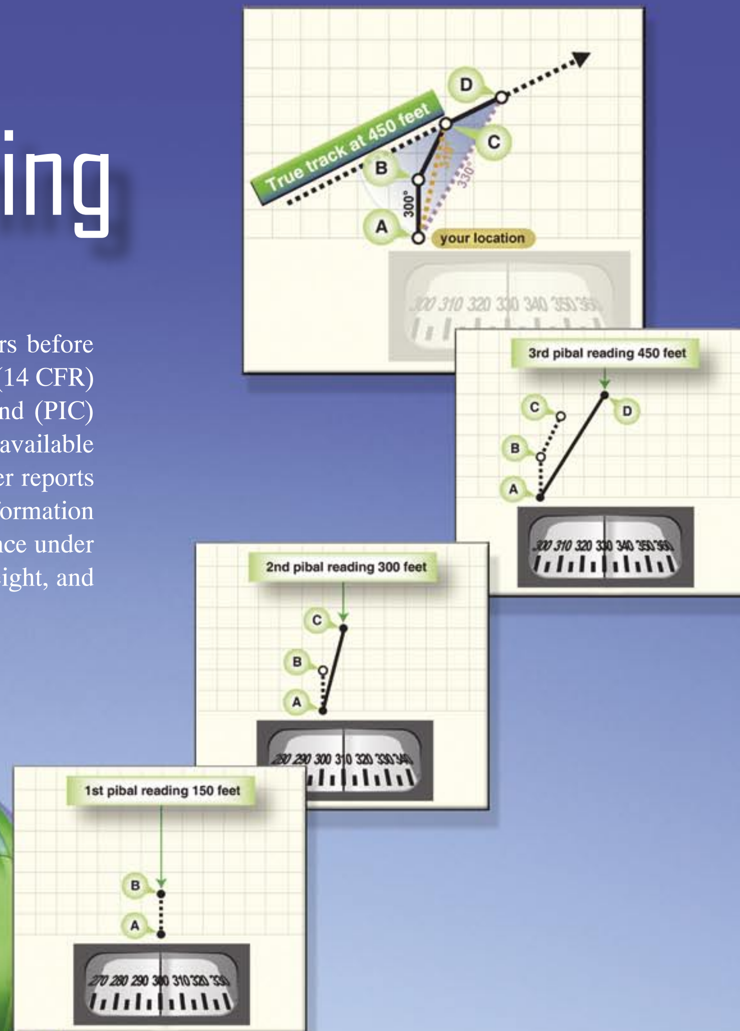
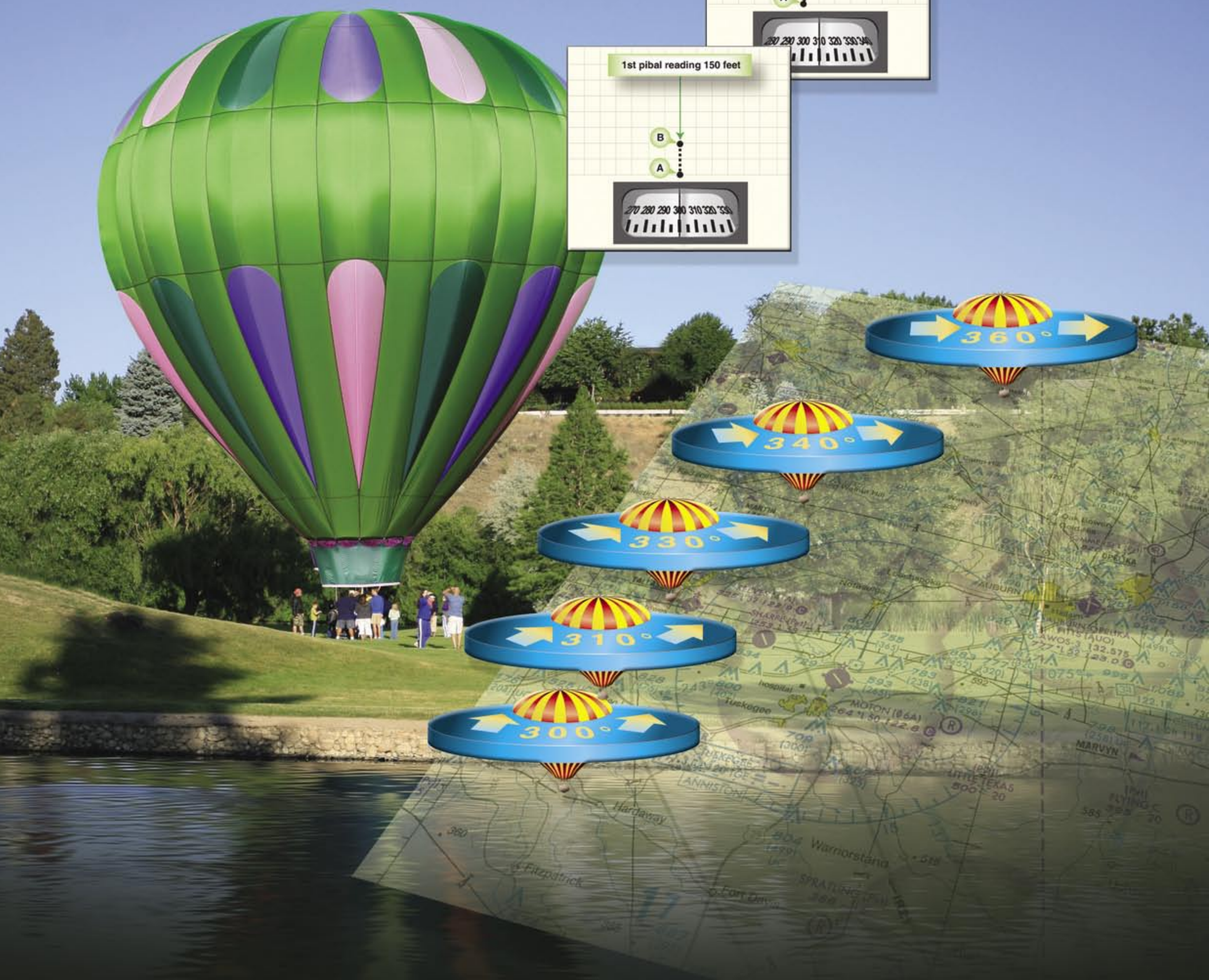
Chapter 3

Preflight Planning

Introduction

Flight planning starts long in advance of the few hours before the launch. Title 14 of the Code of Federal Regulations (14 CFR) part 91, section 91.103 states: "Each pilot in command (PIC) shall, before beginning a flight, become familiar with all available information concerning that flight…(to include) weather reports and forecasts, fuel requirements…(and) other reliable information appropriate to the aircraft, relating to aircraft performance under expected values of airport elevation,…aircraft gross weight, and wind and temperature."





The practical test standards (PTS), for both Private and Commercial certificates, indicate a number of items that must be considered, evaluated, and planned in the execution of a safe flight. Some of these items are the use and interpretation of weather data to plan a flight, the use and interpretation of aeronautical charts and local area maps, and performance and limitation of the balloon.

Weather Theory and Reports will be covered in some detail in Chapter 4 and The National Airspace System (NAS) will be reviewed in Chapter 5. The following discussions assume familiarity with both subjects, and will introduce a number of other new subjects.

Purpose of Flight

Preflight planning will vary according to the flight's purpose. For example, if a training flight is planned, more detailed attention to map work and performance planning may be appropriate. If a passenger-carrying flight is being undertaken, a meeting point for the passengers and crew will need to be designated, and refreshments will need to be planned. If the flight is to participate in an organized rally, particular attention must be paid to weather trends and wind plotting, to ensure the pilot is able to reach the intended target and score points. These type of considerations are part of the initial balloon preflight planning process.

Weather

A good balloon pilot studies the weather several days before the day of the flight in order to understand the weather trends, cycles, and the correlation of weather report information with the actual weather in a particular flying area. Most, if not all, weather reporting information is computed for a large regional area, whereas balloon flying is generally conducted in an area about 15 square miles. When a balloon pilot makes the correlation between the weather outlooks and forecasts, and how that will impact winds and environment in the local flying area, he or she is well on the way to understanding the effects of weather on preflight planning, as well as the balloon flight.

Particular attention should be paid to the location and movement of pressure systems and the jet stream, frontal activity, temperatures in front of and behind frontal zones, and winds. As the proposed flight date draws closer, a reasonable prediction of possible weather can be forecast, but a pilot must remember that a weather forecast more than 72 hours prior to a flight is not an absolute. It is also worthwhile to watch local and nationally televised weather broadcasts to gain insights on the weather systems that may be affecting the desired flying area at the time of the flight.

Unofficial sources of weather information can also prove helpful for obtaining weather information about a particular area. It is beneficial to contact balloon pilots who fly in the area of intended flight to learn of nuances in the weather patterns, especially during initial training or when flying in a new area. Another source of information for weather is pilots who fly other types of aircraft in the proposed flight area. They can be located through the local airport's fixed base operator (FBO). People who make their living outside, particularly farmers, have a unique perspective on local weather. They often offer weather information on local weather that is unavailable through a commercial source.

When possible, it is valuable for a balloon pilot to visit the local National Weather Service (NWS) office. *[Figure 3-1]* NWS provides information and sources for a number of weather products, which must be considered in the weather planning process. A visit to the NWS office also gives a balloonist the opportunity to talk with the individuals who provide the weather information used in the briefings. NWS can provide the balloonist with a clear explanation of what products and information are required to make an intelligent flight decision.

Figure 3-1. *National Weather Service Office, Falcon Field, Peachtree City, Georgia.*

The night before a flight is anticipated (or in the morning, in the event of an afternoon flight), a call should be made to the Flight Service Station (FSS) for an outlook briefing. These are generally available 6 hours or more before a specific flight period. (There are three different types of briefings available: standard, abbreviated, and outlook. They will be discussed in more detail in Chapter 4, Weather Theory and Reports). This briefing information is used to make tentative decisions regarding the flight, such as go/no-go, and potential directions of travel. Additionally, a pilot should pay particular attention to local and regional forecasts in the media, as they may provide information specific to the area of flight.

Prior to flight, a standard briefing should be obtained from the FSS. This briefing will contain the most recent weather information and data, and will serve either to verify information obtained through other sources, or validate the possibility of a go/no-go decision. It is also helpful to check one or more automated weather reporting sites, such as the Automatic Terminal Information Service (ATIS) or Automatic Weather Observing System (AWOS) that are close to the intended flying area. ATIS and AWOS provide the advantage of a real-time, immediate information source. They may be contacted by telephone, or often monitored by aviation radio. Phone numbers for the ATIS and AWOS systems may be found in the Airport/Facility Directory (A/FD). Radio frequencies for the ATIS and AWOS are shown on aviation sectional charts.

Gathering weather information en route to the launch site can be done by searching for indications of current winds. For example, observe how the leaves on a tree move, track the smoke from a factory smokestack, or notice the direction a flag blows. All of these signs give good indications of the current winds, both on the ground and at low altitude. Once at the launch site, or possible launch site, most experienced pilots inflate and release a pibal (pilot balloon) to assess on site wind speeds and direction. *[Figure 3-2]*

Figure 3-2. *Preparing to release a pibal.*

Many pilots develop historical data on weather conditions in their home flying areas. When shared with the beginning pilot, this weather data provides a wealth of information on trends and cycles. The comparison of individual predictions with actual weather experienced offers understanding and insight into micro-area weather conditions. Comparison of weather reports from nearby weather reporting stations with the actual weather experienced is also be an excellent learning tool. This exercise provides insight into the weather patterns common in a particular flying area. See Appendix A for a sample weather briefing checklist that may be used as a guide to develop personal forms for recording weather briefings.

There are numerous sources of weather information available on the Internet. These include but are not limited to web sites operated by the NWS (www.nws.noaa.gov), Intellicast (www.intellicast.com), and Unisys (www.weather.unisys.com). Web sites devoted to weather and ballooning include but are not limited to Blastvalve.com (www.blastvalve.com/weather), US Airnet.com (www.usairnet.com), and the Balloon Federation of America (BFA) at www.bfa.net. Ballooning enthusiast Ryan Carlton has developed a wind forecasting site that is located at ryancarlton.com/wind.php. All of these sites provide resources and reference information on weather.

It should be remembered that none of these web sites provide an official weather briefing. It is necessary to call the FSS, or use an on-line briefing service such as Direct User Access Terminal System (DUATS) to receive an official briefing. Failure to receive a proper briefing may create a liability issue for a pilot in the event of an incident or accident.

Some weather related tips are:

- Forecasts are a good place to start, but are not the end of weather planning. Unforecast events happen continuously. Proficiency in understanding small area weather is necessary, and can only be developed with practice and experience.
- Balloons generally fly early in the morning, within the first two hours after sunrise, to avoid unstable conditions, which may prove to be hazardous to balloon flights and operations. It may be possible to fly in the late afternoon, within an hour or two of sunset, when thermal effects are calming down and winds are usually decreasing.
- Almost all balloon flying is done in relatively benign weather conditions and mild winds. Most pilots prefer to launch and fly in winds less than 7 knots. While balloon flying is performed in higher winds, pilots accept that the faster the winds, the more they are exposed to risk and injury. Balloon flight manuals list the maximum launch winds for a particular balloon; this information, as well as personal limitations, are considerations for any pilot.
- Balloons do not fly in significant (or unstable) weather. A balloon should not be launched in the face of a squall line, or during a tornado warning or watch.
- Flying in precipitation is a bad practice. Rainwater (or any frozen precipitation) on the balloon causes it

to get wet and become heavier, often to the point of being unable to maintain altitude without exceeding temperature limitations of the envelope. A wet envelope heated to flight temperatures can be seriously damaged because the heat often causes fabric coatings and treatments to degrade, decreasing the life of the fabric. If a balloon gets wet, it should never be dried out by the application of heat to the point of equilibrium, or neutral buoyancy.

- Precipitation also often causes the atmosphere to become increasingly unstable. Downdrafts, wind gusts, and the possibility of hail and lightning follow. The pilot may be the last one to know that it is raining because the balloon will shield him or her from the precipitation. Ground crew can detect the slightest trace of precipitation before a pilot does, and need to communicate this information immediately to the pilot. In the face of possible precipitation, cancellation of the flight is the best plan.

Navigation

Navigation of a balloon is unlike that of any other aircraft because it cannot be steered in the conventional sense. Directional control is achieved through the use of differing wind directions at different altitudes. With effort, study, and some practice, it is possible for a balloon pilot to determine a point on the ground at some distance, and fly to it with relative ease and accuracy.

The first step in learning balloon navigation is understanding the maps used in balloon flight. Two types of maps are used: sectional aeronautical charts and local topographical maps. Both have their uses and each has advantages and disadvantages. Another type of map may be available to the balloon pilot. This is a local area map developed by the local balloon club which shows prohibited zones and sensitive areas.

Sectional aeronautical charts (or sectionals) are published on a routine basis by the National Aeronautical Charting Office (NACO), a division of the Federal Aviation Administration (FAA). *[Figure 3-3]* These charts are at a scale of 1:500,000 (one inch representing 500,000 inches on the ground, or about 7.9 miles), are similar to an automobile road map, and provide useful information to a balloon pilot flying under visual flight rules (VFR). Charts are generally named for the most prominent city contained within the area of the sectional chart.

There are also sectional charts with a smaller scale, 1:250,000, to represent the areas immediately surrounding Class B airspace, which is the airspace surrounding major air traffic facilities in the United States. Airspace is discussed in detail in Chapter 5, The National Airspace System. These charts (commonly referred to as terminal area charts) show a significantly increased level of detail, and, if available, may be of more value than a standard sectional.

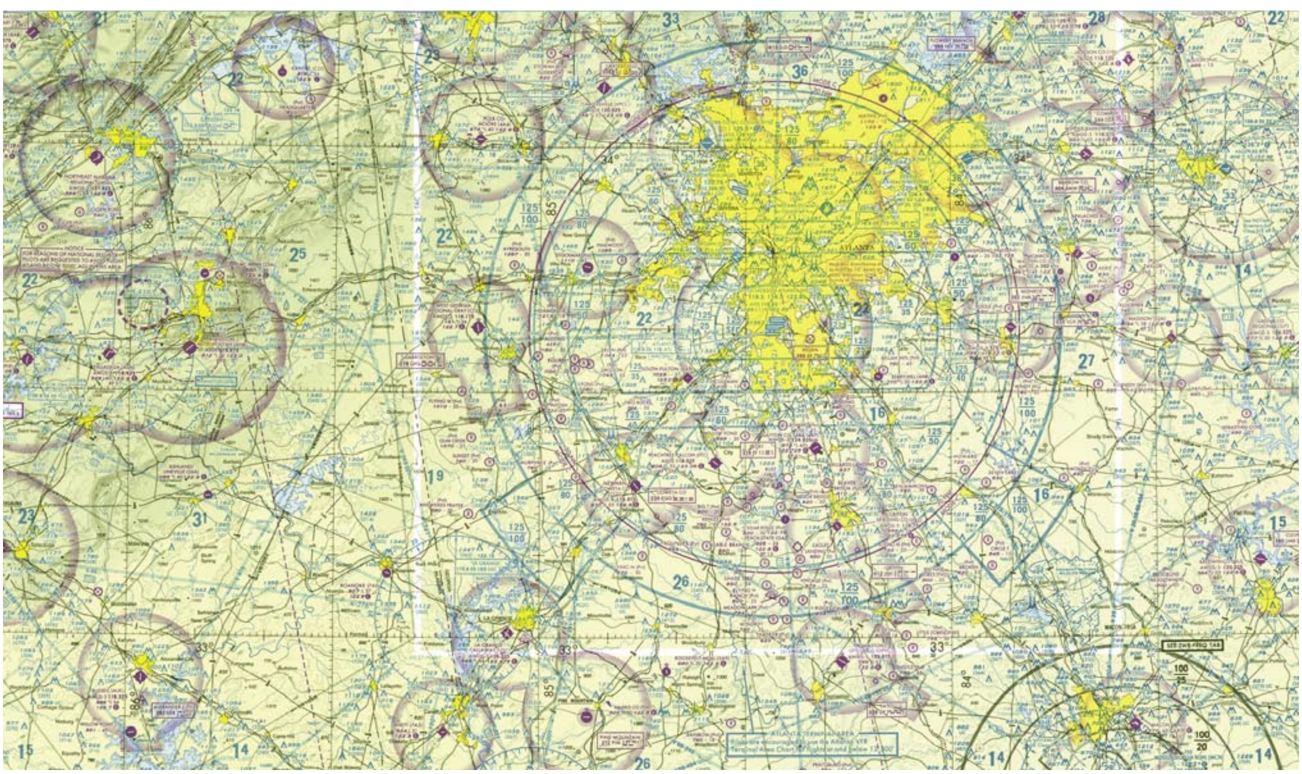


Figure 3-3. *Sectional chart depicting the Atlanta-Hartsfield-Jackson International Airport Class B airspace.*

Sectionals depict many different things, including controlled and uncontrolled airspace, airports, major roads and highways, cities and small towns, etc. They also indicate obstacles to flight, such as major transmission lines, radio, TV, and water towers, smokestacks, and other items. The legend of the sectional provides a means to identify these landmarks. A more detailed explanation of sectionals and the information they contain, is found in the FAA Aeronautical Chart User's Guide, a publication of the NACO. This publication may be found at many pilot supply stores where sectionals are sold, or may be purchased online, along with the maps themselves, at www.naco.faa.gov.

Pilots review the sectional chart and familiarize themselves with the airspace they may be using when flying in a new area or refreshing their memory of a frequently flown area. The sectional helps a pilot determine obstacles to flight (towers, powerlines, etc), as well as locating landmarks for use during the flight. While sectionals offer much valuable information on an area, their lack of resolution on a small scale means they do not provide enough information for a balloon flight. The length of the average balloon flight is 6 to 8 miles. On the sectional, this equates to the distance between the first joint and tip of one's thumb. This lack of significant detail is a disadvantage for navigation in a balloon, but sectionals are useful as a source of general information about a given area.

A good topographic chart, such as the commercially available United States Geological Survey (USGS) maps offer more value to the balloon pilot. These maps depict information on a relatively small scale and are more useful to the balloon pilot. They show individual terrain features such as roads and road networks, built up areas, schools and churches, and will indicate wooded areas, as well as open pastureland. *[Figure 3-4]*

With any map, it is important to insure the map is current and has an accurate depiction of north. To check the orientation of a map, select one particular road or feature with a specific directional orientation. Then orient the map to that feature, matching the direction of the road with the map. Place a compass (preferably a sighting compass) on the map to determine the azimuth. Use the same compass that will be used for computing the flight path. Ensure that nothing is affecting the compass reading. It is important to distinguish "true north," used by most cartographers, and "magnetic north," as indicated on the compass. Once the azimuth is established, sketch a compass rose, or place a "stick-on" type compass rose on the map.

Once the map is oriented and aligned to north, fill in other information as necessary as reminders. For example, airspace

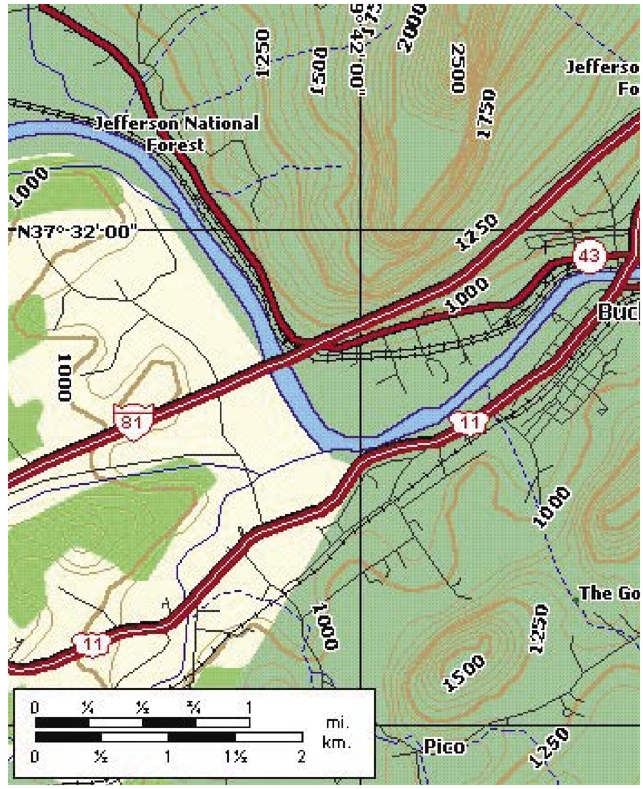


Figure 3-4. *Detailed topological map.*

that may preclude balloon operations, local no-fly areas, or areas with potential landowner relations problems should be marked. If the pilot is flying competitively, he or she may elect to mark designated "targets" on the map for ease in identifying them at a later time.

Perhaps the most underutilized use of maps is predicting likely flight paths, landmarks, and potential landing sites. Using the simple technique outlined below, this field technique allows pilots accurate real time and on-site weather data for flight planning information. A pilot needs to know where he or she is going in order to plan how to get there. This is a necessary part of flight planning, and learning the basic skills and knowledge required to plot this information improves the flight experience.

Pat Cannon, a former BFA National Champion and competitive pilot, developed a technique derived from a NWS procedure (that was later modified) to plot the information obtained from a pibal reading. This procedure requires a pencil, large square graph paper, an aviation plotter, pibals, the compass used to calibrate the map, and a watch with a sweep second hand. Two assumptions are made with this procedure. First, most pibals rise at an average rate of 300 feet per minute (fpm). (A chart of pibal climb rates can be found in Appendix B.) Therefore, after 30 seconds, a pibal will be approximately 150 feet above ground level (AGL).

Second, for the purposes of this exercise, the winds do not have any significant speed changes.

Prior to starting the plot, a scale depicting the wind speed must be established. In this example illustrated, two squares on the graph paper will represent a wind speed of 5 miles per hour (mph). In the absence of a wind meter, or other accurate wind reading, a rough estimate of the wind speed may be made using the technique shown in *Figure 3-5*.

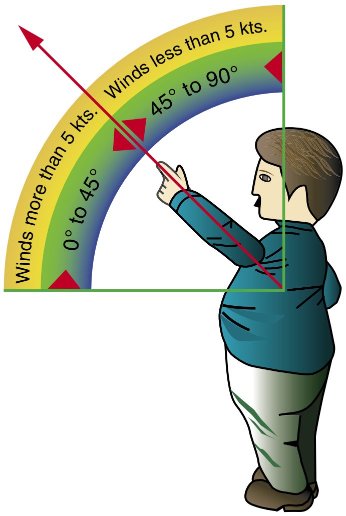


Figure 3-5. A *method for determining wind speed.*

To begin plotting the pibal recording information, release the pibal and track it with the compass. After 30 seconds, take a reading and make a mark on the graph paper to represent the start point. Make a second mark to represent the direction plotted. In *Figure 3-6,* a track of 300° at 5 mph is depicted. Label the first two points "A" and "B." *[Figure 3-6]*

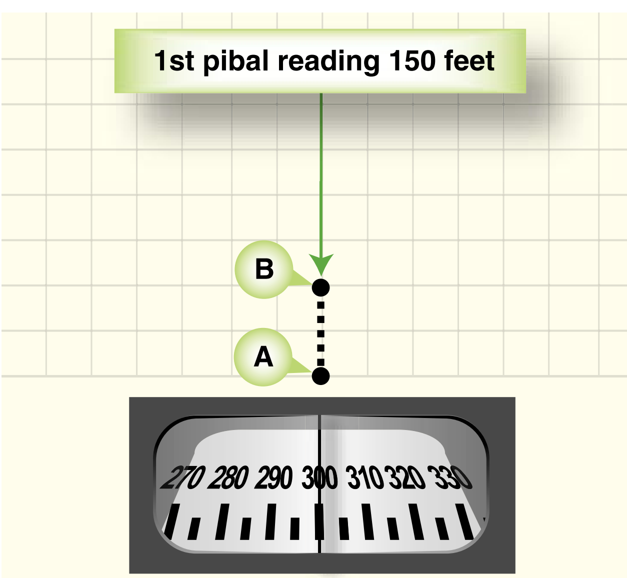


Figure 3-6. *First pibal plot showing 300° at 30 seconds.*

At 1 minute, take a second reading. The pibal will be at approximately 300 feet AGL. In this example, the reading taken is 310°. Using the plotter, draw a line 10° off the original azimuth (the A-B line), and make another mark approximately two squares away from the mark labeled "B." For clarity, this is be labeled "C". See the example in *Figure 3-7.* (NOTE: The angles in the successive graphics are exaggerated for clarity.)

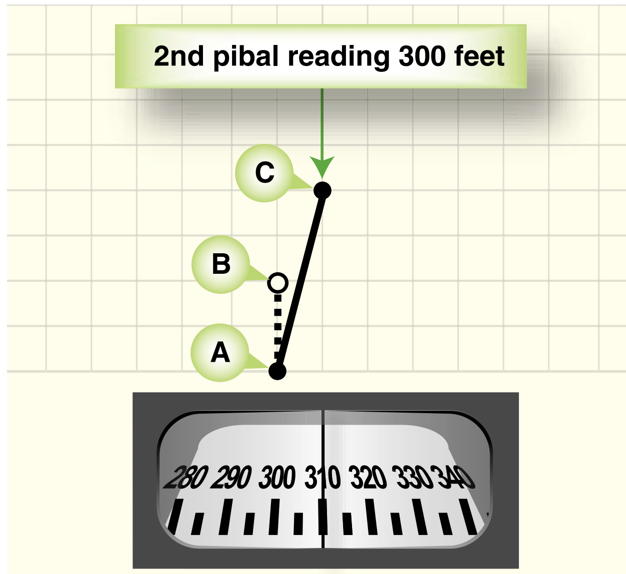


Figure 3-7. *Second pibal plot showing 310° at 1 minute.*

At 1:30 minutes, take another reading. The pibal will be at approximately 450 feet. Using the plotter, draw a line 30° off the original azimuth (the A-B line), and make another mark approximately two squares away from the mark labeled "C." This mark may be labeled "D" for clarity. *[Figure 3-8]*

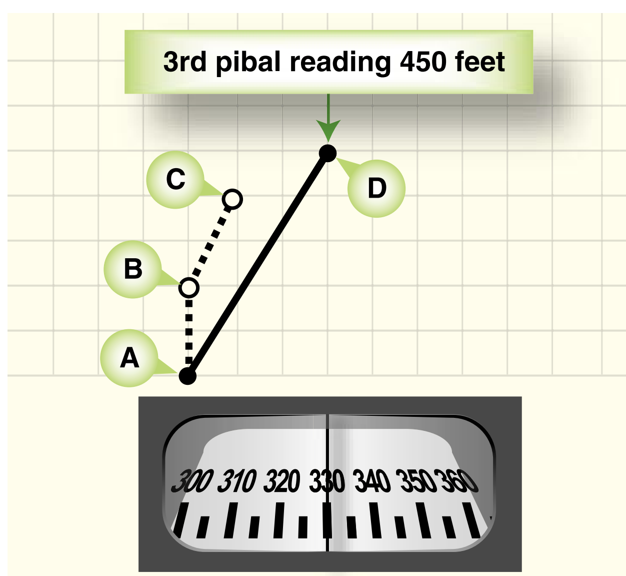


Figure 3-8. *Third pibal plot showing 330° at 1:30 minutes.*

Although plotting can be continued as long as the pibal remains in sight, only the three points marked will be used for this exercise. *Figure 3-9* illustrates the results of the above sequence.

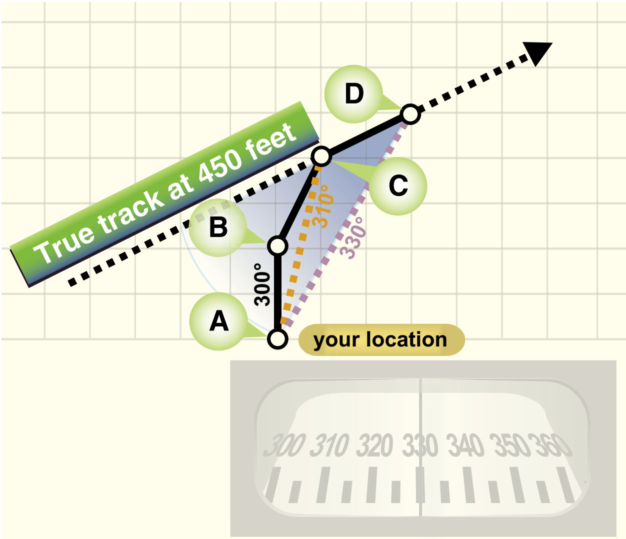


Figure 3-9. *A line drawn through the last two plots provides a basis to measure the angle and determine the wind at that altitude. In this case, it is 450 feet.*

To determine the wind directions at different altitudes, extend lines between the plotted points as shown in *Figure 3-9* back through the initial azimuth. Using the plotter, measure the angle between the lines (the angle between the A-B line and the C-D line). That angle, added to the original azimuth heading, gives a good approximation of the winds at that altitude. For the example shown in this sequence, the true track at 450 feet AGL is 005°. A grid appropriate for this computation is located in Appendix B.

This exercise demonstrates a practical method for determining approximate wind directions using items readily available to most pilots. It does not require expensive handheld calculators, laptop computers, or a theodolite that costs thousands of dollars. There is some error inherent in this process that can be lessened with experience and practice, but the readings obtained by this method can offer real time, on site weather data no forecast or briefer can provide. *[Figures 3-10* and *3-11]*

The information on basic surface winds and winds aloft readings gathered by this method can be used by a pilot to project a flight path and anticipated landing sites with a sectional or topographic map. This plot will form a "V," with the cone beginning at the launch site. The two legs will represent the extremes of the plotted measurements. The difference between these two extremes is called steerage. Flying higher will track the flight path closer to the winds aloft reading, while contour flying will put the balloon closer to the ground track leg. Varying altitude will allow the pilot to fly down the middle of the "v." Accuracy will depend on the consistency of the conditions, but flight paths and landing sites may be predicted, after practice, with a high degree of reliability.

Assume for exercises one and two that winds are at 5 miles per hour.

Exercise 1: The morning of the flight, the following pibal plots are taken:

30 seconds:	117°
1 minute:	122°
1:30 minutes:	135°
2 minutes:	140°
2:30 minutes:	144°
3 minutes:	150°

What is the wind direction at 600 feet above ground level (AGL)? At 900 feet AGL?

Exercise 2: On an afternoon flight, the following readings are taken:

30 seconds:	290°
1 minute:	273°
1:30 minutes:	277°
2 minutes:	279°
2:30 minutes:	282°
3 minutes:	284°

What is the wind direction at 600 feet?

Figure 3-10. *Practice pibal plots. These exercises are designed to assist the student pilot in devleoping proficiency in using the pibal plotting method. (answers on next page)*

The balloon pilot, more than pilots who fly other types of aircraft, must have the capability of visualizing the winds aloft in three dimensions. Continued spatial awareness (how the balloon is moving through the air), is important for maintaining control of the balloon and navigating to the desired point on the ground. Every other safety measure taken is compromised by inflating a balloon and taking off without proper planning and an understanding of the winds and terrain to be navigated. *[Figure 3-12]*

Exercise 1: The pibal is climbing at approximately 300 fpm. The winds between the third and fourth reading are for 600 feet AGL, and the winds between the fifth and sixth reading are for 900 feet AGL.

For the first computation, draw a line between the third and fourth plots, extending back through the original azimuth line of 117°. Measure the angle created between the original azimuth and the new line. That angle is 36°. Add 36° to the original azimuth of 117°. The resulting 153° should be the wind direction at approximately 600 feet AGL.

For the second computation, follow the same procedure. Draw a line from the fifth plot to the sixth plot, extending back through the original azimuth line. Measure the angle created between the original azimuth and the new line. Add the result of 68° to the original azimuth of 117°. The resulting 185° equals the wind direction at approximately 900 feet AGL.

Exercise 2: This exercise is a little more difficult, due to two factors: (1) the winds are starting out bearing to the left instead of to the right, which occurs during some weather and wind patterns; and (2) after the first reading, it is impossible to draw the lines back through the original azimuth line; therefore,another method must be used.

Draw a line through the first and second plots, the 300 feet AGL wind line. Measure the angle between that line and the original azimuth. That angle is 35°. Subtact 35° from the original azimuth of 290°, and the result is 255°. This line become a new baseline azimuth.

Draw a line between the fourth and fifth plots back through the new azimuth line. Measure the angle. Add the resulting 30° to the new azimuth line. The result of 285° is the appriximate wind direction at 600 feet.

Figure 3-11. *Additional practice pibal plots.*

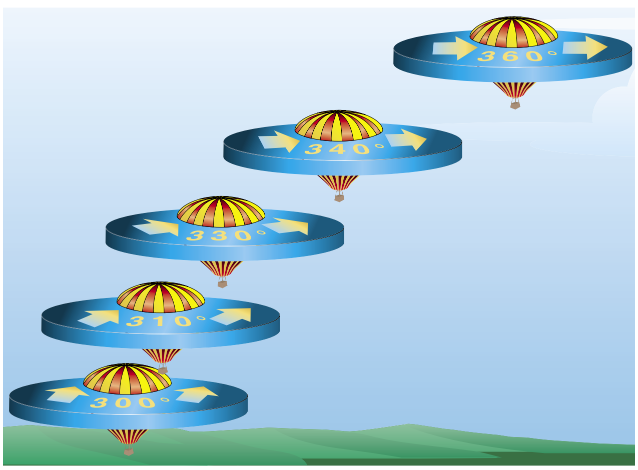


Figure 3-12. *As the balloon ascends, the flightpath inclines to the right. Correlate this visualization to a map to determine the ground track of the balloon during flight.*

Performance Planning

Prior to a discussion of performance planning, a number of terms must be defined.

Maximum Allowable Gross Weight is that maximum amount of weight that the balloon may lift, under standard conditions. This figure is usually stipulated in design criteria, and addressed in the Type Certificate Data Sheet pertaining to that balloon. It can also be found on the weight and balance page of the flight manual for that particular balloon. An average of 1,000 cubic feet of air, when heated, will lift 20 pounds.

Useful lift (load) in aviation is the potential weight of the pilot, passengers, equipment, and fuel. It is the basic empty weight of the aircraft (found in the flight manual for each balloon) subtracted from the maximum allowable gross weight. This term is frequently confused with payload, which in aviation is defined as the weight of occupants, cargo, and baggage.

Density altitude is defined in the Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25) as "pressure altitude corrected for nonstandard temperature." Density altitude is determined by first finding pressure altitude, and then correcting this altitude for nonstandard temperature variations. For example, when set at 29.92, the altimeter may indicate a pressure altitude of 5,000 feet. Under standard temperature conditions (59 °F), this may allow for a useful load of 1,050 pounds. However, if the temperature is 20° above standard, the expansion of the air raises the density altitude level (the air is less dense, thereby mimicking the density of the air at a higher altitude). Using temperature correction data from tables or graphs, it may be found that the density level is above 8,000 feet, and the useful load is then reduced to 755 pounds. This definition, however, has a tendency to confuse many new (and some not-so-new) pilots, so a more thorough explanation is justified.

The AIM explains density altitude as being nothing more than a way to comparatively measure aircraft performance. Paragraph 7-5-6 states, in part, "Density altitude is a measure of air density. It is not to be confused with pressure altitude, true altitude or absolute altitude. It is not to be used as a height reference, but as a determining criteria [sic] in the performance capability of an aircraft." With respect to ballooning, this is a more useful definition of the term.

How does density altitude affect balloon performance? Density altitude affects balloon performance in two ways. First and more important, as a balloon gains altitude, it loses capacity, insofar as its lifting capability is concerned. This means a balloon capable of lifting 1,400 pounds at sea level may only be able to lift 1,150 pounds or less at 4,000 feet. For a pilot who seldom leaves the local area, this rarely causes a problem. For the pilot who travels from the low area of the Southeast to fly in the mile-high altitudes of Albuquerque,