

# 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**:

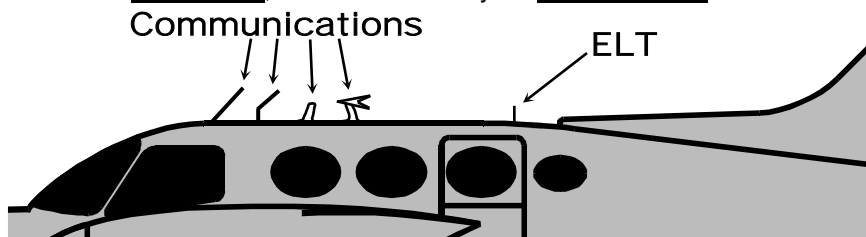
FREQUENCY BAND	FREQUENCY RANGE	USED FOR	WAVELENGTH
<u>Low</u> Frequency — <b>LF</b>	30-300 kHz	<b>Loran &amp; ADF</b>	10,000 – 1,000 m
<u>Medium</u> Frequency — <b>MF</b>	300 – 3,000 kHz	<b>ADF</b>	1,000 – 100 m
<b>AM</b> ( <u>A</u> mplitude <u>M</u> odulation) Broadcast	535 – 1,605 kHz	<b>ADF &amp;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

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 1/2, 1/4, 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.

When aircraft communications were first initiated, the only radios available were of the **Amplitude Modulation (AM)** type. **Frequency Modulation (FM)** would definitely be preferable because of its immunity to noise or interference, but that would require changing over all radios in the air and on the ground simultaneously. That ain't gonna happen!

## COMMUNICATION Antenna:

1. **VHF** frequencies from **118.0** to **137.975 MHz**.
2. **Wavelength** approximately **two meters**.
3. Approximately 1/2 **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., 1/4 of the wavelength).
4. If there are **two radios**, there will normally be **two antennas**.



**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.

## 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.

**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.

## LORAN Antenna:

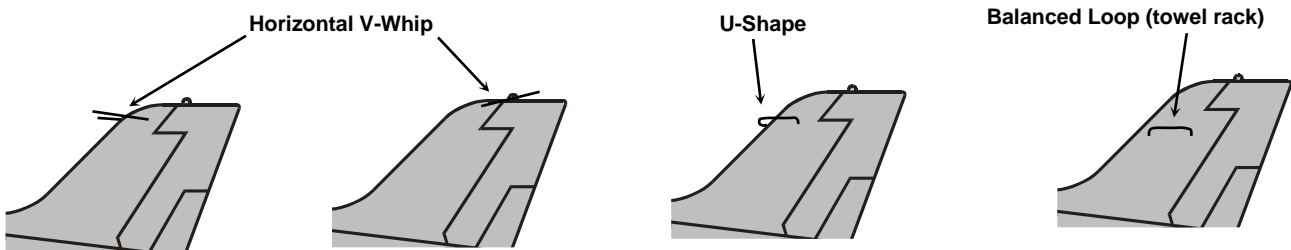
1. **LF** frequencies from **90** to **110 kHz**.
2. **Looks** virtually the **SAME AS** a **COMMUNICATION ANTENNA** even though it operates at a lower frequency.
3. Typically a **WHIP** (straight or bent) mounted to the **TOP** or **BOTTOM** of the fuselage.
4. If an aircraft looks like it has three communication antennas, one of them is probably for the loran.

## More About ANTENNAS

### VOR / LOCALIZER Antenna:

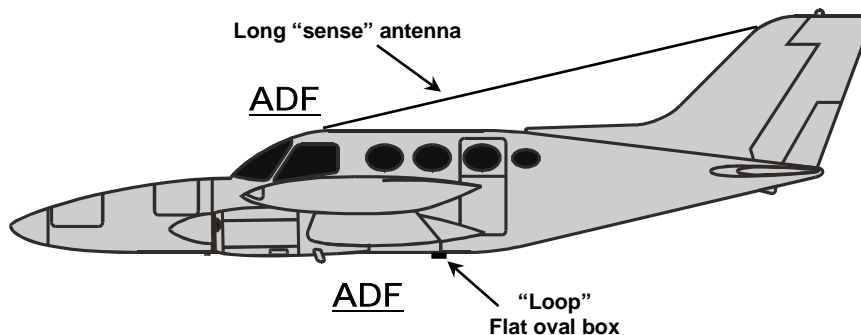
1. **VHF** frequencies **108** to **117.95 MHz**.
2. Most often attached to the **vertical fin** and shaped like a **horizontal V-whip** or **rectangular** with a **tubular cross-section**.
3. In some applications the VOR/localizer antenna **can be combined** with the **communications antenna** to take 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**.

### VOR / LOCALIZER



### 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**.



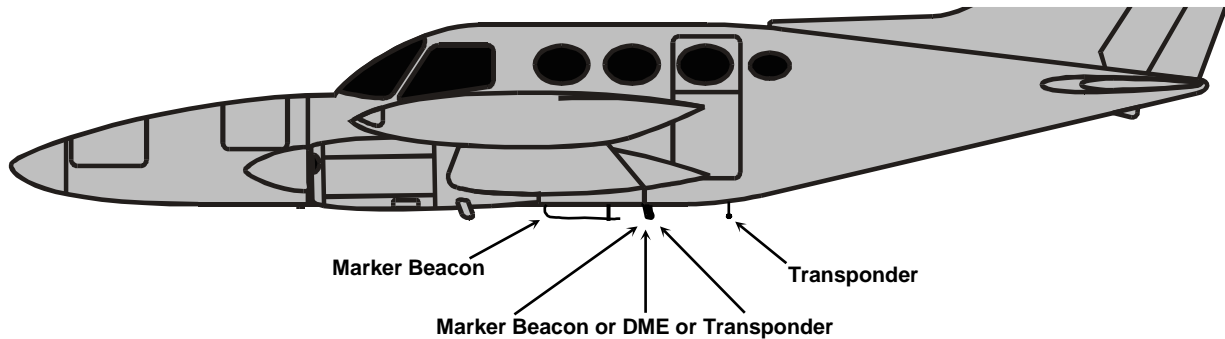
### GLIDESLOPE Antenna:

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.

## Even More About ANTENNAS

### 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:

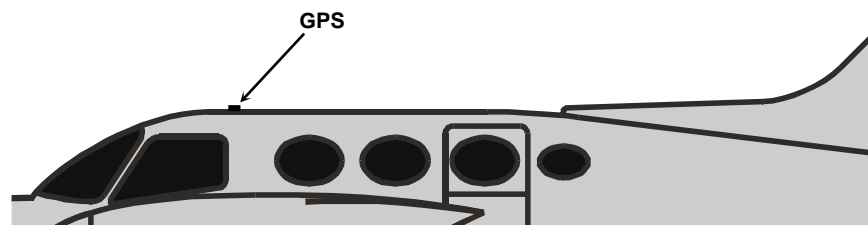
1. **UHF** frequencies. **Transmits** on **1090 MHz** and **receives** on **1030 MHz**.
2. Normally located on the **BELLY**, may be a **2-inch VERTICAL METAL WHIP** with a **SMALL BALL** on the end **or** a small **fiberglass FIN** or blade **identical to** the **DME** antenna.
3. The **DME** and **transponder** 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**.