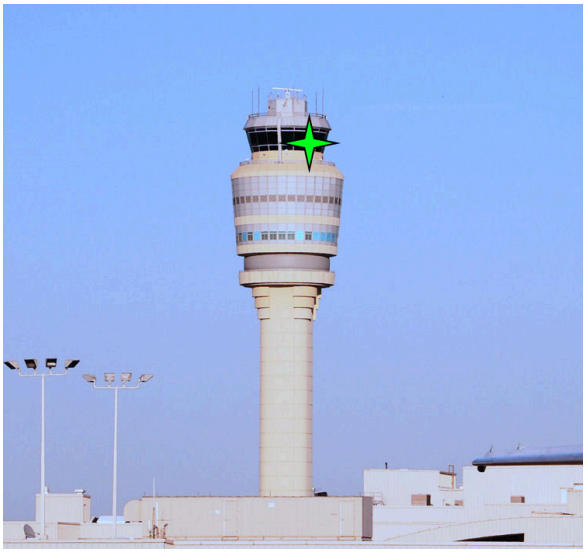
Communications, Light Signals, and Runway Lighting Systems

Objective	
To ensure the applicant learns and can exhibit a clear understanding of aviation radio communications, phraseology, basic ATC procedures, and ATC light gun signals.	
Purpose	
Whether operating at a busy towered airport, or a quiet non-towered airport, radio communications are an essential part of every flight. This lesson introduces pilots to the basics of ATC and other radio communications so that they can operate safely and effectively in all kinds of airspace.	

Schedule	**Equipment**
• **Ground Lesson**: 20 minutes • **Student Q&A**: 10 minutes	• Airport Diagrams • VFR Sectional Chart • Chart Supplement • Whiteboard / Markers (optional)
Student Actions	**Instructor Actions**
• Ask any questions, receive study material for the next lesson. • Watch linked video. • Review listed references.	• Deliver the ground lesson (below). • Answer student questions.

Completion Standards

- Student can explain the following concepts:
  - Various types of ATC frequencies and their purpose
  - Various types of self-announcing frequencies and their purpose
  - Proper ATC Phraseology, the Phonetic Alphabet, Required Readbacks
  - Proper self-announcing procedures and phraseology.
  - How to determine the correct frequencies.
  - Lost Procedures
  - Lost Comms Procedures, ATC Light Gun Signals
  - Runway Status Lights
- Before each flight, student performs the following:
  - Selects and activates appropriate frequencies
  - Communicates on the radio using proper phraseology and complies with ATC instructions

References

- Airplane Academy - “15 Actionable Tips for Confidence with ATC (with Practical Examples)”
    - YouTube - https://www.youtube.com/watch?v=ExnLJ-bWekI
- FAA-H-8083-3C (Airplane Flying Handbook) - Chapter 2, Page 18-21 [Taxiing], Chapter 8 [Airport Traffic Patterns]
- FAA-H-8083-25C (Pilot’s Handbook of Aeronautical Knowledge) - Chapter 14 [Airport Operations]
- AIM-2024-03-21 (Aeronautical Information Manual) - Chapter 2, Section 1-6 [Runway Status Lights], Chapter 2, Section 3 [Airport Marking Aids and Signs], Chapter 4, Section 2 [Radio Communications Phraseology and Techniques], Chapter 4, Section 3 [Airport Operations], Chapter 5, Section 2-4 [Taxi Clearance], Chapter 5, Section 5-2 [ATC Clearance/Readbacks]
- Pilot/Controller Glossary
- FAA AC 90-48E (Pilot’s Role in Collision Avoidance), FAA AC 90-66C (Non-Towered Airport Flight Operations)
- FAA-S-ACS-6C (Private Pilot ACS) - Area III Task A
- FAA-S-ACS-7B (Commercial Pilot ACS) - Area III Task A
- FAA-S-ACS-25 (CFI ACS) - Area VI Task A

Ground Lesson Outline

- Basics of ATC Radio Communication
    - ATIS Broadcast, Ground, Tower, Approach/Departure, Center, Guard (121.5), FSS
    - Listen before transmitting! Think, then speak.
    - “Two-Way Radio Communications”
    - Transponder Usage
    - Mandatory Compliance - But PIC has ultimate authority over safety of flight! Say “Unable” if necessary!
- Phraseology for ATC Communications
    - Phonetic Alphabet, Runway Numbers - e.g. 25 = “Two Five”, Proper use of Callsigns
    - [ATC Facility Name], [Callsign], [Position], [Request]
        - Ex: “Orlando Tower, Cessna N12345, Holding Short of Runway 7, Ready for Departure”
    - ATIS Letter Usage - On Initial call to ground (for departure), or approach/tower (for arrival)
    - Required Readbacks - Taxi Clearances, Hold Short Instructions, Takeoff/Landing Clearances
- Basics of CTAF/Practice Area Radio Communications - Self-announcing procedures, UNICOM, ASOS
- Phraseology for CTAF/Practice Area Communications
    - [Frequency Name], [Callsign], [Position], [Intentions], [Frequency Name Again]
        - Ex: “Apopka Traffic, Cessna N12345, 5 miles west at 1,500 feet, entering a left downwind for Runway 33, Apopka Traffic”
        - Ex: “Lake Apopka Traffic, Cessna N12345, 2,500 feet, North Shore of Lake Apopka, Steep Turns, Lake Apopka Traffic”
- Determining the Correct Frequency - On the Ground, In the Air
- Lost Procedures - 121.5 (Guard), Don’t hesitate to declare an Emergency, Radar Assistance
- Lost Comms Procedures - Issues that can cause lost comms, ATC Light Gun Signals
- Runway Status Lights

Common Errors

- Use of improper frequencies.
- **Improper procedure and phraseology when using radio communications**
    - **For example: Neglecting to state the aircraft call sign/n number at non-towered airports, failure to state position, runway of takeoff, and the airport of operation**.
- Failure to acknowledge, or properly comply with, ATC clearances and instructions.
- Failure to understand, or to properly comply with, ATC light signals.

Ground Lesson Content

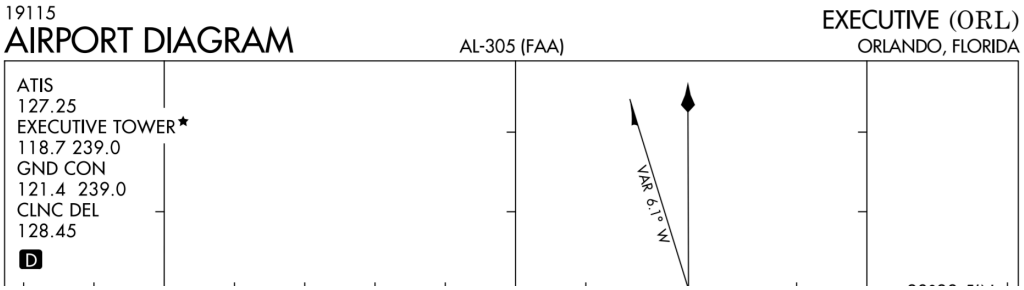
- **Basics of ATC Radio Communication**
  - **Common Frequencies**
    - **ATIS Broadcast** - Only available at some towered airports, broadcasts a recorded loop containing the weather and other important information, coded with a letter (e.g. N = “November”)
    - **Ground** - Provides taxi clearances.
    - **Tower** - Provides takeoff and landing clearances.
    - **Approach/Departure** - In some busier areas, provide radar services to arriving and departing aircraft that are at low altitude near a major airport but not in the immediate vicinity.
    - **Center** - Provide radar services to aircraft in cruise flight.
    - **Guard (121.5)** - Universal emergency frequency, monitored by most ATC facilities at all times.
    - **FSS** - Flight Service Stations are not ATC but can provide in-flight services to pilots. (Weather, filing and closing flight plans, etc)
  - **Listen before transmitting! Think, then speak.**
  - **“Two-Way Radio Communications”** - Some airspaces (e.g. Class C, Class D) require pilots to simply establish “Two-Way Radio Communications” before entering.
    - If ATC reads back the callsign, two-way communications have been established.
    - If ATC does not read back the callsign (e.g. “aircraft calling, standby”), two-way communications *have not* been established.
  - **Transponder Usage** - The transponder provides data about your airplane (altitude, GPS position [ADS-B], etc.) to ATC radar, along with a 4 digit code. (0000-7777)
    - VFR Airplanes all use 1200 when not assigned another code.
    - ATC can assign a code before takeoff or during flight.
    - Aircraft should keep the transponder in altitude-reporting mode (ALT) at all times!
  - **Mandatory Compliance** - Compliance with ATC instructions is mandatory!
    - **Not absolute! - PIC has ultimate authority over safety of flight!** Say “Unable” if necessary!
- **Phraseology for ATC Communications**
  - **Phonetic Alphabet** - When saying callsigns or other alphanumeric identifiers, pilots must use the phonetic alphabet.

NATO Phonetic Alphabet

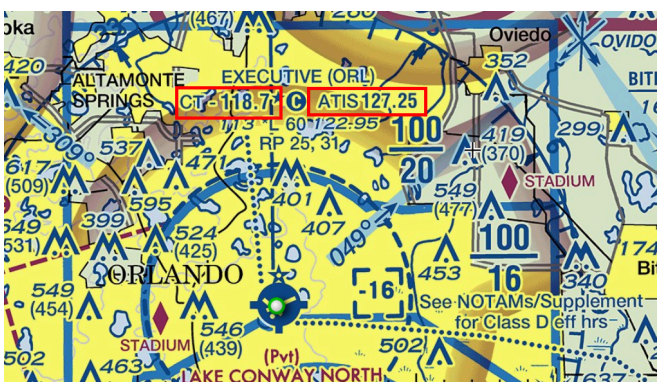
A	Alpha	N	November
B	Bravo	O	Oscar
C	Charlie	P	Papa
D	Delta	Q	Quebec
E	Echo	R	Romeo
F	Foxtrot	S	Sierra
G	Golf	T	Tango
H	Hotel	U	Uniform
I	India	V	Victor
J	Juliet	W	Whiskey
K	Kilo	X	X-ray
L	Lima	Y	Yankee
M	Mike	Z	Zulu

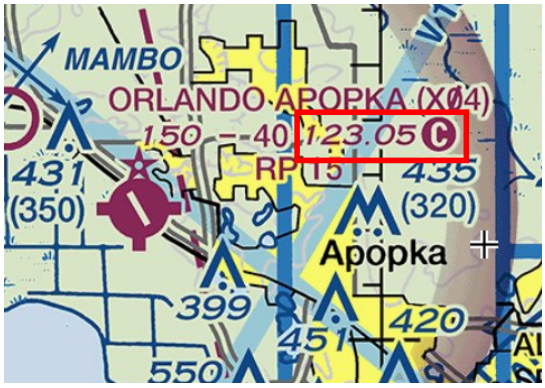
  - **Runway Numbers - e.g. 25 = “Two Five”** - Spoken one number at a time.

    - **Proper use of Callsigns** - Always use the full aircraft callsign on initial call, however ATC may choose to abbreviate your callsign (e.g. “Cessna N12345” -> “Cessna 345”)
        - Only use your abbreviated callsign **after ATC shortens it first**
    - **Format:**
        - **[ATC Facility Name], [Callsign], [Position], [Request]**
        - **Example:** “Orlando Tower, Cessna N12345, Holding Short of Runway 7, Ready for Departure”
    - **ATIS Letter Usage** - On Initial call to ground (for departure), or approach/tower (for arrival)
    - **Required Readbacks** - For safety reasons, certain communications require pilot readbacks. All readbacks must **always include the aircraft callsign**.
        - **Taxi Clearances** - Must include at a minimum any runway crossings and hold short instructions.
        - **Hold Short Instructions**
        - **Takeoff/Landing Clearances** - Must include the runway number.
- **Basics of CTAF/Practice Area Radio Communications** - “Common Traffic Advisory Frequency”
    - **Self-announcing procedures** - Aircraft self-announce position and attention “in the blind” (no expectation of response)
        - Pilots can work together with each other on the frequency to avoid conflicts
    - **UNICOM** - “Universal Integrated Community” - Single frequency used for communicating by all personnel on a non-towered airport, often the same frequency as the CTAF frequency.
    - **ASOS Broadcast** - An automated, recorded weather broadcast available at some airports, particularly non-towered airports
- **Phraseology for CTAF/Practice Area Communications**
    - **Format:**
        - **[Frequency Name], [Callsign], [Position], [Intentions], [Frequency Name Again]**
        - **Example:** “Apopka Traffic, Cessna N12345, 5 miles west at 1,500 feet, entering a left downwind for Runway 33, Apopka Traffic”
        - **Example:** “Lake Apopka Traffic, Cessna N12345, 2,500 feet, North Shore of Lake Apopka, Steep Turns, Lake Apopka Traffic”
- **Determining the Correct Frequency**
    - **On the Ground** - Use the Chart Supplement or consult the Airport Diagram or VFR Sectionals.



    - **In the Air** - Important frequencies are printed on VFR Sectional maps.





- **Lost Procedures** - There is always an ATC facility somewhere within range listening on **121.5** (Guard)
  - Call “in the blind” on Guard
    - **Example:** “Any ATC facility, Cessna N12345 on Guard, lost and in need of assistance!”
  - **If you require ATC assistance, do not hesitate to declare an emergency**
  - ATC may also provide *radar assistance*, that is to say, they may give you a squawk code and help you identify your position via ATC radar.
- **Lost Comms Procedures** - Communications can be lost for a variety of reasons, including electrical system failure, incorrect radio/intercom settings, or simply dialing in the wrong frequency.
  - **ATC Light Gun Signals** - If a landing at a towered airport must be made without radio communications, **carefully** approach the airport traffic pattern and look for light gun signals from the tower.
  - See also:
    - FLY8MA.com Flight Training - “Real Light Gun Signals | ATC Tower”
    - YouTube - https://www.youtube.com/watch?v=nxoakUa8UqQ

Color and Type of Signal	Movement of Vehicles, Equipment and Personnel	Aircraft on the Ground	Aircraft in Flight
Steady green	Cleared to cross, proceed or go	Cleared for takeoff	Cleared to land
Flashing green	Not applicable	Cleared for taxi	Return for landing (to be followed by steady green at the proper time)
Steady red	Stop	Stop	Give way to other aircraft and continue circling
Flashing red	Clear the taxiway/runway	Taxi clear of the runway in use	Airport unsafe, do not land
Flashing white	Return to starting point on airport	Return to starting point on airport	Not applicable
Alternating red and green	Exercise extreme caution!!!!	Exercise extreme caution!!!!	Exercise extreme caution!!!!

- **Runway Status Lights** - Runway Status Lights are a fully automated system that provides runway status information to pilots and surface vehicle operators to clearly indicate when it is unsafe to enter, cross, takeoff from, or land on a runway. The RWSL system processes information from surveillance systems and activates Runway Entrance Lights (REL) and Takeoff Hold Lights (THL), in accordance with the position and velocity of the detected surface traffic and approach traffic. This provides an additional layer of safety that does not depend on human Air Traffic Controllers to prevent runway incursions.