ANTENNAS

BASIC RADIO STUFF:
1. Radio frequencies range from 30 kHz (Kilohertz — thousands of cycles per second) to 30,000 MHz (megahertz — millions of cycles per second).
2. This frequency range is broken down into various “BANDS” that are grouped by “WAVELENGTH” measured in meters or centimeters:

<table>
<thead>
<tr>
<th>FREQUENCY BAND</th>
<th>FREQUENCY RANGE</th>
<th>USED FOR</th>
<th>WAVELENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Frequency — LF</td>
<td>30–300 kHz</td>
<td>Loran &amp; ADF</td>
<td>10,000 – 1,000 m</td>
</tr>
<tr>
<td>Medium Frequency — MF</td>
<td>300 – 3,000 kHz</td>
<td>ADF</td>
<td>1,000 – 100 m</td>
</tr>
<tr>
<td>AM (Amplitude Modulation) Broadcast</td>
<td>535 – 1,605 kHz</td>
<td>ADF &amp; Broadcast radio</td>
<td>560 – 187 m</td>
</tr>
<tr>
<td>High Frequency — HF</td>
<td>2 – 30 MHz</td>
<td>Long Range Communications</td>
<td>100 – 10 m</td>
</tr>
<tr>
<td>Very High Frequency — VHF</td>
<td>30 – 300 MHz</td>
<td>Communications, VOR, ELT &amp; Marker Beacons</td>
<td>10 – 1 m</td>
</tr>
<tr>
<td>Ultra High Frequency — UHF</td>
<td>300 – 3,000 MHz</td>
<td>Transponder, Radar, Glideslope, DME, &amp; GPS</td>
<td>100 – 10 cm</td>
</tr>
</tbody>
</table>

3. **LOW** frequency radio signals travel long distances, but are more susceptible to interference from atmospheric conditions. This interference also affects long range High Frequency “HF” radios.
4. VHF and UHF are much less prone to interference, but are limited to line-of-sight range.
5. Generally, the size of an antenna depends on the frequency and wavelength it is designed to receive or transmit. Wavelength being inversely proportional to frequency. Antennas are normally designed to be ½, ¼, or some other fraction of the wavelength.
6. **COMMUNICATIONS** antennas are usually mounted vertically so they can receive and transmit in all directions (Note: Comm radios use Amplitude Modulation — “AM”).
7. **NAVIGATION** antennas are normally mounted horizontally due to their directional nature.

COMMUNICATION Antenna:
1. VHF frequencies from 118.0 to 137.975 MHz.
2. Wavelength approximately two meters.
3. Approximately ½ meter long (20 inch) whip (bent or straight) or can be in the shape of a smaller “blade” or “V-blade” (boomerang sitting on top of a vertical support), normally mounted vertically to the top of the aircraft (with about 20 inches of copper wire coiled inside; i.e., ⅛ of the wavelength).
4. If there are two radios, there will normally be two antennas.

ELT Antenna:
1. VHF frequency 121.5 MHz.
2. Usually slightly shorter than a communication antenna due to its fixed frequency.
3. Most often a thin whip antenna mounted vertically on top of the fuselage.
4. Sometimes ELT antennas are attached to the ELT transmitter (or buried in the vertical tail) and therefore no external antenna is observed.

LORAN Antenna:
1. LF frequencies from 90 to 110 kHz.
2. Looks virtually the same as a communication antenna, even though it operates at a lower frequency.
3. Typically a whip (straight or bent) mounted to the top or bottom of the fuselage.
4. If an aircraft looks like it has three communication antennas, one of them is probably for the loran.

IMHO — One of the dumbest things Obama ever did was to sign the order dismantling the LORAN system... leaving us without a backup for long range navigation. A violent solar storm or concerted enemy attack could easily take out the entire GPS network leaving us wallowing in deep s#!t — IMHO.

NOTE: Many “NAV-COMM” units share the same box, but very few components are shared. So if the NAV or COMM fails, the other unit in the same box is still likely to be working.

Chap 3 — Navigation & Radios

Radio Shack

EVERYTHING EXPLAINED for the Professional Pilot

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More About ANTENNAS

**VOR / LOCALIZER Antenna:**
1. **VHF** frequencies 108 to 117.95 MHz.
2. Most often attached to the vertical fin and shaped like a horizontal V-whip or rectangular with a tubular cross-section.
3. In some applications the VOR/localizer antenna can be combined with the communications antenna to take the shape of a boomerang sitting on top of a vertical support. In this case the vertical support is the communications antenna while the horizontal boomerang section is for the VOR/localizer.

<table>
<thead>
<tr>
<th>Horizontal V-Whip</th>
<th>U-Shape</th>
<th>Balanced Loop (towel rack)</th>
</tr>
</thead>
</table>

**ADF Antenna:**
1. **LF, MF and AM broadcast** frequencies 190 to 1605 kHz.
2. Older ADFs have a long “sense” antenna stretching from the top of the cockpit to the vertical fin and in addition a small “loop” antenna mounted on the underside of the fuselage.
3. Newer installations combine the sense and loop into one rectangular or teardrop-shaped fiberglass box mounted on the belly. This arrangement eliminates the significant parasite drag of the long sense antenna.

<table>
<thead>
<tr>
<th>Long “sense” antenna</th>
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**GLIDESLOPE Antenna:**
1. **UHF** frequencies from 329.15 to 335 MHz.
2. Can sometimes be a wire embedded in a wide, oval shaped plastic plate installed inside the windshield near the top.
3. Or… a T-shaped antenna on top or in front of the windshield.
4. Or… a small fiberglass appendage that looks like a boomerang mounted on top of the cockpit or sometimes to the belly.
5. Or… a U-shaped band with a brace through the center mounted on the nose.
6. Or… can sometimes be combined with the VOR antenna.
**MARKER BEACON Antenna:**
1. **VHF** frequency 75 MHz (low-power, about three watts).
2. Can be a **small BLADE** mounted on the **belly** somewhat longer than a DME blade.
3. Or... a **thick WIRE** on the **belly** that **BENDS** sharply **REARWARD** with a **metal support** near its **tail**.
4. Or... a "canoe-shaped" fiberglass attachment mounted on the **belly**.

**TRANSPONDER Antenna:**
1. **UHF** frequencies. Transmits on 1090 MHz and receives on 1030 MHz.
2. Normally located on the **BELLY**, may be a 2-inch **VERTICAL METAL WHIP** with a **SMALL BALL** on the end or a small fiberglass **FIN** or blade identical to the DME antenna.
3. The **DME** and **transponder** operate in approximately the same frequency range and therefore require the antennas be placed **as far apart as possible** to avoid interference (at least 6-feet apart).

**DME Antenna:**
1. **UHF** frequencies 962 to 1213 MHz.
2. Small **FIN** or blade mounted on the **BELLY**.

**GPS Antenna:**
1. **UHF** frequency 1575 MHz.
2. Thin **CIRCULAR** or **RECTANGULAR** or **teardrop-shaped** fiberglass box mounted on the **TOP** of the fuselage.

**TROUBLESHOOTING Radios:**
1. Keep all antennas **CLEAN** and **FREE from GREASE** and **OIL**. A dirty antenna will not work properly. **TRANSPONDER** antennas or any other antennas located on the belly need to be cleaned on a regular basis to keep those radios operating correctly.
2. Check for **LOOSE** antenna-to-airframe **CONNECTIONS** or **SWELLING** and **CRACKING** of the **FIBERGLASS** sheathing on **COMMUNICATION antennas**. Corroded metal underneath the fiberglass can expand and cause the fiberglass sheathing to swell and split.
3. **VOR** antennas are susceptible to **cracks** where the **antenna bends**.
4. **Long-wire ADF** sense antennas are also prone to **cracks** at the **attachment points**.