

BC³ Academy
Air and Aerospace Manual
Cathy Hyatt and Jimmy Bryant

Lesson Plan 1 by Jimmy Bryant
Franklin Road Christian School

1. Every student should receive a map. The maps do not have to be flight maps. Flight maps will include location of airports, heights of obstructions (antennas, towers, mountains), and elevation. Flight maps can be found or purchased on the Internet or purchased at a flight shop. The teacher should choose two to four cities in advance for a flight plan. The students need to draw straight lines between each city. Markers, instead of pens or pencils, should be used to draw the lines. The lines will allow the students to calculate the heading angle and distance. The students can also measure elevation changes between each city and find the height of any obstacles that might be in the flight path.
2. After drawing lines between each city, the students will measure the heading angle. A flight plotter, which is basically a scaled ruler with a protractor attached, is actually used to find the heading. These are relatively inexpensive and can be purchased on the Internet or at a local flight shop. They are also used to measure the distance between points. Circular protractors will also work. Teachers could also make these protractors. Circular pieces of posterboard diameter could be cut out. The teacher should make sure that the size will be in proportion to the map size. Two or three in. diameter should work. Compass points with degrees need to be marked around the edges from 0° to 360° in increments of 10°. The protractors should have a small hole in the center to find the flight path line. After the teacher makes one, the rest could be copied to regular paper and then cut out. This just depends on how durable the teacher wants to make the protractors. The teacher should demonstrate exactly what to do on an overhead or chalkboard. An example picture can be found in the presentation. Every time a measurement is made, 0° must be pointing north. Place the protractor on the middle of the line with the line showing through the hole and 0° pointing north. Because the line will cross the protractor in two points, the angle that is read should be the angle that is in the same direction as the flight path. Students can write their measurements next to the line. Since the protractor does not have every angle, the teacher can show the students how to estimate the angles that do not fall exactly on one of the points.

3. The students need to calculate the distance between the cities. If flight plotters are available, they can be used to measure distance. If they are not available, each student will need a ruler. The teacher needs to make sure that the maps that are used have a scale on them. For flight navigation, nautical miles are used. Most flight maps will have a scale with nautical miles, statute miles (5280 ft.), and kilometers. The teacher can take this time to explain the differences between each of the three measurements. Most students have never even heard of a nautical mile. Problems with converting measurements can be done. A nautical mile is equal to about 1.16 statute miles. Each student will measure the distance between the cities with a ruler. They will then mark the distance and lay the ruler on the scale to see how many nautical miles are between the cities. They can also see find the number of statute miles and kilometers.
4. The students will calculate one of the following values: distance, velocity, or time. The distance formula is $Distance = velocity \times time$. An average speed for a small airplane is 120 knots (nautical miles per hour). Teachers can show the students how to solve this equation for any of the values. This would also be a good time for teachers to explain the different values for velocity. Since the students have already calculated distances, let them calculate the time required between each part of the flight path. The teacher could pick two cities in the US or around the world and find the distance between them in advance. Many different word problems similar to the problem in the presentation could be set up for the students to work. The teacher could use this to compare the speeds and times of different planes. Information about speeds for other planes can be found on the Internet by searching for each plane or manufacturer (Boeing 737, 707, 747, 777, Airbus A300, F-22 Raptor, F-15 Eagle, F-18 Hornet, etc.)

The teacher should evaluate the maps to make sure the angles and distances are correct. A teacher could go into many other areas with this information, dependent only upon the subject and grade level. I have listed several of these areas below.

1. Using vector diagrams and trigonometry to calculate the effect of wind on a plane. The actual flight term is wind correction angle. More information can be found on the flight navigation website.
2. Fuel calculations can be done after determining the distance and flight time. The teacher would need to research how much fuel a particular plane uses per hour and then make calculations from there. For a more realistic problem, alternate and reserve amounts of fuel will need to be added.
3. The weights of the plane with fuel and a payload can be calculated.
4. The students can design, build and test a wing
5. Find the physics involved in flying an airplane or helicopter

Lesson Plan 2
Cathy T. Hyatt
Christiana Middle School
Remedial Math

The Double Dose Math Class consists of students who have made below 40 on their Terra Nova Scores. There are no more than 15 students in a class at a time. Hands-on centers, games, and computer technology is used daily to enhance the prior learning from the regular math classes.

1. The students will pull up the C-130 fact sheet from <http://www.chinfo.navy.mil/>
2. The students will write the operating weight, maximum payload, and maximum take-off weight in correct order, and read the following numbers: 80,606—38,536---155,000
3. The students will then calculate the difference between the operating weight and take-off weight using dry board and marker at the computer. The students will be working in pairs and will check each other's work before receiving the correct answer.
4. The students will solve a two step equation by adding the operating weight and maximum payload, then subtracting the total from the take-off weight. The students will be working together as partners to answer the problem correctly. Then they will check their answers.
5. The teacher will be used as a facilitator to answer questions, help with problem solving, and monitor learning.

Suggested Activities

1. Numbers from the fact sheet range from hundreds to thousands. This particular lesson's numbers could be arranged from least to greatest. Different problems could be presented using the various numbers.
2. Logical thinking could be presented with this lesson. The operating weight (80,606) and the maximum payload (38,536), do not equal the maximum take-off weight of the C-130. What's the difference not only of the numbers, but what could cause the additional weight? FUEL: the reserve, the alternative supply and the amount it takes to get from point A to point B.
3. More advanced students could plan a flight using the amount of fuel it takes the C-130 to fly from point A to point B.
4. Algebra could be instilled by using variables in place of one of the numbers in the equations.

Hands-on Activities

1. Let the students go outside and using their arm-span to arm-span determine how many arm-lengths it would take to equal one wing on a C-130.
2. Create a model of the C-130 using appropriate ratios.
3. Field trip to the Smyrna Airport.

Additional Resources

1. Contact Information

- Staggerwing Museum—Lorraine Carter
- Arnold Engineering—Raquel March
- MTSU Ground School—Janet McGee
- EAA—Dave Swindler
- Corporate Flight—David Augustin
- Wings of Eagles—Kelly Russ
- Air National Guard—Capt. Robin Celatka
- Army National Guard—Col. Terry Ethridge
- Nashville Airport—Kathy Hatter
- Smyrna Airport—John Black

2. Web Sites

- Flight Navigation--<http://www.navfltsm.addr.com/>
- Flight Charts and Maps-- <http://www.jeppesen.com/>
<http://www.aeroplanner.com/>
<http://www.sportys.com/>
- Staggerwing Museum—<http://www.staggerwing.com/>
- Arnold Engineering—<http://www.arnold.af.mil/>
- Air National Guard—<http://www.tnnash.ang.af.mil/>
- Experimental Aircraft Association—<http://www.eaa.org/>
- C-130 Fact Sheet--<http://www.chinfo.navy.mil/>