CORE SUBJECTS: MATHEMATICS, GEOGRAPHY

PROPER PLANNING PREVENTS POOR PERFORMANCE—and that's especially true when it comes to planning a flight! Pilots spend quality time before every flight researching the information they need to make that flight safe—and more fun. They answer questions such as: At what airport should I land? How long are the runways? Can I get fuel? And, most important: Is there a good restaurant at the airport?

To explore the nuances of flight planning, we'll look at two comparative flights from the Wright Brothers home of Dayton, Ohio, to the area of the first powered flight, near First Flight Airport, North Carolina.

We'll plan one flight using approximate data for the *Wright Flyer*, the very first powered airplane to make a controlled flight. We'll take some liberties here; for instance we will assume that the aircraft could structurally make the trip, that it had enough fuel on board for the trip, and that it could reach an altitude sufficient for all terrain clearance. An identical flight will be planned using approximate data for a Piper Archer, a popular four-seat, single-engine airplane.

From these two flight-planning examples, we introduce the students to the concepts of temperature conversion, working with aircraft ground speed, wind direction and speed, distance to travel, weather, fuel usage, and other aviation issues relating to math and science.

A manual flight computer called E6-B is used to plot flight paths. Every student pilot learns to use an E6-B.

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A student pilot uses an aeronautical ruler to mark a flight path.

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ACTIVITY: From Dayton to First Flight

Photocopy this activity for classroom use.
Go to www.aopa.org/path for student worksheets.

TEACHERS:

From this activity, students will apply the basics of flight planning like a general aviation pilot.

MATERIALS:

Calculator

TO DO IT:

1. Pilots measure temperature in degrees Celsius rather than Fahrenheit. The following formula is used to convert from one to the other.

°C = 5/9 x (°F-32)

Calculate the following temperature in degrees Celsius:

(a) 32°F (b) 100°F (c) 54 °F (d) 88°F

2. Pilots often need to squeeze a great deal of information into a small space. Here is an example of a weather report for pilots.

METAR KMGY 052020Z AUTO 03016G23KT 3SM BKN004 OVC014 30/22 A2990

What does it all mean? Let's break it down for you.

METAR	KMGY	052020Z	AUTO	03016G23KT	3SM	BKN004 OVC014	30/22	A2990
meteorogicial report	airport Identifier (Dayton-Wright Brothers, OH)	5th day of the month, 8:20pm Greenwich Mean Time (Zulu Time).*	automated report	wind from 30 degrees at 16 knots, gusting to 23 knots	visibility is 3 statute (standard) miles	cloud cover is broken at 400 feet above the airport and overcast at 1400 feet above the airport	temperature is 30 degrees Celsius, dew point is 22 degrees Celsius	barometric pressure is 29.90 inches of mercury

Can your students translate the following weather report? When you have a pilot visit your classroom, ask her to bring a weather report for the day for the students to practice.

METAR KFFA 102107Z 01005KT 10SM 26/16 A3012

* Greenwich Mean Time (GMT) is international time, the basis of the world time clock. It helps eliminate confusion across multiple time zones. It is called Zulu Time in aviation and other applications. Greenwich, England, was chosen as "zero hour" because it is latitude 0 degrees 0 minutes 0 seconds. If you live in the east, your Zulu Time is GMT minus four hours (five hours for daylight savings time); if you live in the west your Zulu Time is GMT minus 7 hours (or 8 for DST). So if you're in New York City at it's noon, your Zulu Time is 0800Z (or 0700Z for DST). Because Zulu Time is based on a 24-hour clock, if it's 5:00 PM (DST) in New York City, that would be 1200Z (5 PM is 1700 hours so it's 17 minus 5). GMT is also known as UTC (coordinated universal time). For more information see http://www.greenwichmeantime.com

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ACTIVITY: From Dayton to First Flight

3. Pilots measure flight distance in nautical miles as well as statute miles that we use on the ground level. One nautical mile (nm) equals 1.15 statute miles; so one nautical mile per hour (knots) equals 1.15 statute miles per hour (mph). Translate the following distances:

To knots:
(a) 200 mph
(b) 100 mph

To mph:
(c) 76 knots
(d) 100 knots

To statute miles:
(e) 50 nm
(f) 100 nm

To nautical miles:
(g) 270 miles
(h) 25 miles

4. Dr. Ivan M. Speedy just bought a Piper Archer that can fly at 120 knots. W. A. Tooslo has a vintage *Wright Flyer* that flies at 32 mph. They are both planning to leave at the same time and fly to the airport in Dayton, Ohio. If Dr. Speedy lives 300 nautical miles away, and Mr. Tooslo lives 170 nautical miles away, who will arrive first?

5. Before departing Dayton, we need to decide what runway we are going to use. Runways are numbered according to magnetic degrees with one zero removed (see module 9 for a full explanation). If Dayton has runways 2 and 20, that means the runways are facing 20 and 200 degrees. We want to take off into the wind. Using the weather report from question # 2, what runway do we want to use?

6. Once we get into the air, we fly 110 knots at a heading of 120 degrees to get to First Flight airport. If the wind is coming from 300 degrees at 30 knots, what heading do we need to take in order to be on course? What will our speed be?

7. The Piper Archer burns 9 gallons per hour and holds 48 gallons of fuel. Will we be able to make the trip nonstop? If not, how far into the trip will we have to refuel? If the *Wright Flyer* burns 1 gallon per hour and holds 1 gallon in its fuel tank, how many fuel stops will it need to make along the route?

8. We have been traveling at a good rate of speed, but now the winds have shifted. The wind is now 90 degrees at 10 knots. In what general direction will we need to turn to stay on course?

9. Phew! First Flight Airport is finally in sight. We tune in the radio to get the weather report and this is what it says:

"Winds are 260 at 5, visibility is 10 miles; temperature is 25 C, dew point 16 C. Altimeter is 30.02."

If First Flight airport has runways 4 and 22, on which should we land?

Congratulations! We made it! We have come a long way since 1903. Let's go refuel, have some lunch, and head on back to Ohio! Let's see, what runway are we using again…?

Credit AOPA's Aviation Services Department.

Answer Key:
1. (a) 0° Celsius (b) 37.7° C c) 12° C d) 31° C **2.** Aviation routine weather report for First Flight Airport, 10th day of the month, 9:07 Zulu; wind 10 degrees at 5 knots; visibility 10 statute miles; sky clear below 12,000 feet; temperature 26 degrees Celsius, dew point 16 degrees Celsius; barometer 30.12 inches of mercury **3.** (a) 174 kts (b) 87 kts (c) 87 mph (d) 115 mph (e) 58 miles (f) 115 miles (g) 235 nm (h) 22 nm **4.** Dr. Speedy will arrive in 2 and a half hours; Mr. Tooslo will arrive in 6 hours and 4 minutes. **5.** Runway 2 **6.** Same course (the wind is directly behind us), 140 kts **7.** Piper Archer: 48 gallons, 9 gallons per hour, it will make it. Wright Flyer: 1 gallon, 1 gallon per hour, it must refuel at least every hour. **8.** To the left or east. **9.** Runway 22

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