
A student executes an autonomous mission and notices the drone consistently stops short of the intended landing point but does not adjust the programmed sequence.

• What error is occurring?
• What should be reviewed in the programming sequence?
• How can troubleshooting improve the outcome?

Assessment Items

1. What is troubleshooting?
   A. Ignoring errors
   B. Identifying and correcting problems
   C. Increasing speed
   D. Hovering
2. What is an autonomous mission?
   A. Manual flight
   B. Programmed flight operation
   C. Random movement
   D. Hover
3. What is a flight deviation?
   A. Correct movement
   B. Difference between expected and actual results
   C. Faster flight
   D. Higher altitude
4. What helps improve performance?
   A. Ignoring results
   B. Evaluation and troubleshooting
   C. Increasing speed
   D. Skipping steps

5. What must always be maintained?
   A. Speed
   B. Safety
   C. Altitude
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Evaluating and troubleshooting autonomous flight ensures improved performance, accuracy, and safe drone operations.

Teacher Notes

• Reinforce evaluation before correction
• Emphasize cause-and-effect in errors
• Encourage multiple iterations for improvement
• Prepare students for advanced programming missions (Week 15)

Week 15 – Advanced Autonomous Mission Development and Execution

Week 15 Overview
Week 15 advances students from basic programming concepts to full autonomous mission development and execution. Students will design, build, and execute multi-step programmed flight paths that simulate real-world drone operations. Emphasis is placed on integrating sequencing, logic, and control into structured missions while maintaining safety and operational awareness. Students will evaluate performance, troubleshoot errors, and refine programmed missions to improve accuracy and efficiency. This week strengthens the connection between programming and real-world drone applications.

Week 15 – Day 1: Introduction to Multi-Step Autonomous Missions

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3

Objective
Students will analyze and design multi-step autonomous drone missions by breaking down tasks into structured programmed sequences.

Essential Question
What makes a programmed sequence a complete autonomous drone mission?

Key Concepts
• Autonomous missions consist of multiple programmed steps
• Mission design requires sequencing and structure
• Each step contributes to overall mission success
• Logical planning improves execution accuracy
• Safety must be integrated into mission design

Vocabulary
• **Autonomous Mission** – A multi-step programmed drone operation
• **Mission Sequence** – Ordered set of programmed steps forming a complete task
• **Waypoint** – A defined location or position in a flight path
• **Mission Planning** – Structuring steps to achieve a specific objective
• **Operational Flow** – The progression of actions in a mission

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with programming interface
• Whiteboard or presentation display
• Mission scenario cards or prompts
• Flight area with defined boundaries

Bellringer
Prompt:
What steps are required to complete a task from start to finish?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Programming uses sequences to control movement
   • Commands must follow logical order
   • Autonomous flight follows programmed instructions
   • Safety must always be maintained

   Discuss:
   • What is the difference between a simple movement and a full mission?
   • How do multiple steps work together to complete a task?

   Bridge to lesson:
   • Today's lesson focuses on building complete autonomous missions using multiple programmed steps

---

2. **Core Concept Introduction**
   • A mission is a structured sequence of programmed actions
   • Missions require planning, sequencing, and purpose

   Key Teaching Point:
   An autonomous mission is a series of logically ordered programmed steps designed to achieve a specific objective.

---

3. **Concept Development**
   A. **Understanding Autonomous Missions**
      • Missions involve:
      - multiple steps
      - defined objectives
      - structured sequence

      • Missions are:
      - purposeful
      - planned

      Emphasize:
      • Missions go beyond simple movement

B. Breaking Down Mission Components

• A mission includes:
- takeoff
- navigation
- task completion
- landing

• Each step:
- contributes to outcome

Emphasize:
• Each step must be clearly defined

C. Understanding Waypoints and Path Structure

• Waypoints define:
- positions
- direction

• Paths connect:
- multiple waypoints

Emphasize:
• Waypoints guide mission flow

D. Structuring Logical Mission Flow

• Logical flow ensures:
- correct sequence
- smooth execution

• Poor structure leads to:
- errors
- inefficiency

Emphasize:
• Structure determines success

E. Integrating Safety into Mission Design

• Safety considerations include:
- environment
- obstacles
- controlled flight area

• Pilots must:
- plan for safe execution

Emphasize:
• Safety is part of mission planning

---

4. **Application to Drone Flight**
   Students apply:
   • Analyze a mission scenario
   • Break mission into steps
   • Organize steps into sequence
   • Prepare for programmed execution

   Students recognize:
   • Mission design requires structure and planning

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Example mission broken into steps
   • Structured sequence for execution

   Students identify:
   • Mission components
   • Logical flow

---

6. **Real-World Connection**
   • Autonomous missions are used in:
     - inspections
     - mapping
     - surveillance

   Emphasize:
   • Real-world missions require planning and structure

---

7. **Key Reinforcement Summary**
   • Missions consist of multiple steps
   • Structure and sequencing are essential
   • Waypoints guide movement
   • Safety must be integrated

   Key Teaching Point:
   Effective autonomous missions require structured planning, logical sequencing, and safety integration.

Formative Questions for Use in This Lesson
• What is an autonomous mission?
• What are mission components?
• What is a waypoint?
• Why is logical flow important?
• How is safety integrated into mission design?

Hands-On Activity
Activity Title: Mission Design Challenge
Objective:
Students will design a multi-step autonomous mission based on a given scenario.

Activity Procedure

1. Students receive mission scenario
2. Identify mission objective
3. Break mission into steps
4. Organize steps into logical sequence
5. Identify waypoints
6. Present mission plan

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Mission Structure	Clear and complete	Mostly clear	Some gaps	Incomplete
Logical Sequencing	Fully logical	Mostly logical	Some errors	Weak
Waypoint Identification	Accurate and clear	Mostly accurate	Some errors	Limited
Safety Integration	Fully integrated	Mostly integrated	Some gaps	Missing

Scenario (C3 Application)

A student designs a mission but places the landing step before completing the navigation portion of the flight.

• What is incorrect about the sequence?
• How should the mission be reordered?
• Why is logical flow critical in mission design?

Assessment Items

1. What is an autonomous mission?
   A. Single command
   B. Multi-step programmed operation
   C. Manual flight
   D. Hover
2. What is a waypoint?
   A. Battery
   B. Defined position in flight path
   C. Speed control
   D. Altitude
3. What is mission sequence?
   A. Random order
   B. Ordered steps
   C. Speed
   D. Direction

4. Why is structure important?
   A. Faster flight
   B. Correct execution
   C. Higher altitude
   D. Longer battery
5. What must be included in mission design?
   A. Speed only
   B. Safety considerations
   C. Random movement
   D. Hover

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Autonomous missions require structured planning, logical sequencing, and safety integration to achieve successful outcomes.

Teacher Notes

• Reinforce difference between sequence and mission
• Emphasize structure before execution
• Encourage detailed planning
• Prepare students for building programmed flight paths (Day 2)

Week 15 – Day 2: Designing Programmed Flight Paths for Autonomous Missions

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.02	Develop a programmed flight path using a drone platform.	C3
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3

Objective
Students will design a programmed flight path for an autonomous drone mission using structured sequencing, waypoints, and logical flow.

Essential Question
How can a programmed flight path be designed to ensure accurate and successful mission execution?

Key Concepts
• Programmed flight paths define mission movement
• Waypoints structure the flight path
• Logical sequencing ensures accurate execution
• Mission planning connects programming to real-world tasks
• Safety must be integrated into flight path design

Vocabulary
• **Flight Path** – The planned route a drone follows
• **Waypoint Sequence** – Ordered positions guiding movement
• **Navigation Plan** – Structured movement from start to finish
• **Path Accuracy** – How closely flight matches intended route
• **Command Structure** – Organization of programming instructions

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with programming interface
• Graph paper or digital mapping tool
• Whiteboard or presentation display
• Mission scenario prompts

Bellringer
Prompt:
How do pilots ensure they follow the correct path during a flight?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Autonomous missions consist of multiple steps
   • Missions require logical sequencing
   • Waypoints guide movement
   • Safety must be integrated into planning

   Discuss:
   • How do we move from mission idea to actual programmed movement?
   • What is needed to ensure a drone follows the correct path?

   Bridge to lesson:
   • Today's lesson focuses on designing programmed flight paths that guide autonomous missions

---

2. **Core Concept Introduction**

   • A programmed flight path defines how a drone moves during a mission
   • Waypoints and sequences create structure

   Key Teaching Point:
   A well-designed flight path uses structured sequencing and waypoints to guide accurate autonomous drone movement.

---

3. **Concept Development**

   A. **Understanding Programmed Flight Paths**

   • Flight paths include:
   - starting position
   - movement sequence
   - ending point

   • Paths define:
   - direction
   - distance

   Emphasize:
   • Flight paths guide the mission

   B. **Understanding Waypoint Sequencing**

   • Waypoints:
   - mark positions
   - guide navigation

   • Sequence determines:
   - order of travel

   Emphasize:
   • Waypoints create structure

C. Structuring Movement Commands

• Commands include:
- movement directions
- turns
- stops

• Must be:
- ordered correctly
- logically connected

Emphasize:
• Commands must match path

D. Ensuring Path Accuracy

• Accuracy depends on:
- correct sequencing
- proper spacing

• Errors result in:
- missed targets
- incorrect movement

Emphasize:
• Precision is critical

E. Integrating Safety into Flight Path Design

• Safety considerations include:
- obstacle avoidance
- flight boundaries
- controlled environment

• Pilots must:
- plan safe routes

Emphasize:
• Safety is built into planning

---

4. Application to Drone Flight

Students apply:
• Design a programmed flight path
• Identify waypoints
• Structure command sequence
• Prepare for execution

Students recognize:
• Flight path design determines mission success

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Sample flight path design
   • Corresponding command sequence

   Students identify:
   • Connection between path and programming

---

6. **Real-World Connection**
   • Flight path design is used in:
   - mapping missions
   - inspections
   - delivery routes

   Emphasize:
   • Accurate path design ensures mission success

---

7. **Key Reinforcement Summary**
   • Flight paths guide movement
   • Waypoints structure navigation
   • Sequencing ensures accuracy
   • Safety must be integrated

   Key Teaching Point:
   Designing a structured and accurate flight path is essential for successful autonomous drone missions.

Formative Questions for Use in This Lesson
• What is a flight path?
• What is a waypoint?
• Why is sequencing important?
• How does path design affect accuracy?
• Why must safety be included?

Hands-On Activity
Activity Title: Programmed Flight Path Design
Objective:
Students will design a complete programmed flight path for a given mission scenario.

Activity Procedure
1. Students receive mission scenario
2. Identify mission objective
3. Draw or map flight path
4. Identify waypoints
5. Create command sequence
6. Prepare for execution (next lesson)

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Flight Path Design	Clear and precise	Mostly clear	Some gaps	Incomplete
Waypoint Accuracy	Fully accurate	Mostly accurate	Some errors	Limited
Command Structure	Fully logical	Mostly logical	Some gaps	Weak
Safety Integration	Fully integrated	Mostly integrated	Some gaps	Missing

---

Scenario (C3 Application)
A student designs a flight path but places waypoints too close to an obstacle, creating a safety risk during execution.

• What is the problem with the design?
• How should the flight path be adjusted?
• Why is safety critical in path design?

Assessment Items

1. What is a flight path?
   A. Speed
   B. Planned route
   C. Battery
   D. Altitude
2. What is a waypoint?
   A. A drone part
   B. A position in a flight path
   C. Speed control
   D. Direction
3. Why is sequencing important?
   A. Faster flight
   B. Correct movement
   C. Higher altitude
   D. Longer battery
4. What affects path accuracy?
   A. Random commands
   B. Proper sequencing
   C. Ignoring planning
   D. Speed
5. What must be included in path design?
   A. Speed
   B. Safety
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Designing accurate and safe programmed flight paths is essential for successful autonomous mission execution.

Teacher Notes

• Reinforce connection between design and execution
• Emphasize accuracy and safety
• Encourage clear mapping of flight paths
• Prepare students for mission execution (Day 3)

Week 15 – Day 3: Executing Autonomous Drone Missions

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will execute a programmed autonomous drone mission while maintaining control awareness and safe operational practices.

Essential Question
What factors ensure successful execution of an autonomous drone mission?

Key Concepts
• Autonomous missions require precise execution
• Programmed commands determine flight behavior
• Monitoring is necessary during execution
• Manual override awareness is critical
• Safety must be maintained at all times

Vocabulary
• **Mission Execution** – Running a programmed drone operation
• **Autonomous Control** – Drone operates based on programmed instructions
• **Manual Override** – Pilot intervention during flight
• **Execution Accuracy** – How closely performance matches the programmed plan
• **Operational Awareness** – Monitoring conditions during flight

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with programming interface
• Student-designed programmed flight paths (from Day 2)
• Flight area with defined boundaries
• Safety checklist

Bellringer
Prompt:
What could cause a programmed drone mission to fail during execution?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Autonomous missions are built from structured sequences
   • Flight paths define movement
   • Waypoints guide navigation
   • Safety must always be maintained

   Discuss:
   • What must be checked before executing a mission?
   • What could go wrong during execution?

   Bridge to lesson:
   • Today's lesson focuses on executing programmed missions and maintaining control during autonomous flight

---

2. **Core Concept Introduction**
   • Execution is the process of running a programmed mission
   • Monitoring ensures safe and accurate operation

   Key Teaching Point:
   Executing an autonomous mission requires careful monitoring, control awareness, and adherence to safety procedures.

---

3. **Concept Development**

   A. Understanding Mission Execution
   • Execution involves:
   - running programmed commands
   - observing flight behavior

   • Requires:
   - correct programming
   - proper setup

   Emphasize:
   • Execution brings programming to life

   B. Monitoring Flight Performance
   • Monitoring includes:
   - observing movement
   - checking accuracy

   • Helps identify:
   - errors
   - deviations

   Emphasize:
   • Continuous monitoring is essential

C. Recognizing Execution Accuracy

• Accuracy means:
- following programmed path
- completing mission steps

• Inaccuracy may include:
- missed waypoints
- incorrect direction

Emphasize:
• Accuracy determines success

D. Maintaining Manual Override Awareness

• Pilots must:
- remain ready to intervene
- stop unsafe flight

• Override is used when:
- unexpected issues occur

Emphasize:
• Safety requires pilot readiness

E. Maintaining Safe Operations During Execution

• Safety includes:
- controlled flight area
- obstacle awareness
- proper spacing

• Pilots must:
- monitor environment
- ensure safe operation

Emphasize:
• Safety is always the priority

---

4. Application to Drone Flight

Students apply:
• Load programmed mission
• Execute autonomous flight
• Monitor drone behavior
• Identify performance accuracy
• Maintain readiness for manual override

Students recognize:
• Execution requires active monitoring

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Executing a programmed mission
   • Monitoring for accuracy and safety

   Students identify:
   • Signs of correct execution
   • Indicators of potential issues

---

6. **Real-World Connection**
   • Mission execution is used in:
   - inspections
   - mapping
   - delivery operations

   Emphasize:
   • Professionals monitor autonomous missions for safety and accuracy

---

7. **Key Reinforcement Summary**
   • Execution runs programmed missions
   • Monitoring ensures accuracy
   • Manual override provides safety control
   • Safe operation is essential

   Key Teaching Point:
   Successful autonomous mission execution requires monitoring, control awareness, and strict adherence to safety procedures.

Formative Questions for Use in This Lesson
• What is mission execution?
• Why is monitoring important?
• What is execution accuracy?
• When is manual override needed?
• Why must safety be maintained?

Hands-On Activity
Activity Title: Autonomous Mission Execution
Objective:
Students will execute their programmed drone mission and monitor performance.

Activity Procedure
1. Students prepare drone and programming system
2. Load programmed flight path
3. Conduct safety check
4. Execute mission
5. Monitor drone performance
6. Record observations
7. Prepare for evaluation (next lesson)

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Execution Accuracy	Highly accurate	Mostly accurate	Some deviation	Inaccurate
Monitoring Awareness	Fully attentive	Mostly attentive	Some lapses	Limited
Manual Override Readiness	Immediate and appropriate	Mostly appropriate	Delayed response	Unprepared
Safety Compliance	Fully maintained	Mostly maintained	Some lapses	Unsafe

---

Scenario (C3 Application)
During an autonomous mission, a drone begins drifting off the programmed path, but the student does not intervene.

• What issue is occurring?
• What should the student do immediately?
• Why is manual override critical during execution?

Assessment Items

1. What is mission execution?
   A. Planning
   B. Running programmed mission
   C. Designing
   D. Hovering
2. What ensures safe execution?
   A. Speed
   B. Monitoring
   C. Height
   D. Distance
3. What is execution accuracy?
   A. Speed
   B. Matching programmed path
   C. Battery life
   D. Altitude
4. When is manual override used?
   A. Never
   B. When issues occur
   C. During planning
   D. After landing
5. What must always be maintained?
   A. Speed
   B. Safety
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Executing autonomous missions requires careful monitoring, accuracy, and readiness to maintain safe drone operations.

Teacher Notes

• Reinforce active monitoring during execution
• Emphasize importance of manual override
• Encourage observation and note-taking
• Prepare students for evaluation and troubleshooting (Day 4)

Week 15 – Day 4: Evaluating and Troubleshooting Autonomous Mission Performance

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.04	Evaluate and troubleshoot autonomous flight performance.	B2
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will evaluate autonomous mission performance and apply troubleshooting strategies to improve accuracy and efficiency.

Essential Question
How can evaluating and troubleshooting autonomous flight improve mission performance?

Key Concepts
• Evaluation compares expected vs actual performance
• Deviations indicate errors in programming or execution
• Troubleshooting identifies and corrects issues
• Iteration improves mission accuracy
• Safety must be maintained during evaluation

Vocabulary
• **Evaluation** – Assessing performance against expected results
• **Troubleshooting** – Identifying and correcting problems
• **Flight Deviation** – Difference between expected and actual movement
• **Iteration** – Repeating a process to improve results
• **Performance Feedback** – Information used to improve outcomes

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with programming interface
• Student mission execution data (from Day 3)
• Evaluation checklist or rubric
• Whiteboard or presentation display

Bellringer
Prompt:
Why is it important to review and improve performance after completing a task?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

Students recall:
• Autonomous missions were executed
• Monitoring identified performance outcomes
• Deviations may have occurred
• Safety was maintained during execution

Discuss:
• What differences were observed between expected and actual flight?
• What caused those differences?

Bridge to lesson:
• Today's lesson focuses on evaluating mission performance and applying troubleshooting strategies

---

2. **Core Concept Introduction**

• Evaluation identifies strengths and weaknesses
• Troubleshooting improves mission outcomes

Key Teaching Point:
Evaluating and troubleshooting autonomous flight allows pilots to improve performance, accuracy, and reliability.

---

3. **Concept Development**

A. Understanding Performance Evaluation

• Evaluation includes:
  - comparing expected vs actual results
  - identifying deviations

• Helps determine:
  - accuracy
  - effectiveness

Emphasize:
• Evaluation reveals improvement areas

B. Identifying Flight Deviations

• Deviations may include:
  - incorrect path
  - missed waypoints
  - timing errors

• Causes may include:
  - programming mistakes
  - environmental factors

Emphasize:
• Deviations indicate problems

C. Analyzing Causes of Errors

• Errors may result from:
- incorrect sequence
- spacing issues
- logic errors

• Analysis requires:
- reviewing commands
- examining execution

Emphasize:
• Understanding cause leads to correction

D. Applying Troubleshooting Strategies

• Troubleshooting includes:
- adjusting commands
- correcting sequence
- refining path

• Goal:
- improve performance

Emphasize:
• Troubleshooting improves results

E. Maintaining Safety During Evaluation

• Safety requires:
- controlled environment
- readiness to intervene
- awareness of surroundings

• Pilots must:
- maintain safe operation

Emphasize:
• Safety remains critical

---

4. Application to Drone Flight

Students apply:
• Review mission execution results
• Identify deviations
• Analyze causes of errors
• Modify programmed sequence
• Prepare for re-execution

Students recognize:
• Evaluation leads to improvement

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Mission with errors
   • Process of identifying and correcting issues

   Students identify:
   • Error types
   • Correction strategies

---

6. **Real-World Connection**
   • Evaluation and troubleshooting are used in:
   - inspections
   - mapping missions
   - automated operations

   Emphasize:
   • Professionals refine missions through evaluation

---

7. **Key Reinforcement Summary**
   • Evaluation identifies issues
   • Deviations indicate errors
   • Troubleshooting improves performance
   • Safety must be maintained

   Key Teaching Point:
   Evaluating and troubleshooting autonomous missions ensures accurate, efficient, and safe drone operations.

Formative Questions for Use in This Lesson
• What is evaluation?
• What is a flight deviation?
• What causes errors in missions?
• What is troubleshooting?
• Why is safety important during evaluation?

Hands-On Activity
Activity Title: Mission Evaluation and Troubleshooting
Objective:
Students will evaluate mission performance and apply troubleshooting strategies.

Activity Procedure
1. Students review mission execution data
2. Identify deviations
3. Analyze causes of errors
4. Modify programmed sequence
5. Prepare corrected mission
6. Present troubleshooting plan

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Evaluation Accuracy	Highly accurate	Mostly accurate	Some gaps	Limited
Error Identification	Thorough and precise	Mostly accurate	Some gaps	Limited
Troubleshooting Strategy	Highly effective	Mostly effective	Limited	Ineffective
Safety Awareness	Fully maintained	Mostly maintained	Some lapses	Unsafe

---

Scenario (C3 Application)
A student reviews a mission and notices that the drone consistently overshoots each waypoint.

• What is the likely issue?
• What adjustment should be made?
• How will troubleshooting improve performance?

Assessment Items

1. What is evaluation?
   A. Ignoring results
   B. Assessing performance
   C. Increasing speed
   D. Hovering
2. What is a flight deviation?
   A. Correct movement
   B. Difference from expected result
   C. Faster speed
   D. Higher altitude
3. What causes mission errors?
   A. Correct sequencing
   B. Programming mistakes
   C. Proper planning
   D. Safety checks
4. What is troubleshooting?
   A. Ignoring problems
   B. Fixing errors
   C. Increasing speed
   D. Hovering
5. What must always be maintained?
   A. Speed
   B. Safety
   C. Distance
   D. Altitude

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Evaluating and troubleshooting autonomous missions improves accuracy, performance, and safe drone operations.

Teacher Notes

• Reinforce cause-and-effect relationships in errors
• Encourage detailed analysis before correction
• Emphasize iterative improvement
• Prepare students for optimization and refinement (Day 5)

Week 15 – Day 5: Autonomous Mission Optimization and Performance Improvement

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
107.04	Evaluate and troubleshoot autonomous flight performance.	B2
105.03	Demonstrate safe and responsible drone flight operations.	C3
106.00	Perform manual drone flight operations using controlled maneuvers.	C3

Objective
Students will refine and optimize autonomous drone missions by applying evaluation data and troubleshooting strategies to improve accuracy and efficiency.

Essential Question
How can iterative improvements optimize autonomous drone mission performance?

Key Concepts
• Optimization improves mission performance
• Iteration allows continuous refinement
• Small adjustments lead to better outcomes
• Evaluation data guides improvements
• Safety must be maintained during all operations

Vocabulary
• **Optimization** – Improving performance through refinement
• **Iteration** – Repeating a process to improve results
• **Refinement** – Making adjustments for improvement
• **Performance Improvement** – Enhancing accuracy and efficiency
• **Adjustment Strategy** – Planned correction to improve outcome

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with programming interface
• Student corrected mission programs (from Day 4)
• Evaluation checklist or rubric
• Flight area with defined boundaries

Bellringer
Prompt:
Why do professionals repeat and improve processes instead of accepting the first result?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Missions were executed (Day 3)
   • Performance was evaluated (Day 4)
   • Errors were identified and corrected

   Discuss:
   • Did the corrections improve performance?
   • What still needs improvement?

   Bridge to lesson:
   • Today's lesson focuses on refining and optimizing missions through repeated improvement

---

2. **Core Concept Introduction**

   • Optimization improves mission performance
   • Iteration leads to refinement

   Key Teaching Point:
   Optimizing autonomous missions requires repeated evaluation, adjustment, and refinement to achieve accurate and efficient performance.

---

3. **Concept Development**

   A. Understanding Optimization in Drone Missions

   • Optimization involves:
   - improving accuracy
   - increasing efficiency

   • Requires:
   - evaluation
   - adjustment

   Emphasize:
   • Optimization improves outcomes

   B. Understanding Iteration

   • Iteration includes:
   - repeating mission
   - applying changes

   • Each cycle:
   - improves performance

   Emphasize:
   • Improvement occurs over time

C. Applying Refinement Strategies

• Refinement includes:
- adjusting commands
- improving sequencing
- correcting spacing

• Goal:
- improve accuracy

Emphasize:
• Small changes create improvement

D. Measuring Performance Improvement

• Improvement measured by:
- reduced deviation
- increased accuracy
- smoother execution

• Comparison:
- before vs after

Emphasize:
• Data shows improvement

E. Maintaining Safety During Optimization

• Safety requires:
- controlled environment
- monitoring flight
- readiness to intervene

• Pilots must:
- ensure safe operations

Emphasize:
• Safety remains priority

---

4. Application to Drone Flight

Students apply:
• Execute corrected mission
• Observe performance changes
• Compare results to previous attempts
• Apply further refinements
• Re-execute mission

Students recognize:
• Iteration improves performance

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Initial mission with errors
   • Improved mission after optimization

   Students identify:
   • Differences in performance
   • Effectiveness of refinement

---

6. **Real-World Connection**
   • Optimization is used in:
   - automated inspections
   - mapping missions
   - delivery operations

   Emphasize:
   • Professionals refine missions for efficiency and accuracy

---

7. **Key Reinforcement Summary**
   • Optimization improves performance
   • Iteration leads to refinement
   • Small adjustments increase accuracy
   • Safety must be maintained

   Key Teaching Point:
   Continuous evaluation and refinement lead to optimized autonomous drone mission performance.

Formative Questions for Use in This Lesson
• What is optimization?
• What is iteration?
• How does refinement improve performance?
• How is improvement measured?
• Why must safety be maintained?

Hands-On Activity
Activity Title: Mission Optimization Challenge
Objective:
Students will refine and optimize an autonomous drone mission through iterative improvement.

Activity Procedure
1. Students execute corrected mission
2. Observe performance results
3. Compare to previous execution
4. Identify remaining deviations
5. Apply additional refinements
6. Re-execute mission
7. Document improvements

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Performance Improvement	Significant improvement	Moderate improvement	Some improvement	Minimal
Refinement Strategy	Highly effective	Mostly effective	Limited	Ineffective
Iteration Process	Thorough and consistent	Mostly consistent	Some gaps	Limited
Safety Compliance	Fully maintained	Mostly maintained	Some lapses	Unsafe

---

Scenario (C3 Application)
A student improves a mission but still notices slight deviations in positioning after execution.

- What should the student do next?
- Why is additional iteration necessary?
- How does refinement improve accuracy?

Assessment Items

1. What is optimization?
   A. Ignoring results
   B. Improving performance
   C. Increasing speed
   D. Hovering
2. What is iteration?
   A. One attempt
   B. Repeating process
   C. Increasing height
   D. Changing battery
3. What is refinement?
   A. Ignoring errors
   B. Adjusting for improvement
   C. Increasing speed
   D. Hovering
4. What measures improvement?
   A. Speed
   B. Comparison of results
   C. Height
   D. Distance
5. What must always be maintained?
   A. Speed
   B. Safety
   C. Altitude
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Optimizing autonomous missions through iteration and refinement leads to improved accuracy, efficiency, and safe drone operations.

Teacher Notes

• Emphasize iterative improvement mindset
• Encourage multiple refinement cycles
• Reinforce data-driven decision making
• Prepare students for advanced mission applications (Week 16)

Week 16 – Applying and Improving Autonomous Drone Missions

Week 16 Overview (Adjusted for Foundational Level)
Week 16 provides students with the opportunity to apply and improve their autonomous drone missions using the programming and flight skills developed in previous weeks. Students will create and execute multi-step programmed missions, focusing on accuracy, control, and safe operation. Emphasis is placed on making simple improvements based on performance, reinforcing sequencing, and maintaining safe flight practices. Students will work with increasing independence while still receiving structured guidance. This week prepares students for final mission demonstrations and end-of-course assessments.

Week 16 – Day 1: Building Multi-Step Autonomous Drone Missions

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.02	Develop a programmed flight path using a drone platform.	C3
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3

Objective
Students will create a multi-step autonomous drone mission using a structured sequence of commands and demonstrate safe mission setup.

Essential Question
How can a multi-step programmed mission be created to complete a task accurately and safely?

Key Concepts
• Autonomous missions use multiple programmed steps
• Sequencing controls drone movement
• Clear structure improves accuracy
• Simple improvements can improve performance
• Safety must be included in every mission

Vocabulary
• **Autonomous Mission** – A programmed sequence of drone movements
• **Sequence** – The order of commands
• **Waypoint** – A position in a flight path
• **Command** – A programmed instruction
• **Accuracy** – How closely the drone follows the intended path

Basic Drone Pilot (DP01)

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with block-based programming interface
• Pre-designed mission examples (simple)
• Whiteboard or display
• Flight area with defined boundaries

Bellringer
Prompt:
What steps are needed to complete a simple task from start to finish?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Autonomous missions are made of multiple steps
   • Flight paths use waypoints
   • Programming uses sequences
   • Missions were executed and improved in Week 15

   Discuss:
   • What made some missions more accurate than others?
   • Why is the order of steps important?

   Bridge to lesson:
   • Today's lesson focuses on building a clear and accurate multi-step mission

---

2. **Core Concept Introduction**
   • A multi-step mission uses several commands to complete a task
   • Clear sequencing helps the drone follow the correct path

   Key Teaching Point:
   A well-structured sequence of commands helps a drone complete a mission accurately and safely.

---

3. **Concept Development**
   A. **Understanding Multi-Step Missions**
      • A mission includes:
        - takeoff
        - movement steps
        - landing

      • Each step:
        - must be in the correct order

      Emphasize:
      • Missions are built step-by-step

B. Building a Sequence of Commands

• Commands include:
- move forward
- turn
- hover
- land

• Commands must:
- follow a logical order

Emphasize:
• Order matters

C. Using Waypoints in a Mission

• Waypoints:
- guide direction
- help structure movement

• Missions follow:
- point to point movement

Emphasize:
• Waypoints help guide accuracy

D. Improving Mission Accuracy

• Accuracy depends on:
- correct spacing
- correct sequence

• Simple fixes include:
- adjusting distance
- adjusting timing

Emphasize:
• Small changes improve results

E. Maintaining Safety During Mission Setup

• Safety includes:
- checking environment
- keeping safe distance
- following flight rules

• Pilots must:
- plan safe missions

Emphasize:
• Safety is part of mission setup

---

4. **Application to Drone Flight**
   Students apply:
   • Create a multi-step mission
   • Organize commands in order
   • Identify waypoints
   • Prepare for execution

   Students recognize:
   • Clear structure leads to better performance

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • A simple multi-step mission
   • Correct sequence of commands

   Students identify:
   • Order of steps
   • How commands control movement

---

6. **Real-World Connection**
   • Autonomous missions are used in:
     - inspections
     - mapping
     - photography

   Emphasize:
   • Real missions follow clear steps

---

7. **Key Reinforcement Summary**
   • Missions use multiple steps
   • Sequence controls movement
   • Waypoints guide direction
   • Small changes improve accuracy
   • Safety must be included

   Key Teaching Point:
   Clear sequencing and simple improvements help create accurate and safe autonomous drone missions.

Formative Questions for Use in This Lesson
• What is a multi-step mission?
• Why is sequence important?
• What is a waypoint?
• How can accuracy be improved?
• Why must safety be included?

Hands-On Activity
Activity Title: Build a Multi-Step Mission
Objective:
Students will create a simple multi-step autonomous drone mission using block-based programming.

Activity Procedure

1. Students review example mission
2. Identify mission objective
3. Create 4–6 step sequence
4. Add movement commands
5. Identify waypoints
6. Prepare mission for execution

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Sequence Structure	Clear and complete	Mostly clear	Some gaps	Incomplete
Command Accuracy	Accurate commands	Mostly accurate	Some errors	Limited
Waypoint Use	Clear and logical	Mostly logical	Some gaps	Limited
Safety Planning	Fully included	Mostly included	Some gaps	Missing

---

Scenario (C3 Application)
A student creates a mission but places the turn command before moving forward, causing the drone to move in the wrong direction.

• What is the mistake in the sequence?
• How should the commands be reordered?
• Why does sequence affect mission accuracy?

Assessment Items

1. What is a multi-step mission?
   A. Single movement
   B. Series of commands
   C. Manual flight
   D. Hover
2. What controls the order of movement?
   A. Speed
   B. Sequence
   C. Height
   D. Battery
3. What is a waypoint?
   A. Battery
   B. Position in flight path
   C. Speed
   D. Direction

4. How can accuracy be improved?
   A. Ignore errors
   B. Make small adjustments
   C. Increase speed
   D. Skip steps
5. What must always be included?
   A. Speed
   B. Safety
   C. Distance
   D. Height

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Building clear and simple multi-step missions helps drones operate accurately and safely.

Teacher Notes

• Keep missions simple (4–6 steps)
• Reinforce sequence before execution
• Focus on accuracy, not complexity
• Provide guided support where needed
• Prepare students for execution (Day 2)

Week 16 – Day 2: Executing Multi-Step Autonomous Drone Missions

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will execute a multi-step autonomous drone mission and monitor performance for accuracy and safety.

Essential Question
What steps help ensure a programmed drone mission is executed safely and accurately?

Key Concepts
• Autonomous missions must be executed carefully
• Monitoring helps identify issues
• Sequence affects performance
• Manual awareness is important
• Safety must be maintained

Vocabulary
• **Execution** – Running a programmed mission
• **Monitoring** – Observing performance during flight
• **Accuracy** – Following the intended path
• **Deviation** – Moving away from the intended path
• **Manual Override** – Pilot control during autonomous flight

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with block-based programming interface
• Student-created missions (from Day 1)
• Flight area with defined boundaries
• Safety checklist

Bellringer
Prompt:
Why is it important to watch and monitor something while it is happening?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Missions were built using sequences
   • Commands control movement
   • Waypoints guide direction
   • Safety must be included in planning

   Discuss:
   • What could go wrong during a mission?
   • Why must pilots stay attentive?

   Bridge to lesson:
   • Today's lesson focuses on executing missions and monitoring performance

---

2. **Core Concept Introduction**

   • Execution is running a programmed mission
   • Monitoring ensures the mission stays on track

   Key Teaching Point:
   Executing a mission requires careful observation and readiness to maintain safe and accurate flight.

---

3. **Concept Development**

   A. **Understanding Mission Execution**

   • Execution involves:
   - running programmed commands
   - observing drone movement

   • Requires:
   - correct setup
   - correct sequence

   Emphasize:
   • Execution follows the programmed plan

   B. **Monitoring During Flight**

   • Monitoring includes:
   - watching direction
   - checking movement

   • Helps identify:
   - mistakes
   - unexpected movement

   Emphasize:
   • Monitoring keeps the mission on track

C. Recognizing Accuracy and Deviation

• Accuracy means:
- following the planned path

• Deviation means:
- moving off the path

Emphasize:
• Noticing deviation is important

D. Maintaining Manual Awareness

• Pilots must:
- stay ready to take control
- stop unsafe flight

• Manual control is used when:
- problems occur

Emphasize:
• Pilots must stay alert

E. Maintaining Safety During Execution

• Safety includes:
- clear flight area
- safe distances
- awareness of surroundings

• Pilots must:
- maintain safe operation

Emphasize:
• Safety is always required

---

4. Application to Drone Flight

Students apply:
• Load programmed mission
• Perform safety check
• Execute mission
• Monitor drone movement
• Identify accuracy or deviation

Students recognize:
• Execution requires active monitoring

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Executing a simple mission
   • Monitoring for accuracy

   Students identify:
   • Correct execution
   • Signs of deviation

---

6. **Real-World Connection**
   • Execution is used in:
   - inspections
   - mapping
   - photography

   Emphasize:
   • Professionals monitor drones during missions

---

7. **Key Reinforcement Summary**
   • Execution runs programmed missions
   • Monitoring ensures accuracy
   • Deviation shows errors
   • Pilots must stay alert
   • Safety must be maintained

   Key Teaching Point:
   Careful monitoring and safety awareness ensure successful mission execution.

Formative Questions for Use in This Lesson
• What is execution?
• Why is monitoring important?
• What is deviation?
• When is manual control needed?
• Why must safety be maintained?

Hands-On Activity
Activity Title: Execute and Monitor Mission
Objective:
Students will execute a multi-step autonomous drone mission and monitor its performance.

Activity Procedure
1. Students prepare drone and system
2. Load programmed mission
3. Conduct safety check
4. Execute mission
5. Observe movement
6. Identify accuracy or deviation
7. Record observations

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Execution Accuracy	Highly accurate	Mostly accurate	Some errors	Inaccurate
Monitoring Awareness	Fully attentive	Mostly attentive	Some lapses	Limited
Manual Readiness	Immediate response	Mostly ready	Some delay	Unprepared
Safety Compliance	Fully maintained	Mostly maintained	Some lapses	Unsafe

---

Scenario (C3 Application)
During a mission, a drone begins drifting off the intended path, and the student continues watching without taking action.

• What is happening during the mission?
• What should the student do?
• Why is manual awareness important?

Assessment Items

1. What is execution?
   A. Planning
   B. Running mission
   C. Designing
   D. Hovering
2. What helps keep a mission on track?
   A. Speed
   B. Monitoring
   C. Height
   D. Distance
3. What is deviation?
   A. Correct path
   B. Moving off path
   C. Hover
   D. Landing
4. When should manual control be used?
   A. Never
   B. When problems occur
   C. During planning
   D. After landing
5. What must always be maintained?
   A. Speed
   B. Safety
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Executing and monitoring missions carefully helps ensure accurate and safe drone operations.

Teacher Notes

• Reinforce active monitoring during execution
• Encourage immediate response to issues
• Keep missions simple and controlled
• Prepare students for evaluation and improvement (Day 3)

Week 16 – Day 3: Evaluating and Improving Autonomous Drone Missions

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.04	Evaluate and troubleshoot autonomous flight performance.	B2
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will evaluate mission performance and make simple improvements to increase accuracy and reliability.

Essential Question
How can observing and making small changes improve a drone mission?

Key Concepts
• Evaluation compares expected and actual performance
• Small changes can improve results
• Errors can be identified and corrected
• Repeating missions helps improve accuracy
• Safety must be maintained

Vocabulary
• **Evaluation** – Looking at results to see what worked and what needs improvement
• **Improvement** – Making changes to get better results
• **Deviation** – Movement away from the intended path
• **Adjustment** – A change made to improve performance
• **Repetition** – Doing something again to improve

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with block-based programming interface
• Student mission programs (from Day 2)
• Observation checklist
• Flight area with defined boundaries

Bellringer
Prompt:
Why do people repeat a task to get better results?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Missions were created and executed
   • Monitoring helped identify performance
   • Some missions were accurate, others had errors

   Discuss:
   • What differences did you notice in mission results?
   • What caused those differences?

   Bridge to lesson:
   • Today's lesson focuses on evaluating and improving missions

---

2. **Core Concept Introduction**

   • Evaluation helps identify what needs improvement
   • Small adjustments can improve accuracy

   Key Teaching Point:
   Evaluating performance and making simple adjustments helps improve mission accuracy and success.

---

3. **Concept Development**

   A. **Understanding Evaluation**

      • Evaluation includes:
      - observing mission results
      - comparing expected vs actual movement

      • Helps identify:
      - what worked
      - what needs improvement

      Emphasize:
      • Evaluation helps guide improvement

   B. **Identifying Deviations**

      • Deviations include:
      - incorrect direction
      - missed waypoint
      - uneven movement

      • Causes may include:
      - incorrect sequence
      - incorrect distance

      Emphasize:
      • Deviations show where changes are needed

C. Making Simple Adjustments

• Adjustments include:
- changing distance
- adjusting direction
- correcting sequence

• Focus on:
- one change at a time

Emphasize:
• Small changes improve results

D. Using Repetition to Improve Performance

• Repetition includes:
- running the mission again
- applying changes

• Each attempt:
- improves accuracy

Emphasize:
• Practice improves performance

E. Maintaining Safety During Improvement

• Safety includes:
- controlled environment
- awareness of surroundings
- readiness to stop flight

• Pilots must:
- maintain safe operation

Emphasize:
• Safety remains a priority

---

4. Application to Drone Flight

Students apply:
• Execute mission
• Observe results
• Identify deviations
• Make one adjustment
• Re-run mission

Students recognize:
• Improvement comes from repetition

---

5. Guided Examples / Demonstration

Instructor demonstrates:
• Mission with a small error
• Adjustment to correct the error

Students identify:
• What changed
• How it improved performance

---

6. Real-World Connection
• Evaluation and improvement are used in:
  ○ inspections
  ○ mapping
  ○ photography

Emphasize:
• Professionals improve results through repeated attempts

---

7. Key Reinforcement Summary
• Evaluation identifies errors
• Deviations show where to improve
• Small adjustments improve accuracy
• Repetition improves performance
• Safety must be maintained

Key Teaching Point:
Simple evaluation and small adjustments help improve mission accuracy and reliability.

Formative Questions for Use in This Lesson
• What is evaluation?
• What is a deviation?
• How can performance be improved?
• Why is repetition important?
• Why must safety be maintained?

Hands-On Activity
Activity Title: Improve the Mission
Objective:
Students will evaluate and improve a mission by making simple adjustments.

Activity Procedure
1. Execute mission
2. Observe performance
3. Identify one deviation
4. Make one adjustment
5. Re-run mission
6. Compare results
7. Record improvement

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Evaluation Accuracy	Accurate and detailed	Mostly accurate	Some gaps	Limited
Adjustment Strategy	Effective change	Mostly effective	Limited	Ineffective
Improvement Outcome	Clear improvement	Some improvement	Minimal	None
Safety Compliance	Fully maintained	Mostly maintained	Some lapses	Unsafe

---

Scenario (C3 Application)

A student notices the drone consistently stops short of the final waypoint.

- What is the problem?
- What adjustment should be made?
- Why should only one change be made at a time?

Assessment Items

1. What is evaluation?
   A. Ignoring results
   B. Reviewing performance
   C. Increasing speed
   D. Hovering
2. What is a deviation?
   A. Correct path
   B. Moving off path
   C. Hover
   D. Landing
3. How can performance improve?
   A. Ignore errors
   B. Make small changes
   C. Increase speed
   D. Skip steps
4. What is repetition?
   A. One attempt
   B. Doing again
   C. Stopping
   D. Changing battery
5. What must always be maintained?
   A. Speed
   B. Safety
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Evaluating performance and making simple improvements helps create accurate and reliable drone missions.

Teacher Notes

• Reinforce “one change at a time” strategy
• Keep evaluation simple and focused
• Encourage repeated attempts
• Prepare students for refinement and consistency (Day 4)

Week 16 – Day 4: Improving Consistency in Autonomous Drone Missions

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.04	Evaluate and troubleshoot autonomous flight performance.	B2
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will improve mission consistency by repeating and refining a programmed mission to achieve similar results across multiple attempts.

Essential Question
How can repeating and refining a mission improve consistency in drone performance?

Key Concepts
• Consistency means similar results each time
• Repetition helps identify patterns
• Small adjustments improve reliability
• Accurate sequencing improves consistency
• Safety must be maintained

Vocabulary
• **Consistency** – Producing similar results each time
• **Refinement** – Making small improvements
• **Reliable Performance** – Consistent and predictable results
• **Adjustment** – A change made to improve performance
• **Repetition** – Doing something multiple times

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with block-based programming interface
• Student mission programs (refined from Day 3)
• Observation checklist
• Flight area with defined boundaries

Bellringer
Prompt:
Why is it important for a task to produce the same result each time?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Missions were executed and evaluated
   • Adjustments were made to improve performance
   • Repetition helped improve results

   Discuss:
   • Did your mission perform the same way each time?
   • What caused differences between attempts?

   Bridge to lesson:
   • Today's lesson focuses on improving consistency through repetition and refinement

---

2. **Core Concept Introduction**
   • Consistency means achieving similar results each time
   • Repetition helps improve reliability

   Key Teaching Point:
   Repeating and refining a mission helps create consistent and reliable drone performance.

---

3. **Concept Development**

   A. Understanding Consistency in Drone Missions
   • Consistency means:
   - similar flight path
   - similar results

   • Inconsistent results may include:
   - different landing positions
   - uneven movement

   Emphasize:
   • Consistency shows control

   B. Using Repetition to Identify Patterns
   • Repetition includes:
   - running the mission multiple times

   • Helps identify:
   - patterns
   - repeated errors

   Emphasize:
   • Repetition reveals patterns

   C. Refining for Consistent Performance
   • Refinement includes:
   - adjusting commands
   - improving sequence
   - correcting distances

• Focus on:
  - small improvements

Emphasize:
• Small changes improve consistency

D. Comparing Multiple Attempts

• Students compare:
  - first attempt
  - second attempt
  - third attempt

• Look for:
  - improvement
  - consistency

Emphasize:
• Comparing results helps improvement

E. Maintaining Safety During Repeated Missions

• Safety includes:
  - monitoring flight area
  - maintaining control awareness
  - readiness to stop flight

• Pilots must:
  - maintain safe operation

Emphasize:
• Safety is required every time

---

4. Application to Drone Flight

Students apply:
• Execute mission multiple times
• Observe consistency
• Compare results
• Make small adjustments
• Repeat mission

Students recognize:
• Consistency improves with repetition

---

5. Guided Examples / Demonstration

Instructor demonstrates:
• A mission performed multiple times
• Improved consistency after refinement

Students identify:
• Differences between attempts
• How refinement improved results

6. **Real-World Connection**
   • Consistency is important in:
   - inspections
   - mapping
   - photography

   Emphasize:
   • Professionals rely on consistent performance

7. **Key Reinforcement Summary**
   • Consistency means similar results
   • Repetition reveals patterns
   • Refinement improves reliability
   • Comparing results supports improvement
   • Safety must be maintained

   Key Teaching Point:
   Consistent performance is achieved through repetition, observation, and simple refinement.

Formative Questions for Use in This Lesson
• What is consistency?
• Why is repetition important?
• How can performance be improved?
• What should be compared between attempts?
• Why must safety be maintained?

Hands-On Activity
Activity Title: Consistency Challenge
Objective:
Students will improve mission consistency through repeated execution and refinement.

Activity Procedure
1. Execute mission (Attempt 1)
2. Observe results
3. Execute mission (Attempt 2)
4. Compare results
5. Make small adjustment
6. Execute mission (Attempt 3)
7. Record consistency

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Consistency of Results	Highly consistent	Mostly consistent	Some variation	Inconsistent
Refinement Strategy	Effective improvements	Mostly effective	Limited	Ineffective
Observation Accuracy	Detailed observations	Mostly accurate	Some gaps	Limited
Safety Compliance	Fully maintained	Mostly maintained	Some lapses	Unsafe

---

Scenario (C3 Application)
A student runs a mission three times and gets different results each time.

• What problem is occurring?
• What should the student focus on improving?
• Why is consistency important?

Assessment Items

1. What is consistency?
   A. Different results
   B. Same results
   C. Faster speed
   D. Higher altitude

2. What helps identify patterns?
   A. Speed
   B. Repetition
   C. Height
   D. Distance

3. What improves consistency?
   A. Ignoring errors
   B. Small adjustments
   C. Increasing speed
   D. Skipping steps

4. What should students compare?
   A. Battery
   B. Attempts
   C. Height
   D. Speed

5. What must always be maintained?
   A. Speed
   B. Safety
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Repeating and refining missions helps achieve consistent and reliable drone performance.

Teacher Notes

• Reinforce repetition as a learning tool
• Encourage simple, focused adjustments
• Avoid over-complicating refinement
• Prepare students for final mission readiness (Day 5)

Week 16 – Day 5: Autonomous Mission Demonstration and Readiness

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
107.04	Evaluate and troubleshoot autonomous flight performance.	B2
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will demonstrate a complete autonomous drone mission and reflect on performance to prepare for final course assessment.

Essential Question
How can a complete mission be performed accurately and safely from start to finish?

Key Concepts
• A complete mission includes planning, execution, and improvement
• Clear sequencing leads to accurate results
• Repetition builds confidence and consistency
• Reflection helps improve performance
• Safety must be maintained

Vocabulary
• **Mission Demonstration** – Performing a complete programmed mission
• **Execution** – Running the mission
• **Consistency** – Achieving similar results each time
• **Reflection** – Thinking about performance to improve
• **Readiness** – Being prepared to perform a task

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with block-based programming interface
• Final student mission programs
• Evaluation checklist or rubric
• Flight area with defined boundaries

Bellringer
Prompt:
What does it mean to be ready to perform a task successfully?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

Students recall:
• Missions were created and executed
• Performance was evaluated and improved
• Consistency was developed through repetition

Discuss:
• What improvements have you made this week?
• What makes a mission successful?

Bridge to lesson:
• Today's lesson focuses on demonstrating a complete mission and preparing for final performance

---

2. **Core Concept Introduction**

• A complete mission includes:
  - planning
  - execution
  - improvement

• Readiness means:
  - being able to perform consistently

Key Teaching Point:
A successful mission demonstration shows accurate execution, consistency, and safe operation.

---

3. **Concept Development**

A. Understanding a Complete Mission

• A complete mission includes:
  - takeoff
  - movement steps
  - landing

• Requires:
  - correct sequence
  - clear structure

Emphasize:
• All steps must work together

B. Demonstrating Mission Execution

• Demonstration includes:
  - running mission from start to finish
  - showing control and accuracy

• Focus on:
  - correct sequence
  - smooth operation

Emphasize:
• Demonstration shows learning

C. Recognizing Consistent Performance

• Consistency includes:
  - similar results across attempts

• Indicates:
  - control
  - understanding

Emphasize:
• Consistency builds confidence

D. Reflecting on Performance

• Reflection includes:
  - thinking about what worked
  - identifying areas for improvement

• Helps:
  - prepare for final assessment

Emphasize:
• Reflection supports improvement

E. Maintaining Safety During Demonstration

• Safety includes:
  - clear flight area
  - awareness of surroundings
  - readiness to stop flight

• Pilots must:
  - maintain safe operation

Emphasize:
• Safety is always required

---

4. Application to Drone Flight

Students apply:
• Prepare mission
• Perform full mission
• Observe performance
• Reflect on results
• Identify one improvement

Students recognize:
• Complete missions require all skills

---

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • A complete mission
   • Expected level of performance

   Students identify:
   • Key elements of a successful mission

---

6. **Real-World Connection**
   • Mission demonstrations are used in:
   - inspections
   - mapping
   - photography

   Emphasize:
   • Professionals must perform missions accurately and safely

---

7. **Key Reinforcement Summary**
   • Complete missions include planning and execution
   • Demonstration shows skill
   • Consistency builds confidence
   • Reflection improves performance
   • Safety must be maintained

   Key Teaching Point:
   A successful mission demonstration combines accuracy, consistency, and safe operation.

Formative Questions for Use in This Lesson
• What is a complete mission?
• What makes a mission successful?
• Why is consistency important?
• What is reflection?
• Why must safety be maintained?

Hands-On Activity
Activity Title: Mission Demonstration
Objective:
Students will perform a complete autonomous mission and reflect on performance.

Activity Procedure
1. Prepare mission program
2. Conduct safety check
3. Execute full mission
4. Observe performance
5. Repeat mission if needed
6. Reflect on results
7. Identify one improvement

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Mission Completion	Fully successful	Mostly successful	Partial	Incomplete
Accuracy	Highly accurate	Mostly accurate	Some errors	Inaccurate
Consistency	Highly consistent	Mostly consistent	Some variation	Inconsistent
Safety Compliance	Fully maintained	Mostly maintained	Some lapses	Unsafe

---

Scenario (C3 Application)
A student completes a mission successfully once but cannot repeat the same result on the next attempt.

• What issue is occurring?
• What should the student focus on improving?
• Why is consistency important before final assessment?

Assessment Items

1. What is a mission demonstration?
   A. Planning
   B. Performing mission
   C. Designing
   D. Hovering
2. What shows readiness?
   A. Speed
   B. Consistency
   C. Height
   D. Distance
3. What helps improve performance?
   A. Ignoring errors
   B. Reflection
   C. Increasing speed
   D. Skipping steps
4. What makes a mission successful?
   A. Speed
   B. Accuracy
   C. Height
   D. Distance
5. What must always be maintained?
   A. Speed
   B. Safety
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Performing and reflecting on a complete mission helps prepare students for final drone operation assessments.

Teacher Notes

• Keep expectations realistic and achievable
• Focus on completion, not perfection
• Encourage confidence building
• Prepare students for Week 17 final mission phase

Week 17 – Final Autonomous Mission Mastery and Performance

Week 17 Overview
Week 17 focuses on final mission mastery as students demonstrate their ability to plan, execute, and improve a complete autonomous drone mission. Students will apply all previously learned skills—including sequencing, mission structure, flight awareness, and safety—to perform consistent and accurate missions. Emphasis is placed on confidence, consistency, and safe operation. Students will refine their missions through guided practice and prepare for final course assessment. This week ensures students are ready to demonstrate foundational proficiency in autonomous drone operations.

Week 17 – Day 1: Final Mission Planning and Readiness

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.02	Develop a programmed flight path using a drone platform.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will finalize and prepare a complete autonomous drone mission for accurate and safe execution.

Essential Question
What steps are needed to prepare a drone mission for successful performance?

Key Concepts
• Final mission planning ensures success
• Clear sequencing improves accuracy
• Preparation reduces errors
• Safety must be included in planning
• Readiness builds confidence

Vocabulary
• **Final Mission** – A complete programmed drone task
• **Preparation** – Getting ready for execution
• **Sequence** – Order of commands
• **Readiness** – Being prepared to perform
• **Accuracy** – Following the intended path

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with block-based programming interface
• Student mission programs
• Mission planning checklist
• Flight area with defined boundaries

Bellringer
Prompt:
Why is preparation important before performing a task?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Missions were created, executed, and improved
   • Adjustments increased accuracy
   • Repetition improved consistency

   Discuss:
   • What made your mission successful?
   • What challenges did you face?

   Bridge to lesson:
   • Today's lesson focuses on final preparation for mission performance

---

2. **Core Concept Introduction**
   • Final preparation ensures mission success
   • Readiness improves confidence and performance

   Key Teaching Point:
   Careful preparation and clear sequencing help ensure successful and safe mission performance.

---

3. **Concept Development**
   A. **Understanding Final Mission Structure**
      • A complete mission includes:
      - takeoff
      - movement steps
      - landing

      • All steps must:
      - work together

      Emphasize:
      • Structure leads to success

B. Reviewing Sequence of Commands

• Sequence must:
- follow correct order
- match intended path

• Students should:
- review commands carefully

Emphasize:
• Correct order improves accuracy

C. Preparing for Accurate Execution

• Preparation includes:
- checking commands
- confirming distances
- verifying direction

• Focus on:
- clear and simple structure

Emphasize:
• Preparation reduces mistakes

D. Ensuring Readiness for Performance

• Readiness includes:
- understanding the mission
- confidence in execution

• Students should:
- be able to explain their mission

Emphasize:
• Readiness builds confidence

E. Maintaining Safety During Preparation

• Safety includes:
- checking environment
- defining flight area
- ensuring safe distances

• Pilots must:
- follow all safety procedures

Emphasize:
• Safety is required before flight

---

4. Application to Drone Flight

Students apply:
• Review mission program
• Verify sequence
• Check environment

• Confirm readiness
• Prepare for execution

Students recognize:
• Preparation leads to better performance

---

5. Guided Examples / Demonstration

Instructor demonstrates:
• Reviewing a mission before execution
• Identifying potential issues

Students identify:
• Correct sequence
• Areas needing adjustment

---

6. Real-World Connection

• Preparation is used in:
  ○ inspections
  ○ mapping
  ○ photography

Emphasize:
• Professionals prepare before every mission

---

7. Key Reinforcement Summary

• Final mission planning ensures success
• Sequence must be correct
• Preparation reduces errors
• Readiness builds confidence
• Safety must be maintained

Key Teaching Point:
Careful preparation and safety awareness lead to successful mission performance.

Formative Questions for Use in This Lesson

• What is a final mission?
• Why is preparation important?
• How does sequence affect performance?
• What does readiness mean?
• Why must safety be maintained?

Hands-On Activity
Activity Title: Final Mission Preparation
Objective:
Students will finalize and prepare their autonomous mission for execution.

Activity Procedure

1. Review mission program
2. Check sequence of commands
3. Verify movement steps
4. Identify potential errors
5. Make final adjustments
6. Conduct safety check
7. Confirm readiness

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Mission Structure	Clear and complete	Mostly complete	Some gaps	Incomplete
Sequence Accuracy	Fully correct	Mostly correct	Some errors	Incorrect
Readiness	Fully prepared	Mostly prepared	Some gaps	Unprepared
Safety Preparation	Fully complete	Mostly complete	Some gaps	Missing

---

Scenario (C3 Application)

A student prepares a mission but does not review the sequence before execution, resulting in incorrect movement during flight.

• What mistake was made?
• What should the student have done before execution?
• Why is preparation important?

Assessment Items

1. What is a final mission?
   A. Planning
   B. Complete task
   C. Hover
   D. Speed
2. What improves accuracy?
   A. Speed
   B. Sequence
   C. Height
   D. Battery
3. What does preparation do?
   A. Adds steps
   B. Reduces errors
   C. Increases speed
   D. Changes direction

4. What is readiness?
   A. Flying fast
   B. Being prepared
   C. Increasing height
   D. Landing
5. What must always be included?
   A. Speed
   B. Safety
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Final preparation ensures missions can be performed accurately, confidently, and safely.

Teacher Notes

• Reinforce preparation as critical step
• Keep missions simple and achievable
• Encourage students to explain their mission
• Prepare students for execution (Day 2)

Week 17 – Day 2: Guided Final Mission Execution

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will execute their final autonomous drone mission with guidance to reinforce accuracy, control, and safety.

Essential Question
How can guided execution improve mission performance and accuracy?

Key Concepts
• Guided execution reinforces correct performance
• Monitoring helps maintain accuracy
• Sequence affects mission success
• Support helps reduce errors
• Safety must be maintained

Vocabulary
• **Execution** – Running a programmed mission
• **Guidance** – Support during performance
• **Accuracy** – Following the intended path
• **Monitoring** – Observing performance
• **Control Awareness** – Being ready to respond

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with block-based programming interface
• Final student mission programs
• Flight area with defined boundaries
• Safety checklist

Bellringer
Prompt:
How can guidance help improve performance when learning a new skill?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Missions were finalized and prepared
   • Sequence and structure were reviewed
   • Safety procedures were confirmed

   Discuss:
   • What changes did you make to your mission?
   • What are you most confident about?

   Bridge to lesson:
   • Today's lesson focuses on executing missions with guidance to reinforce performance

---

2. **Core Concept Introduction**

   • Guided execution supports accurate performance
   • Monitoring helps identify and prevent errors

   Key Teaching Point:
   Executing a mission with guidance helps reinforce correct sequencing, accuracy, and safe operation.

---

3. **Concept Development**

   A. Understanding Guided Execution

   • Guided execution includes:
   - support during mission
   - reminders of correct steps

   • Helps:
   - reinforce correct performance

   Emphasize:
   • Guidance improves learning

   B. Executing the Mission Step-by-Step

   • Students:
   - follow programmed sequence
   - observe each movement

   • Focus on:
   - completing mission correctly

   Emphasize:
   • Sequence must be followed

   C. Monitoring Accuracy During Execution

   • Monitoring includes:
   - watching movement
   - checking direction

• Helps:
  - maintain correct path

Emphasize:
• Monitoring supports accuracy

D. Maintaining Control Awareness

• Students must:
  - stay focused
  - be ready to respond

• Includes:
  - awareness of surroundings

Emphasize:
• Awareness ensures safe operation

E. Maintaining Safety During Execution

• Safety includes:
  - clear flight area
  - safe distances
  - readiness to stop flight

• Pilots must:
  - maintain safe operation

Emphasize:
• Safety is always required

---

4. Application to Drone Flight

Students apply:
• Execute mission
• Follow sequence
• Monitor performance
• Respond if needed
• Maintain safety

Students recognize:
• Guided execution improves performance

---

5. Guided Examples / Demonstration

Instructor demonstrates:
• Guided execution of a mission
• Monitoring and correcting minor issues

Students identify:
• Correct performance
• How guidance supports execution

---

6. **Real-World Connection**
   • Guided execution is used in:
   - training environments
   - supervised operations

   Emphasize:
   • Professionals learn through guided practice

---

7. **Key Reinforcement Summary**
   • Guided execution improves accuracy
   • Sequence must be followed
   • Monitoring supports performance
   • Awareness ensures control
   • Safety must be maintained

   Key Teaching Point:
   Guided execution builds confidence and reinforces correct mission performance.

Formative Questions for Use in This Lesson
• What is guided execution?
• Why is monitoring important?
• How does sequence affect performance?
• What is control awareness?
• Why must safety be maintained?

Hands-On Activity
Activity Title: Guided Mission Execution
Objective:
Students will execute their mission with guidance to reinforce accuracy and safety.

Activity Procedure
1. Prepare drone and system
2. Review mission sequence
3. Conduct safety check
4. Execute mission
5. Monitor performance
6. Receive guidance
7. Repeat mission if needed

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Execution Accuracy	Highly accurate	Mostly accurate	Some errors	Inaccurate
Monitoring Awareness	Fully attentive	Mostly attentive	Some lapses	Limited
Response to Guidance	Immediate improvement	Mostly responsive	Some response	Limited
Safety Compliance	Fully maintained	Mostly maintained	Some lapses	Unsafe

---

Scenario (C3 Application)
During a guided mission, a student ignores instructor feedback and continues flying incorrectly.

• What mistake is being made?
• What should the student do?
• Why is guidance important?

Assessment Items

1. What is guided execution?
   A. Independent work
   B. Supported performance
   C. Planning
   D. Hovering
2. What helps maintain accuracy?
   A. Speed
   B. Monitoring
   C. Height
   D. Distance
3. What must be followed during execution?
   A. Speed
   B. Sequence
   C. Height
   D. Distance
4. What is control awareness?
   A. Ignoring surroundings
   B. Staying alert
   C. Increasing speed
   D. Landing
5. What must always be maintained?
   A. Speed
   B. Safety
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure
Guided execution helps reinforce correct performance and prepares students for independent mission operation.

Teacher Notes
• Provide consistent but minimal guidance
• Encourage student independence gradually
• Focus on accuracy over perfection
• Prepare students for independent execution (Day 3)

Week 17 – Day 3: Independent Mission Execution

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
107.04	Evaluate and troubleshoot autonomous flight performance.	B2
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will independently execute their autonomous drone mission and demonstrate consistent performance.

Essential Question
How can a mission be executed independently with accuracy and consistency?

Key Concepts
• Independent execution shows mastery
• Consistency demonstrates understanding
• Monitoring supports performance
• Evaluation helps identify improvement
• Safety must be maintained

Vocabulary
• **Independent Execution** – Performing a mission without step-by-step guidance
• **Consistency** – Producing similar results each time
• **Monitoring** – Observing performance
• **Evaluation** – Reviewing results to improve
• **Control Awareness** – Staying alert during flight

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with block-based programming interface
• Final student mission programs
• Observation checklist
• Flight area with defined boundaries

Bellringer
Prompt:
What does it mean to perform a task independently?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   - Missions were prepared and executed with guidance
   - Monitoring helped maintain accuracy
   - Guidance improved performance

   Discuss:
   - What did you improve during guided execution?
   - What challenges remain?

   Bridge to lesson:
   - Today's lesson focuses on independent mission execution

---

2. **Core Concept Introduction**
   - Independent execution shows readiness
   - Consistency demonstrates control and understanding

   Key Teaching Point:
   Independent mission execution demonstrates a student's ability to apply skills accurately, consistently, and safely.

---

3. **Concept Development**

   A. Understanding Independent Execution
   - Independent execution includes:
     - performing mission without guidance
     - following programmed sequence
   - Requires:
     - confidence
     - preparation

   Emphasize:
   - Independence shows mastery

   B. Executing the Mission Without Guidance
   - Students:
     - perform mission start to finish
     - rely on preparation
   - Focus on:
     - correct sequence
     - smooth operation

   Emphasize:
   - Preparation supports independence

C. Monitoring for Accuracy and Consistency

• Monitoring includes:
- observing movement
- checking direction

• Students should:
- look for consistent results

Emphasize:
• Monitoring supports performance

D. Evaluating Performance After Execution

• Evaluation includes:
- identifying deviations
- recognizing improvements

• Students should:
- reflect on results

Emphasize:
• Evaluation improves future performance

E. Maintaining Safety During Independent Operation

• Safety includes:
- clear flight area
- awareness of surroundings
- readiness to stop flight

• Pilots must:
- maintain safe operation

Emphasize:
• Safety is always required

---

4. Application to Drone Flight

Students apply:
• Execute mission independently
• Monitor performance
• Evaluate results
• Repeat mission if needed

Students recognize:
• Independent execution demonstrates mastery

---

5. Guided Examples / Demonstration

Instructor demonstrates:
• Example of independent execution
• Expected performance level

Students identify:
• Key elements of successful execution

6. **Real-World Connection**
   • Independent execution is required in:
   - inspections
   - mapping
   - photography

   Emphasize:
   • Professionals operate independently

7. **Key Reinforcement Summary**
   • Independent execution shows mastery
   • Consistency demonstrates control
   • Monitoring supports performance
   • Evaluation improves results
   • Safety must be maintained

   Key Teaching Point:
   Independent execution demonstrates readiness for real-world drone operation.

Formative Questions for Use in This Lesson
• What is independent execution?
• Why is consistency important?
• What is monitoring?
• How does evaluation help?
• Why must safety be maintained?

Hands-On Activity
Activity Title: Independent Mission Execution
Objective:
Students will independently execute their mission and demonstrate consistent performance.

Activity Procedure
1. Prepare drone and system
2. Conduct safety check
3. Execute mission independently
4. Monitor performance
5. Evaluate results
6. Repeat mission if needed
7. Record consistency

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Execution Accuracy	Highly accurate	Mostly accurate	Some errors	Inaccurate
Consistency	Highly consistent	Mostly consistent	Some variation	Inconsistent
Evaluation Awareness	Detailed reflection	Mostly accurate	Some gaps	Limited
Safety Compliance	Fully maintained	Mostly maintained	Some lapses	Unsafe

---

Scenario (C3 Application)

A student executes a mission independently but does not monitor the drone during flight, resulting in errors.

- What mistake is being made?
- What should the student do during execution?
- Why is monitoring important?

Assessment Items

1. What is independent execution?
   A. Guided performance
   B. Unsupported performance
   C. Planning
   D. Hovering
2. What shows mastery?
   A. Speed
   B. Independence
   C. Height
   D. Distance
3. What helps maintain accuracy?
   A. Speed
   B. Monitoring
   C. Height
   D. Distance
4. What helps improve performance?
   A. Ignoring results
   B. Evaluation
   C. Increasing speed
   D. Skipping steps
5. What must always be maintained?
   A. Speed
   B. Safety
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Independent mission execution demonstrates readiness, confidence, and the ability to perform drone operations safely and accurately.

Teacher Notes

• Minimize intervention to promote independence
• Observe performance for assessment readiness
• Reinforce safety expectations
• Prepare students for formal evaluation (Day 4)

Week 17 – Day 4: Final Mission Performance Evaluation

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.04	Evaluate and troubleshoot autonomous flight performance.	B2
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will evaluate their autonomous mission performance using a structured rubric and identify areas for improvement.

Essential Question
How can performance be evaluated to improve mission accuracy and consistency?

Key Concepts
• Evaluation measures performance
• Rubrics provide clear expectations
• Observations identify strengths and weaknesses
• Reflection supports improvement
• Safety must be maintained

Vocabulary
• **Evaluation** – Reviewing performance to determine effectiveness
• **Rubric** – A tool used to measure performance
• **Performance Criteria** – Standards used to judge success
• **Reflection** – Thinking about performance to improve
• **Consistency** – Producing similar results each time

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with block-based programming interface
• Student mission programs
• Evaluation rubric (provided by teacher)
• Observation checklist
• Flight area with defined boundaries

Bellringer
Prompt:
Why is it important to measure performance using clear criteria?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Missions were executed independently
   • Performance was monitored and evaluated
   • Consistency was developed through repetition

   Discuss:
   • What does a successful mission look like?
   • How do you know if a mission is successful?

   Bridge to lesson:
   • Today's lesson focuses on evaluating mission performance using clear criteria

---

2. **Core Concept Introduction**
   • Evaluation uses criteria to measure performance
   • Rubrics help define expectations

   Key Teaching Point:
   Using a rubric helps students evaluate performance clearly and identify areas for improvement.

---

3. **Concept Development**

   A. Understanding Performance Evaluation
   • Evaluation includes:
   - observing mission
   - comparing to expectations

   • Helps identify:
   - strengths
   - areas for improvement

   Emphasize:
   • Evaluation supports improvement

   B. Using a Rubric to Measure Performance
   • A rubric includes:
   - performance criteria
   - levels of achievement

   • Students use rubric to:
   - score performance

   Emphasize:
   • Rubrics provide clear expectations

   C. Identifying Strengths and Areas for Improvement
   • Students identify:
   - what worked well
   - what needs improvement

• Focus on:
  - accuracy
  - consistency

Emphasize:
• Identifying strengths builds confidence

D. Reflecting on Performance

• Reflection includes:
  - thinking about results
  - planning improvement

• Students should:
  - identify one improvement

Emphasize:
• Reflection leads to improvement

E. Maintaining Safety During Evaluation

• Safety includes:
  - safe flight area
  - awareness of surroundings
  - readiness to stop flight

• Pilots must:
  - maintain safe operation

Emphasize:
• Safety is always required

---

4. Application to Drone Flight

Students apply:
• Execute mission
• Use rubric to evaluate
• Identify strengths
• Identify one improvement
• Reflect on performance

Students recognize:
• Evaluation improves performance

---

5. Guided Examples / Demonstration

Instructor demonstrates:
• Using a rubric to evaluate a mission
• Identifying strengths and improvements

Students identify:
• How scoring works
• How evaluation supports learning

---

6. **Real-World Connection**
   • Evaluation is used in:
   - inspections
   - mapping
   - training

   Emphasize:
   • Professionals evaluate performance regularly

---

7. **Key Reinforcement Summary**
   • Evaluation measures performance
   • Rubrics define expectations
   • Strengths and improvements must be identified
   • Reflection supports improvement
   • Safety must be maintained

   Key Teaching Point:
   Using a structured evaluation helps improve mission accuracy and consistency.

Formative Questions for Use in This Lesson
• What is evaluation?
• What is a rubric?
• Why are criteria important?
• What is reflection?
• Why must safety be maintained?

Hands-On Activity
Activity Title: Evaluate the Mission
Objective:
Students will evaluate their mission performance using a rubric.

Activity Procedure
1. Execute mission
2. Observe performance
3. Use rubric to score
4. Identify strengths
5. Identify one improvement
6. Reflect on results
7. Prepare for final demonstration

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Accuracy	Highly accurate	Mostly accurate	Some errors	Inaccurate
Consistency	Highly consistent	Mostly consistent	Some variation	Inconsistent
Evaluation Use	Accurate scoring	Mostly accurate	Some gaps	Limited
Safety Compliance	Fully maintained	Mostly maintained	Some lapses	Unsafe

Scenario (C3 Application)
A student completes a mission but gives themselves a high score without using the rubric criteria.

• What mistake is being made?
• What should the student do differently?
• Why are rubrics important?

Assessment Items

1. What is evaluation?
   A. Ignoring results
   B. Reviewing performance
   C. Increasing speed
   D. Hovering
2. What is a rubric?
   A. A drone
   B. A scoring tool
   C. A battery
   D. A controller
3. What do criteria provide?
   A. Speed
   B. Expectations
   C. Height
   D. Distance
4. What is reflection?
   A. Ignoring results
   B. Thinking about performance
   C. Increasing speed
   D. Landing
5. What must always be maintained?
   A. Speed
   B. Safety
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure
Evaluating performance using clear criteria helps improve accuracy, consistency, and readiness for final mission demonstration.

Teacher Notes
• Reinforce use of rubric—not guessing
• Keep evaluation simple and structured
• Encourage honest reflection
• Prepare students for final demonstration (Day 5)

Week 17 – Day 5: Final Autonomous Mission Demonstration

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
107.04	Evaluate and troubleshoot autonomous flight performance.	B2
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will perform a complete autonomous drone mission demonstrating accuracy, consistency, and safe operation.

Essential Question
What does successful mission performance look like from start to finish?

Key Concepts
• A complete mission demonstrates learning
• Accuracy and consistency show mastery
• Execution must follow correct sequence
• Evaluation supports improvement
• Safety must be maintained

Vocabulary
• **Final Demonstration** – A complete performance of a learned skill
• **Execution** – Running the programmed mission
• **Accuracy** – Following the intended path
• **Consistency** – Producing similar results
• **Safety Compliance** – Following all safety rules

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with block-based programming interface
• Final student mission programs
• Final performance rubric
• Flight area with defined boundaries

Bellringer
Prompt:
What does it mean to successfully complete a task from start to finish?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   - Missions were planned, executed, and improved
   - Performance was evaluated using a rubric
   - Consistency was developed through repetition

   Discuss:
   - What makes your mission successful?
   - What are you most confident about today?

   Bridge to lesson:
   - Today's lesson is the final mission demonstration

---

2. **Core Concept Introduction**
   - A final demonstration shows mastery of skills
   - Success includes accuracy, consistency, and safety

   Key Teaching Point:
   A successful final mission demonstrates correct execution, consistent performance, and safe operation.

---

3. **Concept Development**

   A. Understanding Final Demonstration Expectations
   - Students must:
     - complete mission
     - follow sequence
     - maintain control
   - Focus on:
     - clear performance

   Emphasize:
   - Demonstration shows learning

   B. Executing the Mission from Start to Finish
   - Includes:
     - takeoff
     - movement sequence
     - landing
   - Students must:
     - follow programmed steps

   Emphasize:
   - Sequence must be correct

C. Demonstrating Accuracy and Consistency

• Accuracy includes:
- correct path
- correct movement

• Consistency includes:
- similar results

Emphasize:
• Accuracy and consistency show mastery

D. Reflecting After Performance

• Reflection includes:
- thinking about performance
- identifying strengths

• Students should:
- recognize improvement

Emphasize:
• Reflection supports growth

E. Maintaining Safety During Final Performance

• Safety includes:
- clear flight area
- awareness of surroundings
- readiness to stop flight

• Pilots must:
- maintain safe operation

Emphasize:
• Safety is always required

---

4. Application to Drone Flight

Students apply:
• Prepare mission
• Perform full mission
• Demonstrate accuracy
• Maintain safety
• Reflect on performance

Students recognize:
• Final demonstration shows mastery

---

5. Guided Examples / Demonstration

Instructor demonstrates:
• Expected level of performance
• Successful mission example

Students identify:
• Key elements of success

---

6. Real-World Connection

• Final mission performance is required in:
- inspections
- mapping
- photography

Emphasize:
• Professionals must perform missions successfully

---

7. Key Reinforcement Summary

• Final demonstration shows mastery
• Sequence must be correct
• Accuracy and consistency are important
• Reflection supports improvement
• Safety must be maintained

Key Teaching Point:
A successful mission demonstration reflects accurate execution, consistent performance, and safe operation.

Formative Questions for Use in This Lesson

• What is a final demonstration?
• What shows mastery?
• Why is accuracy important?
• Why is consistency important?
• Why must safety be maintained?

Hands-On Activity
Activity Title: Final Mission Demonstration
Objective:
Students will perform a complete autonomous mission demonstrating mastery of course skills.

Activity Procedure

1. Prepare drone and system
2. Conduct safety check
3. Execute full mission
4. Demonstrate accuracy
5. Maintain safe operation
6. Complete mission
7. Reflect on performance

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Mission Completion	Fully successful	Mostly successful	Partial	Incomplete
Accuracy	Highly accurate	Mostly accurate	Some errors	Inaccurate
Consistency	Highly consistent	Mostly consistent	Some variation	Inconsistent
Safety Compliance	Fully maintained	Mostly maintained	Some lapses	Unsafe

---

Scenario (C3 Application)
A student completes the mission but skips part of the programmed sequence, resulting in an incomplete task.

• What mistake is being made?
• What should the student have done differently?
• Why is sequence important?

Assessment Items

1. What is a final demonstration?
   A. Planning
   B. Performing task
   C. Hovering
   D. Speed
2. What shows mastery?
   A. Speed
   B. Accuracy
   C. Height
   D. Distance
3. What must be followed during execution?
   A. Speed
   B. Sequence
   C. Height
   D. Distance
4. What supports improvement?
   A. Ignoring results
   B. Reflection
   C. Increasing speed
   D. Skipping steps
5. What must always be maintained?
   A. Speed
   B. Safety
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Completing a final mission demonstration shows readiness, confidence, and the ability to perform drone operations safely and accurately.

Teacher Notes

• Focus on completion and confidence
• Avoid over-correcting during performance
• Celebrate student success
• Prepare for Week 18 (final assessments and closure)

Week 18 – Final Assessment and Course Closure

Week 18 Overview
Week 18 provides a structured conclusion to the Basic Drone Pilot course through comprehensive review, final assessment preparation, and course closure. Students will revisit key concepts in aviation fundamentals, airspace awareness, mission planning, safety procedures, manual flight, and autonomous operations. Emphasis is placed on reinforcing understanding, building confidence, and preparing for final demonstrations of learning. This week ensures students are ready to successfully complete course assessments and recognize their growth as drone pilots.

Week 18 – Day 1: Course Review and Final Preparation

Standard	Description	RBT Level
101.00	Explain foundational aviation concepts and their impact on drone operations.	B2
103.00	Interpret controlled and uncontrolled airspace classifications and operational requirements.	B2
104.00	Apply mission planning and operational decision-making for drone operations.	C3
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3

Objective
Students will review key course concepts and prepare for final written and performance assessments.

Essential Question
How does reviewing key concepts prepare you for successful performance and assessment?

Key Concepts
• Review strengthens understanding
• Key concepts support performance
• Preparation builds confidence
• Safety remains a priority
• All skills work together

Vocabulary
• **Review** – Looking back at learned material
• **Preparation** – Getting ready for assessment
• **Airspace** – Controlled and uncontrolled flight areas
• **Mission Planning** – Organizing a drone operation
• **Safety Procedures** – Rules that protect people and equipment

Materials Needed
• Student notes and prior lesson materials
• Review guide or checklist
• Whiteboard or presentation materials
• Sample questions
• Classroom drones (for reference only, no flight required)

Bellringer
Prompt:
What is one skill you feel most confident about in this course and why?

Instructional Content

1. **Lesson Connection / Prior Knowledge**
   Students recall:
   • Aviation fundamentals were learned early in the course
   • Airspace and safety were practiced
   • Mission planning and flight skills were developed
   • Autonomous missions were completed

   Discuss:
   • What skills have you improved the most?
   • What topics do you need to review?

   Bridge to lesson:
   • Today's lesson focuses on reviewing all key concepts to prepare for final assessments

2. **Core Concept Introduction**
   • Review helps reinforce learning
   • Preparation supports successful performance

   Key Teaching Point:
   Reviewing key concepts and practicing recall helps prepare students for successful assessment and performance.

3. **Concept Development**
   A. **Reviewing Aviation Fundamentals**
      • Includes:
        - basic flight principles
        - drone components

      • Students should:
        - recall key concepts

      Emphasize:
      • Foundations support all learning

B. Reviewing Airspace Awareness

• Includes:
- controlled vs uncontrolled airspace
- safe operation requirements

• Students should:
- recognize airspace types

Emphasize:
• Airspace awareness ensures safe flight

C. Reviewing Mission Planning Concepts

• Includes:
- planning steps
- decision-making

• Students should:
- recall mission structure

Emphasize:
• Planning improves performance

D. Reviewing Safety Procedures

• Includes:
- pre-flight checks
- safe operation

• Students should:
- recognize safety steps

Emphasize:
• Safety is always required

E. Connecting All Course Concepts

• Students recognize:
- how concepts work together

• Includes:
- planning + safety + execution

Emphasize:
• All skills support successful operation

---

4. Application to Drone Flight

Students apply:
• Answer review questions
• Participate in discussion
• Identify strengths and gaps
• Prepare for assessment

Students recognize:
• Review supports performance

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Sample review questions
   • How to think through answers

   Students identify:
   • Key concepts being tested

6. **Real-World Connection**
   • Review is used in:
   - certification preparation
   - professional training

   Emphasize:
   • Professionals review before testing

7. **Key Reinforcement Summary**
   • Review strengthens understanding
   • Preparation builds confidence
   • Concepts are connected
   • Safety remains essential
   • Practice supports success

   Key Teaching Point:
   Strong review and preparation lead to successful performance and assessment outcomes.

Formative Questions for Use in This Lesson
• Why is review important?
• What is airspace?
• What is mission planning?
• Why are safety procedures important?
• How do concepts connect?

Hands-On Activity
Activity Title: Course Review Challenge
Objective:
Students will review key concepts through guided questions and discussion.

Activity Procedure
1. Review notes and materials
2. Answer review questions
3. Participate in discussion
4. Identify strengths
5. Identify areas to improve
6. Ask clarifying questions
7. Prepare for assessment

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Participation	Highly engaged	Mostly engaged	Some participation	Limited
Concept Recall	Strong recall	Mostly accurate	Some gaps	Limited
Preparation	Fully prepared	Mostly prepared	Some gaps	Unprepared
Reflection	Thoughtful	Adequate	Basic	Limited

Scenario (C3 Application)
A student skips reviewing course material and struggles during the final assessment.

• What mistake was made?
• What should the student have done?
• Why is review important?

Assessment Items

1. What is the purpose of review?
   A. Skip content
   B. Strengthen understanding
   C. Increase speed
   D. Change direction

2. What does airspace refer to?
   A. Drone battery
   B. Flight area
   C. Speed
   D. Controller

3. What is mission planning?
   A. Flying randomly
   B. Organizing a flight
   C. Increasing speed
   D. Landing

4. What is the purpose of safety procedures?
   A. Increase speed
   B. Protect people and equipment
   C. Change direction
   D. Hover

5. What does preparation do?
   A. Adds confusion
   B. Builds confidence
   C. Reduces learning
   D. Slows performance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Reviewing key concepts and preparing for assessment helps ensure success and confidence in demonstrating learned skills.

Teacher Notes

• Keep review focused and structured
• Reinforce key concepts across standards
• Encourage student questions
• Prepare students for written assessment (Day 2)

Week 18 – Day 2: Final Written Assessment

Standard	Description	RBT Level
101.00	Explain foundational aviation concepts and their impact on drone operations.	B2
103.00	Interpret controlled and uncontrolled airspace classifications and operational requirements.	B2
104.00	Apply mission planning and operational decision-making for drone operations.	C3
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
107.00	Apply programming concepts to autonomous drone flight operations.	C3

Objective
Students will demonstrate their understanding of key course concepts through a written assessment.

Essential Question
How can knowledge of drone concepts be demonstrated through assessment?

Key Concepts
• Assessment measures understanding
• Knowledge supports safe operation
• Concepts must be applied correctly
• Preparation improves performance
• Accuracy is important

Vocabulary
• **Assessment** – A tool used to measure knowledge
• **Concept** – An idea or principle learned
• **Application** – Using knowledge in a situation
• **Accuracy** – Correct answers
• **Performance** – Demonstration of knowledge

Materials Needed
• Printed or digital final assessment
• Answer sheets (if applicable)
• Pencils or devices
• Classroom timer

Bellringer
Prompt:
What strategies help you perform well on a test?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:

   • Key concepts were reviewed in Day 1
   • Important topics include:
   - aviation fundamentals
   - airspace
   - mission planning
   - safety procedures
   - programming basics

   Discuss:

   • What areas do you feel confident in?
   • What strategies will you use today?

   Bridge to lesson:

   • Today's lesson focuses on demonstrating knowledge through a written assessment

---

2. **Core Concept Introduction**

   • Assessment measures knowledge and understanding
   • Accuracy reflects understanding

   Key Teaching Point:
   A written assessment allows students to demonstrate what they have learned throughout the course.

---

3. **Concept Development**

   A. **Understanding the Purpose of Assessment**

   • Assessment:
   - measures knowledge
   - shows understanding

   • Students should:
   - answer carefully

   Emphasize:

   • Assessment reflects learning

   B. **Applying Knowledge to Questions**

   • Students must:
   - read each question
   - choose the correct answer

   • Focus on:
   - applying knowledge

   Emphasize:

   • Application shows understanding

C. Using Test-Taking Strategies

• Strategies include:
- reading all choices
- eliminating incorrect answers

• Students should:
- take their time

Emphasize:
• Strategies improve performance

D. Managing Time During Assessment

• Students should:
- pace themselves
- answer all questions

• Focus on:
- completing the test

Emphasize:
• Time management supports success

E. Maintaining Focus and Integrity

• Students must:
- work independently
- stay focused

• Includes:
- following directions

Emphasize:
• Integrity is important

---

4. Application to Drone Operations

Students apply:
• Knowledge of aviation concepts
• Understanding of safety
• Awareness of airspace
• Basics of mission planning
• Programming concepts

Students recognize:
• Knowledge supports safe and effective operation

---

5. Guided Examples / Demonstration

Instructor reviews:
• Sample question format
• How to select the best answer

Students identify:
• Correct reasoning

6. **Real-World Connection**
   • Written assessments are used for:
   - certification exams
   - training evaluations

   Emphasize:
   • Knowledge testing is part of professional development

7. **Key Reinforcement Summary**
   • Assessment measures understanding
   • Application shows knowledge
   • Strategies improve performance
   • Time management is important
   • Integrity must be maintained

   Key Teaching Point:
   Accurate responses and focused effort demonstrate understanding of course material.

Formative Questions for Use in This Lesson
• What is an assessment?
• Why is accuracy important?
• What strategy can help you succeed?
• Why is time management important?
• Why must integrity be maintained?

Hands-On Activity
Activity Title: Final Written Assessment
Objective:
Students will complete a written assessment demonstrating their understanding of course content.

Activity Procedure
1. Review instructions
2. Begin assessment
3. Read each question carefully
4. Select best answer
5. Manage time effectively
6. Complete all questions
7. Submit assessment

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Accuracy	90–100%	80–89%	70–79%	Below 70%
Completion	All questions	Most completed	Some missing	Many missing
Effort	Strong effort	Good effort	Moderate effort	Limited effort
Focus	Fully focused	Mostly focused	Some distractions	Unfocused

Scenario (C3 Application)
A student rushes through the test without reading questions carefully and makes avoidable mistakes.

• What mistake is being made?
• What strategy should the student use?
• Why is accuracy important?

Assessment Items (Sample Set)

1. What is the purpose of airspace classification?
   A. Increase speed
   B. Organize flight areas
   C. Change direction
   D. Control battery
2. What is a key part of mission planning?
   A. Flying randomly
   B. Planning steps
   C. Ignoring safety
   D. Increasing speed
3. What does safety procedure protect?
   A. Speed
   B. People and equipment
   C. Height
   D. Distance
4. What is a sequence in programming?
   A. Random commands
   B. Ordered steps
   C. Increased speed
   D. Landing
5. What is accuracy?
   A. Speed
   B. Correct answers
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure
A written assessment provides an opportunity to demonstrate knowledge and understanding of key course concepts.

Teacher Notes
• Maintain testing environment
• Do not provide instructional support during assessment
• Monitor for integrity
• Prepare for flight assessment (Day 3)

Week 18 – Day 3: Final Flight Skills Assessment

Standard	Description	RBT Level
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
106.01	Execute basic drone flight maneuvers including hover, yaw, and directional control.	C3
106.02	Demonstrate controlled takeoff, navigation, and landing procedures.	C3
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will demonstrate manual drone flight skills including controlled takeoff, maneuvering, and landing while maintaining safe operation.

Essential Question
What skills are required to safely and accurately control a drone during flight?

Key Concepts
• Controlled flight demonstrates skill
• Maneuvers require precision
• Smooth operation improves performance
• Awareness supports control
• Safety must be maintained

Vocabulary
• **Takeoff** – Lifting the drone into flight
• **Hover** – Maintaining a steady position
• **Yaw** – Rotating the drone
• **Navigation** – Moving in a controlled direction
• **Landing** – Bringing the drone safely to the ground

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Controllers or tablets
• Flight area with clearly defined boundaries
• Safety checklist
• Flight performance rubric

Bellringer
Prompt:
What is the most important skill when controlling a drone?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

Students recall:

- Manual flight skills were practiced in previous weeks
- Basic maneuvers were developed:
  - hover
  - yaw
  - directional movement
- Safety procedures were applied during all flights

Discuss:

- Which maneuver do you feel most confident performing?
- What is most important for safe flight?

Bridge to lesson:

- Today's lesson focuses on demonstrating manual flight skills

---

2. **Core Concept Introduction**

- Flight assessment measures control and precision
- Safe operation is required during all maneuvers

Key Teaching Point:
Demonstrating controlled and safe flight shows readiness for real-world drone operation.

---

3. **Concept Development**

A. Understanding Flight Assessment Expectations

- Students must:
  - perform basic maneuvers
  - demonstrate control

- Includes:
  - takeoff
  - hover
  - navigation
  - landing

Emphasize:

- Control and safety are priorities

B. Performing Controlled Takeoff and Landing

- Takeoff should be:
  - smooth
  - controlled

- Landing should be:
  - accurate
  - stable

Emphasize:

- Start and finish are critical

C. Demonstrating Basic Maneuvers

• Includes:
- hover
- yaw
- directional movement

• Students must:
- maintain control

Emphasize:
• Precision improves performance

D. Maintaining Control Awareness During Flight

• Students must:
- stay focused
- monitor movement

• Includes:
- awareness of surroundings

Emphasize:
• Awareness supports control

E. Maintaining Safety During Flight

• Safety includes:
- clear flight area
- safe distances
- proper operation

• Pilots must:
- maintain safe behavior

Emphasize:
• Safety is always required

4. Application to Drone Flight

Students apply:
• Perform takeoff
• Execute maneuvers
• Maintain control
• Complete landing
• Follow safety procedures

Students recognize:
• Flight skills demonstrate ability

5. **Guided Examples / Demonstration**
   Instructor demonstrates:
   • Expected level of flight performance
   • Proper takeoff and landing

   Students identify:
   • Key elements of control and safety

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6. **Real-World Connection**
   • Manual flight skills are required in:
   - inspections
   - photography
   - emergency response

   Emphasize:
   • Pilots must demonstrate control

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7. **Key Reinforcement Summary**
   • Controlled flight demonstrates skill
   • Maneuvers require precision
   • Awareness supports control
   • Safety must be maintained
   • Practice leads to improvement

   Key Teaching Point:
   Safe and controlled flight demonstrates readiness and responsibility as a drone pilot.

Formative Questions for Use in This Lesson
• What is controlled flight?
• What is hover?
• Why is landing important?
• What is control awareness?
• Why must safety be maintained?

Hands-On Activity
Activity Title: Final Flight Skills Demonstration
Objective:
Students will demonstrate manual flight skills through controlled maneuvers.

Activity Procedure
1. Prepare drone and controller
2. Conduct safety check
3. Perform controlled takeoff
4. Execute hover and yaw
5. Perform directional movement
6. Complete controlled landing
7. Shut down safely

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Takeoff & Landing	Smooth and precise	Mostly controlled	Some instability	Uncontrolled
Maneuver Control	Highly accurate	Mostly accurate	Some errors	Limited control
Awareness	Fully aware	Mostly aware	Some lapses	Unaware
Safety Compliance	Fully maintained	Mostly maintained	Some lapses	Unsafe

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Scenario (C3 Application)
A student performs maneuvers quickly but loses control during landing.

• What mistake is being made?
• What should the student focus on?
• Why is control important during landing?

Assessment Items

1. What is hover?
   A. Landing
   B. Staying in place
   C. Speed
   D. Direction
2. What is yaw?
   A. Moving forward
   B. Rotating
   C. Landing
   D. Speed
3. What is required for safe flight?
   A. Speed
   B. Control
   C. Height
   D. Distance
4. What is navigation?
   A. Hovering
   B. Moving directionally
   C. Landing
   D. Speed
5. What must always be maintained?
   A. Speed
   B. Safety
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Demonstrating safe and controlled flight shows readiness and confidence in drone operation skills.

Teacher Notes

• Evaluate based on control, not speed
• Keep expectations realistic for foundational level
• Ensure safety protocols are followed
• Prepare students for autonomous mission assessment (Day 4)

Week 18 – Day 4: Final Autonomous Mission Assessment

Standard	Description	RBT Level
107.00	Apply programming concepts to autonomous drone flight operations.	C3
107.02	Develop a programmed flight path using a drone platform.	C3
107.03	Execute an autonomous drone mission based on programmed instructions.	C3
107.04	Evaluate and troubleshoot autonomous flight performance.	B2
105.03	Demonstrate safe and responsible drone flight operations.	C3

Objective
Students will demonstrate their ability to execute and evaluate a programmed autonomous drone mission safely and accurately.

Essential Question
What does a successful autonomous drone mission demonstrate?

Key Concepts
• Autonomous missions show applied learning
• Programming sequence controls movement
• Execution must follow planned steps
• Evaluation supports improvement
• Safety must be maintained

Vocabulary
• **Autonomous Mission** – A drone flight controlled by programmed commands
• **Sequence** – Ordered steps in a program
• **Execution** – Running the programmed mission
• **Troubleshooting** – Identifying and correcting errors
• **Performance** – How well the mission is completed

Materials Needed
• Classroom drones (DJI Tello EDU or similar)
• Tablets or computers with block-based programming interface
• Student mission programs
• Flight area with defined boundaries
• Autonomous mission rubric

Bellringer
Prompt:
What is the difference between manual flight and autonomous flight?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

   Students recall:
   • Missions were created and refined in previous weeks
   • Guided and independent execution were completed
   • Performance was evaluated and improved

   Discuss:
   • What changes improved your mission?
   • What is most important for success today?

   Bridge to lesson:
   • Today's lesson focuses on final autonomous mission assessment

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2. **Core Concept Introduction**

   • Autonomous missions demonstrate applied programming and flight skills
   • Success depends on sequence, accuracy, and safety

   Key Teaching Point:
   A successful autonomous mission demonstrates correct programming, accurate execution, and safe operation.

---

3. **Concept Development**

   A. **Understanding Autonomous Mission Expectations**

   • Students must:
   - execute programmed mission
   - follow correct sequence

   • Focus on:
   - completion
   - accuracy

   Emphasize:
   • Execution shows learning

   B. **Executing the Programmed Mission**

   • Includes:
   - takeoff
   - movement sequence
   - landing

   • Students must:
   - allow program to control flight

   Emphasize:
   • Program controls movement

C. Demonstrating Accuracy and Completion

• Accuracy includes:
- correct path
- correct movements

• Completion includes:
- full mission sequence

Emphasize:
• Accuracy and completion are essential

D. Evaluating and Troubleshooting Performance

• Students should:
- identify errors
- suggest corrections

• Includes:
- recognizing incorrect movement

Emphasize:
• Evaluation improves future missions

E. Maintaining Safety During Autonomous Operation

• Safety includes:
- clear flight area
- safe distances
- readiness to stop flight

• Pilots must:
- maintain safe operation

Emphasize:
• Safety is always required

---

4. Application to Drone Flight

Students apply:
• Execute autonomous mission
• Observe performance
• Evaluate results
• Identify improvements

Students recognize:
• Autonomous missions demonstrate skill application

---

5. Guided Examples / Demonstration

Instructor demonstrates:
• Example of successful mission
• Example of minor error and correction

Students identify:
• Key elements of success

6. Real-World Connection

• Autonomous missions are used in:
- mapping
- inspections
- agriculture

Emphasize:
• Programming supports efficient operations

7. Key Reinforcement Summary

• Autonomous missions show applied learning
• Sequence controls movement
• Accuracy ensures success
• Evaluation supports improvement
• Safety must be maintained

Key Teaching Point:
Successful autonomous missions demonstrate correct programming, execution, and safe operation.

Formative Questions for Use in This Lesson

• What is an autonomous mission?
• What controls the drone?
• Why is sequence important?
• What is troubleshooting?
• Why must safety be maintained?

Hands-On Activity
Activity Title: Autonomous Mission Assessment
Objective:
Students will execute and evaluate a programmed drone mission.

Activity Procedure

1. Prepare drone and system
2. Conduct safety check
3. Load mission program
4. Execute mission
5. Observe performance
6. Evaluate results
7. Identify one improvement

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Mission Completion	Fully successful	Mostly successful	Partial	Incomplete
Sequence Accuracy	Fully correct	Mostly correct	Some errors	Incorrect
Evaluation	Clear and accurate	Mostly accurate	Some gaps	Limited
Safety Compliance	Fully maintained	Mostly maintained	Some lapses	Unsafe

---

Scenario (C3 Application)
A student runs a program but does not check for errors beforehand, resulting in incorrect movement.

• What mistake is being made?
• What should the student have done?
• Why is checking the sequence important?

Assessment Items

1. What controls the drone in an autonomous mission?
   A. Pilot
   B. Program
   C. Speed
   D. Battery
2. What is sequence?
   A. Random movement
   B. Ordered steps
   C. Speed
   D. Landing
3. What does execution mean?
   A. Planning
   B. Running program
   C. Landing
   D. Hover
4. What is troubleshooting?
   A. Ignoring errors
   B. Fixing problems
   C. Increasing speed
   D. Landing
5. What must always be maintained?
   A. Speed
   B. Safety
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

Executing and evaluating an autonomous mission demonstrates the ability to apply programming and flight skills safely and effectively.

Teacher Notes

• Keep missions simple and achievable
• Evaluate based on completion and accuracy
• Reinforce safety throughout
• Prepare students for final reflection and closure (Day 5)

Week 18 – Day 5: Course Reflection, Recognition, and Next Steps

Standard	Description	RBT Level
101.00	Explain foundational aviation concepts and their impact on drone operations.	B2
104.00	Apply mission planning and operational decision-making for drone operations.	C3
105.00	Apply safety procedures and regulatory requirements for drone operations.	C3
106.00	Perform manual drone flight operations using controlled maneuvers.	C3
107.00	Apply programming concepts to autonomous drone flight operations.	C3

Objective
Students will reflect on their learning, recognize their achievements, and identify next steps in drone education and application.

Essential Question
How has this course prepared you for future learning and real-world drone applications?

Key Concepts
• Reflection supports growth
• Achievement builds confidence
• Skills transfer to real-world use
• Learning continues beyond the course
• Safety remains essential

Vocabulary
• **Reflection** – Thinking about what was learned
• **Achievement** – Accomplishments gained through effort
• **Application** – Using skills in real situations
• **Progress** – Improvement over time
• **Next Steps** – Future learning opportunities

Materials Needed
• Reflection worksheet or prompts
• Certificates or recognition materials
• Course materials (optional review)
• Presentation materials (optional)

Bellringer
Prompt:
What is one skill you are most proud of learning in this course?

Instructional Content

1. **Lesson Connection / Prior Knowledge**

Students recall:
- Aviation concepts were learned
- Airspace and safety were practiced
- Missions were planned and executed
- Manual and autonomous flight skills were developed

Discuss:
- What was your biggest improvement?
- What was your biggest challenge?

Bridge to lesson:
- Today's lesson focuses on reflecting on learning and recognizing achievements

---

2. **Core Concept Introduction**

- Reflection helps understand growth
- Recognizing achievement builds confidence

Key Teaching Point:
Reflecting on learning and recognizing progress helps students understand their development and prepare for future opportunities.

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3. **Concept Development**

A. Reflecting on Learning

- Students consider:
  - what they learned
  - how they improved
- Includes:
  - skills
  - knowledge

Emphasize:
- Reflection supports growth

B. Recognizing Achievement

- Students identify:
  - accomplishments
  - successful performance
- Includes:
  - completed missions
  - improved skills

Emphasize:
- Achievement builds confidence

C. Connecting Skills to Real-World Application

• Skills apply to:
- careers
- hobbies
- future courses

• Students recognize:
- real-world use

Emphasize:
• Skills are transferable

D. Identifying Next Steps

• Next steps include:
- advanced courses
- certification pathways
- continued practice

• Students should:
- set a goal

Emphasize:
• Learning continues

E. Reinforcing Safety as a Lifelong Skill

• Safety includes:
- responsible operation
- awareness of rules

• Students must:
- continue safe practices

Emphasize:
• Safety is always required

---

4. Application to Drone Operations

Students apply:
• Reflect on learning
• Identify achievements
• Connect skills to future use
• Set goals

Students recognize:
• Learning extends beyond the course

---

5. Guided Examples / Demonstration

Instructor models:
• Example reflection
• Example goal-setting

Students identify:
• What strong reflection looks like

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6. **Real-World Connection**
   • Reflection and goal-setting are used in:
   - education
   - careers
   - certification pathways

   Emphasize:
   • Growth continues beyond the classroom

---

7. **Key Reinforcement Summary**
   • Reflection supports growth
   • Achievement builds confidence
   • Skills transfer to real-world use
   • Learning continues
   • Safety remains essential

   Key Teaching Point:
   Recognizing growth and setting future goals prepares students for continued success.

Formative Questions for Use in This Lesson
• What did you learn?
• What are you most proud of?
• How can you use these skills?
• What is your next step?
• Why is safety important?

Hands-On Activity
Activity Title: Reflection and Goal Setting
Objective:
Students will reflect on their learning and identify future goals.

Activity Procedure
1. Complete reflection prompts
2. Identify key achievements
3. Describe skill improvement
4. Connect learning to real-world use
5. Set one future goal
6. Share reflections (optional)
7. Participate in recognition

Performance Rubric

Criteria	Advanced	Proficient	Developing	Beginning
Reflection Depth	Insightful and detailed	Clear and complete	Basic	Limited
Achievement Recognition	Strong understanding	Adequate	Some gaps	Limited
Future Planning	Clear and realistic	Mostly clear	Some gaps	Limited
Participation	Fully engaged	Mostly engaged	Some participation	Limited

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Scenario (C3 Application)

A student completes the course but does not reflect on what they learned or how they improved.

• What opportunity is being missed?
• Why is reflection important?
• How can reflection help future success?

Assessment Items

1. What is reflection?
   A. Ignoring learning
   B. Thinking about learning
   C. Increasing speed
   D. Flying
2. What does achievement mean?
   A. Failure
   B. Accomplishment
   C. Speed
   D. Height
3. What is application?
   A. Ignoring skills
   B. Using skills
   C. Landing
   D. Hovering
4. What is a next step?
   A. Ending learning
   B. Future learning
   C. Speed
   D. Distance
5. What must always be maintained?
   A. Speed
   B. Safety
   C. Height
   D. Distance

Answer Key

1. B
2. B
3. B
4. B
5. B

Closure

This course has built a strong foundation in drone operations, safety, and mission execution, preparing students for continued growth and future opportunities.

Teacher Notes

• Celebrate student success
• Keep tone positive and encouraging
• Emphasize growth, not perfection
• Reinforce safety as lifelong responsibility
• Provide next-step opportunities if available