Introduction 1

This is the second of two main flashcard sets (The first is: "Part 107 Study Guide Notes")

Remember, you can go online to download the FAA Study Guide (see link in hyperlink list). Some additional notes are added here to supplement the study guide content.

Hyperlink list for all web addresses in these cards can be obtained at: https://www.windowview.org/zfaa/

Tip: when you study; include memorizing abbreviations and these are often times presented with **bold colored text**.

Other text appears as words in bold text to help focus on **keywords** or **numbers** for awareness or to remember.

Introduction 2

If someone sent you a copy of the **Flashcard Hero formatted files** for the note cards and study test questions, please *visit the website address listed below*. Many hours were spent developing these files and updated cards may now exist.

Also, an **optional**, but not required, **donation** is requested for the development of these flashcards. If you use the cards for a while and value them, you can make a donation at any time. The request is modest ($5.00; use web address below).

Flashcard and test question availability:

https://www.windowview.org/zfaa/part107.html

Introduction 3

Flashcard Version (this set of cards): June 2023. - v1.0

Hyperlinks Listing: Obtain the PDF document with links from the flashcard download page.

Encouragements and Input Opportunity:

If you wish to provide a comment, suggest additional and helpful information, you can send an email to:

[redacted]

(remove the spaces when typing the address in your email client program 'email to')

Introduction 4 - Special Request

Please help anyone else to obtain the Flashcards (Note Cards) or the Test Question Cards by referring them to the web link listed here that introduces the flashcard and test question availability:

https://www.windowview.org/zfaa/

Special Request: please don't just send the files to someone else.

First, because the option to give a donation is helpful and in recognition of the effort to make these resources available.

Second, files may be updated since you obtained these files.

>>> Study Notes 2 - Sources Included

5

Note: The flashcard deck **"Part 107 Study Guide Notes"** covers the FAA's **Remote Pilot – Small Unmanned Aircraft Systems Study Guide (2016).**

- In 2016 a list of documents to study covered some 14 documents which appear below under the heading: "List of additional documents (1 & 2)"
- More recently in 2023 the FAA web pages indicate what needs study is what is listed on the next card.
- This set of flashcards "Part 107 Study Notes 2" include content from both listings.

>>> FAA listing (2023)

6

- Airmen Certification Standards (PDF)
- Knowledge Test Study Guide (PDF)
- Pilot's Handbook of Aeronautical Knowledge
- Federal Register Vol. 86, No. 10, Operation of Small Unmanned Aircraft Systems Over People

  All new knowledge test questions were drafted from the rule only, beginning on page 68
- Federal Register Vol. 86, No. 10, Remote Identification of Unmanned Aircraft

  All new knowledge test questions were drafted from the rule only, beginning on page 116
- Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25B) Chapter 17: Aeromedical Factors

  Applicable information found on pages 22 through 27 (pages 17-22 through 17-27 in full version of the handbook)

>>> Part 107 Updates — Newer topics

7

Since 2016, updates to Part 107 and associated regulations include:

operations over people

https://www.faa.gov/uas/commercial_operators/operations_over_people [See "Part 107 Study Guide Notes flashcards]

updates to the night rule- flying at night

https://www.faa.gov/newsroom/night-authorization-available-part-107-drone-pilots [See "Part 107 Study Guide Notes flashcards]

Remote Identification

https://www.faa.gov/uas/getting_started/remote_id/drone_pilots [this topic is addressed later in this set of flashcards]

>>> FAA and DOT Listing 2016

8

The lists on the next two cards are from the Department of Transportation (DOT) along with FAA 2016 list of documents to review for the Part 107 awareness and certification test.

This is a more comprehensive list of documents to study in preparing to take the FAA Part 107 certification test includes a Department of Transportation and FAA listing in: FAA-G-8082-20 Remote Pilot Knowledge Test Guide (U.S. Department of Transportation Federal Aviation Administration 2016)

https://www.goldsealgroundschool.com/uav-groundschool.com/library/remote_pilot_ktg.pdf

This deck of flashcards covers some details or provides an overview of topics in that listing ...

>>> List of additional documents - Part 1

9

- **14 CFR part 47 Title Aircraft Registration**
- **14 CFR part 48 Registration and Marking Requirements for Small Unmanned Aircraft Systems**
- **4 CFR part 71 Designation of Class A, B, C, D and E Airspace Areas; Air Traffic Service Rotes; and Reporting Points**
- **14 CFR part 107 Operation and Certification of Small Unmanned Aircraft Systems**
- **AC 00-6 Aviation Weather**
- **AC 150/5200-32 Reporting Wildlife Aircraft Strikes**

Continues on next card ...

>>> List of additional documents- Part 2

10

- **AC 107-2 Small Unmanned Aircraft Systems (sUAS)**
- **AIM Aeronautical Information Manual**
- **FAA-H-8083-2 Risk Management Handbook**
- **FAA-H-8083-25 Pilot's Handbook of Aeronautical Knowledge**
- **SAFO 09013 Fighting Fires Caused By Lithium Type Batteries in Portable Electronic Devices**
- **SAFO 10015 Flying in the wire environment**
- **SAFO 10017 Risks in Transporting Lithium Batteries in Cargo by Aircraft**
- **SAFO 15010 Carriage of Spare Lithium Batteries in Carry-on and Checked Baggage**

>>> Study Notes 2 - Flashcards

11

After reviewing the FAA Study Guide (2016) document, the notes on these cards are intended to provide any information not covered or presented in the study guide.

NOTE: These flashcards provide an overview with some but not all details for each section of the following topics. The intended content is to cover what might appear on the certification test.

>>> PART 107 - CHAPTER 4. SUBPART A, GENERAL

12

Model aircraft that are operated in accordance with **Part 101** Subpart E, Model Aircraft, which applies to model aircraft meeting all of the following criteria:

• The aircraft is flown strictly for hobby or recreational use;

• A UA that is: Capable of sustained flight in the atmosphere

The remainder of the Applicability section are covered in the study guide.

Abbreviations/Acronyms Used in the Advisory Circular. These are all covered in the flashcards for the FAA Study Guide.

Accident Reporting 13

The remote PIC of the sUAS is required to report an accident to the FAA within 10 days if it meets any of the following thresholds:

At least serious injury to any person or any loss of consciousness. A serious injury is an injury that qualifies as **Level 3 or higher on the Abbreviated Injury Scale (AIS)** of the Association for the Advancement of Automotive Medicine (AAAM).

Level 1 being a minor injury, **Level 2** is moderate,

Level 3 is serious, **Level 4** is severe, **Level 5** is critical, and **Level 6** is a non-survivable injury.

[Note: 10 days not 10 business days!]

Accident Reporting - Damage to property 14

Damage to any property, other than the small UA, if the cost is **greater than $500 to repair or replace** the property (whichever is lower).

The following note needs a look because of potentially tricky 107 certification test questions:

Note: For example, a small UA damages a property whose fair market value is $200, and it would cost $600 to repair the damage. Because the fair market value is below $500, this accident is **not required to be reported**. (Focus on the $200 to **replace**!)

Similarly, if the aircraft causes $200 worth of damage to property whose fair market value is $600, that accident is also not required to be reported because the **repair** cost is below $500.

Accident Reporting 15

The accident report must be made within 10 calendar-days of the operation that created the injury or damage;

… the advisory circular (AC) lists information to be submitted includes: PIC's contact info; certification number; registration number; location; date; time; person(s) injured and extent; property damage and extent; description of what happened.

National Transportation Safety Board (**NTSB**) Reporting. In addition to the report submitted to the FAA Regional Operations Center (**ROC**), and in accordance with the criteria established by the NTSB.

CHAPTER 5. PART 107 SUBPART B, OPERATING LIMITATIONS FOR SMALL UNMANNED AIRCRAFT SYSTEMS (sUAS) 16

This chapter covers information on the PIC, Person Manipulating Flight Controls, Loss of control, VO, plus:

Autonomous Operations. An autonomous operation is generally considered an operation in which the remote pilot inputs a flight plan into the Control Station (CS), which sends it to the autopilot onboard the small UA. During automated flight, flight control inputs are made by components onboard the aircraft, not from a CS. Thus, the remote PIC could lose the control link to the small UA and the aircraft would still continue to fly the programmed mission/return home to land.

(Example: waypoints programmed into drone)

Aeronautical Decision-Making (ADM) and Crew Resource Management (CRM). 17

ADM is a systematic approach to the mental process used by pilots to consistently determine the best course of action in response to a given set of circumstances. A remote PIC uses many different resources to safely operate an sUAS and needs to be able to manage these resources effectively.

CRM is a component of ADM, where the pilot of sUAS makes effective use of all available resources: **human resources, hardware, and information.**

This skill set includes **situational awareness**, proper allocation of tasks to individuals, avoidance of work overloads in self and in others, and effectively communicating with other members of the crew, such as VOs and persons manipulating the controls of an sUAS.

Aircraft Registration. 18

A small UA must be registered, as provided for in 14 CFR **part 47** or **part 48** prior to operating under part 107.

Registration of Foreign-Owned and Operated sUAS. If sUAS operations involve the use of foreign civil aircraft, the operator would need to obtain a Foreign Aircraft Permit pursuant to 14 CFR **part 375**, § 375.41 before conducting any **commercial** air operations under this authority.

See Part 107 Study Guide Notes for the following:

sUAS Maintenance, Inspections, and Condition for Safe Operation; Medical Condition; Physical or Mental Incapacitations

VLOS Aircraft Operation. 19

The remote PIC and person manipulating the controls must be able to see the small UA at all times during flight. Therefore, the small UA must be operated closely enough to the CS to ensure visibility requirements are met during small UA operations.

Unaided Vision. VLOS must be accomplished and maintained by unaided vision, except vision that is corrected by the use of eyeglasses (spectacles) or contact lenses. **Vision aids, such as binoculars, may be used only momentarily to enhance situational awareness.**

The use of a **Visual Observer (VO)** is optional. The remote PIC may choose to use a VO to **supplement situational awareness** and VLOS.

[The remainder of most of Chapter 5 content is covered in the study guide notes flashcards]

Speed and Altitude 20

Determining Groundspeed. There are many different types of sUAS and different ways to determine groundspeed.

Determining Altitude. In order to comply with the maximum altitude requirements of part 107, as with determining groundspeed, there are multiple ways to determine a small UA's altitude above the ground or structure.

Note: while there may be various ways, most **control stations** provide such information on screen (e.g., drone flight monitored with a smartphone or manufacturer provided CS. With a drone that has GPS, these parameters are monitored.

Part 107 permits transportation of property by sUAS for compensation or hire. These operations must be conducted within a **confined area** and in **compliance** with the operating restrictions of part 107. When conducting the transportation of property, the transport must occur wholly within the bounds of a state. It **may not involve** transport between, **1)** Hawaii and another place in Hawaii through airspace outside Hawaii, **2)** the District of Columbia (DC) and another place in DC, or **3)** a territory or possession of the United States and another place in the same territory or possession, as this is defined by statute as interstate air transportation.

Limitations. sUAS operations involving the transport of property must be conducted within VLOS of the remote pilot.

Hazardous Materials. Part 107 does not allow the carriage of hazardous materials because the carriage of hazardous materials poses a higher level of risk.

An in-flight emergency is an unexpected and unforeseen serious occurrence or situation that requires urgent, prompt action. In case of an in-flight emergency, the remote PIC is **permitted** to deviate from any rule of part 107 to the extent necessary to respond to that emergency. A remote PIC who exercises this emergency power to deviate from the rules of part 107 is required, **upon FAA request**, to send a written report to the FAA explaining the deviation. Emergency action should be taken in such a way as to minimize injury or damage to property.

Careless or Reckless Operation. As with manned aircraft, remote PICs are prohibited from engaging in a careless or reckless operation.

Part 107 includes the option to apply for a **Certificate of Waiver (CoW)**. This CoW will allow an sUAS operation to deviate from certain provisions of part 107 if the Administrator finds that the proposed operation can be safely conducted under the terms of that CoW.

CoW's include: **Operation from a moving vehicle or aircraft**; Daylight operation; Visual observer; **Operation of multiple small unmanned aircraft systems**; Yielding the right of way; **Operation over people**; Operation in certain airspace; Operating limitations for small unmanned aircraft.

Application Process. The application must contain a complete description of the proposed operation and a justification, including supporting data and documentation (as necessary), that establishes that the proposed operation can safely be conducted under the terms of a CoW.

Remote Pilot Certification. A person exercising the authority of PIC in compliance with part 107 is considered a “remote pilot in command” (remote PIC). As such, prior to acting as remote PIC, he or she must obtain a remote pilot certificate with an sUAS rating.

This aeronautical knowledge can be obtained through self-study, taking an online training course, taking an in-person training course, or any combination thereof.

- Be at least 16 years of age.
- Be able to read, speak, write, and understand the English language. However, the FAA may make an exception if the person is unable to meet one of these requirements due to medical reasons, such as a hearing impairment.
- Be in a physical and mental condition that would not interfere with the safe operation of an sUAS.
- Pass the initial aeronautical knowledge test at an FAA-approved knowledge testing center (KTC). However (except) pilot under part 61 …

Applicants Without Part 61 Certificates. 25

1. Pass an initial aeronautical knowledge test administered at a KTC (see paragraph 6.6).

2. Complete the Remote Pilot Certificate and/or Rating Application for a remote pilot certificate (FAA Form 8710-13).

• **Option 1 (Online Form):** This is the fastest and simplest method

• **Option 2 (Paper Application):**

(FYI: Part 61 is airline pilot and if you have such certification the Part 107 process is slightly different)

Aeronautical Knowledge Tests (Initial and Recurrent) 26

1. Applicable regulations relating to sUAS rating privileges, limitations, and flight operation;
2. Airspace classification and operating requirements, and flight restrictions affecting small UA operation;
3. Aviation weather sources and effects of weather on small UA performance;
4. Small UA loading and performance;
5. Emergency procedures;
6. Crew Resource Management (CRM);
7. Radio communication procedures;
8. Determining the performance of small UA;
9. Physiological effects of drugs and alcohol;
10. Aeronautical decision-making (ADM) and judgment;
11. Airport operations; and
12. Maintenance and preflight inspection procedures.

Initial Training Course (for Part 61 Pilots) 27

As described in paragraph 6.4, a pilot (**Part 61 pilot**) applying for a remote pilot certificate may complete an initial training course instead of the knowledge test. The training course can be taken online at www.faasafety.gov.

The training includes these key topics of study:

1. Applicable regulations relating to sUAS rating privileges, limitations, and flight operation
2. Effects of weather on small UA performance
3. Small UA loading and performance
4. Emergency procedures
5. Crew Resource Management (CRM)
6. Determining the performance of small UA
7. Maintenance and preflight inspection procedures

CHAPTER 7. sUAS MAINTENANCE AND INSPECTION 28

7.1 Applicability. Section 107.15 requires the remote PIC to perform checks of the UA prior to each flight to determine if the sUAS is in a condition for safe operation.

This chapter provides guidance on how to inspect and maintain an sUAS. Additionally, Appendix C, sUAS Maintenance and Inspection Best Practices, contains expanded information and best practices for sUAS maintenance and inspection.

Scheduled and Unscheduled maintenance are addressed in the study guide.

Preflight inspection items listed in the AC (part 1) 29

1. Visual condition inspection of the UAS 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.
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 prior to any flight
10. Control link transceiver, communication/navigation data link transceiver, and antenna(s)

Preflight inspection items listed in the AC (part 2) 30

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
16. Check flight termination system, if installed
17. Check fuel for correct type and quantity
18. Check battery levels for the aircraft and CS
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

Preflight inspection items listed in the AC (part 3) 31

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
24. At a controlled low altitude, fly within range of any interference and recheck all controls and stability

Benefits of Record keeping. sUAS owners and operators may find record keeping to be beneficial. This could be done by documenting any repair, modification, overhaul, or replacement of a system component resulting from normal flight operations, and recording the time-in-service for that component at the time of the maintenance procedure.

APPENDIX A. RISK ASSESSMENT TOOLS 32

Aeronautical Decision-Making (ADM). The ADM process addresses all aspects of decision making in a solo or crew environment and identifies the steps involved in good decision making. These steps for good decision making are as follows: **1)** Identifying Personal Attitudes Hazardous to Safe Flight; **2)** Learning Behavior Modification Techniques; **3)** Learning How to Recognize and Cope with Stress; **4)** Developing Risk Assessment Skills; **5)** Using All Available Resources with More Than One Crewmember (**CRM**); **6)** Evaluating the Effectiveness of One's ADM Skills.

Hazard Identification. Hazards in the sUAS and its operating environment must be identified, documented, and controlled. **Severity and Likelihood Criteria.**

APPENDIX B. SUPPLEMENTAL OPERATIONAL INFORMATION 33

Weight and Balance (W&B). Before any flight, the remote PIC should verify the aircraft is correctly loaded by determining the W&B condition of the aircraft. Although a maximum **gross takeoff weight** may be specified, the aircraft may not always safely take off with this load under all conditions. **Weight changes** during flight also have a direct effect on aircraft performance. Fuel burn is the most common weight change that takes place during flight.

Battery Fires. Lithium-based batteries are highly flammable and capable of ignition. A battery fire could cause an in-flight emergency by causing a loss of control (LOC) of the small UA. Lithium battery fires can be caused when a battery short circuits, is improperly charged, is heated to extreme temperatures, is damaged as a result of a crash, is mishandled, or is simply defective. The remote PIC should consider following the manufacturer's recommendations, when available, to help ensure safe battery handling and usage.

Table C-1. sUAS Condition Chart …

1. Structural or skin cracking

2. Delamination of bonded surfaces

3. Liquid or gel leakage

4. Strong fuel smell

5. Smell of electrical burning or arcing

6. Visual indications of electrical burning or arcing

7. Noticeable sound (decibel) change during operation by the propulsion system

8. Control inputs not synchronized or delayed

9. Battery casing distorted (bulging)

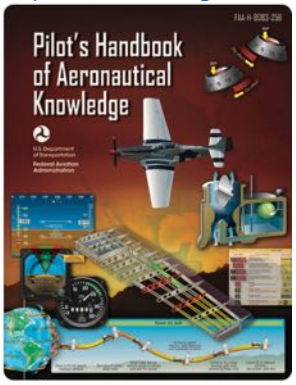
10. Diminishing flight time capability (electric powered propulsion systems)

11. Loose or missing hardware/fasteners

>>> FAA-H-8083-25 Pilot's Handbook of Aeronautical Knowledge 35

Handbook available at:

https://www.faa.gov/aviation/phak/pilots-handbook-aeronautical-knowledge-faa-h-8083-25b



This handbook is over 500 pages and has some content that seems more appropriate for pilots of regular airplane / aircraft.

The following flashcards will focus on details similar but not exactly as presented in the FAA Study Guide (2016)—and various chapters not applicable to UA and sUAS are not included here.

Chapter One - Introduction 36

This chapter is background and history to flight and while interesting and worth reading, is not outlined here. The summary does include the following: "In keeping with the FAA's belief that safety is a learned behavior, the FAA offers many courses and seminars to enhance air safety. ... Operational safety practices include, but are not limited to, **collision avoidance** procedures consisting of proper **scanning techniques**, use of **checklists**, runway incursion avoidance, positive transfer of controls, and workload management… . The FAA has incorporated these techniques along with decision-making methods, such as aeronautical decision-making (ADM), risk management, and crew resource management (CRM), which are covered more completely in Chapter 2, Aeronautical Decision-Making." And these words do have a bearing on why there is a Part 107 certification!

Chapter 2 - Aeronautical Decision-Making 37

"For over 25 years, the importance of good pilot judgment, or **aeronautical decision making (ADM)**, has been recognized as critical to the safe operation of aircraft, as well as accident avoidance."

"The goal of **risk management** is to proactively identify safety-related hazards and mitigate the associated risks. Risk management is an important component of ADM."

1. Accept no unnecessary risk
2. Make risk decisions at the appropriate level
3. Accept risk when benefits outweigh dangers (costs)
4. Integrate risk management into planning at all levels

Hazardous Attitudes and Antidotes (see Study Guide Notes Flashcards)

Likelihood and Severity of an Event 38

Likelihood is nothing more than taking a situation and determining the **probability** of its occurrence.

The following are guidelines for making assignments.

- **Probable**—an event will occur several times
- **Occasional**—an event will probably occur sometime
- **Remote**—an event is unlikely to occur, but is possible
- **Improbable**—an event is highly unlikely to occur

***Severity** of an Event*

The next element is the **severity** or consequence of a pilot's action(s).

- **Catastrophic**—results in fatalities, total loss
- **Critical**—severe injury, major damage
- **Marginal**—minor injury, minor damage
- **Negligible**—less than minor injury, less than minor system damage

Mitigating Risk (e.g., Pilot's perspective) 39

- Wait for the weather to improve to good visual flight rules (VFR) conditions
- Take an instrument-rated pilot
- Delay the flight
- Cancel the flight
- Drive (as in instead of fly to a destination)

Checklist to determine physical and mental readiness for flying, includes (all pilots including PICs): Illness, Medication, Stress, Alcohol, Fatigue, Emotion

The PAVE, CARE, TEAM Checklists & DECIDE Model (covered in 'Part 107 Study Guide Notes' flashcards)

Single-Pilot Resource Management (SRM)

Single-Pilot Resource Management (SRM) is about how to gather information, analyze it, and make decisions.

Enhanced Situational Awareness 40

An advanced avionics aircraft offers increased safety with enhanced situational awareness.

Although **aircraft flight manuals** (**AFM**) explicitly prohibit using the moving map, topography, terrain awareness, traffic, and weather datalink displays as the primary data source, these **tools** nonetheless give the pilot unprecedented information for enhanced **situational awareness**

Chapter 3: Aircraft Construction 41

Aircraft Construction (which is for full sized aircraft) … so only a few notes will appear here that apply to UA and possibly drones ... one example test question asked about rudder function (responsible for yaw).

Lift and Basic Aerodynamics

Four forces act upon an aircraft in relation to straight-and level, unaccelerated flight. These forces are: **thrust, lift, weight, and drag**.

Thrust is the forward force produced by the power plant/ propeller.

Drag is a rearward, retarding force and is caused by disruption of airflow by the wing, fuselage, and other protruding objects.

Weight is the combined load of the aircraft itself, the crew, the fuel, and the cargo or baggage.

Lift opposes the downward force of weight, is produced by the dynamic effect of the air acting on the wing, and acts perpendicular to the flight path through the wing's center of lift (CL).

Chapter 4 - Principles of Flight 42

Air is a Fluid - When most people hear the word "fluid," they usually think of liquid. However, gasses, like air, are also fluids.

Viscosity - Viscosity is the property of a fluid that causes it to resist flowing.

Friction - Another factor at work when a fluid flows over or around an object is called friction

Pressure - Pressure is the force applied in a perpendicular direction to the surface of an object.

Atmospheric Pressure - Although there are various kinds of pressure, pilots are mainly concerned with atmospheric pressure. It is one of the basic factors in weather changes, helps to lift an aircraft, and actuates some of the important flight instruments.

Density Altitude 43

… the term density altitude is used for correlating aerodynamic performance in the nonstandard atmosphere. Density altitude is the **vertical distance above sea level** in the standard atmosphere at which a given density is to be found. The density of air has significant effects on the aircraft's **performance** because as air becomes **less dense**, it **reduces**:

- **Power** because the engine takes in less air
- ***Thrust because a propeller is less efficient in thin air***
- **Lift** because the thin air exerts less force on the airfoils

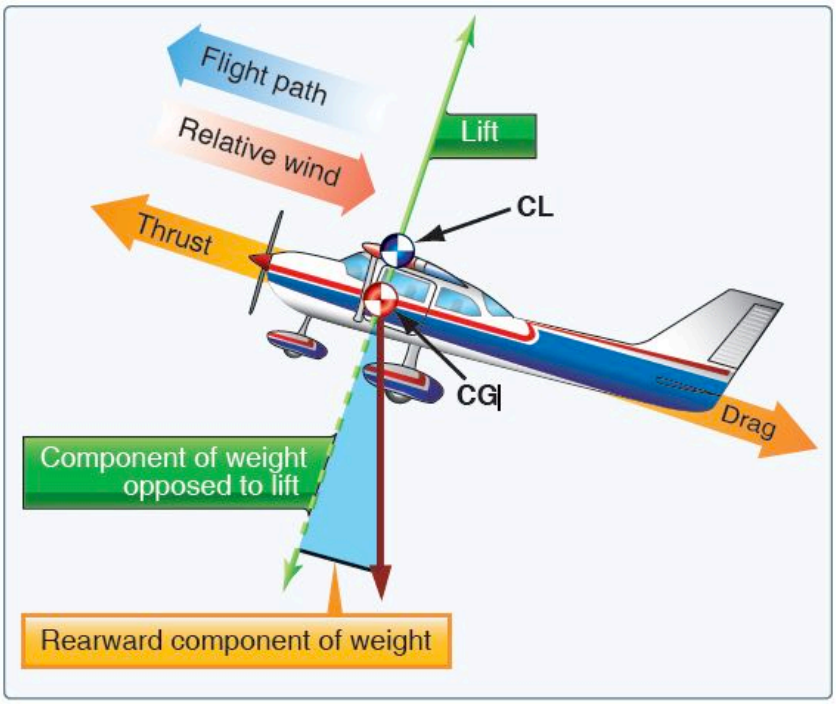
As noted in the study guide, in general, think about less density in the air at higher altitudes means less performance. Pressure, Temperature and Humidity have an impact of Density (of the air)

Effects on Density 44

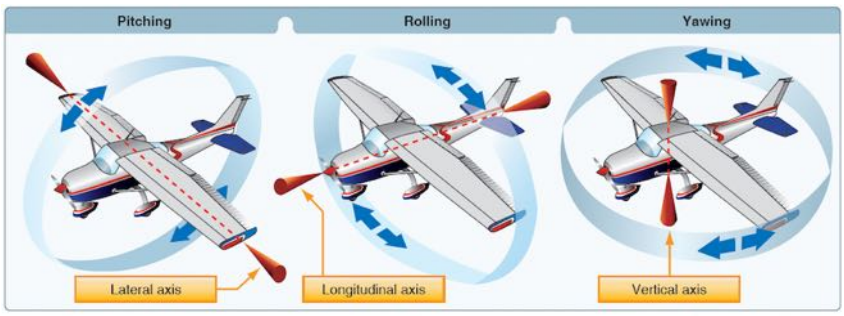
Effect of Pressure on Density - Since air is a gas, it can be compressed or expanded. When air is compressed, a greater amount of air can occupy a given volume. Conversely, when pressure on a given volume of air is decreased, the air expands and occupies a greater space. At a lower pressure, the original column of air contains a smaller mass of air.

Effect of Temperature on Density - Increasing the temperature of a substance decreases its density. Conversely, decreasing the temperature increases the density.

Effect of Humidity (Moisture) on Density - … as the water content of the air increases, the air becomes less dense, increasing density altitude and decreasing performance.



Axes of an Aircraft 46



- the motion about its **lateral** axis is "**pitch**," (tail: **elevators**)
- the motion about the aircraft's **longitudinal** axis is "**roll**," (wing: **ailerons**)
- the motion about its **vertical** axis is "**yaw**." Yaw is the left and right movement of the aircraft's nose (tail: **rudder**).

Aerodynamic Forces in Flight Maneuvers 47

Forces in Turns - see notes in Study Guide Notes flashcards and sample questions about change in weight as an aircraft makes a turn.

Stalls - An aircraft stall results from a **rapid decrease in lift** caused by the separation of airflow from the wing's surface brought on by exceeding the critical **Angle of Attack (AOA)**.

An airplane can stall at any speed. Angle of attack is a better parameter to use to avoid a stall. For a given configuration, the airplane always stalls at the same AOA, referred to as the critical AOA. This critical AOA does **not** change with:

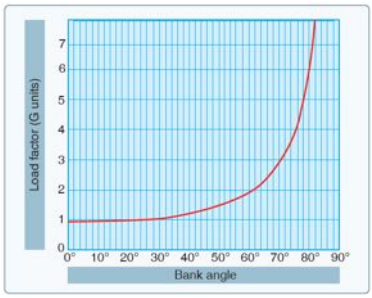
- Weight
- Bank angle
- Temperature
- Density altitude
- Center of gravity

Load Factors 48

In aerodynamics, the maximum load factor (at given bank angle) is a proportion between lift and weight and has a **trigonometric relationship**. The load factor is measured in **Gs (acceleration of gravity)**, a unit of force equal to the force exerted by gravity on a body at rest and indicates the force to which a body is subjected when it is accelerated. Any force applied to an aircraft to deflect its flight from a straight line produces a stress on its structure.

The amount of this force is the load factor.

This graphic is in the **supplement document** provided during the test and a load factor question may appear (requiring a look at this graphic).



Effect of Load Distribution 49

The effect of the position of the **center of gravity (CG)** on the load imposed on an aircraft's wing in flight is significant to climb and cruising performance. **An aircraft with forward loading is "heavier" and consequently, slower than the same aircraft with the CG further aft.**

Effect of Weight on Stability and Controllability Overloading also affects stability. An aircraft that is stable and controllable when loaded normally may have very different flight characteristics when overloaded.

As noted in Study Guide flashcards: "The aft CG limit is the most rearward position at which the CG can be located for the most critical maneuver or operation. As the CG moves aft, a less stable condition occurs, which decreases the ability of the aircraft to right itself after maneuvering or turbulence." Pilot's Handbook, Page 10-3

Certificate of Aircraft Registration - Before an aircraft can be flown legally, it must be registered with the FAA Aircraft Registry. The Certificate of Aircraft Registration, which is issued to the owner as evidence of the registration …

Airworthiness Certificate - [for an airplane] An Airworthiness Certificate is issued by a representative of the FAA after the aircraft has been inspected, is found to meet the requirements of 14 CFR part 21, and is in condition for safe operation.

Aircraft Maintenance

Aircraft Inspections

***Preflight Inspections** (applies to UA and sUAS!)*

Excessive weight reduces the flight performance in almost every respect. For example, the most important **performance deficiencies** of an **overloaded aircraft** are:

- Higher takeoff speed
- Longer takeoff run
- Reduced rate and angle of climb
- Lower maximum altitude
- Shorter range
- Reduced cruising speed
- Reduced maneuverability
- Higher stalling speed
- Higher approach and landing speed
- Longer landing roll
- Excessive weight on the nose wheel or tail wheel

Atmospheric pressure is one of the basic factors in weather changes, helps to lift the aircraft, and actuates some of the most important flight instruments in the aircraft. These instruments often include the **altimeter**, the airspeed indicator (ASI), the vertical speed indicator (VSI), and the manifold pressure gauge.

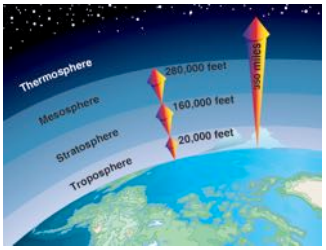
Pressure Altitude

Density Altitude

Effects of Pressure on Density

The primary factors most affected by **performance** are the takeoff and landing distance, rate of climb, ceiling, payload, range, speed, maneuverability, stability, and fuel economy.

Composition of the Atmosphere



In any given volume of air, nitrogen accounts for 78 percent of the gases that comprise the atmosphere, while oxygen makes up 21 percent. Argon, carbon dioxide, and traces of other gases make up the remaining one percent.

Atmospheric Circulation - Certain factors combine to set the atmosphere in motion, but a major factor is the uneven heating of the Earth's surface.

Atmospheric Pressure - The unequal heating of the Earth's surface not only modifies air density and creates circulation patterns; it also causes changes in air pressure or the force exerted by the weight of air molecules.

Circulation 54

Coriolis Force - The force created by the rotation of the Earth is known as the Coriolis force. The Coriolis force causes the general flow to break up into three distinct cells in each hemisphere.

Circulation patterns are further complicated by seasonal changes, differences between the surfaces of continents and oceans, and other factors such as frictional forces caused by the topography of the Earth's surface that modify the movement of the air in the atmosphere

Measurement of Atmosphere Pressure 55

Atmospheric pressure historically was measured in inches of mercury ("Hg) by a mercurial barometer. The **barometer** measures the height of a column of mercury inside a glass tube. A section of the mercury is exposed to the pressure of the atmosphere, which exerts a force on the mercury. An increase in pressure forces the mercury to rise inside the tube.

Standard sea level pressure (SLP) is defined as **29.92 "Hg** and a standard temperature of **59 °F (15 °C)**. Atmospheric pressure is also reported in millibars (mb), with 1 "Hg equal to approximately 34 mb. Standard sea level pressure is **1,013.2 mb**. Typical mb pressure readings range from 950.0 to 1,040.0 mb.

Altitude and Atmospheric Pressure 56

As altitude increases, atmospheric pressure decreases. On average, with every 1,000 feet of increase in altitude, the atmospheric pressure decreases 1 "Hg.

At higher altitudes, with a decreased atmospheric pressure, takeoff and landing reduced distances are increased, while climb rates decrease.

… due to the decreased density of the air, aircraft engines and propellers are less efficient. This leads to reduced rates of climb and a greater ground run for obstacle clearance.

Wind and Currents - Air flows from areas of high pressure into areas of low pressure because air always seeks out lower pressure.

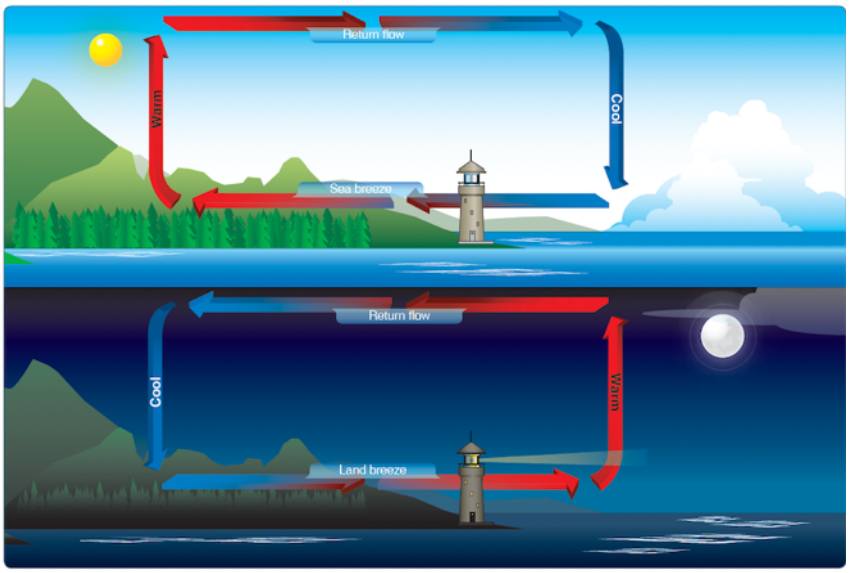
Convective Currents 57

Plowed ground, rocks, sand, and barren land absorb solar energy quickly and can therefore give off a large amount of heat; whereas, **water, trees, and other areas of vegetation** tend to more slowly absorb heat and give off heat. The resulting uneven heating of the air creates small areas of local circulation called convective currents.

Convective currents cause the bumpy, turbulent air sometimes experienced when flying at lower altitudes during warmer weather. On a low-altitude flight over varying surfaces, **updrafts** are likely to occur over pavement or barren places, and **downdrafts** often occur over water or expansive areas of vegetation like a group of trees.

Convective currents are particularly noticeable in areas with a land mass directly adjacent to a large body of water ...

Sea Breeze, Land Breeze 58



Low-Level Wind Shear 59

Wind shear is a sudden, drastic change in wind speed and/or direction over a very small area. Wind shear can subject an aircraft to violent updrafts and downdrafts, as well as abrupt changes to the horizontal movement of the aircraft.

Atmospheric Stability

The stability of the atmosphere depends on its ability to resist vertical motion. A **stable atmosphere** makes vertical movement difficult, and small vertical disturbances dampen out and disappear. In an **unstable atmosphere**, small vertical air movements tend to become larger, resulting in turbulent airflow and convective activity. Instability can lead to significant turbulence, extensive vertical clouds, and severe weather.

In the Study Guide (& Pilot's Handbook Chapter 12) 60

Inversion, Moisture and Temperature, Relative Humidity

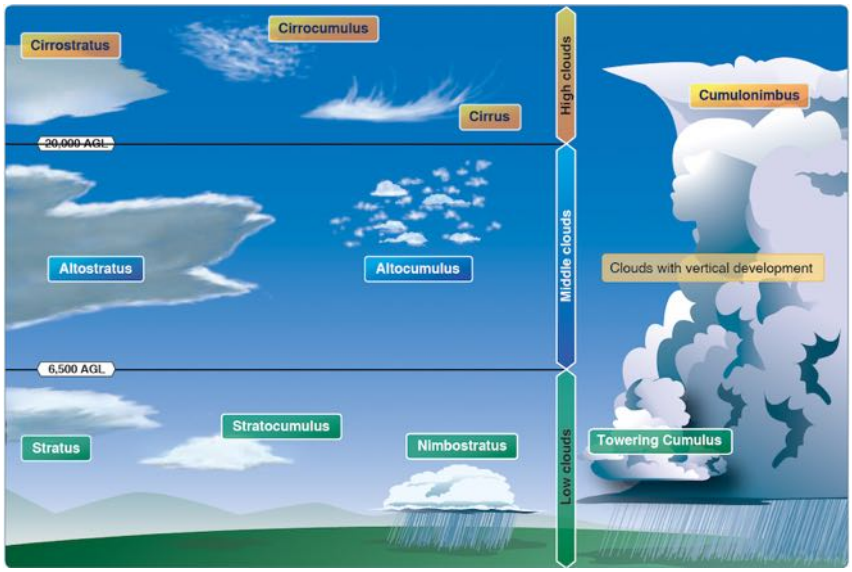
Temperature/Dew Point Relationship If air reaches the saturation point while temperature and dew point are close together, it is highly likely that fog, low clouds, and precipitation will form.

Dew and Frost, Fog

Clouds

Clouds are visible indicators and are often indicative of future weather. **For clouds to form**, there must be adequate water vapor and condensation nuclei, as well as a method by which the air can be cooled. When the air cools and reaches its saturation point, the invisible water vapor changes into a visible state.

Clouds 61



Troposphere is up to 20,000 ft

Stratosphere is above 20,000 ft

CLOUDS by level and height 62

Low clouds are those that form near the Earth's surface and extend up to about 6,500 feet AGL. They are made primarily of water droplets but can include supercooled water droplets that induce hazardous aircraft icing. Typical low clouds are **stratus, stratocumulus, and nimbostratus**.

Middle clouds form around 6,500 feet AGL and extend up to 20,000 feet AGL. They are composed of water, ice crystals, and supercooled water droplets. Typical middle-level clouds include **altostratus and altocumulus**.

High clouds form above 20,000 feet AGL and usually form only in stable air. They are made up of ice crystals and pose no real threat of turbulence or aircraft icing. Typical high level clouds are **cirrus, cirrostratus, and cirrocumulus.**

The following is a list of cloud classifications: 63

• **Cumulus**—heaped or piled clouds
• **Stratus**—formed in layers
• **Cirrus**—ringlets, fibrous clouds, also high level clouds above 20,000 feet
• Castellanus—common base with separate vertical development, castle-like
• **Lenticularus**—lens-shaped, formed over mountains in strong winds
• **Nimbus**—rain-bearing clouds
• Fracto—ragged or broken
• Alto—middle level clouds existing at 5,000 to 20,000 feet

Ceiling 64

For aviation purposes, a **ceiling** is the lowest layer of clouds reported as being **broken** or **overcast**, or the vertical visibility into an **obscuration** like **fog** or **haze**.

Visibility - Closely related to cloud cover and reported ceilings is visibility information. Visibility refers to the **greatest horizontal distance** at which prominent objects can be viewed with the naked eye.

Precipitation - Precipitation refers to any type of water particles that form in the atmosphere and fall to the ground

Fronts - As an air mass moves across bodies of water and land, it eventually comes in contact with another air mass with different characteristics

Chapter 13 - Aviation Weather Services 65

Flight Service Station (FSS)

The FSS is the primary source for preflight weather information. A preflight weather briefing from an FSS can be obtained 24 hours a day by calling **1-800-WX BRIEF** from anywhere in the United States and Puerto Rico.

- **Standard Briefing -** A standard briefing provides the most complete information and a more complete weather picture.
- **Abbreviated Briefing -** An abbreviated briefing is a shortened version of the standard briefing. It should be requested when a departure has been delayed
- **Outlook Briefing -** An outlook briefing should be requested when a planned departure is 6 hours or more away

METAR - TAF … AIRMET, SIGMET 66

See Part 107 Study Guide Notes flashcards

- **AIRMETs** (WAs) are examples of **inflight weather** advisories that are issued every 6 hours with intermediate updates issued as needed for a particular area forecast region.
- **SIGMETs** (WSs) are **inflight advisories** concerning non-convective weather that is potentially hazardous to all aircraft. They report weather forecasts that include severe icing not associated with thunderstorms, severe or extreme turbulence or **clear air turbulence (CAT)** not associated with thunderstorms, dust storms or sandstorms that lower surface or inflight visibilities to below three miles, and volcanic ash.

For more complete coverage … see the Pilot's Guide for details related to topics such as:

Types of airports;

Airport Data Sources;

Chart Supplement U.S. (formerly Airport/Facility Directory)

[<- covered in 'Part 107 study guide notes' flashcards];

NOTAM; [<- covered in 'Part 107 study guide notes' flashcards];

Automated Terminal Information Service (ATIS);

Runway markings; Signs;

etc.

A few topics are touched on briefly here ...

Types of Airports 68

The law defines airports by **categories of airport activities**, including commercial service, primary, cargo service, reliever, and general aviation airports

Towered Airport A towered airport has an operating control tower. Pilots operating from a towered airport are required to maintain two-way radio communication with ATC and to acknowledge and comply with their instructions

- Civil Airports—airports that are open to the general public
- Private Airports—airports designated for private or restricted use only, not open to the general public.
- Military/Federal Government airports

  A **non-towered airport** does not have an operating control tower. Two-way radio communications are not required, although it is a good operating practice for pilots to transmit their intentions on the specified frequency for the benefit of other traffic in the area.

Sources for Airport Data 69

Aeronautical Charts

Chart Supplement U.S. (formerly Airport/Facility Directory) provides the most comprehensive information on a given airport.

Notices to Airmen (NOTAM)

Automated Terminal Information Service (ATIS)

The Automated Terminal Information Service (ATIS) is **a recording** of the local weather conditions and other pertinent non-control information broadcast on a local frequency in a looped format.

Airport Markings and Signs 70

Runway Markings and Signs

Runway markings vary depending on the type of operations conducted at the airport. A basic **VFR** runway may only have centerline markings and runway numbers. Refer to Appendix C of this publication for an example of the most common runway markings that are found at airports.

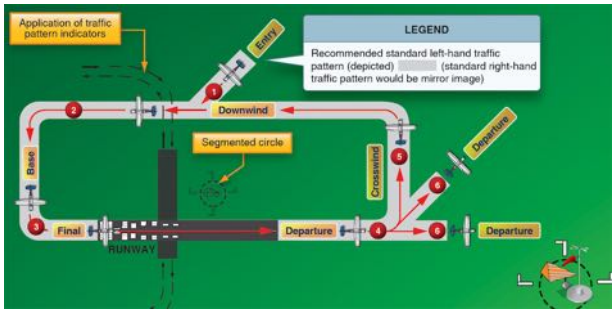
R plus ## is runway designation … if **R15**, then that orients aircraft **landing** and **taking off** TOWARD **150** degrees (R36 is 360 due north; R18 is 180 degrees due south—**magnetic** compass direction)

Holding positions

Taxiways

Airport Lighting The majority of airports have some type of lighting for night operations. The variety and type of lighting systems depends on the volume and complexity of operations at a given airport [e.g., Beacons, Approach Lighting Systems, Runway lighting (End identifier, Edge lights, etc.]

Takeoff and Landing 71



One thing to remember is that aircraft takeoff and land heading INTO wind … and when given a wind direction in degrees relative to a runway, then we can determine which is the downwind direction and thus which end f the runway will be used for takeoff or landing an aircraft.

- Upwind (departure)
- Crosswind
- Downwind
- Base/Final Leg

Runway numbers are R1 to R36 which indicates 10 to 360 is the heading direction for takeoffs and landings.

R16 would be a runway pilots would takeoff and land by heading toward 160 degrees.

Radio Communications 72

While not required for a UA or sUAS (drone) PIC, there are training references to listening in on radio transmissions, but not routine of communicating by radio.

—————— Aircraft Pilots: ——————

Operating in and out of a towered airport, as well as in a good portion of the airspace system, requires that an aircraft have two-way radio communication capability. For this reason, a pilot should be knowledgeable of radio station license requirements and radio communications equipment and procedures.

Air Traffic Control (ATC) Services - 1 73

Besides the services provided by an FSS as discussed in Chapter 12, “Aviation Weather Services,” numerous other services are provided by ATC. For UAS PICs, this topic for flight clearance is covered in the “Part 107 Study Guide Notes” flashcards.

Primary Radar - Radar is a device that provides information on range, azimuth, and/or elevation of objects in the path of the transmitted pulses.

Also … The ATC radar beacon system (ATCRBS) is often referred to as “secondary surveillance radar.”

Transponder - The transponder is the airborne portion of the secondary surveillance radar system and a system with which a pilot should be familiar

Air Traffic Control (ATC) Services - 2 74

Optional Info: **Automatic Dependent Surveillance–Broadcast (ADS-B) -** Automatic Dependent Surveillance−Broadcast (ADS−B) is a surveillance technology being deployed throughout the NAS to facilitate improvements needed to increase the capacity and efficiency of the NAS, while maintaining safety. ADS-B supports these improvements by providing a higher update rate and enhanced accuracy of surveillance information over the current radar-based surveillance system.

Radar Traffic Advisories - Radar equipped ATC facilities provide radar assistance to aircraft on instrument flight plans and VFR aircraft provided the aircraft can communicate with the facility and are within radar coverage.

Collision Avoidance 75

Optional Info: Title 14 of the CFR **part 91** has established right-of-way rules, minimum safe altitudes, and VFR cruising altitudes to enhance flight safety.

Clearing Procedures: Before takeoff; Climbs and descents; Straight and Level; Traffic patterns; Traffic VOR sites; Training operations

Runway Incursion Avoidance

A **runway incursion** is “any occurrence in the airport runway environment involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in a loss of required separation with an aircraft taking off, intending to take off, landing, or intending to land.”

Chapter 15 - Airspace 76

See the "Part 107 Study Guide Notes" flashcards

This Chapter 15 covers topics already addressed in the Study Guide.

Chapter 16 - Navigation 77

This chapter provides an introduction to cross-country flying under **visual flight rules (VFR)**. It contains practical information for planning and executing cross-country flights for the beginning pilot.

Sectional Charts - Sectional charts are the most common charts used by pilots today. The charts have a scale of 1:500,000 (1 inch = 6.86 nautical miles (NM) or approximately 8 statute miles (SM))

VFR Terminal Area Charts - VFR terminal area charts are helpful when flying in or near Class B airspace. They have a scale of 1:250,000 (1 inch = 3.43 NM or approximately 4 SM).

Important topics 78

See other flashcards for the Study Guide:
Latitude and Longitude (Meridians and Parallels)

Time Zones

Variation - Variation is the angle between true north (**TN**) and magnetic north (**MN**). It is expressed as east variation or west variation depending upon whether MN is to the east or west of TN.

Flight Planing

VFR waypoints provide VFR pilots with a supplementary tool to assist with position awareness while navigating visually in aircraft equipped with area navigation receivers

Chapter 17 - Aeromedical Factors 79

Intro: It is important for a pilot to be aware of the mental and physical standards required for the type of flying performed. This chapter provides information on medical certification and on a variety of aeromedical factors related to flight activities

Obtaining a Medical Certificate - Most pilots must have a valid medical certificate to exercise the privileges of their airman certificates. [This chapter includes a listing of specific disqualifying conditions ... include medical, psychological

See the study guide notes flashcards that cover conditions of significance to UA and sUAS PICs.

>>> PART 89 - REMOTE IDENTIFICATION OF UNMANNED AIRCRAFT 80

- As of the date this flashcard was created (spring 2023), the FAA appears to require a remote ID be installed on all sUAS starting in **September 16, 2023**.
- Evidence of all manufacturers installing such electronic devices is as yet unclear and searching the web to find new UA or sUAS with built in ID is advisable or finding add-on devices for older sUAS is not yet clear.
- However, the following cards are included to recognize and anticipate the future application of remote IDs according to FAA requirements

[Regardless of when these flashcards were assembled, best advice is to get current updates at FAA DroneZone web site]

Subpart A - General 81

Declaration of compliance means a record submitted to the FAA by the producer of a standard remote identification unmanned aircraft or remote identification broadcast module …

Home-built unmanned aircraft means an unmanned aircraft that an individual built solely for education or recreation.

§ 89.5 Falsification, reproduction, alteration, or omission. This part covers problems with compliance with Part 89.

The main purpose of the flashcards is to focus on

Subpart B - Operating Requirement

§ 89.101 Applicability. 82

(a) Except as provided in paragraph (b) of this section, this subpart applies to the following:

(1) Persons operating unmanned aircraft registered or required to be registered under part 47 or 48 of this chapter.

(2) Persons operating foreign civil unmanned aircraft in the United States.

(b) This subpart does not apply to unmanned aircraft operations under part 91 of this chapter that are transmitting ADS–B Out pursuant to § 91.225. (Automatic Dependent Surveillance−Broadcast (ADS−B))

§ 89.105 Remote identification requirement.

Except as otherwise authorized by the Administrator or as provided in § 89.120, **after September 16, 2023**, **no person may operate an unmanned aircraft within the airspace of the United States unless the operation meets the requirements of** § 89.110 or § 89.115.

§ 89.110 Operation of standard remote identification unmanned aircraft. 83

(1) **From takeoff to shutdown**, the standard remote identification unmanned aircraft must broadcast the message elements of § 89.305.

(2) The person manipulating the flight controls of the unmanned aircraft system must land the unmanned aircraft as soon as practicable if the standard remote identification unmanned aircraft is no longer broadcasting the message elements of § 89.305.

- **serial number** is listed on an FAA-accepted declaration of compliance, or the standard remote identification unmanned aircraft is covered by a design approval or production approval issue ...

§ 89.110 Operation of standard remote identification unmanned aircraft. 84

- Its remote identification equipment is functional and complies with the requirements of this part from takeoff to shutdown.
- Its remote identification equipment and functionality have not been disabled.
- The Certificate of Aircraft Registration of the unmanned aircraft used in the operation must include the serial number of the unmanned aircraft,

§ 89.115 Alternative remote identification. 85

a person may operate an unmanned aircraft that is not a standard remote identification unmanned aircraft if all of the following conditions are met:

The *Equipage* section that follows appears to require the remote ID broadcast module meet requirements and that the Certificate of Aircraft Registration includes serial number *… followed by Remote ID operating requirements … but then notes* ***the Remote ID need not be in use in FAA-recognized identification areas.*** Part 89 provides guidance on establishing such areas.

§ 89.120 Operations for aeronautical research or to show compliance with regulations.

§ 89.125 Automatic Dependent Surveillance-Broadcast (ADS-B) **Out prohibition**. Out equipment cannot be used to comply with the remote identification requirements of this part [addressed later in Part 89.

[**out equipment** not defined: web search reveals: "ADS-B Out works by broadcasting information about an aircraft's GPS location, altitude, ground speed and other data to ground stations and other aircraft, once per second." So the remoteID device has to be ON the sUAS.]

§ 89.305 Minimum message elements broadcast by standard remote identification unmanned aircraft. 86

(a) The **identity** of the unmanned aircraft, consisting of:

(1) A **serial number** assigned to the unmanned aircraft by the person responsible for the production of the standard remote identification unmanned aircraft; or

(2) A session ID.

(b) An indication of the **latitude** and **longitude** of the **control station**.

(c) An indication of the geometric **altitude** of the **control station**.

(d) An indication of the **latitude** and **longitude** of the **unmanned aircraft**.

(e) An indication of the geometric **altitude** of the **unmanned aircraft**.

(f) An indication of the **velocity** of the unmanned aircraft.

(g) A **time** mark identifying the Coordinated Universal Time (UTC) time of applicability of a position source output.

(h) An indication of the emergency status of the unmanned aircraft.

§ 89.310 Minimum performance requirements ... 87

(a) ***Control station location.*** The location of the control station of the unmanned aircraft must be generated and encoded into the message elements and must correspond to the location of the person manipulating the flight controls of the unmanned aircraft system.

(b) ***Time mark.*** The time mark message element must be synchronized with all other remote identification message elements.

(c) ***Self-testing and monitoring.***

(1) Prior to takeoff, the unmanned aircraft must **automatically test** the remote identification functionality and notify the person manipulating the flight controls of the unmanned aircraft system of the result of the test.

§ 89.310 Minimum performance requirements ... 88

(2) The unmanned aircraft *must **not** be able to take off if the remote identification equipment is not functional*.

(3) The unmanned aircraft must **continuously monitor** the remote identification functionality from takeoff to shutdown and must provide notification of malfunction or failure to the person manipulating the flight controls of the unmanned aircraft system.

(d) ***Tamper resistance.*** The unmanned aircraft must be designed and produced in a way that reduces the ability of a person to tamper with the remote identification functionality.

(e) ***Error correction.*** The remote identification equipment must incorporate error correction in the broadcast of the message elements in § 89.305.

(f) ***Interference considerations.*** The remote identification equipment must not interfere with other systems or equipment installed on the unmanned aircraft, and other systems or equipment installed on the unmanned aircraft must not interfere with the remote identification equipment.

Remainder of Part 89 89

Coverage by the flashcards pauses here … what is already covered should be adequate to pass the Part 107 test … and the following sections of Part 89 include topics such as:

Remote ID message

Minimum performance of remote ID

Means of compliance

Remote ID design and production

Labeling

Acceptance of a declaration of compliance

Part 89 On the web:

https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-89

>>> 14 CFR part 71 90

Designation of Class A, B, C, D and E Airspace Areas; Air Traffic Service Rotes; and Reporting Points

The flashcards for the **FAA Study Guide (2016)** may be sufficient, however the following cards are included if any other details appear worthy of noting.

The online Federal Register Notice for Part 71 is located at:

https://www.ecfr.gov/current/title-14/chapter-I/subchapter-E/part-71

The following cards are likely to be more accurate or detailed than the FAA Study Guide published in 2016.

§ 71.1 Applicability.

§ 71.3 [Reserved]

§ 71.5 Reporting points. All bearings and radials in this part are true and are applied from point of origin and all mileages in this part are stated as nautical miles.

§ 71.9 Overlapping airspace designations. 91

When **overlapping airspace** designations apply to the same airspace, the operating rules associated with the more restrictive airspace designation apply.

Starting with Class A, … A is more restrictive than the following B, C, D, E, and G. And then B is more restrictive than C, D, E, G … etc., class by class with E finally more restrictive than G.

§ 71.11 **Air Traffic Service (ATS) routes.**

(a) … route is based on a centerline that extends from one navigation aid, fix, or intersection, to another navigation aid, fix, or intersection specified for that route.

(b) An ATS route does not include the airspace of a prohibited area.

§ 71.13 Classification of Air Traffic Service (ATS) routes. 92

In subpart A of this part:

(1) Jet routes.

(2) Area navigation (RNAV) routes.

(b) In subpart E of this part:

(1) VOR Federal airways.

(2) Colored Federal airways.

(i) Green Federal airways.

(ii) Amber Federal airways.

(iii) Red Federal airways.

(iv) Blue Federal airways.

(3) Area navigation (RNAV) routes.

§ 71.33 Class A airspace areas. 93

(a) That airspace of the United States, including that airspace overlying the waters within **12 nautical miles of the coast** of the 48 contiguous States, **from 18,000** feet MSL to and including FL600 (i.e., **60,000 ft**) excluding the states of Alaska and Hawaii.

(b) That airspace of the State of **Alaska**, including that airspace overlying the waters within 12 nautical miles of the coast, from 18,000 feet MSL to and including FL600 but not including the airspace less than 1,500 feet above the surface of the earth and the Alaska Peninsula west of longitude 160°00′00″ West.

(c) The airspace areas listed as **offshore airspace** areas in subpart A of FAA Order JO 7400.11G (incorporated by reference, see § 71.1) that are designated in international airspace within areas of domestic radio navigational signal or ATC radar coverage, and within which domestic ATC procedures are applied.

§ 71.41 Class B & 71.51 C airspace. 94

Class B airspace areas listed in subpart B of FAA Order JO 7400.11G (incorporated by reference, see § 71.1) consist of specified airspace within which all aircraft operators are subject to the minimum pilot qualification requirements, operating rules, and aircraft equipment requirements of part 91 of this chapter. Each Class B airspace area designated for an airport in subpart B of FAA Order JO 7400.11G (incorporated by reference, see § 71.1) contains at least one primary airport around which the airspace is designated.

Class C airspace areas listed in subpart C of FAA Order JO 7400.11G … (remaining wording as above for Class B

§ 71.61 Class D airspace. 95

The Class D airspace areas listed in subpart D of FAA Order JO 7400.11G … (remaining wording as above for Class B

NOTES:

- Remember, Part 71 addresses regular pilots of aircraft.
- Language on following cards for Class E is more than what is needed for the certification test and what is covered in the Class E description in the FAA Study Guide (2016).

§ 71.71 E airspace 96

Class E Airspace consists of:

(a) The airspace of the United States, including that airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous states and Alaska, extending **upward from 14,500 feet MSL** up to, but **not including 18,000 feet MSL**, **and** the airspace **above FL600**, excluding—

(1) The Alaska peninsula west of longitude 160°00′00″ W.; and

(2) The airspace below 1,500 feet above the surface of the earth.

(b) The **airspace areas designated for an airport** in subpart E of FAA Order JO 7400.11G ... within which all aircraft operators are subject to the operating rules specified in part 91 of this chapter.

(c) The airspace areas listed as domestic airspace areas in subpart E of FAA Order JO 7400.11G ... which extend upward from **700** feet or more above the surface of the earth when designated in conjunction with an airport for which an approved instrument approach procedure has been prescribed, **or** from **1,200** feet or more above the surface of the earth for the purpose of transitioning to or from the terminal or *en route* environment. When such areas are designated in conjunction with airways or routes, the extent of such designation has the lateral extent identical to that of a Federal airway and extends upward from 1,200 feet or higher. Unless otherwise specified, the airspace areas in the paragraph extend upward from 1,200 feet or higher above the surface to, but not including, 14,500 feet MSL.

(d) The Federal airways described in subpart E of FAA Order JO 7400.11G … .

(e) The airspace areas listed as *en route* domestic airspace areas in subpart E of FAA Order JO 7400.11G ... Unless otherwise specified, each airspace area has a lateral extent identical to that of a Federal airway and extends upward from 1,200 feet above the surface of the earth to the overlying or adjacent controlled airspace.

(f) The airspace areas listed as offshore airspace areas in subpart E of FAA Order JO 7400.11G... that are designated in international airspace within areas of domestic radio navigational signal or ATC radar coverage, and within which domestic ATC procedures are applied. Unless otherwise specified, each airspace area extends upward from a specified altitude up to, but not including, 18,000 feet MSL.

Unless otherwise designated:

(a) Each **reporting point** listed in subpart H of FAA Order JO 7400.11G ... applies to all directions of flight. In any case where a geographic location is designated as a reporting point for less than all airways passing through that point, or for a particular direction of flight along an airway only, it is so indicated by including the airways or direction of flight in the designation of geographical location.

(b) Place names appearing in the reporting point descriptions indicate VOR or VORTAC facilities identified by those names.

Part 47 included here for 'completeness' but see **Part 48** on following flashcards which is more for **sUAS** and **UAs**.

Applies to:

- requirements for registering **aircraft** (i.e., airplanes)
- applies to each applicant for, and holder of, a Certificate of Aircraft Registration, AC Form8050–3
- and holder of, a Dealer's Aircraft Registration Certificate, AC Form 8050–6.

1) Individual who is a citizen of the United States or one of its possessions; **2)** Partnerships; **3)** Corporation or association organized under the laws of the United States or a State, the District of Columbia, or a territory or possession of the United States, **4)** Resident alien (immigrant); admitted to US for permanent residency

§ 47.3 Registration required. 101

… the aircraft is not registered under the laws of a foreign country and is:

1) Owned by a citizen of the United States;

2) individual citizen of a foreign country lawfully admitted for permanent residence in the United States;

3) Owned by a corporation

4) United States Government; or a State, the District of Columbia, a territory or possession of the United States, or a political subdivision of a State, territory, or possession.

CANNOT register if

Has been registered by its owner;

Temporary authorization required by § 47.31(c)

Is an aircraft of the Armed Forces of the United States

No person may operate an aircraft that is eligible for registration … unless 102

(1) Has been registered by its owner;

(2) Is carrying aboard the temporary authorization required by § 47.31(c); or

(3) Is an aircraft of the Armed Forces of the United States.

(4) Governmental units … and Puerto Rico

§ 47.5 Applicants. 103

- A person who wishes to register an aircraft in the United States must submit an Aircraft Registration Application, AC Form 8050–1 under this part.
- by and in the legal name of its owner.
- registration is not evidence of ownership of aircraft in any proceeding in which ownership by a particular person is in issue
- "owner" includes a buyer in possession, a bailee, or a lessee of an aircraft

§ 47.7 United States citizens and resident aliens. 104

- a U.S. citizen must certify citizenship in the Aircraft Registration Application, AC Form 8050–1.
- a resident alien must furnish a representation of permanent residence and the applicant's alien registration number issued by the Department of Homeland Security.
- *Trustees.* An applicant for aircraft registration under 49 U.S.C. 44102 that holds legal title to an aircraft in trust must comply with … [requirements under this sub part].
- *Partnerships.* A partnership may apply for a Certificate of Aircraft Registration … including if co-owned by Resident alien(s) or One or more resident aliens and one or more U.S. citizens.

Sections 47.8 to 47.11 105

§ 47.8 Voting trusts.

(a) If a voting trust is used to qualify a domestic corporation as a U.S. citizen, the corporate applicant must submit to the Registry— ...

47.9 Corporations not U.S. citizens.

(a) Each corporation applying for registration of an aircraft under 49 U.S.C. 44102 must submit to the Registry with the Aircraft Registration Application, AC Form 8050–1— ...

§ 47.11 Evidence of ownership.

Except as provided in §§ 47.33 and 47.35, each person that submits an Aircraft Registration Application, AC Form 8050–1 under this part must also submit the required evidence of ownership, recordable under §§ 49.13 and 49.17. [this appears to apply to many scenarios other than a simple purchase of a UA or Drone from a merchant]

§ 47.13 Signatures and instruments made by representatives. 106

(a) Each person signing an Aircraft Registration Application, AC Form 8050–1, or a document submitted as supporting evidence under this part, must sign in ink or by other means acceptable to the FAA.

§ 47.14 Serial numbers for unmanned aircraft. 107

(a) The **unmanned aircraft serial number** provided as part of any application for aircraft registration of any standard remote identification unmanned aircraft must be the serial number issued by the manufacturer of the unmanned aircraft in accordance with the design and production requirements of part 89 of this chapter. The serial number provided in this application must not be listed on more than one Certificate of Aircraft Registration at the same time.

(b) is essentially worded as (a) but focuses on registration of any unmanned aircraft with a remote identification broadcast module …

[Unmanned aircraft greater than 55 pounds in weight may be what is referenced here, otherwise Part 107 is focused on lesser weight sUAS]

§ 47.15 Registration number. 108

Number required. An applicant **for aircraft registration** must place a U.S. registration number (registration mark) on the Aircraft Registration Application, AC Form 8050–1, and on any evidence submitted with the application.

- Aircraft not previously registered anywhere
- Aircraft last previously registered in the United States
- Aircraft last previously registered in a foreign country.
- Duration of a U.S. registration number assignment.
- A U.S. registration number may not exceed five symbols in addition to the prefix letter “N”.
- An aircraft manufacturer may apply to the Registry for enough U.S. registration numbers to supply estimated production for the next 18 months.

§ 47.16 Temporary registration numbers. 109

Temporary registration numbers are issued by the FAA to manufacturers, distributors, and dealers who are holders of Dealer's Aircraft Registration Certificates, AC Form 8050–6, for temporary display on aircraft during flight allowed under Subpart C of this part.

§ 47.17 Fees. (3 Examples)

Certificate of Aircraft Registration (each aircraft) $5.00

Dealer's Aircraft Registration Certificate $10.00

Renewal Certificate of Aircraft Registration $5.00

§ 47.19 Registry. 110

Subpart B - Certificates of Aircraft Registration

§ 47.31 Application.

(a) Each applicant for a Certificate of Aircraft Registration, AC Form 8050–3 must submit the following to the Registry:

(1) An Aircraft Registration Application, AC Form 8050–1, signed by the applicant

(2) The original Aircraft Bill of Sale, AC Form 8050–2, or other evidence of ownership; and

(3) The fee required

§ 47.40 Registration expiration and renewal. 111

Initial Registration. A Certificate of Aircraft Registration issued in accordance with § 47.31 expires **seven years** after the last day of the month in which it is issued.

Renewal. Each holder of a Certificate of Aircraft Registration, AC Form 8050–3, containing an expiration date may apply for renewal of a Certificate of Aircraft Registration by submitting an Aircraft Registration Renewal Application, AC Form 8050–1B, and the fee required by § 47.17 during the six months preceding the expiration date for the Certificate of Aircraft Registration.

A **Certificate of Aircraft Registration** issued under this paragraph **after January 23, 2023** expires seven years after the last day of the month in which it was issued.

§ 47.41, 47.43, 47.45, and 47.47 112

§ 47.41 Duration and return of Certificate.

§ 47.43 Invalid registration.

§ 47.45 Change of address.

Within 30 days after any change in a registered owner's mailing address, the registered owner must notify the Registry in writing of the change of address.

§ 47.47 Cancellation of Certificate for export purpose.

Subpart C - Dealers' Aircraft Registration Certificate 113

§ 47.61 Dealer's Aircraft Registration Certificates.

§ 47.63 Application.

§ 47.65 Eligibility.

§ 47.67 Evidence of ownership.

§ 47.69 Limitations.

§ 47.71 Duration of Certificate; change of status.

>>> 14 CFR part 48 Registration and Marking Requirements for Small Unmanned Aircraft Systems 114

§ 48.1 Applicability.

This part provides registration and identification requirements for small unmanned aircraft that are part of a small unmanned aircraft ... requirements must be made under Part 47 or Part 48

§ 48.10 Definitions.

US citizen, 2) partnership; 3) Corporation or association, 4) Registry (FAA); 5) Resident alien

§ 48.15 Requirement to register. 115

No person may operate a small unmanned aircraft that is eligible for registration unless one of the following criteria has been satisfied:

(a) The owner has **registered** and **marked** the aircraft in accordance with this part;

(b) The aircraft is operated exclusively in compliance with 49 U.S.C. 44809 and **weighs 0.55 pounds or less on takeoff**, including everything that is on board or otherwise attached to the aircraft; or

(c) The aircraft is an aircraft of the Armed Forces of the United States.

§ 48.20 Eligibility for registration. 116

A small unmanned aircraft may be registered under 49 U.S.Code 44103 (Registration of Aircraft) and under this part only when the aircraft is **not** registered under the laws of a foreign country and is

(a) Owned by a U.S. citizen

(b) Owned by an individual citizen of a foreign country lawfully admitted for permanent residence in the United States

(c) Owned by a corporation

(d) an aircraft of U.S. Govt, State, DC, territory or possession of the U.S.

§ 48.25 Applicants. 117

- a person must provide the information required by § 48.110 to the Registry in a form and manner prescribed by the Administrator. Upon submission of this information, the FAA issues a Certificate of Aircraft Registration to that person.
- registered by its owner using the legal name of its owner, unless the owner is less than 13 years of age. Someone 13 or older would then register.
- registration is not evidence of aircraft ownership in any proceeding
- "owner" includes a buyer in possession, a bailee, a lessee of a small unmanned aircraft under a contract of conditional sale, and the assignee of that person

§ 48.30 Fees. 118

(a) The fee for issuing or renewing a Certificate of Aircraft Registration as described in § 48.100 is $5.00 per aircraft.

(b) The fee for issuing or renewing a Certificate of Aircraft Registration as described in § 48.105 is $5.00 per certificate.

(c) Each application for and renewal of a Certificate of Aircraft Registration must be accompanied by the fee described in paragraphs (a) and (b), as applicable, paid to the Federal Aviation Administration through the web-based aircraft registration system, or in another manner if prescribed by the Administrator.

§ 48.100 Registration: Small unmanned aircraft operated for any purpose other than exclusively limited recreational operations. 119

for any purpose other than operating exclusively in compliance with 49 U.S.C. 44809 constitutes registration for the small unmanned aircraft identified on the application.

An aircraft is registered when the applicant receives a Certificate of Aircraft Registration for the specific aircraft. The effective date of registration is shown by the date of issue on the Certificate of Aircraft Registration issued for the aircraft.

A Certificate of Aircraft registration issued under this part expires **3 years** after the date of issue unless it is renewed.

Renewal follows **every 3 years**

Other events affecting effectiveness of Certificate. 120

Registration … effective, unless **registration** has **ended** by reason of having been revoked, canceled, expired, or the ownership is transferred, until the date upon which one of the following events occurs:

- the aircraft is registered under the laws of a foreign country.
- small unmanned aircraft is totally destroyed or scrapped
- The holder of the Certificate ... loses U.S. citizenship.
- Thirty days have elapsed since the death of the holder of the Certificate
- loses status as a resident alien, unless that person becomes a citizen of the United States
- A corporation ceases to be lawfully organized
- aircraft was not operated exclusively within the United States during the period of registration under this part

§ 48.105 Registration: Small unmanned aircraft intended exclusively for limited recreational operations. 121

- *Certificate of Aircraft Registration.* A Certificate of Aircraft Registration issued in accordance with § 48.110 for small unmanned aircraft ...
- *Effective date of registration.* An aircraft is registered ... The effective date of registration is shown by the date of issue on the Certificate of Aircraft Registration issued under this part.
- ***Registration renewal.*** … registration… **expires 3 years** after the date of issue unless it is renewed.

Other events affecting effectiveness of Certificate. 122

(1) The holder of the Certificate of Aircraft Registration loses U.S. citizenship.

(2) Thirty days have elapsed since the death of the holder of the Certificate of Aircraft Registration.

(3) The owner, if an individual who is not a citizen of the United States, loses status as a resident alien, unless that person becomes a citizen of the United States at the same time.

§ 48.110 Application. 123

Required information:

- Applicant's name or the name of the authorized representative
- Applicant's physical address
- Applicant's email address
- Applicant's telephone number(s)
- The aircraft manufacturer and model name.
- For any standard remote identification unmanned aircraft, the serial number issued by the manufacturer
- any unmanned aircraft equipped with a remote identification broadcast module, the serial number issued by the manufacturer
- must be submitted to the Registry through the web-based small unmanned aircraft registration system in a form and manner prescribed by the Administrator.
- FAA will issue a Certificate of Aircraft Registration upon completion of the application requirements

§ 48.115 Requirement to maintain current information. 124

- the information provided under § 48.110 remains accurate.
- **update** the information using the web-based small unmanned aircraft **registration** system **within 14 calendar days** of the following:

1. A change in the information provided under § 48.110.
2. When aircraft registration requires cancellation for any reason including **sale** or **transfer**, destruction, or export.

§ 48.120 Invalid registration. 125

… invalid if, at the time it is made:

(a) The aircraft is registered in a foreign country;

(b) The applicant is not the owner, except when the applicant registers on behalf of an owner who is under 13 years of age;

(c) The applicant is not eligible to submit an application under this part; or

(d) The interest of the applicant in the aircraft was created by a transaction that was not entered into in good faith, but rather was made to avoid (with or without the owner's knowledge) compliance with 49 U.S.Code 44101–44103.

§ 48.125 Foreign civil aircraft. 126

Except for corporations eligible to register under § 48.20(c), the FAA will issue a recognition of ownership to persons required to comply with the provisions of this part pursuant to an authorization to operate issued under part 375 of this title. The recognition of ownership does not have the effect of U.S. aircraft registration.

§ 48.200 General - Subpart C - Aircraft Marking 127

(a) No person may operate a small unmanned aircraft registered in accordance with this part unless the aircraft **displays a unique identifier** in accordance with the requirements of § 48.205 of this subpart.

(b) A unique identifier is one of the following:

(1) The **registration number** issued to an individual or the registration number issued to the aircraft by the Registry upon completion of the registration process provided by this part; or

(2) **If authorized** by the Administrator, the small unmanned aircraft **serial number** provided with the application for Certificate of Aircraft Registration under § 48.110(a).

§ 48.205 Display and location of unique identifier. 128

(a) The unique identifier must be maintained in a condition that is **legible**.

(b) The unique identifier must be **affixed to the small unmanned aircraft** by any means necessary to ensure that it will remain affixed for the duration of each operation.

(c) The unique identifier must be legibly **displayed on an external surface** of the small unmanned aircraft.

>>> 14 CFR part 107 Operation and Certification of Small Unmanned Aircraft Systems 129

This document in the Federal register is found on the web at:

https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-107

The eCFR source is dated **June 28, 2016** and thus please review the flashcards entitled: **"Part 107 Study Guide Notes"**

The FAA Study Guide (2016) covers the majority of what is in this eCFR and that document is at:

https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/media/remote_pilot_study_guide.pdf

Advisory Circular No: 00-6B; date: 8/23/16;

https://www.faa.gov/documentlibrary/media/advisory_circular/ac_00-6b.pdf

This advisory circular (AC) was published by the Federal Aviation Administration (FAA) Flight Standards Service (AFS), with contributions from the National Weather Service (NWS).

While content in this Advisory Circular may in full or part be included in the study guide, ***the following cards are intended to provide added clarity***.

Vertical Structure. The Earth's atmosphere is subdivided into five concentric layers:

1. **Troposphere**. The troposphere begins at the Earth's surface and extends up to about **11 kilometers (36,000 feet)** high. This is where we live and where we fly sUAS.
2. **Stratosphere**. The stratosphere extends from the tropopause up to 50 kilometers (31 miles) above the Earth's surface (163,680 feet)
3. **Mesosphere**. The mesosphere extends from the stratopause to about 85 kilometers (53 miles) above the Earth
4. **Thermosphere**. The thermosphere extends from the mesopause to 690 kilometers (430 miles) above the Earth
5. **Exosphere**. The exosphere is the outermost layer of the atmosphere, and extends from the thermopause to 10,000 kilometers (6,200 miles) above the Earth.

(NOTE: The Pilot's Handbook illustrates the troposphere only up to 20,000 feet)

Looking at the Study Guide's graphic may seem to show the troposphere extends to 20,000 feet …
the **Advisory Circular No:** 00-6B (as in previous card) indicates 36,000 feet … for clarification … just note the following that explains the difference:

"The **tropopause** occurs at approximately 20,000 feet over the poles and at approximately 60,000 feet above the equator. The International Standard Atmosphere (ISA) assumes that the average height of the tropopause is **36,000 feet**." (Quote from the internet)

Introduction. Temperature is one of the most basic variables used to describe the state of the atmosphere. … Matter … Energy …

Heat ... is the total kinetic energy of the atoms and molecules composing a substance. The atoms and molecules in a substance do not all move at the same velocity. Thus, there is actually a range of kinetic energy among the atoms and molecules

Temperature ... is a numerical value representing the average kinetic energy of the atoms and molecules within matter. … Measurement …

Temp Scales: degrees Kelvin (K); Fahrenheit (°F), **Celsius (°C) scale** is the most commonly used temperature scale worldwide and in meteorology (used in METER and TAF)

FYI: [°F] = ([°C] x 9/5) + 32 and [°C] = ([°F] – 32) x 5/9

Heat Transfer 134

Heat transfer is **energy transfer** as a consequence of temperature difference. When a physical body (e.g., an object or fluid) is at a different temperature than its surroundings or another body, transfer of thermal energy, also known as heat transfer (or heat exchange) occurs in such a way that the body and the surroundings reach thermal equilibrium (balance). **Heat transfer always occurs from a hot body to a cold body**. Where there is a temperature difference between objects in proximity, heat transfer between them can never be stopped; it can only be slowed down.

Other terms in the AC: Radiation; Solar and Terrestrial Radiation; Solar Zenith Angle.

Conduction 135

Conduction is the **transfer of energy** (including heat) by molecular activity from one substance to another in contact, or through, a substance. Heat always flows from the warmer substance to the colder substance. The **rate** of heat transfer is greater with larger temperature differences and depends directly on the ability of the substance(s) to conduct heat. During **conduction**, the warmer substance cools and loses heat energy, while the cooler substance warms and gains heat energy.

[Whether by radiation, conduction, convection, or a combination of these, the temperature response to the input (or output) of some specified quantity of heat varies from one substance to another]

Isothermal Layer & Temperature Inversion 136

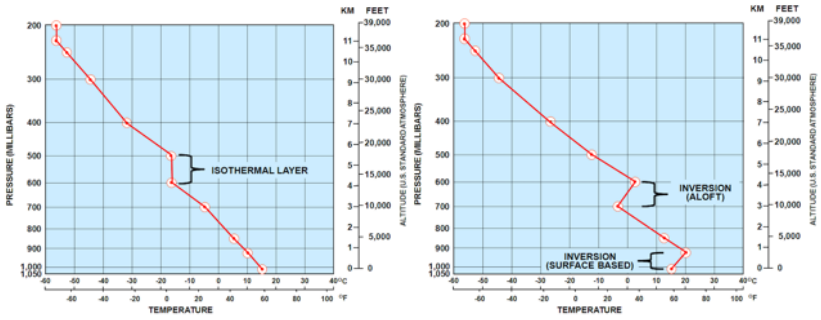
Isothermal Layer. An isothermal layer is a layer within the atmosphere where the temperature remains constant with height

Temperature Inversion. A temperature inversion, or simply inversion, is a layer in which the temperature increases with altitude. If the base of the inversion is at the surface, it is termed a **surface-based inversion**. If the base of the inversion is not at the surface, it is termed an **inversion aloft**.

An inversion may also occur at any altitude when conditions are favorable.

The principal characteristic of an inversion layer is its marked **stability**, so that very little turbulence can occur within it

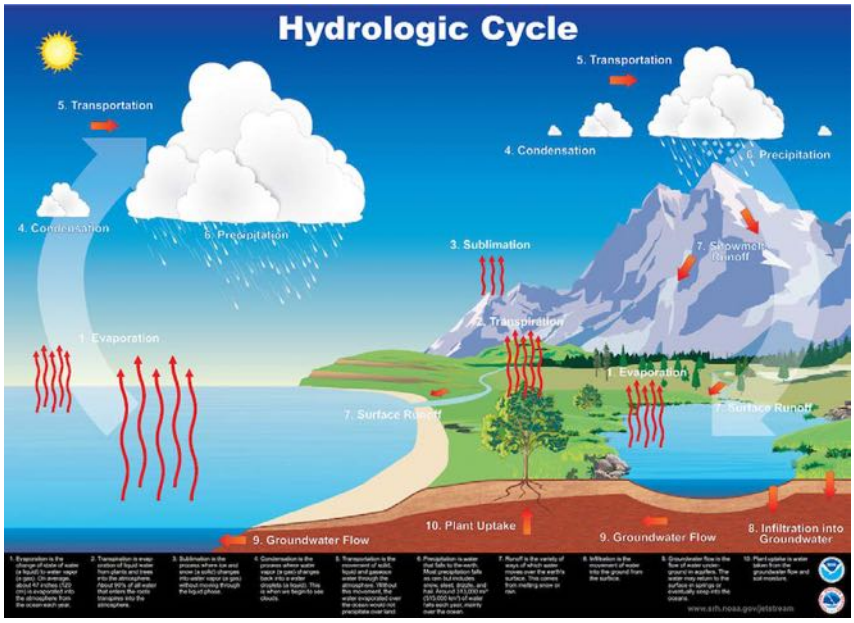
Isothermal Layer & Temperature Inversion Graphics 137



Introduction. Water vapor is the gaseous form of water and one of the most important of all constituents of the atmosphere. It constitutes only a small percentage of the Earth's atmosphere, varying from only trace amounts to 4 percent by volume, and its amount varies widely in space and time. **Approximately half of all of the atmospheric water vapor is found below 2 kilometers (6,500 feet) altitude**, and only a minute fraction of the total occurs above the tropopause.

Water vapor is … a **vehicle for the transfer** of heat energy and as a regulator of the Earth's temperatures

Hydrologic Cycle 139



Water - Terminology (1) 140

Evaporation is the phase transition by which a liquid is changed to a vapor (gas).

Transpiration is the evaporation of water from plants

Sublimation is the phase transition by which a solid is changed into vapor (a gas) without passing through the liquid phase

Condensation. Condensation is the phase transition by which vapor (a gas) is changed into a liquid

Transportation. Transportation is the movement of solid, liquid, and gaseous water through the atmosphere.

Precipitation. Precipitation results when tiny condensation particles grow through collision and coalescence.

Water - Terminology (2) 141

Runoff occurs when there is excessive precipitation and the ground is saturated (i.e., cannot absorb any more water).

Infiltration is the movement of water into the ground from the surface

Groundwater flow is the flow of water underground in aquifers. The water may return to the surface in springs or eventually seep into the oceans.

Plant uptake is water taken from the groundwater flow and soil moisture

Saturation. Saturation is the maximum possible quantity of water vapor that an air parcel can hold at any given temperature and pressure

Relative Humidity 142

Relative humidity is the ratio, usually expressed as a percentage, of water vapor actually in the air parcel compared to the amount of water vapor the air parcel could hold at a particular temperature and pressure.

$$Relative\ Humidity = \frac{Water\ vapor\ content}{Water\ vapor\ capacity}$$

While relative humidity is the most common method of describing atmospheric moisture, it is also the most misunderstood. **Relative humidity can be confusing because it does not indicate the actual water vapor content of the air, but rather how close the air is to saturation**.

An air parcel with 100 percent relative humidity is saturated, while an air parcel with relative humidity less than 100 percent is unsaturated.

Dew Point 143

Dew point ... is the temperature an air parcel must be cooled at constant pressure and constant water vapor pressure to allow the water vapor in the parcel **to condense into water (dew)**. When this temperature is below 0 °C (32 °F), it is sometimes called the **frost point**. Lowering an air parcel's temperature reduces its capacity to hold water vapor.

Temperature-Dew point Spread (Dew point Depression). The difference between an air parcel's temperature and its dew point is the dew point depression, or commonly referred to as the spread. Surface aviation weather reports (e.g., Aviation Routine Weather Reports (METAR)/Aviation Selected Special Weather Reports (SPECI)) provide observations of both temperature and dew point.

Water - Terminology (3) 144

Change of Phase. Water changes from one state of matter (solid, liquid, or vapor) to another at the temperatures and pressures experienced near the surface of the Earth. Interestingly, water is the only substance on Earth that exists naturally in all three phases: as water droplets and ice crystals (visible as clouds) and as water vapor.

Latent heat is the quantity of heat energy either released or absorbed by a unit mass of a substance when it undergoes a phase transition (change of state).

Weather is not a capricious act of nature, but rather the atmosphere's response to unequal rates of radiational heating and cooling across the surface of the Earth and within its atmosphere. The absorption of incoming solar radiation causes heating, while the emission of outgoing terrestrial radiation causes cooling.

4.2 The Earth-Atmosphere Energy Balance.

4.3 Heat Imbalances Between Earth's Surface and the Atmosphere.

4.4 Heat Imbalance Variations with Latitude. [parallel beams of incoming solar radiation strike lower latitudes more directly than higher latitudes]

Convection in the Atmosphere 146

convection transports heat from the Earth's surface into the atmosphere. Because air is a poor conductor of heat **convection** is much more important than **conduction** as a heat transport mechanism within the atmosphere

Seasons & Diurnal Temperature Variation 147

Seasons are caused by the tilt of the Earth's rotational axis as the Earth orbits the sun (see Figure 4-6). The Earth's rotational axis is tilted by **23½°** from the perpendicular drawn to the plane of the Earth's orbit about the sun and points the same direction in space all year long. The North Pole is tilted most directly toward the sun Solstice (~December 22).

Diurnal temperature variation is the daytime maximum and nighttime minimum of air temperature due to variations of insolation caused by the rising and setting of the sun (variations of solar zenith angle) as the Earth rotates around its axis.

AC 00-6 **CHAPTER 5. ATMOSPHERIC PRESSURE AND ALTIMETRY** 148

Atmospheric Pressure. The atoms and molecules that make up the various layers in the atmosphere are always moving in random directions. Despite their tiny size, when they strike a surface they exert pressure.

Atmospheric pressure is the force per unit area exerted by the weight of the atmosphere.

Barometer. The instrument Torricelli designed to measure pressure was called a barometer. The **aneroid barometer** is the type mostly commonly used by meteorologists and the aviation community.

Pressure Units 149

millibars (mb or mbar), which denote pressure as a force per square centimeter (at **Sea Level 1013.2 mb**)

International System of Units (SI): **hectopascal** (hPa) adopted by most countries -- used in the Aviation Routine Weather Report (METAR)/Aviation Selected Special Weather Report (SPECI) code (at Sea Level 1013.2 hPa)

The unit **inch of mercury** (inHg or Hg) is still used in the United States for altimetry. (at **Sea Level 29.92 inHg**)

Pressure Changes with Altitude. As we move upward through the atmosphere, the weight of the air above us decreases

1 "Hg equal to approximately 34 mb

Pressure Units (continued) 150

Temperature Effects on Pressure. Like most substances, air expands as it becomes warmer and contracts as it cools

Sea Level Pressure (SLP). Since pressure varies greatly with altitude, we cannot readily compare station pressures between stations at different altitudes. To make them comparable, we adjust them to some common level. **Mean sea level (MSL)** is the most useful common reference.

Density Effects on Pressure. Density is directly related to pressure. Assuming constant mass and temperature, an air parcel with a higher pressure is denser than an air parcel with a lower pressure.

Air pressure decreases with height in the atmosphere. Therefore, the density also decreases with height. In the atmosphere, pressure has the greatest effect on density in the vertical direction.

Temperature and Water Vapor Effects on Density. 151

Density is inversely related to **temperature**. Assuming constant mass and pressure, an air parcel with a higher temperature is less dense than an air parcel with a lower temperature.

Density of an air parcel is inversely related to its **quantity of water vapor**. Assuming constant pressure, temperature, and volume, air with a greater amount of water vapor is less dense than air with a lesser amount of water vapor.

Altitude 152

Altitude seems like a simple term: it means the vertical elevation of an object above the surface of the Earth. But in aviation, it can have many meanings.

True altitude is the actual vertical distance above **MSL**.

If an altimeter does not indicate true altitude, what does it indicate?

Indicated Altitude. Varies with air temperature at altitude

Altimeter Setting. Since the altitude scale is adjustable, a pilot can set his or her altimeter to read true altitude at some specified height.

But for a UA or sUAS, other perspectives on altitude deserve attention as follows ...

Density Altitude. 153

Density altitude is indirectly related to atmospheric density; as air density increases, the density altitude decreases. At lower altitude the air is more dense; at higher altitudes the air is less dense.

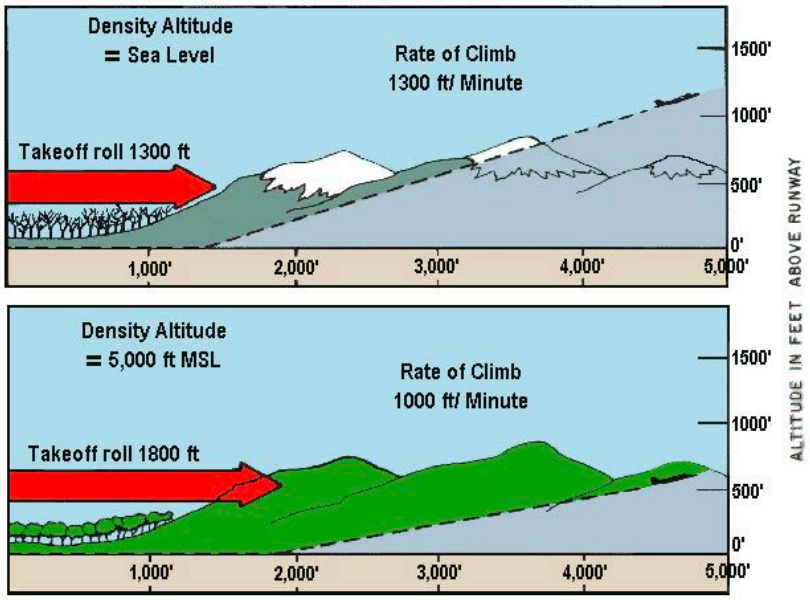
For example: density altitude is an index to aircraft performance such that higher density altitude decreases performance. High density altitude is a hazard since it reduces aircraft performance in the following three ways:

1. It reduces power because the UA engine takes in less air to support combustion.

2. It reduces thrust because there is less air for the propeller to work with, or a jet has less mass of gases to force out of the exhaust.

3. It reduces lift because the light air exerts less force on the airfoils.

High Density Altitude Effects on Flight 154



Density Effects Performance 155

The net results are that **high density altitude lengthens** a pilot's **takeoff**, and **landing** rolls and **reduces** his or her rate of **climb**. Before lift-off, the plane must attain a **faster groundspeed**, and, therefore, **needs more runway**; and the **reduced power and thrust** add a need for still more runway.

The plane lands at a faster groundspeed and, therefore, needs more room to stop. At a prescribed indicated airspeed, it is flying at a faster true airspeed, and, therefore, covers more distance in a given time, which means climbing at a shallower angle. Adding to this are the problems of reduced power and rate of climb. Figure on previous flashcard shows the effect of density altitude on takeoff distance and rate of climb.

A weather chart is a map on which data and analyses are presented that describe the state of the atmosphere over a large area at a given moment in time.

The possible variety of such charts is enormous, but in meteorological history there has been a more or less standard set of charts, including surface charts and the constant pressure charts of the upper atmosphere. Because **weather systems are three-dimensional (3-D)**, **both surface and upper air charts are needed**. Surface weather charts depict weather on a constant-altitude (usually sea level) surface, while upper air charts depict weather on constant-pressure surfaces.

The National Weather Service (NWS) produces many weather charts that support the aviation community.

AC 00-6 **CHAPTER 7. WIND (Intro Only)** 157

Wind is the air in motion relative to the surface of the Earth. Although we cannot actually see the air moving, we can measure its motion by the force that it applies on objects.

For example, leaves rustling or trees swaying on a windy day indicate that the wind is blowing.

Winds are a major factor to both weather and aircraft. Winds cause the formation, dissipation, and redistribution of weather. Winds also affect aircraft during all phases of flight. This chapter discusses how winds are named and the origin of wind.

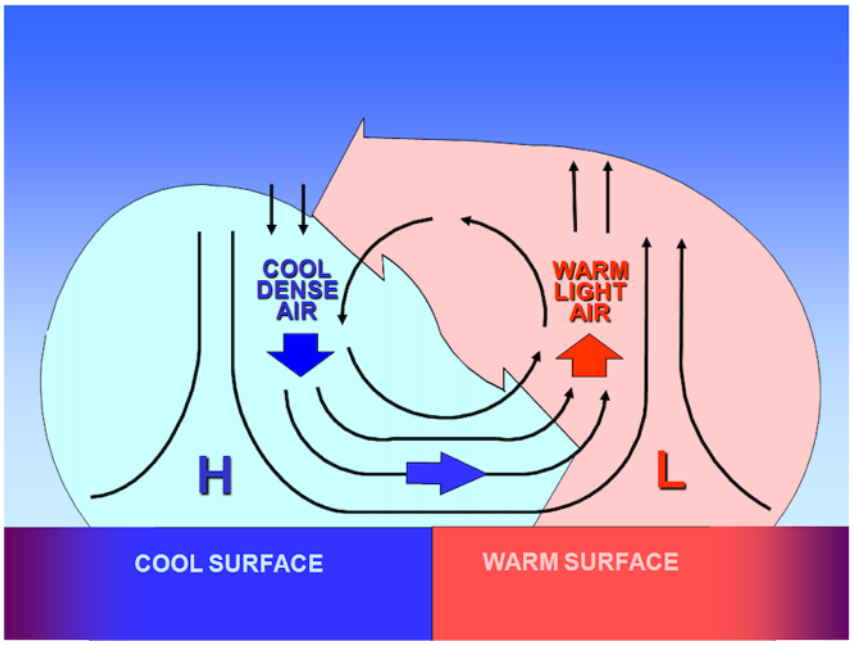
AC 00-6 **CHAPTER 9. LOCAL WINDS** 158

Local winds are small-scale wind field systems driven by diurnal heating or cooling of the ground. Air temperature differences develop over adjacent surfaces. Air in contact with the ground heats during the day and cools at night. Low-level pressure gradients develop with higher pressure over the cooler, denser air, and lower pressure over the warmer, less dense air.

Hazards. Local winds can produce aviation weather hazards. Turbulence and shifting surface winds are common. Clouds and precipitation (including thunderstorms) can develop in the rising air over the warmer surface given sufficient moisture and lift.

[NOTE: skipping CHAPTER 8. GLOBAL CIRCULATIONS AND JET STREAMS]

Local Wind Circulation 159



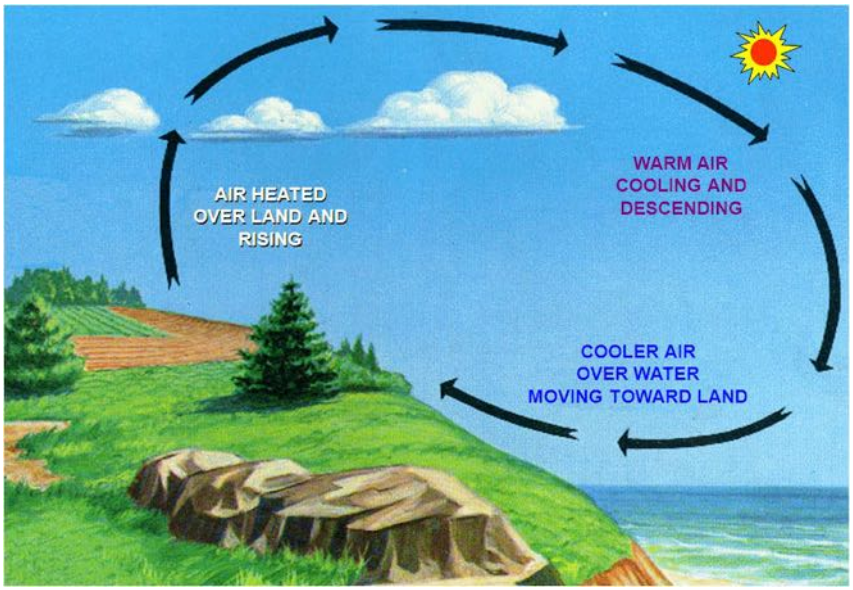
Sea Breeze 160

A sea breeze (see Figure next flashcard) is a coastal local wind that blows from sea to land, and caused by temperature differences when the sea surface is colder than the adjacent (warmer) land. Sea breezes usually blow on relatively calm, sunny, summer days.

Effects of Coastline Shape. Locally, the shape of the coastline plays an important role in the development of convection along sea breezes.

Land Breeze. A land breeze is a coastal breeze blowing from land to sea caused by the temperature difference when the sea surface is warmer than the adjacent land. Land breezes usually occur at night and during early morning.

Sea Breeze 161



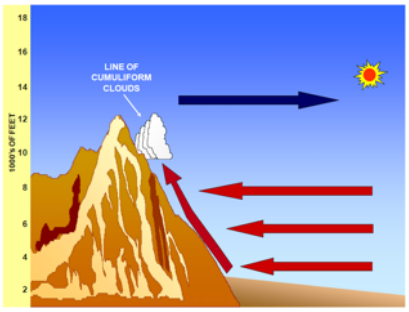
Mountain-Plains Wind System. 162

A mountain-plains wind system (see next flashcard) is the diurnal cycle of local winds between a mountain or mountain range and the adjacent plains.

During the daytime, this wind system is the equivalent of one-half of a valley breeze.

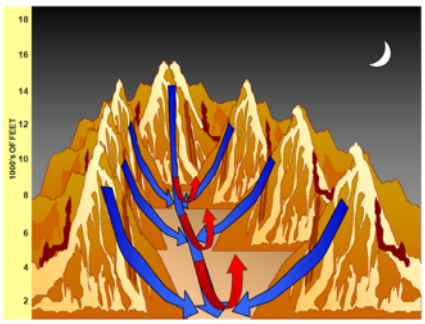
Air in contact with the sloping terrain becomes warmer (less dense) than air above the plains.

This is because the air in contact with the sloping terrain heats up faster than the air above the plains.



Mountain Breeze 163

A mountain breeze (see Figure 9-10) is the nightly downslope winds commonly encountered in mountain valleys. Air in contact with the sloping terrain cools faster than air above the valley. Pressure over the sloping terrain is higher than over the valleys (along a horizontal reference). Cooler air over the sloping terrain is denser than warmer air over the valley.



[NOTE skipping: CHAPTER 10. AIR MASSES, FRONTS, AND THE WAVE CYCLONE MODEL see Study Guide (2016) flashcards]

AC 00-6 **CHAPTER 11. VERTICAL MOTION AND CLOUD FORMATION** 164

A cloud is a visible aggregate of minute water droplets and/or ice particles in the atmosphere above the Earth's surface. Fog differs from cloud only in that the base of fog is at the Earth's surface while clouds are above the surface.

Clouds form in the atmosphere as a result of condensation of water vapor in **rising currents of air**, or by the evaporation of the lowest layer of fog. Rising currents of air are necessary for the formation of vertically deep clouds capable of producing precipitation heavier than light intensity.

11.2 Vertical Motion Effects on an Unsaturated Air Parcel. 165

As a bubble or parcel of **air ascends** (rises), it moves into an area of lower pressure (pressure decreases with height). As this occurs, the parcel expands. This requires energy, or work, which takes heat away from the parcel, so the air cools as it rises . This is called an **adiabatic process**.

The **rate** at which the parcel cools as it is lifted is called the **lapse rate**.

[Note: This concept of lapse rate and adiabatic process has shown up at least once as an online example test question .. see use of these terms on following cards]

Adiabatic Lapse Rate - NOAA Online Definition 166

The rate of decrease of temperature experienced by a parcel of air when it is lifted in the atmosphere under the restriction that it cannot exchange heat with its environment.

For parcels that remain unsaturated during lifting, the (dry adiabatic) lapse rate is 9.8°C per kilometer.

Lapse Rate

The rate of change of an atmospheric variable, usually temperature, with height. A steep lapse rate implies a rapid decrease in temperature with height (a sign of instability) and a steepening lapse rate implies that destabilization is occurring.

Vertical Motion Effects on a Saturated Air Parcel. 167

The Lifting Condensation Level (LCL) is the level at which a parcel of moist air lifted dry adiabatically becomes saturated. At this altitude, the temperature-dew point spread is zero and relative humidity is 100 percent.

Further lifting of the saturated parcel results in condensation, cloud formation, and latent heat release. Because the heat added during condensation offsets some of the cooling due to expansion, the parcel now cools at the moist adiabatic lapse rate …

As the saturated air parcel expands and cools, however, its water vapor content decreases. This occurs because some of the **water vapor is condensed** to water droplets or deposited into ice crystals to **form a cloud**.

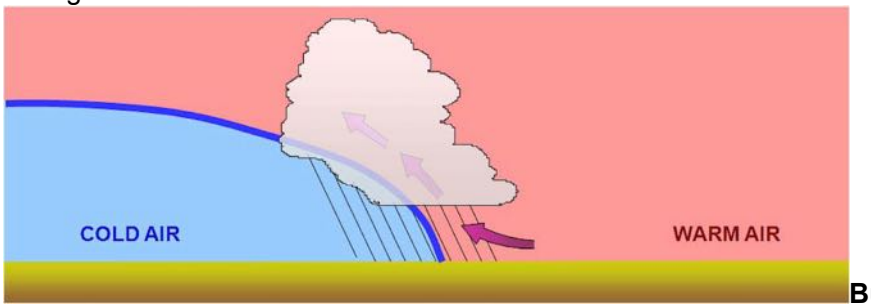
Common Sources of Vertical Motion (1) 168

Orographic Effects. Winds blowing across **mountains** and valleys cause the moving air to alternately ascend and descend. If relief is sufficiently great, the resulting expansional cooling and compressional warming of air affects the development and dissipation of clouds and precipitation.

Frictional Effects. In the Northern Hemisphere, the surface wind spirals clockwise and outward from high pressure, and counterclockwise and inward into low pressure due to frictional force. The end result is that winds diverge away from surface high pressure, causing the air to sink, compress, and warm, which favors the dissipation of clouds and precipitation.

Common Sources of Vertical Motion (2) 169

Frontal lift occurs when the cold, denser air wedges under the warm, less dense air, plowing it upward, and/or the warmer air rides up and over the colder air in a process called overrunning. Cloud and precipitation will form given sufficient lift and moisture content of the warm air.



Buoyancy. Air near the ground can warm at different rates depending on the insular properties of the ground with which it is in contact

Convective clouds and precipitation pose a distinctly different flying environment than **stratiform clouds** and precipitation.

Absolute stability is the state of a column of air in the atmosphere when its lapse rate of temperature is less than the moist adiabatic lapse rate. This includes both isothermal and inversion temperature profiles.

Neutral stability is the state of a column of air in the atmosphere in which an ascending (or descending) air parcel always has the same temperature (density) as the surrounding environmental air.

INSTABILITY 171

Absolute instability is the state of a column of air in the atmosphere when it has a superadiabatic lapse rate of temperature (i.e., greater than the dry adiabatic lapse rate).

An air parcel displaced vertically would be accelerated in the direction of the displacement. The kinetic energy of the parcel would consequently increase with increasing distance from its level of origin.

Conditional instability is the state of a column of unsaturated air in the atmosphere when its lapse rate of temperature is less than the dry adiabatic lapse rate, but greater than the moist adiabatic lapse rate.

CHAPTER 13. CLOUDS 172

A cloud is a visible aggregate of minute water droplets and/or ice particles in the atmosphere above the Earth's surface. Fog differs from cloud only in that the base of fog is at the Earth's surface while clouds are above the surface.

Cirriform: High-level clouds that form above 20,000 feet (6,000 meters) and are usually composed of ice crystals. High-level clouds are typically thin and white in appearance, but can create an array of colors when the sun is low on the horizon. Cirrus generally occur in fair weather and point in the direction of air movement at their elevation.

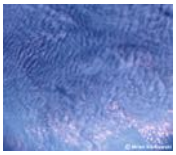
Nimbus comes from the Latin word meaning "rain." These clouds typically form between 7,000 and 15,000 feet (2,100 to 4,600 meters) and bring steady precipitation. As the clouds thicken and precipitation begins to fall, the bases of the clouds tend to lower toward the ground

CLOUDS 173

Cumuliform: Clouds that look like white, fluffy cotton balls or heaps and show the vertical motion or thermal uplift of air taking place in the atmosphere. The level at which condensation and cloud formation begins is indicated by a flat cloud base, and its height will depend upon the humidity of the rising air. The more humid the air, the lower the cloud base. The tops of these clouds can reach over 60,000 feet (18,000 meters).

Stratiform: Stratus is Latin for "layer" or "blanket." The clouds consist of a featureless low layer that can cover the entire sky like a blanket, bringing generally gray and dull weather. The cloud bases are usually only a few hundred feet above the ground. Over hills and mountains, they can reach ground level when they may be called fog. Also, as fog lifts off the ground due to daytime heating, the fog forms a layer of low stratus clouds.

High Clouds. Cirrus (Ci), Cirrocumulus (Cc), and Cirrostratus (Cs) are high-level clouds. 174

High Clouds are composed almost entirely of ice crystals.  **Cirrus (Ci)** 
Cirrocumulus (Cc)

 **Cirrostratus (Cs)**

Middle Clouds. Altocumulus (Ac), Altostratus (As), and Nimbostratus (Ns) are mid-level clouds 175

Middle Clouds are composed primarily of water droplets; however, they can also be composed of supercooled liquid water droplets and/or ice crystals when temperatures are below freezing.

 **Altocumulus (Ac)**  Altocumulus Lenticularis (aka Altocumulus Standing Lenticular, ACSL)  **Altostratus (As).**  **Nimbostratus (Ns).**

Low Clouds. Cumulus (Cu), Towering cumulus (TCu), Stratocumulus (Sc), Stratus (St), and Cumulonimbus (Cb) 176

Low Clouds are low clouds composed of water droplets. However, they can also be composed of supercooled liquid water droplets and/or ice crystals when temperatures are below freezing.

 **Cumulus (Cu)**

 **Towering Cumulus (TCu)**

Low Clouds 177

 **Stratocumulus (Sc).**

 **Stratus (St).**

 **Cumulonimbus (Cb)**

 **Cumulonimbus (Cb) with Anvil**

Precipitation is any of the forms of water particles, whether liquid or solid, that fall from the atmosphere and reach the ground. The precipitation types are:

drizzle, rain, snow, snow grains, ice crystals, ice pellets, hail, and small hail and/or snow pellets.

Precipitation Types. The vertical distribution of temperature will often determine the type of precipitation that occurs at the surface. Snow occurs when the temperature remains below freezing throughout the entire depth of the atmosphere.

Adverse wind is a category of hazardous weather that is responsible for many weather-related accidents. Adverse winds include: crosswinds, gusts, tailwind, variable wind, and a sudden wind shift. Takeoff and landing are the most critical periods of any flight and are most susceptible to the effects of adverse wind. The most at-risk group is **General Aviation (GA)** pilots flying aircraft with lower crosswind and tailwind threshold values.

Crosswind. A crosswind is a wind that has a component directed perpendicularly to the heading of an aircraft. The potential of drift produced by crosswind is critical to air navigation, and can have its biggest impact during takeoff and landing

ADVERSE WIND 181

Gust. A gust is a fluctuation of wind speed with variations of 10 knots or more between peaks and lulls.

Tailwind. A tailwind is a wind with a component of motion from behind the aircraft

Variable Wind/Sudden Wind Shift. A variable wind is a wind that changes direction frequently, while a sudden wind shift is a line or narrow zone along which there is an abrupt change of wind direction

Wind Shear. Wind shear is the change in wind speed and/or direction, usually in the vertical. The characteristics of the wind shear profile are of critical importance in determining the impact for an aircraft on takeoff or landing.

AC 00-6 **CHAPTER 16. WEATHER, OBSTRUCTIONS TO VISIBILITY, LOW CEILING, AND MOUNTAIN OBSCURATION** 182

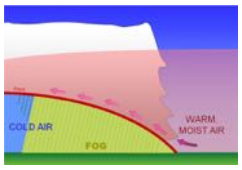
Weather and obstructions to visibility include: fog, mist, haze, smoke, precipitation, blowing snow, dust storm, sandstorm, and volcanic ash.

Fog is a visible aggregate of minute water droplets that are based at the Earth's surface and **reduces horizontal visibility to less than 5/8 statute mile** (1 kilometer); unlike drizzle, it does not fall to the ground. **Fog** differs from cloud only in that **its base must be at the Earth's surface**, while clouds are above the surface.

Fog Types. Fog types are named according to their formation mechanism: **Radiation Fog**, **Advection fog**, **Upslope Fog**, **Frontal Fog**

Obstruction 183

Advection fog forms when moist air moves over a colder surface (see Figure 16-3), and the subsequent cooling of that air to below its dew point. It is most common along coastal areas.



Frontal Fog. When warm, moist air is lifted over a front, clouds and precipitation may form .

Steam Fog. When very cold air moves across relatively warm water, enough moisture may evaporate from the water surface to produce saturation

Radiation fog 184

"Radiation fog is a very common type of fog throughout the United States. It is most prevalent during the fall and winter. It forms overnight as the air near the ground cools and stabilizes. When this cooling causes the air to reach saturation, fog will form."
https://www.weather.gov/safety/fog-radiation

Mist, Haze, Smoke, Precipitation 185

Mist is a visible aggregate of minute water droplets or ice crystals suspended in the atmosphere that reduces visibility to less than 7 statute miles (11 kilometers), but greater than, or equal to, 5/8 statute mile (1 kilometer).

Haze is a suspension in the air of extremely small particles invisible to the naked eye and sufficiently numerous to give the air an opalescent appearance

Smoke is a suspension in the air of small particles produced by combustion due to fires, industrial burning, or other sources

Precipitation is any of the forms of water particles, whether liquid or solid, that fall from the atmosphere and reach the ground. Snow, rain, and drizzle are types of precipitation. Heavy snow may reduce visibility to zero. Rain seldom reduces surface visibility below 1 mile except in brief, heavy showers.

Others include: Blowing Snow, Dust Storm, Sandstorm, Volcanic Ash

Low Ceiling and Mountain Obscuration 186

Low Ceiling. Stratus is the most frequent cloud associated with low ceilings. Stratus clouds, like fog, are composed of extremely small water droplets or ice crystals suspended in air. An observer on a mountain in a stratus layer would call it fog. Stratus and fog frequently exist together

Mountain Obscuration. A mountain obscuration is a condition in which mountains or mountain ridges are obscured due to clouds, precipitation, smoke, or other obscurations.

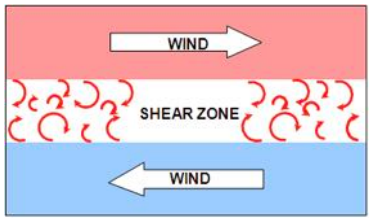
AC 00-6 **CHAPTER 17. TURBULENCE** 187

Aircraft turbulence is irregular motion of an aircraft in flight, especially when characterized by rapid up-and-down motion caused by a rapid variation of atmospheric wind velocities

Turbulence is caused by convective currents (called convective turbulence), obstructions in the wind flow (called mechanical turbulence), and wind shear.

Convective turbulence is turbulent vertical motions that result from convective currents and the subsequent rising and sinking of air.

Wind Shear 188



Wind Shear Turbulence. Wind shear is the rate of change in wind direction and/or speed per unit distance. Wind shear generates turbulence between two wind currents of different directions and/or speeds.

Temperature Inversion. A temperature inversion is a layer of the atmosphere in which temperature increases with altitude. Inversions commonly occur within the lowest few thousand feet above ground due to nighttime radiational cooling, along frontal zones, and when cold air is trapped in a valley. Strong wind shears often occur across temperature inversion layers, which can generate turbulence

AC 00-6 **CHAPTER 18. ICING** 189

In general, icing is any deposit of ice forming on an object. It is one of the major weather hazards to aviation. Icing is a cumulative hazard. The longer an aircraft collects icing, the worse the hazard becomes.

Supercooled Water. Freezing is a complex process. Pure water suspended in the air does not freeze until it reaches a temperature of -40 °C.

Structural icing is the stuff that sticks to the outside of the airplane. It occurs when supercooled water droplets strike the airframe and freeze. Structural icing can be categorized into three types: rime, clear (or glaze), and mixed.

Icing intensities are described in the Aeronautical Information Manual (AIM).

Icing Factors 190

Structural icing is determined by many factors. The meteorological quantities most closely related to icing type and severity are, in order of importance: Supercooled Liquid Water Content (SLWC), temperature (altitude), and droplet size. However, aircraft type/design and airspeed are also important factors.

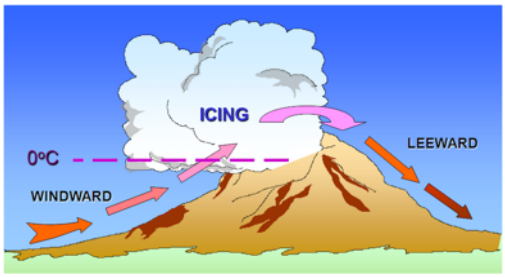
Icing in Stratiform Clouds. Icing in middle and low-level stratiform clouds is confined, on the average, to a layer between 3,000 and 4,000 feet thick.

Icing in Cumuliform Clouds. The icing layer in cumuliform clouds is smaller horizontally, but greater vertically than in stratiform clouds

Icing with Fronts. Most icing reports occur in the vicinity of fronts.

Icing with Mountains. Icing is more likely and more severe in mountainous regions.

Icing with Mountains 191

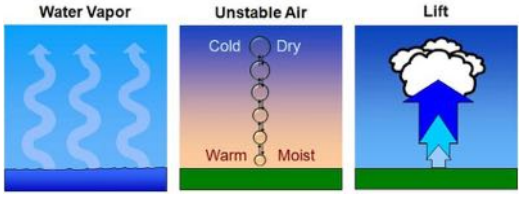


The most severe icing occurs above the crests and on the ridges' windward side. This zone usually extends to about 5,000 feet above the mountaintops, but can extend much higher if cumuliform clouds develop.

Icing Hazards. Structural icing degrades an aircraft's performance. It destroys the smooth flow of air, increasing drag while decreasing the ability of the airfoil to create lift. The actual weight of ice on an airplane is insignificant when compared to the airflow disruption it causes.

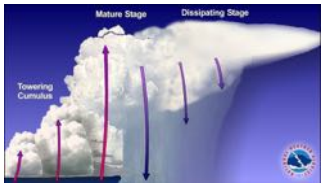
AC 00-6 **CHAPTER 19. THUNDERSTORMS** 192

A thunderstorm is a local storm, invariably produced by a cumulonimbus cloud, and always accompanied by lightning and thunder, usually with strong gusts of wind, heavy rain, and sometimes with hail. There are as many as 40,000 thunderstorm occurrences each day worldwide, and the United States certainly experiences its share.



Necessary Ingredients for Thunderstorm Cell Formation
… thunderstorm cell is the convective cell of a cumulonimbus cloud having lightning and thunder. It undergoes three distinct stages during its life cycle (see Figure in FAA Study Guide Notes flashcards): towering cumulus, mature, and dissipating. The total life cycle is typically about 30 minutes.

Thundestorms 193



Thunderstorm Types. There are three principal thunderstorm types: single cell, multi-cell (cluster and line), and supercell. All thunderstorms are hazardous to aircraft.

Hazards. A thunderstorm can pack just about every aviation weather hazard into one vicious bundle. These hazards include: lightning, adverse winds, downbursts, turbulence, icing, hail, rapid altimeter changes, static electricity, and tornadoes.

Thunderstorm Turbulence 194

Turbulence is present in all thunderstorms. Severe or extreme turbulence is common. Gust loads can be severe enough to stall an aircraft at maneuvering speed or to cause structural damage at cruising speed. The strongest turbulence occurs with **shear** between updrafts and downdrafts. Outside the cumulonimbus cloud, turbulence has been encountered several thousand feet above, and 20 miles laterally from, a severe storm.

The wind-shear zone between the gust front and surrounding air is very turbulent airspace.

Additional topics: Icing, Hail, Rapid Altimeter Changes, Static Electricity, Tornado

Advisory Circular closing chapters ... 195

Chapter 20 Weather Radar

Chapter 21 Tropical Weather

Chapter 22 Arctic Weather

If interested you can review the original document at:

https://www.faa.gov/documentlibrary/media/advisory_circular/ac_00-6b.pdf

In summary: This AC 00-6B was later 'cancelled' but offers text and graphics not presented in the FAA 2016 study guide. Therefore, for your information (FYI) … some wording here seems to relate to a couple example test questions that are not directly linked to the 2016 Study Guide content.

>>> AC 150/5200-32 Reporting Wildlife Aircraft Strikes (optional info; not on current study list) 196

This Advisory Circular is located at:

https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_150_5200-32B.pdf

The ending pages starting at 7 to 8 include a reporting form with mailing address (no postage necessary)

[While not on the current study list this is noteworthy]

This Advisory Circular (AC) explains the importance of **reporting collisions between aircraft and wildlife**, more commonly referred to as wildlife strikes. It also explains recent improvements in the Federal Aviation Administration's (FAA's) Bird/Other Wildlife Strike Reporting system, how to report a wildlife strike, what happens to the wildlife strike report data, how to access the FAA National Wildlife Strike Database (NWSD), and the FAA's Feather Identification program.

Background (first paragraph) 197

The FAA has long recognized the threat to aviation safety posed by wildlife strikes. Each year in the United States, wildlife strikes to U.S. civil aircraft cause about $718 million in damage to aircraft and about 567,000 hours of civil aircraft down time. For the period 1990 to 2011, over 115,000 wildlife strikes were reported to the FAA. About 97 percent of all wildlife strikes reported to the FAA involved birds, about 2 percent involved terrestrial mammals, and less than 1 percent involved flying mammals (bats) and reptiles. Waterfowl (ducks and geese), gulls, and raptors (mainly hawks and vultures) are the bird species that cause the most damage to civil aircraft in the United States, while European starlings are responsible for the greatest loss of human life. Vultures and waterfowl cause the most losses to U.S. military aircraft.

Types of Animals to Report if Involved in a Strike with Aircraft. 198

a. All birds.

b. All bats.

c. All terrestrial mammals larger than 1 kg (2.2 lbs) (e.g., report rabbits, muskrats, armadillos, foxes, coyotes, domestic dogs, deer, feral livestock, etc., but not rats, mice, voles, chipmunks, shrews, etc.). If in doubt, report the incident with a note in the comment section, and the Database Manager will determine whether to include the report into the National Wildlife Strike Database (NWSD) based on body mass.

d. Reptiles larger than 1 kg (2.2 lbs).

When to Report a Wildlife Aircraft Strike. 199

A wildlife strike has occurred when:

a. A strike between wildlife and aircraft has been witnessed.

b. Evidence or damage from a strike has been identified on an aircraft.

c. Bird or other wildlife remains, whether in whole or in part, are found:

(1) Within 250 feet of a runway centerline or within 1,000 feet of a runway end unless another reason for the animal's death is identified or suspected.

(2) On a taxiway or anywhere else on or off the airport that you have reason to believe was the result of a strike with an aircraft. Examples might be:

(i) A bird found in pieces from a prop strike on a taxiway.

(ii) A carcass retrieved within 1 mile of an airport on the final approach or departure path after someone reported the bird falling out of the sky and a report of a probable wildlife strike.

d. The presence of birds or other wildlife on or off the airport had a significant negative effect on a flight (i.e., aborted takeoff, aborted landing, high-speed emergency stop, or the aircraft left pavement area to avoid collision with wildlife).

How to Report a Bird/Wildlife Strike. (1) 200

The FAA strongly encourages pilots, airport operations, aircraft maintenance personnel, Air Traffic Control personnel, engine manufacturers, or anyone else who has knowledge of a strike to report it to the National Wildlife Strike Database (NWSD). The FAA makes available an online reporting system at the Airport Wildlife Hazard Mitigation web site (http://www.faa.gov/go/wildlife) or via mobile devices at http://www.faa.gov/mobile. Anyone reporting a strike can also print the FAA's Bird/Other Wildlife Strike Report Form (Form 5200-7) at the end of this AC or download it from the web site to report strikes.

How to Report a Bird/Wildlife Strike. (2) 201

8. FAA National Wildlife Strike Database Management and Data Analysis.

9. Access to the FAA National Wildlife Strike Database.

On April 24, 2009, the FAA made the NWSD available to the public. (http://www.faa.gov/go/wildlife)

10. Bird/ Wildlife Identification.

The identification of the exact species of bird struck (e.g., ring-billed gull, Canada goose, mallard, mourning dove, or red-tailed hawk as opposed to gull, goose, duck, dove, or hawk) is particularly important. This species information is critical for airports and biologists developing and implementing wildlife hazard management programs at airports because a problem that cannot be measured or defined cannot be solved

How to Report a Bird/Wildlife Strike. (3) 202

Bird strike identification using feathers, DNA, or other body parts or materials from birds involved in bird-aircraft strikes will be provided free-of-charge to all U.S. airport operators, all U.S. aircraft owners/operators (regardless of where the strike happened), and to any foreign air carrier if the strike occurred at a U.S. airport.

11. Instructions for Collecting and Submitting Bird/Wildlife Remains for Identification.

This is the last section of the Advisory Circular which includes feather identification by the Smithsonian Institution.

Additional information on sending bird remains to the Smithsonian is available at http://www.faa.gov/go/wildlife.

>>> AC 107-2 Small Unmanned Aircraft Systems (sUAS) 203

This Advisory Circular is found at:

https://www.faa.gov/documentlibrary/media/advisory_circular/ac_107-2.pdf

The AC is dated June 21, 2016

This is again a document that covers topics presented in the 2016 FAA Study Guide for Part 107.

The following flashcards are intended to add any detail not found in the “Part 107 Study Guide Notes” flashcards.

AC 107-2 Purpose 204

This advisory circular (AC) provides guidance in the areas of airman (remote pilot) certification, aircraft registration and marking, aircraft airworthiness, and the operation of small Unmanned Aircraft Systems (sUAS) in the National Airspace System (NAS) to promote compliance with the requirements of Title 14 of the Code of Federal Regulations (14 CFR) Part 107

CHAPTER 2. REFERENCES

This list includes 14 CFR Parts 1, 48, 71, 73, 87, 91, 93, 101, 107; plus NOTAM

[web link: https://pilotweb.nas.faa.gov/PilotWeb]

FAA ACs, Notices, and Orders (current editions), Mobile Sources, List of Handbooks, Manuals, etc., RTCA Inc. documents and Public Law PL 112-95, Title III, Subtitle B.

CHAPTER 3. BACKGROUND (short, not addressed here)

>>> AIM Aeronautical Information Manual 205

AIM online at: https://www.faa.gov/air_traffic/publications/atpubs/aim_html/

AIR NAVIGATION

1. AIR NAVIGATION
2. AERONAUTICAL LIGHTING AND OTHER AIRPORT VISUAL AIDS
3. AIRSPACE
4. AIR TRAFFIC CONTROL
5. AIR TRAFFIC PROCEDURES
6. EMERGENCY PROCEDURES
7. SAFETY OF FLIGHT
8. MEDICAL FACTS FOR PILOTS
9. AERONAUTICAL CHARTS AND RELATED PUBLICATIONS
10. HELICOPTER OPERATIONS

1. BIRD/OTHER WILDLIFE STRIKE REPORT
2. VOLCANIC ACTIVITY REPORTING FORM (VAR)
3. ABBREVIATIONS/ACRONYMS
4. FAA FORM 7233−4 INTERNATIONAL FLIGHT PLAN
5. FAA FORM 7233−1 FLIGHT PLAN

In spite of reference to AIM in sUAS related documentation, this AIM document appears geared toward pilots of regular aircraft and not directly applicable to Part 107 UA or sUAS PICs.

>>> FAA-H-8083-2 Risk Management Handbook 206

https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/media/faa-h-8083-2.pdf

According to **National Transportation Board (NTSB)** statistics, in the last 20 years, approximately **85 percent of aviation accidents have been caused by "pilot error."**

Personality can play a large part in the manner in which hazards are gauged. People who might be reckless in nature take this on board the flight deck.

Experience *is the knowledge acquired over time and increases with time as it relates to association with aviation and an accumulation of experiences*

>>> Risk Management Handbook 207

While listed on an earlier reference list, recent communications with the FAA do not note this as a pertinent source for the knowledge test. **This is for pilots of airplanes!**

2008 (with errata noted)

https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/media/faa-h-8083-2.pdf

2022 version:

https://www.faa.gov/sites/faa.gov/files/2022-06/risk_management_handbook_2A.pdf

>>> SAFO 10015 Flying in the wire environment 208

While listed back in 2016, this **Safety Alert For Operators (SAFO)** appears no longer applicable to the Part 107 topics for the test.

Web location:

https://www.faa.gov/sites/faa.gov/files/other_visit/aviation_industry/airline_operators/airline_safety/SAFO10015.pdf

>>> SAFO 09013 Fighting Fires Caused By Lithium Type Batteries in Portable Electronic Devices 209

While listed back in 2016, this Safety Alert For Operators (SAFO) appears no longer applicable to the Part 107 topics for the test.

Web location: https://nbaa.org/wp-content/uploads/2018/01/SAFO09013SUP.pdf

FYI: (quotes from the SAFO)— "Lithium batteries are capable of ignition and subsequent explosion due to overheating. Overheating may be caused by shorting, rapid discharge or overcharging."

"**WARNING**: Do not use fire resistant burn bags to isolate burning lithium-type batteries. Transferring a burning appliance into a burn bag may be extremely hazardous. Do not move the device until you are certain the fire is extinguished and the device is cool."

>>> SAFO 10017 Risks in Transporting Lithium Batteries in Cargo by Aircraft 210

While listed back in 2016, this Safety Alert For Operators (SAFO) appears no longer applicable to the Part 107 topics for the test.

FYI: (quote from SAFO) - "These recommendations are limited to lithium batteries transported in the cargo hold of an aircraft (including cargo holds that are not distinct from the flight deck), and do not apply to lithium batteries carried onboard by passengers and crew members, or otherwise stowed in the passenger cabin of the aircraft."

Web ;location:

https://www.faa.gov/news/press_releases/media/safo10017.pdf

[**Important Note:** Refer directly to the airline you use for travel regarding carry on of batteries for any type device.]

>>> SAFO 15010 Carriage of Spare Lithium Batteries in Carry-on and Checked Baggage 211

While listed back in 2016, this Safety Alert For Operators (SAFO) appears no long applicable to the Part 107 topics for the test.

See note on SAFO 10017 regarding batteries on an aircraft.

Web location:

https://www.copac.es/wp-content/uploads/2016/03/20151510140021.pdf

[**Important Note:** Refer directly to the airline you use for travel regarding carry on of batteries for any type device.]