A105 COMMUNICATIONS

References: Aeronautical Information Manual (AIM) Chapter 4, Section 2

INTRODUCTION
Proper radio communications are vital skills necessary for the safe operation of aircraft in the national airspace system. Aviation has a very specific language and procedure for communication. Clear and concise communications are essential for the safe operation of aircraft. Miscommunications can quickly lead to unsafe situations. The utilization of correct communications enables simultaneous safe aircraft operation of numerous aircraft.

The objectives of this lesson are to learn the proper radio communication procedures and phraseology and to have a basic understanding ofavionics.

PILOT USE OF RADIOS
Airplane communication radios greatly facilitate flying. Pilots use radios to:
1. Obtain Air Traffic Control (ATC) clearances
    a. Ground Control
    b. Tower Control, e.g., takeoffs and landings
    c. Approach and Departure Control (in the vicinity of the airport)
    d. Enroute Control

2. Obtain weather briefings; file flight plans, etc., with Flight Service Station (FSS).

3. Communicate with Fixed Base Operators (FBOs) and other aircraft on UNICOM and MULTICOM frequencies

FREQUENCIES
Aircraft Radios normally operate within a
- High Frequency band (HF) = 3 – 30 MHZ
- Very High Frequency band (VHF) = 30 -300 MHZ
- Ultra High Frequency band (UHF) = 300 – 3000 MHZ

Civilian airplane communication radios operate on frequencies between 118.000 MHz and 135.975 MHz, in the VHF civilian aviation sector. (Military also uses UHF.)

1. Most new communication radios have 720 channels by having a channel every .025 MHz.

2. Virtually all FAA frequencies are in multiples of .025 MHz. Radio communications are a critical link in the ATC system. The link can be a strong bond between you and the controller or it can be broken with surprising speed and disastrous results.

Radio communications are a critical link in the ATC (Air Traffic Control) system.
The link can be a strong bond between you and the controller, but it can be broken with surprising speed and disastrous results.

The most important factor in pilot-controller communications is <u>understanding</u>.
a. Good phraseology enhances safety and is a mark of a professional pilot.
b. Jargon, chatter, and 'CB" slang have no place in ATC communications.

PHONETIC ALPHABET
Pilots should use the phonetic alphabet when identifying your aircraft during initial contact with Air Traffic Control facilities. Work through the following listing of alphabetic phonetic equivalents,

saying each aloud to learn it. Use the phonetic equivalents for single letters and for spelling out groups of letters or difficult words during adverse communication conditions.

Alpha	**N**ovember	**1** One
Bravo	**O**scar	**2** Two
Charlie	**P**apa	**3** Tree
Delta	**Q**uebec	**4** Four
Echo	**R**omeo	**5** Fife
Foxtrot	**S**ierra	**6** Six
Golf	**T**ango	**7** Seven
Hotel	**U**niform	**8** Eight
India	**V**ictor	**9** Niner
Juliet	**W**hiskey	**0** Zero
Kilo	**X**-ray	
Lima	**Y**ankee	
Mike	**Z**ulu	

Although Morse code is not used as frequently as it once was, occasionally you may need it for identification, e.g. at a VOR without voice facilities. You do not need to memorize the Morse code, but you do need to be able to interpret it.

FIGURES

1. Figures indicating hundreds and thousands in round numbers, as for ceiling heights, and upper wind levels up to 9,900 are spoken in accordance with the following:
EXAMPLES: **500 is "FIVE HUNDRED."**
4,500 is "FOUR THOUSAND FIVE HUNDRED."

2. Figures above 9,900 are spoken by separating the digits preceding the word "thousand."
EXAMPLES: **10,000 is "ONE ZERO THOUSAND."**
"13,500 is "ONE TREE THOUSAND FIVE HUNDRED."

3. Airway numbers. Airways are routes between navigational aids, such as VORs (i.e., airways are highways in the sky).
EXAMPLE: **VI2 is "VICTOR TWELVE."**

4. All other numbers are spoken by pronouncing each digit.
EXAMPLE: **10 is "ONE ZERO."**

5. When a radio frequency contains a decimal point, the decimal point is spoken as "point."
EXAMPLE: **122.1 is "ONE TWO TWO POINT ONE."**

ALTITUDES AND FLIGHT LEVELS

1. Up to but not including 18,000 ft. MSL, state the separate digits of the thousands, plus the hundreds, if appropriate.
EXAMPLES: **12,000 is "ONE TWO THOUSAND."**
12,500 is "ONE TWO THOUSAND FIVE HUNDRED."

2. At and above 18,000 ft. MSL (FL 180), state the words "flight level" followed by the separate digits of the flight level.
EXAMPLE: **FL 190 is "FLIGHT LEVEL ONE NINER ZERO"** (19,000 ft. MSL).

DIRECTION

The three digits of bearing, course, heading, and wind direction should always be magnetic. You will not use true headings until later training.

Wind velocity (speed) is always included with wind direction, e.g., "THREE FOUR ZERO AT ONE ZERO."

a. ATC gives winds in magnetic direction.
b. FSS gives winds in true direction, from weather reports and forecasts.

SPEED

1. Say the separate digits of the speed followed by the word "knots"
EXAMPLES: **25O is "TWO FIVE ZERO KNOTS."**
185 is "ONE EIGHT FIVE KNOTS."

2. The controller may omit the word "knots" when using speed adjustment procedures, e.g.
"INCREASE SPEED TO ONE FIVE ZERO."

TIME

Aviation uses international standard time; a 24-hour system for uniformity. The international standard time is called Coordinated Universal Time (UTC), which is referred to as **Zulu**. UTC is actually the time at the 0° meridian, which passes through the Royal Observatory in Greenwich, England.

The FAA uses UTC or Zulu time for all operations. Use the time conversion table below to find UTC. When converting from UTC or Zulu time to local time, subtract the hours. Subtract one hour for Daylight Savings Time.

The 24-hr. clock system is used in radio transmissions. The hour is indicated by the first two figures and the minutes by the last two figures.
EXAMPLES: **0000 is "ZERO ZERO ZERO ZERO"** (midnight)
0920 is "ZERO NINER TWO ZERO" (9:20 a.m.)
1850 is "ONE EIGHT FIVE ZERO" (6:50 p.m.)

RADIO TECHNIQUES

Listen before you transmit. If you change frequencies and make an immediate transmission without listening first, your transmission may block communication from another airplane or ATC.

Think before keying your transmitter. Know what you want/need to say when pressing the mike button.

The microphone should be very close to your lips and after pressing the mike button, a slight pause may be necessary. When you release the button, wait a few seconds to give time for a response.

Be alert to the sounds or lack of sounds in your receiver. If you hear nothing, check your volume, recheck your frequency, and try again.

CONTACT PROCEDURES

1. Initial contact (first radio call you make to a given facility or the first call to a different controller within the facility): Use the following format (four basics):

- **WHO** you are calling
- **WHO** you are
- **WHERE** you are in relation to the airport and other aircraft
- **WHAT** you want (what your intentions are – landing, over-flying, requesting information, etc.)

WHO YOU ARE CALLING: The name of the facility being called. Examples: “Laughlin Ground”, “Laughlin Tower”, “Denver Departure”, “Denver Approach”.

WHO YOU ARE: Aircraft identification numbers = prefix “N” followed by digits /letters of the registration number. When the aircraft manufacturers name or model is stated, the prefix “N” is dropped.

Note: vUSAF UPT uses pre-arranged call signs: AXXXX (e.g. AF1022, Air Force 1022)

WHERE YOU ARE: Your location on the ground or in the air in relation to the airport (three dimensional: Bearing / Distance / Altitude / Fix).
Example: “KDLF ramp”, “12 miles east at 6,500”, “Base, Runway 13 Right”, “Clear of Runway 13 Right at Alpha 3”.

WHAT YOU WANT: Your request stated clearly and concisely.
Examples: “Request taxi, East Departure”, “South arrival, initial, full stop”, “Request taxi KDLF ramp”.

MISUNDERSTANDINGS
Always make sure you understand what you have been told before taking any action. When in doubt, never hesitate to say “Say Again”? Misunderstandings kill people. If you are not sure, ASK!

AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS)
The purpose of ATIS is to relieve ATC workload. They need not repeat the same information to every pilot. If available, the ATIS frequency is listed on the sectional chart under the tower control frequency for the airport. ATIS is a continuous transmission that provides the following information:

Time of ATIS information
Surface wind direction (magnetic) and velocity
Clouds and ceiling, visibility and obstructions to visibility
Temperature and dewpoint
Altimeter setting
Active runway and instrument approaches in use
ATC frequencies
Notices To Airmen (NOTAMs) and other relevant airport information, e.g., closed runways

The ATIS broadcast is updated whenever any official weather is received, regardless of content or changes, or when a change is made in other pertinent data, such as a runway change.

Normally updated every hour, each new broadcast is labeled with a letter of the alphabet
At the beginning of the broadcast, e.g., “this is information Alpha," or “information Bravo."

GROUND CONTROL
At a towered airport, the Ground Controller coordinates the movement of aircraft in the movement area on the airport. The movement area consists of the runways and taxiways. The non-movement areas are the ramps and parking areas. Taxi approval must be obtained prior to moving an aircraft or vehicle onto the movement area. When you call Ground Control, you need to say at least four things: Who you are, who you are calling, your location, that you have ATIS, and where you wish to go.

1. Call the Ground Control by name, e.g. “Laughlin Ground”
2. Give your call-sign, e.g. “Air Force one zero two two”
3. Your location, e.g. “Laughlin Ramp”

4. Tell the Ground Controller that you have ATIS (if appropriate), e.g., "Information Golf" if Golf is the current ATIS designation.
5. Indicate where you want to go and that you are ready to taxi, e.g., "request taxi, south departure"

The Ground Controller will respond with at least your identification and directions:
a. The airplane identification, e.g., "Air Force One Zero Two Two (A1022)
b. Directions to taxi to the active runway, e.g., "Taxi to Runway 31L".

You should acknowledge the controller, e.g., "A1022 taxi to Runway 31L." Continue to monitor Ground as you taxi unless advised otherwise. (You will normally switch to the tower frequency just before you are ready for take off). **ALWAYS READ BACK ALL HOLD SHORT INSTRUCTIONS!**

TOWER CONTROL
The tower controller coordinates all aircraft activity on the active runway and near the airport.

When you are ready for takeoff, tell the tower three things, for example:
a. Address the tower, e.g., "Laughlin tower.
b. Identify your airplane, e.g., "A1022".
c. State your intention (request), e.g., "Ready to take off Runway 31L, South Departure.

The tower controller then issues a clearance for takeoff, if appropriate, e.g., "A1022 cleared for takeoff Runway 31L, south departure approved. However, listen carefully to the tower controller's response.
a. The controller may issue certain restrictions on your departure, such as right turn or maintain runway heading or make left traffic.
b. The tower may not clear you due to traffic, e.g., "A1022, hold short of Runway 31L, landing traffic", or "A1022, line up and wait Runway 31L."

You must read back *all* hold short instructions, e.g., "A1022, hold short of Runway 31L".

Once you have received a clearance for takeoff, you should acknowledge, e.g., "A1022, cleared for takeoff Runway 31L.

If there is a Departure Control to contact, the tower will direct you to that frequency when appropriate, e.g., "A1022, contact Departure Control on 120.1."

Tower Control is also used for landing. Contact Tower Control when advised by Approach Control to do so. Tower will route you (if appropriate) to the active runway and coordinate your approach with the other traffic. Address the tower, telling them who you are, where you are, and what you want. EXAMPLE: "Laughlin Tower, A1022, inbound, 31L, full stop".

APPROACH AND DEPARTURE CONTROL (FOR VFR AIRCRAFT)
The Approach or Departure Controller coordinates arriving and departing traffic, usually to a busy airport with a control tower. These controllers coordinate traffic outside the traffic pattern area. Use of Approach and Departure Control is mandatory in Class B and Class C airspace areas for all aircraft, including VFR traffic.
a. Class B airspace exists around major airports (e.g., Denver, CO)
b. Class C airspace exists around other busy airports (e.g., Colorado Springs, CO)

When approaching an area serviced by Approach Control, you should contact them for traffic advisories, sequencing for landing, and instructions for flying through a busy area. You initiate the contact.

When leaving busy traffic areas tower will advise you to contact Departure Control. Tower initializes the frequency change.

A NOTE ON RADIO TRAFFIC AT UPT air traffic is sometimes moderate to heavy with multiple aircraft in the landing pattern, taking off, transiting areas, etc. Make it a habit to listen to communications applicable to your environment. If you are in the landing pattern, pay attention to communications. In so doing, you can know the location of aircraft that you cannot even see! If you are taking off, pay attention to radio traffic! You must only enter the runway area when you are so cleared! Read back ALL hold short instructions, and comply with the same.

Paying attention can save your life! Example: You are cleared to takeoff on runway 13R. You hear another aircraft on final calling for a landing on 13R, and the tower inadvertently clears the aircraft to land without mentioning you! The aircraft is behind you, but you have no idea how far. If the tower cleared him to land and remembered you, the tower would have said something like, “Cessna 5011A, winds 090 at 10, cleared to land runway 13R; DA20 traffic on the roll.”

DO make sure that your radio volume is at a level that promotes clear, comfortable understanding.	DO NOT Use more words than you must to convey the message! Be succinct, but thorough!
DO make all radio calls at the appropriate time.	DO NOT use slang, CB terms, etc. BE PROFESSIONAL!
DO question anything that you do not understand!	DO NOT argue with a Controller or other aircraft!
	DO NOT try to talk when someone else is talking; fly the aircraft and await a clear radio to talk.

DA20-C1 AVIONICS

GARMIN 340 AUDIO SYSTEM

- Connects crew stations with the radios.
- Provides an intercom for intra-cabin communication.
- Allows the crew to select audio sources and control which radio will be used to transmit when the push-to-talk (PTT) button is pressed.

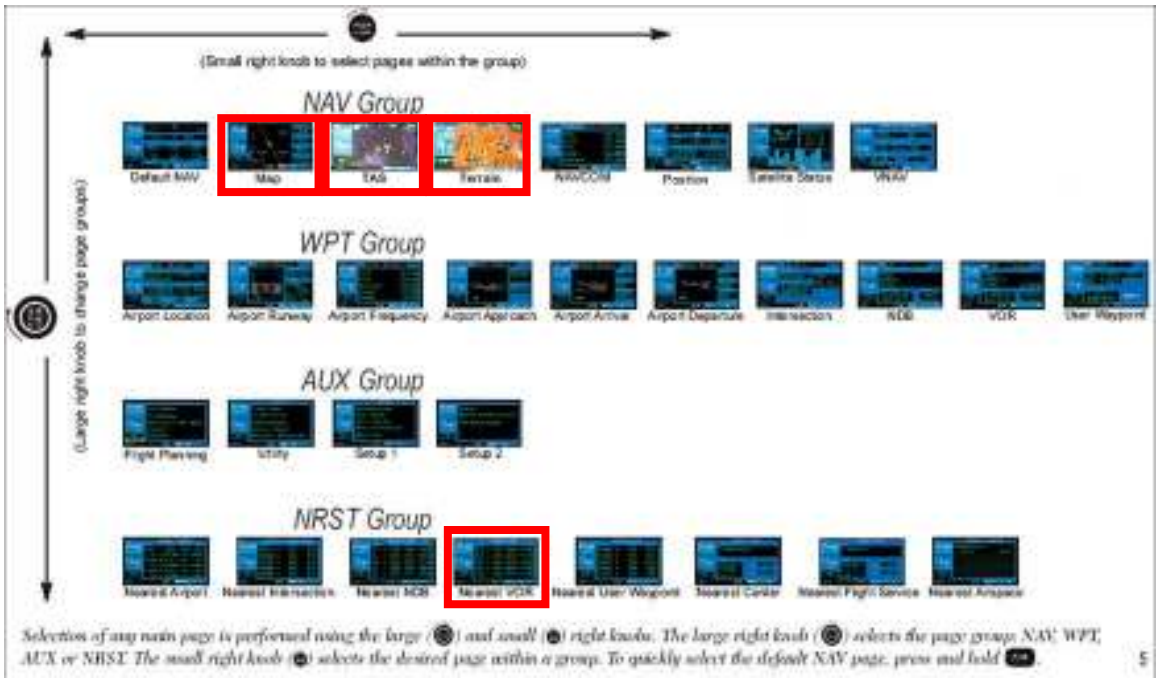
- Right Seat Pilot Microphone Squelch - Outer Knob
  - Controls sensitivity of microphone voice activation.
- Right Seat Pilot Intercom Volume - Inner Knob
  - Controls volume of intercom.
    Technique: set this volume (the volume of your voice and your IP's voice) a little quieter than the radio volume to avoid drowning out incoming radio calls with intra-cockpit chatter.
  - Pull out to control passenger intercom volume.
    Technique: if this knob appears inoperative, make sure it is NOT pulled out.
- Left Seat Pilot's Intercom Volume and Microphone Squelch
  - Same as Right Seat Pilot's VOL/SQ knobs.
  - Inner knob full counterclockwise will power OFF the unit.
    Technique: Do not touch your IP's intercom volume.
- Audio Monitor Buttons
  - Lights extinguished are muted
- Transmitter Selection (MIC) Buttons
- Navigation Radio Monitor Buttons
- *COM 1/2 Split
  - Allows pilot to listen/broadcast on COM 1 while co-pilot simultaneously listens/broadcasts on COM 2.
- *SPKR – Cabin Speaker On/Off
- *PA - In conjunction with PTT buttons, allows crew to be heard through the cabin speaker
- *PILOT ICS ISOLATION
  - Isolates pilot from copilot and passengers.
  - Copilot and passengers can continue to use intercom without the pilot hearing their conversation.
- *CREW ICS ISOLATION
  - Isolates pilot and copilot from passengers.
  - Passengers can continue to use intercom.

GARMIN GNS 430

There are many functions included in the GNS-430. However, we will only use a fraction of the capability of this radio. The following functions are used:

- Communications – COM 1
- Navigation – GPS and VLOC
- Traffic Advisory System – TAS
- Terrain Alert System

The GNS 430 is organized into four chapters (NAV, WPT, AUX, and NRST) with a number of pages in each chapter. We typically will use only four pages as outlined in red below.



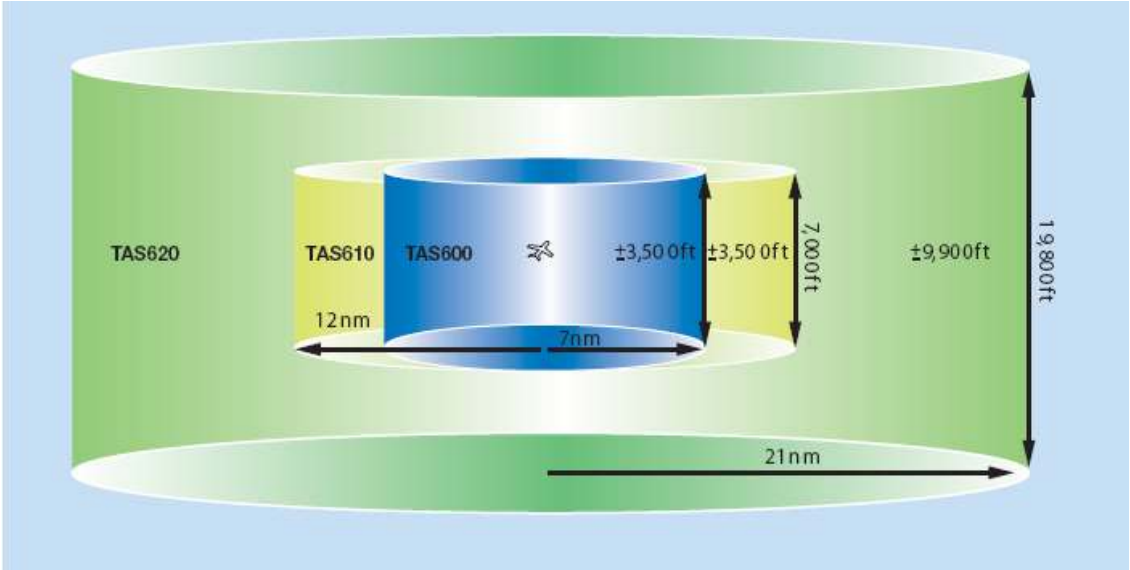
The various knobs and buttons are explained.

- C Knob
  - Push to turn SQ (squelch) on/off.
  - Twist to power on/off and adjust COM volume.
- V Knob
  - Twist to adjust VLOC (Nav Radio) volume.
  - Push to ID the VOR on/off.
- C Flip-flop button
  - Swaps COM active/standby frequencies.
- V Flip-flop button
  - Swaps VLOC active/standby frequencies.
- The PUSH C/V knob

  - Push to move the light blue field between COM and VLOC for frequency changes.
  - Twist outer knob to change the numbers on the left side of the decimal.
  - Twist inner knob to change the numbers on the right side of the decimal.
- CDI - Selects between GPS and VLOC navigation data.
- OBS – Activates the Omnidirectional Bearing Selector (OBS) knob on the VOR.
- ENT - Enter / Approve
- RNG - Adjusts zoom level for moving maps and TAS
- D→ - Direct-To function
- MENU - Menu for current page
- CLR
  - Clear/Cancel
  - Default Nav – Hold for 3 seconds to return to NAV page 2 (map page).
- The PUSH CRSR knob
    - Twist outer knob to select the Chapter.
    - Twist inner knob to select the Page.

TRAFFIC ADVISORY SYSTEM - TAS 600

The Traffic Advisory System is located on NAV page three. This interrogates transponders from nearby aircraft within the coverage volume. It provides warning to the flight crew when the calculated time to closest approach (CPA) of any intruder and the protected area around the aircraft reaches the 30-second threshold. It provides a 30-second decision time at a closure rate of up to 1200 knots.



TAS provides three levels of advisory

- The first level of alert is Other Traffic - OT
- A hollow, white diamond shape
- Altitude in hundreds of feet above (+) or below (-) your aircraft

- The second level of advisory
- A solid diamond shape
- Arrow indicates the movement direction of the aircraft

- The third level of advisory
- A solid, yellow circle
- Calculated probability of intercept for altitude and direction
- Audible warnings over intercom

In the GND Mode, the TAS automatically mutes audible warnings at speeds below 35 kts. To activate the audible warnings, push **MENU** and select “EXIT GND MODE” and push **ENT**.

TERRAIN ALERT SYSTEM

Whenever the aircraft is within 1000 feet of the surface, the terrain page turns yellow. Whenever the aircraft is within 100 feet of the surface, the page turns red. This alerts the pilot to the hazard of flying into the surface of the earth.

As we fly into airports that are not for public use, for example the Fowler and Bullseye airports, it is necessary to inhibit the Terrain function in order to use the TAS.

To inhibit the Terrain Alert Warning:
Push **MENU** and select “INHIBIT TERRAIN” and push **ENT**. Once operation at those airports is completed, the Terrain Alert System is reactivated.

SL40 COM 2 RADIO

This radio is the second communications radio in the aircraft.

Controls

- Power/Volume/Squelch
- The knob on the left side of the SL40 controls power on/off, volume and squelch test.
- Rotate the knob clockwise past the detent to turn the power on.
- Rotate the knob to the right to increase speaker and headphone volume.
- Pull the knob out to disable automatic squelch.
- The dual concentric knobs on the right side of the SL40 are used to select frequencies in the STANDBY field or to view the features available within a function.
- Turn the large, outer knob to change a frequency in 1 MHz increments.
- Turn the small, inner knob to change a frequency in 25 KHz increments.
- Note that only two numbers are displayed to the right of the decimal point.
- Press the flip-flop (arrows) button to move a frequency from STANDBY to ACTIVE.

EC (Emergency Channel) - Press the EC button to load the Emergency Channel (121.50 MHz) as the standby frequency. The Monitor function is automatically enabled.

MON (Monitor) - Press the MON button to listen to the standby frequency. When the active frequency receives a signal, the unit will switch automatically to the active frequency.

RCL (Recall) - Press the RCL button to retrieve stored frequencies.

MEM (Memory) - Press the MEM button to store the displayed Standby frequency in memory.

Several annunciators are used to indicate the operating modes of the SL40.

- The TX (Transmit) annunciator is lighted when transmitting.
- An LED will be lighted above the MON and RCL buttons when these functions are selected.
- An "s" will appear to the left of the Standby frequency.
- An "m" will appear to the left of the Standby frequency when you are using the MON function.
- An "I" indicates the Intercom function is being used.
- If the avionics bus drops below 9 VDC, the SL40 will not transmit.

ATC RADAR BEACON SYSTEM

The Air Traffic Control Radar Beacon System (ATCRBS) is often referred to as “secondary surveillance radar.” This system consists of three components: Interrogator, Transponder and Radarscope. The advantages of ATCRBS are the reinforcement of radar targets, rapid target identification and a unique display of selected codes.

The transponder is the airborne portion of the secondary surveillance radar system. A transponder is also required to operate in certain types of airspace:

-At or above 10,000’ MSL except in airspace below 2,500’ AGL
-Within an Air Defense Identification Zone (ADIZ).
-Within 30 nm of Class B airspace below 10,000’ MSL.
-Within, above and below all Class C airspace up to 10,000’ MSL.
-Within 10 miles of certain airports, except the airspace that is outside Class D airspace and below 1200’ AGL.

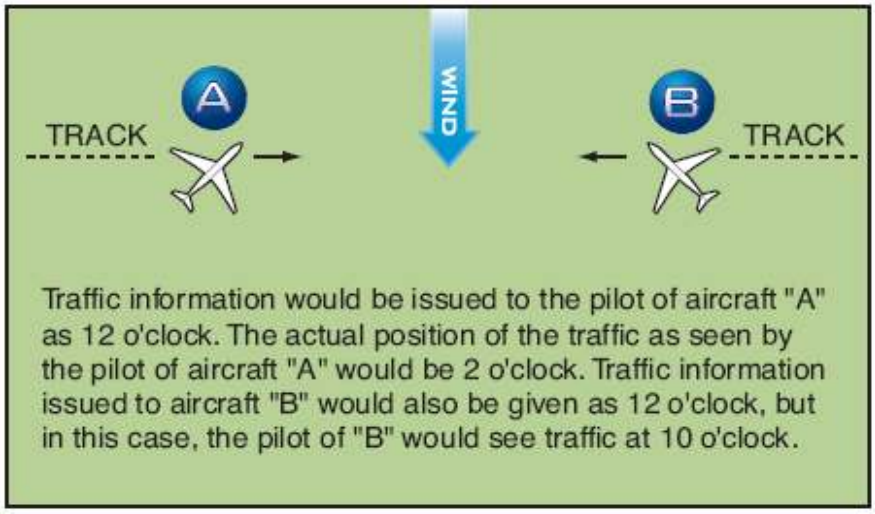
The various features of the **Garmin GTX 327** Transponder include:
IDENT – Activates Special Position Identification (SPI) signal for 18 seconds.
VFR - Press once – selects '1200' as active code, Press twice – reverts to previously active code.
ON – Engages reply to Mode A interrogations.
STBY – Halts response to all ATCRBS interrogations.
ALT/STBY Selection - When groundspeed is greater than 35 knots, unit automatically selects ALT mode. When groundspeed is less than 35 knots + 10 seconds, unit automatically selects STBY.
FUNC – Cycles transponder through display functions
Pressure Altitude – displays current pressure altitude as received from altitude digitizer
Flight Time – begins when unit senses liftoff
Count Up Timer
Count Down Timer
START/STOP – Initiates the timer
CRSR – Cycles position in active field
CLR – Clears the entry

A transponder code consists of four numbers from zero to seven (4,096 possible codes). There are some standard codes, or ATC may issue a four-digit code to an aircraft. The standard codes are:

1200 – VFR code in the U.S.
7500 – Hijack code.
7600 – Loss of communication code.
7700 – Emergency code.
7777 – Military interceptor operations code (NEVER SQUAWK THIS CODE).
0000 – Code for military use in the U.S.

RADAR SERVICES

Radar equipped ATC facilities provide radar assistance to VFR aircraft provided the aircraft can communicate with the facility and are within radar coverage. This basic service includes: Safety alerts, traffic advisories and limited vectoring on request.



ATC issues traffic information based on observed radar targets. The traffic is referenced by azimuth from the aircraft in terms of the 12-hour clock. The distance in nautical miles, direction in which the target is moving, and the type and altitude of the aircraft, if known, are also given.

An example would be: “Traffic 10 o’clock 5 miles east bound, Type unknown, 3,000 feet.” The pilot should note that traffic position is based on the aircraft ground track, and that wind correction can affect the clock position at which a pilot locates traffic.