



**Homeland Security
and Emergency Services**

Part 107 Small Unmanned Aircraft Systems (UAS) Test Prep Course

Introductions

- **Student Introductions**
 - Name, Agency, Length of time as a responder, UAS experience
- **Instructional Team and Staff**



Disclaimer

- Focus of this course is to prepare you to take the Part 107 knowledge test.
 - Subject areas may not be covered in depth and will require further self-study.
 - Consider attending UAS Operator/Night Flight at DHSES
 - Specialized courses also available
- The rules, regulations, and technology associated with UAS are evolving, so the information in this workshop may change.

Recreational/ Hobbyist Operators

- USC 44809: Exemption for Limited Operations of Unmanned Aircraft
 - For personal interests and enjoyment only such as taking photographs for personal use and not for sale or compensation to another individual.
- Recreational operators should follow community-based safety guidelines (eg AMA)
- Aircraft Registration:
 - Register with FAA at <https://registermyuas.faa.gov/>
 - Cost: \$5 covers all aircraft for 3 years
- Either complete a free FAA online training course 'TRUST' or hold a current Part 107 remote pilot certificate.



Non Recreational / Hobbyist (Commercial)

- Use of UAS for anything other than Recreational / Hobby profit or not (e.g., real estate, volunteer fire)
- Requires Remote Pilot In Command (RPIC) to hold FAA Part 107 Certificate
- Aircraft Registration:
 - Register with FAA at <https://registermyuas.faa.gov/>
 - Cost: \$5 covers each aircraft for 3 years
- Commercial uses include:
 - Photography / imagery, mapping
 - Real-estate photography - videography
 - Delivering goods (e.g., medical supplies, online purchases)



FAA Part 107 Rules

- UAS Rules (Part 107) define the operational limits.
- Part 107 also establishes certification requirements for UAS operators and requires pilots pass an aeronautical knowledge test at an FAA-approved knowledge test center.



Part 107 Test - Description

- The UAV test contains 60 questions; you are allowed 2 hours to complete.
- The minimum passing score is 70 percent.
- All test questions are objective and multiple-choice by the selection of a single response.
- Each test question is independent of other questions; therefore, a correct response to one does not depend upon, or influence, the correct response to another.



Part 107 Test – Content

- UAS airman knowledge test covers the following 13 knowledge areas:
 1. Applicable regulations relating to small unmanned aircraft system rating privileges, limitations, and flight operation.
 2. Airspace classification, operating requirements, and flight restrictions affecting small unmanned aircraft operation.
 3. Aviation weather sources and effects of weather on small unmanned aircraft performance.



Part 107 Test – Content

4. UAS weight and loading
5. Emergency procedures
6. Crew resource management
7. Radio communication procedures
8. Determining the performance of small unmanned aircraft
9. Physiological effects of drugs and alcohol
10. Aeronautical decision-making and judgment
11. Airport operations
12. Maintenance and preflight inspection procedures
13. Operations at night/RID/OOP

Part 107 Test – Tips

- Carefully read the instructions given with the test.
- Read each question carefully before answering. Answer each question in accordance with the latest regulations and guidance publications.
- After formulating an answer, determine which answer option corresponds with your answer; the answer you choose should completely resolve the problem.
- From the options given, it may appear there is more than one possible answer; however, there is only one answer that is correct and complete.
- The other options are either incomplete, erroneous, or derived from popular misconceptions.
- All paper work must be turned in to the test center representative upon completion.
- Bring reading glasses/magnifying glass

FAA Part 107 Test Centers

- Create an IACRA account and apply for a remote pilot certificate

<https://iacra.faa.gov>

Tutorial video:

<https://www.youtube.com/watch?v=5UMZJF5zd7U&feature=youtu.be>

- Register for exam and locate nearest test center using the PSI portal

<https://faa.psiexams.com>

Exam is referred to either:

“Unmanned Aircraft General – Small (UAG)”

or

“Unmanned Aircraft Systems (UAS) Drone Knowledge Test”

Key Acronyms to Learn

- AGL = Above Ground Level
- COA = Certificate of Authorization
 - BAPS = Blank Area Public Safety COA
 - SGI = Special Government Interest
- FAA = Federal Aviation Administration
- NOTAM = Notice to Air Missions
- RPIC = Remote Pilot in Command
- VTOL = Vertical Takeoff and Landing
- UAS = Unmanned Aircraft System
- VLOS = Visual Line of Site
- USS = UAS Service Supplier
- VO = Visual Observer
- 107 = CFR 107 (Small UAS Rules)
- OOP = Operations over People
- RID = Remote ID



End of Module

Module 2: Part 107 Regulations

14 CFR Part 107

- What is “Part 107”?
- 14 CFR Part 107 - Federal regulations applicable to sUAS operations
- Only for operations conducted inside the US
- Flight controls can be manipulated by operator when:
 - Holder of a valid and current remote pilot certificate
 - Or under direct supervision of a RPIC whom can immediately take control of the sUAS if necessary.

Note: Part 107 does not apply to amateur rockets, free or moored balloons, kites public aircraft, public operations.

To Become a Remote Pilot in Command (RPIC)

- To be an RPIC you must:
 - Be at least 16 years old.
 - Be able to read, speak, write, and understand English (exceptions may be made if the person is unable to meet one of these requirements for a medical reason, such as hearing impairment).
 - Be in a physical and mental condition to safely operate a small UAS.
 - Pass an initial in person aeronautical knowledge exam (all 13 topics).
 - Every two years complete an FAA recurrent knowledge course online (no charge).
 - Report permanent address changes to FAA within 30 days

Pilot and Crew Roles

- The RPIC is directly responsible and is the authority for the operation of the UAS
 - Responsible for maintaining safe separation between the sUAS and manned aircraft to avoid collisions.
 - Can only be a RPIC for one UAS at a time (unless holding a waiver)
 - Can transfer RPIC during the flight
 - Ensures all crew-members are ready for duty (ex. not impaired by drugs/alcohol)
- Visual Observers – Individual solely responsible for maintaining visual on aircraft in flight and clearing the area for hazards
 - VO's are optional (may be required when operating under waivers, authorization etc.)

Pilot and Crew Roles

- The aircraft must remain in sight of the RPIC or VO.
- Can use VO's but the RPIC must be able to regain visual.
- Cannot 'leapfrog' multiple VO's to get beyond ones VLOS.
- Pilot who does not hold a Part 107 pilot certificate may fly a commercial operation while under the direct supervision of an RPIC.

RPIC Emergency Authority

- In an emergency situation requiring immediate action, the RPIC may deviate from any rule necessary to meet the needs of the emergency and create a safe situation.
- A written report must be filed within 10 days, IF REQUESTED BY THE ADMINISTRATOR (or designee)
 - **If no report is requested, do not file one.**
- Example: Flying above the flight altitude required by Part 107 to avoid a collision with a manned aircraft is a deviation from the rule, but necessary to meet the needs of the emergency.

Demonstration of Compliance

- The RPIC, owner or person manipulating the flight controls of a UAS must make the following available upon request of an Administrator (or designee):
 - Part 107 Remote Pilot Certificate with recurrent training verification, if necessary
 - Other pertinent documents or records for that flight (authorizations, waivers
 - Allow the administrator to determine compliance by testing or inspecting the UAS, RPIC, person manipulating the controls and/or the VO.
 - Government-issued photo ID
 - Aircraft registration

Aircraft Registration

- Aircraft used in Part 107 commercial operations must be registered regardless of weight.
- Aircraft weighing less than .55lbs (including attached payload) do NOT require registration when used for rec/hobby.
- **Be careful how the FAA asks this question on the test.**
- Part 107 registration for non rec/hobby: \$5 per aircraft
- Section 44809 rec/hobby registration: \$5 unlimited aircraft
- Registrations are valid for 3 years from the end of the month it was originally issued.
- An operator of a foreign civil aircraft must hold a foreign aircraft permit issued by DOT **and** comply with applicable FAA requirements before engaging in any commercial air operations in the U.S.

Prior to Flight Requirements

- Preflight/Checklist according to manufactures specifications
 - If manufacturer does not provide a checklist, create your own
 - Add additional steps suited to your job
- Maintain the aircraft using schedule provided by manufacturer
- RPIC must ensure objects carried on the sUAS are secure.
 - Objects must not adversely affect the flight characteristics or controllability of the sUAS

Careless, Reckless, or Hazardous Operation

- Must not operate the UAS in a careless or reckless manner as to endanger life or property of another
- Shall not drop any object that would create an undue hazard to people or property unless properly secured and precautions taken
- Cannot drop hazardous materials at any time
- Yield to manned aircraft at all times 'see and avoid'
- Shall not fly in restricted airspace (TFR etc) without prior approval

Careless, Reckless, or Hazardous Operation

NTSB holds DJI Mavic 2 drone pilot responsible for collision

Accident Reporting

- Need to report the following to the FAA within 10 days for any of the following:
 - Injury which causes any person(s) loss of consciousness.
 - Injuries that are Serious, Severe, Critical or Death (hospitalization but reversible-lacerations, broken bones, head trauma)
 - Damage to property exceeds \$500 to repair or replace (do not include UAS cost)

Example: UAS pilot loses control of aircraft and strikes a parked vehicle.

- 1) Vehicle is valued at \$600 damage to it is \$200 (do not report)
- 2) Vehicle is valued at \$200 and damage to it is \$1000 to repair (do not report)
- 3) Vehicle is valued at \$10000, repair costs are over \$500 (must report)

Accident Reporting

According to 49 CFR §830.5

An immediate notification to the NTSB is required when:

An aircraft accident or any of the following incidents occur:

- Flight control system malfunction or failure
- In-flight fire
- Mid-air collision

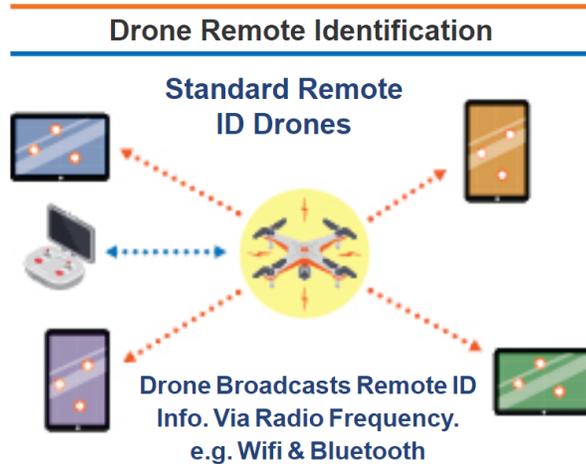


Remote ID (RID)

- Purpose
 - Provides the ability of a drone in flight to provide identification and location information that can be received by other parties (i.e. law enforcement).
 - Helps the FAA, law enforcement, and other agencies find the control station when a drone appears to be flying in an unsafe manner or where it is not allowed to fly.
 - Lays the foundation of the safety and security groundwork needed for more complex drone operations.
 - Implementation
 - New sUAS will have RID integrated into the platform
 - Older sUAS will need to install an add-on module
- Several methods of RID compliance

Remote ID (RID)

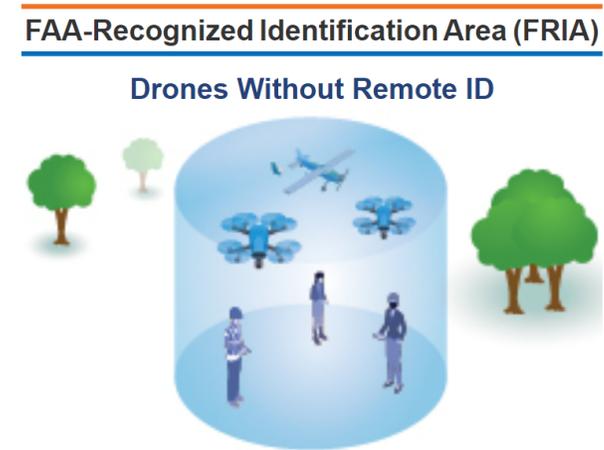
3 WAYS DRONE PILOTS CAN MEET REMOTE ID RULE



- Remote ID capability is built into the drone
- From takeoff to shutdown, drone broadcasts:
 - Drone ID
 - Drone location and altitude
 - Drone velocity
 - Control station location and elevation
 - Time mark
 - Emergency status



- Remote ID capability through module attached to drone
- Limited to visual line of sight operations
- From takeoff to shutdown, drone broadcasts:
 - Drone ID
 - Drone location and altitude
 - Drone velocity
 - Takeoff location and elevation
 - Time mark



- Drones without Remote ID can operate without broadcasting
- Drones without Remote ID must operate within visual line of sight and within the FRIA
- Anyone can fly there, but FRIAs can only be requested by community-based organizations and educational institutions

Remote ID (RID)

- RID will provide information about drones in flight such as:
 - A unique identifier for the drone;
 - The drone's latitude, longitude, geometric altitude, and velocity;
 - An indication of the latitude, longitude, and geometric altitude of control station (standard) or take-off location (broadcast module);
 - A time mark
 - Emergency status (Standard Remote ID Drone only)
- If Remote ID stops broadcasting the aircraft must return to origin and land immediately
- Make sure you have internet/data connection during preflight
- ADS-B is not a substitute for RID broadcast
- Remote ID is required for all aircraft operated under Part 107
- Recreational/Hobby RID not required under 250g
- SUAS serial number must be listed on the aircraft's Certificate of Registration



Remote ID (RID)

Implementation dates:

December 16, 2022:

- Drone manufacturers must comply with the final rule's requirements for them.

September 16, 2023:

- All drone pilots must meet the operating requirements of part 89. For most operators this will mean flying a Standard Remote ID Drone, equipping with a broadcast module, or flying at a FRIA.

March 16, 2024:

- Deadline extended to allow for purchase of broadcast module.

Operations Over People

- Special provisions effective April 21, 2021
- Can operate over crew if directly associated with the flight
- Can fly over people when under safe cover (protective structure overhang/stationary vehicle)
- FAA has 4 new Categories with compliance standards

Operations Over People - Categories

- **Category 1** – Under 250 grams / 0.55 lbs of total weight, including laceration protection if required (no exposed rotating parts), RPIC self certifies.
- **Category 2** – Weight more than .55 lbs does not have an airworthiness certificate/ Impact energy equivalent to under 11 ft-pounds of kinetic energy and laceration protection if required (no exposed rotating parts), performance base eligibility
- **Category 3** – Weight more than .55 lbs does not have an airworthiness certificate / Impact energy equivalent to under 25 ft-pounds of kinetic energy, laceration protection if required (no exposed rotating parts) and operational mitigations, performance base eligibility
- **Category 4** – Type certificate aircraft under Part 21 must have an airworthiness certificate (certification of products and parts, including the engineering, airworthiness, production and quality systems)



Operations Over People

Open air assembly may include:

sporting events, concerts, parades, protests, community festivals, or parks and beaches during certain events.

Some potential examples that might not included individual persons or families exiting a shopping center, athletes participating in friendly sports in an open area without spectators, individuals or small groups taking leisure in a park or on a beach, or individuals walking or riding a bike along a bike path.

Operations Over People

- Category 1, 2 and 4 permitted over open air assemblies if compliant with Remote ID (§ 89.110 or § 89.115(a)). This is subject to waiver.
- Category 3 operations are not permitted over an open-air assembly of persons per § 107.125(b). :The operation is within or over a closed- or restricted-access site and all people on site are on notice that a small UAS may fly over them
- Category 4 – permitted over open air assemblies if not expressly prohibited by the operating limitations in the FAA-approved Flight Manual and is compliant with Remote ID (§ 89.110 or § 89.115(a)). This is subject to waiver.

Operations Over People

Labeling

- Category 1 not required
- Category 2 & 3 Required / Category 3 labeling also serves to inform the RPIC of the operating limitations that he or she is required to observe
- Category 4 as specified in Type Certificate includes the category/categories for which the UAS is eligible to conduct operations.

Labeling must be in English, Legible, Prominent, and Permanently affixed

Flying Over/From Moving Vehicles

For Category 1, 2 or 3:

- The small unmanned aircraft must remain within or over a closed- or restricted-access site, and all people inside a moving vehicle must be on notice that a small unmanned aircraft may fly over them

Or

- The small unmanned aircraft does not maintain sustained flight over moving vehicles

For Category 4:

Permissible as long as the applicable operating limitations in the approved Flight Manual or as otherwise specified by the Administrator do not prohibit such operation.

Alcohol and Drugs

- Part 107 prohibits from being RPIC, VO or a crewmember if:
 - Consumed alcohol within preceding 8 hours
 - BAC of .04
 - Under the influence of alcohol
 - Taking or utilizing any drugs that affects mental or physical capabilities

Alcohol and Drugs

107.57 and 107.59 Offenses involving alcohol or drugs

- A conviction for the violation of any Federal or State statute relating to
 - growing, processing, manufacture, sale, disposition, possession, transportation, or importation of narcotic drugs, marijuana, or depressant or stimulant drugs or substances
 - refusal to submit to testing or furnish results to the administrator are grounds for:
 - Denial of an application for a remote pilot certificate for a period of up to one year after the date of that act; or
 - Suspension or revocation of a remote pilot certificate.

Operation in Certain Airspace

- Permitted only to fly in Class G airspace
- Can ONLY fly in Class B, C, D, E (designated airport surface area) with:
 - ATC Approval
 - Pre-arranged Authorization
 - Certificate of Authorization or Waiver (COA)
 - Low Altitude Authorization and Notification Capability (LAANC)
 - Part 107 waivers
- Cannot operate in restricted areas unless prior approval has been granted

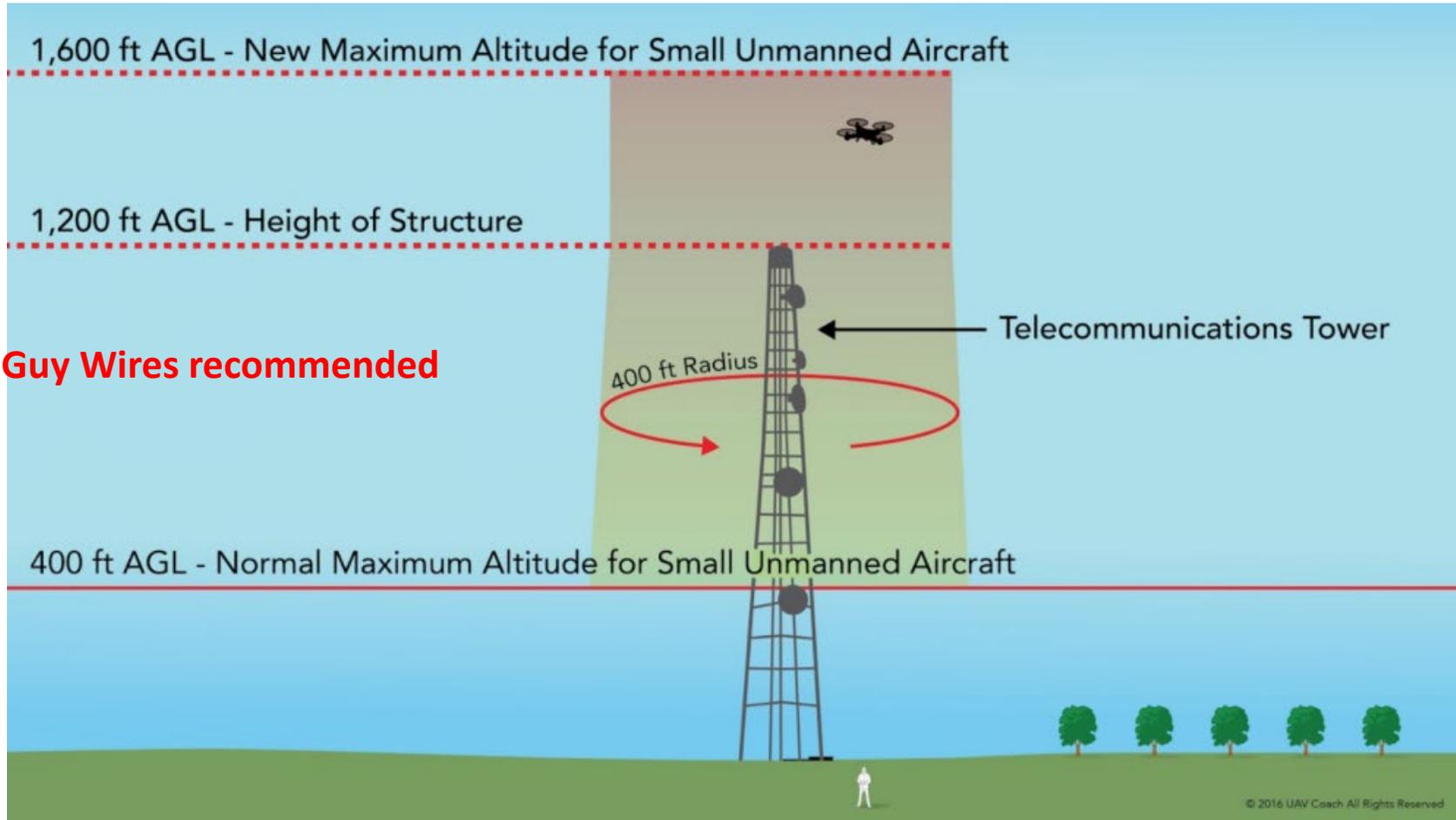
Operating Limitations

- Altitude limit of the UAS is 400' AGL above obstacles
- Ground speed cannot exceed 100 mph (87 knots)
- Minimum visibility 3SM
- Cloud clearance requirements
 - 500' below cloud / 2000' horizontally from cloud
- Can exceed 400' only if:
 - Obtain a waiver or authorization
 - Maintain within 400' of the structure
 - Do not fly higher than 400' above the structure's highest point.



Operating Limitations

1500'-2000' from Guy Wires recommended



Waivers

- Section 107.25, Operation from a moving vehicle or aircraft. However, no waiver of this provision will be issued to allow the carriage of property of another by aircraft for compensation or hire
- Section 107.31, Visual line of sight aircraft operation. However, no waiver of this provision will be issued to allow the carriage of property of another by aircraft for compensation or hire
- Section 107.33, Visual observer
- Section 107.35, Operation of multiple small unmanned aircraft systems.

End of Module Regulations Test

Break

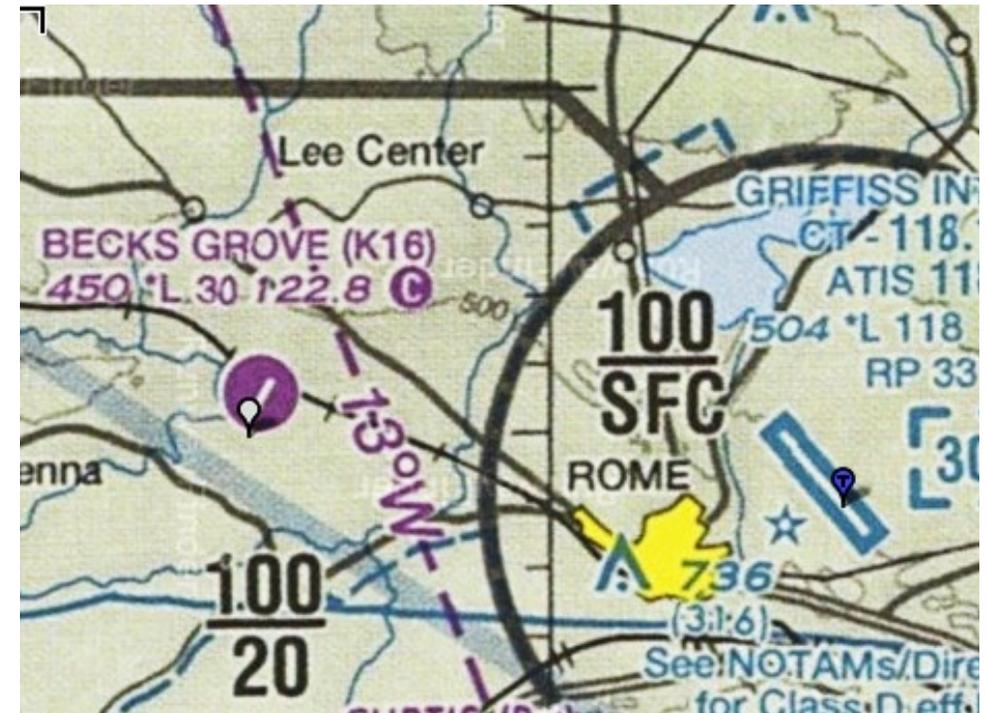
Module 3: Airport Operations

Definition of 'Airport'

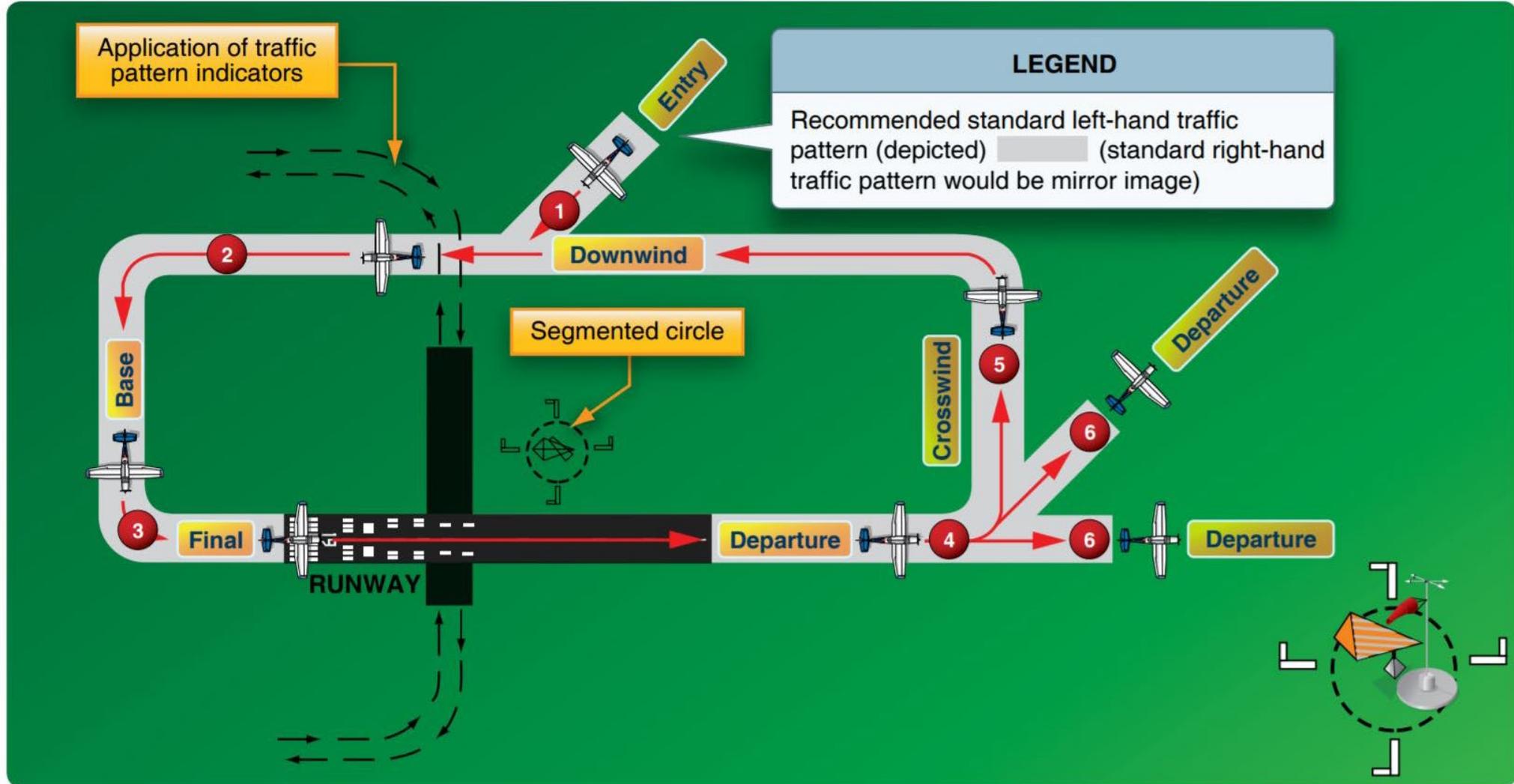
- Any area of land or water used or intended for landing or takeoff of aircraft
- Includes an area used or intended for airport buildings, facilities, as well as rights of way together with the buildings and facilities
- Consider “heliports” when mission planning

Types of Airports

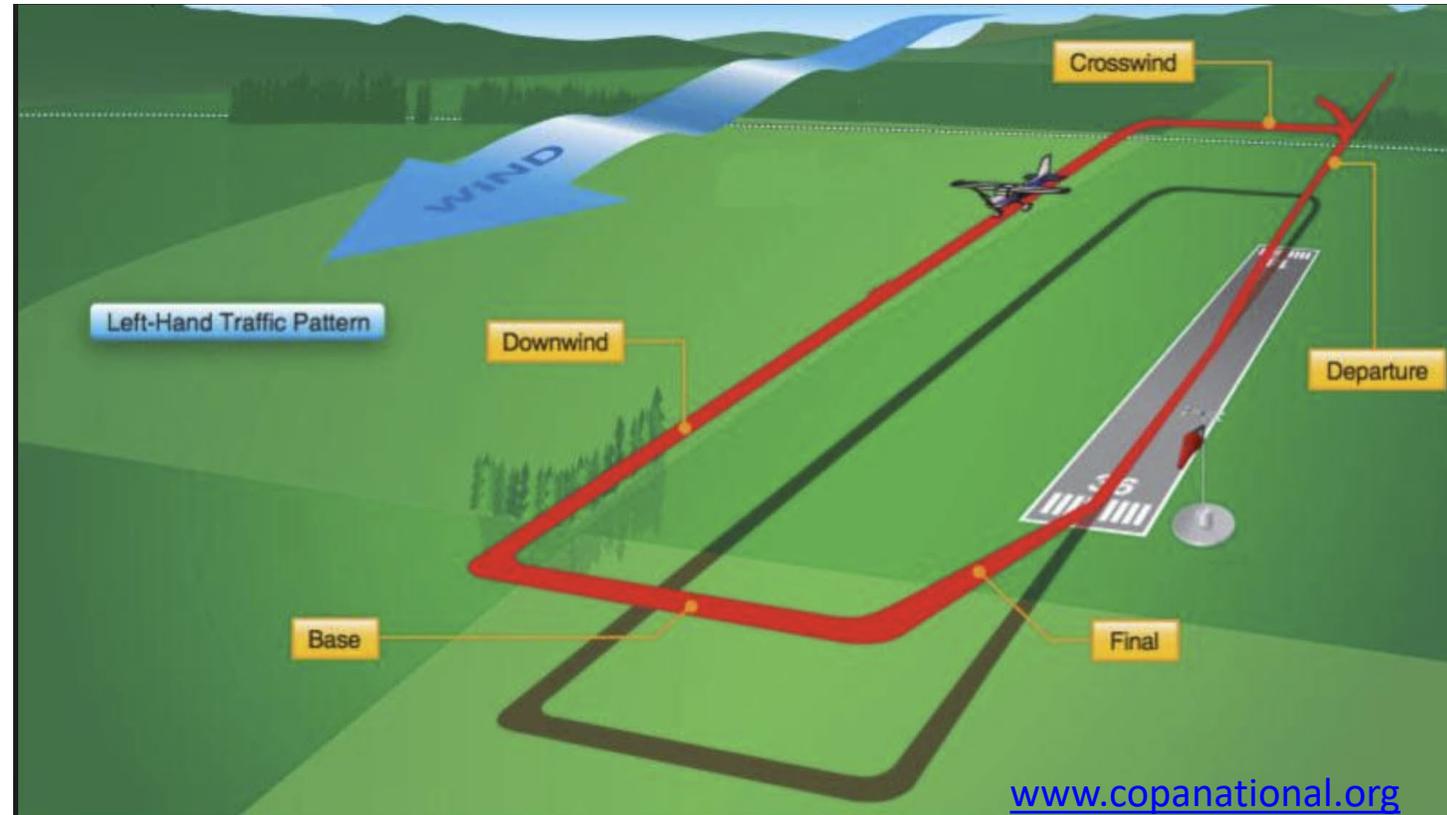
- There are two types of airports
 - Towered
 - Has a operating control tower
 - ATC is responsible for “safe and expeditious flow of traffic”
 - Traffic count must warrant this level of service.
 - Two-way radio com required
 - Non-Towered
 - No tower / two-way comm NOT required
 - UNICOM frequency - Pilots “Self Announce” position/intentions.
- Additionally categorized as
 - Civil Airports - Public Use
 - Military / Federal Government Airports
 - Military airfields, NASA ranges
 - Private Airports
 - Private / restricted – not open to public
 - Two-way radio comm NOT required



Airport Traffic Pattern



Airport Traffic Pattern



Traffic Pattern altitude 1000' AGL unless designated otherwise.

Pilots required to fly the pattern consistent with any FAA pattern established for that airport (generally to the left – but not always)

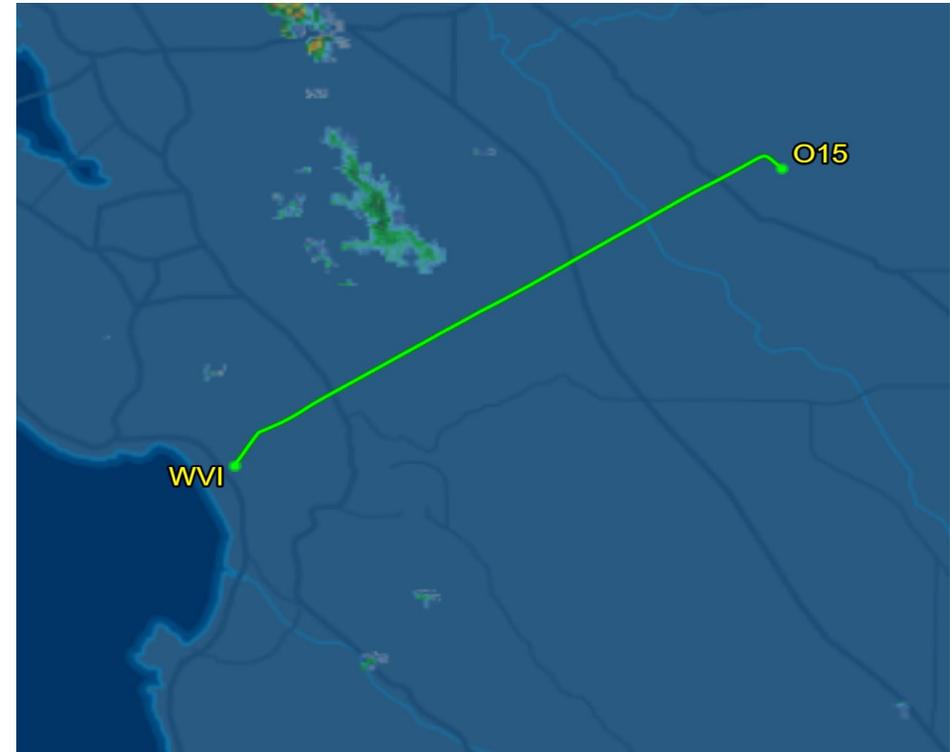
Aircraft generally takes off into the wind

Traffic Pattern Discussion

Is this preventable? (Watsonville Municipal Airport, Santa Cruz Co, California 8/18/22)



Cessna 152 (in Pattern)



Cessna 340 Twin (Direct)

Traffic Pattern Discussion

Is this preventable? (Watsonville Municiple Airport, Santa Cruz Co, California 8/18/22)

In Flight Collision



Traffic Pattern Discussion

Is this preventable? (Watsonville Muncipale Airport, Santa Cruz Co, California 8/18/22)

Aftermath



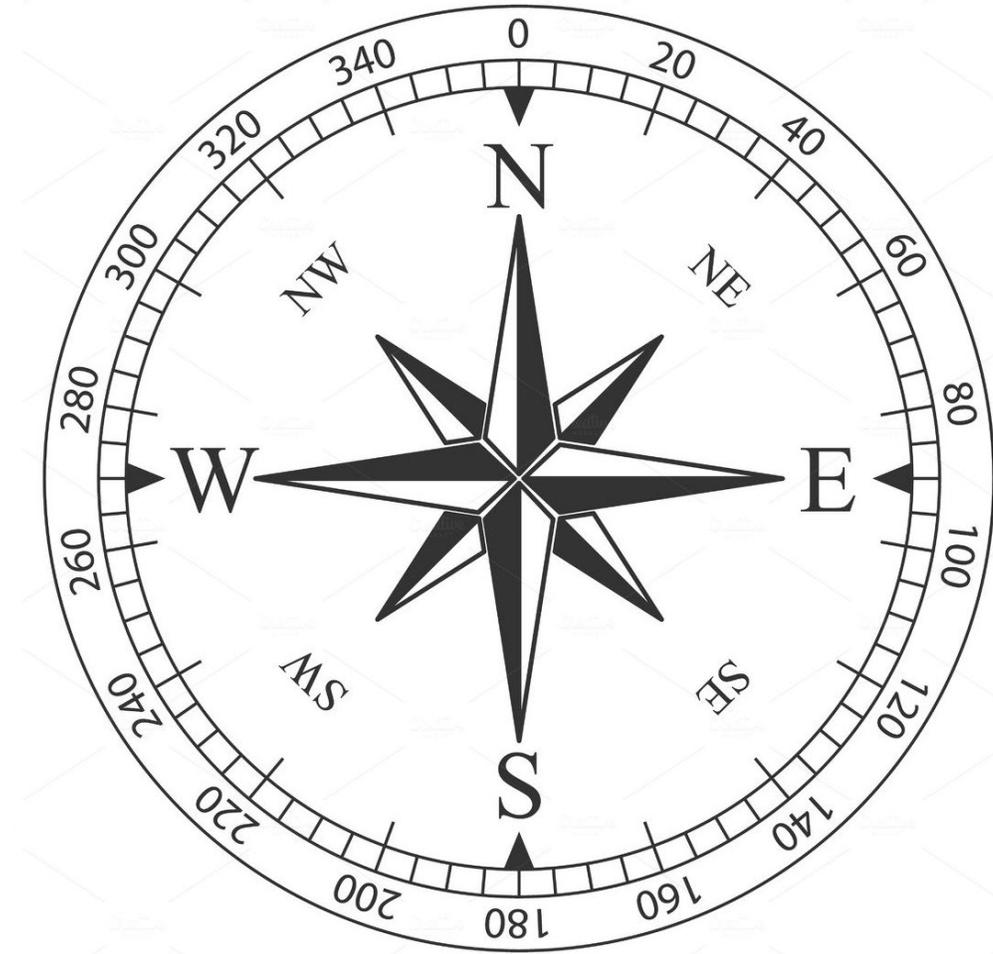
Cessna 152



Cessna 340 Twin

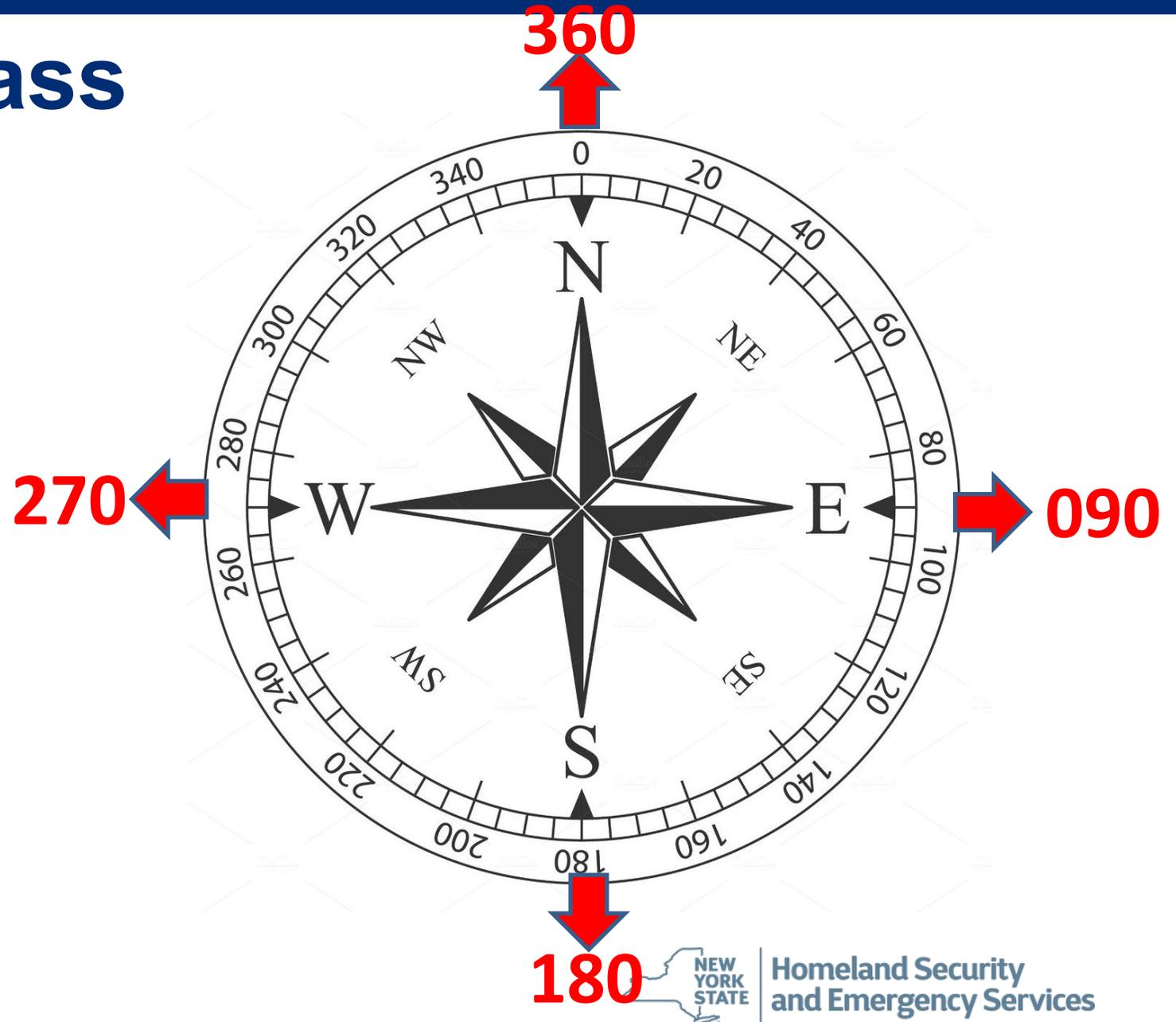
Magnetic Compass

- Tracks magnetic north, not True North
 - Magnetic North “floats as the polarization of the planet changes.
 - Currently located over northern Canada
 - True North is the North Pole (fixed location)



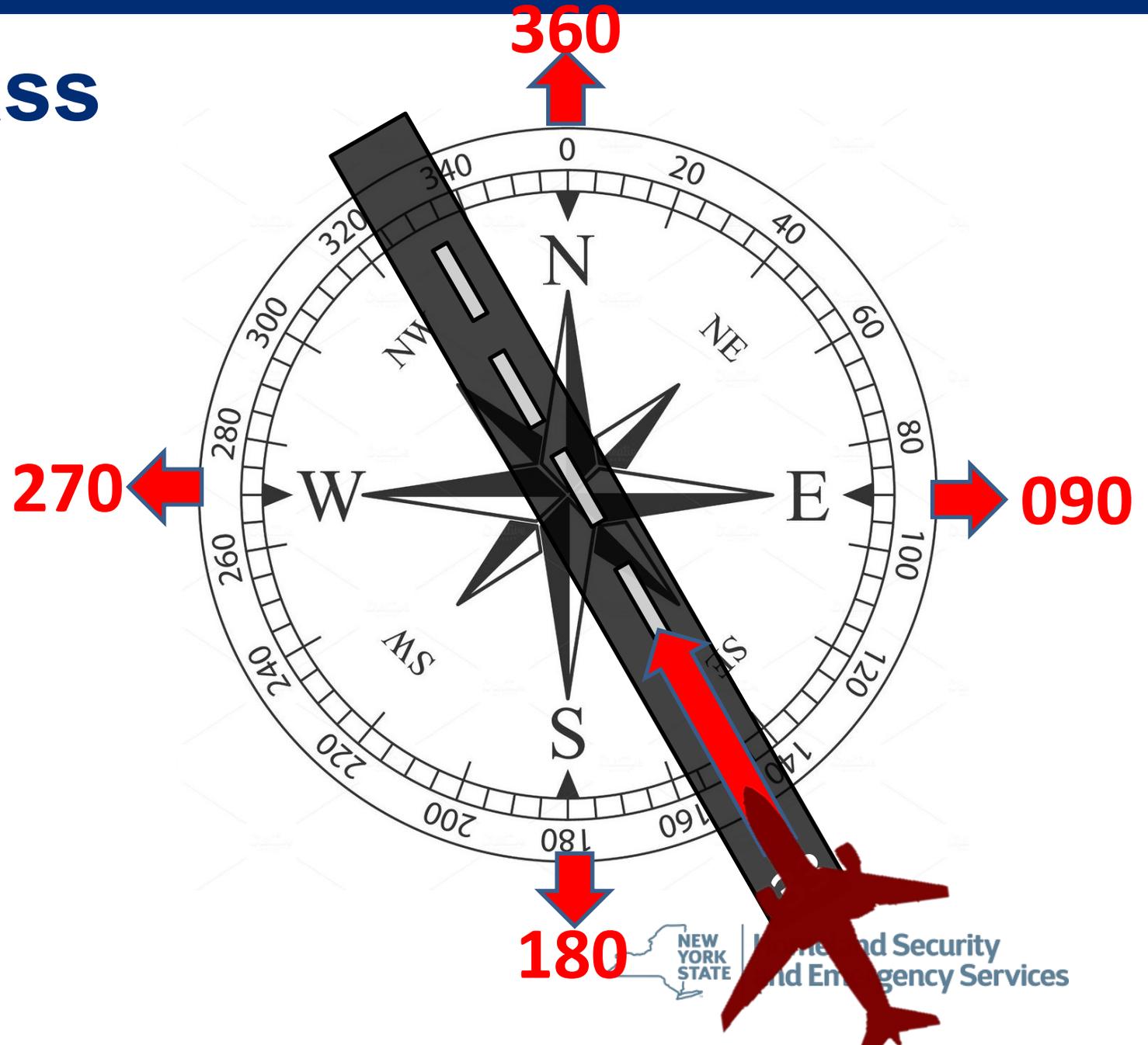
Magnetic Compass

- Headings are called out in 3 digits
 - Stated “two-seven-zero”
 - North heading is “360”



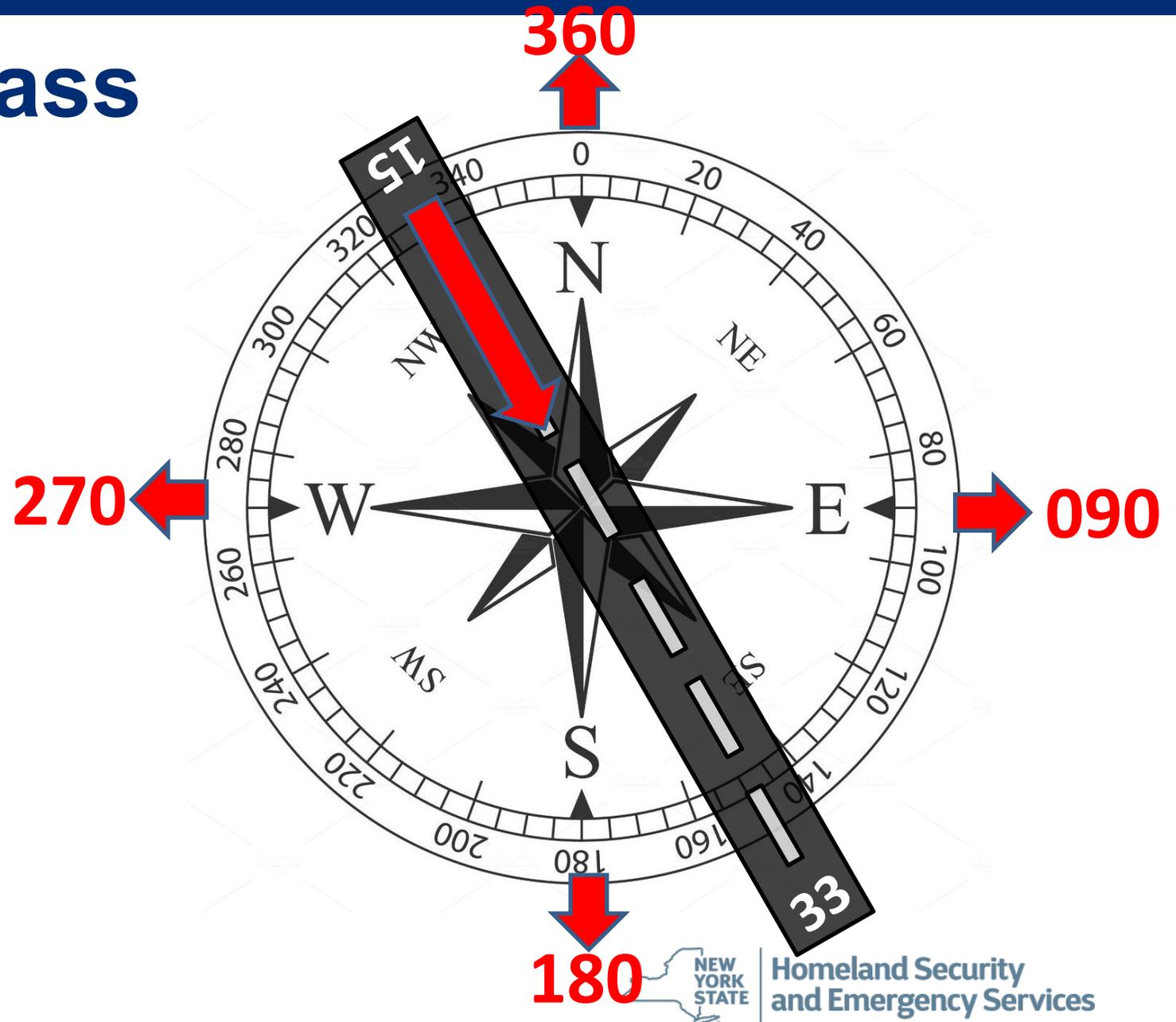
Magnetic Compass

- Runways are oriented based on magnetic heading
 - To the nearest 10 degrees
- Designated with two numbers
 - Eg. Runway 33
 - Last zero in heading is dropped



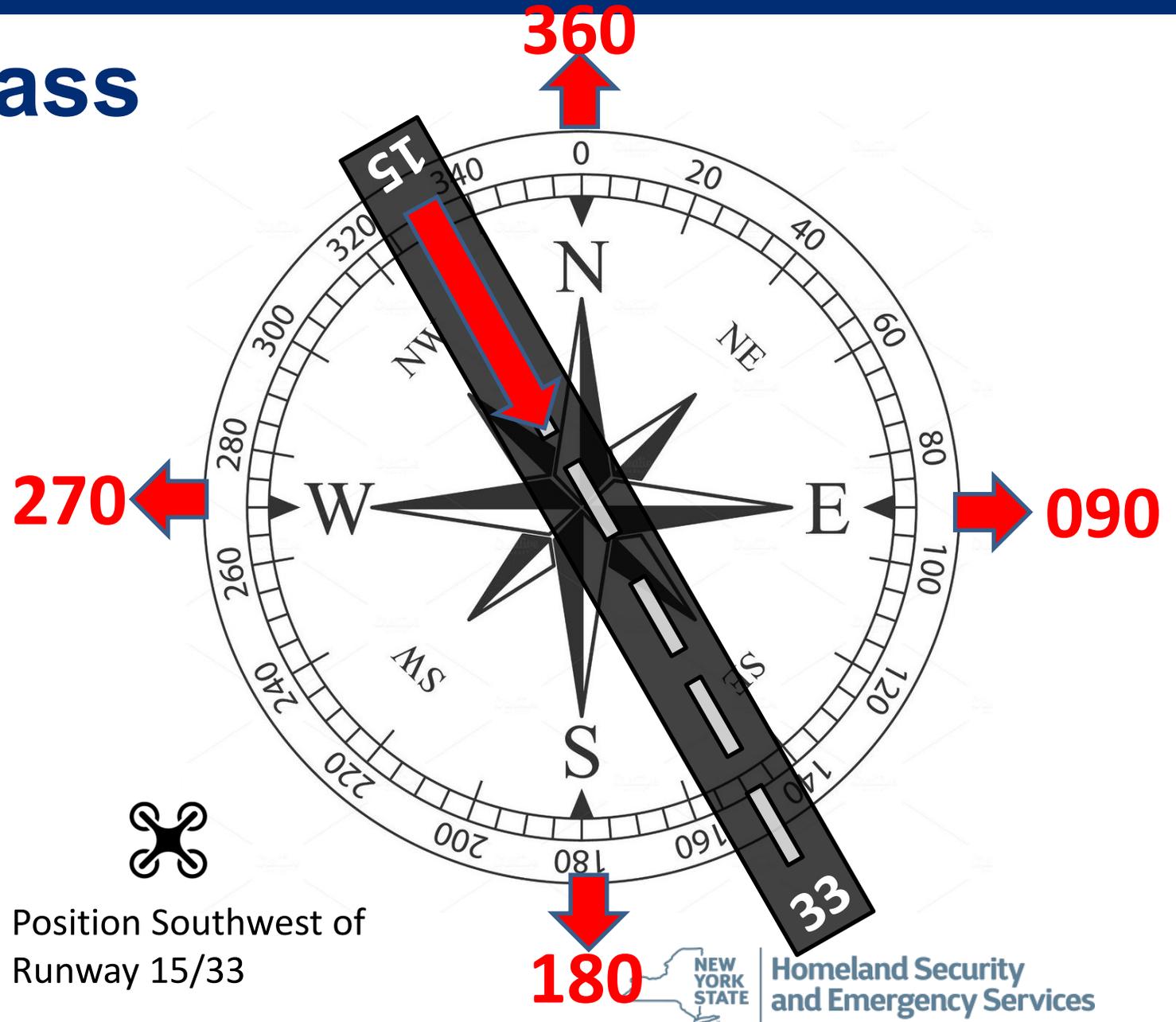
Magnetic Compass

- Opposite runways designated 180 degrees opposed
- Ex: $330-180=150$



Magnetic Compass

- Your position
 - Relative to runway
 - Indicate position and distance
 - Doesn't have to be exact



Position Southwest of Runway 15/33

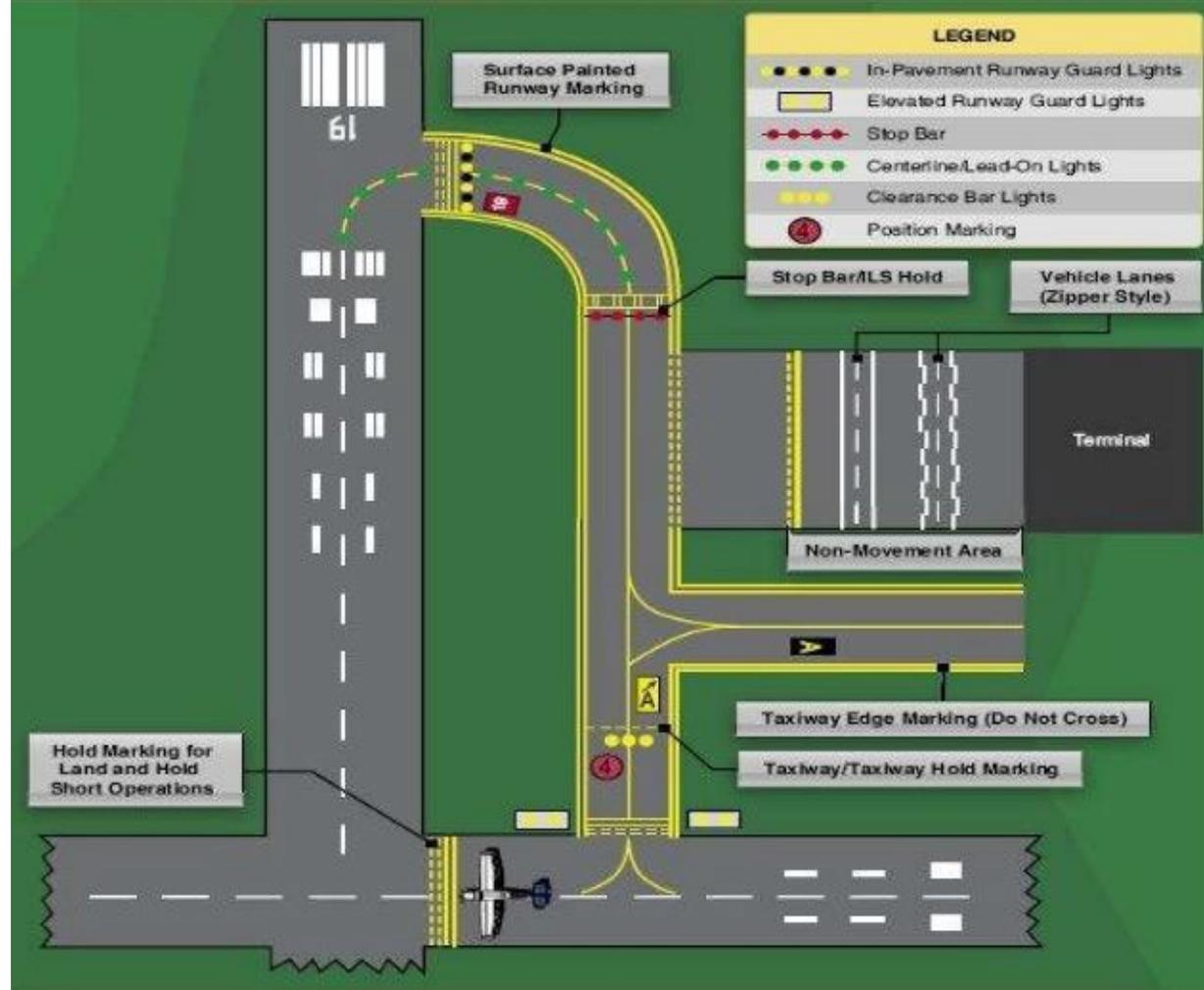
Airport Signs and Markings

<p>Taxiway/Runway Hold Position: Hold short of runway on taxiway</p>	<p>A 4-22  H</p>	<p>Runway Safety Area/Obstacle Free Zone Boundary: Exit boundary of runway protected areas</p>
<p>Runway Approach Hold Position: Hold short of aircraft on approach</p>	<p>B 4-APCH TERM → I</p>	<p>Inbound Destination: Defines directions for arriving aircraft</p>
<p>ILS Critical Area Hold Position: Hold short of ILS approach critical area</p>	<p>C ILS 22 → J</p>	<p>Outbound Runway Marker Indicates direction to an outbound runway and direction</p>
<p>No Entry: Identifies paved areas where aircraft entry is prohibited</p>	<p>D  B → K</p>	<p>Taxiway Direction: Defines direction & designation of intersecting taxiway(s)</p>
<p>Taxiway Location: Identifies taxiway on which aircraft is located</p>	<p>E B 4 L</p>	<p>Runway Distance Remaining: Provides remaining runway length in 1,000 feet increments</p>
<p>Runway Location: Identifies runway on which aircraft is located</p>	<p>F 22 HS-1 M</p>	<p>Hot Spot Area on an airport surface requiring extra vigilance</p>
<p>Runway Safety Area/Obstacle Free Zone Boundary: Exit boundary of runway protected areas</p>	<p>G   N</p>	<p>Taxiway Ending Marker: Indicates taxiway does not continue</p>

Figure 65. U.S. Airport Signs.

See Page 2-62 in Private Pilot Book

Airport Signs and Markings

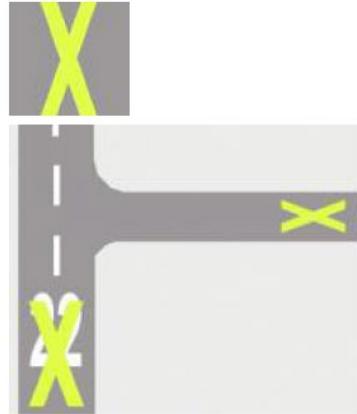


See Page 2-61 in Private Pilot Book

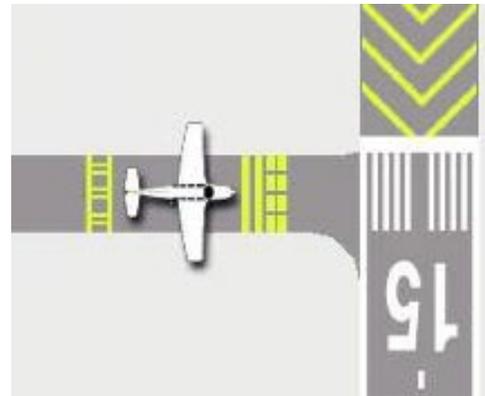


Airport Signs and Markings

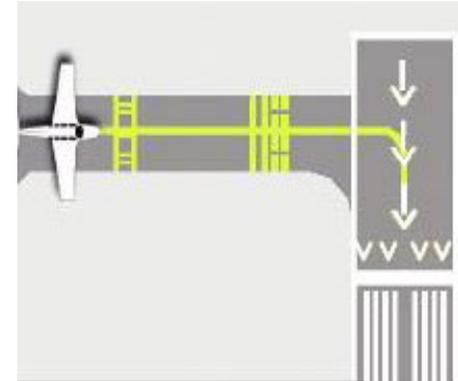
- Closed Runway
 - Not available for takeoff or landing



- Chevron Markings
 - Blast Area
 - May not taxi, takeoff or land.



- Displaced Threshold
 - Available for taxi/takeoff
 - Not available for landing



Sources for Airport Information

- When operating around the vicinity of an airport:
- Review the current data for that airport
- Data available provides the pilot with information, such as communication frequencies, services available, closed runways, or airport construction
- Four common sources of information are:
 - Aeronautical Charts
 - Chart Supplement U.S. (formerly Airport/Facility Directory)
 - Notices to Air Mission (NOTAMs)
 - Automated weather service/systems (ATIS, ASOS, AWOS)

Aeronautical Charts

- An aeronautical chart is the road map for a manned and remote pilot
- Provides information on areas where a pilot intends to operate
- The two aeronautical charts used by pilots are:
 - Sectional Chart - Most commonly used by VFR and Remote Pilots
 - Terminal Area Chart – Detailed information for Class B and C airports

Sectional Charts

- Primary navigational reference used by the pilot community revised every 56 days
- Including wealth of information airport data, navigational aids, airspace, and topography
- Legend includes ATC frequencies and information on airspace

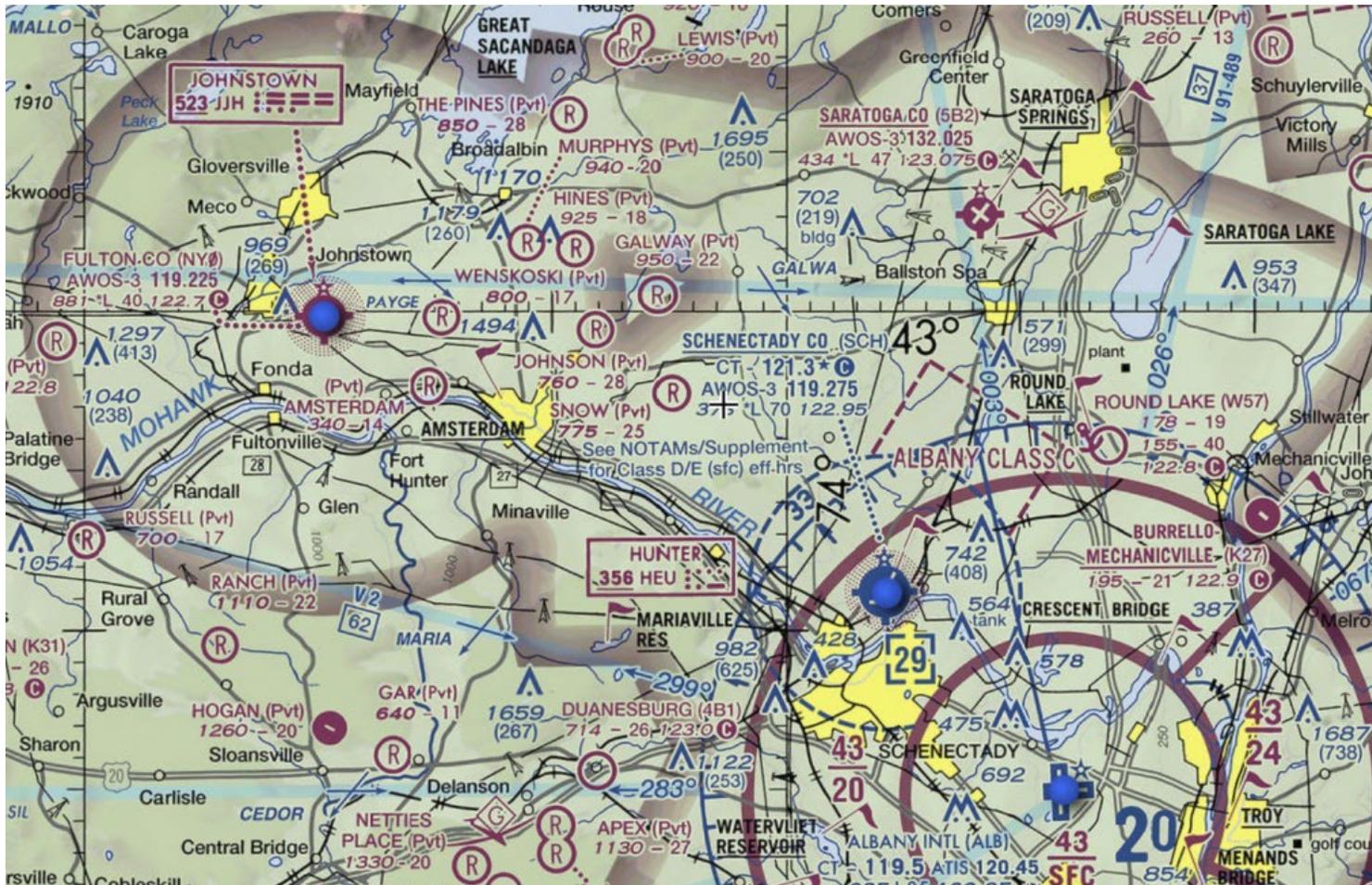


Chart Supplement

- Provides detailed supplemental information not included on sectional charts
 - Ex, Runway heading, hours of operation, obstacles, activities such as parachute jumping or hang gliding operations

SCHENECTADY CO (SCH)(KSCH) P (ANG) 3 N UTC-5(-4DT) N42°51.15' W73°55.74'

378 B LRA NOTAM FILE SCH

RWY 04-22: H7001X150 (ASPH-GRVD) S-95, D-175, 2D-348, 2D/2D2-850 HIRL 0.9% up NE

RWY 04: MALSR. PAPI(P2L)—GA 3.0° TCH 55'. Trees.

RWY 22: PAPI(P2L)—GA 3.0° TCH 50'. Trees.

RWY 10-28: H4850X150 (ASPH-GRVD) S-55, D-134, 2S-170, 2D-218, 2D/D1-430, 2D/2D2-541, C5-559 MIRL

RWY 10: PAPI(P2L)—GA 4.0° TCH 50'. Thld dsplcd 200'. Tree.

RWY 28: REIL. PAPI(P2L)—GA 3.0° TCH 50'.

SERVICE: S6 **FUEL** 100LL, JET A **OX2** **LGT** REIL Rwy 28 OTS indef. When twr clsd, ACTIVATE HIRL Rwy 04-22 and MIRL Rwy 10-28 and MALSR Rwy 04—CTAF. **MILITARY—JASU** (A/M32A-86) (MA-1A) (AM32-95) **FUEL** A+ +(Mil) (NC-100LL, A) **FLUID** SP(Mil) LOX(Mil) **OIL** O-148-156(Mil).

AIRPORT REMARKS: Attended 1230-0330Z†. 60' dropoff 150' from Rwy 28 end. Birds on and invof arpt. Noise abatement procedure in effect for large acft remaining in pattern ctc airfield manager for details. No ultra-light opr in Class D airspace without apvl from ATCT. Military C130 pattern opr conducted daily. No fld or braking action reports avbl between 0330Z† and 1230Z† daily. Ldg fee for itinerant multi-engine acft requesting twr svc 0330-1200Z†. Flight Notification Service (ADCUS) avbl.

AIRPORT MANAGER: (518) 399-0111

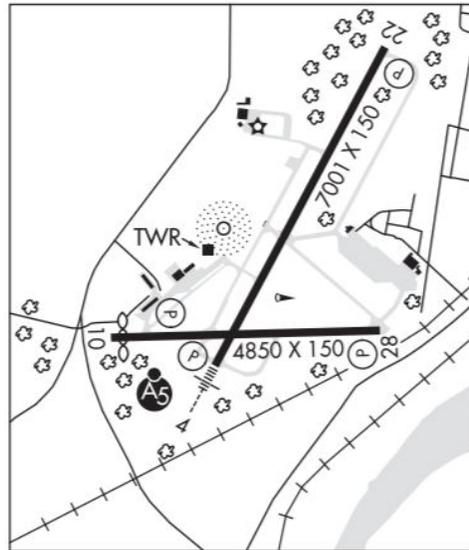
WEATHER DATA SOURCES: AWOS-3 119.275 (518) 399-6586.

COMMUNICATIONS: CTAF 121.3 UNICOM 122.95

® **ALBANY APP/DEP CON** 118.05

TOWER 121.3 (1230-0330Z†) **GND CON** 121.9

NEW YORK
H-11C, 12K, L-32G
IAP, AD



AIRSPACE: CLASS D svc 1230-0330Z† other times CLASS G.

RADIO AIDS TO NAVIGATION: NOTAM FILE ALB.

ALBANY (L) VORTACW 115.3 ALB Chan 100 N42°44.84' W73°48.19' 332° 8.4 NM to fld. 272/13W.

VOR unusable:

- 020°-059° byd 13 NM blo 6,000'
 - 060°-080°
 - 100°-135° byd 8 NM blo 10,000'
 - 120°-135° byd 37 NM blo 14,500'
 - 136°-175° byd 8 NM blo 6,000'
 - 176°-193° byd 17 NM blo 8,000'
 - 176°-193° byd 25 NM blo 12,000'
 - 194°-221° blo 6,000'
 - 194°-221° byd 28 NM blo 8,000'
 - 310°-320° byd 30 NM blo 5,000'
 - 330°-019° blo 3,000'
 - Byd 10 NM blo 6,000'
 - Byd 19 NM blo 9,000'
 - Byd 28 NM blo 10,000'
- TACAN & DME unusable:
- 030°-055° byd 10 NM
 - 155°-195° byd 28 NM blo 5,500'
 - 255°-340° byd 28 NM

HUNTER NDB (MHW) 356 HEU N42°51.25' W73°56.01' at fld. 333/14W. NOTAM FILE SCH.

ILS 109.7 I-SCH Rwy 04. Class IB. Glideslope unmonitored when twr clsd.

COMM/NAV/WEATHER REMARKS: UNICOM use 130.55 for svc from FBO.

CONTINUED ON NEXT PAGE

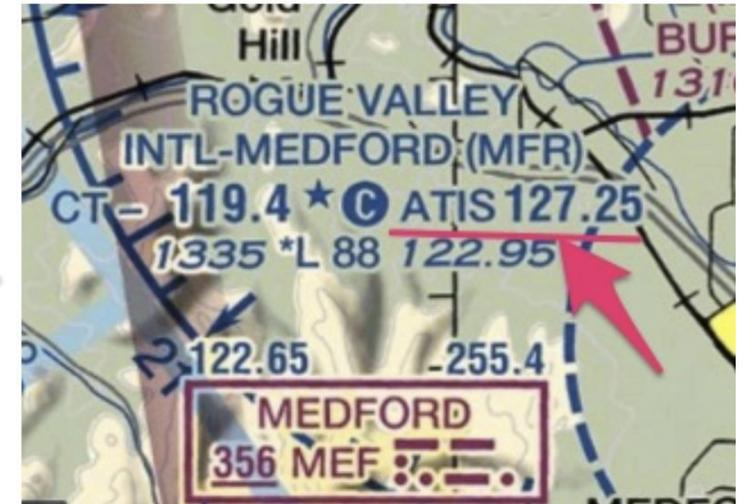
Weather Information

- Four common sources for weather and airport information
 - ATIS – Automated terminal information service
 - AWOS – Automated weather observation system
 - ASOS – Automated surface observation system
 - Provides current weather information at an airport
 - Pre-recorded on frequency
 - Flight Services – 1800-WXBrief (live briefer)
- Bottoms of clouds or “ceilings” are reported in AGL (height above ground level)

RME ATIS

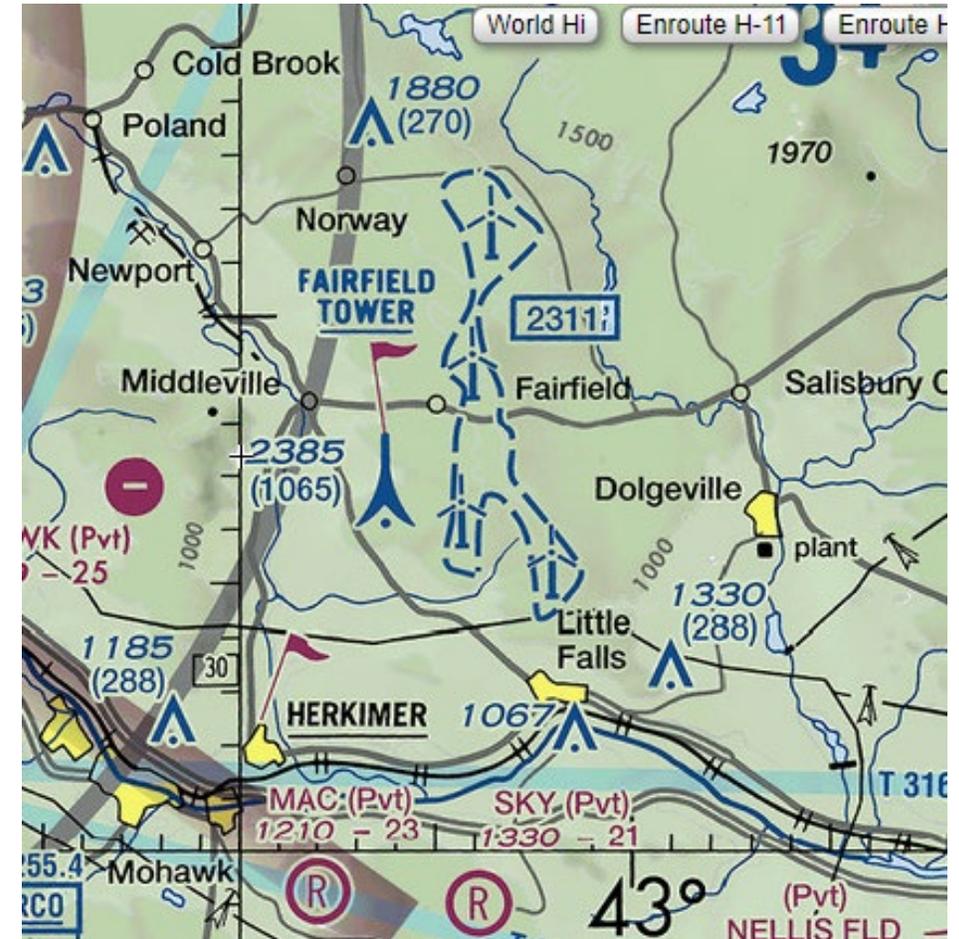


SYR AWOS



Hazards

- Radio and Antenna Towers - Antenna towers often have guy wires that can extend about 1500' – 2,000' horizontally from the structure
- Wires are often difficult to see, even more so at dusk and when there is decreased visibility
- Common hazards:
 - Power lines
 - Trees
 - Smoke stacks



End of Module Airport Operations Test

Module 4: Radio Communications

Radio Communications

- Remote pilots are required to:
 - Understand traffic patterns
 - Radio procedures
 - Aircraft phraseology
- Monitoring and understanding aviation radio communications
 - Increases situational awareness
 - Increases safety when operating in NAS
 - Pilots/ATC typically use standard phraseology
- Remote pilots are **NOT** permitted to transmit on aviation frequencies EXCEPT in emergency situations

Phonetic Alphabet

International Civil Aviation Organization (ICAO) adopted a standard phonetic alphabet for aviation

Character	Pronunciation	Character	Pronunciation
A	Alpha	S	Sierra
B	Bravo	T	Tango
C	Charlie	U	Uniform
D	Delta	V	Victor
E	Echo	W	Whiskey
F	Foxtrot	X	X-Ray
G	Golf	Y	Yankee
H	Hotel	Z	Zulu
I	India	0	Zero
J	Juliet	1	One
K	Kilo	2	Two
L	Lima	3	Three
M	Mike	4	Fo-wer
N	November	5	Five
O	Oscar	6	Six
P	Papa	7	Seven
Q	Quebec	8	Ait
R	Romeo	9	Niner



Aircraft to Ground Communications

- Tower
 - Manned tower controller
 - Provides traffic separation and clearance for takeoffs and landings
 - Traffic operation count sufficient to require operating tower
 - May have operating hours (see chart supplement for hours of operation)
- CTAF – Common Traffic Advisory Frequency
 - Allows pilots to communicate “ship-to-ship”
 - Pilots self-announce position calls and intentions
- UNICOM
 - Open frequency for non-flying/taxiing operations
 - Generally used by fixed base operators (FBO)



Frequencies

- Always refer to the sectional charts or chart supplement to identify local airports/airfields
- UNICOM – often 122.8 and found used at most non towered airports

NAME (NAM) (F)
 118.3 * **UNICOM**
 285 L 72 122.95

- Control Tower (CT)

CT - 118.3

- CTAF – Common Traffic Advisory Freq

UNICOM
 122.8



Figure 20

Aircraft Identification

- Each aircraft has a N number assigned to it
 - example: N2112X
- Often the N is replaced by the Manufacture or model of aircraft
 - example “Cessna 2112X....”
- Larger aircraft often utilize flight number instead of the N number
 - example United Airlines 2112....



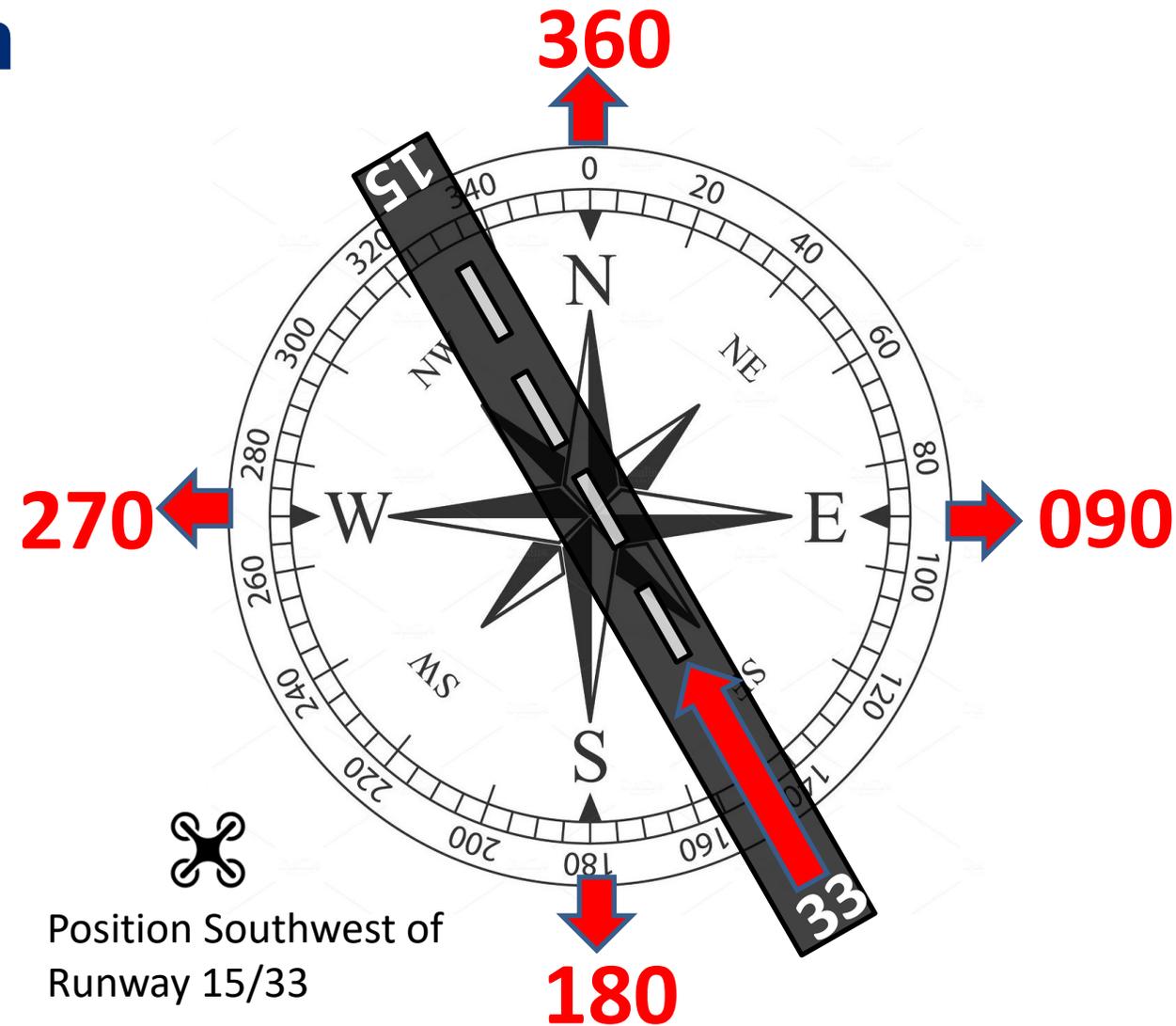
Aircraft approaching Airport

- Initial announcement/contact is typically 10 miles out
 - Broadcast aircraft ID, Intended airport, position, intentions
 - Example manned aircraft approaching non-towered airport:
“Pine Planes traffic, Cessna 2112 x-ray 10 miles north inbound landing, Pine Planes Traffic”
- Aircraft Reporting altitude – is stated to ATC - 10,500 feet MSL
“ONE ZERO THOUSAND, FIVE HUNDRED”
- Often next call will be identifying entering downwind leg and runway selection.
- Follow up communications will call the base & runway and final & runway
- Inbound to an airport with no tower, FSS or UNICOM in operation, a pilot should self-announce on MULTICOM frequency



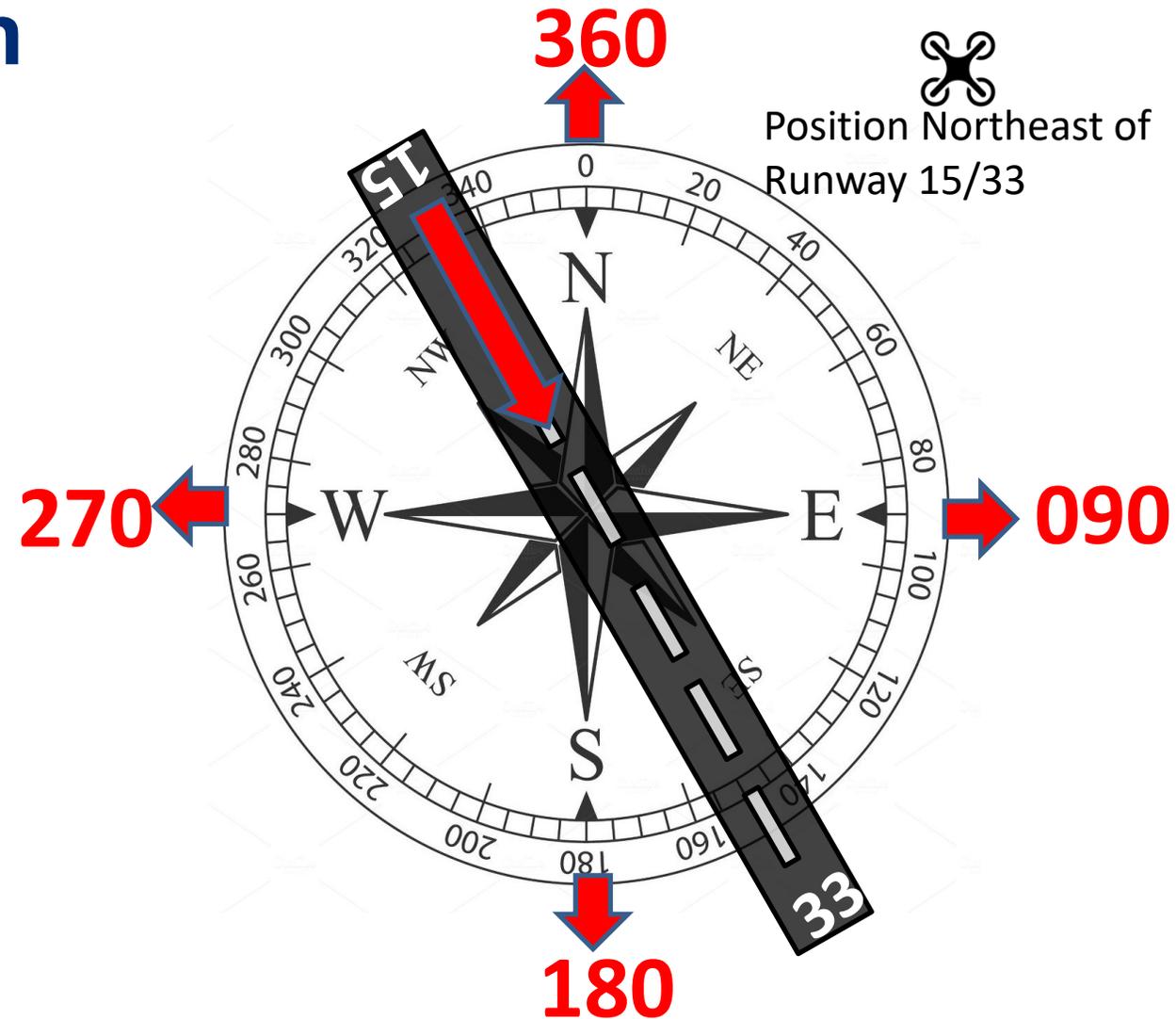
Determine Aircraft Location

- If you hear, while monitoring a non-towered airport CTAF frequency, “White Cessna turning left base Runway 33 - Brookhaven.”
- Where should you be looking for the aircraft in relation to the pattern?



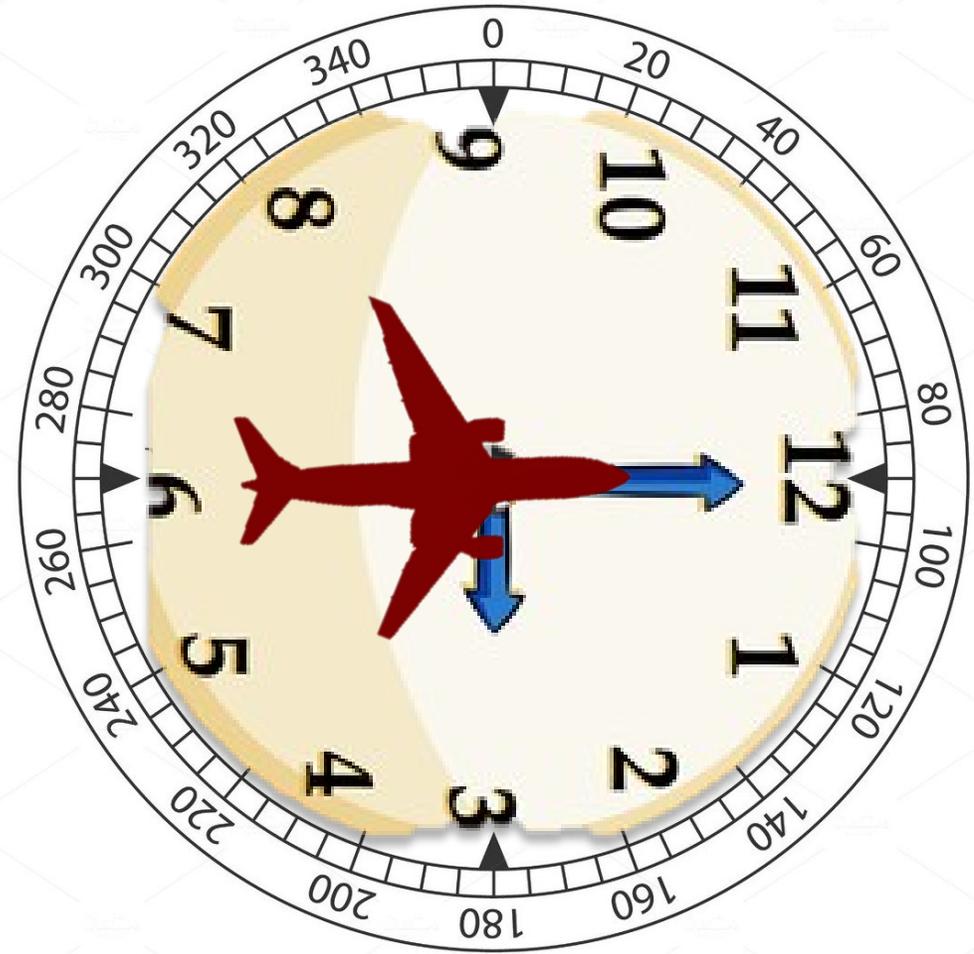
Determine Aircraft Location

- If you hear, while monitoring a non-towered airport CTAF frequency, “White Bonanza is entering left downwind 15 - Brookhaven.”
- Where is the plane in relation to the airport, North, South, East, West side of the airport?



Traffic Calls

- Aircraft clock position
 - 12 o'clock is always in front of the aircraft
- Ex: ATC calls "Traffic 3 o'clock 2 miles"
 - Traffic is south



Radio Procedure Safety Considerations

- Not mandatory that all manned aircraft use radios
- Always carefully scan around entire flight area
- Monitor aircraft frequencies for increased situational awareness
- Some aircraft do not follow 'standard' procedures
- May not hear all the communications on your handheld
 - VHF is line of sight
 - Trees and buildings could block transmissions



End of Module Radio Communications Test

Lunch

Module 5: Airspace Classification

Airspace Classification



Air Traffic Control and NAS

- The primary purpose of the ATC system is to prevent a collision between aircraft operating in the system and to organize and expedite the flow of traffic. In addition to its primary function, the ATC system has the capability to provide (with certain limitations) additional services
- The safety of flight is a top priority of all pilots and the responsibilities associated with operating an aircraft should always be taken seriously
- Classification of airspace largely depends on what goes on inside it.
 - 'Ceiling' is the top of the airspace
 - 'Floor' is the bottom of the airspace

Airspace Classification

- Class A - begins at 18,000 MSL (commercial flights/military/airliners)
- Class B - Larger towered airports, solid blue, (typically surface to 10,000 airport elev) Towered (LaGuardia, JFK, etc)
- Class C - Midsize towered airports, solid magenta, (typically surface to 4000' airport elev) Towered, Radar, IFR approaches (Albany, Syracuse etc.)

Airspace Classification

- Class D - Smaller towered airport, dashed blue, (typically surface to 2500' airport elev) Towered, IFR approaches turns to E if tower closes (Sch'dy, Rome etc)
- Class E – Shaded magenta (starts at 700' AGL inside, 1200' AGL outside)
- Class F – Not used in the United States
- Class E 'surface area' – Around smaller non towered airports, dashed magenta, that may IFR approaches. (Chautaugua ,Glens Falls)
- Class G – General, where most of your flying will occur

Airspace Classification

Class B - Larger towered airports, solid blue

- Located in big cities
- Lots of rules
- Most traffic larger, faster aircraft



Airspace Classification

Class C - Midsize towered airports, solid magenta

- Located in mid-sized cities
- Mix of large/small or fast/slow aircraft



Airspace Classification

Class D - Smaller towered airport, segmented blue

- Municipal airports located in smaller communities
- Mostly smaller aircraft
- Enough traffic to justify a tower controller



See Page 2-68 in
Private Pilot Book

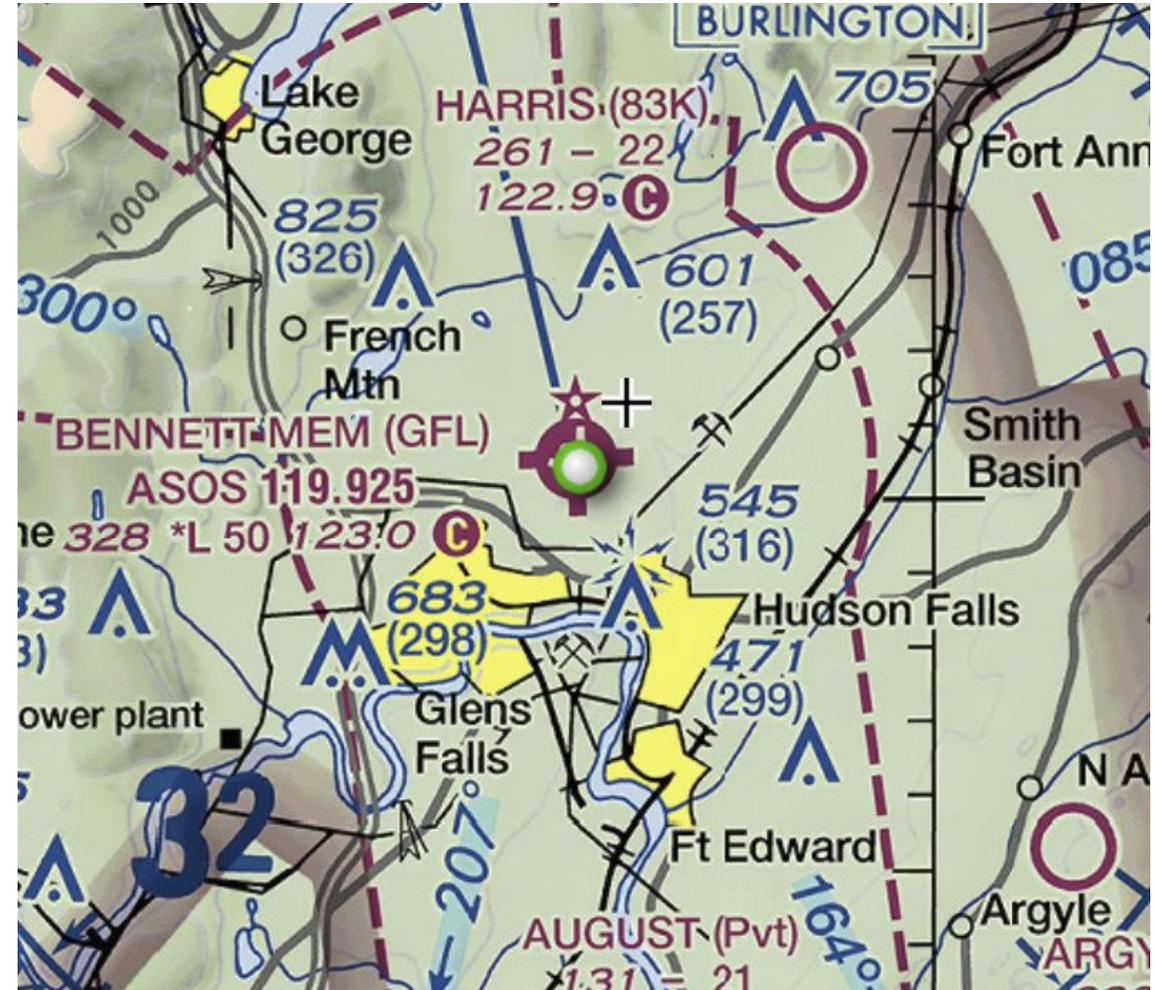


Homeland Security
and Emergency Services

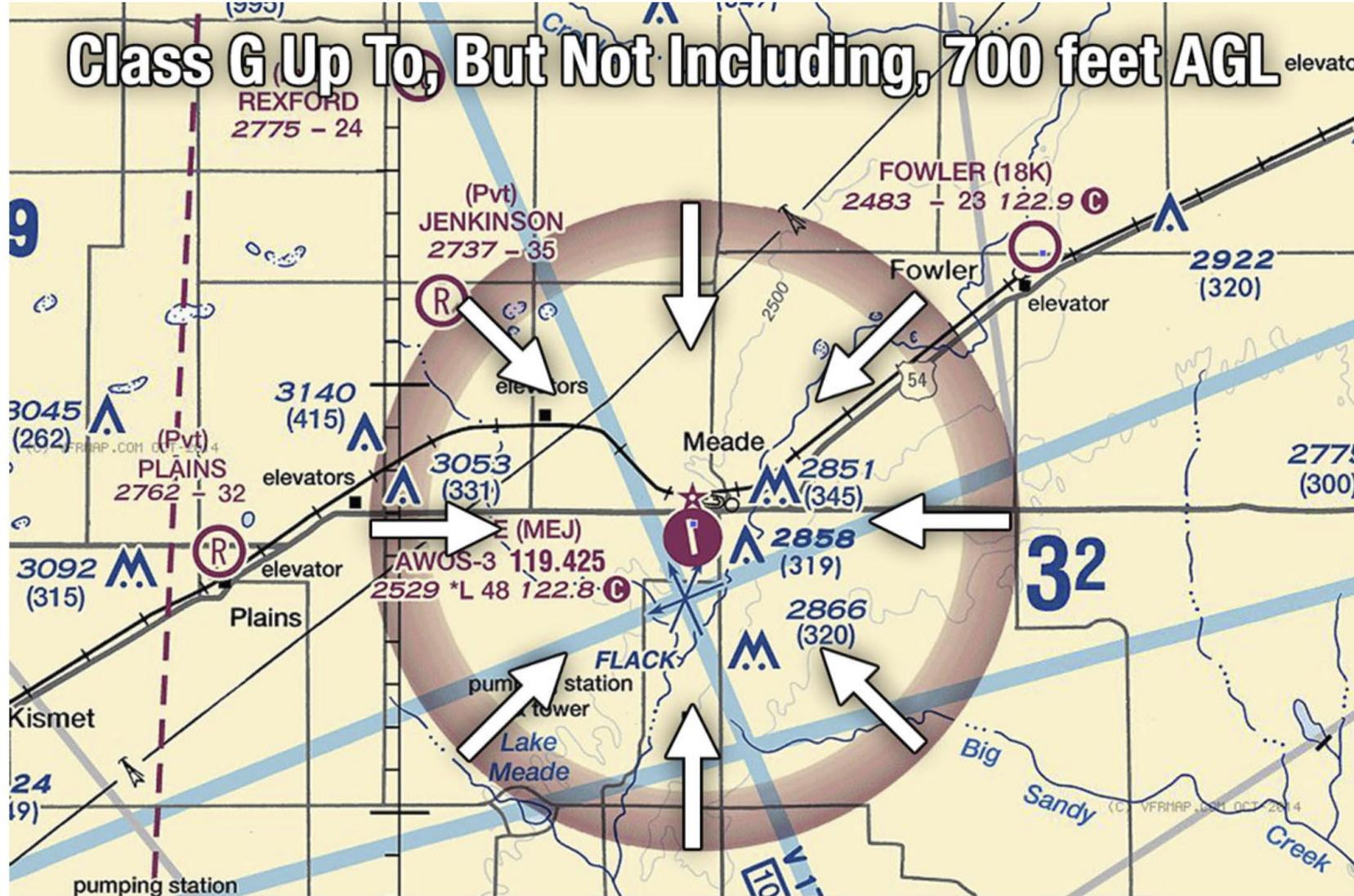
Airspace Classification

Class E 'surface area' – Around smaller non towered airports, dashed magenta

- Mostly small aircraft
- Not enough traffic to justify control tower
- Less stringent weather and equipment requirements



Airspace Classification



Operations around Airports

- If in G airspace - no contact is needed
- If in B, C, D or E (surface) airspace – prior FAA ATC approval or required (FAA Dronezone)
- Extreme caution should be used when operating around any airfield:
 - Understand the traffic patterns, especially approach and departure
 - Helicopters often operate at lower altitudes
 - Geofencing may prevent prop startup within +/- 1.5 miles of the center of the airport
 - Always yield to manned aircraft even if they are on the ground at an airport
 - PIC is prohibited from operating the sUAS in a manner disrupting aircraft operations

See Page 1-1 in Private Pilot Book

SECTIONAL AERONAUTICAL CHART

SCALE 1:500,000

LEGEND Airports having Control Towers are shown in Blue, all others in Magenta. Consult Airport/Facility Directory (A/FD) for details involving airport lighting, navigation aids, and services. For additional symbol information refer to the Chart User's Guide.

AIRPORTS

- Other than hard-surfaced runways
- Hard-surfaced runways 1500 ft. to 8069 ft. in length
- Hard-surfaced runways greater than 8069 ft., or same multiple runways less than 8069 ft.
- Open dot within hard-surfaced runway configuration indicates approximate VOR, VOR-DME, or VORTAC location.

All recognizable hard-surfaced runways, including those closed, are shown for visual identification. Airports may be public or private.

ADDITIONAL AIRPORT INFORMATION

- Private (Pvt) - Nos-public use having emergency or landmark value.
- Military - Other than hard-surfaced. All military airports are identified by abbreviations AFB, NAS, AAF, etc. For complete airport information consult DOD FLIP.
- Heliport Selected
- Unverfield
- Abandoned-paved, having landmark value, 3000 ft. or greater
- Ultralight Flight Park Selected

Services—fuel available and field attended during normal working hours depicted by use of ticks around basic airport symbol. (Normal working hours are Mon thru Fri 10:00 A.M. to 4:00 P.M. local time. Consult A/FD for service availability at airports with hard-surfaced runways greater than 8069 ft.)

★ Rotating airport beacon in operation Sunset to Sunrise

AIRPORT DATA

Box indicators FAR 93 Special Air Traffic Rules & Airport Traffic Patterns

FSS NO SVFR

FAR 91 Location Identifier

NAME (NAM) (PNAM)

CT - 118.3 * ATIS 123.8

285 L 72 122.95

RP 23, 34

VFR Advy 125.0

AOE

UNICOM

ICAO Location Identifier shown outside contiguous U.S.

Airport of Entry

FSS - Flight Service Station
NO SVFR - Fixed wing special VFR flight is prohibited.
CT - 118.3 - Control Tower (CT) primary frequency
* - Star indicates operation part-time (see tower frequencies) tabulation for hours of operation.
Ⓢ - Indicates Common Traffic Advisory Frequencies (CTAF)
ATIS 123.8 - Automatic Terminal Information Service
ASOS/AWOS 135.42 - Automated Surface Weather Observing Systems (shown where full-time ATIS is not available). Some ASOS/AWOS facilities may not be located at airports.
UNICOM - Aeronautical advisory station
VFR Advy - VFR Advisory Service shown where full-time ATIS not available and frequency is other than primary CT frequency.

285 - Elevation in feet
L - Lighting in operation sunset to sunrise
+L - Lighting limitations exist, refer to Airport/Facility Directory.
72 - Length of longest runway in hundreds of feet; usable length may be less.

When information is lacking, the respective character is replaced by a dash. Lighting codes refer to runway edge lights and may not represent the longest runway or full length lighting.

AIRPORT TRAFFIC SERVICE AND AIRSPACE INFORMATION

Only the controlled and reserved airspace effective below 18,000 ft. MSL are shown on this chart. All times are local.

- Class B Airspace
- Class C Airspace (mode C See FAR 91.215(AIM.))
- Class D Airspace
- Class E (sfc) Airspace
- Class E Airspace with floor 700 ft. above surface.
- Class E Airspace with floor 1200 ft. or greater above surface that abuts Class G Airspace.

40 - Ceiling of Class D Airspace in hundreds of feet. (A minus ceiling value indicates surface up to but not including that value).

2400 MSL Differentiates floors of Class E Airspace greater than 700 ft. above surface.
4500 MSL Class E Airspace exists at 1200' AGL unless otherwise designated as shown above. Class E Airspace low altitude Federal Airways are indicated by center line. Intersection - Arrows are directed towards facilities which establish intersection.

132° V 69
Total mileage 169
Class E Airspace low altitude RNAV routes are indicated by center line.

T319 TK313 (helicopter only) RNAV waypoint

AIRPORT TRAFFIC SERVICE AND AIRSPACE INFORMATION (continued)

- Prohibited, Restricted, and Warning Areas; Canadian Advisory, Danger, and Restricted Areas.
- Alert Area and MOA - Military Operations Area
- Special Airport Traffic Area (See FAR Part 93 for details)
- ADIZ - Air Defense Identification Zone
- Mode C (See FAR 91.215(AIM.))
- National Security Area
- Terminal Radar Service Area (TRSA)
- MTR - Military Training Route

MISCELLANEOUS

- 1° E - Isogonic Line (2010 VALUE)
- Ultralight Activity
- Hang Glider Activity
- Glider Operations
- Unmanned Aircraft Activity
- Parachute Jumping Area (See Airport/Facility Directory).
- Marine Light
- VFR Waypoints (See Airport/Facility Directory for latitude/longitude).

TOPOGRAPHIC INFORMATION

- Roads & Road Markers
- Railroad
- Power Transmission Lines
- Aerial Cable
- Landmark Feature - stadium, factory, school, golf course, etc.
- Outdoor Theatre
- Lookout Tower 618 (Elevation Base of Tower)
- CG Coast Guard Station
- Race Track
- Tank-water, oil or gas
- Oil Well Water Well
- Mine or Quarry
- Mountain Pass 11823 (Elevation of Pass)

(Pass symbol does not indicate a recommended route or direction of flight and pass elevation does not indicate a recommended clearance altitude. Hazardous flight conditions may exist within and near mountain passes.)

Perennial Lake
Non-Perennial Lake
Dams
Pier
Rocks
Bridges and Viaducts

RADIO AIDS TO NAVIGATION

- VHF OMNI RANGE (VOR)
- VORTAC
- VOR-DME
- Non-Directional Radiobeacon (NDB)
- NDB-DME
- Other facilities. i.e., FSS Outlet, RCO, etc.

COMMUNICATION BOXES

122.1R 122.6 123.6

OAKDALE OAK

382 * HIWAS

122.1R CHICAGO CHI

Heavy line box indicates Flight Service Station (FSS). Frequencies 121.5, 122.2, 243.0 and 255.4 (Canada - 121.5, 126.7 and 243.0) are available at many FSSs and are not shown above boxes. All other frequencies are shown.

Certain FSSs provide Airport Advisory Service, see A/FD.
R - Receive Only.

Frequencies above this line box are removed to NAVAID site. Other FSS frequencies providing voice communication may be available as determined by altitude and terrain. Consult Airport/Facility Directory for complete information.

Underline indicates no voice on this frequency.
Crosshatch indicates Shutdown Status
* Operates less than continuous or On-Request.
ASOS/AWOS
A HIWAS
FSS radio providing voice communication

OBSTRUCTIONS

- 1000 ft. and higher AGL
- below 1000 ft. AGL
- Group Obstruction
- Obstruction with high-intensity lights May operate part-time
- Elevation of the top above mean sea level
- 2049 Height above ground (1149) Under construction or reported; position and elevation unverified.

NOTICE: Guy wires may extend outward from structures.

OBSTRUCTIONS (continued)

NAME (VPXYZ)

UAS – Sectional Chart Legend

AIRPORTS	AIRPORT DATA
  <p>Other than hard-surfaced runways</p>  <p>Seaplane Base</p>	<p>Box indicators FAR 93 Special Air Traffic Rules & Airport Traffic Patterns</p> <p>FSS NO SVFR</p> <p>FAR 91 Location identifier</p> <p>NAME (NAM)(PNAM)</p> <p>CT - 118.3 * ATIS 123.8</p> <p>285 L 72 122.95</p> <p>RP 23, 34</p> <p>VFR Advsy 125.0</p> <p>AOE</p> <p>UNICOM</p> <p>ICAO Location indicator shown outside contiguous U.S.</p> <p>Runways with Right Traffic Patterns (public use) RP Special conditions exist - see Chart Supplement</p> <p>Airport of Entry</p>
  <p>Hard-surfaced runways 1500 ft. to 8069 ft. in length</p>   <p>Hard-surfaced runways greater than 8069 ft., or same multiple runways less than 8069 ft.</p>   <p>Open dot within hard-surfaced runway configuration indicates approximate VOR, VOR-DME, or VORTAC location.</p> <p>All recognizable hard-surfaced runways, including those closed, are shown for visual identification. Airports may be public or private.</p>	
<h3>ADDITIONAL AIRPORT INFORMATION</h3>	
 <p>Restricted or Private – (Soft surfaced runway, or hard surfaced runway less than 1500' in length.) Use only in emergency, or by specific authorization.</p>	<p>FSS – Flight Service Station NO SVFR – Fixed wing special VFR flight is prohibited. CT- 118.3 – Control Tower (CT) primary frequency * – Star indicates operation part-time (see tower frequencies tabulation for hours of operation). Ⓢ – Indicates Common Traffic Advisory Frequencies (CTAF) ATIS 123.8 – Automatic Terminal Information Service ASOS/AWOS 135.42 – Automated Surface Weather Observing Systems (shown where full-time ATIS is not available). Some ASOS/AWOS facilities may not be located at airports. UNICOM – Aeronautical advisory station VFR Advsy – VFR Advisory Service shown where full-time ATIS not available and frequency is other than primary CT frequency.</p> <p>285 – Elevation in feet L – Lighting in operation sunset to sunrise *L – Lighting limitations exist, refer to Airport/Facility Directory. 72 – Length of longest runway in hundreds of feet; usable length may be less.</p> <p>When information is lacking, the respective character is replaced by a dash. Lighting codes refer to runway edge lights and may not represent the longest runway or full length lighting.</p>
  <p>Military – Other than hard-surfaced. All military airports are identified by abbreviations AFB, NAS, AAF, etc. For complete airport information, consult DOD FLIP.</p>	
 <p>Heliport Selected</p>  <p>Unverified</p>  <p>Abandoned—paved, having landmark value, 3000 ft. or greater</p>  <p>Ultralight Flight Park Selected</p>	
   <p>Services—fuel available and field attended during normal working hours depicted by use of ticks around basic airport symbol. (Normal working hours are Mon thru Fri 10:00 A.M. to 4:00 P.M. local time. Consult Chart Supplement for service availability at airports with hard-surfaced runways greater than 8069 ft.</p> <p>★ Rotating airport beacon in operation Sunset to Sunrise</p>	

COMMUNICATION BOXES



- Underline indicates no voice on frequency.
- //// - Crosshatch indicates Shutdown status.
- ★ - Operates less than continuous or On-Request.
- A** - ASOS/AWOS
- H** - HIWAS
- T** - TWEB

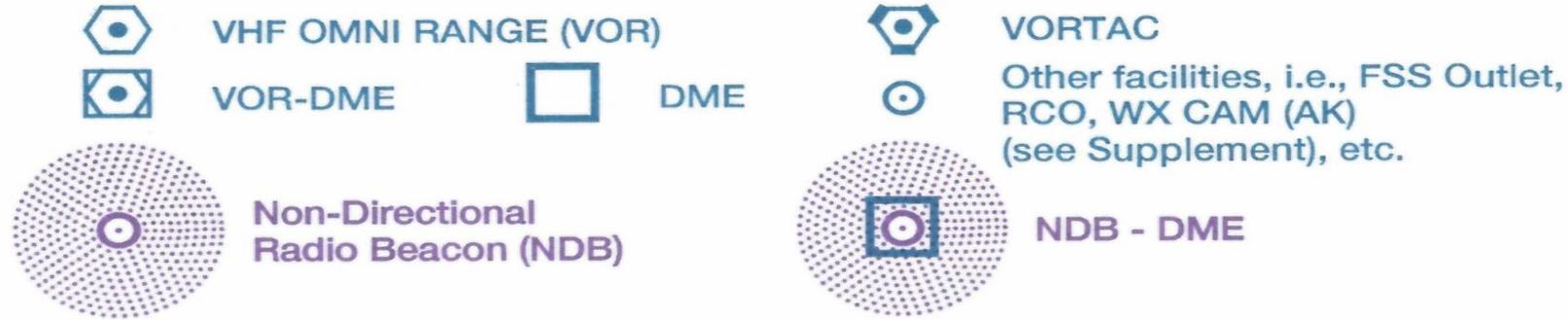
Heavy line box indicates Flight Service Station (FSS). Frequencies 121.5, 122.2, 243.0 and 255.4 (Canada - 121.5, 126.7 and 243.0) are available at many FSSs and are not shown above boxes. All other frequencies are shown.

R - Receive only

FSS radio providing voice communication →

Frequencies above thin line box are remoted to NAVAID site. Other FSS frequencies providing voice communication may be available as determined by altitude and terrain. Consult Supplement for complete information.

RADIO AIDS TO NAVIGATION



OBSTRUCTIONS

1000 ft and higher AGL

Above 200 ft & below 1000 ft AGL (above 299 ft AGL in urban area)

Obstruction with high-intensity lights; may operate part-time

Wind Turbine

Group Obstruction

Wind Turbine Farm

Elevation of the top above mean sea level

Height above ground

Under construction or reported: position and elevation unverified

NOTICE: Guy wires may extend outward from structures.

2894' UC

2049

(1149)

UC

MISCELLANEOUS

A - Aerobic Practice Area (See Supplement.)

G - Glider Operations

H - Hang Glider Activity

U - Ultralight Activity

UA - Unmanned Aircraft Activity

Parachute Jumping Area (See Supplement.)

STADIUM

Intermittent TFR site (within 3 NM, up to & incl 3000' AGL)

Marine Light

VPXYZ

VFR Waypoints (See chart tabulation for latitude/longitude.)

Space Launch Activity Area (See Supplement.)

-1°E-

Isogonic Line (2015 VALUE)

NAME (VPXYZ)

TOPOGRAPHIC INFORMATION

Power Transmission Line

Aerial Cable

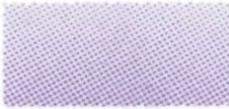
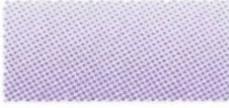
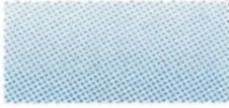
Lookout Tower 618 (Elevation Base of Tower)

Mountain Pass 11823 (Elevation of Pass)

Pass symbol does not indicate a recommended route or direction of flight and pass elevation does not indicate a recommended clearance altitude. Hazardous flight conditions may exist within and near mountain passes.

AIRPORT TRAFFIC SERVICE AND AIRSPACE INFORMATION

Only the controlled and reserved airspace effective below 18,000 ft. MSL are shown.

-  Class B Airspace
-  Class C Airspace (Mode C - see FAR 91.215/AIM.)
-  Class D Airspace
-  Ceiling of Class D Airspace in hundreds of feet (A minus ceiling value indicates surface up to but not including that value.)
-  Class E (sfc) Airspace
-  Class E Airspace with floor 700 ft. above surface that laterally abuts Class G Airspace.
- CLASS G**
-  Class E Airspace with floor 700 ft. above surface that laterally abuts 1200 ft. or higher Class E Airspace
-  Class E Airspace with floor 1200 ft. or greater above surface that laterally abuts Class G Airspace

2400 MSL

4500 MSL


Differentiates floors of Class E Airspace greater than 700 ft. above surface.
 Class E Airspace exists at 1200' AGL unless otherwise designated as shown above.
 Class E Airspace low altitude Federal Airways are indicated by center line.
 Intersection - Arrows are directed towards facilities which establish intersection.



Total mileage between NAVAIDs on direct Airways
 Class E Airspace low altitude RNAV 2 Routes are indicated by center line.



-  Prohibited, Restricted, and Warning Areas; Canadian Advisory, Danger, and Restricted Areas
-  Alert Area and MOA - Military Operations Area
-  Special Airport Traffic Area (See FAR 93 for details.)
-  ADIZ - Air Defense Identification Zone
-  MODE C (See FAR 91.215/AIM.)
-  National Security Area
-  Terminal Radar Service Area (TRSA)
-  MTR - Military Training Route

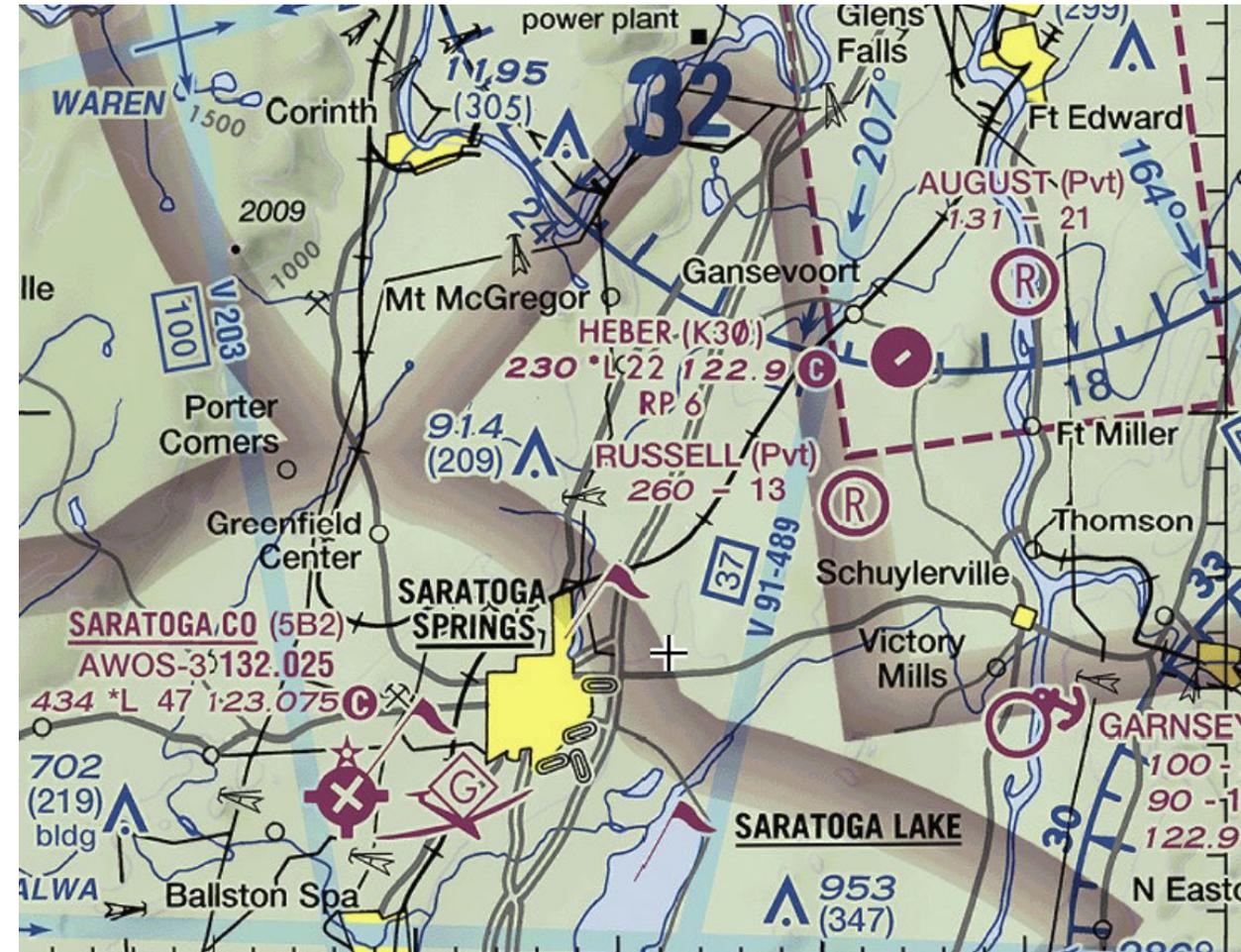
VOR's

- VOR – VHF Omni Directional Range
 - Radio Navigational Aid used by manned pilots. Allows the ability to fly to or from the station depicted on the sectional chart
- DME – Directional Measuring Equipment
 - Provides distance to/from a VOR
- Not used by remote PICs, but important to understand airways. Manned traffic can be concentrated along these routes.



Common symbols on Sectional Chart

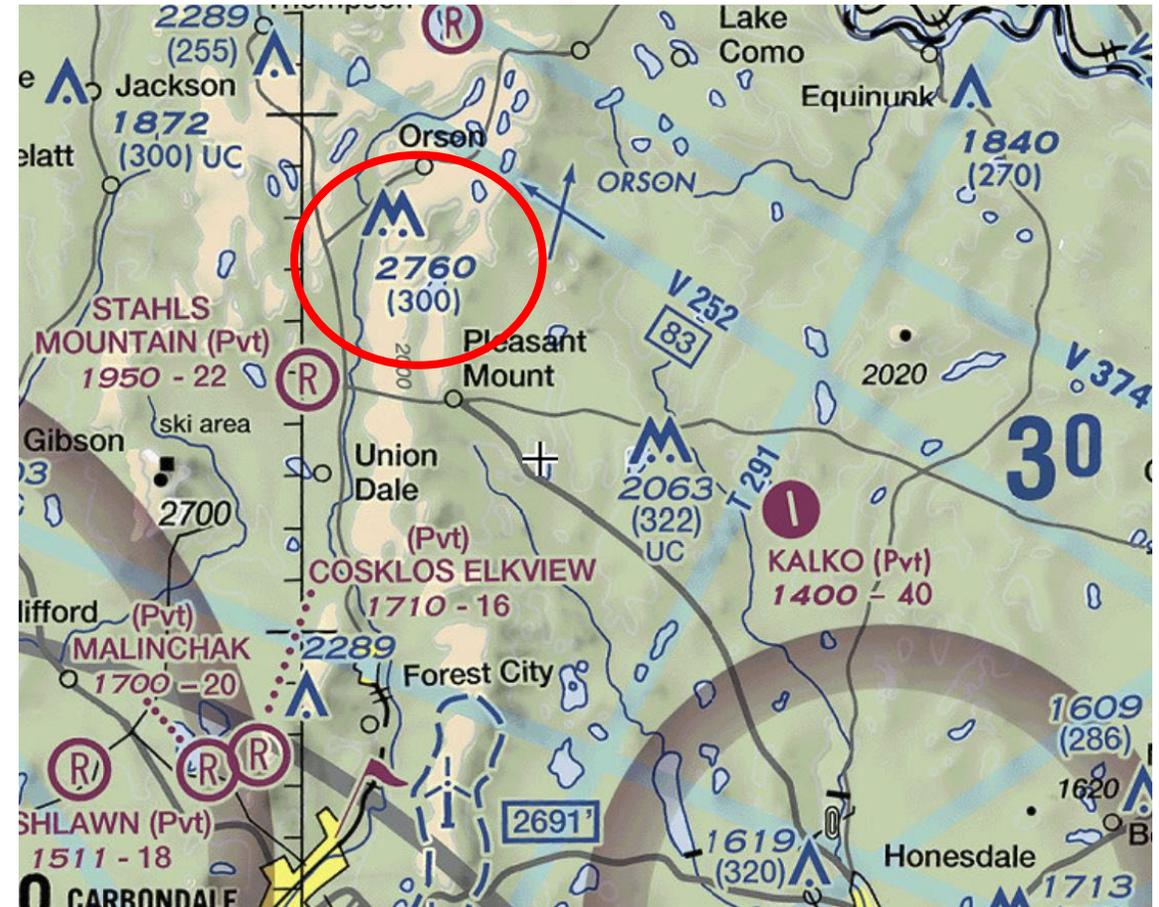
- Glider activity
- Powerlines
- Seaport
- Congested area
- VFR checkpoint
- Restricted airfield
- Non-towered airport



Structures/Obstacles

- Top number : MSL
- Bottom number in (xxx) : AGL

Provides a clue as to the MSL altitude of the surface around the obstacle



Maximum Elevation Figure (MEF)

Example:

Elevation of obstacle top (MSL)	13161
Possible vertical error	+100
Obstacle Allowance	+200
equals	13461
Raise to the following 100' level	13500
Maximum Elevation Figure (MEF)	135

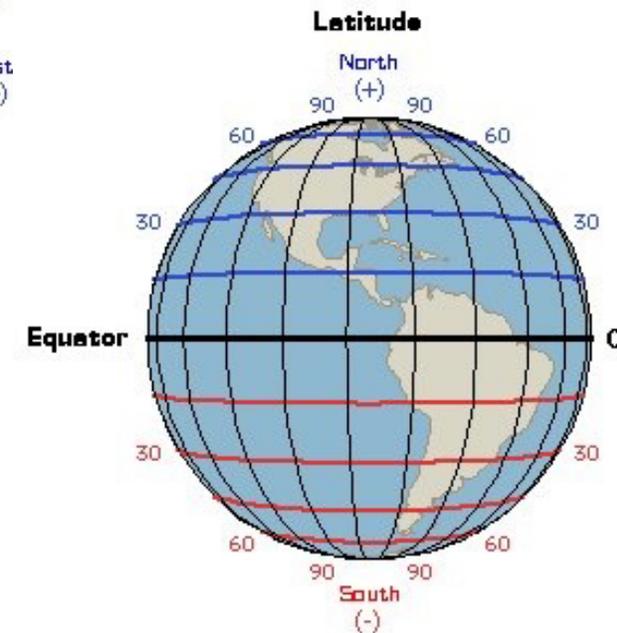
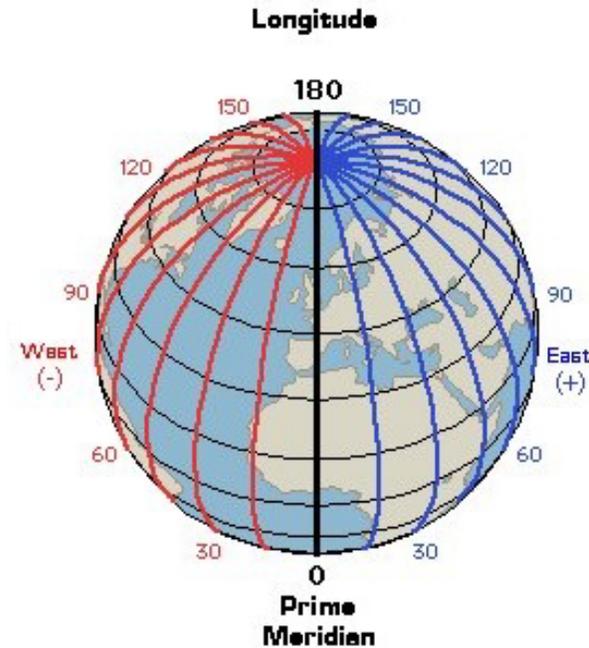


Scheduled Break

Sky Vector - Exercise

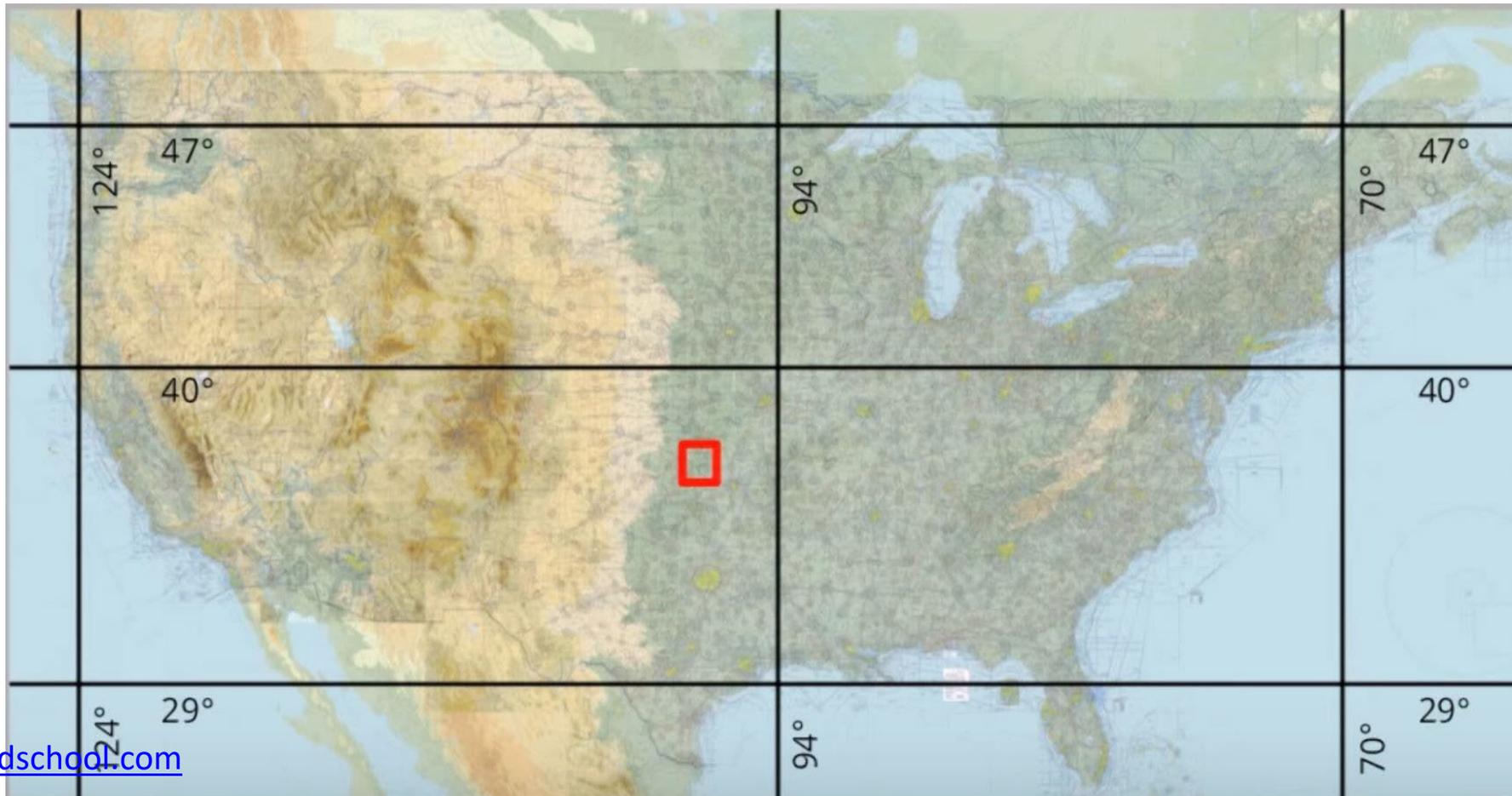
Longitude/Latitude on Sectional Chart

- Any location on Earth is described by two numbers--its longitude (coordinates) and its latitude
- Longitude – vertical lines (0°- prime meridian – Greenwich, England)
 - Increases right to left or east to west (ex 070° to 124° West)
 - Lines of longitude are drawn from the north pole to the south pole and cross the equator at right angles
 - Lines of longitude bend toward the poles
- Latitude – horizontal lines (equator)
 - Starts at the equator and increases bottom to top or south to north (ex 029° to 047° North)
 - (note: approximately 69 miles between degrees)
 - Lines of Latitude are EQUAL distance between them



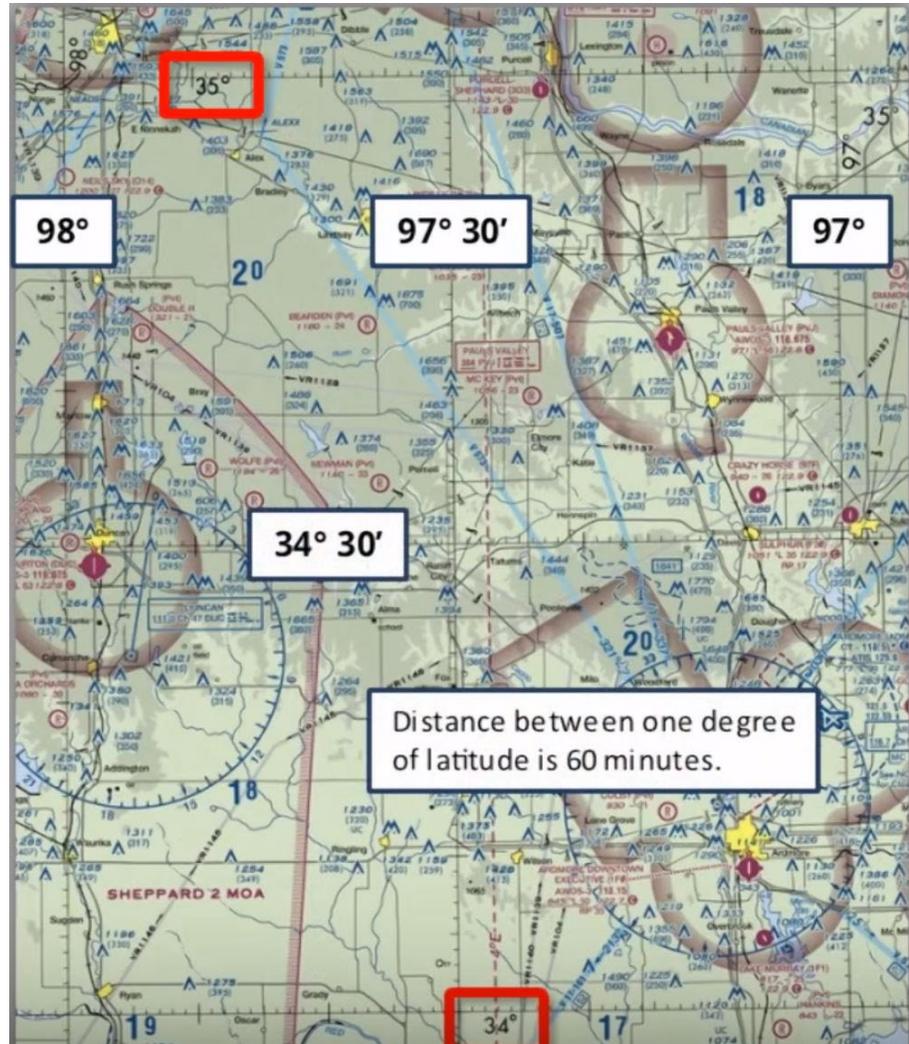
Longitude/Latitude on Sectional Chart

- Aeronautical Sectional Charts provide Lat/long information for positional awareness, navigation assistance.



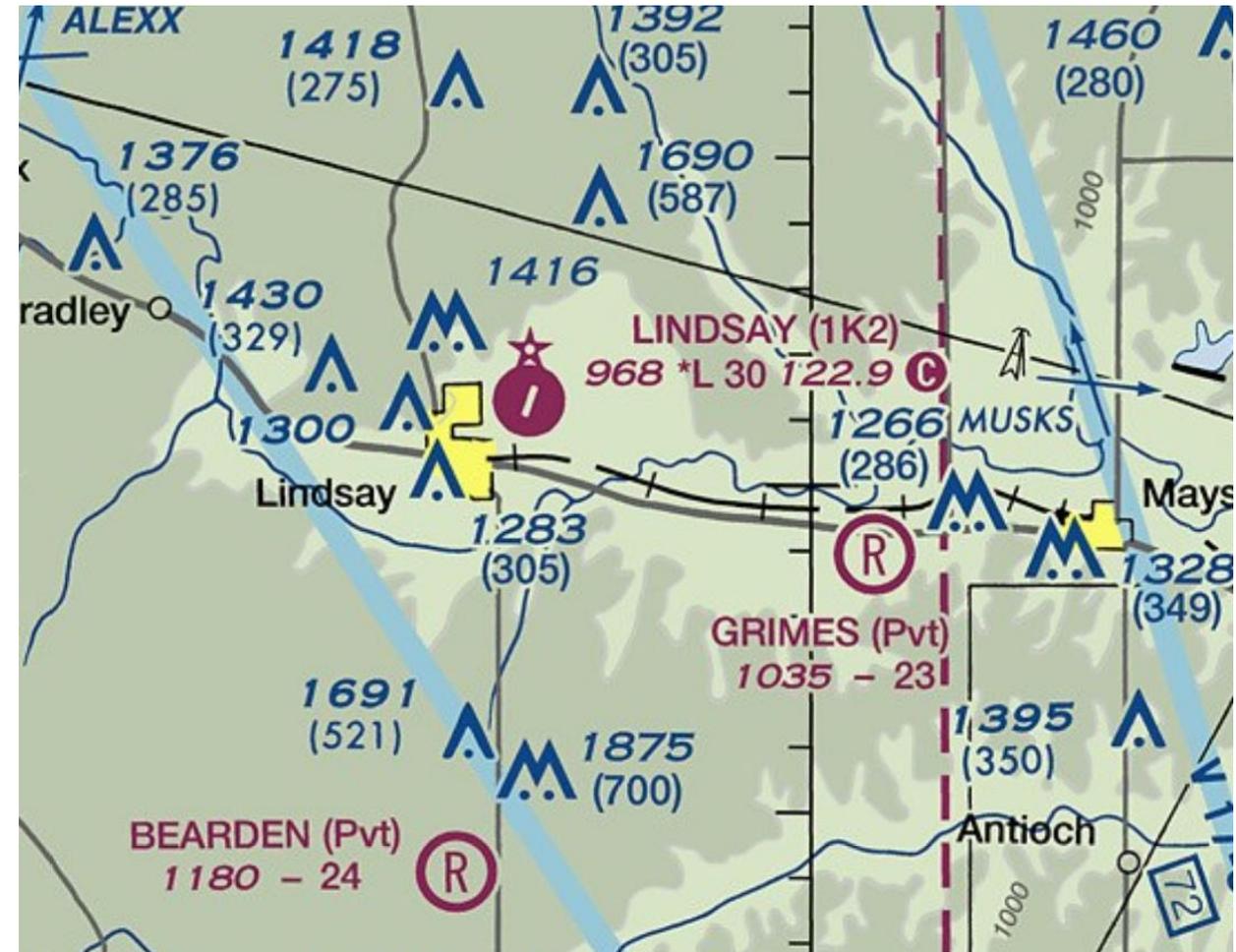
Longitude/Latitude on Sectional Chart

Adjacent lines are 30 minutes apart



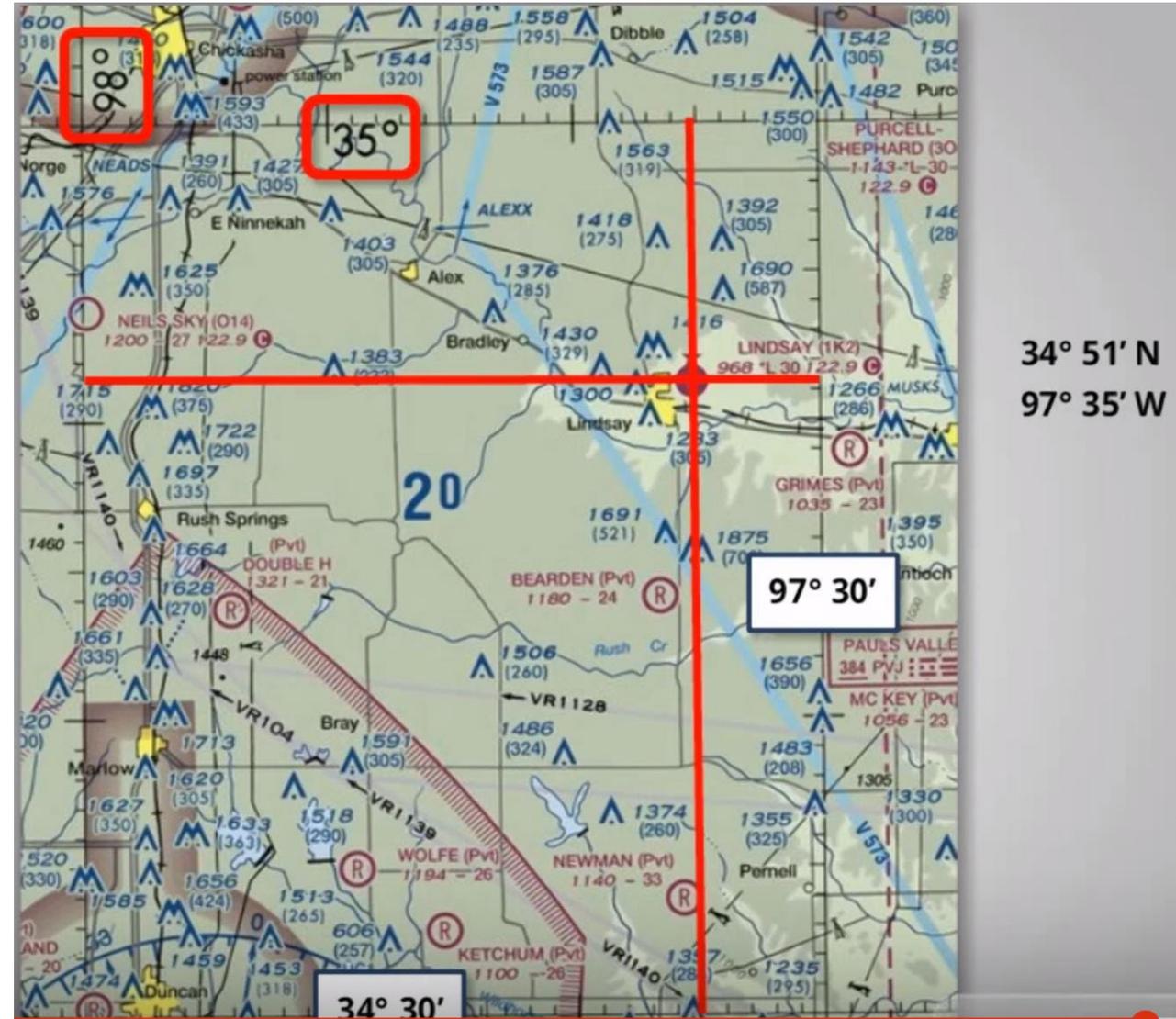
Longitude/Latitude on Sectional Chart

Example: Provide longitude/latitude
for LINDSAY (1K2)

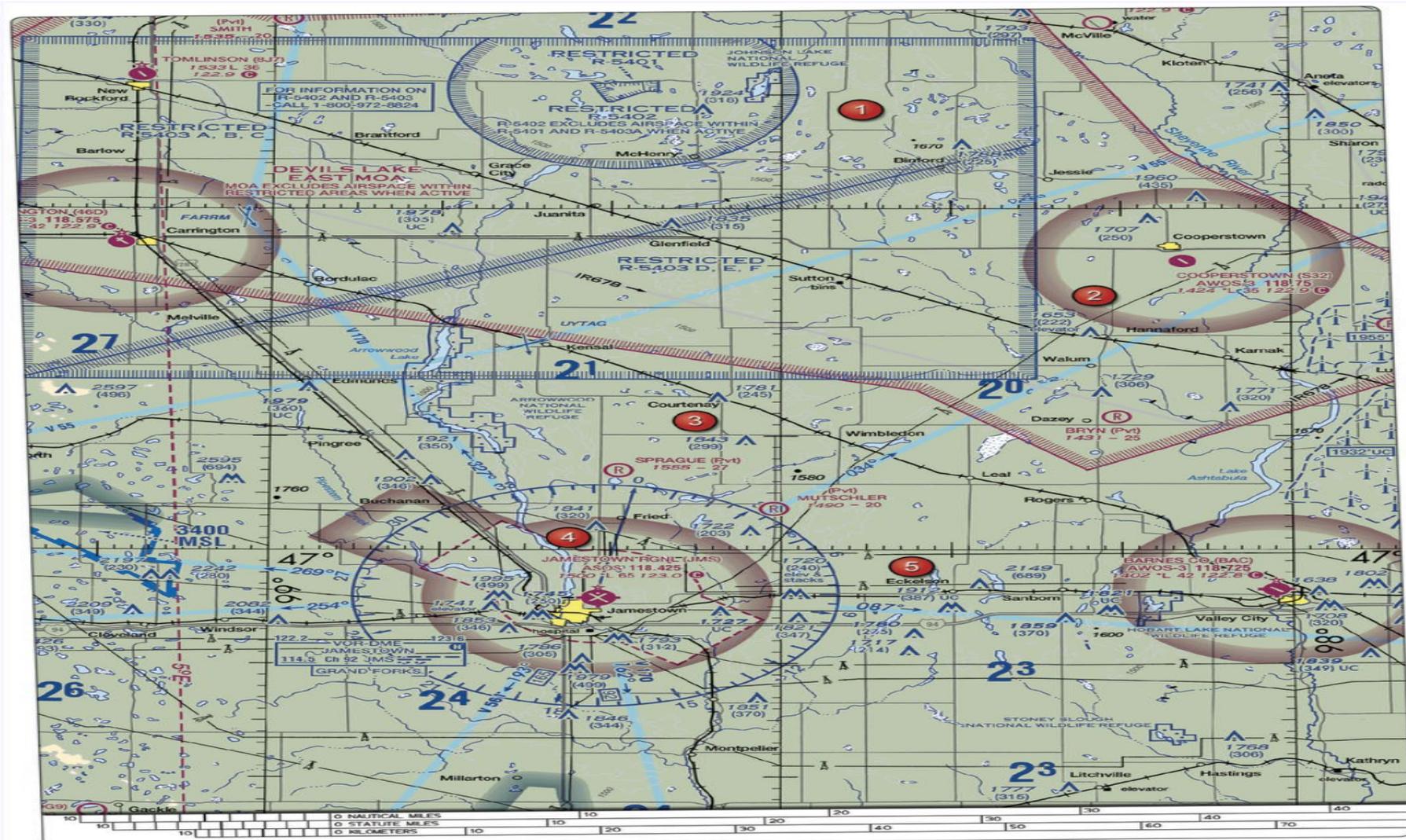


Longitude/Latitude on Sectional Chart

Example: Provide longitude/latitude for LINDSAY (1K2)



Exercise – Lat & Long – Test Figure from chart in book – Pg 2-25. Figure 26



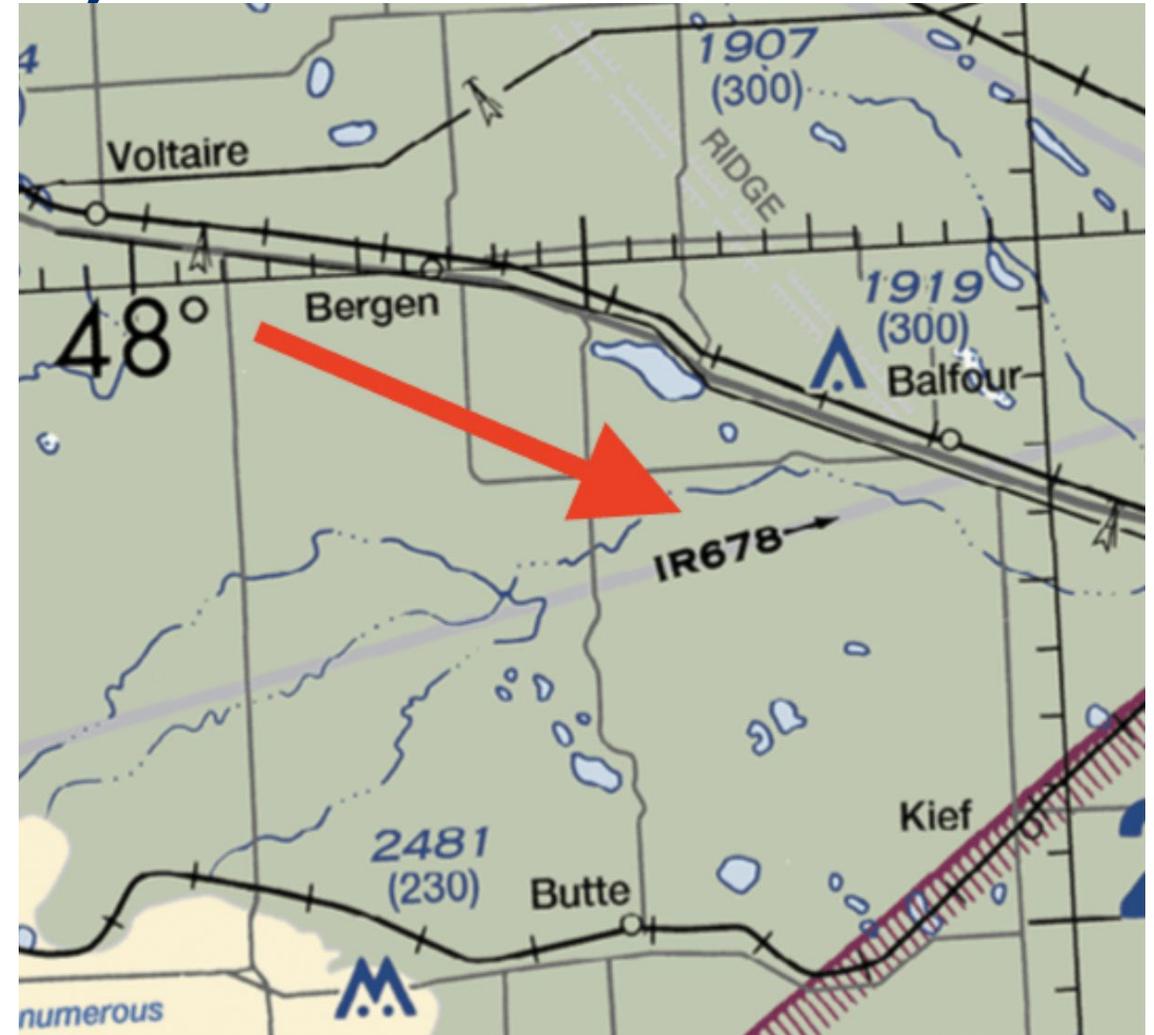
Airways 'highways in sky'

- V - Victor Airways – VOR to VOR
Begin at 1200' AGL
- T – Tango Airways – RNAV
terminal transition routes (High
altitude en-route)
- Higher chance of manned aircraft
traffic congestion along these
routes.
- Use extra caution if operating on
or near them.



Military Training Routes (MTR)

- Marked by arrow symbols in sectional charts
- , VR (visual rules) or IR (instrument rules) prefix followed by a number
- If three digits (e.g. VR-120) operations **above** 1500 feet.
- If four digits (e.g. VR-1053) indicates that the operations are being conducted **below** 1500 feet.
- Military aircraft in these routes fly at very high speeds, drone pilots should avoid being in these areas.



Special Use Airspace

- Airspace set aside for a particular purpose
- They alert us to hazards or national security issues
- Several of these exist in New York State
- Information included on side panels of sectional charts
- SUAs Include:
 - Prohibited Areas
 - Restricted Areas
 - Warning Areas
 - Military Operations Areas (MOAs)
 - Alert Areas
 - Controlled Firing Areas
 - Temporary Flight Restrictions (TFRs)

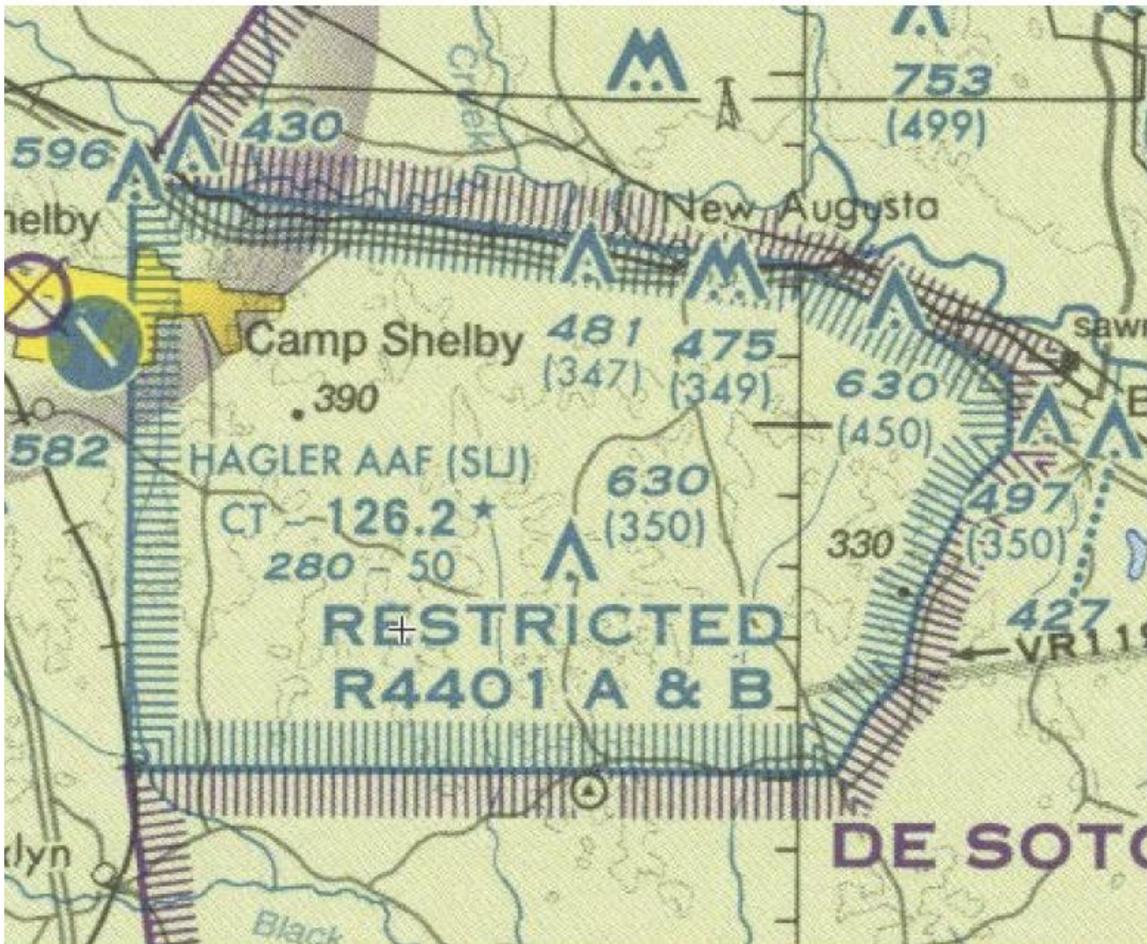


Restricted Areas

- Operations are hazardous to non-participating aircraft
- Not wholly prohibited, but is subject to restrictions.
- Pilots need approval from the controlling agency to enter
- Activities within these areas must be confined because of their nature, or limitations may be imposed upon aircraft operations that are not a part of those activities, or both
- Restricted areas denote the existence of unusual, often invisible, hazards to aircraft (e.g., artillery firing, aerial gunnery, or guided missiles)

Restricted Areas

Charted with an “R” followed by a number (e.g., R-4401) and are depicted on the en-route chart appropriate for use at the altitude or FL being flown. Restricted area information can be obtained in the special use area of the Sectional Chart.



SPECIAL USE AIRSPACE ON NEW ORLEANS SECTIONAL CHART

Unless otherwise noted altitudes are
MSL and in feet. Time is local.
"TO" an altitude means "To and including."
FL - Flight Level
NO A/G - No air to ground communications.
Contact Flight Service for information.

† Other times by NOTAM.
NOTAM - Use of this term in Restricted
Areas indicates FAA and DoD NOTAM
systems. Use of this term in all
other Special Use areas indicates the
DoD NOTAM system.

U.S. P-PROHIBITED, R-RESTRICTED, W-WARNING, A-ALERT, MOA-MILITARY OPERATIONS AREA

NUMBER	ALTITUDE	TIME OF USE	CONTROLLING AGENCY/ CONTACT FACILITY	FREQUENCIES
R-2103 A	TO BUT NOT INCL 10,000	CONTINUOUS	CAIRNS APP	
R-2103 B	10,000 TO 15,000	BY NOTAM 6 HRS IN ADVANCE	JACKSONVILLE CNTR	
R-2905 A, B	TO 10,000	INTERMITTENT BY NOTAM	TYNDALL APP	
R-2908	TO 12,000	NOV-DEC 0800-1600 MON-FRI †24 HRS IN ADVANCE	PENSACOLA TRACON	
R-2914 A	UNLIMITED EXCL AIRSPACE WITHIN R-2917	CONTINUOUS	JACKSONVILLE CNTR	
R-2914 B	8500 TO UNLIMITED	CONTINUOUS	JACKSONVILLE CNTR	
R-2915 A, B	UNLIMITED	CONTINUOUS	JACKSONVILLE CNTR	
R-2915 C	8500 TO UNLIMITED	CONTINUOUS	JACKSONVILLE CNTR	
R-2917	TO 5000	CONTINUOUS	EGLIN APP	
R-2918	UNLIMITED	CONTINUOUS	JACKSONVILLE CNTR	
R-2919 A	UNLIMITED	CONTINUOUS	JACKSONVILLE CNTR	
R-2919 B	8500 TO UNLIMITED	CONTINUOUS	JACKSONVILLE CNTR	
R-4401 A	TO BUT NOT INCL 4000	BY NOTAM 24 HRS IN ADVANCE	HOUSTON CNTR	
R-4401 B	4000 TO BUT NOT INCL 10,000	BY NOTAM 24 HRS IN ADVANCE	HOUSTON CNTR	
R-4401 C	10,000 TO BUT NOT INCL FL 180	BY NOTAM 24 HRS IN ADVANCE	HOUSTON CNTR	
R-4403 A	TO 12,000	INTERMITTENT 1000-0300 BY NOTAM 24 HRS IN ADVANCE	HOUSTON CNTR	
R-4403 B	TO 6000	INTERMITTENT 1000-0300 BY NOTAM 24 HRS IN ADVANCE	HOUSTON CNTR	
R-4403 C, E	TO 10,000	INTERMITTENT 2000-0500 & 1800-2000 1 NOV-1 MAR BY NOTAM 24 HRS IN ADVANCE	HOUSTON CNTR	
R-4403 F	4000 TO 10,000	INTERMITTENT 2000-0500 & 1800-2000 1 NOV-1 MAR BY NOTAM 24 HRS IN ADVANCE	HOUSTON CNTR	

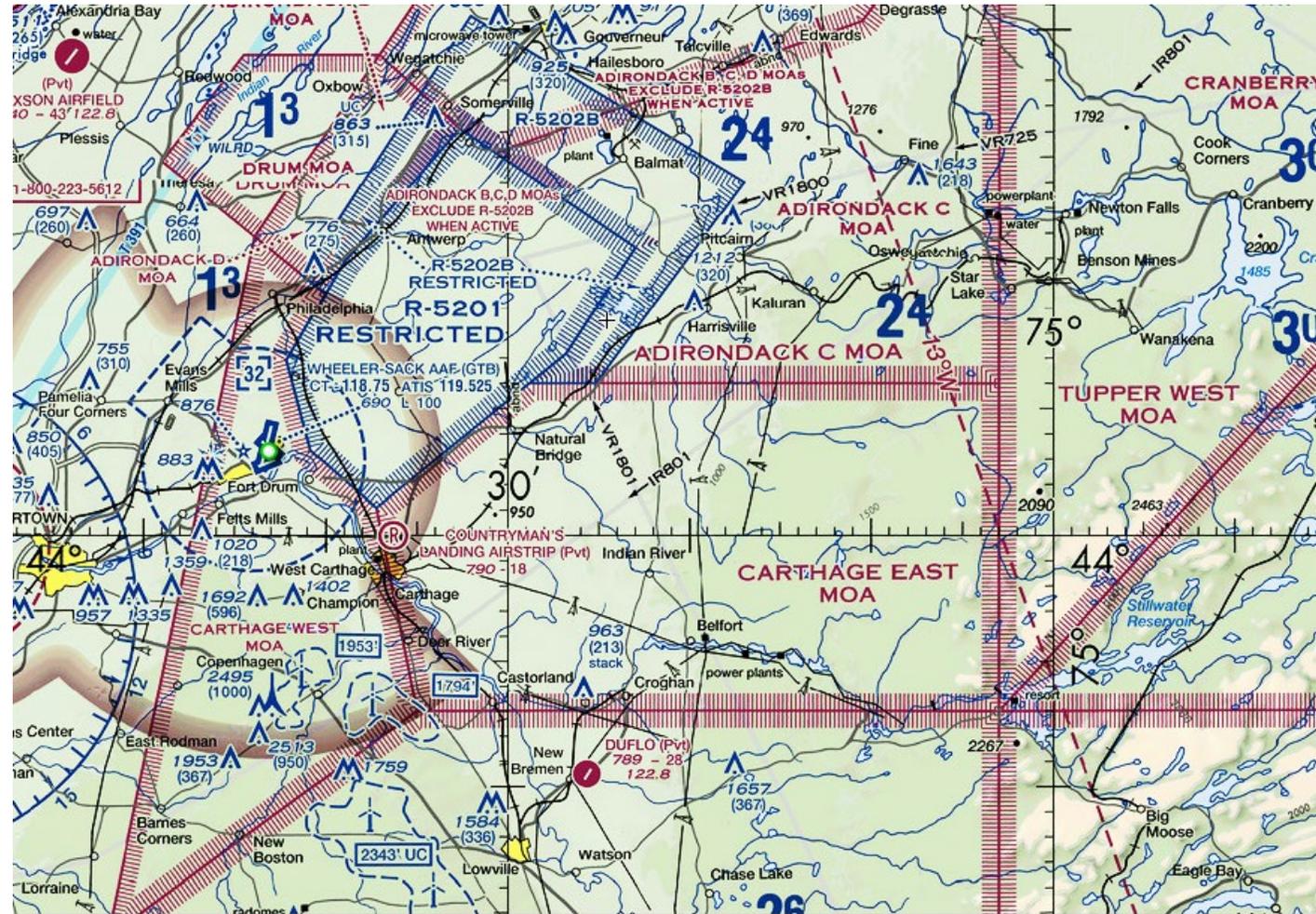
Warning Areas

- Similar in nature to restricted areas
- A warning area is airspace of defined dimensions, extending from 3 NM outward from the coast of the US, containing activity that may be hazardous to non-participating aircraft.
 - May be located over domestic or international waters or both.
- Purpose is to warn non-participating pilots of potential danger.
- Airspace is designated with a “W” followed by a number (ex W-237).



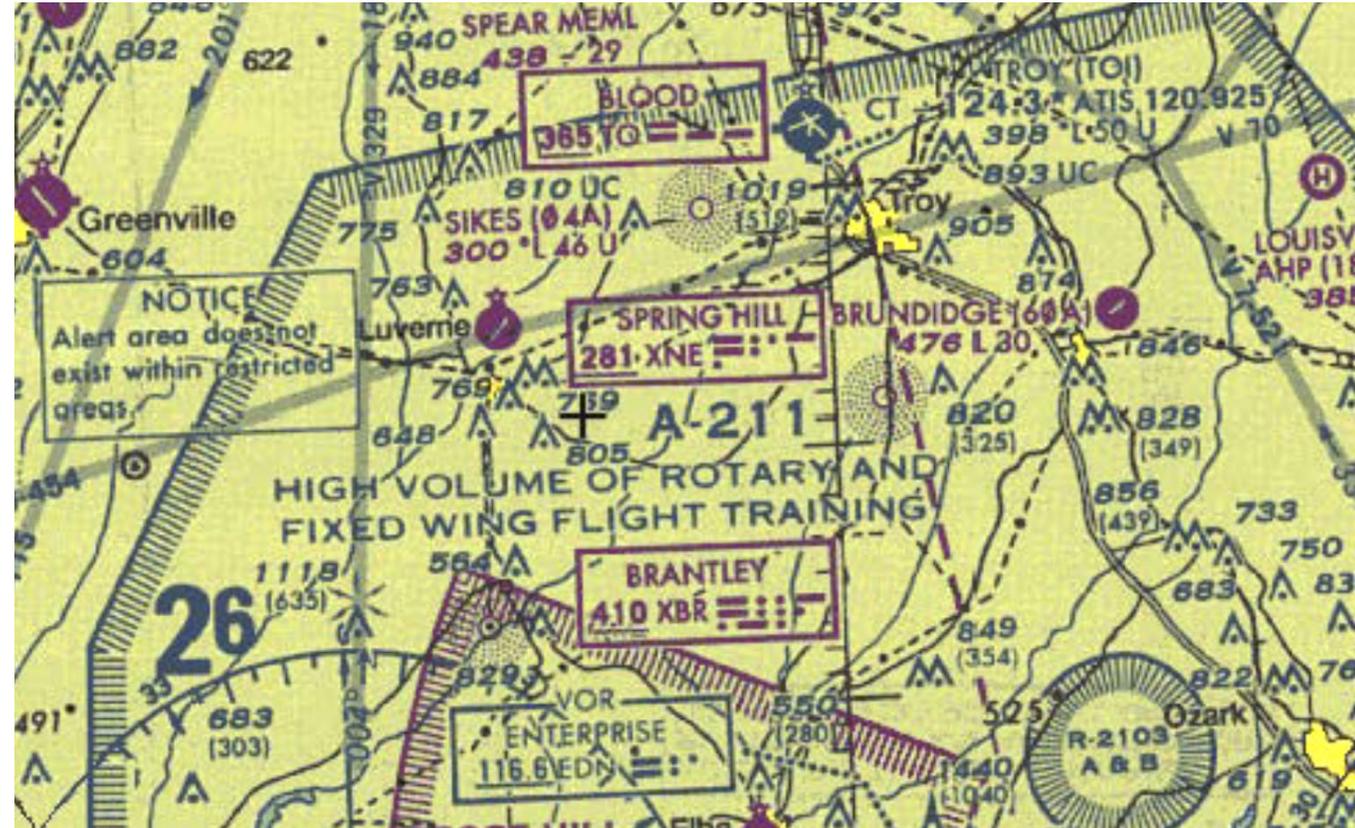
Military Operating Area (MOAs)

- Airspace established for the purpose of separating certain military training activities from IFR traffic.
- When MOA is “Hot”, non-participating traffic may be cleared through if separation can be provided by ATC.
 - Otherwise, ATC reroutes or restricts nonparticipating IFR traffic.
- MOAs are depicted on charts but are not numbered (e.g., “Adirondack C MOA”). See the back of the sectional charts with times of operation, altitudes affected, and the controlling agency.



Alert Areas

- Airspace designed to inform non-participating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity
- Pilots should exercise caution in alert areas.
- Pilots of participating aircraft, as well as pilots transiting the area, shall be equally responsible for collision avoidance.
- Alert areas are depicted on aeronautical charts with an “A” followed by a number (e.g., A-211)



Temporary Flight Restrictions (TFR)

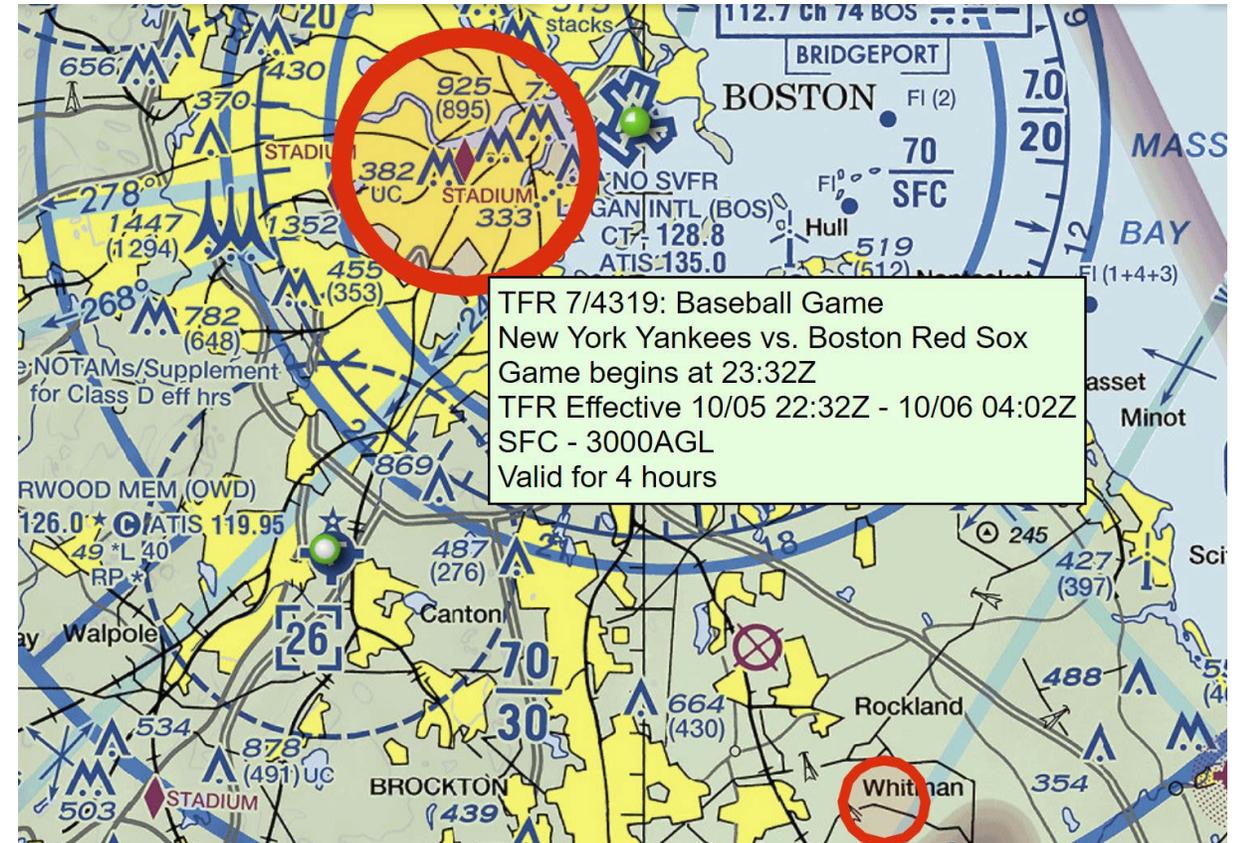
Designates location of the temporary restriction, effective time period, area defined in statute miles, and altitudes affected

The NOTAM also contains the FAA coordination facility and telephone number, the reason for the restriction, and any other information deemed appropriate.

- Provide protection for
 - Persons and property in the air or on the surface from an existing or imminent hazard
 - Protect declared national disasters for humanitarian reasons
 - Protect the President, Vice President, or other public figures
- Provide a safe environment for the operation of disaster relief aircraft.
- Prevent an unsafe congestion of sightseeing aircraft above an incident or event, that may generate a high degree of public interest
- Pilots should check the NOTAMs as part of flight planning

Temporary Flight Restrictions (TFR)

It is a pilot's responsibility to be aware of TFRs in their proposed area of flight. One way to check is to visit the FAA website, www.tfr.faa.gov, and verify that there is not a TFR in the area.



Notice to Air Missions (NOTAM)

Time-critical aeronautical information either temporary in nature or not sufficiently known in advance to permit publication on aeronautical charts or in other operational publications.

NOTAMs contain current notices to air missions that are considered essential to the safety of flight, as well as supplemental data affecting other operational publications.

- Hazards, such as air shows, parachute jumps, kite flying, and rocket launches
- Flights by important people such as heads of state
- Inoperable lights on tall obstructions
- Temporary erection of obstacles near airfields
- Passage of flocks of birds through airspace (known as a BIRDTAM)
- Some UAS Flights

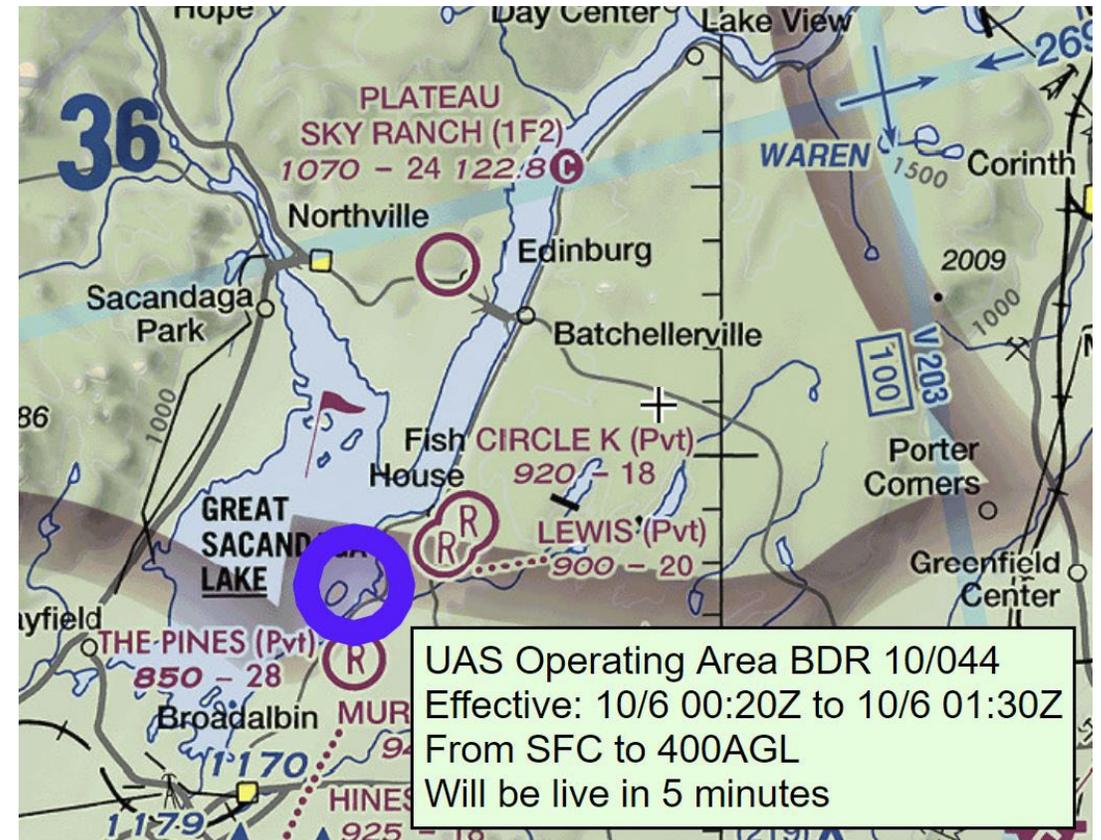
NOTAMS are NOT required for Part 107 flights

NOTAMS may be required for waivers, authorizations, or COAs

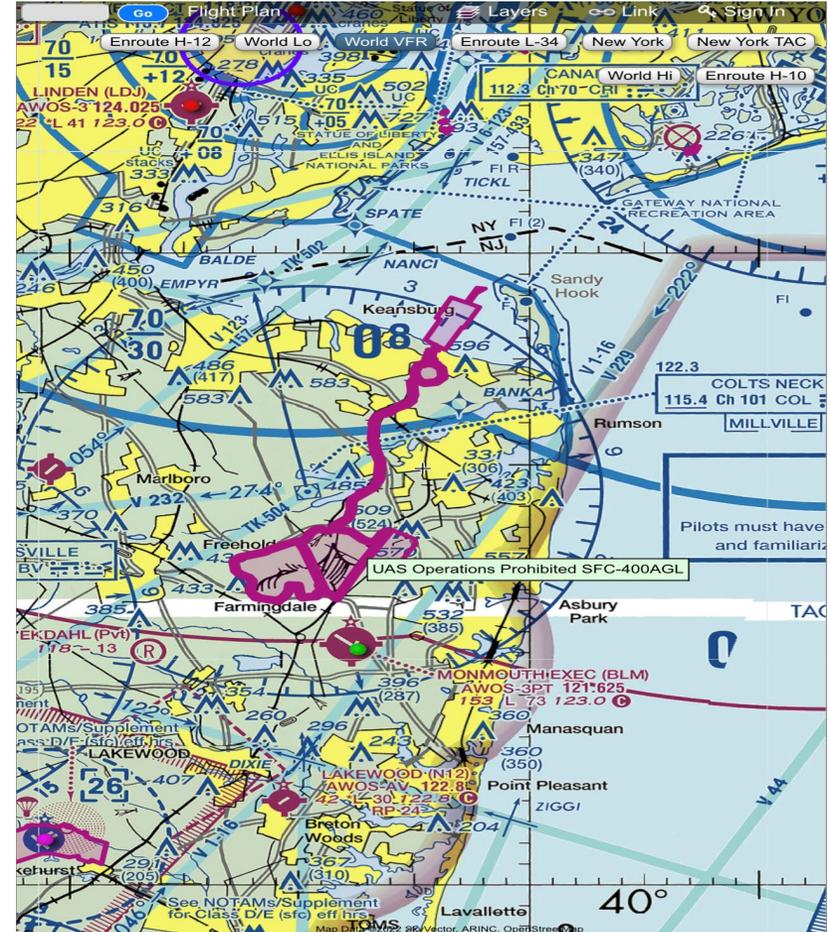
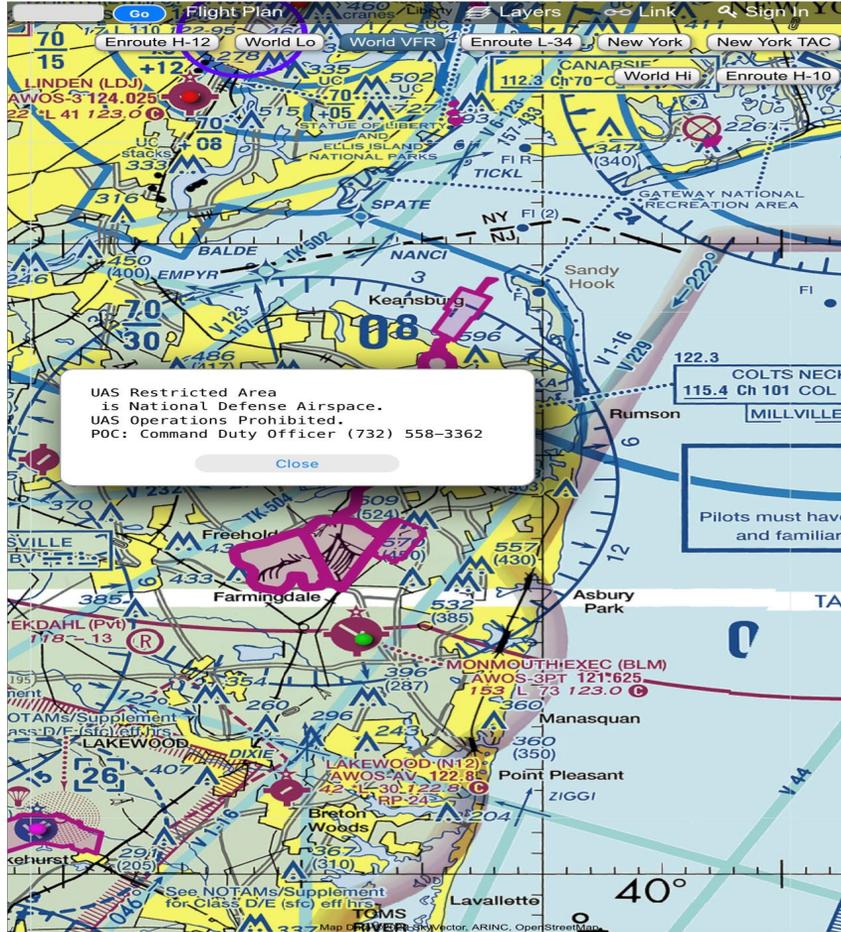
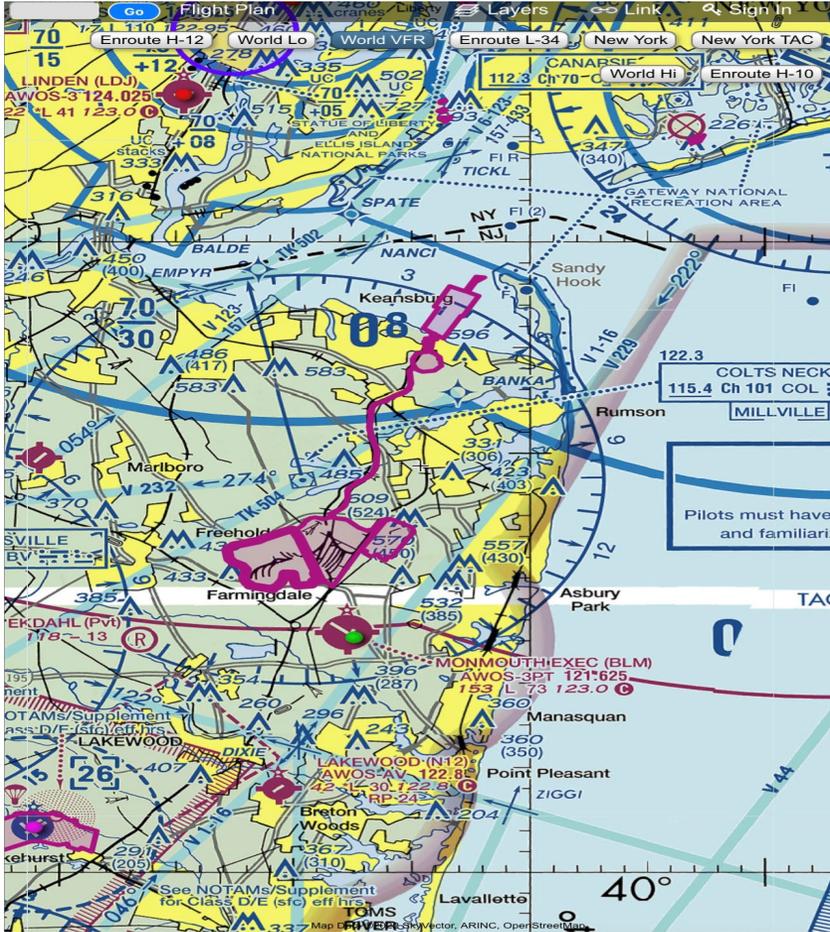


UAS Operating Area

- Similar to a NOTAM
- Information will be given to manned pilots during briefing
- SkyVector – View DROTAM



UAS Operating Area



Examples of DROTAMs

End of Module Airspace Classification Test



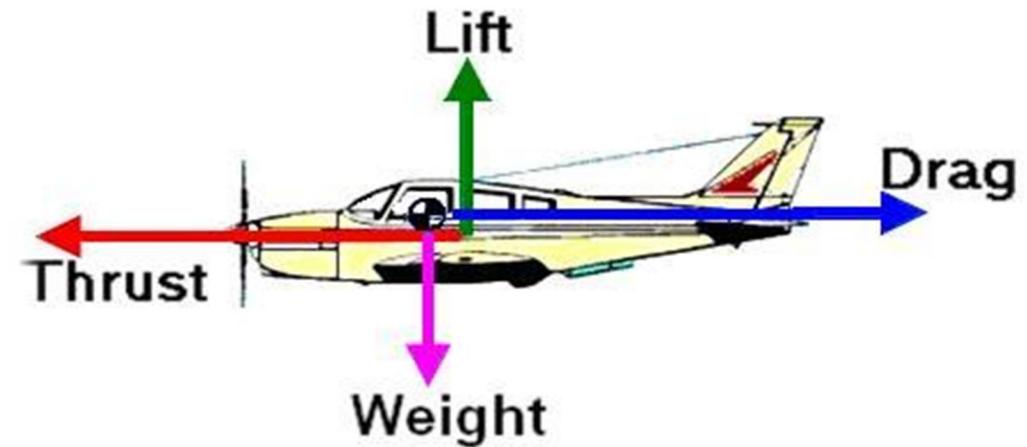
**Homeland Security
and Emergency Services**

Part 107 Small Unmanned Aircraft Systems (UAS) Test Prep Course

Module 6: Aerodynamics and UAS Loading

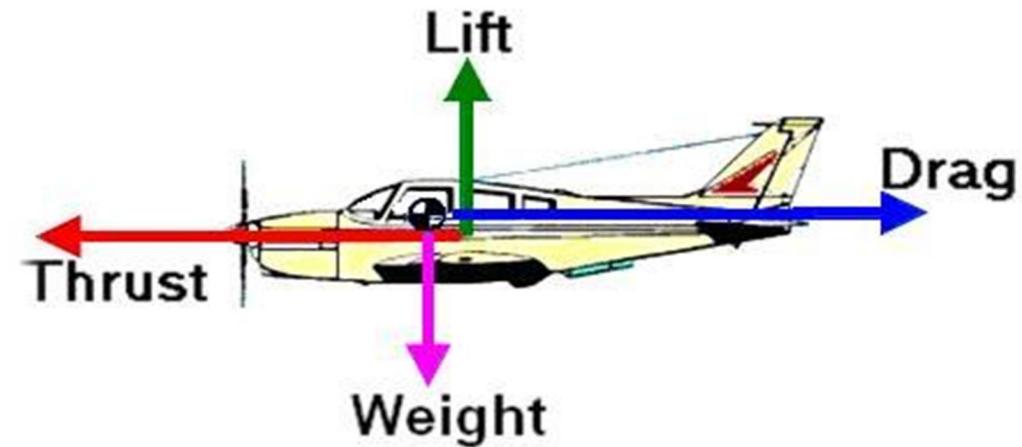
The Four Forces

- Four forces acting on an airplane:
 - Lift
 - Weight
 - Thrust
 - Drag
- For the purposes of discussion these are described here as TOTAL FORCES.
 - They split out into different parts later in the discussion



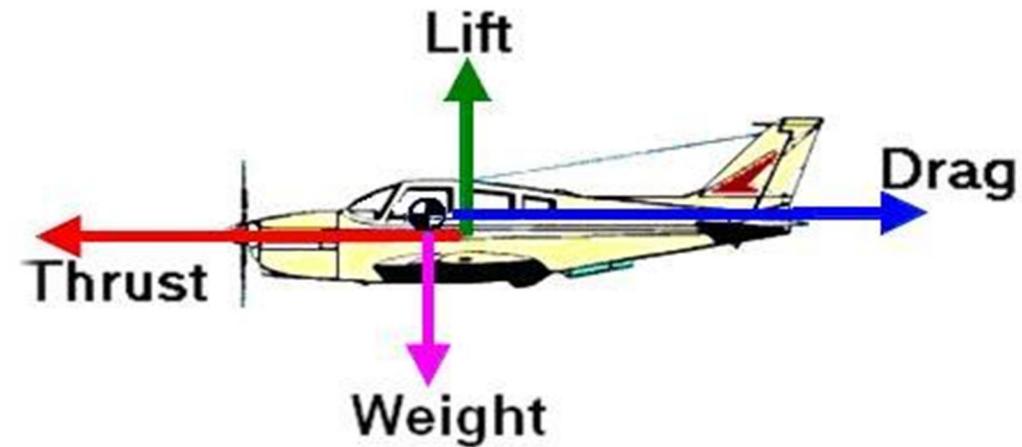
The Four Forces

- Total lift opposes total weight (gravity)
 - Produced by dynamic effect of air acting on the airfoil
 - Produced VERTICALLY or HORIZONTALLY (propeller)
 - Acts PERPENDICULAR to the flight path through the “Center of Lift” or “Center of Pressure”
- Total Weight is combined load of aircraft, crew, fuel and baggage
 - Pulls aircraft down toward center of Earth using gravity
 - Opposes lift and acts downward through aircraft’s center of gravity



The Four Forces

- Total Thrust is the forward force produced by the engine / propeller combination
 - Opposes or overcomes the force of drag
 - Acts parallel to the longitudinal axis
- Total Drag is the force that resists motion
 - Opposes thrust
 - Produced as a by-product of lift
 - The more lift generated, the more drag is also generated.
- Steady State Flight
 - In level, un-accelerated flight, lift is equal to weight and thrust is equal to drag
 - In a steady state climb, lift is equal to weight and thrust is equal to drag.



The Four Forces

- **Lift**

- Lift is determined by
 - Airfoil Design (length, thickness, “camber”)
 - Angle of Attack –
 - Angle between the wing chord line and the direction of the relative wind
 - Airspeed
 - Air Density

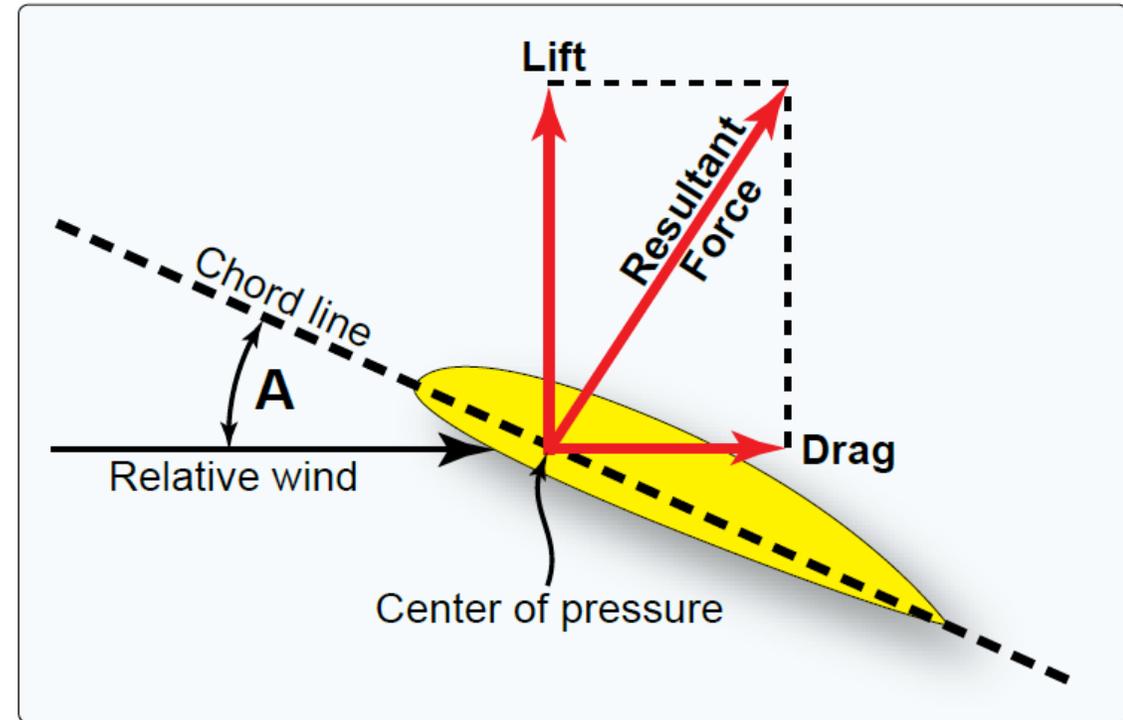


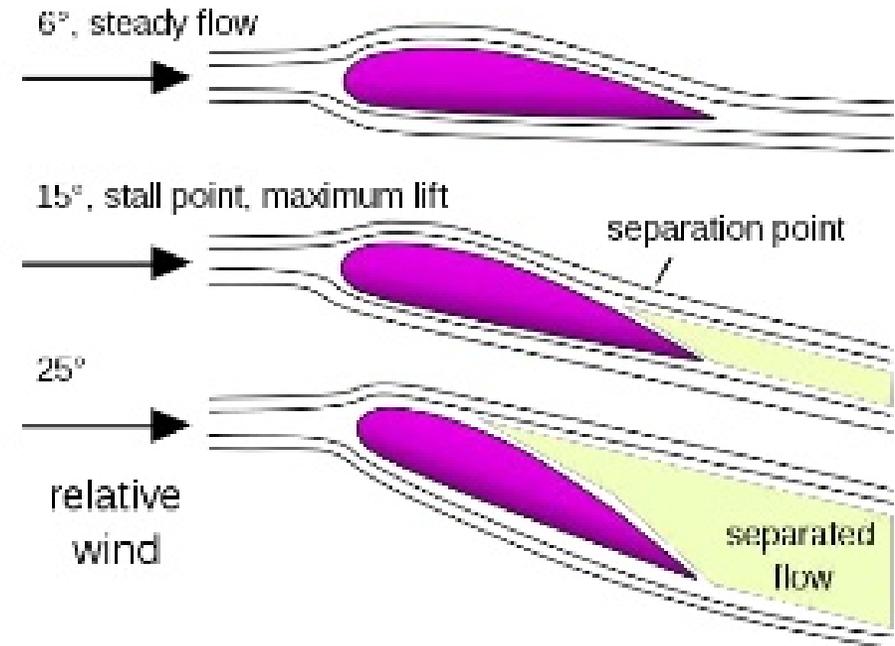
Figure 1. Lift Vector.

See Page 2-1 in Private Pilot Book



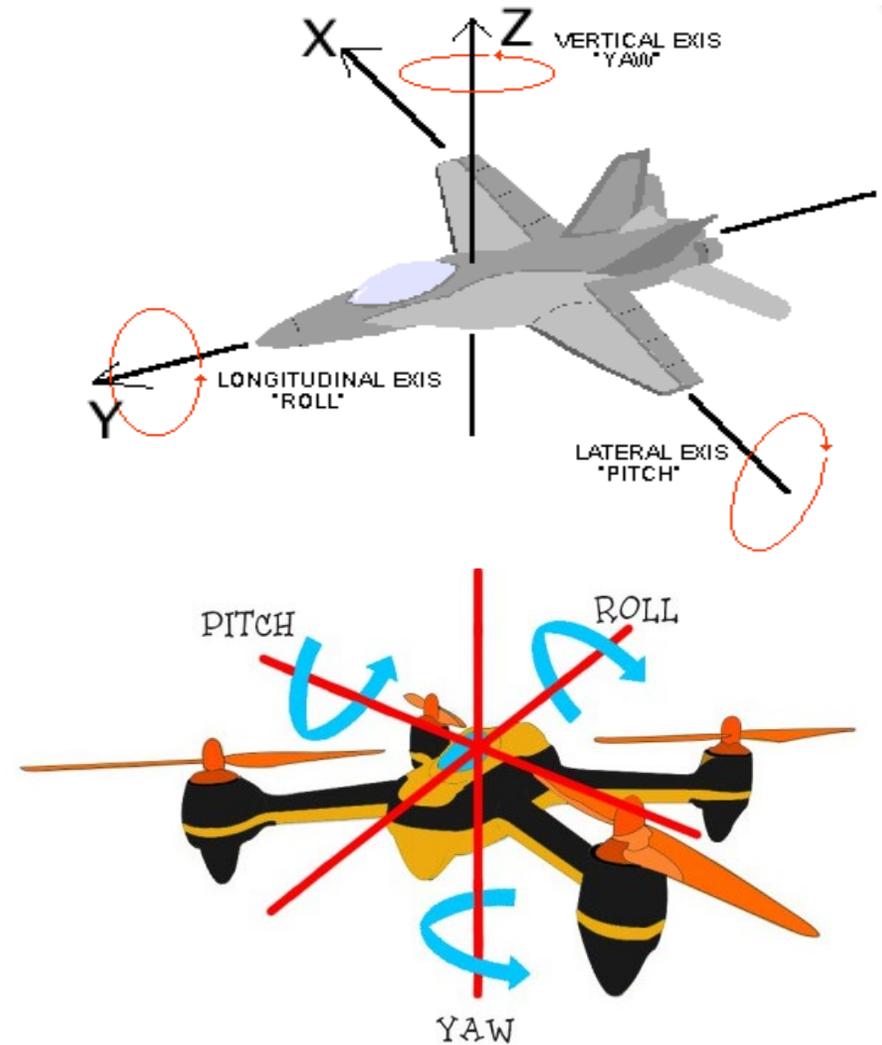
Aerodynamic Stall

- **Stall Speed**
 - Increases with bank angle
 - Wing always STALLS at the critical AoA (at which the airflow separates from the upper surface) **regardless of airspeed, weight, load factor, or density altitude**



Control Surfaces

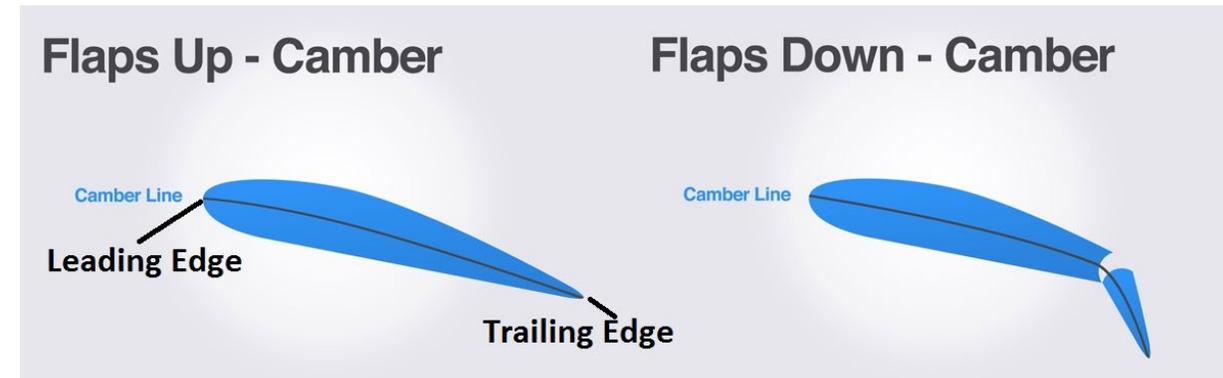
- **Ailerons**
 - Causes aircraft to “Roll” along longitudinal axis.
 - Bank control
- **Elevator**
 - Causes aircraft to “pitch” along lateral axis
 - Causes nose up or down
- **Rudder**
 - Causes aircraft to “yaw” along vertical axis
 - Moves nose left or right



Control Surfaces

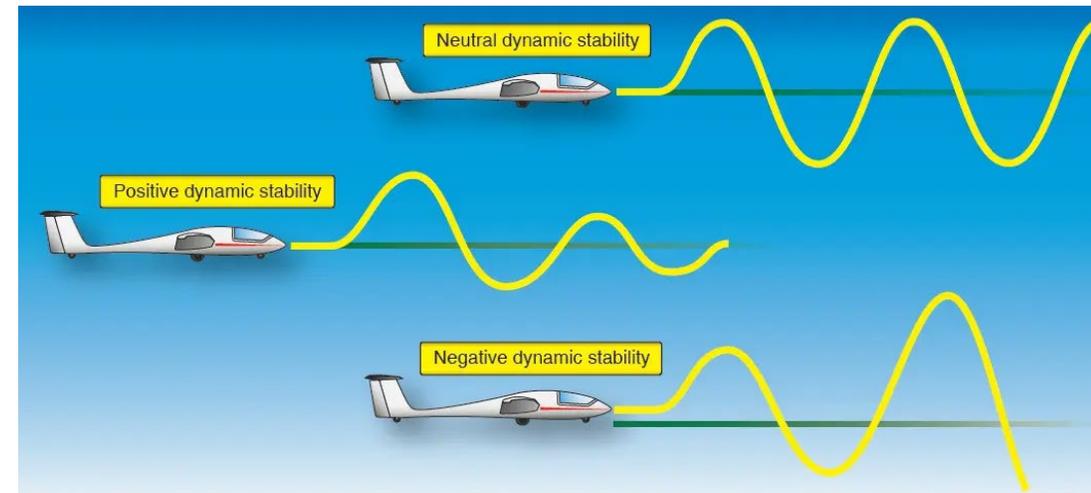
- **Wing Flaps**
 - Extending flaps increases wing camber and angle of attack
 - Increases wing lift and induced drag
 - Enables the pilot to increase the angle of descent without increasing the airspeed.

- **Trim** – relieves pilot from holding constant pressure on controls



Aircraft Stability

- **Stability**
 - Aircraft's ability to return to original flight path
 - Two types of stability – Static and Dynamic
 - Static Stability
 - Describes aircraft's **initial** reaction to a force acted upon it
 - Can be positive, negative or neutral
 - Dynamic Stability
 - Describes the aircraft's reaction to positive static stability
 - Can be positive, negative or neutral



Aircraft Stability

- **Maneuverability and Controllability**
 - Maneuverability
 - Ability to maneuver easily and withstand the stress imposed by maneuvers
 - Governed by:
 - Weight
 - Inertia
 - Size and location of flight controls
 - Controllability
 - Capability of aircraft ability to respond to pilot control inputs



Load Factor

- Load Factor is measured in Gs (acceleration of gravity)
 - Standing on the ground is 1G
- Forced exerted when aircraft is maneuvering
- Results of Increased bank angle
 - Increase in Gs
 - Increase in relative weight
 - **Increases Stall Speed**
- Wing must be able to support increased weight and stress
- Ex: At 60 deg bank angle, load factor is 2 Gs

See Page 2-2 in Private Pilot Book

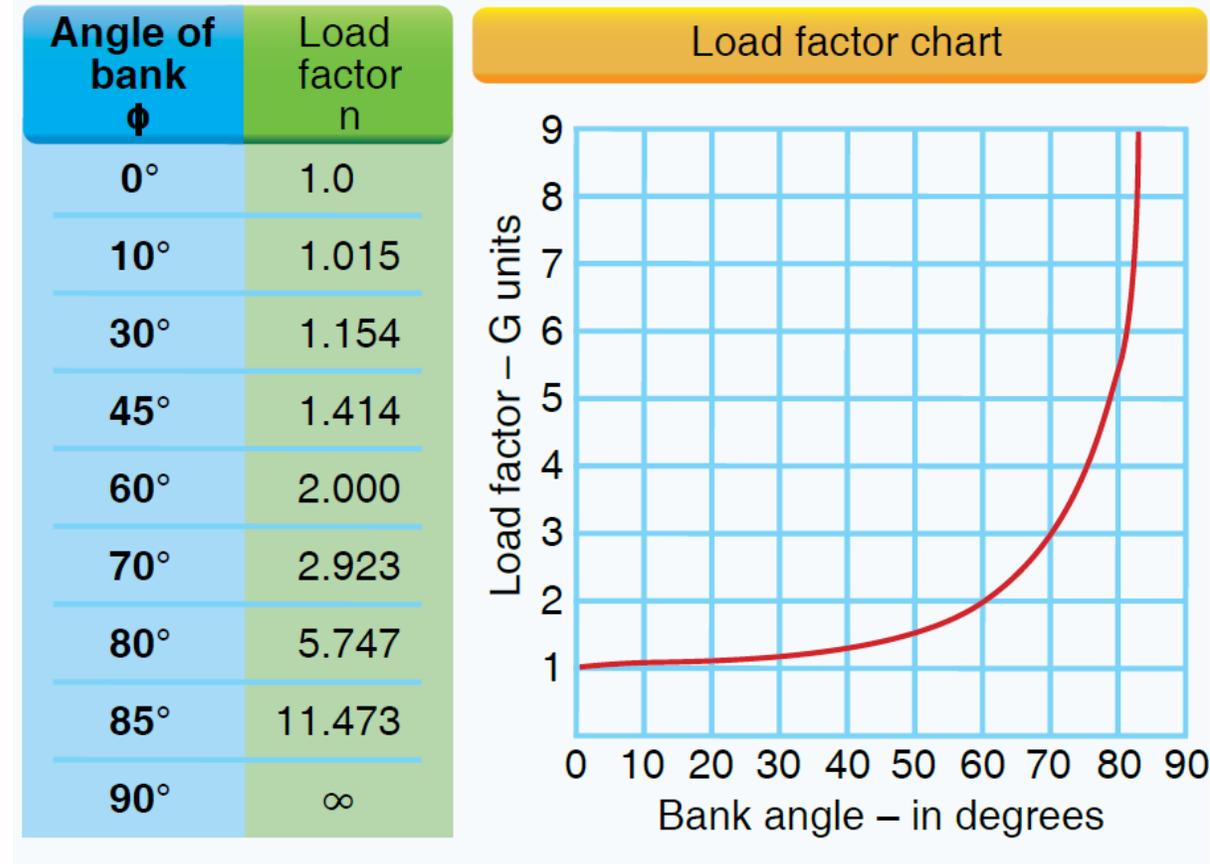


Figure 2. Load Factor Chart.



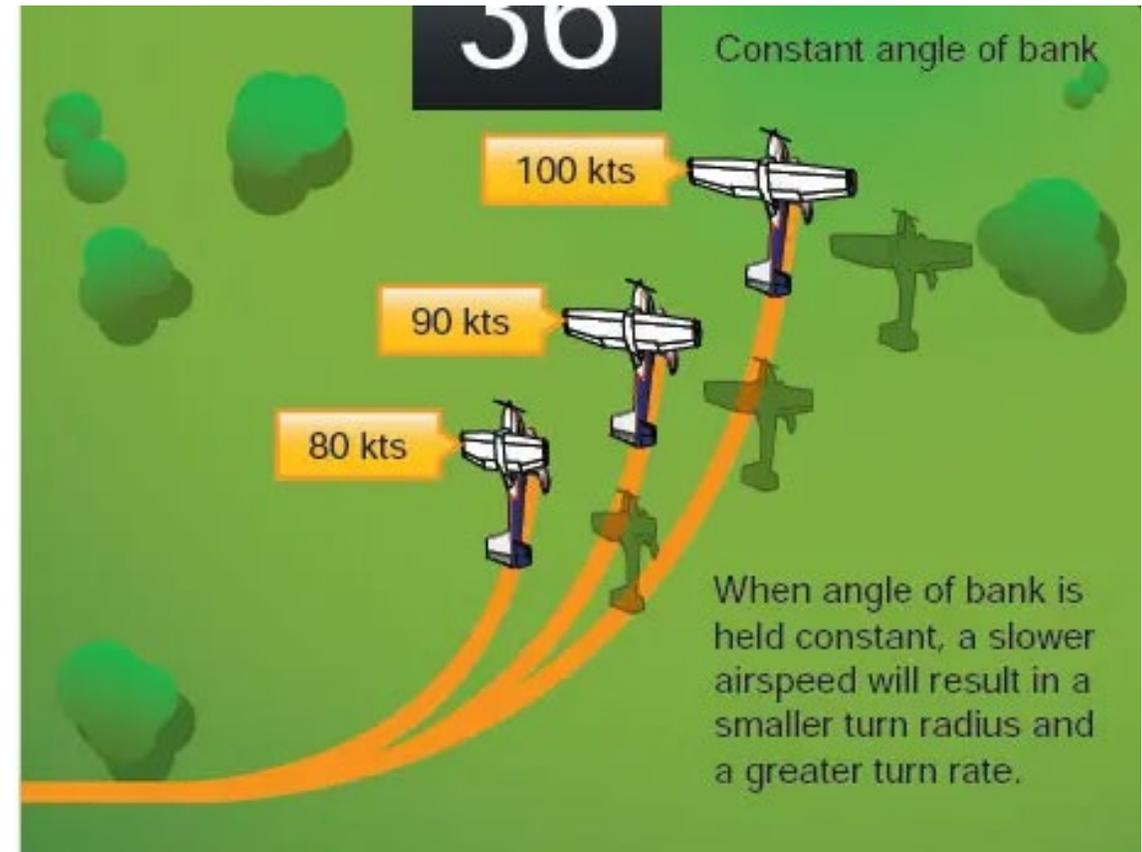
Rate/Radius of Turn

- Constant altitude coordinated turn
- Rate of Turn – How fast aircraft completes a circle
- Radius of Turn – How large the diameter of the circle is



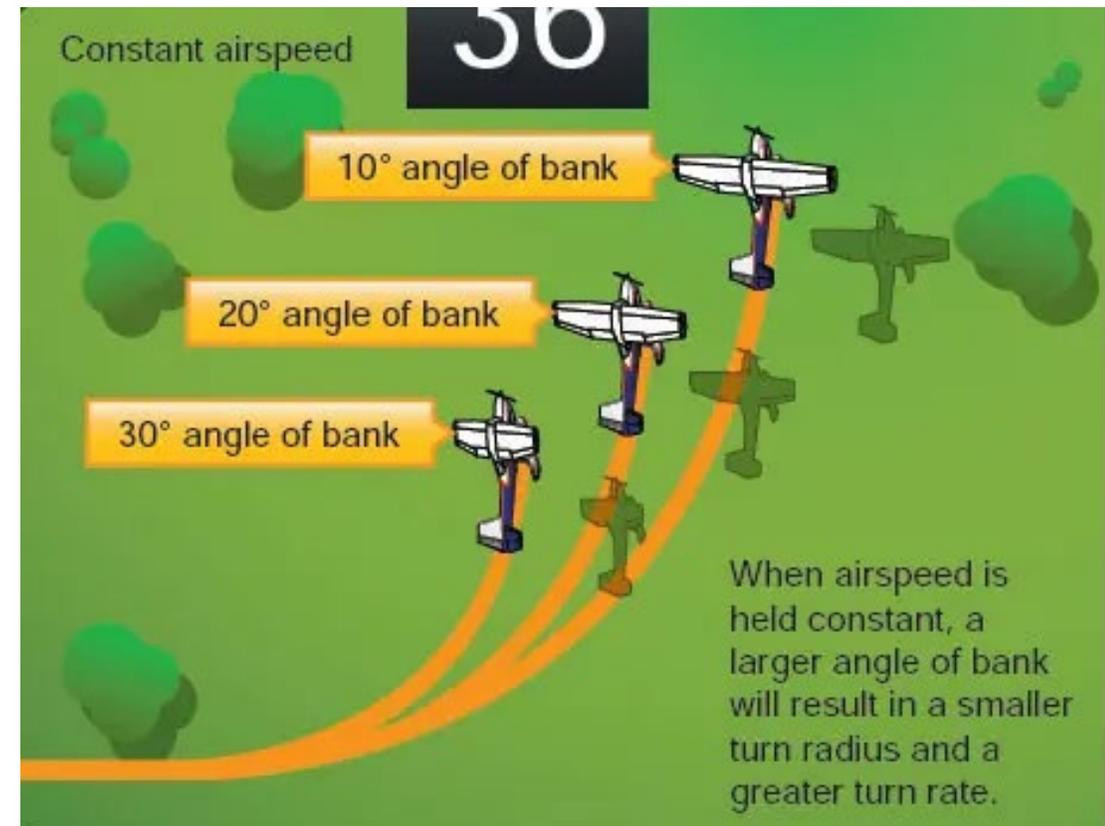
Rate/Radius of Turn

- **Constant Bank Angle**
 - Rate of Turn - Rate of Turn varies by speed
 - Radius of Turn – Size of circle varies by speed



Rate/Radius of Turn

- **Constant Airspeed**
 - Rate of Turn - Rate of Turn varies by bank angle
 - Shallow bank angle makes larger circle
 - Radius of Turn – Size of circle varies by bank angle



Aerodynamic Spin

- **Spin**

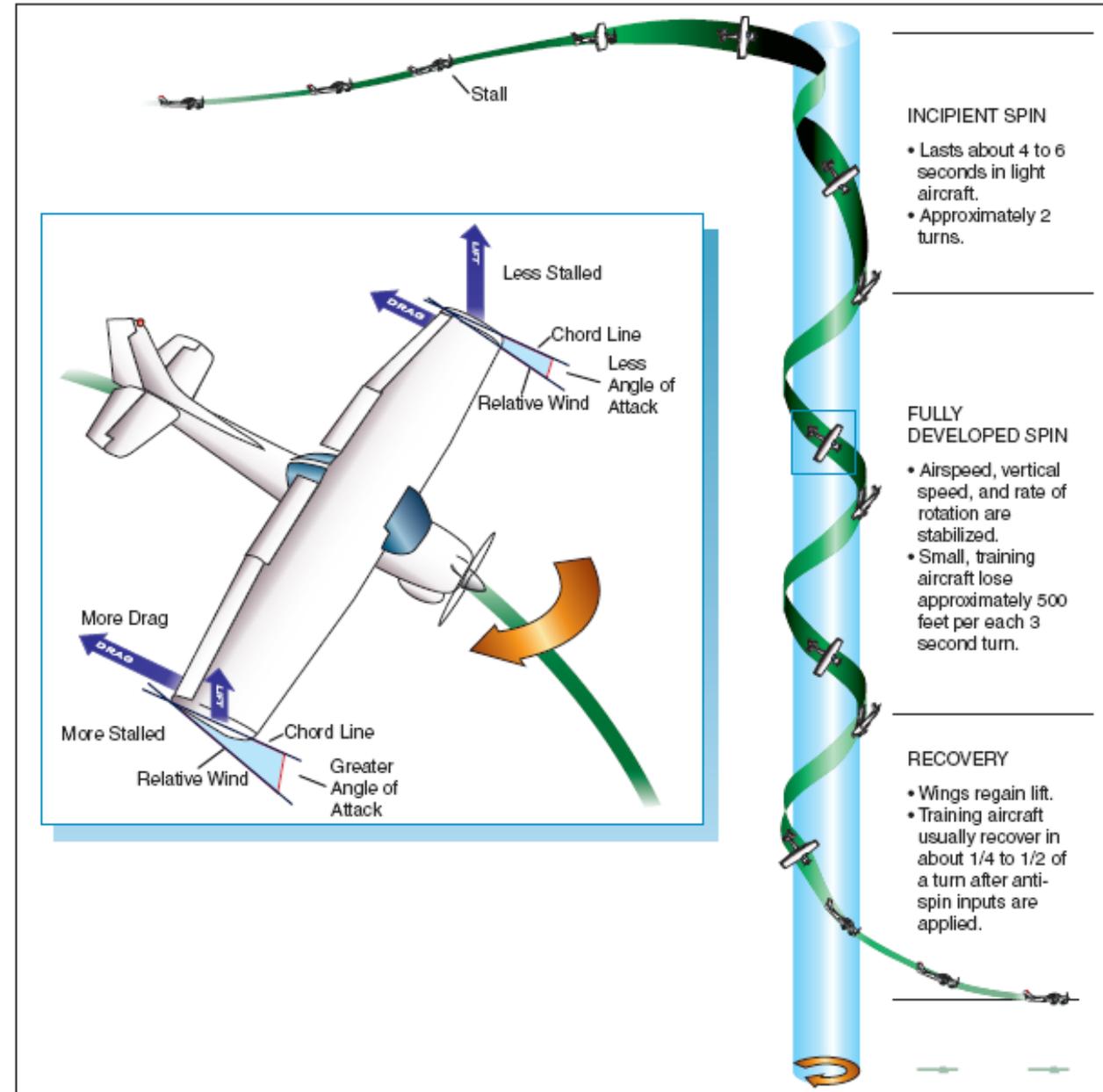
- Aggravated stall results in “autorotation”
- Aircraft follows a downward cork-screw path.
- As aircraft rotates the rising wing is less stalled than the descending wing

- **Spin Characteristics**

- **Both wings must be stalled to spin**
- During auto-rotation, airspeed is slow, near stall speed

- **Avoiding Spins**

- Don't stall – no stall, no spin
- Stay in “coordinated” flight

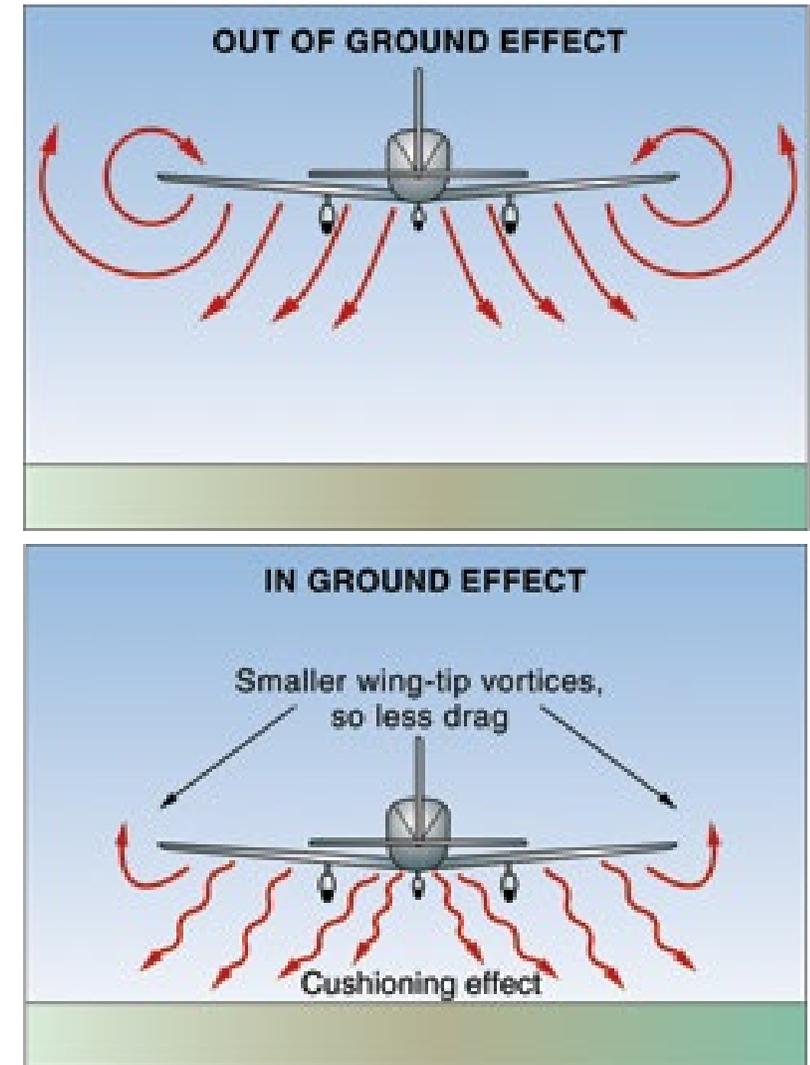


Aerodynamic Spin



Ground Effect

- Occurs during takeoff and landing
- Height above surface is approx. one wing (half of the total wingspan)
- Caused by **interference** of the landing surface with the **airflow patterns** about the aircraft in flight
- This interference reduces the up wash, downwash, and wingtip vortices.
- Provides a “cushioning” effect
- Resulting effect is thrust required at low airspeeds on landing will be reduced. Any excess speed at the flare may cause considerable floating.
 - Carrying too much energy on landing



Weight and Balance

- **Weight and Balance**
 - Operating within weight and Balance limits
 - Structural integrity
 - Adversely affects performance
 - Maintain weight distribution within CG limits
- **Overloading**
 - May not be able to T/O – Ground Effect
 - May have unexpected or unusual flight characteristics
 - Poor Performance
 - May be catastrophic in an emergency
 - If **CG** (center of gravity) is moved backward airplanes become **less stable at all speeds**

Weight and Balance

- **Overloading Performance Deficiencies**
 - Higher Take Off Speed
 - Longer T/O Run
 - Reduced Rate and Angle of Climb
 - Lower Max Altitude
 - Shorter Range
 - Reduced Cruising Speed
 - Reduced Maneuverability
 - Higher Stall Speed
 - Higher Approach and Landing Speed
 - Longer Landing Roll



End of Module

Break

Module 7: Weather Theory

Weather Theory

- **Weather Facts**

- Complicated topic – this is a VERY high level overview!
- **All weather is the result of an unequal heating of the earth's surface**
 - Every physical process of weather is accompanied by, or is the result of, a heat exchange
- Weather generally moves from west to east
- Air moves sideways from areas of high pressure to areas of low pressure in order to equalize
 - This is what causes wind (advective movement of air)
- Warm air is less dense than cold air causing it to rise (convective movement of air)

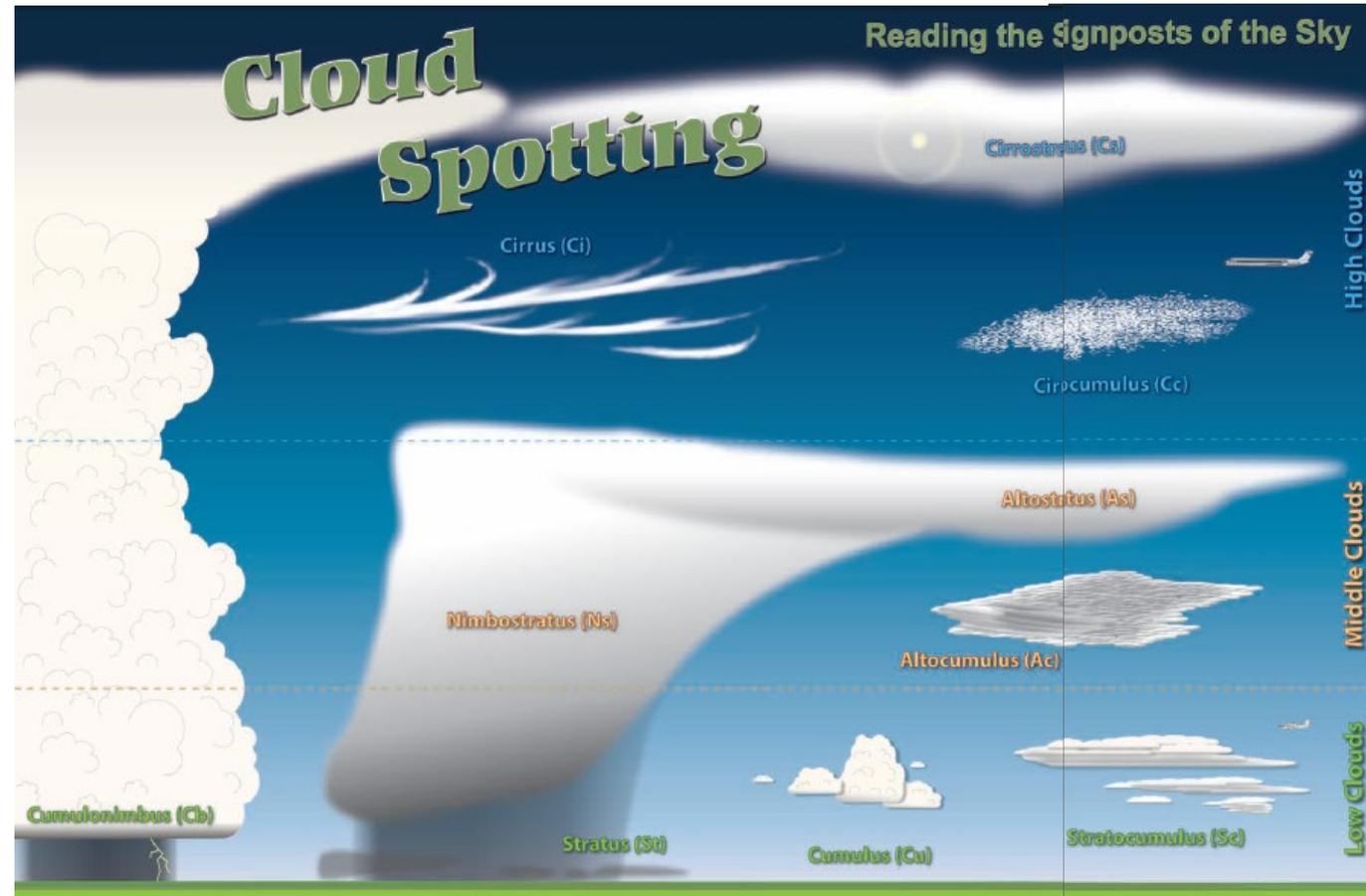
Effects of Wind

- **Effect of Obstructions on Wind**
 - Obstruction on the ground can create unseen hazards for RPICs
 - Large structures can break up wind flow and create wind gusts that change direction and speed rapidly
 - Mountains – wind flows smoothly up the windward side and is very turbulent on the leeward side – into the mountain



Clouds – Signposts In The Sky

- Clouds are classified as:
 - High, Middle, Low
 - Clouds with Extensive Vertical Development
- Understanding the cloud types helps pilots to predict upcoming weather (near-term)
- Clouds form when relatively warm, moist air rises at the surface, cools and water vapor turns from gas (invisible) to small droplets (visible).
- This course focuses on Low clouds and clouds with vertical development (thunderstorms)



Low Clouds

✓ Unstable Atmosphere



Cumulus

These puffy clouds are formed of liquid water droplets near the ground and can be turbulent. Over land, they develop on clear days due to daytime convection. They typically appear in the morning, grow, and then dissipate in the evening.

✓ **CAUTION! Cumulus can build to cumulonimbus**



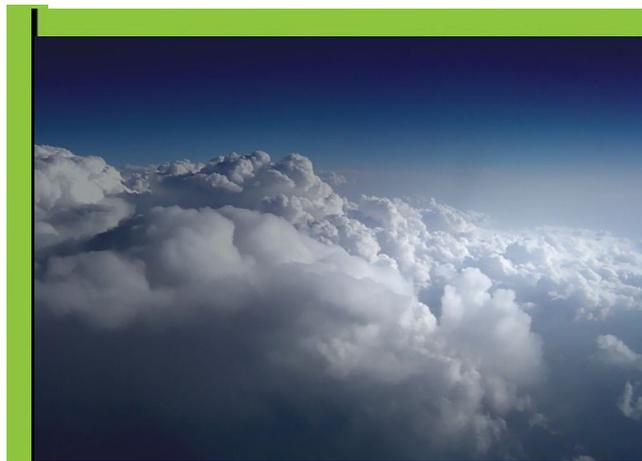
Cumulonimbus

These towering giants can produce tornados, thunderstorms, lightning, hail, icing conditions, and devastating turbulence. The FAA recommends keeping a distance of 20 nautical miles from these clouds.

✓ Cumulus means “Stacked” or “layered”

✓ Nimbus means “rain”

Low Clouds



Stratocumulus

These gray or whitish patch, sheet, or layered clouds almost always have dark tessellations (honeycomb appearance), rounded masses, or rolls. They are often found in marine environments and can form from the breakup of stratus layers.



Stratus

These "good IFR" clouds tend to be smooth but moderate icing and some turbulence may exist. Stratus layers have a uniform base, which, if thick enough, may produce drizzle, ice, or snow.

✓ **Stable Atmosphere**

✓ **Stratus means "horizontal grey layered"**



Low Clouds

- **Standing Lenticular Altocumulus Clouds**
 - Formed on crests of waves created by barriers in the wind flow
 - Show little movement – standing
 - Wind flowing through these clouds can be very strong
 - Expect strong turbulence on leeward side of mountain and smooth conditions on windward side
 - **Presence is good indication of strong turbulence should be avoided**



Atmospheric Stability

- **Atmospheric Stability** – Overall stability of an air mass determines its typical weather characteristic
 - **Stable Air Mass** – resists vertical movement
 - **Unstable Air Mass** – vertical movement increases and results in turbulence and convective activity, severe weather
- Moisture and temperature determine stability
 - Cool dry air very stable
 - Warm moist air greatest instability

Unstable Air	Stable Air
Cumuliform clouds	Stratiform clouds and fog
Showery precipitation	Continuous precipitation
Rough air (turbulence)	Smooth air
Good visibility (except in blowing obstructions)	Fair to poor visibility in haze and smoke



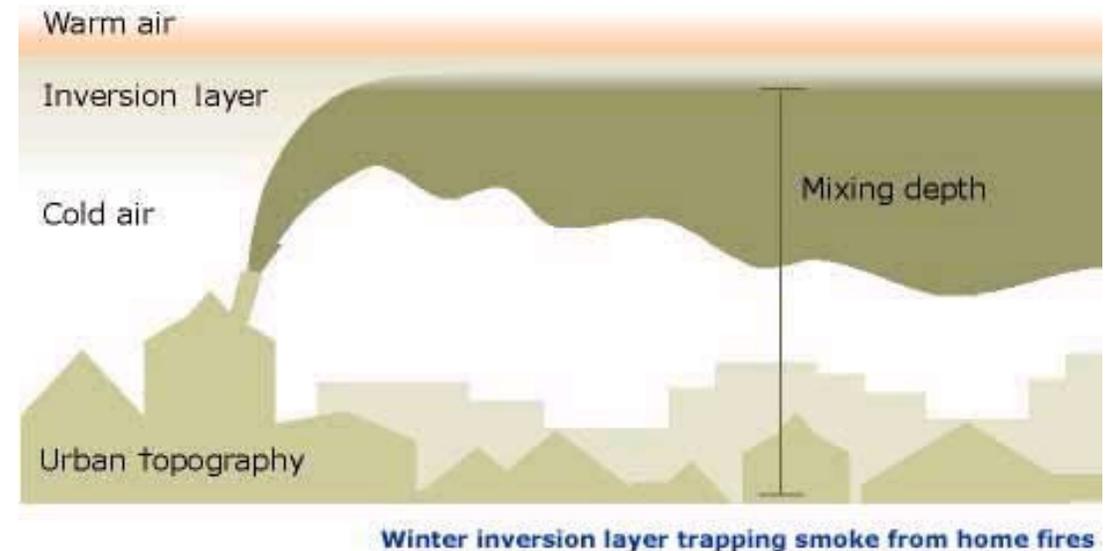
Atmospheric Stability

- **Stability**
 - **Unstable Air Mass** is an air mass passing over a warmer surface from below, and convective currents form, causing the air to rise. This creates an **unstable air mass with good surface visibility and forms moist, unstable air causing cumulus clouds, showers, and turbulence**
 - **Stable Air Mass** is an air mass passing over a colder surface and does not form convective currents but instead creates a **stable air mass with poor surface visibility** due to the fact **that smoke, dust, and other particles cannot rise out of the air mass and are instead trapped near the surface.** A stable air mass can produce low stratus clouds and fog.



Atmospheric Stability

- **Inversion**
 - Occurs when air temp rises with altitude
 - Normally as air rises it expands and cools
 - Commonly shallow layers stable air close to the ground
 - Freezing rain falling through colder air may freeze during its descent forming ice pellets
 - Ice pellets always indicate freezing rain at a higher altitude



Atmospheric Stability

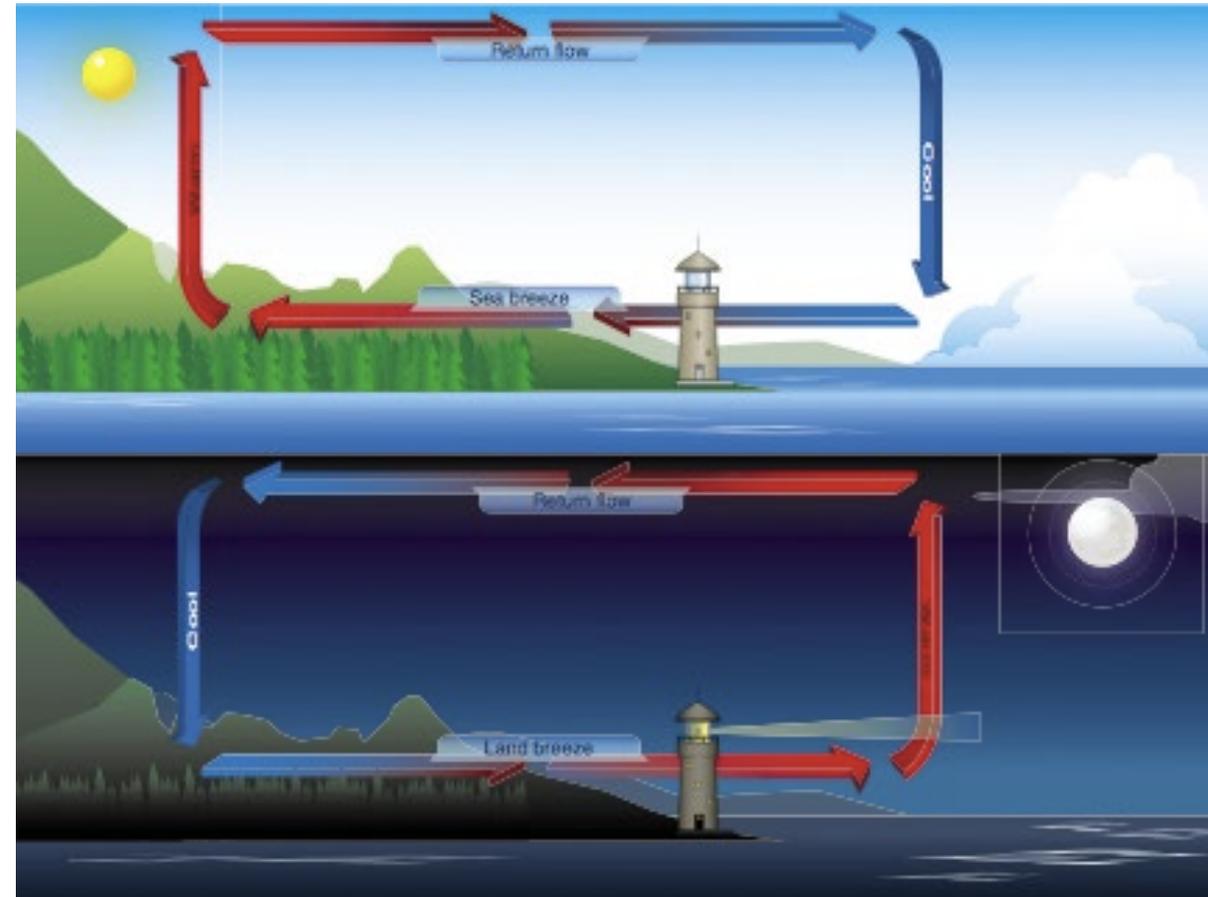
- **Inversion**

- When air temp stops rising with alt and acts as a lid keeping weather pollutants trapped
- If relative humidity is high formation of clouds, fog, haze or smoke may result in the layer
- Surfaced based inversions occurs on clear, cool nights when the air within a few hundred feet is cooled by the ground the air above remains warm
- Frontal inversion occurs when warm air spreads over cooler air or cooler air is forced under a warm layer



Convective Air Currents

- Key Points
 - Land heats and cools much faster than water
 - Warm air rises / cold air descends
 - Convection - unequal heating of the earth's surface (solar heating)
 - **The development of thermals depends on Solar heating**
- Sea Breeze
 - Caused by cool, more dense air moving inland from water
 - Once over land, air warms and rises
 - Returns outbound to water
- Land Breeze
 - Opposite of sea breeze at night
 - Cooler, more dense air flows toward warmer water
 - Air warms and rises



Weather Fronts

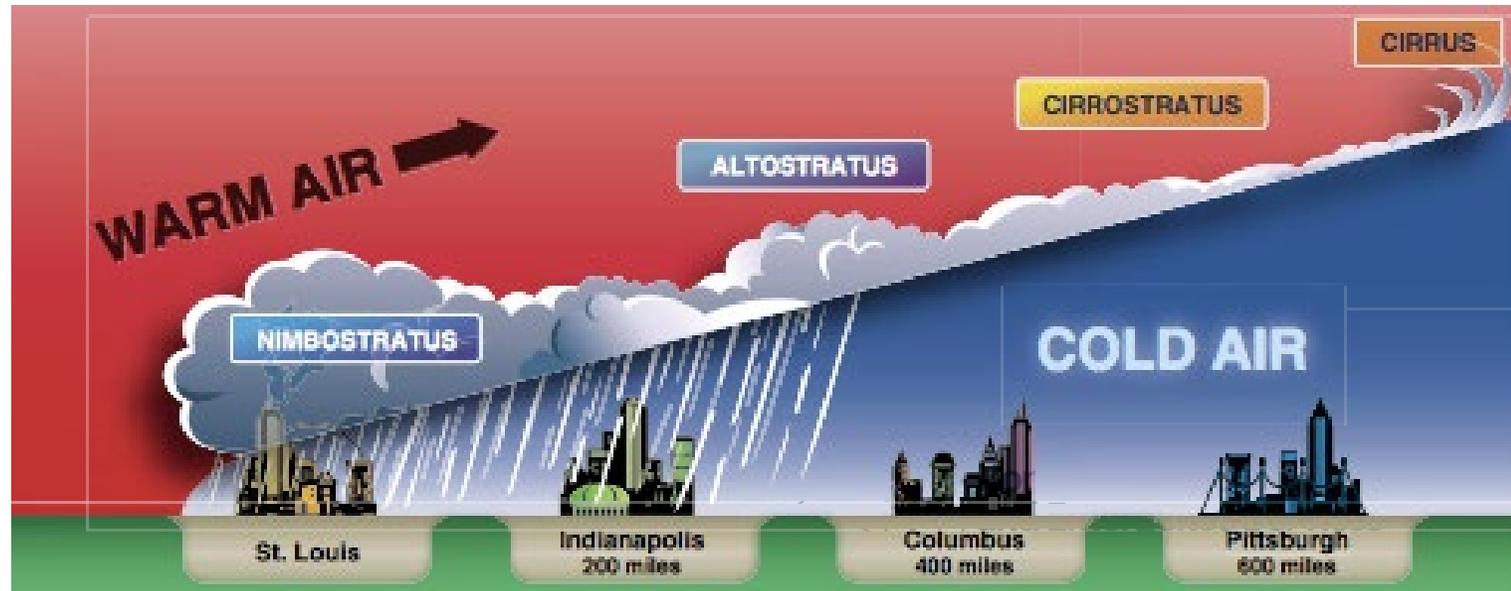
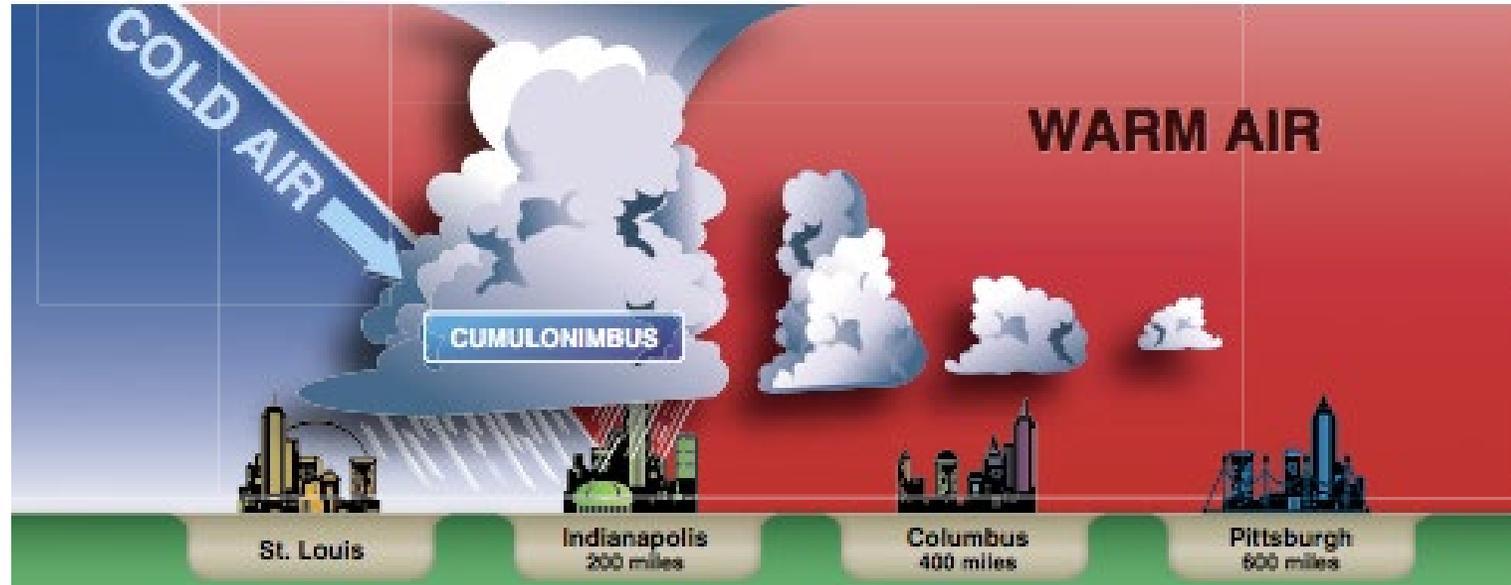
- **Fronts** – air moves from its origin and comes in contact with a different type air mass
 - The boundary between two air masses
 - The zone between two is a frontal zone
 - In frontal zones temp, humidity and wind often change rapidly over short distances
 - **Warming of weather from below causes a decrease in the stability of an air mass**



Frontal Types / Movement

• Fronts

- There are several types of fronts
 - Cold
 - Warm
 - Stationary
 - Occluded
- Takes its term from the advancing air mass



Temperature / Dew Point Relationship

- Dew Point
 - The temperature to which air must be cooled to become saturated with water vapor.
 - When cooled below the dew point, moisture capacity is reduced, and airborne water vapor will condense to form liquid water known as dew
- Relative Humidity
 - Relationship between temperature and dew point

Temperature / Dew Point Relationship

- Warm air moves over a cooler surface, warm air cools and loses ability to retain moisture
- **Clouds, fog, or dew will always form when water vapor condenses**
- Moisture (water vapor) changes from gaseous form to visible
 - Fog – Steam, Radiation, Upslope, Ice and Advection
 - Dew
 - Frost
 - Clouds
 - Rain
 - Snow



Temperature / Dew Point Relationship

- Fog
 - Steam Fog - Forms in winter when cold, dry air passes from land areas over comparatively warm waters (similar to the "steam" produced over a hot bath or a hot drink)- **causes *Low level turbulence and icing which can be hazardous***
 - Radiation Fog - Formed by the cooling of low flatland areas after sunset by infrared thermal radiation with calm winds and clear skies, warm moist air then cools to the dew point, usually does not last long after sunrise, is most common in autumn and early Winter



Temperature / Dew Point Relationship

- Fog
 - Upslope Fog - forms when wind causes moist air up the slope of a mountain (orographic lifting) condenses into fog caused by adiabatic cooling (pressure change as it relates to temperature) with the drop in pressure with altitude – ***wind is required to move air masses***
 - Ice Fog - only seen in polar /artic regions. Temp at 14 F (-10°C) is too cold for the air to contain super-cooled water droplets so it forms small tiny ice crystals.



Temperature / Dew Point Relationship

- **Dew and Frost**

- Cool, clear, calm night - moisture can condense out on the cooler surfaces (dew)
- Frost
 - Frost is the disposition of water vapor into ice crystals.
 - Forms when both the collecting surface is below the dew point of the adjacent air and dew point is below freezing.
- Frost can pose a risk if formed on a wing by drastically reducing lift and increasing drag
- The UAS must be cleaned and free from frost before takeoff



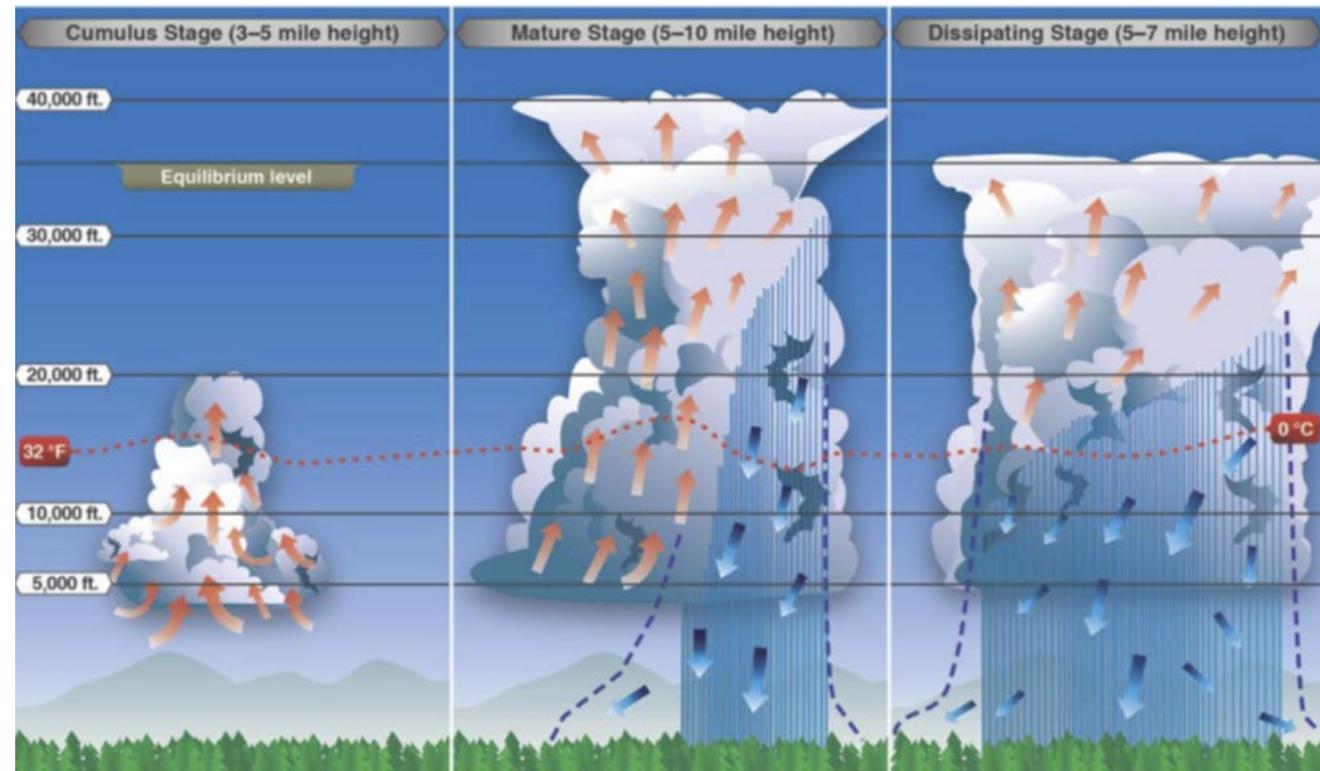
Structural Icing

- **Structural Icing – two conditions must be met**
 - Fly through visible moisture – rain or clouds
 - Temp at or below 32° (0°C)
 - Aerodynamic cooling can lower the temp of the airfoil (parts of airframe)
- Three Types of structural icing
 - Clear
 - Formed from large water drops
 - Hits surface, spreads out, then freezes
 - Most dangerous – heavy, can freeze control surfaces
 - Rime
 - Formed from light drizzle
 - Freezes rapidly with air pockets, no time to spread out
 - Changes shape of airfoil – reduces aerodynamic efficiency
 - Mixed – Combination of clear and rime



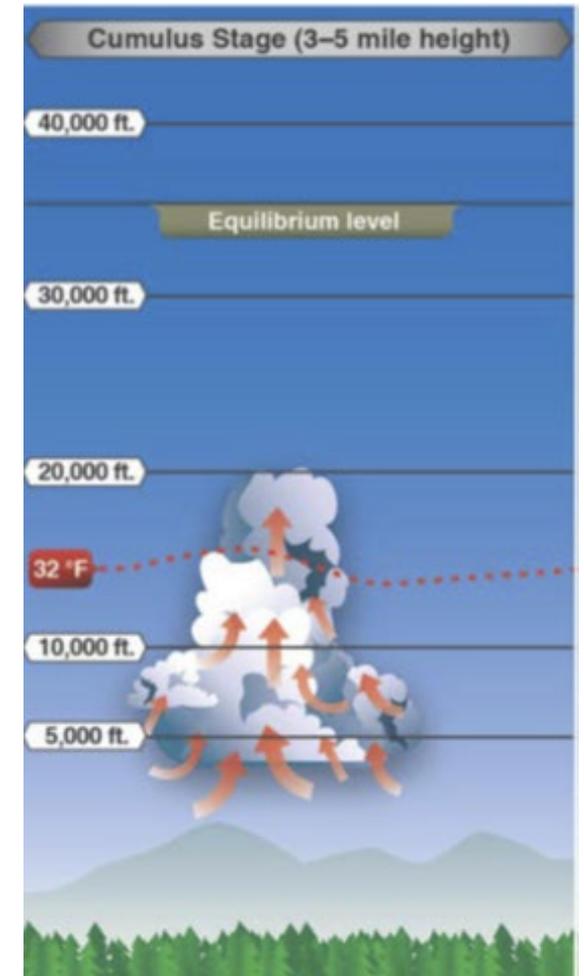
Thunderstorms

- They appear individually or in groups (air mass or orographic thunderstorm)
- Heating at the surface creates air mass thunderstorms
- Air moving up in mountainous regions cause orographic thunderstorms
- Cumulonimbus clouds in a line in non-frontal bands are called squall line thunderstorms
- Thunderstorms are extremely hazardous to flight because of the wind shear
 - Updrafts/downdrafts can exceed 3000' fpm
 - Can produce, large hailstones, lightning, tornadoes, heavy rain
- There are three stages of thunder storms



Thunderstorms

- **Thunderstorm – Life Cycle – Three Stages**
 - Cumulus
 - Most don't grow into thunderstorms
 - Key feature to cumulus is the **updraft**
 - Can exceed 3000 fpm
 - Inadvisable to operate UAS in an area of developing thunderstorms
 - Water droplets start small and grow to raindrop size as cloud grows
 - Rising air carries liquid water above freezing level
 - Eventually growing heavier and failing
 - Cold rain drags air creating the downdraft – w/ updraft -now mature



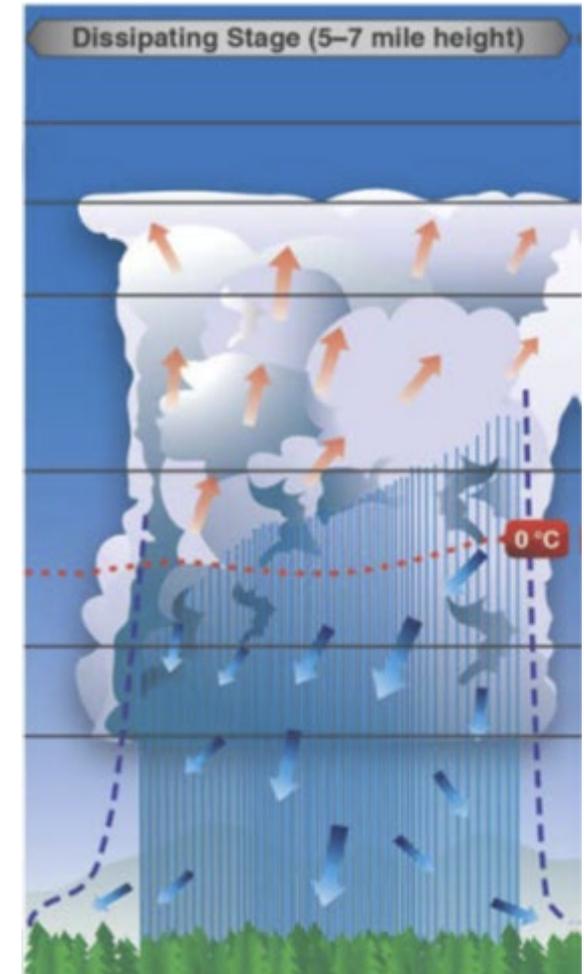
Thunderstorms

- **Thunderstorm – Life Cycle – Three Stages**
 - Mature – **MOST DANGEROUS**
 - Precipitation beginning to fall indicated the downdraft has developed and the cell is mature
 - Cold rain in downdraft retards compressional heating and remains cooler than surrounding air
 - Downward speed is then accelerated and may exceed 2500 fpm
 - **Downdraft spreads outward at surface resulting in strong gusty surface winds, sharp temp drop and rapidly rising pressure**



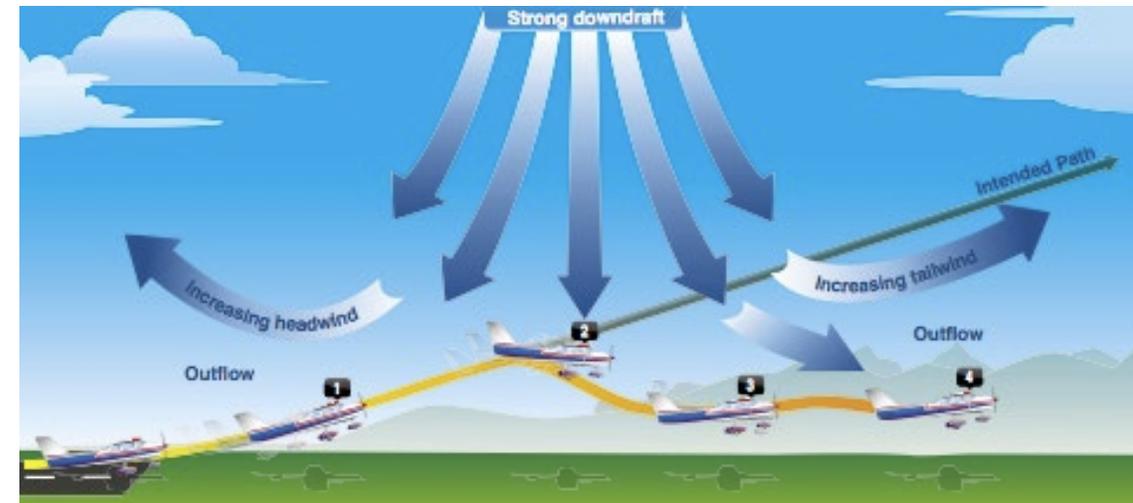
Thunderstorms

- **Thunderstorm – Life Cycle – Three Stages**
 - Dissipating
 - Downdrafts w/o updrafts characterize the dissipating stage and the storm dies rapidly
 - When the rain stops and downdrafts have ended the dissipating stage is complete



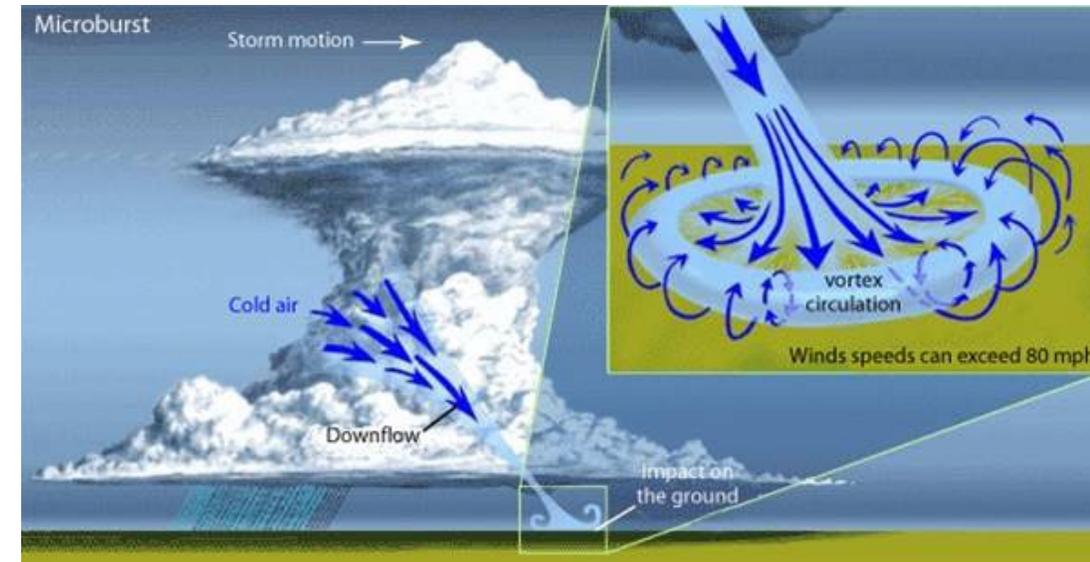
Low-Level Wind Shear

- **Result is a sudden drastic change in direction and/or speed**
 - Violent updrafts or downdrafts
 - Extremely dangerous at low altitudes
 - Associated with
 - Passing frontal systems
 - Thunderstorms
 - Temperature inversions
 - Strong upper level winds
 - Disrupts normal flight attitude
 - Headwind quickly changes to tailwind – decrease airspeed and performance
 - 5-15 min. duration
 - Downdrafts up to 6000' fpm
 - Headwind losses of 30-90 Kts
 - Strong turbulence
 - Hazardous wind direction changes



Microburst

- **Microburst** – convective precipitation into dry air at cloud base
- Column of sinking air (downdraft) within a thunderstorm and is usually less than or equal to 2.5 miles in diameter.
- Can cause extensive damage at the surface, and in some instances, can be life-threatening.
- Two Types – wet and dry
- Both are leading cause of low-level wind shear



End of Module

Break

Module 8: Weather Sources/Effects of Weather

Three Types of Information Provided by FAA

- **Weather Related Terms**

- Observations
 - METAR - **M**eteorological **T**erminal **A**viation **R**outine / Aviation Routine Weather Report
- Forecasts
 - FA – Aviation Forecast
 - FB – Wind and Temp aloft forecast
 - TAF – Terminal Aerodrome Forecast
- Advisories
 - AIRMET – Airman’s Meteorological Information
 - SIGMET – Significant Meteorological Information
 - Convective SIGMET – SIGMET involving Convective Activity
 - PIREP – **P**ilot **R**eport



Weather Sources and Effects on sUAS

- **Weather Sources**

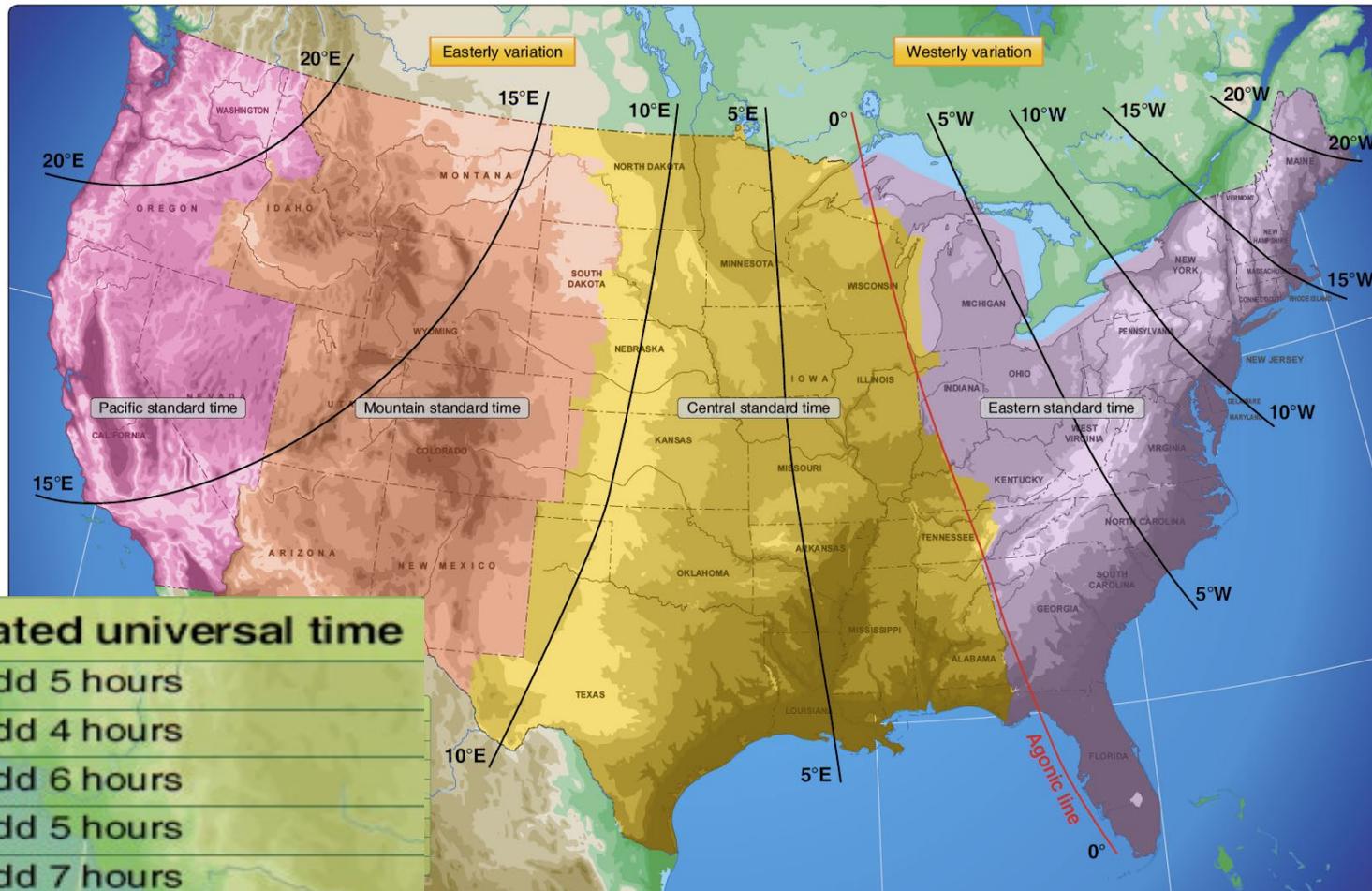
- Aviation Weather / Forecast
 - Collaboration of:
 - Nat'l Weather Service
 - FAA
 - DOD
 - Various other sources
- Surface Observations – Provide detailed local weather and forecasts
 - AWOS – **A**utomated **W**eather **O**bservation **S**ystem
 - ASOS – **A**utomated **S**urface **O**bserving **S**ystem

Aviation Times Defined

See Page 2-26 in Private Pilot Book

- **Weather Related Terms**
 - UTC – Universal Coordinated Time
 - GMT – Greenwich Mean Time
 - Zulu Time

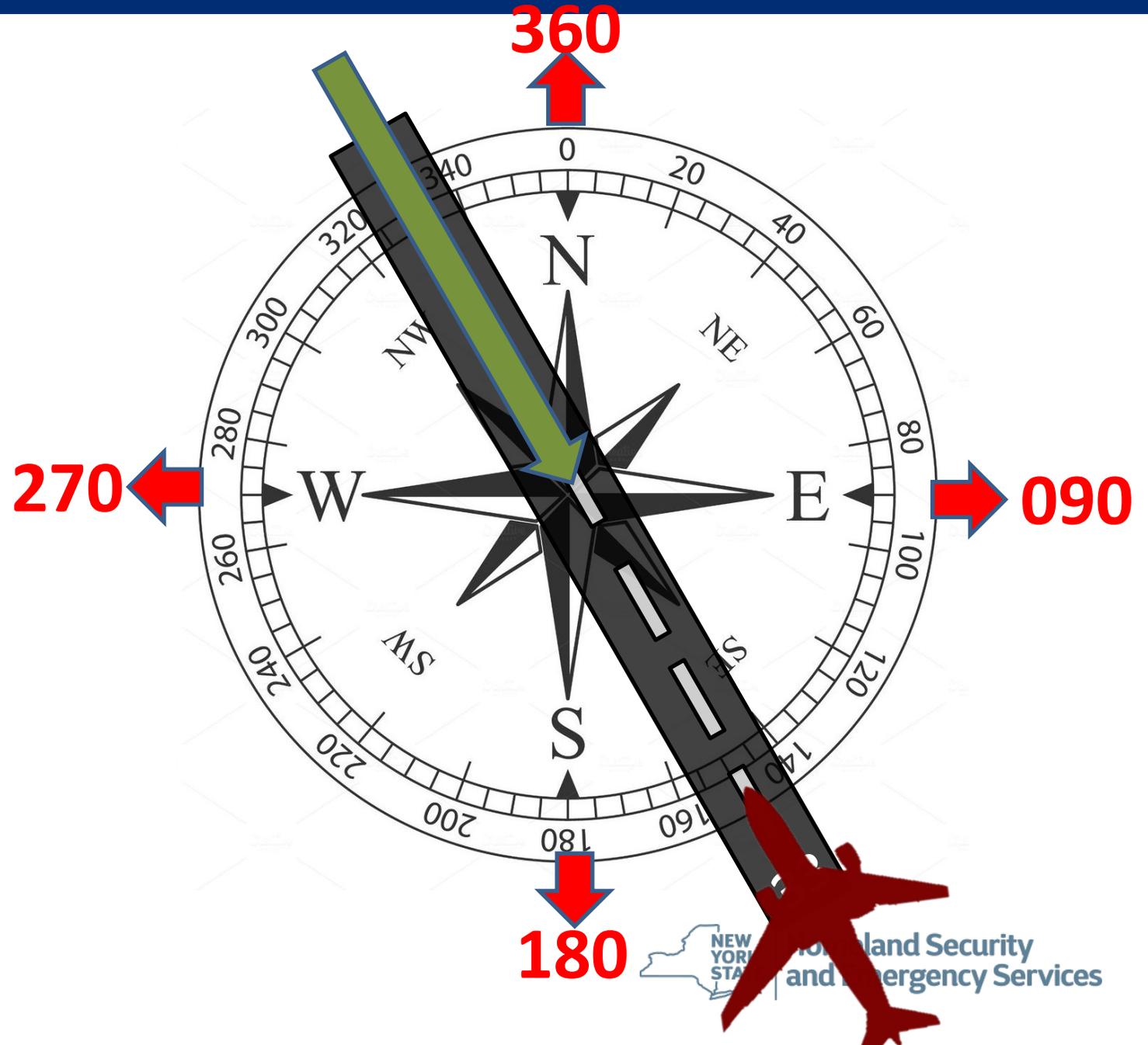
Figure 27. Time Conversion Table



To convert from	To coordinated universal time
Eastern standard time	add 5 hours
Eastern daylight time	add 4 hours
Central standard time	add 6 hours
Central daylight time	add 5 hours
Mountain standard time	add 7 hours
Mountain daylight time	add 6 hours
Pacific standard time	add 8 hours
Pacific daylight time	add 7 hours

Wind Direction

- Wind Direction is always FROM or “Out of”
- Ex: Weather reports “wind 330 at 10 knots”
 - Wind is coming FROM the northwest GOING southeast
- Airplanes always try to land into the wind as much as possible



Ceiling and Visibility

- **Ceiling** – lowest part of cloud layer reported as broken or overcast or visibility into an obscuration like fog or haze
 - Broken Cloud Layer
 - When 5/8 to 7/8 of the sky is covered
 - Overcast Layer
 - Completely covered
- **Visibility** – greatest horizontal distance at which prominent objects can be viewed with naked eye
 - Current visibility reported in METAR
 - Is included in aviation forecasts

Weather Sources and Effects on sUAS

- **Weather Related Terms**

- ICAO – International **C**ivil **A**viation **O**rganization
- Flight Rules
 - VFR – **V**isual **F**light **R**ules
 - 3 SM visibility. Ceiling over 1,000ft
 - IFR – **I**nstrument **F**light **R**ules (Less than VFR conditions)



Weather Sources and Effects on sUAS

- **Weather Sources**

- **METAR - Meteorological Terminal Aviation Routine**
 - generated from surface obs, automated station and possible updated by person
 - **SPECI** - special report of meteorological conditions, issued when one or more elements meet specified criteria, also used to identify reports of observations recorded ten minutes following an improvement (in visibility, weather or cloud)
- **TAF - Terminal Aerodrome Forecast**



Weather Sources and Effects on sUAS

Qualifier		Weather Phenomena		
Intensity or Proximity 1	Descriptor 2	Precipitation 3	Obscuration 4	Other 5
- Light	MI Shallow	DZ Drizzle	BR Mist	PO Dust/sand whirls
Moderate (no qualifier)	BC Patches	RA Rain	FG Fog	SQ Squalls
+ Heavy	DR Low drifting	SN Snow	FU Smoke	FC Funnel cloud
VC in the vicinity	BL Blowing	SG Snow grains	DU Dust	+FC Tornado or waterspout
	SH Showers	IC Ice crystals (diamond dust)	SA Sand	SS Sandstorm
	TS Thunderstorms	PL Ice pellets	HZ Haze	DS Dust storm
	FZ Freezing	GR Hail	PY Spray	
	PR Partial	GS Small hail or snow pellets	VA Volcanic ash	
		UP *Unknown precipitation		

The weather groups are constructed by considering columns 1–5 in this table in sequence: intensity, followed by descriptor, followed by weather phenomena (e.g., heavy rain showers(s) is coded as +SHRA).

* Automated stations only



Weather Sources and Effects on sUAS

- **Aviation Forecasts**

Sky Cover	Contraction
Less than $\frac{1}{8}$ (Clear)	SKC, CLR, FEW
$\frac{1}{8}$ – $\frac{2}{8}$ (Few)	FEW
$\frac{3}{8}$ – $\frac{4}{8}$ (Scattered)	SCT
$\frac{5}{8}$ – $\frac{7}{8}$ (Broken)	BKN
$\frac{8}{8}$ or (Overcast)	OVC

Ceiling determined by lowest level broken (BKN), overcast (OVC), or vertical visibility obscured sky (think BOO).

Scattered (SCT) or Few (FEW) clouds are NOT a ceiling.



Weather Sources and Effects on sUAS

- **Aviation Weather Reports**

- **METAR - Meteorological Terminal Aviation Routine**

- Type of Report – two type: routine METAR / SPECI
 - Station Identifier – Airport (KRME, KSYR, KJFK)
 - Date and Time -two digit date 4 digit time in Zulu (UTC)
 - **Wind Direction reported in (True heading) / Speed**
 - Visibility - RVR – Dist. pilot can see while on the runway
 - Weather Qualifiers / Phenomena –()+ VC=vacinity
 - Sky Condition (clouds) – amount / Reported in hundreds of feet AGL
 - Temp./Dew Point – M= negative degrees
 - Altimeter Reading / Setting – inches of mercury
 - Remarks - RMK



METAR Reports

See Page 2-12 in Private Pilot Book

METAR	KINK	121845Z	11012G18KT	15SM	SKC	25/17	A3000
METAR	KBOI	121854Z	13004KT	30SM	SCT150	17/6	A3015
METAR	KLAX	121852Z	25004KT	6SM	BR	SCT007	SCT250 16/15 A2991
SPECI	KMDW	121856Z	32005KT	1 1/2SM	RA	OVC007	17/16 A2980 RMK RAB35
SPECI	KJFK	121853Z	18004KT	1/2SM	FG	R04/2200	OVC005 20/18 A3006

Figure 12. Aviation Routine Weather Reports (METAR).

METAR KINK

KINK – Location Winkler County Airport Wink, Texas

12 Day / 1845Z Time Created

11012G18KT – Wind Direction 110° / Speed 12Kts / Gusts 18 Kts

Visibility 15 Statue Miles

SKC – Sky Clear

25/17 – Temp. / Dew Point in Celsius

A3000 – Altimeter Setting



METAR Reports

See Page 2-12 in Private Pilot Book

```
METAR KINK 121845Z 11012G18KT 15SM SKC 25/17 A3000
METAR KBOI 121854Z 13004KT 30SM SCT150 17/6 A3015
METAR KLAX 121852Z 25004KT 6SM BR SCT007 SCT250 16/15 A2991
SPECI KMDW 121856Z 32005KT 1 1/2SM RA OVC007 17/16 A2980 RMK RAB35
SPECI KJFK 121853Z 18004KT 1/2SM FG R04/2200 OVC005 20/18 A3006
```

Figure 12. Aviation Routine Weather Reports (METAR).

METAR KBOI

KBOI – Location Boise Air Terminal/Gowen Field Boise, Idaho

12 Day / 1854Z Time Created

13004KT – Wind Direction 130°/ Speed 04Kts

Visibility 30 Statue Miles

SCT150 – Scattered (3/8-4/8) 15 Thousand Feet

17/06 – Temp. / Dew Point in Celsius

A3015 – Altimeter Setting



METAR Reports

See Page 2-12 in Private Pilot Book

```
METAR KINK 121845Z 11012G18KT 15SM SKC 25/17 A3000
METAR KBOI 121854Z 13004KT 30SM SCT150 17/6 A3015
METAR KLAX 121852Z 25004KT 6SM BR SCT007 SCT250 16/15 A2991
SPECI KMDW 121856Z 32005KT 1 1/2SM RA OVC007 17/16 A2980 RMK RAB35
SPECI KJFK 121853Z 18004KT 1/2SM FG R04/2200 OVC005 20/18 A3006
```

Figure 12. Aviation Routine Weather Reports (METAR).

METAR KLAX

KLAX – Location Los Angeles International Airport, Los Angeles, California

12 Day / 1852Z Time Created

25004KT – Wind Direction 250°/ Speed 04Kts

Visibility 6 Statue Miles

BR - Mist

SCT007 – Scattered 700 Feet

SCT250 – Scattered 25 Thousand Feet

16/15 – Temp. / Dew Point in Celsius

A2991 – Altimeter Setting



METAR Reports

See Page 2-12 in Private Pilot Book

METAR KINK 121845Z 11012G18KT 15SM SKC 25/17 A3000
METAR KBOI 121854Z 13004KT 30SM SCT150 17/6 A3015
METAR KLAX 121852Z 25004KT 6SM BR SCT007 SCT250 16/15 A2991
SPECI KMDW 121856Z 32005KT 1 1/2SM RA OVC007 17/16 A2980 RMK RAB35
SPECI KJFK 121853Z 18004KT 1/2SM FG R04/2200 OVC005 20/18 A3006

Figure 12. Aviation Routine Weather Reports (METAR).

SPECI KMDW SPECI - special report of meteorological conditions

KMDW – Location Chicago Midway International Airport, Chicago, Illinois

12 Day / 1856Z Time Created

32005KT – Wind Direction 320° / Speed 05Kts

Visibility 1 and 1/2 Statue Miles

RA – Moderate Rain

OVC007 – Overcast 7 Hundred Feet

17/16 – Temp. / Dew Point in Celsius

A2980 – Altimeter Setting

RMK – Remarks

RAB – Rain Began 35 min past the hour



METAR Reports

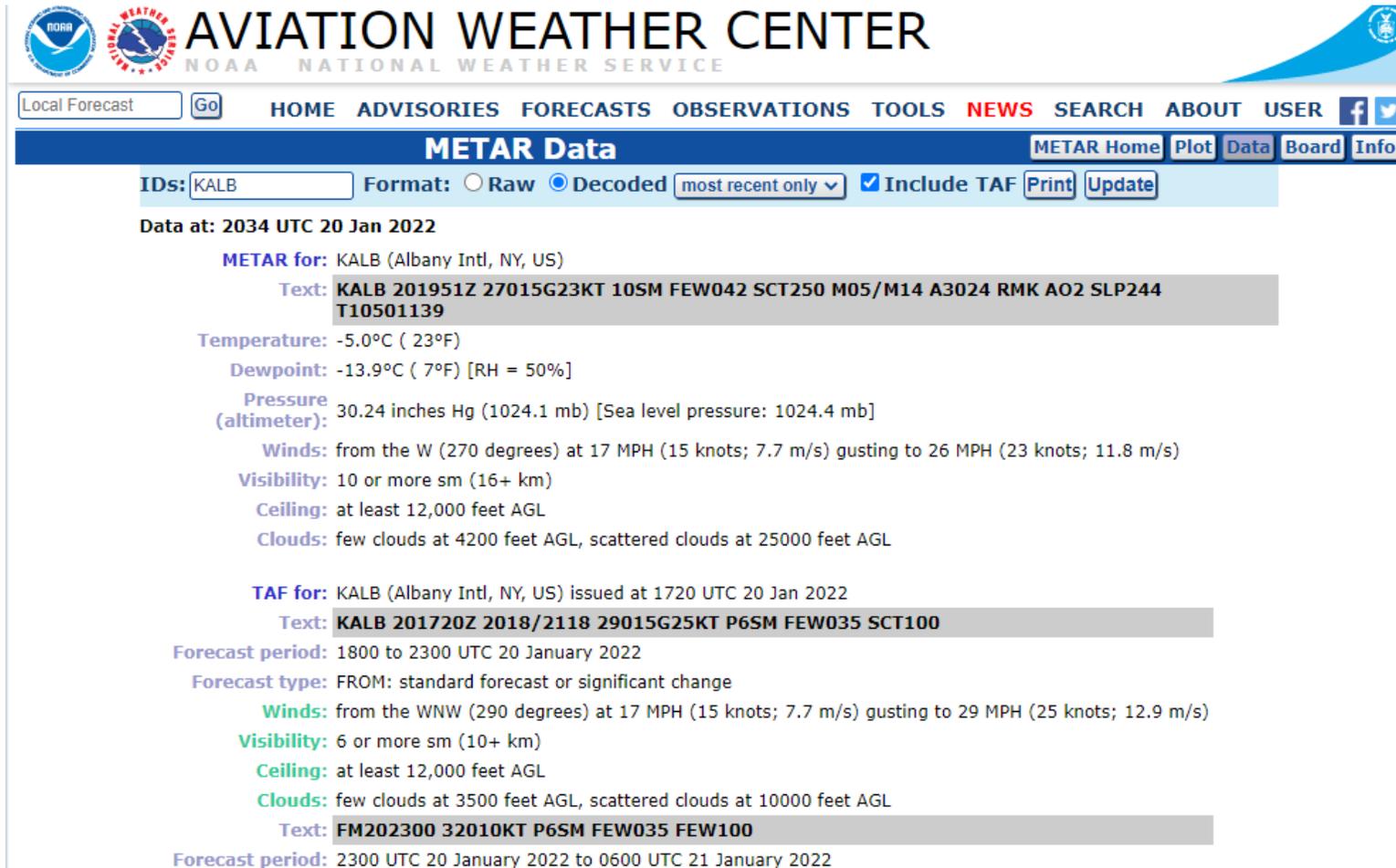
See Page 2-12 in Private Pilot Book

METAR KINK 121845Z 11012G18KT 15SM SKC 25/17 A3000
METAR KBOI 121854Z 13004KT 30SM SCT150 17/6 A3015
METAR KLAX 121852Z 25004KT 6SM BR SCT007 SCT250 16/15 A2991
SPECI KMDW 121856Z 32005KT 1 1/2SM RA OVC007 17/16 A2980 RMK RAB35
SPECI KJFK 121853Z 18004KT 1/2SM FG R04/2200 OVC005 20/18 A3006

Figure 12. Aviation Routine Weather Reports (METAR).

SPECI KJFK **SPECI - special report of meteorological conditions**
KJFK – Location John F Kennedy International Airport, NY, New York
12 Day / 1853Z Time Created
18004KT – Wind Direction 180°/ Speed 04Kts
Visibility - 1/2 Statue Miles
FG – Fog
R04/2200 - Runway Visual Range - Runway 04 Visibility: 2200
OVC005 – Overcast 5 Hundred Feet
20/18 – Temp. / Dew Point in Celsius
A3006 – Altimeter Setting

Supplemental Weather Services





AVIATION WEATHER CENTER
 NOAA NATIONAL WEATHER SERVICE

Local Forecast
[HOME](#) [ADVISORIES](#) [FORECASTS](#) [OBSERVATIONS](#) [TOOLS](#) [NEWS](#) [SEARCH](#) [ABOUT](#) [USER](#)



METAR Data

IDs:
 Format: Raw Decoded

 Include TAF

Data at: 2034 UTC 20 Jan 2022

METAR for: KALB (Albany Intl, NY, US)
Text: **KALB 201951Z 27015G23KT 10SM FEW042 SCT250 M05/M14 A3024 RMK AO2 SLP244 T10501139**

Temperature: -5.0°C (23°F)
Dewpoint: -13.9°C (7°F) [RH = 50%]
Pressure (altimeter): 30.24 inches Hg (1024.1 mb) [Sea level pressure: 1024.4 mb]
Winds: from the W (270 degrees) at 17 MPH (15 knots; 7.7 m/s) gusting to 26 MPH (23 knots; 11.8 m/s)
Visibility: 10 or more sm (16+ km)
Ceiling: at least 12,000 feet AGL
Clouds: few clouds at 4200 feet AGL, scattered clouds at 25000 feet AGL

TAF for: KALB (Albany Intl, NY, US) issued at 1720 UTC 20 Jan 2022
Text: **KALB 201720Z 2018/2118 29015G25KT P6SM FEW035 SCT100**

Forecast period: 1800 to 2300 UTC 20 January 2022
Forecast type: FROM: standard forecast or significant change
Winds: from the WNW (290 degrees) at 17 MPH (15 knots; 7.7 m/s) gusting to 29 MPH (25 knots; 12.9 m/s)
Visibility: 6 or more sm (10+ km)
Ceiling: at least 12,000 feet AGL
Clouds: few clouds at 3500 feet AGL, scattered clouds at 10000 feet AGL
Text: **FM202300 32010KT P6SM FEW035 FEW100**

Forecast period: 2300 UTC 20 January 2022 to 0600 UTC 21 January 2022

Terminal Aerodrome Forecasts

- **TAF - Terminal Aerodrome Forecast**
 - Follows the same format/abbreviations as METARs
 - Official FAA forecast of aviation activity for U.S. airports within five statute miles
 - Concise statement of the expected meteorological conditions at an airport during a specified period usually for 24 hours
 - Valid for 24 to 30 hours
 - Updated four times daily 0000z, 0600z, 1200z, 1800z
 - Can be either routine (TAF) or amended (TAF AMD)
 - Contains
 - Type of Report, ICAO Station Identifier, Date and Time of Origin, Valid Period Date and Time, Forecast Meteorological Conditions

Terminal Aerodrome Forecasts

TAF

```
KMEM 121720Z 1218/1324 20012KT 5SM HZ BKN030 PROB40 1220/1222 1SM TSRA OVC008CB  
FM122200 33015G20KT P6SM BKN015 OVC025 PROB40 1220/1222 3SM SHRA  
FM120200 35012KT OVC008 PROB40 1202/1205 2SM-RASN BECMG 1306/1308 02008KT BKN012  
BECMG 1310/1312 00000KT 3SM BR SKC TEMPO 1212/1214 1/2SM FG  
FM131600 VRB06KT P6SM SKC=  
  
KOKC 051130Z 0512/0618 14008KT 5SM BR BKN030 TEMPO 0513/0516 1 1/2SM BR  
FM051600 18010KT P6SM SKC BECMG 0522/0524 20013G20KT 4SM SHRA OVC020  
PROB40 0600/0606 2SM TSRA OVC008CB BECMG 0606/0608 21015KT P6SM SCT040=
```

Figure 15. Terminal Aerodrome Forecasts (TAF).

See Page 2-15 in Private Pilot Book

Terminal Aerodrome Forecasts

TAF

KMEM 121720Z 1218/1324 20012KT 5SM HZ BKN030 PROB40 1220/1222 1SM TSRA OVC008CB
 FM122200 33015G20KT P6SM BKN015 OVC025 PROB40 1220/1222 3SM SHRA
 FM120200 35012KT OVC008 PROB40 1202/1205 2SM-RASN BECMG 1306/1308 02008KT BKN012
 BECMG 1310/1312 00000KT 3SM BR SKC TEMPO 1212/1214 1/2SM FG
 FM131600 VRB06KT P6SM SKC=

KMEM – Location Memphis Intl Airport, Memphis, TN

121720Z – 12 Day / 1720Z Time Created

1218/1324 – Valid Period 12th at 18Z through 13th at 24Z

20012KT – Winds 200 deg at 12 Kts

5SM – 5 Statute Miles Visibility

HZ - Haze

BKN030 – Ceiling Broken at 3,000 Feet

Probability of 40% chance from 12th at 20Z through 12th at 22Z Visibility 1 Statute Mi

Thunder Storms and Rain Ceiling Overcast at 800' Cumulonimbus clouds

See Page 2-15 in Private Pilot Book



**Homeland Security
and Emergency Services**

Terminal Aerodrome Forecasts

TAF

```
KMEM 121720Z 1218/1324 20012KT 5SM HZ BKN030 PROB40 1220/1222 1SM TSRA OVC008CB  
FM122200 33015G20KT P6SM BKN015 OVC025 PROB40 1220/1222 3SM SHRA  
FM120200 35012KT OVC008 PROB40 1202/1205 2SM-RASN BECMG 1306/1308 02008KT BKN012  
BECMG 1310/1312 00000KT 3SM BR SKC TEMPO 1212/1214 1/2SM FG  
FM131600 VRB06KT P6SM SKC=
```

FM122200 – From 12th at 2200Z

33015G20KT – Winds from 330 deg at 15Kts Gusting 20 Kts

P6SM – Visibility is greater than 6 Statute Miles

BKN 015 OVC025 – Ceiling is Broken at 1,500' then Overcast at 2,500'

40% Probability from 12th at 20Z through 12th at 22Z Visibility could be 3 Statute Miles with Moderate Rain Showers

See Page 2-15 in Private Pilot Book



Terminal Aerodrome Forecasts

TAF

KMEM 121720Z 1218/1324 20012KT 5SM HZ BKN030 PROB40 1220/1222 1SM TSRA OVC008CB
 FM122200 33015G20KT P6SM BKN015 OVC025 PROB40 1220/1222 3SM SHRA
 FM120200 35012KT OVC008 PROB40 1202/1205 2SM-RASN BECMG 1306/1308 02008KT BKN012
 BECMG 1310/1312 00000KT 3SM BR SKC TEMPO 1212/1214 1/2SM FG
 FM131600 VRB06KT P6SM SKC=

FM120200 – From 12th at 0200Z

See Page 2-15 in Private Pilot Book

35012KT – Winds from 350 deg at 12Kts

OVC008 – Ceiling Overcast at 800'

40% Probability from 12th at 02Z through 12th at 05Z Visibility could be 2 Statute Miles with Light Rain and Snow

BECMG – Becoming from 13th at 06Z through 13th at 08Z, Winds could be 020 deg at 8 Kts Broken 1,200'

BECMG – Becoming from 13th at 10Z through 13th at 12Z, Winds Calm, 3 Statute Mile Visibility and Mist

SKC – Skies Clear, Temporarily From 12th at 12Z through 12th at 14Z Visibility could be ½ Statute Mile in Fog

From 13th at 1600Z Winds Variable at 6 kts, Viability greater than 6 statute miles, skies clear



Terminal Aerodrome Forecasts

```
KOKC 051130Z 0512/0618 14008KT 5SM BR BKN030 TEMPO 0513/0516 1 1/2SM BR  
FM051600 18010KT P6SM SKC BECMG 0522/0524 20013G20KT 4SM SHRA OVC020  
PROB40 0600/0606 2SM TSRA OVC008CB BECMG 0606/0608 21015KT P6SM SCT040=
```

Figure 15. Terminal Aerodrome Forecasts (TAF).

What is the visibility forecasted at KOKC on the 5th at 1400Z hrs?

What is the sky condition forecasted KOKC on the 5th at 1600Z hrs?

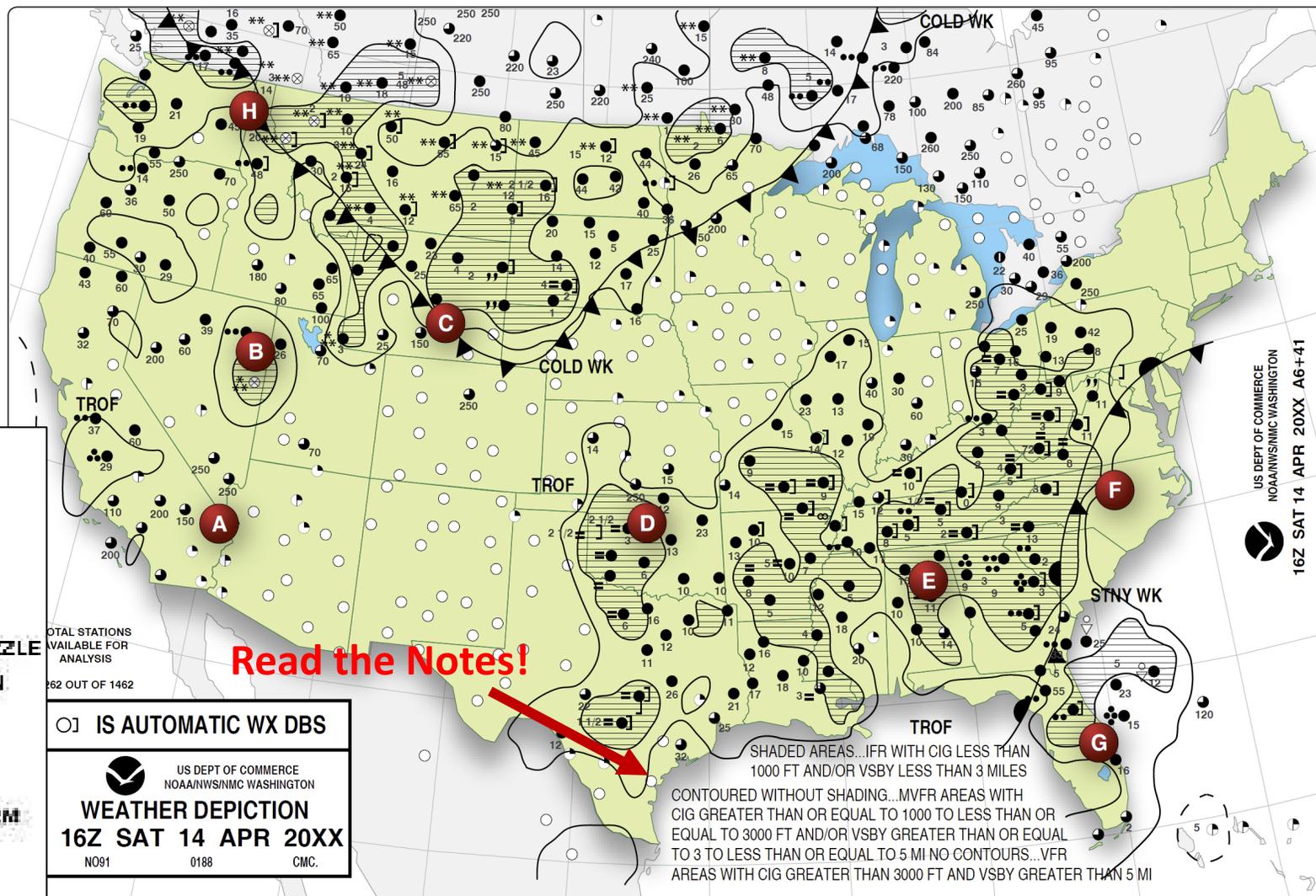
What precipitation is forecasted at KOKC on the 6th after 0400Z hrs?

See Page 2-15 in Private Pilot Book

Weather Depiction Chart

See Page 2-17 in Private Pilot Book

- Quick picture of weather conditions as of the time stated on the chart.
- Thus, it presents general weather conditions on which to base flight planning.



PRESENT WEATHER

VISIBILITY (TO 5 MI.)

SKY COVER

CEILING (HUNDREDS OF FEET)

○ CLEAR

◐ FOG

◑ SCATTERED

◒ BROKEN

◓ BREAKS IN OVERCAST

◔ OVERCAST

⊗ OBSCURED

⊘ MISSING OR PARTIAL OBSCURATION

≡ MIST

≡≡ FOG

⊖ HAZE

⊖⊖ SMOKE

⊖⊖⊖ DRIZZLE

⊖⊖⊖ RAIN

⊖⊖⊖ FREEZING DRIZZLE

⊖⊖⊖ FREEZING RAIN

⊖⊖⊖ ICE PELLETS

⊖⊖⊖ SNOW

⊖⊖⊖ SHOWER

⊖⊖⊖ THUNDERSTORM

TOTAL STATIONS AVAILABLE FOR ANALYSIS: 62 OUT OF 1462

○ IS AUTOMATIC WX DBS

US DEPT OF COMMERCE
NOAA/NWS/NMC WASHINGTON

WEATHER DEPICTION
16Z SAT 14 APR 20XX

N091 0188 CMC.

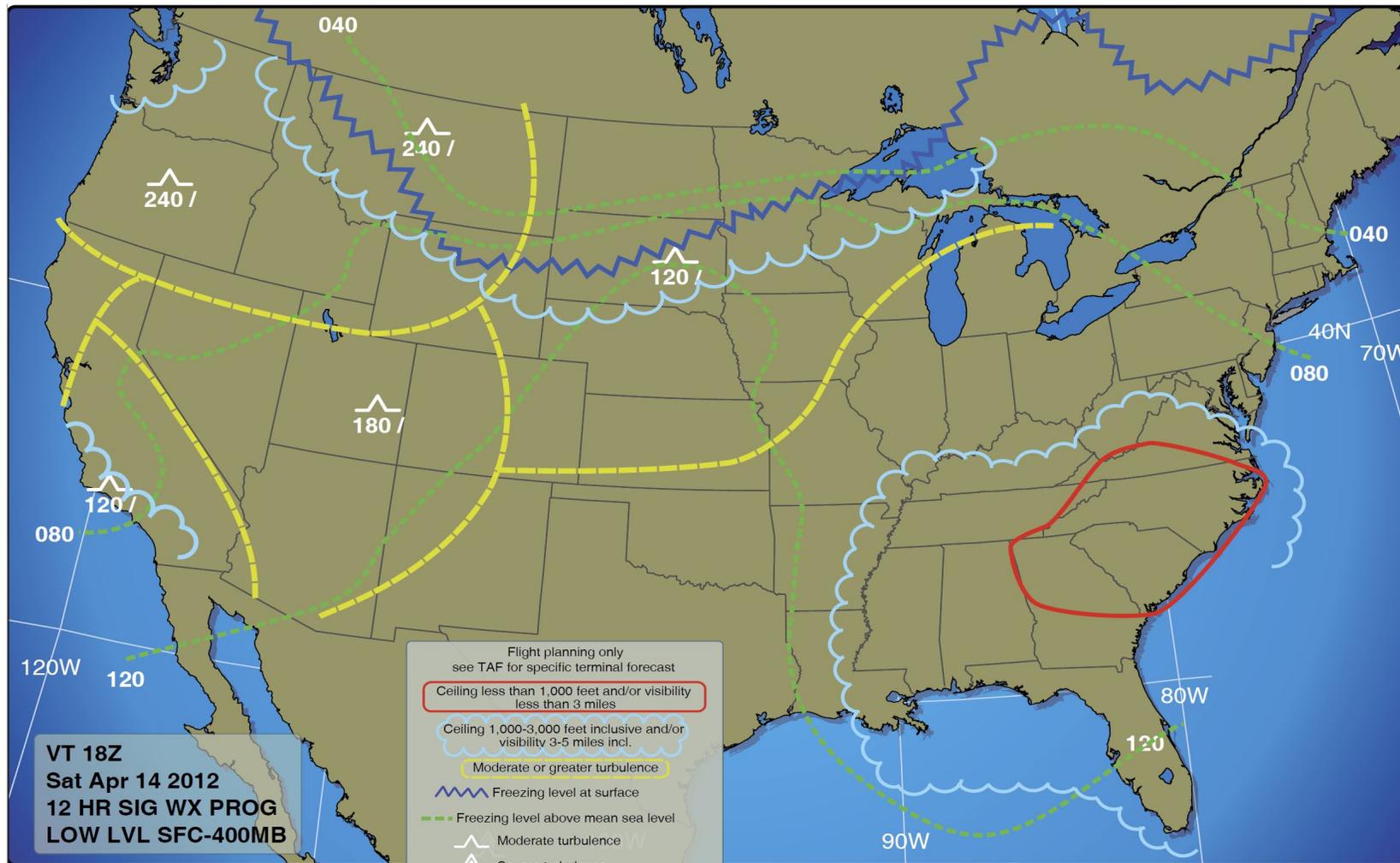
SHADED AREAS...IFR WITH CIG LESS THAN 1000 FT AND/OR VSBY LESS THAN 3 MILES

CONTOURED WITHOUT SHADING...MVFR AREAS WITH CIG GREATER THAN OR EQUAL TO 1000 TO LESS THAN OR EQUAL TO 3000 FT AND/OR VSBY GREATER THAN OR EQUAL TO 3 TO LESS THAN OR EQUAL TO 5 MI NO CONTOURS...VFR AREAS WITH CIG GREATER THAN 3000 FT AND VSBY GREATER THAN 5 MI

US DEPT OF COMMERCE
NOAA/NWS/NMC WASHINGTON

16Z SAT 14 APR 20XX A6+41

Low Level Significant Weather Prognostic Chart



Flight planning only
see TAF for specific terminal forecast

Ceiling less than 1,000 feet and/or visibility less than 3 miles

Ceiling 1,000-3,000 feet inclusive and/or visibility 3-5 miles incl.

Moderate or greater turbulence

Freezing level at surface

Freezing level above mean sea level

Moderate turbulence

Severe turbulence

Extreme turbulence

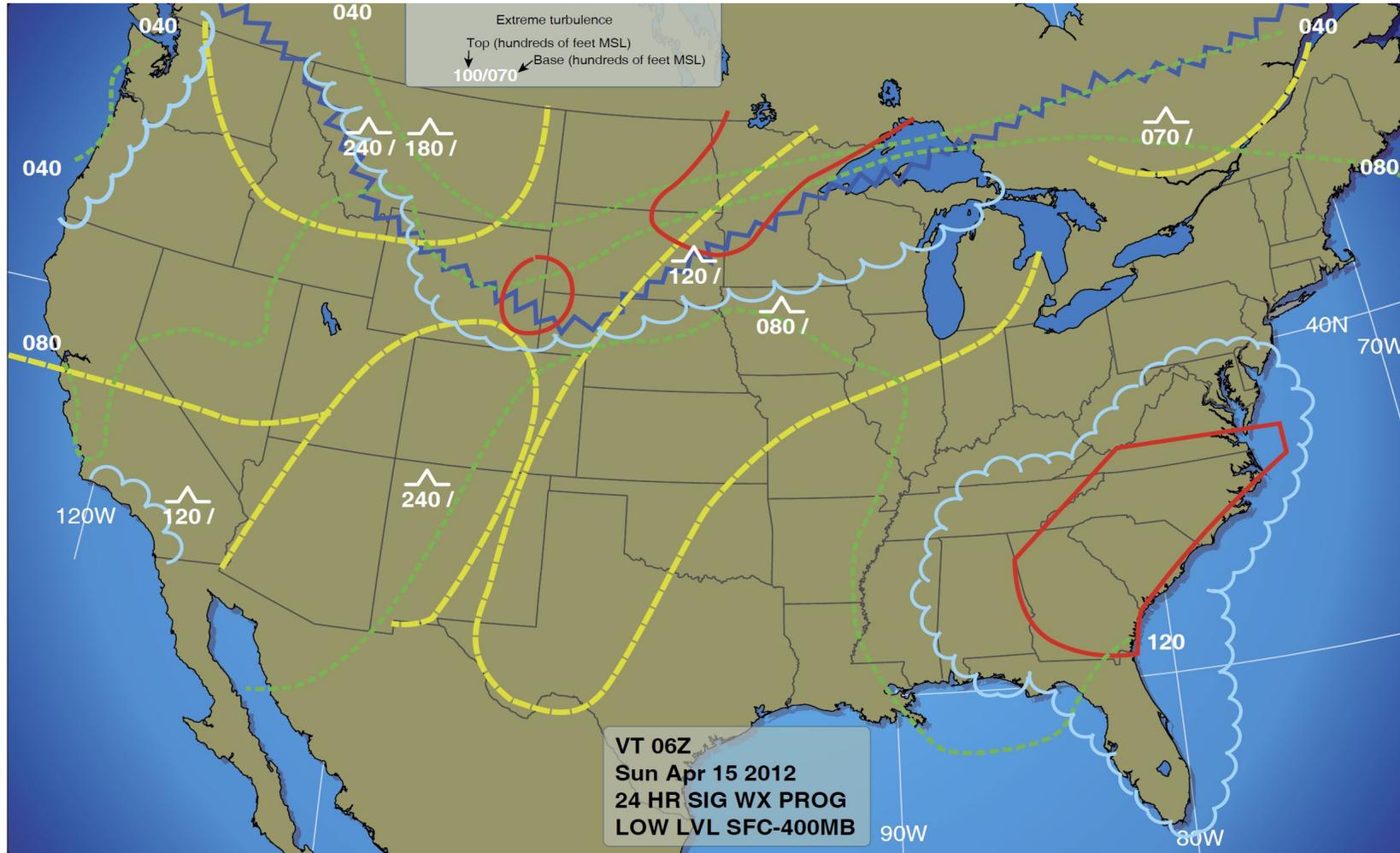
Top (hundreds of feet MSL)
↓
Base (hundreds of feet MSL)

100/070

Figure 19. Low-Level Significant Weather (SIGWX) Prognostic Charts.

See Page 2-18 in Private Pilot Book

Low Level Significant Weather Prognostic Chart



Flight planning only
see TAF for specific terminal forecast

Ceiling less than 1,000 feet and/or visibility less than 3 miles

Ceiling 1,000-3,000 feet inclusive and/or visibility 3-5 miles incl.

Moderate or greater turbulence

Freezing level at surface

Freezing level above mean sea level

Moderate turbulence

Severe turbulence

Extreme turbulence

Top (hundreds of feet MSL)
Base (hundreds of feet MSL)

100/070

Figure 19. Low-Level Significant Weather (SIGWX) Prognostic Charts.

See Page 2-18 in Private Pilot Book

Aviation Weather Advisories

- **Aviation Advisories**

- AIRMETs - **AIR**man's **MET**eorological Information

- Advises of weather that maybe hazardous, other than convective activity, to single engine, other light aircraft, and Visual Flight Rule (VFR) pilots
- AIRMET categories include Icing conditions, mountain obscuration, or turbulence

- SIGMETs - **SIG**nificant **MET**eorological Information

- Advisories that affect all aircraft.
- Can be non-convective or convective
- Non-Convective SIGMENTS include severe icing, severe or extreme turbulence, dust/sand storms.

Aviation Weather Advisories

- **Aviation Advisories**
 - **Convective (Thunderstorms) SIGMETS (WST)**
 - Advisories that deal with convective activity.
 - Reports include:
 - Surface winds greater than 50 knots
 - Hail $\geq \frac{3}{4}$ inch
 - Tornadoes
 - Also – imbedded thunderstorms, lines of thunderstorms, thunderstorms with heavy or greater precipitation that affect 40% or more of 3,000 sq/miles



Weather Briefings

Weather Briefing 1800 – WXBRIEF (800 992-7433)

- **Standard Briefing**
 - Any time you are planning a flight and you have not received a previous briefing
- **Abbreviated Briefing**
 - Need information to supplement mass disseminated data, update a previous briefing, or when you need only one or two specific items
- **Outlook Briefing**
 - Proposed time of departure is six or more hours from the time of the briefing

Weather Briefings

SMS Text Message Service

Terms of Service

Leidos Flight Service provides weather conditions via SMS Text Message. Message and data rates may apply.

The following capabilities are available by messaging them to **358-782** (FLTSVC):

- **METARs and TAFs at an airport** Request current weather and forecast information for any airport.
Examples:
Text "*METAR BWI*" and you will receive the latest METAR for Baltimore Washington International Airport.
Text "*METAR BWI PT*" and you will receive the latest METAR for Baltimore Washington International Airport in plain text.
Text "*TAF BWI*" and you will receive the latest TAF for Baltimore Washington International Airport.
Text "*MT FDK PT*" and you will receive the latest METAR and TAF for Frederick Airport in plain text.
Note: the requests are case independent.
- **Adverse Condition Updates** This service allows you to check if there are any new Adverse Conditions or TFRs since you filed your flight plan. This content is recorded and can be used to provide confirmation that you received the most up-to-date adverse conditions for your flight. Text "*ACU*" and you will receive a summary of any new conditions detected for your upcoming flight or you will get a positive indication there are no new conditions reported.
- To request information about the text message options text "*Help*" to **358-782** (FLTSVC)

Weather Briefing SMS Text Message Service

- METARs and TAFs at an Airport

Type in "MT KRME PT"



Homeland Security
and Emergency Services

Weather Briefings




AVIATION WEATHER CENTER

NOAA NATIONAL WEATHER SERVICE



[HOME](#) [ADVISORIES](#) [FORECASTS](#) [OBSERVATIONS](#) [TOOLS](#) [NEWS](#) [SEARCH](#) [ABOUT](#) [USER](#)

Aircraft Reports Data

[AIREP Home](#)
[Plot](#)
[Data](#)
[Info](#)

Center ID: Distance: Format: Raw Decoded | Type: Age:

Data at: 1700 UTC 02 Mar 2018

IAD UA /OV BRV315007/TM 1201/FL070/TP CRJ2/TA M11/TB MOD/IC RIME

BWI UA /OV BAL23505/TM 1210/FL100/TP E170/IC MOD RIME

BWI UA /OV BAL/TM 1210/FL100/TP E170/TA M10/IC MOD RIME 110-100

BWI UA /OV KBWI/TM 1213/FL030/TP B737/TB CONT MOD/RM CONT MOD TURB DURC UP TO FL030 AWC-WEB/

BWI UA /OV KBWI/TM 1215/FL500/TP B737

SBY UA /OV KSBY/TM 1220/FLUNKN/TP C208

SBY UA /OV KSBY/TM 1220/FLUNKN/TP C208

JST UA /OV JST/TM 1220/FL185/TP E75L/TB OCNL MOD 185-200

SBY UA /OV KSBY/TM 1220/FLUNKN/TP C208

SBY UA /OV KSBY/TM 1220/FLUNKN/TP C208

DCA UA /OV DCA 328/TM 1220/FL020/TP B737/TB MODERATE/RM TB ON DEPARTURE

SBY UA /OV KSBY/TM 1220/FLUNKN/TP C208

DCA UA /OV DCA 180/TM 1224/FL011/TP E170/WV 330 23G43/RM +- 10 KNOTS ALL THE WAY DOWN FINAL

IAD UA /OV IAD270010/TM 1225/FL085/TP B738/TB MOD BLO 080/RM DURGC

RIC UA /OV RIC270010/TM 1227/FL070/TP B738/TB CNSTANT MODERATE/RM SMOOTH ABOVE 090

DCA UA /OV DCA 330/TM 1230/FL009/TP E170/TB MODERATE/RM +- 15 KNOTS CONTINUOS MODERATE TB ON FINAL

LYH UA /OV LYH040015/TM 1230/FL070/TP BE58/TB MOD/RM MOD TURB DURC FROM LYH

WAL UA /OV SWL040015/TM 1232/FL260/TP E190/TB MOD CHOP

LYH UA /OV LYH040020/TM 1233/FL090/TP BE58/TB NEG/RM SMOOTH AT 90

IAD UUA /OV KIAD/TM 1238/FL040/TP CRJ2/TB MOD-SEV/RM **VERY BUMPY ON DESCENT. PRETTY MUCH EVERY ONE ON THE PLANE THREW UP. PILOTS WERE ON THE VERGE OF THROWING UP.** AWC-WEB

BWI UUA /OV BWI/TM 1246/FL040/TP B738/SK IMC/RM 10KT GAIN ON TAKEOFF



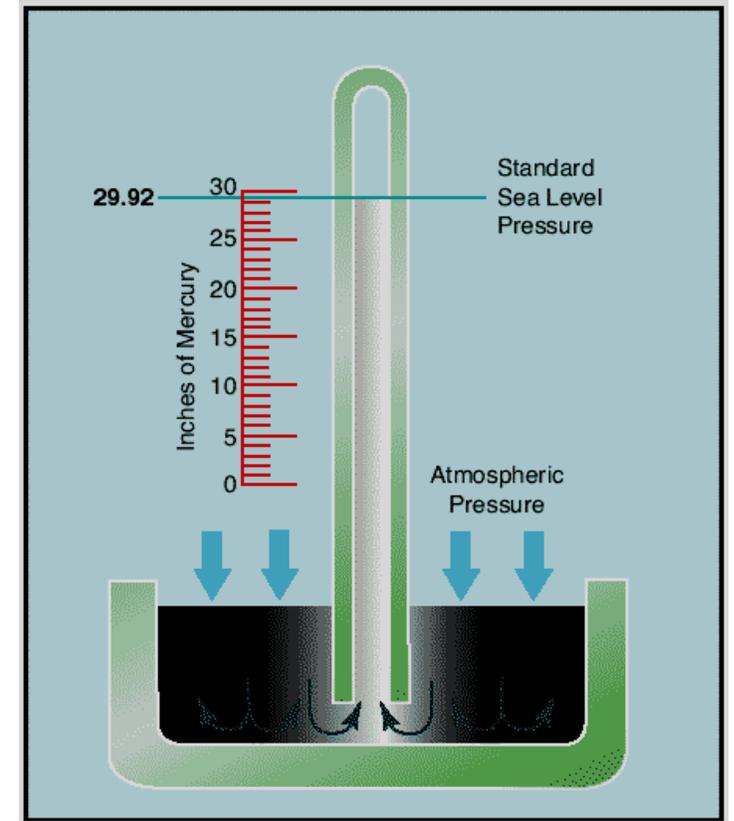
End of Module

Break

Module 9: Effects of Weather on UAS Performance

Atmospheric Pressure

- The atmosphere above us has weight that is exerted on us as pressure.
- The higher you go up, the less atmosphere there is and less weight (pressure) exerted on us
- The actual pressure differs not only with altitude, but also with temperature and density of the air
- We measure atmospheric pressure in inches of mercury (hg) or metric (millibars)
- How “thick” is the air?
 - Aircraft are “air-breathers”
 - The more air molecules flowing over a wing, the greater the lift (performance)
 - Any condition that “thins” the air reduces performance.



Thinner, less dense air = decreased performance
Thicker, more dense air = increased performance

Atmospheric Pressure

International Standard Atmosphere (ISA) defines a standard frame of reference which is the basis of performance charts

Standard Sea Level Pressure	29.92”Hg	1013.2 Mb
Standard Temperature	59F	15C

All local pressure readings are converted to standard sea level to provide a standard

Density Altitude

- Conditions that affect air density. Remember the “H”s.
 - Height (Altitude): Air is thinner as you go up. Air Density is less.
 - Heat (Outside Air Temperature): Heated air is much less dense than colder air
 - Humidity: Humid air is less dense.
 - Humidity is the amount of moisture in the air.
 - ATIS reports TEMP/DEW POINT spread – this measures humidity.
 - Water molecules are lighter than air molecules making humid air less dense than dry air. (steam rises)
 - **Density altitude is “Pressure altitude” corrected for non-standard temperature.**
- Remember: Density Altitude calculates how high the airplane “thinks it is” vs. how high it actually is.
 - Aircraft are “air breathers” like humans
 - They generally perform less well the higher you go.



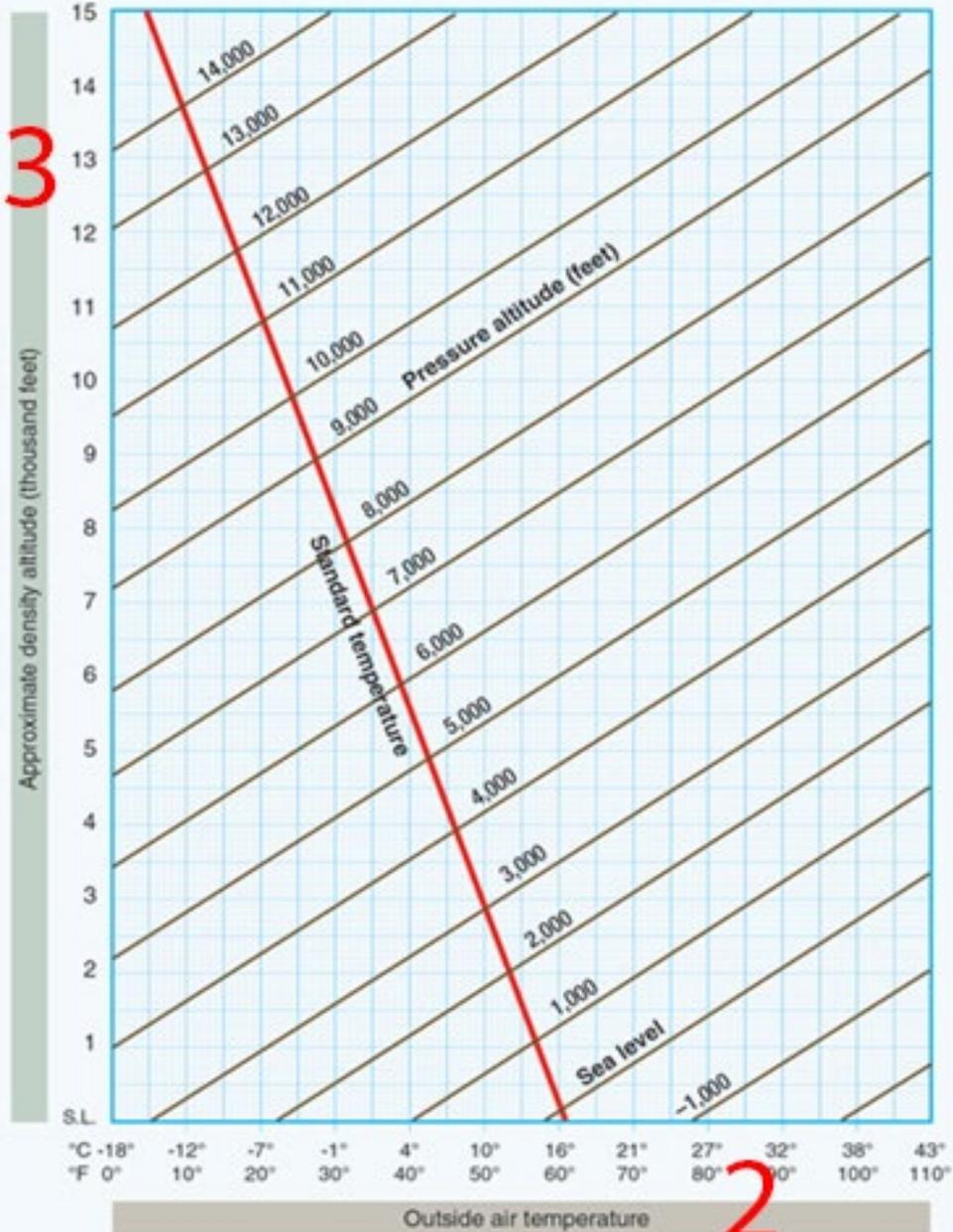
Performance Charts

- Performance charts allow us to calculate how well our aircraft are going to “act” in a given set of weather conditions
- These are new for unmanned aircraft. Likely most fixed wing sUAS will have these.

Performance Charts



DENSITY ALTITUDE CHART



Altimeter setting (°Hg)	Pressure altitude conversion factor
28.0	1,824
28.1	1,727
28.2	1,630
28.3	1,533
28.4	1,436
28.5	1,340
28.6	1,244
28.7	1,148
28.8	1,053
28.9	957
29.0	863
29.1	768
29.2	673
29.3	579
29.4	485
29.5	392
29.6	298
29.7	205
29.8	112
29.9	20
29.92	0
30.0	-73
30.1	-165
30.2	-257
30.3	-348
30.4	-440
30.5	-531
30.6	-622
30.7	-712
30.8	-803
30.9	-893
31.0	-983

See Page 2-8 in Private Pilot Book

Determine the density altitude at an airport that is 3,500 feet MSL with an altimeter setting of 28.8 and temp. of 75° Fahrenheit

- A. 2,200 feet MSL.
- B. 3,750 feet MSL.
- C. 6,250 feet MSL.



Negative Impacts on Performance

- At High altitudes or on hot, humid days aircraft performance decreases:
 - Takeoff and landing distance rolls are longer
 - Acceleration is slower
 - Shallower climb profiles
 - Propeller efficiency is reduced because it exerts less force
- Other Factors affected
 - Operating Ceiling
 - Payload
 - Range
 - Speed
 - Maneuverability
 - Fuel economy (endurance)



Result of Poor Performance Planning



Video Analysis – What Went Wrong?

- Altitude of airport?
- How was the aircraft loaded?
- Was the air warmer or cooler?
- Pilot mindset? Did he pay attention to the signs of critical performance problems?
- Final turn before rising terrain – Load Factor discussion



End of Module Weather Test



Lunch

Module 10: UAS Maintenance & Pre- Flight Inspection

Aircraft Maintenance

- Maintenance Includes:
 - Scheduled and unscheduled overhaul
 - Repair
 - Inspection
 - Modification / Replacement
 - System software upgrades of UAS and components necessary for flight
- **Maintain in accordance with manufacturer's instructions**
- **If not, develop a program**
- If discrepancies or issues are found, mark the aircraft out of service and should not be flown until properly repaired
- Consider engaging larger on-line community for your platform



Scheduled Maintenance

- Scheduled inspection / replacement of aircraft components
 - Based on either hours in use or set time
- Documenting any repair, modification, overhaul, or replacement of a system component resulting from normal flight operations
- If none exists the operator should establish a scheduled maintenance protocol.
- Over time, the operator should be able to establish a reliable maintenance schedule for the sUAS and its components.

Unscheduled Maintenance

- During preflight RPIC may discover that an sUAS a need for service (such as lubrication), repair, modification, overhaul, or replacement outside of the scheduled maintenance period as a result of normal flight operations or resulting from a mishap.
- IF such a condition is found, the remote PIC tag the aircraft out of service **should not** conduct flight operations until the **discrepancy is corrected**.

Performing Maintenance

- The manufacturer may require certain maintenance tasks be performed by the **manufacturer or by a person or facility (personnel) specified by the manufacturer.**
- It is highly recommended that the maintenance be performed **in accordance with the manufacturer's instructions.**
- If the operator is **unable** to perform the required maintenance, the **operator should consider** outsourcing maintenance and repairs.

Pre-Flight Inspection

- Before each flight, the remote PIC must inspect the sUAS to ensure that it is in a condition for safe operation, such as inspecting for equipment damage or malfunction(s).
- Should be conducted in accordance with the sUAS manufacturer's inspection procedures when available (usually found in the manufacturer's owner or maintenance manual)
- Should encompass the entire system
 - Include ground control station (GCS), payload system, C2 Links, etc.

Pre-Flight Inspection

- The preflight inspection should include a visual or functional check of the following items:
 1. **Visual condition inspection** of components;
 2. **Airframe** structure (including undercarriage)
All flight control surfaces, and linkages
 3. **Registration markings**, for proper display and legibility;
 4. Moveable **control surface(s)**, including airframe attachment point(s);
 5. **Servo motor(s)**, including attachment point(s);
 6. **Propulsion system**, including power plant(s), propeller(s), rotor(s), ducted fan(s), etc.
- See handout for additional details

Pre-Flight Inspection

- **Pre-Flight Inspection** - following items:
 7. Verify all systems (e.g., aircraft and control unit) have an **adequate energy supply** for the intended operation and are functioning properly;
 8. **Avionics**, including **control link transceiver**, communication/navigation equipment, and antenna(s);
 9. **Calibrate UAS compass per manufacturer recommendation** prior to any flight;
 10. Control link transceiver, communication/navigation data link transceiver, and antenna(s);

Pre-Flight Inspection

- **Pre-Flight Inspection** - following items:
 11. **Display panel**, if used, is functioning properly;
 12. Check **ground support equipment**, including **takeoff and landing systems**, for proper operation;
 13. Check that **control link correct functionality** is established **between the aircraft and the CS**;
 14. Check for **correct movement of control surfaces** using the CS;
 15. Check **onboard navigation and communication data links**;



Pre-Flight Inspection

- **Pre-Flight Inspection** - following items:
 16. Check **flight termination system**, if installed;
 17. Check **fuel for correct type and quantity**;
 18. Check **battery levels** for the aircraft and CS;
 - Ensure batteries are not “bloated”
 - **Damaged LiPO batteries can cause an in-flight fire**
 19. Check that **any equipment**, such as a camera, is **securely attached**;
 20. Verify communication with UAS and that the **UAS has acquired GPS location from at least four satellites**



Pre-Flight Inspection

- **Pre-Flight Inspection** - following items:
 21. **Start the UAS propellers** to inspect for any **imbalance or irregular operation**;
 22. **Verify all controller operation for heading and altitude**;
 23. If required by **flight path walk through**, verify any **noted obstructions** that may interfere with the UAS; and
 24. At a controlled low altitude, **fly within range of any interference and recheck all controls and stability**.

Record Keeping

- **Benefits of Recordkeeping**

- Documenting any repair, modification, overhaul, or replacement of system components
- Retrievable from either hardcopy and/or electronic logbook format
- Documented maintenance and inspection events reinforces owner/operator responsibilities for airworthiness through systematic condition for safe flight determinations.
- May provide essential safety support for commercial operators that may experience rapidly accumulated flight operational hours/cycles.
- Methodical maintenance and inspection data collection can prove to be very helpful in the tracking of sUAS component service life, as well as systemic component, equipage, and structural failure

End of Module Maintenance and Pre-Flight Test

Module 11: Physiological Factors

Physiological Factors Affecting Pilot Performance

- What we eat and drink, what our emotional state is, and how we “feel” all play a role in our effectiveness as pilots
- Understanding these issues and how to mitigate them increases safety
 - Hyperventilation
 - Stress
 - Fatigue
 - Dehydration
 - Heatstroke
 - Alcohol and Drugs
 - Understanding Vision and Flight



Hyperventilation

- **Hyperventilation**
 - Is the excessive rate and depth of respiration leading to abnormal loss of carbon dioxide from the blood.
 - Generally occurs in high-stress situations
 - Visual impairment
 - Lightheaded or dizzy sensation
 - Tingling sensations
 - Unconsciousness
 - Hot and cold sensations
 - Breathing normally is both the best prevention and the best cure for hyperventilation



Stress

- **Stress**
 - Stressors
 - Physical stress (noise or vibration)
 - Physiological stress (fatigue)
 - Psychological stress (difficult work or personal situations)
 - Two Categories of Stress
 - Acute (short term) – Fight or Flight(run)
 - Chronic (long term) – constant stress that presents an intolerable burden, exceeds the ability of an individual to cope.
 - Loneliness
 - Financial worries
 - Relationship
 - Work problems



Fatigue

- **Fatigue**
 - Physical fatigue results from:
 - Sleep loss
 - Exercise, or physical work
 - Mental fatigue - prolonged performance of cognitive work
 - If suffering from fatigue, do not fly
 - Get adequate rest



Dehydration

- **Dehydration** - critical loss of water from the body
 - Causes
 - Weather - Hot temperatures, Wind, Humidity
 - Diuretic drinks – Coffee/Tea, Alcohol, Caffeinated soft drinks
 - Can be one of the causes of fatigue
 - Severe dehydration can cause dizziness, nausea, abdominal cramps, weakness
 - Be sure to drink plenty of water.
 - Drink two to four quarts of water every 24 hours
Eight-glasses-a-day



Heat Stroke

- **Heat stroke** - inability of the body to control its temperature
 - Heatstroke – How to recognize
 - by the symptoms of dehydration, but also has been known to be recognized only upon complete collapse
 - Stay hydrated, wear appropriate clothing for the conditions



Alcohol and Drugs

- **Alcohol**

- Alcohol can severely impair a pilots ability to fly
- It is illegal to fly or perform any crew member duties in a civil aircraft
 - **within eight hours of ANY alcohol consumption or**
 - **Have a BAC of .04 or greater**
- Best rule of thumb is to give at *least eight hours* from “bottle to throttle”
- After effects of alcohol can impact pilot judgment and contribute to fatigue (i.e. hangover – keep this in mind!)



Alcohol and Drugs

- **Over-the-counter drugs**

- A pilot should never fly while taking certain over the counter drugs such as decongestants, allergy medicine, etc
- They may cause adverse side effects that could significantly reduce a pilot's ability to fly at peak performance



IMSAFE – Am I fit to fly?

- The PILOT is responsible for determining whether they are fit to fly a particular flight
- We must constantly evaluate our well-being and decide whether to fly or not.
- Common mnemonic used is “IMSAFE”:
 - **I**llness
 - **M**edication
 - **S**tress
 - **A**lcohol
 - **F**atigue
 - **E**motion / Eating

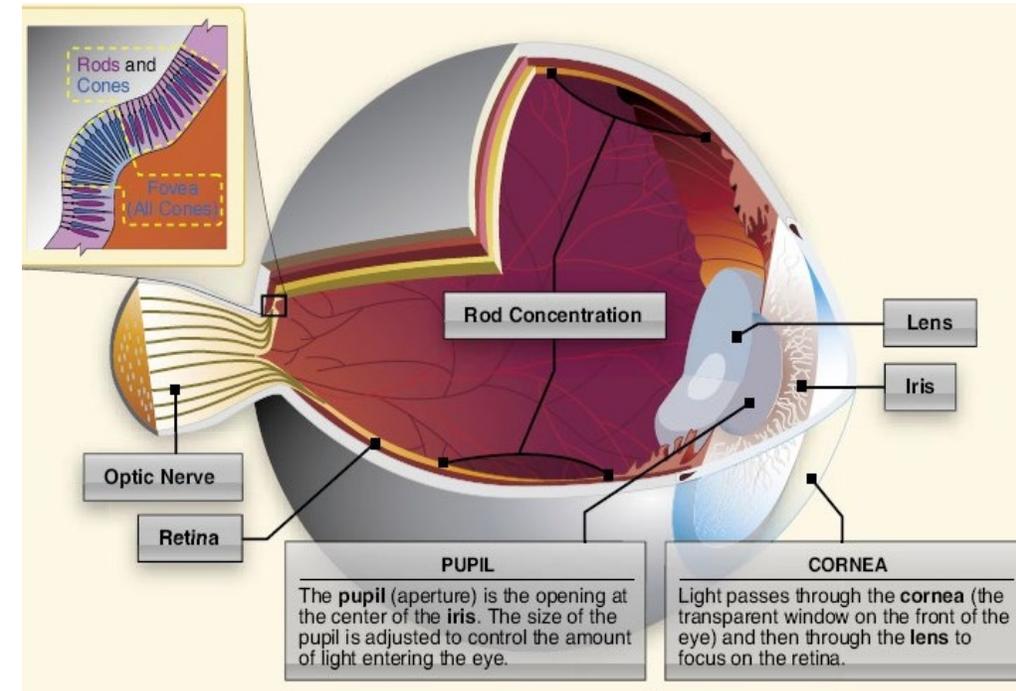


The Human Eye

- **Vision** - The more a pilot understands about the eyes and how they function, the easier it is to use vision effectively and Compensate for potential problems.
 - The more you understand about how eyes function, the easier it is to use vision effectively and compensate for potential problems.
 - Scanning Techniques – High level overview

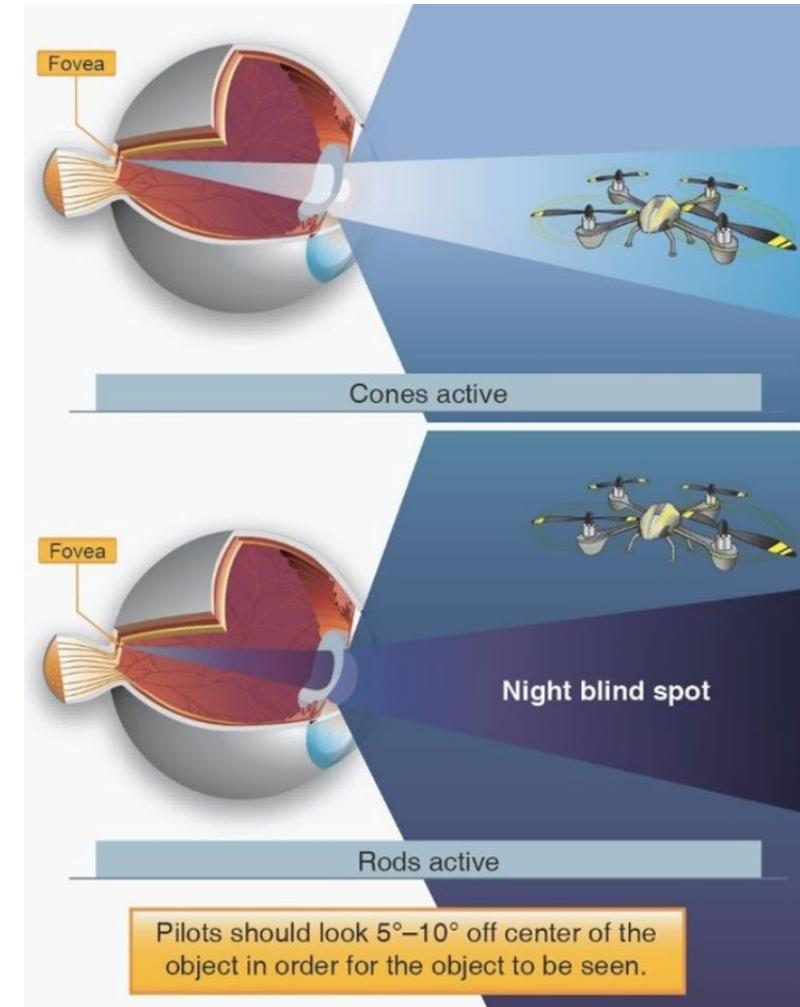
The Human Eye

- Eye is like a camera – light enters through lens, falls on retina, then converted to electrical impulses
- Eye is subject to limitations
 - Blind Spots
 - Illusions
- At night, sharpness (acuity), color, depth perception, and judgment of size may be lost.



The Human Eye

- **Cones and Rods** – light-sensitive receptors that record the image and send to optic nerve for transmission to the brain
 - **Cones** – responsible for color vision during day
 - Cones are concentrated in the center of the retina
 - Center of visual field – detail and color sensitivity.
 - **Rods** – responsible for detecting movement and provide vision in dim light
 - Very sensitive in low or no light (about 10,000 times more sensitive than cones)
 - Very few rods in center of retina
 - Primary receptors for night vision
- Area where optic nerve enters eyeball has no rods or cones – blind spot



End of Module

Break

Module 12: Aeronautical Decision Making / Crew Resource Management

Aeronautical Decision Making (ADM)

**Human Factors is about people.
It is about people in their
working and living environment,
and it's about their relationship
with equipment, procedures,
and the environment.**

**Approx 80% of all aviation accidents are related to
human factors – landings 24.1 % and Takeoff 23.4%**



ADM Example – Poor Judgement

- **Eastern Air Lines Flight 401**

- Lockheed L-1011-1 Tristar jet that crashed into the Florida Everglades on December 29, 1972, causing 101 fatalities.
- All three pilots, two of 10 flight attendants, and 96 of 163 passengers, died; 75 passengers and crew survived
- The crash occurred while the **entire flight crew was preoccupied with a non-functioning landing gear indicator light and failed to notice that the autopilot had inadvertently been disconnected**

- **General Aviation Example**

- Most midair collision accidents and reported near midair collision incidents occur during good VFR weather conditions (i.e., clear days) and during the hours of daylight. This is when more aircraft are likely to be flying.

Key ADM Drivers

- **Accident Prevention Techniques**
 - Topic of ADM first discussed in the military then expanded to commercial aviation
 - Accident rates dropped dramatically
 - Focus on establishing a culture of safety
 - Provide resources for on-going training
 - Objectively look at issues affecting pilot judgement
- Formalized ADM training emerged in the General Aviation training curriculum during early 1990s
 - ADM training still evolving in aviation training

The screenshot shows the National Transportation Safety Board (NTSB) website. The header includes the NTSB logo and the text "NATIONAL TRANSPORTATION SAFETY BOARD". Below the header is a navigation menu with links for HOME, NEWS & EVENTS, SAFETY ADVOCACY, INVESTIGATIONS, DISASTER ASSISTANCE, LEGAL, and ABOUT. A search bar is located in the top right corner.

The main content area is titled "Aviation: Data & Stats" and features a prominent blue banner for "2017 NTSB US Civil Aviation Accident Statistics". Below the banner, there is an "Introduction" section with the following text:

Welcome to the NTSB's Summary of US Civil Aviation Accidents for Calendar Year (CY) 2017. This summary combines information on accidents involving air carriers (regulated by Title 14 Code of Federal Regulations [CFR] Part 121), commuter and on-demand carriers (regulated by 14 CFR Part 135), and general aviation (primarily regulated by 14 CFR Part 91).

For 2017, this summary uses data updated on October 31, 2019.

Below the text is a table titled "Accident Summary for Major Segments of US Civil Aviation CY 2017":

Segment	Accidents	Fatal Accidents	Fatalities
Part 121 Air Carriers	32	0	0
Part 135 Commuter and On-Demand Carriers	50	8	16
General Aviation	1233	203	331
Total US Civil Aviation	1315	211	347

At the bottom of the page, there is a link to "Map of US Civil Aviation Accidents, 2017".

ADM / CRM / SRM Introduction

- **Aeronautical Decision Making (ADM)**
 - Decision making in the aviation environment
 - A systematic approach to determine the best course of action based the latest set of **PERCIEVED** facts
 - Personal Attitudes can influence decision-making
- **Crew Resource Management (CRM)**
 - Refers to the effective use of all available resources: human, hardware, and information resources
 - The goal of all flight crews is to make good Aeronautical Decisions through the use of CRM
- **Single-Pilot Resource Management (SRM)**
 - The art and science of managing all available resources
 - Enables Pilot to asses and manage risk to make accurate timely decisions



Create a Safety Culture

- **CRM ACTIVITIES INCLUDE**

- Information transfer, problem solving, decision making, maintaining situation awareness, and dealing with automated systems
- **CRM Training** today, certain essentials are universal:
 - Focus on the functioning of **crewmembers as teams**, not as a collection of technically competent individuals.
 - Instruct crewmembers how to behave in ways that foster crew effectiveness.
 - Provide opportunities for **crewmembers to practice** the Skills necessary to be effective team leaders and team members.
 - Include effective team behaviors during normal, routine operations.

Steps for Good Decision-Making Overview

- Identifying personal attitudes hazardous to safe flight
 - Discussed in detail later
 - Learning behavior modification techniques to mitigate hazardous attitudes.
- Learning how to recognize and cope with stress.
 - Adequate sleep, food/water, proper pre-operational planning
- Developing risk assessment skills.
- Effective use of all available resources
 - Use of additional crew members
 - Additional situational awareness aids such as ATC radio, current charts
- Evaluating the effectiveness of one's ADM skills.
 - Perform post-flight analysis



Hazardous Attitudes

- All of us, from time to time will experience one or more of these
- The trick is to identify these in ourselves, and change our behavior

<u>HAZARDOUS ATTITUDE</u>	<u>ANTIDOTE</u>
Antiauthority: “Don't tell me.”	Follow the rules. They are usually right.
Impulsivity: Do something quickly.	Not so fast. Think first.
Invulnerability: It won't happen to me.	It could happen to me.
Macho: “The right stuff. I can do it.”	Taking chances is foolish.
Resignation: “I give up, What's the use?”	I'm not helpless. I can make a difference.



Analyzing Risk vs Hazard

- Determining how much Risk to assume given hazards of an operation can be complex.
 - Best to determine this before an operation commences
- What is a hazard?
 - Real or perceived adverse condition that affects a flight
- What is risk?
 - Measuring the severity and affect of the hazard and evaluating options on how best to deal with it.
 - Risk level is not the same to all people
- Risk management involves:
 - Assessing degree of risk
 - Determining best course of action to mitigate it

UAS Risk Assessment Matrix

Date: _____

Mission Type: _____

<p>Step 1. Risk Assessment Review questions and input the score for Risk and Gain according to currently available information. Score items according to instinct and the examples given. <i>Absence of data automatically sets the score to maximum point value and circle the value.</i></p>	<p>C. sUAS/Resources - Performance / Batteries... <input type="checkbox"/></p> <p>Fully Mission Capable Partially Mission Capable</p>	<p>Transfer – If practical, locate a better suited asset to conduct the mission i.e. different aircraft, surface asset, or crew.</p> <p>Avoid – Circumvent hazard: Wait for risk to subside i.e. wait until daylight or weather passes, wait for additional resources</p> <p>Accept – In all cases the benefit must justify the assumption of low risk. The decision to accept risk must be made with the stipulation that risk is reevaluated as the mission progress. (No adjustment to Risk Assessment)</p> <p>Reduce – Reduce or limit risk exposure: bring in fresh or more experienced crew.</p>
<p>Planning: Thoroughness of pre-mission planning. Factors which increase risk: Immediate Launch, Normal Pre-Plan, in-mission change.</p> <p>Adequate Minimal None</p>	<p>Communications: Ability to maintain comms throughout mission w/ ATC and multiple observers.</p> <p>Adequate Marginal None</p>	<p>Step 3 Apply Risk Values Risk vs. Gain</p> <p>Low Gain – Situation with intangible benefits or a low probability for providing concrete results</p> <p>Medium Gain – Situation that provides immediate, tangible benefits. Examples include saving property, protecting the environment, deterring illegal operations.</p> <p>High Gain– Situation that provides immediate, tangible benefits that if ignored could result in loss of life. Given the mission description above, what is the “Gain” for this mission?</p> <p>Risk VS Gain</p> <p><input type="checkbox"/> <input type="checkbox"/></p>
<p>Event: Refers to mission complexity and guidance. Factors which may increase risk: incomplete details or non-standard mission.</p> <p>Clear Guidance Complex/Innovation Required</p>	<p>Environment: External condition surrounding mission: Weather, Cloud ceiling, night, illumination, sea state, terrain, power lines/structures, airfields</p> <p>Benign Marginal Hazardous</p>	<p>Step 2 Risk Management Reduction</p> <p>Risk Management is the decision to control or reduce hazards. <i>Control Options</i> below assist in risk control or reduction. Review the options and reassess the risks as appropriate, enter final value in the box.</p> <p>Spread Out – Disperse the risk by launching additional assets.</p>
<p>Asset: Selection of appropriate resources. Factors that affect risk: time with qualification, familiarity w/OP area, fatigue, flight time (total time & time w/sUAS), knowledge of asset capabilities</p> <p>A. Pilots</p> <p>Excellent Adequate Marginal</p> <p>B. Crew</p> <p>Excellent Adequate Marginal</p>	<p>Add the values for each Risk Assessment and plot the final Risk Assessment on graph below if above 20 then STEP 2</p>	<p>It is recommended that any mission which results in a Risk Assessment value above 20, requires re-evaluation and/or Command guidance.</p> <p><i>Use the Risk vs. Gain Chart (next page) for recommendations on whether to proceed</i></p>

Risk	High Gain	Medium Gain	Low Gain
Low Risk	Accept the Mission. Continue to monitor Risk Factors, if conditions or mission changes.	Accept the Mission. Continue to monitor Risk Factors, if conditions or mission changes.	Accept the Mission. Re-evaluate Risk vs. Gain, should Risk Factors change.
Medium Risk	If available contact division or program coordinator for guidance. Continue to monitor RISK, employ options to minimize RISK	If available contact division or program coordinator for guidance. Continue to monitor RISK, employ options to minimize RISK	Do not accept the Mission.
High Risk	Only accept HIGH RISK missions when loss of life or injury is imminent.		

It is recommended that any mission which results in a Risk Assessment value above 20, requires re-evaluation and/or Command approval.



Situational Awareness (SA)

- Is the **accurate perception** and understanding of factors and conditions
- The ability to see what's happening now as well as several minutes into the future.
- Avoid fixation on any single factor
- Effective workload management ensures operations are accomplished by:
 - Planning – knowing what is needed next
 - Prioritizing
 - Sequencing tasks to avoid work overload
- When a work overload situation exists, a pilot needs to:
 - Stop
 - Think
 - Slow down
 - Prioritize



ADM Models

Decision-Making in a Dynamic Environment

- A solid approach to decision-making is through the use of analytical models, such as the **3P, DECIDE, PAVE**.
- Good decisions result when pilots:
 - Gather all available information
 - Objectively review it
 - Analyze the options
 - Rate the options
 - Select a course of action
 - Evaluate that course of action for correctness.
- In some situations, there is not always time to make decisions based on analytical decision-making skills.



ADM Models

DECIDE Model

Detect - the fact that a change has occurred.

Estimate - the need to counter or react to the change.

Choose - a desirable outcome (in terms of success) for the flight.

Identify - actions that could successfully control the change.

Do - takes the necessary action.

Evaluate - the effect(s) of his action countering the change.



ADM Models

The PAVE Checklist

Another way to mitigate risk is to perceive hazards. By incorporating the PAVE checklist into preflight planning, the pilot divides the risks of flight into four categories:

Pilot-in-command (PIC)

Aircraft

en**V**ironment

External pressures

(PAVE) which forms a part of a pilot's decision-making process.

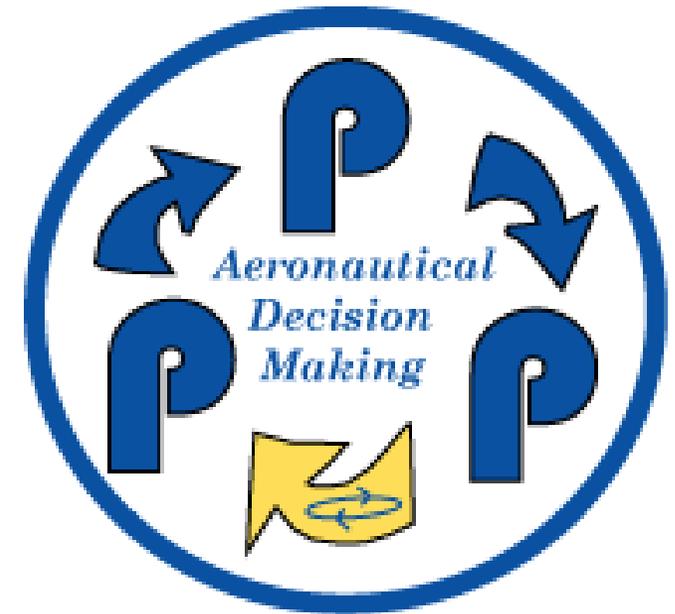


ADM Models

(3P) Model

The Perceive, Process, Perform (3P) model for ADM offers a simple, practical, and systematic approach that can be used during all phases of flight. To use it, the pilot will:

- Perceive the given set of circumstances for a flight
- Process by evaluating their impact on flight safety
- Perform by implementing the best course of action



Post-Flight Analysis

- **Post-Flight:**

- Provide an Objective Analysis of the effectiveness of your ADM skills.
- Understand that we don't do everything right all the time.
- Debrief or Hot Wash following every flight
 - Identify areas where you can improve
 - There is typically more than one right answer to ADM, some better than others



Common Factors Causing Accidents

Which errors in judgement/procedure can cause these problems?

- Inadequate preflight preparation and/or planning
- Failure to maintain direction control and UAS strikes a pole
- Thunderstorms started after launch
- Failure to see and avoid objects or obstructions
- Manned aircraft narrowly misses UAS during operation
- Battery goes critical downwind from landing location
- Selection of unsuitable terrain
- Improper operation of flight controls



ADM/CRM Quiz

1) A local TV station has hired a remote pilot to operate their small UAS to cover news stories. The remote pilot has had multiple near misses with obstacles on the ground and two small UAS accidents. What would be a solution for the news station to improve their operating safety culture?

- A) The news station should recognize hazardous attitudes and situations and develop standard operating procedures that emphasize safety.
- B) The news station should implement a policy of no more than five crashes/incidents within 6 months.
- C) The news station does not need to make any changes; there are times that an accident is unavoidable.

2) Most midair collision accidents occur during

- A) Hazy days.
- B) Clear days.
- C) Cloudy days.

3) What is the antidote when a pilot has a hazardous attitude, such as “Antiauthority”?

- A) Rules do not apply in this situation
- B) Follow the rules.
- C) I know what I am doing



End of Module

Module 13: Emergency Procedures

Emergency Defined

- **Define In-Flight Emergency**
 - An inflight emergency is usually an unexpected and unforeseen event that can have serious consequences for an unprepared remote pilot.
 - During an **In-flight emergency only**, a remote pilot is permitted to deviate from any part of 14 CFR part 107 to respond to the emergency.
 - **May be required to report if asked by the FAA**

Emergency Procedures

- **Part 107 - Emergency Procedure Requirements:**
 - RPIC may take any action necessary to ensure no hazard to other people or property
 - All crew (VO, and non-certified operators) must be briefed on the flight and the planned emergency procedures
 - Plan for emergency landing Location – exit strategy
- FAA **example**, if during a flight the small UA experiences as **battery fire**, the remote pilot may need to climb the small UA **above 400' AGL** to maneuver **to a safe landing area**. In this instance, a report will need to be made only if asked to do so by the FAA.

UAS Components Susceptible to Failure

- GCS/IPAD Failure
 - Battery failure
 - Cable Failure
 - Software Failure – Reboot
 - IPAD Reboot
 - IPAD IOS Updates
- Controller Failure
 - Firmware Update
 - Battery Failure
- Aircraft Failure
 - Firmware Updates Malfunction
 - Battery Malfunction / Failure
 - Motor Failure
 - Load Shift
 - Performance - Wind / Weather

Emergency Procedures

DEVELOP EMERGENCY PROCEDURES

- Loss of aircraft Orientation / GPS
 - Procedures to regain control of aircraft

COMPASS LOSS W/ GPS LOSS ATTI MODE

- **Gain Altitude – If Possible**
- Fly Away from Interference
- If Situation Continues
- Return to **HP**, or Land Where Safest
- Follow **LOSS OF ORIENTATION & IPAD**

LOST LINK

Establish Look Out
 Insure GS Power On
 Switch GS to “P” Mode
 Check GS Antenna
 Reposition GS to Avoid Interference
 Clear HP Landing Area

FLY AWAY

Switch to ATTI Mode
 ADVISE ATC / AIRPORT
 Aircraft Heading and Alt
 Speed & Describe UAS
 Max. Remaining Flight

Emergency Procedures

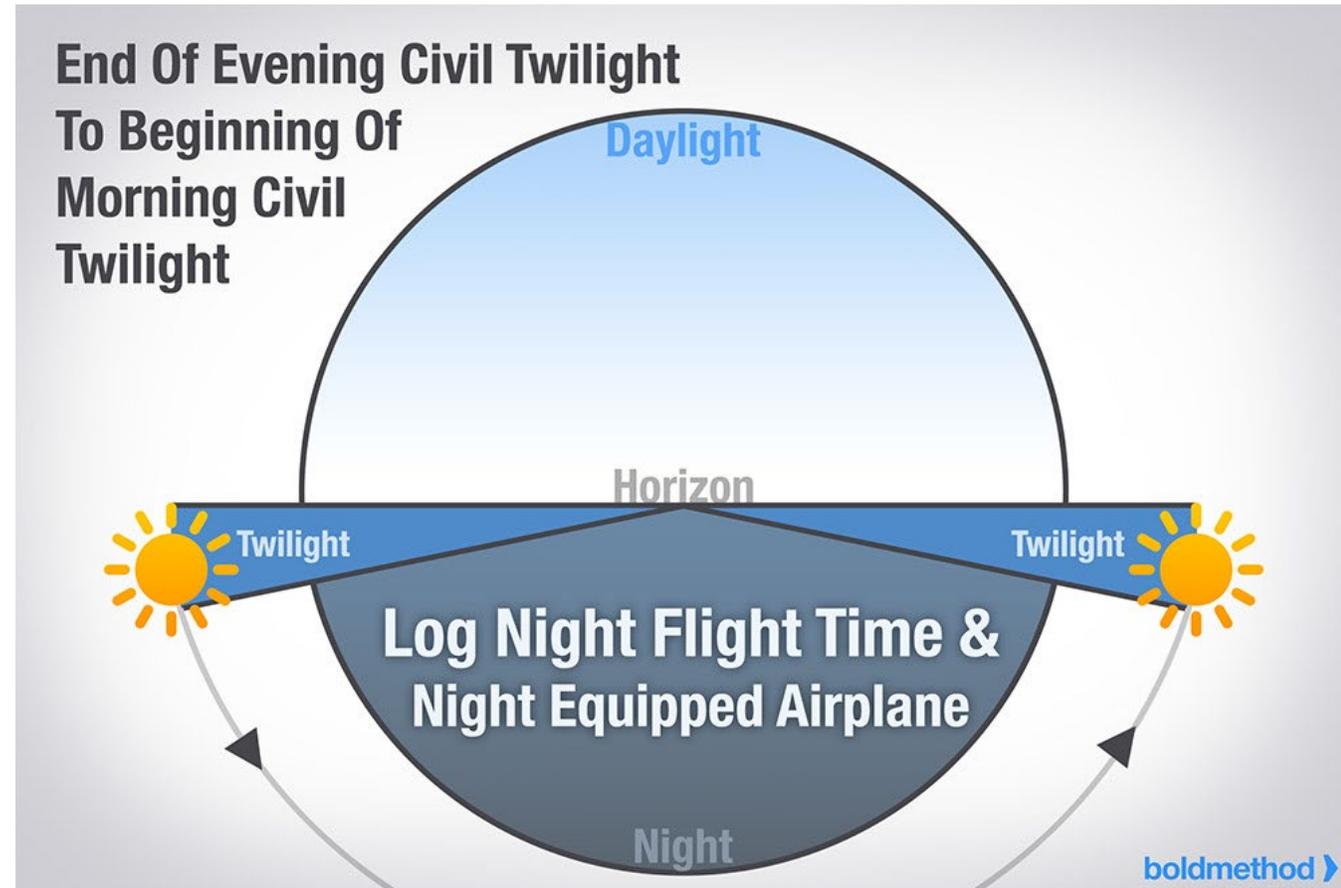
- **Summary**
 - RPIC Permitted to deviate from the rules to respond to the emergency
 - May have to report to FAA, **if asked**
 - RPIC responsible for safe operation at all times
 - **RPIC must inspect the aircraft and ensure it is in safe operating condition for flight**
 - Must correct any irregularities' before flight
 - RPIC responsible to brief all crew (VO and Unlicensed Operators)
 - During an In-flight Emergency, RPIC must take any action to insure there is no hazard to people or property

End of Module

Module 14: Civil Twilight & Night Ops

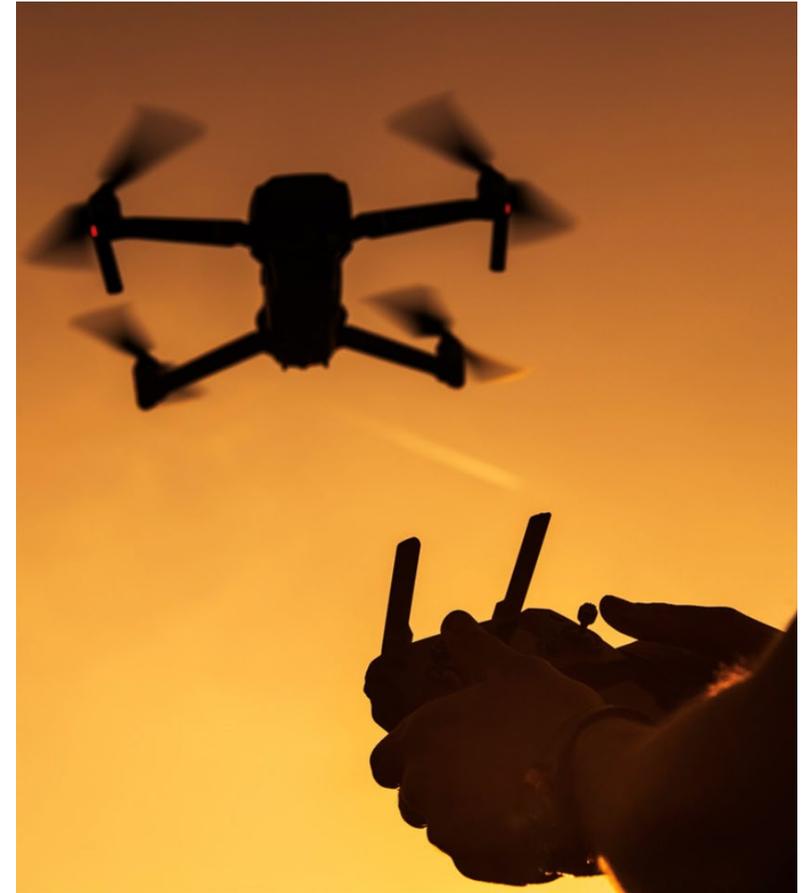
Night Defined

- **Night Terms - 14 CFR § 1.1**
 - In the contiguous United States, **evening civil twilight is the time between sunset and 30 minutes after sunset. Morning civil twilight is the time from 30 minutes prior to sunrise until sunrise**
 - Night is the time between the **end of evening civil twilight and the beginning of morning civil twilight**, as published in The Air Almanac and converted to local time.



Night Operations Lighting Requirements

- During civil twilight and at night, the sUAS must be equipped with **anti-collision lights** that are:
 - **Capable of being visible for at least 3 statute miles** from the control station
 - **Flash rate** sufficient to avoid a collision
- The RPIC has the **discretion to reduce the intensity** of the lighting in the interest of operational safety (may NOT turn them off).

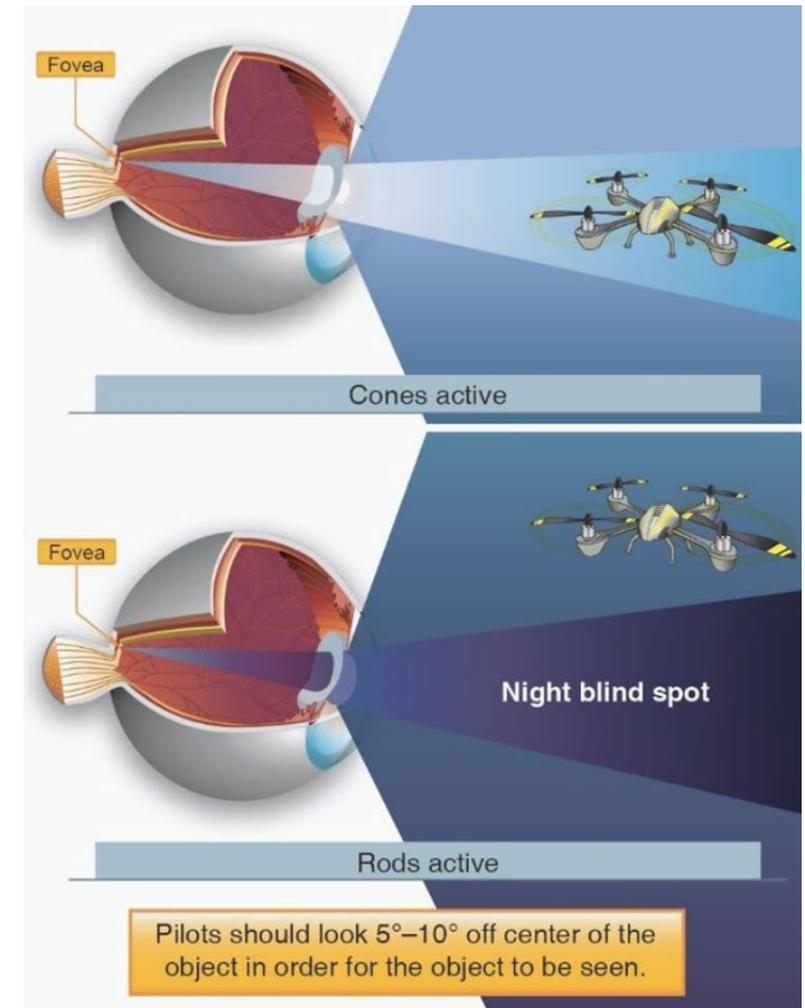


Source: 14 CFR § 107.29; AC 107-2, Small Unmanned Aircraft Systems (sUAS) (as amended)



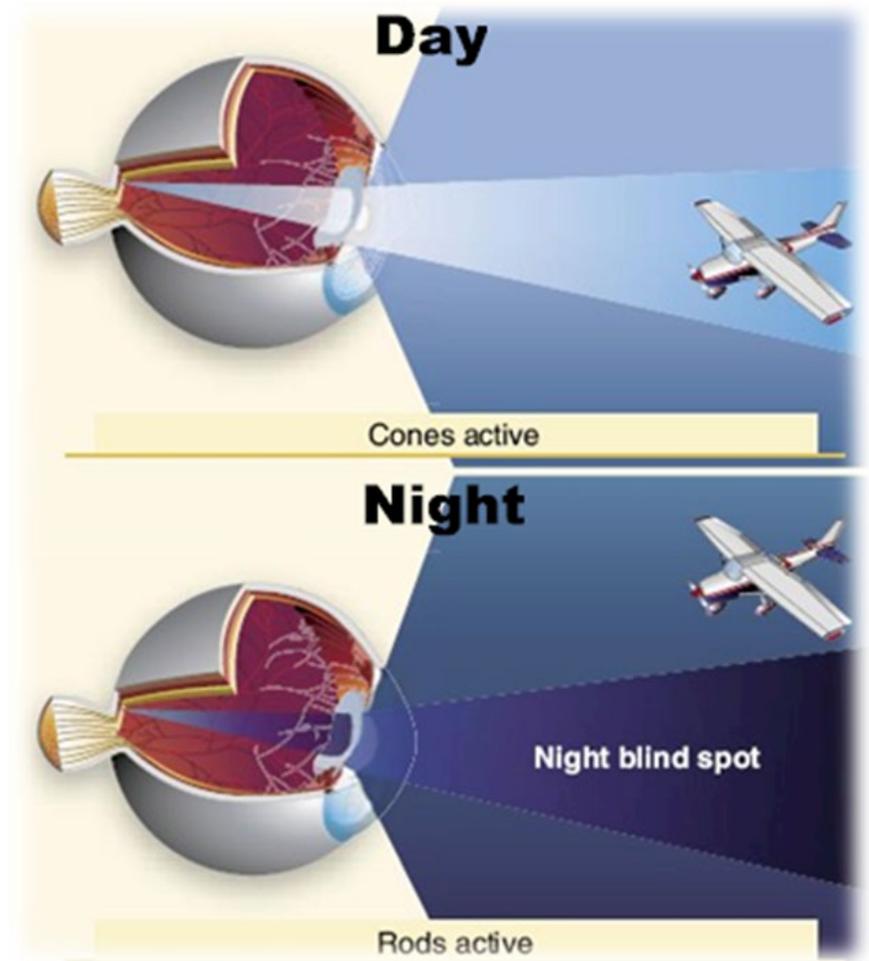
Scanning Techniques – Day Time

- **Scanning Techniques**
 - To scan effectively, scan right to left or left to right.
 - Start at the greatest distance (top) and move inward (bottom).
 - Each movement should not exceed 10 degrees
 - Each area should be observed for at least three seconds to enable collision detection
 - Practice is critical to this important task



Scanning Techniques – Night Time

- **Vision –**
 - Scanning technique at night is to practice “off-center viewing”
 - Off-Center Viewing
 - Do not look directly at an object at night.
 - Look just left or right to bring it in focus.
 - Do not sweep across the horizon.
 - Focus for a few seconds on successive areas of the sky, allowing time for your brain to recognize movement.



Night Operations Challenges

- **Night flight** involves **increased risks** that are not present during daylight operations
 - Reduce risk by **implementing protocols to mitigate** the risks you've identify for each operation



Night Operations Challenges

- **Challenges and Mitigation strategies**
 - **Circadian Rhythm Effects:** is a natural, internal process that regulates the sleep–wake cycle and repeats roughly every 24 hours
 - **Avoid stressors** that can limit night vision - exhaustion, hypoglycemia/low blood sugar, tobacco
 - **Obstacle Avoidance with Lack of Visual Cues**
 - **Survey the op** area before each flight
 - **Ambient lighting** - ensure that the lights won't be turned on before and during the operation



Night Illusions

- **Autokinesis**
 - Happens when a pilot **stares at a bright, stationary light** set against a pitch-black background, such as a star or the light from another aircraft. After a few seconds, the light **could appear to be moving toward the aircraft**. Attempting to avoid the impending “collision,” the pilot may become disoriented and lose control of the aircraft. To prevent this illusion, **avoid staring at one point of light for more than a few seconds and maintain a normal scan pattern**.



Night Illusions

- **Flicker Vertigo**
 - While rare, exposure to **flickering lights** can trigger an imbalance in brain-cell activity in some people, **leading to disorientation, dizziness, nausea, confusion, headaches, and sometimes seizures and loss of consciousness**. It can be prevented by looking away from the light source when possible.



Night Illusions

Reversible Perspective Illusion

- An aircraft may appear to be moving away when it is, in fact approaching
 - Mitigate this by paying attention to the aircraft position lights.
 - Red (left), green (right), white (tail)
 - Be aware they are different than on sUAS



Night Illusions

Reversible Perspective Illusion

- Notice some lights may not be visible depending on position



End of Module

Module 15: Practice Test (Take Home)

Course Evaluation

Scan Below QR Code

