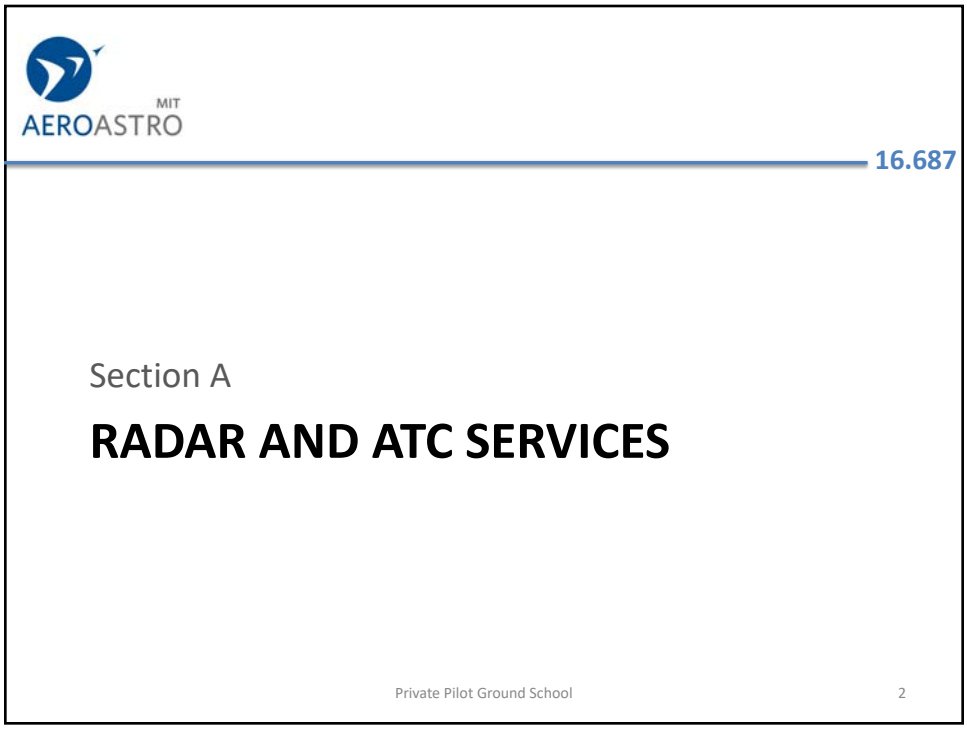

16.687
Private Pilot Ground School
Massachusetts Institute of Technology
IAP 2019
Communication and Flight Information
Instructor: Tina P. Srivastava, Ph.D.


MIT
AEROASTRO
16.687
Section A
RADAR AND ATC SERVICES
Private Pilot Ground School
2

What is a Transponder?

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- Device that enhances your radar return on ATC's screen
- Receives an interrogation signal from ground radar unit and replies with a "squawk" signal
- Provides lateral position (azimuth), vertical information (altitude), and transponder code

Transponder Operations

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FAR 91.413: Must be tested and inspected within the preceding 24 calendar months

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Why a Transponder?

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- ATC radar can determine horizontal position of a "primary target," but not altitude or identity
- On-board transponder may respond to interrogation with
  - A four-digit octal "squawk" code (Mode A)
  - Pressure altitude (Mode C) obtained from "encoding altimeter"
  - ICAO 24-bit address that uniquely identifies the airplane (Mode S; developed at Lincoln Laboratory)
  - GPS-derived position and velocity (ADS-B via extended squitter Mode S or UAT)

Note that old systems are retained as new ones added!

Transponder Squawk Codes

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- VFR Squawk Code: **1200**
  - Use when operating under Visual Flight Rules

    AND
  - Not assigned an alternate squawk code by ATC
  - Once advised that radar service is terminated upon leaving Class B, C, or D airspace
- Emergency Squawk Codes:
  - Hijacking -> **7500**
  - Lost Communications -> **7600**
  - General Emergency -> **7700**

Terminal VFR Radar Services

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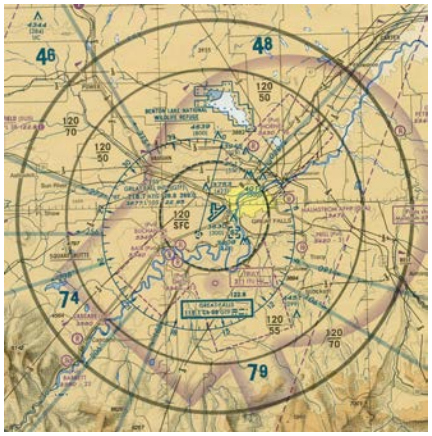
- Basic Radar Service:
  - Voluntary
    - Safety alerts
    - Traffic Advisories
    - Limited radar vectoring
    - Sequencing at certain terminal areas
- TRSA
  - Terminal Radar Services Area
  - Voluntary
- Class C
  - Required
- Class B
  - Required



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Requesting Radar Services

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- As with other initial calls:
  - Who they are
  - Who you are
  - Where you are
  - What you want
- Example: "Boston Approach: Cirrus 707WT, 5 south of Hanscom, request VFR advisories Provincetown."

Confirming Radar Service

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- An Approach controller will call back with “7WT, squawk 4231 and ident”
- Pilot types this code in and presses the “ident” button (highlights the aircraft on controller’s screen), reading back the code but not the ident instruction.
- Controller calls 10 seconds later with “7WT radar contact seven miles south of the Bedford airport.”

Once the controller says “radar contact” you know that he or she will advise you regarding nearby traffic or hazardous weather.

Wind Complicates Warnings

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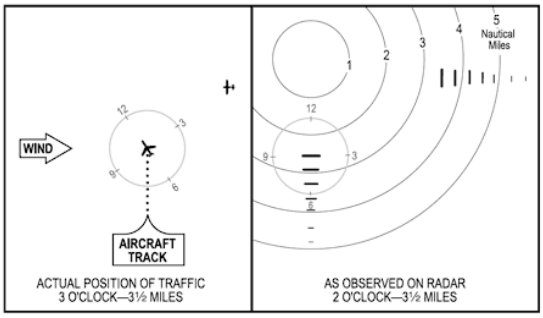
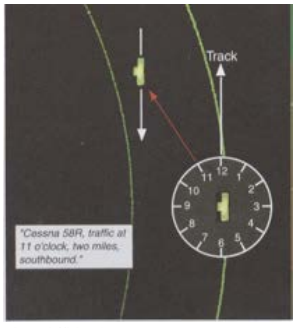
- Controllers reference traffic from your airplane with reference to clock direction





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Practice Question

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An ATC radar facility issues the following advisory to a pilot flying on a heading of 360deg:

"Traffic 10 O'Clock, 2 Miles, Southbound…"

Where should the pilot look for this traffic?

A. Northwest
B. Northeast
C. Southwest

Practice Question

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Automatic Terminal Information Service (ATIS)

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- Prerecorded and broadcast continuously on its own frequency
- Typically updated hourly; each update gets a new letter stamp, e.g., "Information Alpha" is updated to become "Information Bravo."
- Available at most towered airports (saves the controller from having to repeat herself to every new customer)
- Sequence:
  - Airport name
  - Letter
  - Time (Zulu)
  - Wind (magnetic)
  - Visibility
  - Ceiling
  - Temperature/Dewpoint (carburetor heroes take note!)
  - Altimeter setting
  - Runway and/or instrument approaches in use
  - Extra information, such as taxiway closures

Example ATIS

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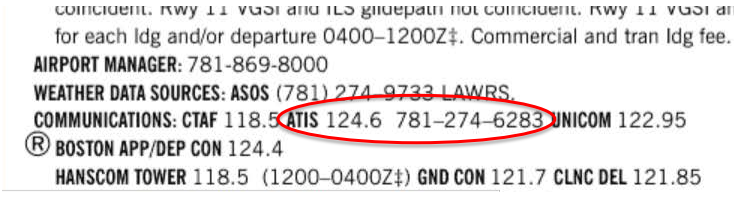
- https://www.youtube.com/watch?v=7lNlSZgaD4U
  - ATIS begins at 00:44 in this video
- KBED (Hanscom)



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Flight Service Stations (FSS)

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- weather briefings via 1-800-WX-BRIEF
- weather information enroute
- flight plans: receiving, opening, closing
- search for pilots who forget to close flight plans
  - call the pilot
  - call the control tower at destination; if no tower, call the FBO or send the local police department to look for the parked airplane
  - initiate a full search
- move your watch to the other wrist if you open a flight plan
- call periodically with position reports if you are not within radar coverage, e.g., in Alaska, or if you are changing route due to weather

Does it make sense to have New York Approach call your mom and tell her you'll be late? Or is there another service that can do this?

(FSS contracted to Lockheed Martin in 2005 and then spun off to Leidos)

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Section B

RADIO PROCEDURES

Phonetic Alphabet

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Letter	Word	Pronunciation	Letter	Word	Pronunciation
A	ALPHA	**AL** FA	N		
B	BRAVO	**BRAH** VOH	O		
C			P		
			Q		
D			R		
E			S		
F			T		
G			U		
H					
I			V		
J			W		
K			X		
L			Y		
M			Z		

Phonetic Alphabet

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Letter	Word	Pronunciation	Letter	Word	Pronunciation
A	ALPHA	**AL** FA	N	NOVEMBER	NO **VEM** BER
B	BRAVO	**BRAH** VOH	O	OSCAR	**OSS** CAH
C	CHARLIE	**CHAR** LEE or **SHAR** LEE	P	PAPA	PAH **PAH**
			Q	QUEBEC	KEH **BECK**
D	DELTA	**DELL** TAH	R	ROMEO	**ROW** ME OH
E	ECHO	**ECK** OH	S	SIERRA	SEE **AIR** RAH
F	FOXTROT	**FOKS** TROT	T	TANGO	**TANG** GO
G	GOLF	GOLF	U	UNIFORM	**YOU** NEE FORM or **OO** *NEE FORM*
H	HOTEL	HOH **TELL**			
I	*INDIA*	**IN** DEE AH			
J	JULIETT	**JEW** LEE **ETT**	V	VICTOR	**VIK** TAH
K	KILO	**KEY** LOH	W	WHISKEY	**WISS** KEY
L	LIMA	**LEE** MAH	X	XRAY	**ECKS** RAY
M	MIKE	MIKE	Y	YANKEE	**YANG** KEY
			Z	ZULU	**ZOO** LOO

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Numbers

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- 9 = “Niner”
- 3 can be “Tree” (pretentious)
- Altitudes should be stated as individual digits
  - 1,200 = “One Thousand, Two Hundred”
- Above 10,000: pronounce each digit
  - 10,000 = “One Zero Thousand”
- Decimal as “point”
  - 124.4 = “One Two Four Point Four”
  - 124.4 in Canada = “One Two Four Decimal Four”

Practice Question

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The correct method of stating 10,500 feet MSL to ATC is

A. “TEN THOUSAND, FIVE HUNDRED FEET.”
B. “TEN POINT FIVE.”
C. “ONE ZERO THOUSAND, FIVE HUNDRED.”

Practice Question

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The correct method of stating 10,500 feet MSL to ATC is

A. "TEN THOUSAND, FIVE HUNDRED FEET."
B. "TEN POINT FIVE."
C. **"ONE ZERO THOUSAND, FIVE HUNDRED."**

Coordinated Universal Time (UTC) – Zulu Time

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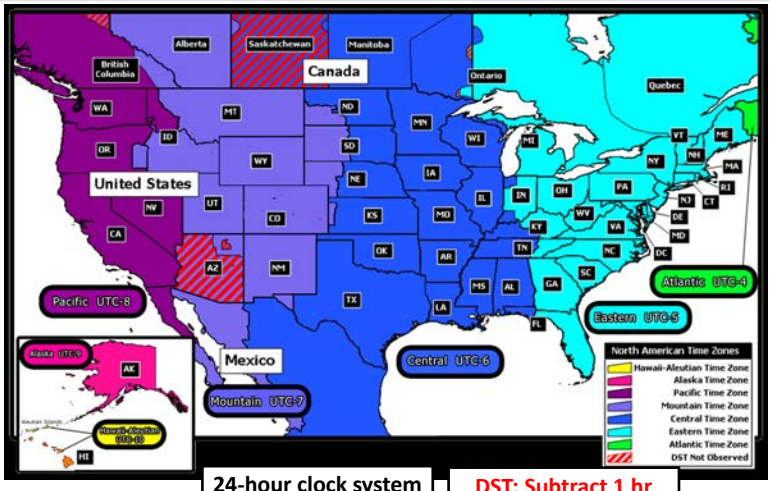

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24-hour clock system **DST: Subtract 1 hr**

Radio Procedures

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- Specific radio procedures and terminologies are used
  - Clarity, Consistency, Effectiveness
- Communication radios in GA use portion of the very high frequency (VHF) range (frequencies from 118.0 MHz – 135.975 MHz)
  - Limited to line of sight (obstructions such as buildings, terrain, curvature of earth can block radio waves)
- Using the radio:
  - State four items: YOU, ME, WHERE, WHAT, [WITH]
  - Acknowledge and comply with ATC instructions
    - Need to use good judgment!

Radio Example

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First: Listen before you talk

- State five items: YOU, ME, WHERE, WHAT, WITH
  - YOU: Hanscom Tower
  - ME: Skyhawk N53569
  - WHERE: 5 mi west of field
  - WHAT: Inbound for landing
  - WITH: Information Whiskey

As Pilot-In-Command (PIC), you can say "unable"

Common Traffic Advisory Frequency (CTAF)

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- Established to increase safety at airports without operating control towers
  - Broadcast your position and intentions to other aircraft in the area
  - Activate pilot controlled lighting on this frequency
  - Frequency listed in the Airport/Facility Directory
- UNICOM
  - Privately owned air/ground communication station
  - In addition to CTAF duties, you can request an airport advisory (winds, favored runway, known traffic) and services (e.g. fuel)

CTAF/UNICOM Procedures

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- Initial call 10 miles from airport
- Report entering downwind, base, and final legs of traffic pattern
- Report exiting the pattern
- Taxiing
- Maneuvering
- Transitioning

CTAF Example

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CTAF/UNICOM is 123.0 MHz

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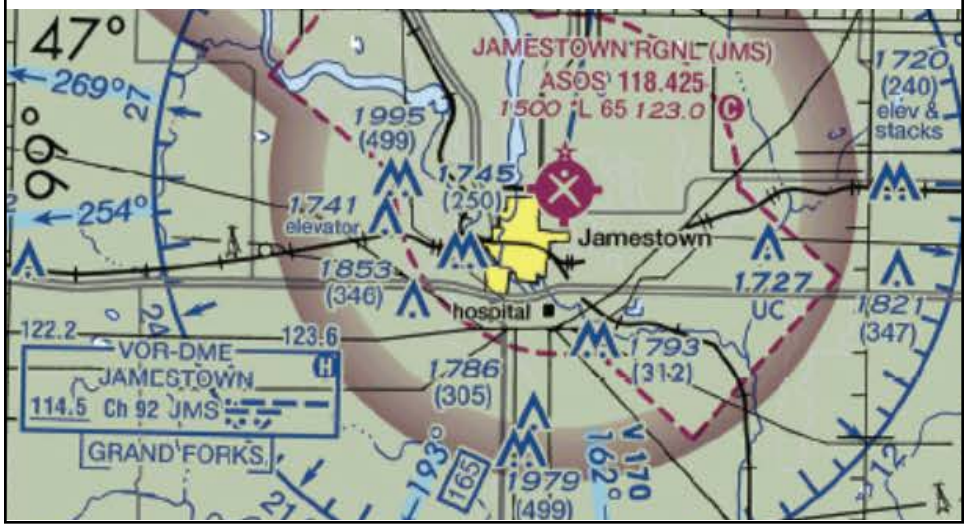

Radar Facilities

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- Departure procedures
  - Clearance delivery
    - Established at busy airports
    - N-number, aircraft type, VFR destination airport, current ATIS information
  - Ground control
    - Directs aircraft and other vehicles on airport surface
    - Progressive taxi
    - "Hold Short"
  - Control tower
    - Contact when ready to take off
    - "Line Up and Wait"
- Arrival procedures
  - Approach control
    - ATC function which provides separation and sequencing of inbound aircraft
    - Traffic advisories/safety alerts when necessary

As Pilot In Command (PIC), you can say "unable"

Lost Communication Procedures

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- Troubleshoot to really make sure you have lost communication!
  - Ensure you are using the correct frequency
  - Check your volume and switches
  - Check your headphone jacks
  - Check the switch position on your audio control panel
    - Try second radio if available
  - Call the last ATC facility, if within range
  - Use handheld if you have it

Lost Communication Procedures

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- If troubleshooting didn't work
  - Don't panic!
  - Squawk 7600 to alert ATC
  - Circle airport of intended use to determine the traffic flow and direction
  - If Class D, then remain outside or above the airspace and circle
  - Enter traffic pattern and maintain visual contact with the control tower to receive light gun signals
  - Acknowledge tower transmissions or light signals:
    - Rock your wings
    - Flash your landing light

Lost Communication Procedures

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ATC Light Signals

GROUND	SIGNAL	AIR
Cleared for Takeoff	Steady GREEN	Cleared to Land
Cleared to Taxi	Flashing GREEN	Return for Landing
STOP	Steady RED	Give Way Continue Circling
Taxi Clear of Runway	Flashing RED	Airport Unsafe DO NOT LAND
Return to Starting Point on Airport	Flashing WHITE	Not Applicable
Exercise EXTREME CAUTION	RED Alternating GREEN	Exercise EXTREME CAUTION

Emergency Procedures

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- Emergency can be a distress or an urgency condition:
  - Distress: threatened by serious and/or imminent danger (fire, mechanical failure, structural failure)
  - Urgency: adversely affect flight safety (doubtful weather, position, fuel endurance)
  - Apprehensive about safety? Immediately request assistance – do not wait until the situation develops into distress condition

1st: Aviate	2nd: Navigate	3rd: Communicate

- What to do?
  - Emergency Frequency: 121.5 (or report on current frequency if talking to ATC)
  - Squawk code: 7700
  - "Mayday, mayday, mayday"
  - Name of station, ID/type of aircraft/nature of distress or urgency, your intentions, fuel remaining, people onboard, any other useful info

Emergency Locator Transmitter (ELT)

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- Emergency signaling devices developed as a means of locating downed aircraft
  - Emit a distinctive audio tone on 121.5 and 243.0 MHz (UHF) if armed and subject to crash-generated forces
    - Newer system also operates on 406.0 MHz
  - Testing
    - Old system ELT can be tested in the first 5 minutes of each hour
    - New system ELT should only be tested by authorized mechanics
  - Battery must be replaced (or recharged)
    - After half the battery's useful life
    - Or when the transmitter has been in use for more than one cumulative hour

AERO ASTRO MIT

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Section C

SOURCES OF FLIGHT INFORMATION

AERO ASTRO MIT

Chart Supplement (formerly Airport/Facility Directory)

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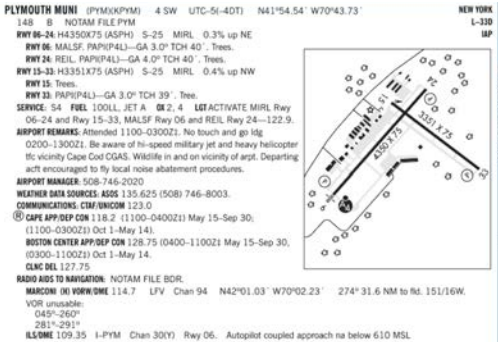
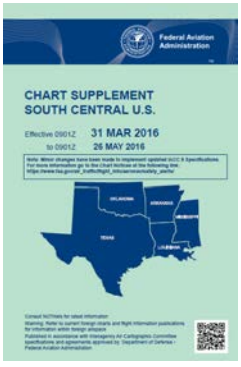
- Contains descriptive listing of all airports, heliports, and seaplane bases which a public-use facilities
  - Divided into seven volumes
  - Reissued every 56 days
  - Designed to use in conjunction with charts



PLYMOUTH MUNI (PYM)(K)PYM 4 SW UTC-5(-4DT) N41°54.54' W70°43.73' NEW YORK L-31D IAP
148 B NOTAM FILE PYM
RWY 06-24: H4350X75 (ASPH) S-25 MIRL 0.3% up NE
RWY 06: MALSF. PAPI(P4L)—GA 3.0° TCH 40'. Trees.
RWY 24: REIL. PAPI(P4L)—GA 4.0° TCH 40'. Trees.
RWY 15-33: H3351X75 (ASPH) S-25 MIRL 0.4% up NW
RWY 15: Trees.
RWY 33: PAPI(P4L)—GA 3.0° TCH 39'. Tree.
SERVICE: S4 FUEL 100LL, JET A OX 2, 4 LGT ACTIVATE MIRL Rwy 06-24 and Rwy 15-33, MALSF Rwy 06 and REIL Rwy 24—122.9.
AIRPORT REMARKS: Attended 1100-0300Z‡. No touch and go ldg 0200-1300Z‡. Be aware of hi-speed military jet and heavy helicopter tfc vicinity Cape Cod CGAS. Wildlife in and on vicinity of arpt. Departing acft encouraged to fly local noise abatement procedures.
AIRPORT MANAGER: 508-746-2020
WEATHER DATA SOURCES: ASOS 135.625 (508) 746-8003.
COMMUNICATIONS: CTAF/UNICOM 123.0
(B) CAPE APP/DEP CON 118.2 (1100-0400Z‡) May 15-Sep 30; (1100-0300Z‡) Oct 1-May 14).
BOSTON CENTER APP/DEP CON 128.75 (0400-1100Z‡ May 15-Sep 30, (0300-1100Z‡) Oct 1-May 14.
CLNC DEL 127.75
RADIO AIDS TO NAVIGATION: NOTAM FILE BDR.
MARCONI (H) VORW/DME 114.7 LFV Chan 94 N42°01.03' W70°02.23' 274° 31.6 NM to fld. 151/16W.
VOR unusable:
045°-260°
281°-291°
ILS/DME 109.35 I-PYM Chan 30(Y) Rwy 06. Autopilot coupled approach na below 610 MSL



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FAR/AIM

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- Federal Aviation Regulations
  - Code of Federal Regulations
    - Official text of public regulations issued by the Federal Government
    - We will cover the different parts of the FARs and the regulations you must know later in the semester
- Aeronautical Information Manual
  - Official guide to basic flight information and ATC procedures
  - Revised several times per year
  - Good reference for procedures, ATC phraseology, Helicopter operations, medical facts, safety of flight, emergency procedures

Source: Public Domain

Notices to Airmen (NOTAMs)

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- Issued for a number of reasons:
  - Airshows, parachute jumps, kite flying, rocket launches
  - TFRs: President and other VIPs
  - Closed runways, taxiways, facilities
  - Inoperable radio navaids
  - Passage of flocks of birds through airspace
  - Volcanic ash
- 5 categories of NOTAMs:
  1. NOTAM (D) -> Information for all navigation aids, airports, heliports, etc.
  2. FDC NOTAM -> Issued by National Flight Data Center, regulatory in nature (such as amendments to sectionals and other charts). Also issue TFRs caused by natural disasters or large-scale public events.
  3. Pointer NOTAM -> issued by FSS to highlight or point out another NOTAM (D) for cross-referencing
  4. Special Use Airspace (SUA) NOTAM -> issued when SUA is active outside of the published schedule
  5. Military NOTAMS -> Pertaining to US Air Force, Army, Marine, and Navy airports

Advisory Circular

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- Non-regulatory guidance and information
- Also explain methods for complying with FARs
- Typically non-binding
  - Some ACs can be regulatory in nature if referenced directly in regulations
- Issued under codes:
  - General – 00
  - Aircraft – 20
  - Airmen – 60
  - Airspace – 70
  - Air Traffic Control and General Operating Rules – 90
  - Airports – 150

Practice Question

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Basic radar service in the terminal radar program is best described as

A. **Safety alerts, traffic advisories, and limited vectoring to VFR aircraft**
B. Mandatory radar service provided by the Automated Radar Terminal Service (ARTS) program
C. Wind-shear warning at participating airports

Practice Question

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