

IMAGINARY FLIGHTS

Lilian Clairmont, Ph.D.

*How do you fly an airplane to its
destination?*

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“Imaginary Flights”

- “Imaginary Flights” is an interdisciplinary project designed to teach addition of vectors and relative motion in 2D simultaneously.
- Students assume the role of “pilots” and explore, first hand, what happens when (a) wind speed is not corrected for; and (b) how to correct for wind speed so as to land their craft at the destination airport.

Learning Objectives & Skills

Objectives

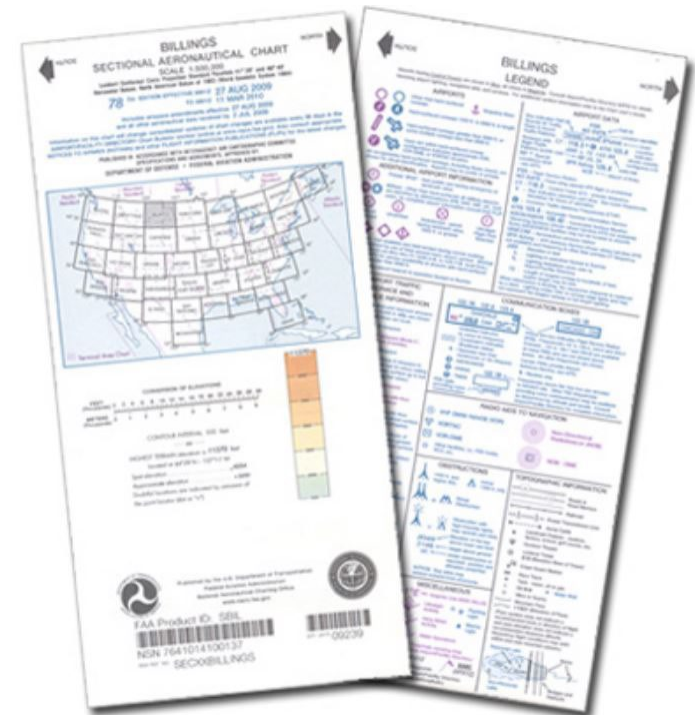
- Vector addition in 2D
- Relative Motion in 2D
- Practicing uniform motion

Skills

- scaling vs. conversion
- angle measurement
- precision of measurements
- chart reading skills (latitude/longitude, etc.)
- Bonus: Geography!

Materials

- Pre-Lab handout (one per student);
 - Flight charts (one per group);
 - Lab handout (one per student)
-
- Straight edge
 - Protractor



Group Size

- The ideal number of students per group is 2. It is possible to conduct the activity with 3, however 4 is too many.
- In the case of 3 students, the teacher should monitor progress to ensure that each student completes their flights on the chart.

Planning the Flights

- For each set: (A) passive and (B) active, include *one test flight and three regular flights*.
- Once you choose the origin and destination airports, look for a third airport that *could* be the destination when simulating no wind corrections. If a third airport is not available, choose another large landmark, such as a lake. Students need to clearly see that they would be ending at a completely different location.

Planning the Flights (cont'd)

- If possible, select all “passive” flights on one side of the chart, and all “active” flights on the other side of it.
- Have a sample chart (the one used to plan all flights) available to students so they can compare results and troubleshoot as they go.

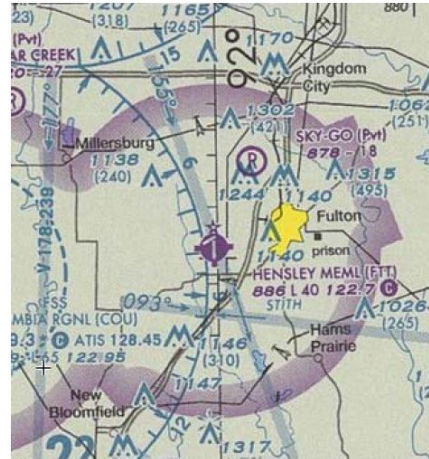
Pre-Lab Assignment

- Typically, an *individual pre-lab assignment* is given *two classes/days* prior to when the activity is to start.
- The pre-lab assists students by familiarizing them with the chart prior to actually using it, and by preparing the chart for the lessons ahead.
- Pre-lab results should be discussed in class *the day before* students are to start the activity.

Chart Information

TOPOGRAPHIC INFORMATION

- Roads
- Railroad
- Bridges and Viaducts
- Power Transmission Lines
- Aerial Cable
- Perennial Lake
- Non-Perennial Lake
- Dams



OBSTRUCTIONS

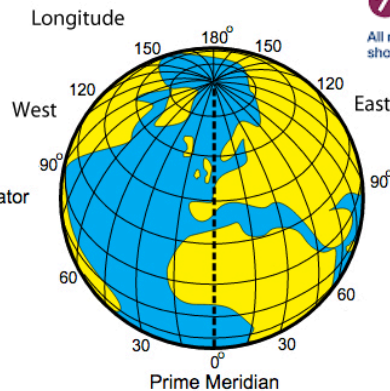
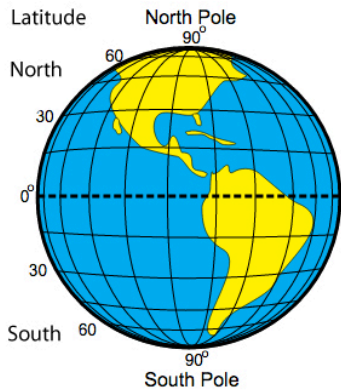
- 1000 ft. and higher AGL
- Below 1000 ft. AGL
- Group Obstruction
- Obstruction with high-intensity lights may operate part-time
- Elevation of the top above mean sea level
2049
(1149)
UC
Height above ground
Under construction or reported: position and elevation unverified

NOTICE: Guy wires may extend outward from structures.

AIRPORTS

- Other than hard-surfaced runways
- Seaplane Base
- Hard-surfaced runways 1500 ft. to 8069 ft. in length
- Hard-surfaced runways greater than 8069 ft. or some multiple runways less than 8069 ft.
- Open dot within hard-surfaced runway configuration indicates approximate VOR, VOR-DME, or VORTAC location.

All recognizable hard-surfaced runways, including those closed, are shown for visual identification. Airports may be public or private.



SECTIONAL AERONAUTICAL CHART

SCALE 1:500,000

Users in **Magenta**. Consult Airport/Facility Directory (A/FD) for details involving airport lighting, navigation aids, and services. For additional information, consult the Airport/Facility Directory (A/FD).

AIRPORT DATA	AIRPORT TRAFFIC SERVICE AND AIRSPACE INFO
<ul style="list-style-type: none"> Indicators FAR 93 FAR 91 	<ul style="list-style-type: none"> Only the controlled and reserved airspace Prohibited and restricted airspace

Project Day

- Each student is assigned two flights – one “passive” and one “active” flight.
- Students in a group assist each other; however, **each student is responsible for their assigned flights – they will do the measuring and drawing on the chart.** This is non-negotiable.
- Their partners help by recording the information, doing calculations, etc. They share their information so that each student has a full report.

Day 1 – Passive Flying

Teachers go through a test flight completely while students follow on their charts.

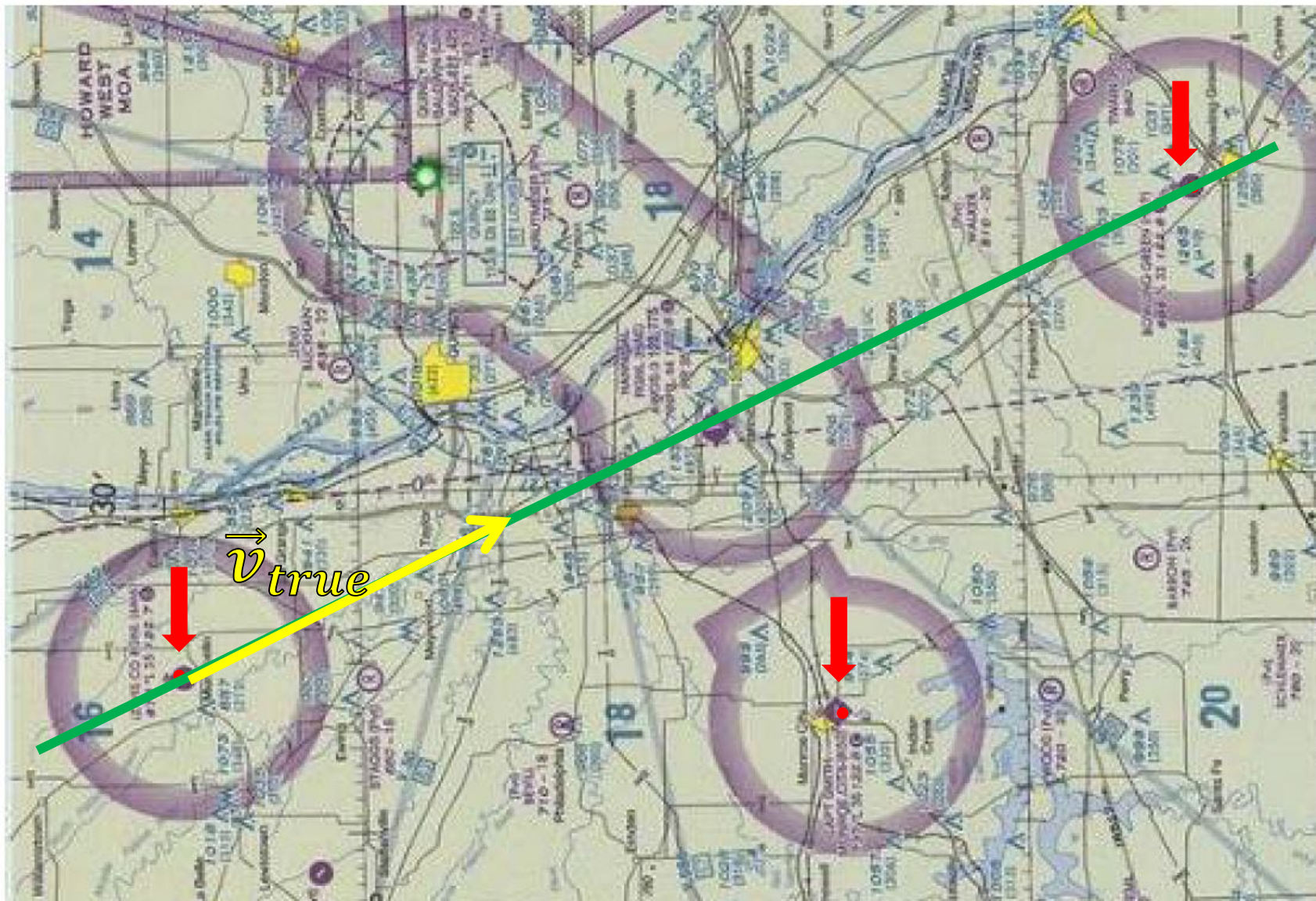
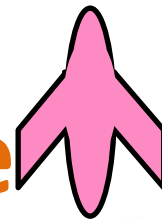
- Remind students to be extremely careful when drawing their lines and measuring their angles. Thick lines, imprecise angles, etc. introduce small errors that get magnified due to scaling.
- Do at least one calculation from the column “Where will the plane be at...?”. Show students how to figure out landmarks at the location of the airplane at that time.

Students complete their “passive flights” after instruction.

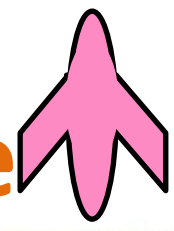
• A planned flight – passive 



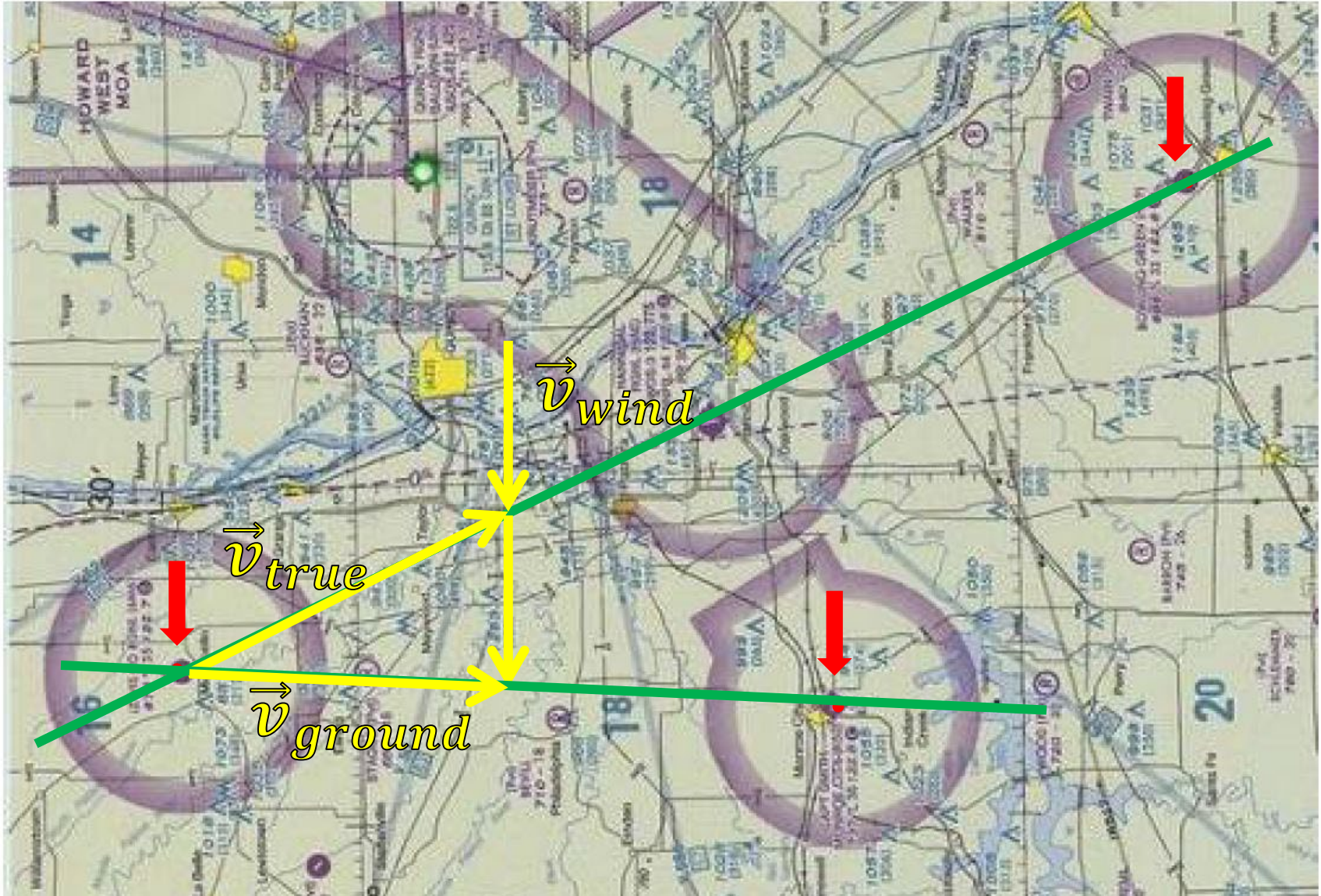
A planned flight – passive



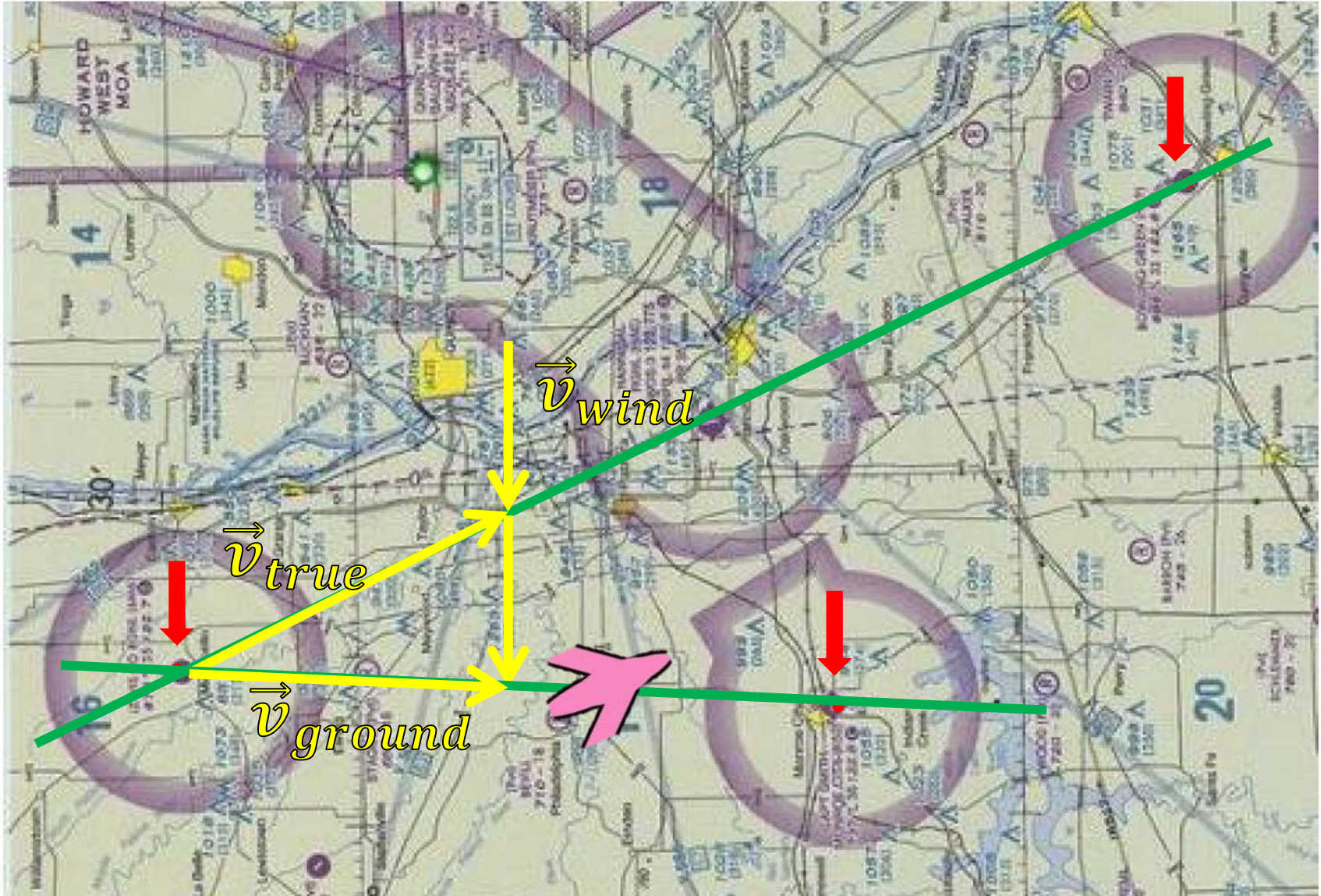
- A planned flight – passive



• A planned flight – passive 



- A planned flight – passive 



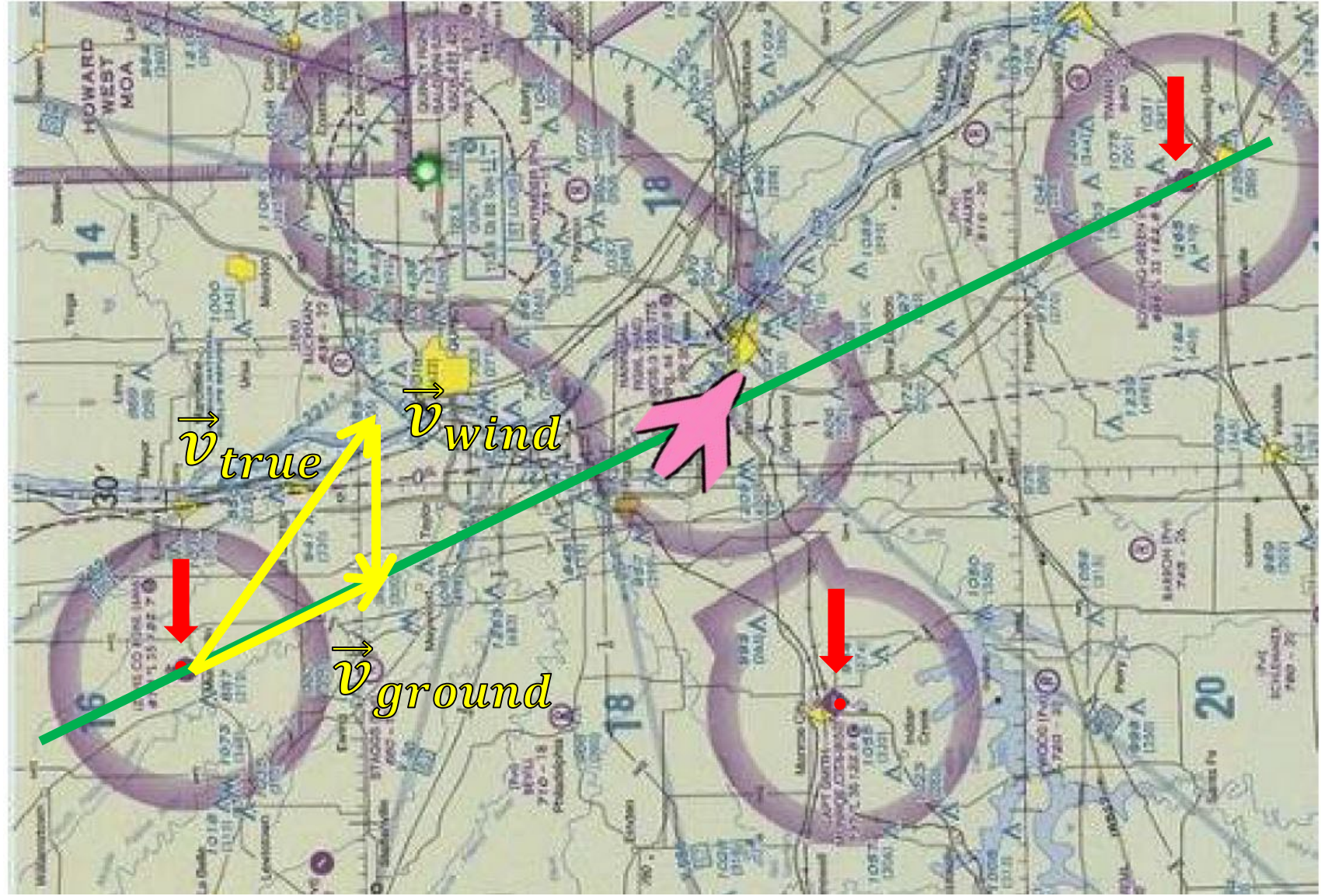
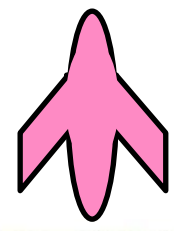
Day 2 – Active Flying

Teachers, repeat instructions (steps 1 and 2) for the second test flight.

NOTES:

- The most important parts of the activity are determining the ground speeds, heading and course in each case. These should be completed in class.

- A planned flight – active



Tips for Successful Project

- It is useful to have a mini airplane (about 1"×1") cutout from colored paper. Position the airplane to help students visualize the difference between “heading” and “course.”



Tips for Successful Project (cont'd)

- The FAA website has downloadable charts for free.

[https://www.faa.gov/air traffic/flight info/aeronav/productcatalog/VFRCharts/Sectional/](https://www.faa.gov/air_traffic/flight_info/aeronav/productcatalog/VFRCharts/Sectional/)

- Outdated flight charts are much cheaper than current ones (expired: \$2.95 vs current: \$9.00; source:

[https://www.mypilotstore.com/mypilotstore/.](https://www.mypilotstore.com/mypilotstore/))

Activity Extensions

Maritime charts