

## ADVANCED: PREFLIGHT

### DESCRIPTION OF SESSION

In this session, participants will explore more deeply the physics, meteorology, philosophy, planning, and preparation that must go into each flight. While the introductory preflight inspection focuses primarily on the airplane and its systems, this session emphasizes a broader view of all the factors that make up a successful, safe flight.

### CATEGORY

- Exploring, Aviation
- U.S. Department of Education, Transportation

### OBJECTIVES

By the end of this session, participants will be able to:

- Discuss aviation weather-related decision making and “go” or “no go” decisions that pilots make before each flight.
- Understand that water is heavier than fuel and can clog a fuel line, starving a plane of fuel.
- Understand weight and balance and how center of gravity affects flight.
- Understand that the Pilot Operating Handbook (POH) contains information specific to each airplane and can help with planning a flight.
- Discuss other factors that might affect the safe conclusion of a flight, such as how a pilot feels that day.

### SUPPLIES

- **Activity 1 supplies**—two fuel samples, one clean and one contaminated with water
- **Activity 4 supplies**—laptop or computer with Wi-Fi access, possibly with a projector if the group is large
- **Activity 5 supplies**—weight and balance charts from the Pilot Operating Handbook
- **Activity 6 supplies**—Pilot Operating Handbook

**ADVISOR NOTE:** Text in italics should be read aloud to participants. As you engage your post in activities each week, please include comments, discussions, and feedback to the group relating to **Character, Leadership, and Ethics**. These are important attributes that make a difference in the success of youth in the workplace and in life.

### ACTIVITIES

Remind participants that airplanes are composed of a number of systems. The following activities each focus on a different system. Discuss design constraints of systems in detail.

#### Activity 1

##### Fuel

Have two fuel samples available, one clean and one contaminated with water. Discuss the difference in the density of fuel versus water and the coloring of the fuel. Ask: *Why does taking a fuel sample work? What does this determine about the placement of the tanks and the placement of the drain holes from an engineering perspective?* (Water is heavier than fuel and will sink to the bottom. Sumps are always at the lowest point so water can sink and get drained out before getting caught in the fuel lines.)

Ask: *Why is it best to fill the tanks after a flight, especially in cold weather?* (So the tanks are full, leaving no room for condensation to form water inside the tanks.)

## **Activity 2**

### **Tires**

Discuss tire pressure and its relation to temperature, as well as the risk of tire blowout if you inflate the tires where it's cold and land where it's much warmer. Ask: *Why would this happen?* (Air expands as it is heated. Tires inflated to full at an airport where it's cold will expand when reaching higher temperatures. The extra pressure on landing could blow the tires.)

## **Activity 3**

### **Fuselage and Building Materials**

Present information about compound fatigue and fuselage materials. Discuss cracks and dents in the fuselage, wiring, bolts, cables, and other parts. Ask: *How do you think metal planes respond versus planes made out of newer compounds? Why does fatigue happen? What are the advantages and disadvantages of metal versus other compounds? Why did the "Spruce Goose" have so much trouble taking off?* (Use as an example bending a wire repeatedly. It eventually breaks. Metal is heavier but probably stronger. Other compounds are lighter but break more easily. Compare plane engineering with car engineering.)

## **Activity 4**

### **Weather**

Visit an online weather briefing site. NOAA's site is excellent (<https://www.aviationweather.gov/>), but you can also use your favorite aviation website. Look at weather maps and discuss high and low pressure and their effects on flying. Discuss turbulence, wind shear, icing, and convection and the associated risks. Show participants METARS and TAFs and discuss the differences. Look at winds and calculate crosswind components. Discuss take-off and landing distance and the effects of wind and weather. Cross reference this with the runway length(s) at your home airport and discuss whether a safe landing is possible during different weather events.

As you discuss various aspects of weather, ask questions such as the following:

- *What happens when you fly from a high pressure area into a low pressure area? (High to low, look out below!) Why?*
- *How does ice change an airfoil's shape? Why is icing such a problem? What other things could increase risk by changing the surface of an airfoil?*
- *How do aircraft get certified for instrument flight?*
- *How is it that those little wires on the wings can distribute a lightning strike?*
- *If the airport you plan to visit doesn't have a TAF, what types of things can you do to get a reasonable guess about the weather during your arrival window?*
- *Do you think a pilot without a lot of experience makes the same "go" or "no go" decisions as a very experienced pilot? Why or why not? What seems the best approach?*

## **Activity 5**

### **Weight and Balance**

Discuss weight and balance, lever arms, center of gravity, and center of lift and explain why it is so important to calculate weight and balance. Ask: *Why and how do weight and balance change as you are flying? What effect does hot weather have on take-off distance and why? What about altitude and density altitude? Do they have an effect on weight and balance?* Look at weight and balance charts and discuss.

## **Activity 6**

### **Flight Planning**

Discuss the relationships between time, distance, speed, fuel, weight, and balance. Discuss g-forces and wind and tie these back to weather. Look at the POH for the airplane and discuss aspects of the flight that can be found in the POH, such as the effects of a fully loaded plane on a short runway with a center of gravity that is aft. Or look at a hypothetical landing place within a short flight and determine if the runway will accommodate the plane's landing distance with today's conditions.

Some sample questions to help focus the discussion might include:

- *Because the range of a flight is a function of rate and time rather than distance, why might you choose a 6,000-foot altitude with a 15-knot headwind over a 4,000-foot altitude with a 30-knot headwind?*
- *Why might a pilot choose to fly at a slower speed? (Less fuel burn might allow you to get to your destination without a fuel stop.)*

## **Activity 7**

### **Personal Factors**

Discuss the personal factors that go into a "go" or "no go" decision. These could include a lack of sleep, use of alcohol, stress at home or at work, etc. Use the "IMSAFE" acronym promoted by the FAA. It stands for "Illness, Medication, Stress, Alcohol, Fatigue, Emotion." Discuss the concept of "get-there-itis" and the social pressure of making it to your destination on time.

## **ADVISOR NOTE**

Some sample questions are below. They are designed to help the participants apply what they have learned to their own interests. You are welcome to use these questions or develop your own questions that relate to your post or specific focus area.

## **REFLECTION**

- *Why is it so important for pilots to do such thorough preflight preparation for a flight?*
- *In this activity, we discussed social, psychological, physical, and scientific factors that all affect a flight. Can you think of another area in your life that takes into account so many different decisions? (There are probably many. Something as simple as going to prom could be an analogy for the peer pressure, health, stress, and other factors that come into play for pilots. Encourage Explorers to get creative.)*

**ADVISOR AND OFFICER REVIEW**

After the meeting, address the following:

- Identify what was successful about the meeting.
- Identify what needed improvement.
- Schedule an officer and Advisor planning meeting to prepare for the next post meeting or activity.

Content for this session provided by Youth Aviation Adventure  
(<http://www.youthaviationadventure.org/yaa/>).

Links to other websites are provided for your convenience and information only. When you click on a link to another website, you will be leaving this website. The fact that we provide links to other websites does not mean that we endorse, authorize, or sponsor the linked website, or that we are affiliated with that website's owners or sponsors. Unless otherwise indicated, the linked sites are not under our control and we are not responsible for and assume no liability for the content or presentation of any linked site or any link contained in a linked site, or any changes or updates to such sites. Your use of a linked site and its content is at your sole risk and may be subject to restrictions and/or limitations. Always take care to abide by the linked site's terms of use, including any permission requirements/guidelines.