Chapter 3

Identifying Hazards and Mitigating Risk

Introduction

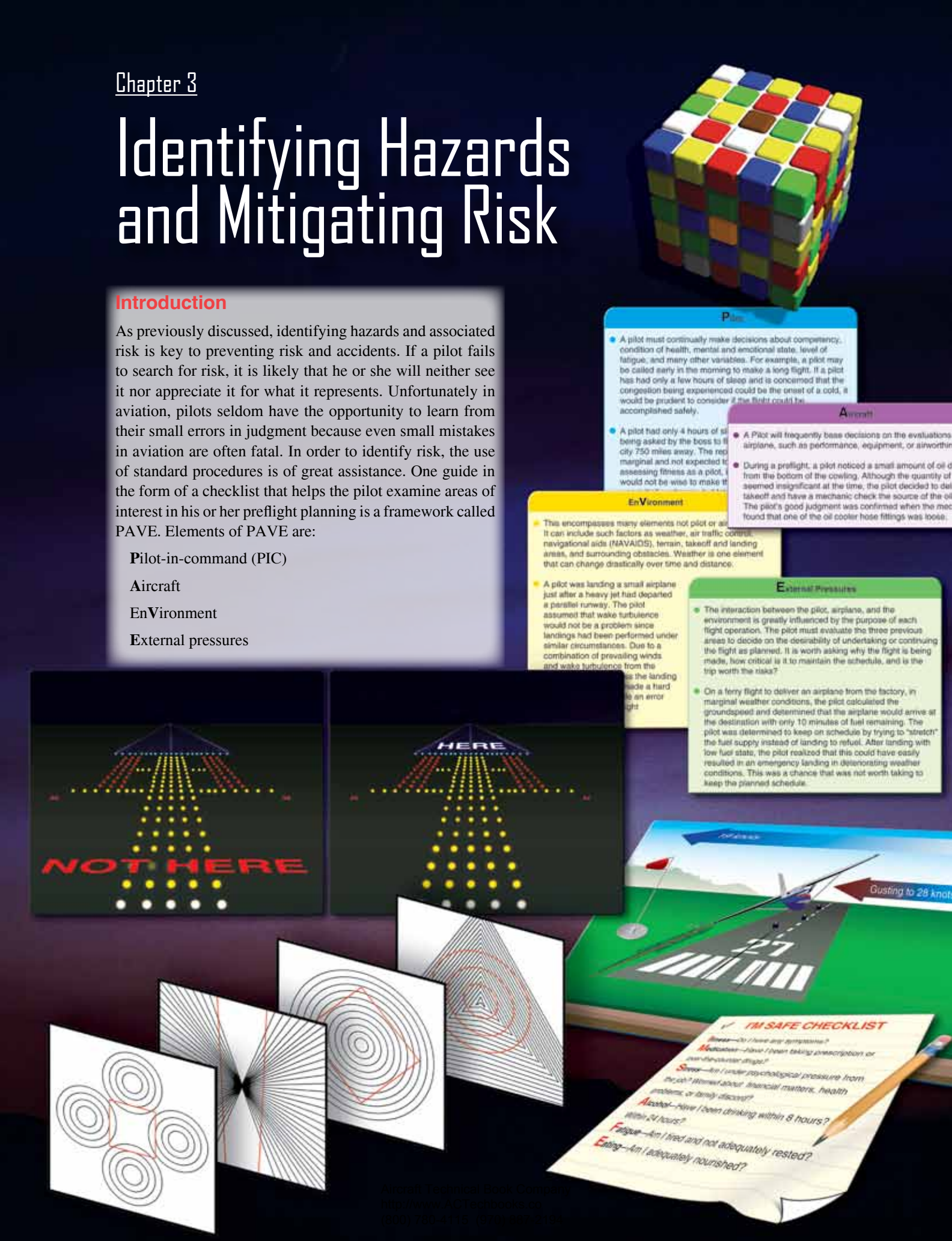
As previously discussed, identifying hazards and associated risk is key to preventing risk and accidents. If a pilot fails to search for risk, it is likely that he or she will neither see it nor appreciate it for what it represents. Unfortunately in aviation, pilots seldom have the opportunity to learn from their small errors in judgment because even small mistakes in aviation are often fatal. In order to identify risk, the use of standard procedures is of great assistance. One guide in the form of a checklist that helps the pilot examine areas of interest in his or her preflight planning is a framework called PAVE. Elements of PAVE are:

Pilot-in-command (PIC)

Aircraft

En**V**ironment

External pressures



Using PAVE helps to identify risk before departure and assists the pilot's decision-making process. *[Figure 3-1]*

With the PAVE checklist, pilots have a simple way to remember each category to examine for risk prior to each flight. Once a pilot identifies the risks of a flight, he or she needs to decide whether the risk or combination of risks can be managed safely and successfully. If not, make the decision to cancel the flight. If the pilot decides to continue with the flight, he or she should develop strategies to mitigate the risks. One way a pilot can control the risks is to set personal minimums for items in each risk category. These are limits

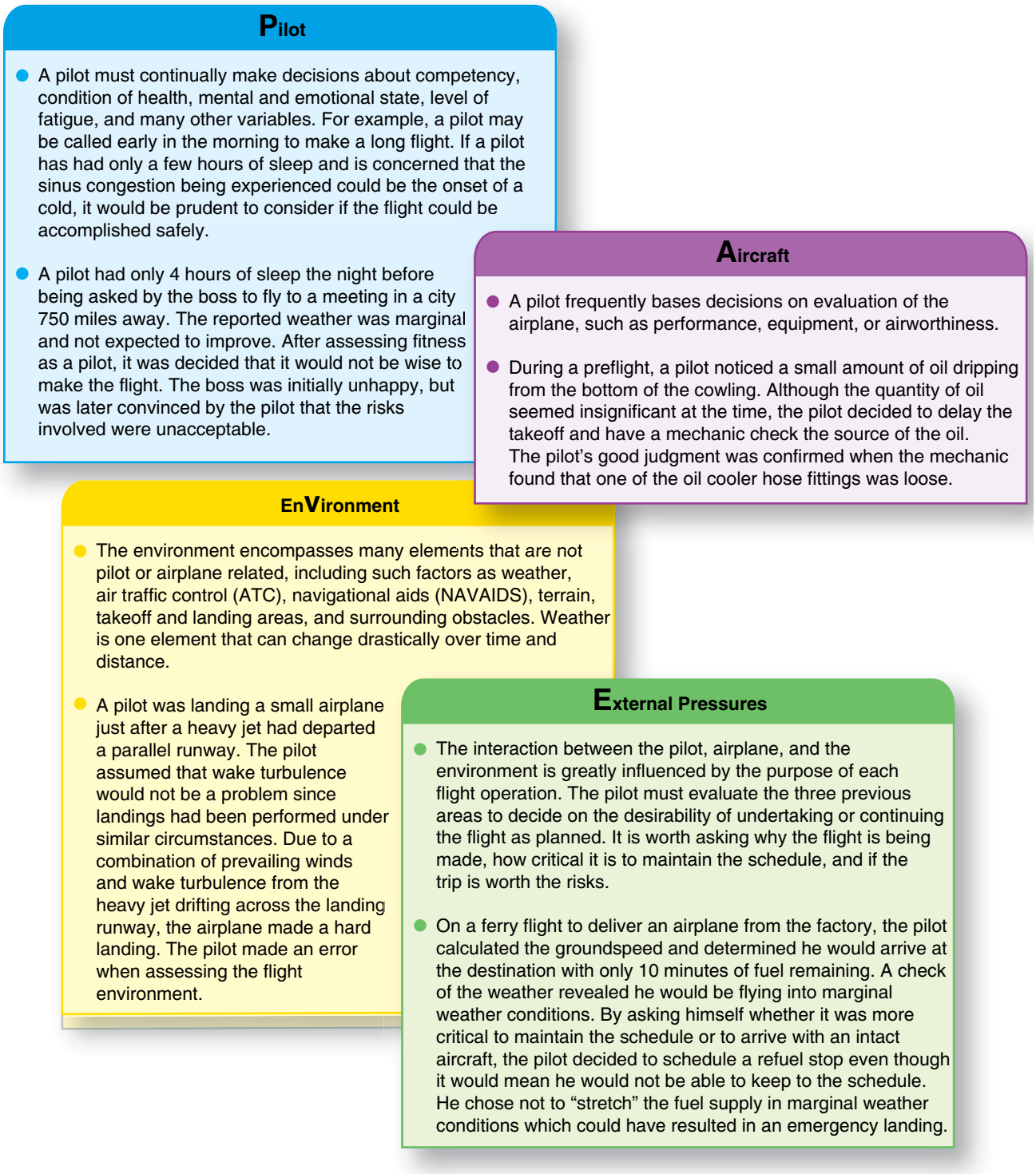


Figure 3-1. *The PAVE checklist.*

unique to that individual pilot's current level of experience and proficiency.

One of the most important concepts that safe pilots understand is the difference between what is "legal" in terms of the regulations, and what is "smart" or "safe" in terms of pilot experience and proficiency.

P = Pilot in command

The pilot in command (PIC) *[Figure 3-2]* is one of the risk factors in a flight. The pilot must ask, "Am I ready for this trip?" in terms of experience, currency, physical, and emotional condition.

The Pilot's Health

One of the best ways pilots can mitigate risk is a self-evaluation to ensure they are in good health. A standardized method used in evaluating health employs the IMSAFE checklist. *[Figure 3-3]* It can easily and effectively be used to determine physical and mental readiness for flying and provides a good overall assessment of the pilot's well being.

1. Illness—Am I sick? Illness is an obvious pilot risk.
2. Medication—Am I taking any medicines that might affect my judgment or make me drowsy?
3. Stress—Am I under psychological pressure from the job? Do I have money, health, or family problems? Stress causes concentration and performance problems.

Figure 3-2. *The highest risk for the pilot is self, and requires special introspective analysis.*

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Figure 3-3. *IMSAFE checklist.*

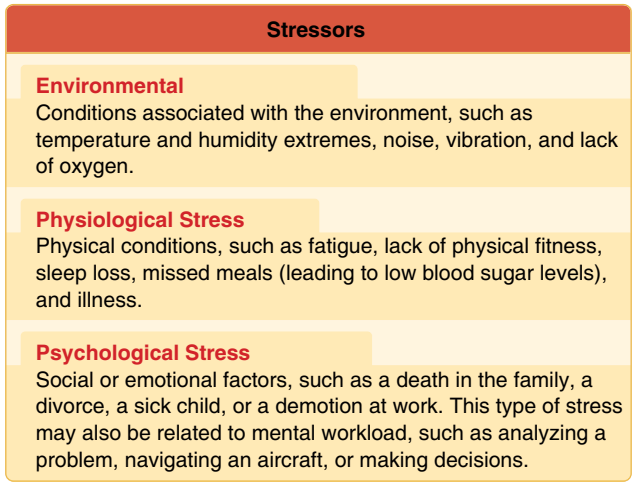


Figure 3-4. *System stressors have a profound impact, especially during periods of high workload.*

While the regulations list medical conditions that require grounding, stress is not among them. The pilot should consider the effects of stress on performance.

4. Alcohol—Have I been drinking within 8 hours? Within 24 hours? As little as one ounce of liquor, one bottle of beer, or four ounces of wine can impair flying skills. Alcohol also renders a pilot more susceptible to disorientation and hypoxia.
5. Fatigue—Am I tired and not adequately rested? Fatigue continues to be one of the most insidious hazards to flight safety, as it may not be apparent to a pilot until serious errors are made.
6. Emotion—Have I experienced any emotionally upsetting event?

Stress Management

Everyone is stressed to some degree almost all of the time. A certain amount of stress is good since it keeps a person alert and prevents complacency. Effects of stress are cumulative and, if the pilot does not cope with them in an appropriate way, they can eventually add up to an intolerable burden. Performance generally increases with the onset of stress, peaks, and then begins to fall off rapidly as stress levels exceed a person's ability to cope. The ability to make effective decisions during flight can be impaired by stress. There are two categories of stress—acute and chronic. These are both explained in Chapter 16, Aeromedical Factors, of the Pilot's Handbook of Aeronautical Knowledge. Factors referred to as stressors can affect decision-making skills and increase a pilot's risk of error in the flight deck. *[Figure 3-4].*

For instance, imagine a cabin door that suddenly opens in flight on a Bonanza climbing through 1,500 feet on a clear sunny day? It may startle the pilot, but the stress would wane when it became apparent that the situation was not a serious hazard. Yet, if the cabin door opened in instrument meteorological conditions (IMC), the stress level would be much higher despite little difference between the two scenarios. Therefore, one can conclude that our perception of problems (and the stress they create) is related to the environment in which the problems occur.

Another example is that mechanical problems always seem greater at night, a situation that all pilots have experienced. The key to stress management is to stop, think, and analyze before jumping to a conclusion. There is usually time to think before drawing conclusions.

There are several techniques to help manage the accumulation of life stress, and prevent stress overload. For example, to help reduce stress levels, set aside time for relaxation each day or maintain a program of physical fitness. To prevent stress overload, learn to manage time more effectively to avoid pressures imposed by getting behind schedule and not meeting deadlines.

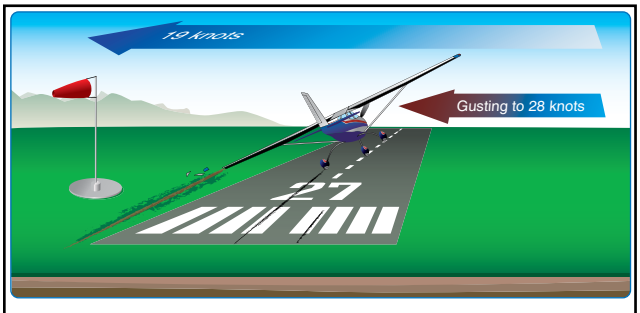
A = Aircraft

What about the aircraft? What limitations will the aircraft impose upon the trip? Ask yourself the following questions:

- Is this the right aircraft for the flight?
- Am I familiar with and current in this aircraft? Aircraft performance figures and the aircraft flight manual (AFM) are based on a new aircraft flown by a professional test pilot, factors to keep in mind while assessing personal and aircraft performance.
- Is this aircraft equipped for the flight? Instruments? Lights? Are the navigation and communication equipment adequate?

- Can this aircraft use the runways available for the trip with an adequate margin of safety under the conditions to be flown? For instance, consider an AFM for an aircraft that indicates a maximum demonstrated crosswind component of 15 knots. What does this mean to a pilot? This is the maximum crosswind that the manufacturer's test pilot demonstrated in the aircraft's certification. *[Figure 3-5]*
- Can this aircraft carry the planned load?
- Can this aircraft operate with the equipment installed?
- Does this aircraft have sufficient fuel capacity, with reserves, for trip legs planned?
- Is the fuel quantity correct? Did I check? (Remember that most aircraft are manufactured to a standard that requires the fuel indicator be accurate when the fuel quantity is full.)

Using the PAVE checklist would help elevate risks that a pilot may face while preparing and conducting a flight. In the case presented in *Figure 3-5,* the pilot disregarded the risk, failed to properly evaluate its impact upon the mission, or incorrectly perceived the hazard and had an inaccurate perception of his skills and abilities.



At 1030, Cessna 150M veered off the runway and collided with a ditch during a crosswind landing. The private pilot, the sole occupant, sustained minor injuries; the airplane sustained substantial damage. The pilot stated in a written report that he configured the airplane for a straight in approach to runway 27. After touchdown, the airplane veered to the left and departed the runway. The airplane continued through an adjacent field and collided with a ditch. The airplane sustained a buckled firewall and a bent left wing spar. The closest official weather observation was 8 nautical miles (NM) east of the accident site. An aviation routine weather report (METAR) was issued at 0954. It stated: winds from 360 degrees at 19 knots gusting to 28 knots; visibility 10 miles; skies 25,000 feet scattered; temperature 25 °C; dew point 2 °C; altimeter 30.04" Hg.

Figure 3-5. *Considering the crosswind component.*

V = Environment

Weather

Weather is a major environmental consideration. As pilots set their own personal minimums, they should evaluate the weather for a particular flight by considering the following:

- What are the current ceiling and visibility? In mountainous terrain, consider having higher minimums for ceiling and visibility, particularly if the terrain is unfamiliar.
- Consider the possibility that the weather may be different from forecast. Have alternative plans and be ready and willing to divert should an unexpected change occur.
- Consider the winds at the airports being used and the strength of the crosswind component. *[Figure 3-5]*
- If flying in mountainous terrain, consider whether there are strong winds aloft. Strong winds in mountainous terrain can cause severe turbulence and downdrafts and be very hazardous for aircraft even when there is no other significant weather.
- Are there any thunderstorms present or forecast?
- If there are clouds, is there any icing, current or forecast? What is the temperature-dew point spread and the current temperature at altitude? Can descent be made safely all along the route?
- If icing conditions are encountered, is the pilot experienced at operating the aircraft's deicing or anti-icing equipment? Is this equipment in good condition and functional? For what icing conditions is the aircraft rated, if any?

Terrain

Evaluation of terrain is another important component of analyzing the flight environment.

- To avoid terrain and obstacles, especially at night or in low visibility, determine safe altitudes in advance by using the altitudes shown on visual flight rules (VFR) and instrument flight rules (IFR) charts during preflight planning.
- Use maximum elevation figures (MEF) *[Figure 3-6]* and other easily obtainable data to minimize chances of an inflight collision with terrain or obstacles.

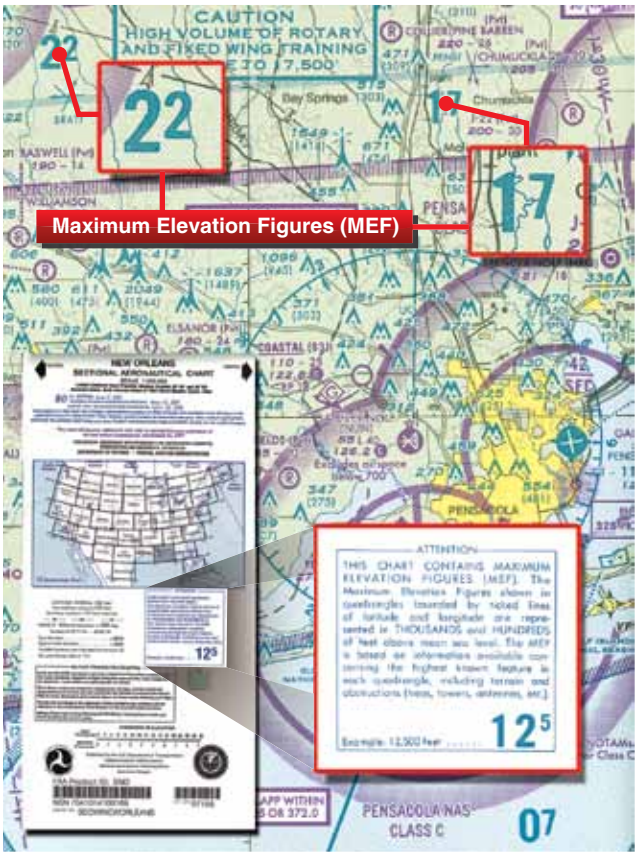


Figure 3-6. *The pilot can easily assess elevations at a glance by simply comparing the intended altitude to the minimum elevation figures (MEFs) depicted on all VFR sectional charts. The MEFs are one of the best sources of elevation information and can be used during both the planning and flight phases.*

Airport

- What lights are available at the destination and alternate airports (e.g., visual approach slope indicator (VASI), precision approach path indicator (PAPI) or instrument landing system (ILS), glideslope guidance)? *[Figure 3-7]* Is the terminal airport equipped with them? Are they working? Will the pilot need to use the radio to activate the airport lights?
- Check the Notices to Airmen (NOTAMS) for closed runways or airports. Look for runway or beacon lights out, nearby towers, etc.
- Choose the flight route wisely. An engine failure gives the nearby airports supreme importance.
- Are there shorter or obstructed fields at the destination and/or alternate airports?

Airspace

- If the trip is over remote areas, are appropriate clothing, water, and survival gear onboard in the event of a forced landing?
- If the trip includes flying over water or unpopulated areas with the chance of losing visual reference to the horizon, the pilot must be prepared to fly IFR.
- Check the airspace and any temporary flight restrictions (TFRs) along the route of flight.

Nighttime

Night flying requires special consideration.

- If the trip includes flying at night over water or unpopulated areas with the chance of losing visual

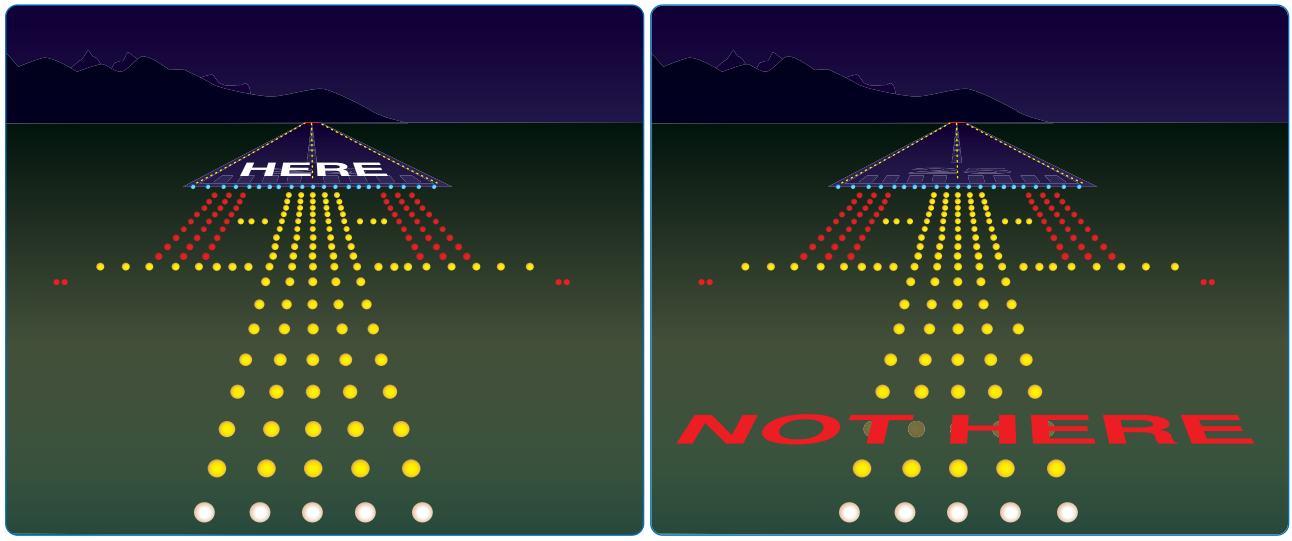


Figure 3-7. *Although runways that provide plain-spoken information (as shown above) would require little interpretation, it is important to understand and interpret runway indicators used in the aviation environment.*