various airports, refer to the *Airport/Facility Directory*. [Figure 12-10]

KEY MIKE	FUNCTION
7 times within 5 seconds	Highest intensity available
5 times within 5 seconds	Medium or lower intensity (Lower REIL or REIL off)
3 times within 5 seconds	Lowest intensity available (Lower REIL or REIL off)

Figure 12-10. Radio control runway lighting.

TAXIWAY LIGHTS

Omnidirectional taxiway lights outline the edges of the taxiway and are blue in color. At many airports, these edge lights may have variable intensity settings that may be adjusted by an air traffic controller when deemed necessary or when requested by the pilot. Some airports also have taxiway centerline lights that are green in color.

OBSTRUCTION LIGHTS

Obstructions are marked or lighted to warn pilots of their presence during daytime and nighttime conditions. Obstruction lighting can be found both on and off an airport to identify obstructions. They may be marked or lighted in any of the following conditions.

- **Red Obstruction Lights**—either flash or emit a steady red color during nighttime operations, and the obstructions are painted orange and white for daytime operations.

- **High Intensity White Obstruction Light**—flashes high intensity white lights during the daytime with the intensity reduced for nighttime.

- **Dual Lighting**—is a combination of flashing red beacons and steady red lights for nighttime operation, and high intensity white lights for daytime operations.

WIND DIRECTION INDICATORS

It is important for a pilot to know the direction of the wind. At facilities with an operating control tower, this information is provided by ATC. Information may also be provided by FSS personnel located at a particular airport or by requesting information on a common traffic advisory frequency (CTAF) at airports that have the capacity to receive and broadcast on this frequency.

When none of these services is available, it is possible to determine wind direction and runway in use by visual wind indicators. A pilot should check these wind indicators even when information is provided on the CTAF at a given airport because there is no assurance that the information provided is accurate.

Wind direction indicators include a wind sock, wind tee, or tetrahedron. These are usually located in a central location near the runway and may be placed in the center of a segmented circle, which will identify the traffic pattern direction, if it is other than the standard left-hand pattern. [Figures 12-11 and 12-12]

The wind sock is a good source of information since it not only indicates wind direction, but allows the pilot to estimate the wind velocity and gusts or factor. The wind sock extends out straighter in strong winds and will tend to move back and forth when the wind is gusty. Wind tees and tetrahedrons can swing freely, and will align themselves with the wind direction. The wind tee and tetrahedron can also be manually set to align with the runway in use; therefore, a pilot should also look at the wind sock, if available.

RADIO COMMUNICATIONS

Operating in and out of a controlled airport, as well as in a good portion of the airspace system, requires that an aircraft have two-way radio communication capability. For this reason, a pilot should be knowledgeable of radio station license requirements and radio communications equipment and procedures.

RADIO LICENSE

There is no license requirement for a pilot operating in the United States; however, a pilot who operates internationally is required to hold a restricted radiotelephone permit issued by the Federal Communications Commission (FCC). There is also no station license requirement for most general aviation aircraft operating in the United States. A station license is required however for an aircraft which is operating internationally, which uses other than a very high frequency (VHF) radio, and which meets other criteria.

RADIO EQUIPMENT

In general aviation, the most common types of radios are VHF. A VHF radio operates on frequencies between 118.0 and 136.975 and is classified as 720 or 760 depending on the number of channels it can accommodate. The 720 and 760 uses .025 spacing (118.025, 118.050) with the 720 having a frequency range up to 135.975 and the 760 going up to 136.975. VHF radios are limited to line of sight transmissions;

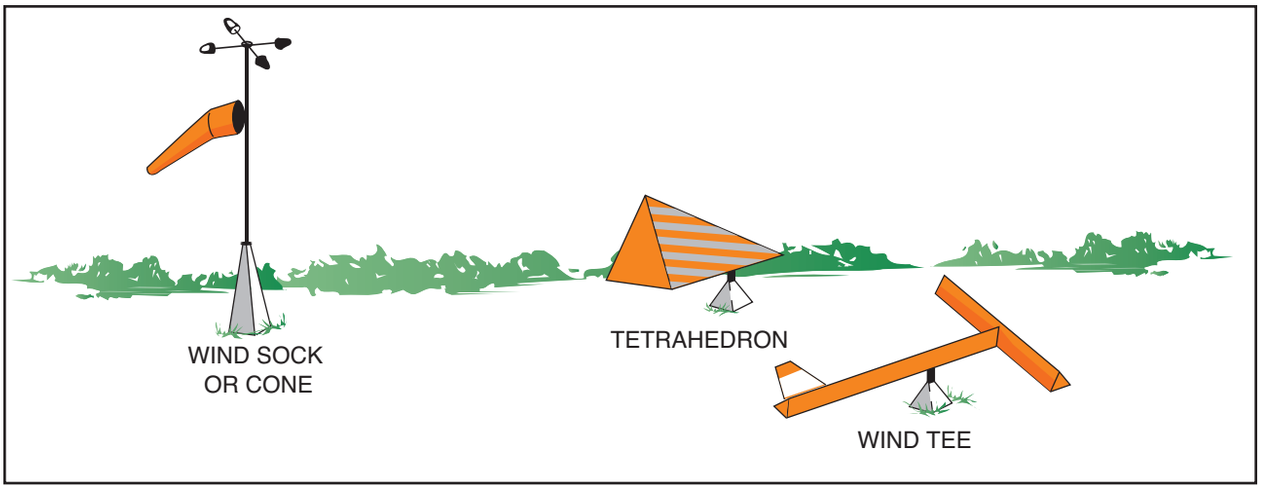

Figure 12-11. Wind direction indicators.

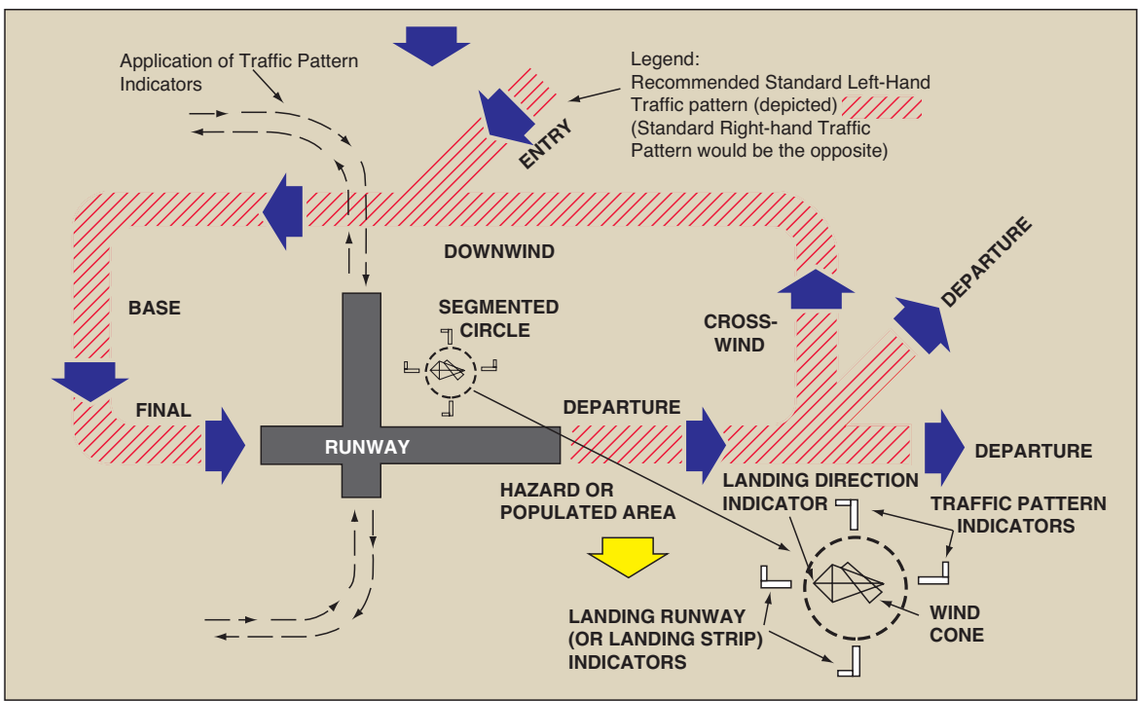

Figure 12-12. Segmented circle and airport traffic pattern.

therefore, aircraft at higher altitudes are able to transmit and receive at greater distances.

Using proper radio phraseology and procedures will contribute to a pilot's ability to operate safely and efficiently in the airspace system. A review of the Pilot/Controller Glossary contained in the *Aeronautical Information Manual* (AIM) will assist a pilot in the use and understanding of standard terminology. The AIM also contains many examples of radio communications, which should be helpful.

The International Civil Aviation Organization (ICAO) has adopted a phonetic alphabet, which should be used in radio communications. When communicating with ATC, pilots should use this alphabet to identify their aircraft. [Figure 12-13]

LOST COMMUNICATION PROCEDURES

It is possible that a pilot might experience a malfunction of the radio. This might cause the transmitter, receiver, or both to become inoperative. If a receiver becomes inoperative and a pilot needs to land at a controlled airport, it is advisable to remain outside or above Class D airspace until the direction and flow of traffic is determined. A pilot should then advise the tower of the aircraft type, position, altitude, and intention to land. The pilot should continue, enter the pattern, report a position as appropriate, and watch

CHARACTER	MORSE CODE	TELEPHONY	PHONIC (PRONUNCIATION)
A	•-	Alfa	(AL-FAH)
B	-•••	Bravo	(BRAH-VOH)
C	-•-•	Charlie	(CHAR-LEE) OR (SHAR-LEE)
D	-••	Delta	(DELL-TAH)
E	•	Echo	(ECK-OH)
F	••-•	Foxtrot	(FOKS-TROT)
G	--•	Golf	(GOLF)
H	••••	Hotel	(HOH-TEL)
I	••	India	(IN-DEE-AH)
J	•---	Juliet	(JEW-LEE-ETT)
K	-•-	Kilo	(KEY-LOH)
L	•-••	Lima	(LEE-MAH)
M	--	Mike	(MIKE)
N	-•	November	(NO-VEM-BER)
O	---	Oscar	(OSS-CAH)
P	•--•	Papa	(PAH-PAH)
Q	--•-	Quebec	(KEH-BECK)
R	•-•	Romeo	(ROW-ME-OH)
S	•••	Sierra	(SEE-AIR-RAH)
T	-	Tango	(TANG-GO)
U	••-	Uniform	(YOU-NEE-FORM) OR (OO-NEE-FORM)
V	•••-	Victor	(VIK-TAH)
W	•--	Whiskey	(WISS-KEY)
X	-••-	Xray	(ECKS-RAY)
Y	-•--	Yankee	(YANG-KEY)
Z	--••	Zulu	(ZOO-LOO)
1	•----	One	(WUN)
2	••---	Two	(TOO)
3	•••--	Three	(TREE)
4	••••-	Four	(FOW-ER)
5	•••••	Five	(FIFE)
6	-••••	Six	(SIX)
7	--•••	Seven	(SEV-EN)
8	---••	Eight	(AIT)
9	----•	Nine	(NIN-ER)
0	-----	Zero	(ZEE-RO)

Figure 12-13. Phonetic alphabet.

for light signals from the tower. Light signal colors and their meanings are contained in figure 12-14.

If the transmitter becomes inoperative, a pilot should follow the previously stated procedures and also monitor the appropriate air traffic control frequency. During daylight hours air traffic control transmissions may be acknowledged by rocking the wings, and at night by blinking the landing light.

When both receiver and transmitter are inoperative, the pilot should remain outside of Class D airspace until the flow of traffic has been determined and then enter the pattern and watch for light signals.

If a radio malfunctions prior to departure, it is advisable to have it repaired, if possible. If this is not possible, a call should be made to air traffic control and the pilot should request authorization to depart without two-way radio communications. If authorization is given to depart, the pilot will be advised to monitor the appropriate frequency and/or watch for light signals as appropriate.

AIR TRAFFIC CONTROL SERVICES

Besides the services provided by FSS as discussed in Chapter 11, there are numerous other services provided by ATC. In many instances a pilot is required to have contact with air traffic control, but even when not required, a pilot will find it helpful to request their services.

PRIMARY RADAR

Radar is a method whereby radio waves are transmitted into the air and are then received when they have been reflected by an object in the path of the beam. Range is