

UAS OPERATIONS
BECOMING A COMMERCIAL SUAS PILOT
PART 107 EXAM PREPARATION



# **GROUP PROJECT: YOUR TURN TO TEACH**



Session Time: Ten, 50-minute session(s)

#### **DESIRED RESULTS**

#### **ESSENTIAL UNDERSTANDINGS**

Learning by teaching is an effective way for students to grow in their understanding of UAS topics.

#### **ESSENTIAL QUESTIONS**

1. What are the most important elements of UAS topics that will appear on the Part 107 Commercial Drone Exam, and how can these best be taught in an informative and engaging way?

#### **LEARNING GOALS**

#### Students Will Know

- Topics that will appear on the Part 107 Commercial Drone Exam.
- How to work in groups to research and prepare presentations aimed at teaching an audience of peers about UAS topics in an engaging manner.

#### Students Will Be Able To

- Review topics that are likely to appear on the Part 107 exam. [DOK-L1]
- Identify key points within a broad UAS topic. [DOK-L1]
- Construct lessons about an assigned topic that aim to teach classmates about the topic in a creative manner with a logical flow. [DOK-L3]
- Summarize research on an assigned topic by presenting it to the class. [DOK-L2]

## ASSESSMENT EVIDENCE

#### Warm-up

Students will take a mock quiz to assess their present knowledge of material that is likely to appear on the Part 107 exam.

#### Formative Assessment

There is no formative assessment for this lesson.

#### Summative Assessment

Students will teach their lesson about an assigned topic to help their classmates review what they have learned in this course and prepare for the Part 107 exam.

## **LESSON PREPARATION**

## MATERIALS/RESOURCES

- Group Project: Your Turn to Teach Presentation
- Group Project: Your Turn to Teach Student Activity
- Group Project: Your Turn to Teach Teacher Notes
- Group Project: Your Turn to Teach Teacher Resource
- Project Packet
  - Group Project: Your Turn to Teach Instructions (Weather)
  - Group Project: Your Turn to Teach Instructions (Regulations)
  - Group Project: Your Turn to Teach Instructions (Operations)
  - Group Project: Your Turn to Teach Instructions (Loading and Performance)
  - Group Project: Your Turn to Teach Instructions (Airspace and Requirements)
  - Group Project: Your Turn to Teach Project Information Sheet (Day 1)
  - Group Project: Your Turn to Teach Daily Goal Sheet (Day 2)
  - Group Project: Your Turn to Teach Daily Goal Sheet (Day 3)
  - Group Project: Your Turn to Teach Daily Goal Sheet (Day 4)
  - Group Project: Your Turn to Teach Daily Goal Sheet (Day 5)
  - Group Project: Your Turn to Teach Rubric

## **LESSON SUMMARY**

Lesson 1: Group Project: Your Turn to Teach

Lesson 2: UAS Jeopardy!

The lesson will begin with a mock quiz that assesses students' present knowledge of material that is likely to appear on the Part 107 exam.

During the next part of the lesson, students will briefly review strategies for preparing for the Part 107 exam. They will then be divided into small groups, and each group will be assigned a topic that test-takers must understand to pass the Part 107 exam. Groups will have five sessions to prepare to teach a lesson about their assigned topic to their classmates. They will also create a study guide and a quiz highlighting the essential information.

In the lesson's remaining five sessions, each group will have one session to teach its lesson to the class, distribute its study guide, and give its quiz. Finally, students will compile all the study guides that they receive into a single resource to help them prepare for the Part 107 exam.

#### **BACKGROUND**

This unit guides students to review what they have learned to this point in the course, in preparation to take the FAA's licensing exam for commercial drone pilots. (The FAA's official name for the exam is the "Unmanned Aircraft General – Small exam"; for the sake of brevity and convenience, however, this lesson will refer to the Part 107 exam because this is how drone pilots typically refer to the exam in conversation.) Although people need to be 14 years old to take the exam, they need to be 16 years old to use the privileges of a commercial drone pilot. As 11th graders, nearly all students taking this course should meet the requirement to take the exam, and most who pass should be old enough to operate as commercial remote pilots.

As students have learned, drones are more than a consumer novelty—they are rapidly changing and evolving into useful tools for many industries. Cinematography, energy, mining, utilities, real estate, customs and border protection, journalism, fire, police, agriculture, and construction industries all use drones. With this growth comes many job opportunities.

The growth trends in the drone industry are clear. The rate of compliance for FAA UAS aircraft registration has consistently increased, along with the number of people taking the Part 107 exam to become certificated commercial UAS pilots. Taking the Part 107 exam to become a commercially-certificated drone pilot is an important step for students—not only in terms of opening doors to different careers, but also for fostering personal growth and overall UAS safety.

#### **MISCONCEPTIONS**

Students—particularly those who have been in AOPA's High School STEM Curriculum since 9th or 10th grade—may assume that because they have learned all of the material that the FAA's Part 107 exam will cover, outside study for the test will not be necessary. It is important to emphasize that the exam is challenging and that to do well on it, students should spend time studying on their own. It is only through self-study—in conjunction with AOPA's curriculum—that students can maximize their potential for success on test day.

Also, students may assume that the Part 107 exam will contain only questions that are relevant to sUAS pilots. This is not the case. Some questions on the exam will cover topics (e.g., airspace requirements, airport procedures, weather reports) that seem more applicable to pilots of manned aircraft. It is important that students be as familiar with these topics as they are with topics that seem more directly related to sUAS. Many of these topics were covered in AOPA's grade 10 curriculum, and they will be reviewed over the course of this unit.

Finally, students who decide to take the Part 107 exam may expect to receive their commercial certificate with an sUAS rating as soon as they pass the exam. This is not the case. After taking and passing the exam, students will need to complete an application using IACRA, the FAA's airman application system, to apply for a certificate. Within 10 days, the application should be validated, which will allow students to print out a temporary drone certificate. The actual certificate will then arrive in the mail.

## **DIFFERENTIATION**

While the activity in this lesson is highly differentiated, you might find it helpful to group students based on ability. For groups of higher achieving students, you might challenge them to go beyond the topics listed under their subject, to create a skit or script as a way to teach the content to their fellow classmates, or to make their quiz into more of a game. For groups of struggling students, you might suggest a more structured approach and provide them with more guidance throughout the activity.

## **LEARNING PLAN**

## **ENGAGE**

## Session 1

Teacher Materials: <u>Group Project: Your Turn to Teach Presentation</u>, <u>Group Project: Your Turn to Teach Teacher Notes</u>
Student Material: <u>Group Project: Your Turn to Teach Student Activity</u>

Slides 1-3: Introduce the topic and learning objectives of the lesson.

Slide 4: Conduct the Warm-Up.

#### Warm-Up

Place students into pairs and distribute **Group Project: Your Turn to Teach Student Activity**. This mock quiz covers a broad range of material that might be found on the Part 107 exam—including questions that focus on both manned and unmanned flight. Each pair should work together to answer the questions. Once all pairs have finished, review the correct answers as a class.

Correct answers are found in Group Project: Your Turn to Teach Teacher Notes.

[DOK-L1; review]

## **EXPLORE**

## Teacher Material: Group Project: Your Turn to Teach Presentation

**Slide 5:** Remind students that the Part 107 exam includes sUAS-specific questions and questions that might seem more relevant to manned pilots. To refresh students' memories about topics covered during the previous semester ("The Flying Environment"), this unit will offer a review of previously learned material. Emphasize, however, that if students want to score well on the exam, they will need to study outside of class.

Inform students that in addition to reviewing their AOPA course materials, they can find numerous study guides available to purchase from commercial providers, including Aviation Supplies & Academics (ASA), Gleim Aviation, and Jeppesen. It is not necessary to spend money, however, as the FAA provides a study guide that can be found at the following link:

"Remote Pilot - Small Unmanned Aircraft Systems Study Guide"
 <a href="https://www.faa.gov/regulations">https://www.faa.gov/regulations</a> policies/handbooks manuals/aviation/media/remote pilot study guide.pdf

Additionally, there are online and video courses available for purchase from commercial sources. Again, however, students do not have to spend money on quality study materials: YouTube contains numerous free videos on a variety of exam topics.



## **Teaching Tips**

Although the following video is too long to show in class, you might want to share it with students (e.g., by emailing them the link or posting the link to a class website) as an example of the kind of relevant, free videos available on YouTube:

"FREE Drone Certification Study Guide: FAA Part 107 sUAS Test" (Length 1:43:30)
 <a href="https://video.link/w/dlx1">https://video.link/w/dlx1</a>

For teachers unable to access Safe YouTube links, the video is also available here: https://www.youtube.com/watch?v=6\_ucCKFJUCU

#### **Slide 6:** Explain that this unit consists of two lessons:

• In this first lesson, which is 10 sessions, students will work in small groups to prepare a class presentation on one topic that the Part 107 exam will assess. Groups will spend five sessions researching and creating their presentation; over the remaining five sessions, each group will teach its assigned topic to the rest of the class.

• In the second lesson, which is one session, students will review what they learned from the presentations by creating and playing a class game of *Jeopardy!* 

At the end of this unit, students should be ready to take the Part 107 exam. Two hours are allowed for the exam, which consists of 60 questions; to pass, a student must answer at least 42 questions correctly (70 percent).

Explain that taking the exam is not a requirement for passing this course; however, students are strongly recommended to take the exam because passing it will allow them to earn a valuable certification and work as commercial sUAS pilots.

#### **EXPLAIN**

Teacher Material: <u>Group Project: Your Turn to Teach Presentation</u>, <u>Group Project: Your Turn to Teach Teacher Resource</u>

Student Materials: Group Project: Your Turn to Teach Project Packet (Instructions, Project Information Sheet, Rubric)



## **Teaching Tips**

Prior to beginning this lesson, create a **Project Packet** for each group. Each group's packet should contain a copy of the project information sheet and rubric plus each daily goal sheet (Days 2–4); you will also need to include the set of instructions for the group's assigned topic. (Each group follows the same procedure, but each set of instructions contains key concepts and reminders that are specific to the assigned topic.)

**Slide 7:** Over the course of 10 sessions, this lesson will help students solidify their knowledge of Part 107 exam topics by becoming teachers of the material. Begin by dividing students into five groups. Each group will be assigned a different topic, as detailed on the following five slides.

- Each group will get five sessions (including this session) to review notes on their topic from prior lessons (including from previous semesters), conduct new research as necessary, and plan a lesson in which they teach the other groups about their assigned topic.
  - Each group will also need to create a study guide that highlights the essential information relevant to its assigned topic that will likely be on the Part 107 exam.
  - Each group will also need to create a quiz that assesses five key concepts from its lesson.
- The remaining five sessions will consist of five presentations. Each group will receive one class period in which to play the role of teachers and present their lesson to the class.
  - Following its presentation, the presenting group should distribute the study guide that it prepared for the class. (Study guides can be printed on paper, or groups may share digital files with their classmates.)
    - After all presentations have been given, students can compile these study guides into a single resource to help them prepare for the Part 107 exam.
  - Finally, the presenting group will give its quiz to the rest of the class. (The quiz can be printed or shared as a digital file, or the presenting group can read aloud each question for the rest of the class to answer on blank paper.)

Emphasize that each group member should plan to do an equivalent and sizable amount of work throughout the lesson; groups will receive planning materials and other resources to support and structure their efforts.

## 7

## **Teaching Tips**

The recommended group size is 3-5 students, divided into 5 groups (one per topic).

- If a class has more than 25 students, keep the total number of groups at 5 and increase the number of students per group.
- If a class size is too small to allow for five groups, one or more topics can be omitted. Poll students to determine which topics they feel most comfortable with already; these should be the first topics omitted. The aim should be for students to research and teach topics they find challenging.

You may wish to allow students to choose their groups based on the topic that they wish to research and teach, though some adjustments may be necessary to ensure that group sizes are equal. Students should be encouraged to choose a topic that they find difficult or feel less than comfortable with because teaching a topic is an excellent way to achieve a better understanding of it.

**Slide 8:** The first topic is **Regulations**. The group teaching this topic should include information about the following key concepts:

- Remote pilot certification and privileges
- Crew roles
- Accident reporting
- sUAS registration
- Preflight actions and inspection
- Daylight/night operations
- Line of sight, operating limitations
- Right-of-way rules
- Operations around people and vehicles
- Alcohol and drugs
- Operational waivers
- Change of address

**Slide 9:** The second topic is **Airspace and Requirements**. The group teaching this topic should include information about the following key concepts:

- Airspace classifications and requirements
- Flight restrictions
- NOTAMs
- Sectional charts
- Airport operations
- Collision avoidance
- Airport markings and signs

**Slide 10:** The third topic is **Weather**. The group teaching this topic should include information about the following key concepts:

- · Effects of weather
- Wind

- Atmospheric stability
- Air masses and fronts
- Visibility and clouds
- Thunderstorms, icing, and fog
- Density altitude
- Aviation weather services (e.g., METARs, weather reports, and forecasts)

**Slide 11:** The fourth topic is **Loading and Performance**. The group teaching this topic should include information about the following key concepts:

- Loading considerations
- · Center of gravity
- Weight and balance definitions and calculations
- Load factor
- Aerodynamics
- Performance
- Stalls

**Slide 12:** The fifth topic is **Operations**. The group teaching this topic should include information about the following key concepts:

- Communications procedures
- Emergency procedures (e.g., lost link, flyaways, loss of GPS, battery fires)
- Aeronautical decision making
- Physiology
- Maintenance procedures



## **Teaching Tips**

Emphasize that the lists of key concepts provided on Slides 8-12 are not exhaustive. If a group decides that additional information is necessary to understand its assigned topic, the group should include that information in its lesson.

Each group shall receive a **Project Packet** that lists the suggested key concepts for its assigned topic, so groups don't have to remember exactly what appears on Slides 8-12.

**Slide 13:** Once students are in their groups and topics have been assigned, explain that each group should decide the format for presenting its lesson to the class. (Emphasize that you will need to approve the format before a group begins work on its lesson.) Possible formats include:

- PowerPoint presentation
- Google slideshow
- Prezi
- Video
- Game
- Storyboard
- Skit/role-play

Make clear to students that these ideas are starting points: creativity is encouraged! Students should consider how to best condense broad topic areas into a single lesson. To do this, each group should begin by identifying the key

concepts within its topic. Finally, re-emphasize that every group member must participate in the project—both by helping prepare the lesson and by participating in the presentation.

Slide 14: Share the Project Packet with each group, and give each group time to review the instructions and rubric. (Remember to give each group the set of instructions specific to its assigned topic.) Note that each group's instructions list the key concepts for its assigned topic (repeated from Slides 8-12). Remind students that these lists are not exhaustive; each group should add key concepts as needed.

Circulate to answer any questions that come up as groups review these materials.

**Slide 15:** Each group should spend the remainder of this session completing the **Project Information Sheet** in its packet. The instructions document (see Day One: Step 1.c) walks groups through each section of the information sheet. When a group has finished its sheet, you should review it for approval. Confirm that each group has done the following:

- Fleshed out the key concepts suggested for the assigned topic and added new ones to research
- Clearly described the format of the lesson and presentation, including media that will be used (e.g., PowerPoint slides, videos)
- Equitably distributed the responsibilities for completing the project (lesson, presentation, study guide, and quiz) among all group members

Remind groups that they are free to change their minds about how to format and present their lesson as they work on it—the point of the information sheet is to help them focus their ideas and make a plan for achieving their goals over the next four days. A group that changes its approach will need to complete a new information sheet and submit it for your approval.

Once you approve a group's information sheet, if time remains in the session, the group's members should begin reviewing and organizing their relevant notes from previous lessons and semesters. This will help them identify gaps in their knowledge that they will need to fill with new research over the next four sessions. They might also get a jump on the next class by working on their goal sheet for Day 2 (included in the **Project Packet**).

#### Session 2

Teacher Materials: Group Project: Your Turn to Teach Presentation, Group Project: Your Turn to Teach Teacher Resource

Student Material: Group Project: Your Turn to Teach Project Packet (Instructions, Daily Goal Sheet [Day 2])

**Slide 16:** Each group should begin by reviewing the instructions and completing the **Daily Goal Sheet** for Day 2. Remind students that responsibilities for achieving goals should be distributed equitably among all group members; multiple group members may share responsibility for a goal, but each group member must help complete at least one goal during this session.

Students should then use the remainder of the session to work toward achieving their goals; this may require conducting new research. Remind students that in addition to creating and preparing to teach a lesson on their topic, each group must complete the following:

- A study guide that will be distributed to the class; it may be as simple as an outline of the lesson, or it may involve more creativity.
- A brief guiz (assessing five key concepts from the lesson) that will be given to the class.



## **Teaching Tips**

You may wish to share with groups the **Teacher Resource** document, which suggests previous lessons and web pages with information that is relevant to each topic—particularly if students struggle to identify appropriate starting points for their research.

Throughout the session, circulate to keep students on task and answer questions as they arise. You should also plan to meet briefly with each group twice: once toward the beginning of the session to discuss the group's goals, and once near the end of the period to confirm the group has achieved its goals. Groups that do not achieve their goals should explain how they plan to modify their efforts during the next session to make better progress.

#### Session 3

Teacher Materials: Group Project: Your Turn to Teach Presentation, Group Project: Your Turn to Teach Teacher Resource

Student Material: Group Project: Your Turn to Teach Project Packet (Instructions, Daily Goal Sheet [Day 3])

**Slide 17:** Each group should begin by reviewing the instructions and completing the **Daily Goal Sheet** for Day 3. Remind students that responsibilities for achieving goals should be distributed equitably among all group members; multiple group members may share responsibility for a goal, but each group member must help complete at least one goal during this session.

Students should then use the remainder of the session to work toward achieving their goals. This may require conducting new research; the **Teacher Resource** document suggests useful starting points. Remind students that in addition to creating and preparing to teach a lesson on their topic, each group must complete a study guide and a quiz.

Throughout the session, circulate to keep students on task and answer questions as they arise. You should also plan to meet briefly with each group twice: once toward the beginning of the session to discuss the group's goals, and once near the end of the period to confirm the group has achieved its goals. Groups that do not achieve their goals should explain how they plan to modify their efforts during the next session to make better progress.

#### Session 4

Teacher Materials: Group Project: Your Turn to Teach Presentation, Group Project: Your Turn to Teach Teacher Resource

Student Material: Group Project: Your Turn to Teach Project Packet (Instructions, Daily Goal Sheet [Day 4])

**Slide 18:** Each group should begin by reviewing the instructions and completing the **Daily Goal Sheet** for Day 4. Remind students that responsibilities for achieving goals should be distributed equitably among all group members; multiple group members may share responsibility for a goal, but each group member must help complete at least one goal during this session.

Students should then use the remainder of the session to work toward achieving their goals. This may require conducting new research; the **Teacher Resource** document suggests useful starting points. Remind students that in addition to creating and preparing to teach a lesson on their topic, each group must complete a study guide and a quiz.

Throughout the session, circulate to keep students on task and answer questions as they arise. You should also plan to meet briefly with each group twice: once toward the beginning of the session to discuss the group's goals, and once near the end of the period to confirm the group has achieved its goals. Groups that do not achieve their goals should explain how they plan to modify their efforts during the next session to make better progress. Emphasize that groups have only one more session to complete their work; presentations will begin in Session 6.

## Session 5

Teacher Materials: Group Project: Your Turn to Teach Presentation, Group Project: Your Turn to Teach Teacher Resource

Student Material: Group Project: Your Turn to Teach Project Packet (Instructions, Daily Goal Sheet [Day 5])

**Slide 19:** Each group should begin by reviewing the instructions and completing the **Daily Goal Sheet** for Day 5. Emphasize that today is the final day for groups to complete their lesson, study guide, and quiz; presentations will begin in Session 6. Students should therefore spend time during today's class practicing their presentation.



## **Teaching Tips**

Groups will probably not have time in class to practice their complete presentation. Instead, encourage each group to practice introducing and concluding its presentation and transitioning between sections and presenters. All group members should understand their responsibilities.

Groups should then use the remainder of the session to complete their lesson, study guide, and quiz. Throughout the session, circulate to keep students on task and answer questions as they arise. You should also plan to meet briefly with each group twice: once toward the beginning of the session to discuss the group's goals, and once near the end of the period to confirm the group has achieved its goals.



## **Teaching Tips**

By the end of class, announce the order in which groups will present. The simplest approach is to begin with Topic 1 and end with Topic 5, but you may prefer to randomize presentations or allow groups to volunteer for each slot. However you decide, it is best that students know in advance so they can fully prepare.

Teacher Materials: Group Project: Your Turn to Teach Presentation, Group Project: Your Turn to Teach Rubric Student Material: Group Project: Your Turn to Teach Project Packet (Instructions, Rubric)

#### Sessions 6-10

**Slide 20:** Each of the remaining sessions for this lesson should follow the same structure: the group whose turn it is to teach its lesson receives the entire session to use as needed. Remind each group to reserve 10-15 minutes at the end of the session to answer questions about its topic, distribute its study guide, and give its quiz to classmates.

As each group gives its presentation, have a copy of the **Rubric** handy for taking notes and scoring the group's work.



#### **Teaching Tips**

To add a further element of fun and competition, you might consider—following all of the group presentations—asking students to vote on their favorite. Extra points could potentially be awarded to the class favorite.

## **EXTEND**

Teacher Materials: <u>Group Project: Your Turn to Teach Presentation</u>, <u>Group Project: Your Turn to Teach Rubric</u> Student Material: Group Project: Your Turn to Teach Project Packet (Instructions, Rubric)

Slide 21: At the end of each presentation, the presenting group should distribute its study guide highlighting the essential information about its topic that the Part 107 exam will likely assess. If possible, print a copy of each study

guide for all students. Students can then compile these study guides into a single study resource for the Part 107 exam. If it is not possible to print copies, groups should create digital study guides that they can share with their classmates.

## **EVALUATE**

Teacher Materials: <u>Group Project: Your Turn to Teach Presentation</u>, <u>Group Project: Your Turn to Teach Rubric</u> Student Material: Group Project: Your Turn to Teach Project Packet (Instructions, Rubric)

**Slide 22:** Each group should conclude its presentation by giving the class a brief quiz that assesses five key concepts from the lesson. After students have taken the quiz, the presenting group should reveal the answers.

#### **Summative Assessment**

Each group's presentation (including its lesson, study guide, and quiz) serves as its summative assessment for this lesson. Use the **Rubric** provided in the **Project Packet** to score groups; assign point values to each criterion as you think best.

[DOK-L3; construct; DOK-L2; summarize; DOK-L1; identify]

## STANDARDS ALIGNMENT

#### COMMON CORE STATE STANDARDS

- RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
- RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
- **RST.11-12.9** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
- WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures /experiments, or technical processes.
- WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- WHST.11-12.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
- WHST.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
- WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
- WHST.11-12.9 Draw evidence from informational texts to support analysis, reflection, and research.

## **REFERENCES**

• Remote Pilot - Small Unmanned Aircraft Systems Study Guide

- https://www.faa.gov/regulations\_policies/handbooks\_manuals/aviation/media/remote\_pilot\_study\_guide.
   pdf
- FREE Drone Certification Study Guide: FAA Part 107 sUAS Test
  - YouTube: <a href="https://www.youtube.com/watch?v=6\_ucCKFJUCU">https://www.youtube.com/watch?v=6\_ucCKFJUCU</a> (Length 1:43:30)

Additionally, see the resources listed in **Group Project: Your Turn to Teach Teacher Resource**