
MULTI-ENGINE
# INSTRUCTOR LESSON PLANS
First Edition


CFI Bootcamp
Flight Instructor Training

# Multi-Engine Instructor Lesson Plans

First Edition

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Flight Instructor Training
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# Multi-Engine Flight Instructor Lesson Plans

First Edition
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**Mike Shiflett's** Aviation credentials and experience are as follows:

**FAA Certificates**
Airline Transport Pilot Certificate – Airplane Multi-Engine Land. CE-525 Type rating
Commercial Pilot Privileges: Airplane Single Engine Land and Sea
Flight Instructor Certificate – Airplane Single and Multi-Engine Land, Instrument Airplane
Former FAA Designated Pilot Examiner – Recreational – ATP including Initial CFI, CFII, MEI

**UK Certificates**
Commercial Pilot – Airplane Single Engine Land
Former UK Flight Examiner for Private Pilot and IMC ratings
Mike has amassed over 16,000 hours of which most were in general aviation aircraft. He also administered around 3,000 practical tests (Checkrides) for the FAA.

Mike has authored numerous courses used by top flight schools and Universities in his previous company. At CFI Bootcamp he authored all the course content including 42 hours of video, 10 books used by students at CFI Bootcamp, and has been featured in many aviation media organizations. He has also presented at EAA Airventure – Oshkosh, WI, Sun-n-Fun, and Aviation conferences as a speaker. He also produced a Podcast "Flight Training the way I see it", and has a weekly webinar called "The Power Hour". The CFI Bootcamp website has links to the webinar and previous Podcasts. He continues to innovate in the aviation industry and is particularly focused on creating courses and training materials to produce better flight instructors.

Mike currently lives in both San Jose, CA, and more often in Miami Beach, FL. He flies from the Opa-Locka airport just north of Miami International.

# Introduction

This is the first edition of Multi-Engine Land Lesson Plans. The work on these started in 2019, and it was started and stopped until the autumn of 2022. Inside, you'll find lesson plans for all Areas of Operations and Tasks from the Private and Commercial Pilot Multi-Engine Land Airman Certification Standards (ACS), both for flight maneuvers and aeronautical knowledge areas. In addition, there are also lesson plans for all Areas of Operations and Tasks for the Flight Instructor Airplane Multi-Engine Practical Test Standards (PTS.), except for the Fundamentals of Instructing.

The lesson plans were written using the Airplane Flying Handbook (FAA-H-8083-3C) and the Pilots Handbook of Aeronautical Knowledge (FAA-H-8083-25B), as the source materials. This book also includes some best practices from Hobie Tomlinson, who knows more about light twins than anyone I know. Jonathan Ray a CFI Bootcamp team member, also helped author numerous lesson plans in this book. His ability to write and attention to detail was very helpful in completing this project.

Following these lesson plans will guide you through each Area of Operation for your Private or Commercial students and Airplane Multi-Engine Flight Instructor (MEI) applicant. I hope you find them comprehensive and well-referenced. The order of the presentation for each lesson plan has been carefully chosen so the lesson "flows" logically.

If you are preparing for the MEI (Airplane Multi-Engine Flight Instructor) checkride, voice the lesson plans out loud. It's the only way to catch things you thought you knew but forgot. It also lets you modify the flow of the lesson by changing the order of the presentation if you feel that is necessary.

Thanks for purchasing your copy. They will serve you for years to come.

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| Postflight Procedures | After Landing, Parking and Securing<br>(PVT / COM ACS task / lesson plan: XI-A.) |

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# Pilot Qualifications

## Objective:

To understand the legal requirements to operate a multi-engine airplane as pilot-in-command (PIC).

## Motivation:

To qualify for and take the practical test (checkride) for Commercial Pilot, airplane multi-engine land, a pilot must know the required qualifications.

## Presentation (45 minutes):

1. Certification requirements:
    a. Certification requirements: 18yrs, read, speak and write English. Receive required logbook endorsements. Pass the knowledge test (within 24 calendar months- § 61.39) and practical test. (§ 61.123.)
    b. Aeronautical knowledge requirements: Demonstrate adequate knowledge in the areas listed in § 61.125(b).
2. Recent flight experience - Flight proficiency requirements:
    a. Demonstrate flight proficiency in § 61.127(b) to the standards of FAA-S-ACS-7A Commercial Pilot ACS).
3. Aeronautical flight experience requirements:
    a. 250hrs of flight time consisting of at least: 100hrs in powered aircraft, 100hrs PIC thatincludes the items listed in § 61.129(a)(2).
    b. Received and logged training time within two-calendar months preceding the month of application of the exam (§ 61.39(a)(6)) and received the applicable endorsements (AC 61-65H, A.1, A.2)
4. Recordkeeping - Must have a logbook detailing the training time and aeronautical experience required for the exam - Time recorded per § 61.51(b).
5. Privileges of the Commercial Pilot:
    a. § 61.133(a) Commercial pilots may carry persons or property for compensation or hire.
    b. AC 120-12A and AC 61-142 define "Private" vs. "Common" carriage and what sharing

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expenses mean.

6. Limitations of the Commercial Pilot - § 61.133(b)(1) - A commercial pilot without an instrment rating may not fly passengers for hire:
    a. Over 50nm
    b. At night

7. Medical certificates - class, expiration, privileges, temporary disqualifications.
    a. Class, expiration, privileges:
        i. With any medical certificate grade, the pilot can utilize the privileges under that grade until expiration. After the expiration date (which varies with age), the pilot can continue using their medical certificate for a lower grade certificate's privileges until the final expiration. In simpler terms, the medical certificate downgrades as time passes until it expires as a Third Class medical.
        ii. § 61.23(a)(1) lists the privileges of a first-class medical certificate. §§ 61.23(a)(2) and (a)(3) list those of a second and third-class medical certificate.
        iii. Medicals expire the 60th month after the month of the date shown on the medical certificate - EXCEPT for the third class over 40yrs old, which expires the 24th month.
        iv. Any privileges listed for a lower grade of medical will also apply to a higher grade medical. For example, a pilot with a 1st class medical may act as a recreational pilot, but a pilot with a 3rd class medical may not act as an airline transport pilot.
        v. Specific requirements for obtaining each certificate are in §§ 67.101 - 67.311.

8. Medical certificates - First class:
    a. Allows a pilot to act as PIC or SIC using an ATP Certificate for a part 121 air carrier and their commercial pilot certificate or Air Traffic Control Tower Operator certificate.
    b. Under 40yrs old: Certificate valid for 12 months, then downgrades to a 3rd class.
    c. Over 40yrs old: Certificate valid for six months, then downgrades to a 2nd class for the next six months, then downgrades to a 3rd class for the remainder of the 60 months.

9. Medical certificates - Second class:
    a. Allows a pilot to act as SIC ONLY using an ATP certificate. PIC using a Commercialcertificate. It also allows the use of a student, sport, recreational, or private pilot certificate, and a flight instructor certificate.
    b. Under 40yrs old: Certificate valid for 12 months.
    c. Over 40yrs old: Certificate valid for 12 months, then downgrades to a third class for another 12 months.

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10. Medical certificates - Third class:
    a. Allows a pilot to act as PIC as a student, sport, recreational, or private pilot and flight instructor.
    b. Under 40yrs old: Certificate valid for 60 months.
    c. Over 40yrs old: Certificate valid for 24 months.

11. Medical certificates - Temporary disqualifications:
    a. If you can't pass any medical grade on the day you wish to fly, you can't fly.
    b. Specific information about the requirements for obtaining each grade of certificate are in §§ 67.101 - 67.311
    c. Example: You are suffering from a head cold and are wondering if your sinuses are being affected. This would stop you from flying. Reference § 67.105(b), - many internal ear conditions which are, or could be aggravated by flying that interferes with clear communication, disqualifies your medical until it is resolved.

12. Documents required to exercise commercial pilot privileges:
    a. What the pilot needs:
        i. Driver's license or other forms of government-issued photo IDs.
        ii. Medical certificate (minimum 2nd class).
        iii. Logbook entry showing the last 24 calendar month flight review (if applicable).
        iv. Logbook entry/entries showing recent flight experience per § 61.57.
        v. Any applicable endorsements.
    b. What the aircraft needs:
        i. Airworthiness certificate.
        ii. Registration.
        iii. Radio operator's license (for pilot and aircraft), if applicable.
        iv. Operating handbook (POH)
        v. Weight and balance appropriate to that aircraft serial number.
        vi. Compliance with any airworthiness directives.

13. Part 68 BasicMed privileges and limitations - General:

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a. Third-class "light" version of a third-class medical with more limitations.

b. The privileges you hold as a pilot using BasicMed are the same privileges you could exercise using your pilot certificate and third-class medical, except you may not act as SIC, only PIC.

c. If using BasicMed, you must have completed the following:

14. BasicMed Privileges:

a. Complete a Comprehensive medical examination checklist (CMEC) that shows that your most recent physical examination was within the past 48 months.

b. You must have held any class FAA medical on or after July 14, 2006.

c. A physician is treating the person for medical conditions that may affect flight safety.

d. Have a course completion certificate issued by a BasicMed medical training course provider within the past 24 calendar months.

15. BasicMed Limitations:

a. Fly with no more than five passengers.

b. Fly an aircraft with a maximum certificated takeoff weight of no more than 6,000 lbs.

c. Fly an aircraft that is authorized to carry no more than six occupants.

d. Flights within the United States at an indicated airspeed of 250 knots or less and an altitude at or below 18,000 feet mean sea level (MSL).

e. You may not fly for compensation or hire.

Presentation references:
Commercial Pilot ACS pg. 3
FARs pt. 61, 67.
Pilot's Handbook of Aeronautical Knowledge, pg. 2-8.
AC 120-12A
AC 68-1A

**Key points:**

- The nuances between private and common carriage - AC 120-12A.
- New FAA guidance on sharing expenses - AC 61-142.
- Medical certificates, privileges, limitations, and durations § 61.23.
- Having the appropriate documents with you when you go flying.

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## Risk Management

Teach how to identify, assess, and mitigate risks encompassing the following:

1. Failure to distinguish proficiency versus currency.
2. Flying unfamiliar airplanes or operating with unfamiliar flight display systems and avionics.

## Questions for the student:

1. Explain how you know you're eligible to take this practical test today.
2. What class of medical do you have? What does it allow you to do, and when does it expire?
3. What are some of the key differences between a 3rd class medical and BasicMed?

## Common errors:

- Failure to not meet aeronautical experience or knowledge requirements before the practical test.
- Failure to understand the limitations of their Commercial Pilot Certificate.
- Lack of knowledge regarding medical certificates.

## Completion Standards:

1. Apply requirements to act as PIC under Visual Flight Rules (VFR) in a scenario given by the evaluator.

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# Cross-Country Flight Planning

## Objective

To understand the various types of navigation, and plan a VFR cross-country flight using available weather, charts, and airport data. Do this by using a Nav Log and Foreflight, and be able to explain how to open a flight plan.

## Motivation

Cross-country flights with airplanes need to be pre-planned using several different forms of navigation. Understanding how to plan a flight manually and using Foreflight will allow you to safely plan a flight that avoids hazards and optimizes the route to save time, money and is regulatory compliant.

## Presentation: (2:00hrs)

1. Definitions and example of pilotage and dead reckoning – VFR Navigation Log.
2. Obtaining the weather briefing for the proposed flight.
3. Weather charts that apply to cross-country flight planning – Especially the winds aloft chart.
4. VFR Aeronautical Charts – True North vs Magnetic North.
5. Identifying landmarks by relating surface features to chart symbols – What makes good check- points.
6. Choosing a route and altitude considering terrain, weather, safety, airspace.
7. Top of Climb – Top of Descent – Cruise is what is left.
8. Performance charts to determine TOC, TOD, and Cruise legs (TOD may not be in POH).
9. If no TOD, then 500 ft./min at 90 KIAS = 1.5nm/min - Altitude to lose/500 ft. min x 1.5= TOD-distance.
10. Definition of TC (True Course), +/- Wind correction angle gives TH (True Heading) /-Variation gives MH (Magnetic Heading) +/- Deviation gives CH (Compass Heading).
11. Using the Nav Log to pre-compute headings, groundspeeds, and leg time –Using a flight computer for Speed, Time Distance calculations, Fuel burn per leg, and calculation of WCA.
12. Discuss differences between pre-flight groundspeed and heading calculations that occur during flight from the pre-calculated NAV LOG data.

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13. Discuss Navigation systems and radar services including GPS, VOR, and flight following, opening a flight plan, and how to get in-flight weather.
14. Intercepting and tracking a given course, radial, or bearing, as appropriate.
15. Diversion to include potential reasons and then, choosing an appropriate alternate airport and route.
16. How to estimate the initial heading, arrival time, and the fuel required.
17. Lost procedures – 4 C's – Climb, Communicate, Confess, Comply.
18. Using ForeFlight for flight planning – Setting up an airplane profile, and how to use the flight-planning components.
19. Getting a weather briefing using ForeFlight.
20. ForeFlight display of SUA including using ADS-B with ForeFlight – TFRs.
21. Weather and traffic – discuss limitations. How to file and open a VFR flight plan.

## Presentation References

FAA-H-8083-3C - Airplane Flying Handbook
FAA-H-8083-25B - Pilots Handbook of Aeronautical Knowledge
FAA-s-ACS- 6B (Private ACS)
NTSB reports Personal stories FAR/AIM

## Navigation - Quick Reference

- Aeronautical Charts
  i. Sectional, and VFR Terminal Area Charts, ForeFlight.
  ii. Overview and legend.
- Measurement of direction
- Variation (PHAK)
  i. The angle between true north and magnetic north deviation.
  ii. The compasses error from magnetic influences within the airplane.
- Effect of Wind
- Fuel Consumption

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## Methods of Navigation

- **Pilotage**
  - i. Navigate by reference to visual landmarks or checkpoints.
  - ii. Choose prominent features.
  - iii. Chose checkpoints every 10-15 miles, and always use cross-check points.
  - iv. Make the first checkpoint close to the start of the flight to confirm the initial heading is
  - v. correct.
- **Dead reckoning**
  - i. Navigation solely by means of computations based on time, airspeed, distance, and direction.
  - ii. It is the process of estimating your position by advancing a known position using course, speed, time, and distance to be traveled. In other words, figure out where you will be at a certain time if you hold the speed, time, and course you plan to travel.
- **Radio navigation**
  - i. VOR / VORTAC.
  - ii. Radials - aligned with magnetic north.
  - iii. Morse identifier; may also have voice.
  - iv. Mostly limited by line of sight. The higher the altitude the more the range.
  - v. T - Term 25 NM 1,000-12,000ft.
  - vi. L - Low alt. 40 NM 1,000-FL 180.
  - vii. H - High alt 40 NM (1000ft-14,500ft) 100 NM (14,500ft-FL180) 130nm (FL180-FL450).
  - viii. To fly to a VOR: Tune it, Identify it, Center the CDI and bracket for wind if nec-essary.
  - ix. Teach how to intercept a VOR radial inbound to the station.
  - x. Using a simulator or navigation trainer/simulator app on the iPad, demonstrate how to

xi. use a VOR.

xii. Tracking to a VOR in wind.

- **GPS**
    i. Uses a constellation of satellites.

    ii. Less affected by weather.Flight Planning.

- **Assemble the necessary materials. (91.103). Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight**
    i. WX Briefing.

    ii. Sectional / VFR terminal charts.

    iii. Chart supplements paper and on Foreflight - Study the info for each airport.

    iv. Plotter, E6B, highlighter, post-its, iPad with Foreflight.

    v. Compass deviation values from the compass card.

    vi. POH - for loading and performance data.

    vii. Night flight: flashlights.

- **Chart the course**
    i. The route should be chosen being mindful of fuel stops, terrain, water, airspace, obstructions, and current and forecasted weather.

    ii. Choose method of navigation.

    iii. Plot the course.

    iv. Choose and mark appropriate checkpoints along the way.

    v. Choose a cruising altitude appropriate for terrain, obstructions, airspace, direction of flight, winds aloft.

    vi. Complete a flight log with a starting point, checkpoints and stopping points.

    vii. Calculate TC and distance for each leg.

    viii. Interpolate winds aloft for each leg.

    ix. Calculate CH = TC + WCA / Var - Dev.

    x. Calculate GS, time, and fuel used for each leg.

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## Completion Standards

This lesson is complete when the student demonstrates the ability to plan a VFR flight using a Nav Log and Foreflight using real-time weather, explains the ATC services available, and can explain how to use Dead reckoning, Pilotage, GPS, and VOR to navigate. The student will also be able to file and simulate opening a VFR flight plan.

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# National Airspace System

## Objective

To understand how to operate in the National airspace system by using aeronautical charts, and by applying your knowledge of airspace to all types of airspace.

## Motivation

By understanding the national airspace systems, you will be able to identify airspace you are in, the airspace ahead and what you need to do to operate in it.

## Presentation: 2:00 hours

1. Classifications.
2. Uncontrolled. (Class G)
3. Controlled.
4. Class E.
5. Class D.
6. Class C.
7. Class B.
8. Class A.
9. Special VFR.
10. Special Use. (Military)
11. Other airspace. (firefighting areas)
12. Emergency Air Traffic Rules.
13. ADIZ.
14. Usage Requirements.
15. Cloud Clearances and Visibility Requirements.

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**AIRSPACE (National Airspace System)**

- United States airspace is organized into six classes (A, B, C, D, E and G), designated either controlled or uncontrolled.

**Uncontrolled Airspace (Class G)**

- ATC Services are not provided.

**Controlled Airspace (Class A, B, C, D and E)**

Class A is most restrictive & class E the least restrictive:

- ATC services provided to IFR aircraft & VFR aircraft:
    i. Separation of aircraft provided with ATC services.
    ii. VFR aircraft may not be required to use ATC services.
    iii. Traffic Advisories.
    iv. Safety Alerts.

| | | | | |
|---|---|---|---|---|
| **Class A** | Controlled | Attitude | | IFR only |
| **Class B** | Controlled | Big | SFC at primary airport  | Looks like an upside-down wedding cake |
| **Class C** | Controlled | Crowded | SFC at primary airport  | Similar to B, but fewer tiers |
| **Class D** | Controlled | Dialogue | | Defined by boundaries |

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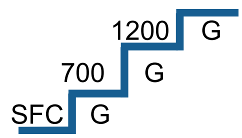
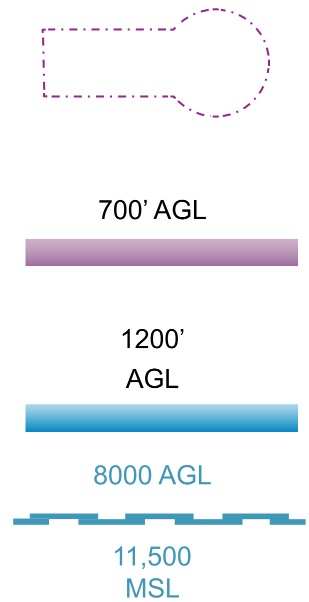
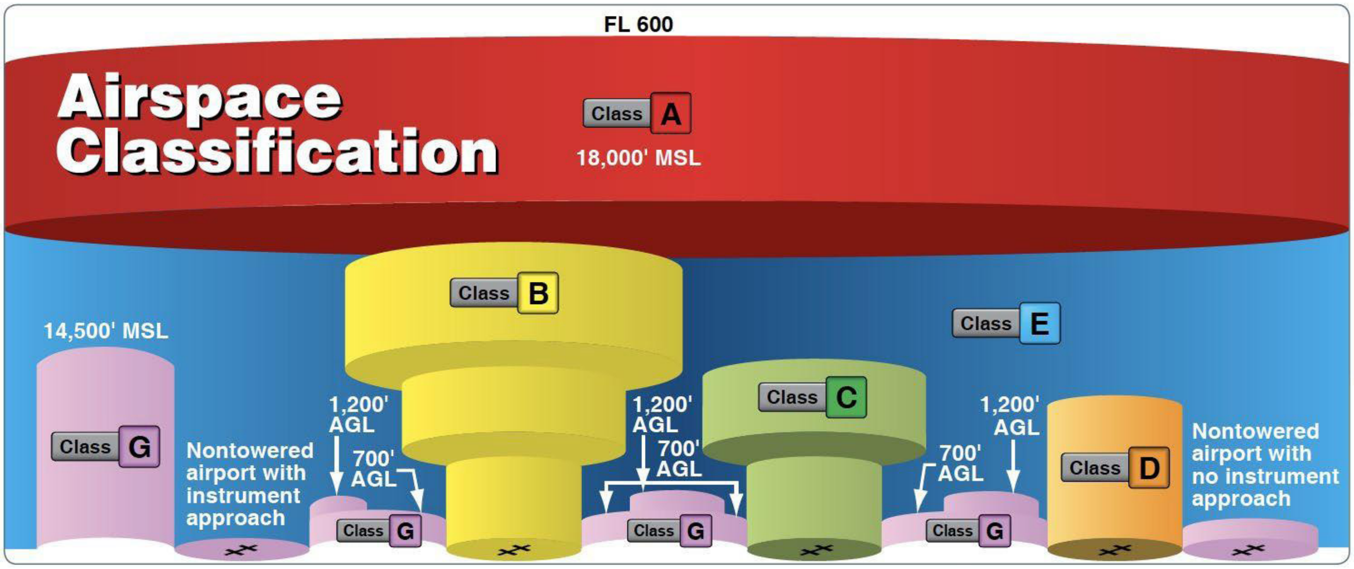
|---|---|---|---|---|
| **Class E** | Controlled | Elsewhere |   | can start at surface or 700, 1200 feet or at specified altitudes   |
| **Class G** | Controlled | Govern-ment Free | | Everywhere else that is not con-trolled airspace |




After completing a review of the above information use a VFR Sectional Chart to point out the different airspace. Have the student identify different airspaces.

| Airspace Classes | Communications | Entry Requirements | Separation | Special VFR in Surface Area |
|---|---|---|---|---|
| A | Required | ATC Clearance | All | N/A |
| B | Required | ATC Clearance | All | Yes |
| C | Required | Two-way communications prior to entry | VFR/IFR | Yes |
| D | Required | Two-way communications prior to entry | Runway operations | Yes |
| E | Not required for VFR | None for VFR | None for VFR | Yes |
| G | Not Required | None | None | N/A |

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**Class A**

- VFR not permitted. Requires an Instrument Rating and IFR Clearance.
- High altitude traffic and jet routes.
- Includes the airspace overlying the waters within 12 nautical miles of the coast from 18,000 feet to FL600 over the 48 states & Alaska.
- Not charted.

**Class B**

- Surrounds the busiest airports.
- Requires 2-way radio communications.
- Requires a clearance to enter.
- Requires a Mode C Transponder.
- Typical dimensions.
- Surface to 10,000 feet MSL.
- Exceptions are numerous. (7,000' – 12,500' MSL).
- Lateral dimensions are adjusted to the specific airport.
- 30-mile radius Mode C Transponder veil.

**Class C**

- Found at airports with an operating control tower, approach radar, and a certain number of operations per year.
- Allows pilots below private pilot to operate there.
- Requires a pilot to establish and maintain 2-way radio communication.
- Requires a Mode C transponder.
- Typically, surface to 4,000 feet AGL.
- Vertical dimensions are typically from the surface to 4,000 FT AGL.
    i. Inner circle – 5 nautical mile radius.
    ii. Outer circle – 10 nautical mile radius.
    iii. Altitude is generally 1,200 feet AGL to 4,000 feet AGL.
    iv. Outer Area – 20 nautical mile radius.
    v. Not shown on chart.

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**Class D**

- At airports that have an operational control tower.
- Requires the pilot to establish and maintain 2-way radio communication.
- A transponder is only required if operating within a Class B Mode C veil.
- The vertical dimensions are typically up to and including 2,500 feet AGL.
- Lateral Dimensions.
    - i. Vary at each Class D.
    - ii. 4 to 8 nautical mile radius (mostly) plus extensions.
    - iii. Extensions.
    - iv. Class D.
    - v. Class E.

**Class D**

Beginning Altitudes for Class E airspace:

- Mnemonic - SETVODA
    - i. Surface.
    - ii. Extension.
    - iii. Transition Area.
    - iv. Victor Airways.
    - v. Offshore - Zippered Lines.
    - vi. Domestic 1200 AGL.
    - vii. Above FL600.

Class E Weather Minimums at different altitudes:

- <10,000 MSL - 3SM, 1000ft above, 500ft below and 2000ft laterally from clouds.
- >10,000 MSL - 5SM, 1000ft above, 1000ft below and 1SM laterally from clouds.
- Other controlled airspace, including that airspace overlying the waters within 12 nautical
- miles of the coast of the 48 contiguous states and Alaska.

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- No requirements (accept above 10,000' MSL or within 2,000' AGL).
- Pilots have the ability to receive ATC services.
- The lateral dimensions vary tremendously.
- The vertical dimensions can start:
    i. Surface.
    ii. 700 feet AGL.
    iii. 1,200 feet AGL.
    iv. 14,500 feet MSL unless below 1,500 feet AGL.
    v. Above FL600.
- Types:
    i. Surface based (NAV, ATC, & WX).
    ii. Extensions. (Instrument approaches)
    iii. Imposes higher weather minimums than uncontrolled airspace.
    iv. Transition areas (Cyan or Magenta vignettes) - 1200 feet and 700 feet AGL.
    v. En-route domestic areas.
    vi. Federal airways.
    vii. Offshore.
- Dimensions vary:
    i. From the surface to the overlying controlled airspace, if controlled airspace does not start at the surface.
- No requirements.
- No ATC services available.

**Note:** After reviewing the above information, use a VFR Sectional chart to look at all airspace and quiz student on the differences.

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| CLOUD CLEARANCE & VISIBILITY REQUIREMENTS | | |
|---|---|---|
| Airspace | Minimum Flight Visibility | Cloud Clearance and Visibility |
| Class A | Not Applicable | Clear of Clouds |
| Class B | 3 statute miles | 500 feet below 1,000 feet above<br>2,000 feet horizontal |
| Class C | 3 statute miles | 500 feet below 1,000 feet above<br>2,000 feet horizontal |
| Class D | 3 statute miles | 500 feet below 1,000 feet above<br>2,000 feet horizontal |
| Class E<br>Less than 10,000 feet MSL | 3 statute miles | 500 feet below, 1,000 feet above,<br>2000 feet horizontally |
| At or above 10,000 feet MSL | 5 statute miles | 1,000 feet below, 1,000 feet above<br>1 statute mile horizontal |
| Class G<br>1,200 feet or less above the | 1 statute mile | Clear of Clouds |
| Night, except as provided in<br>section 91.155(b) | 3 statute miles | 500 feet below 1,000 feet above<br>2,000 feet horizontal |
| More than 1,200 feet above<br>the surface but less than | | |
| Day | 1 statute miles | 500 feet below 1,000 feet above<br>2,000 feet horizontal |
| Night | 3 statute miles | 500 feet below 1,000 feet above<br>2,000 feet horizontal |

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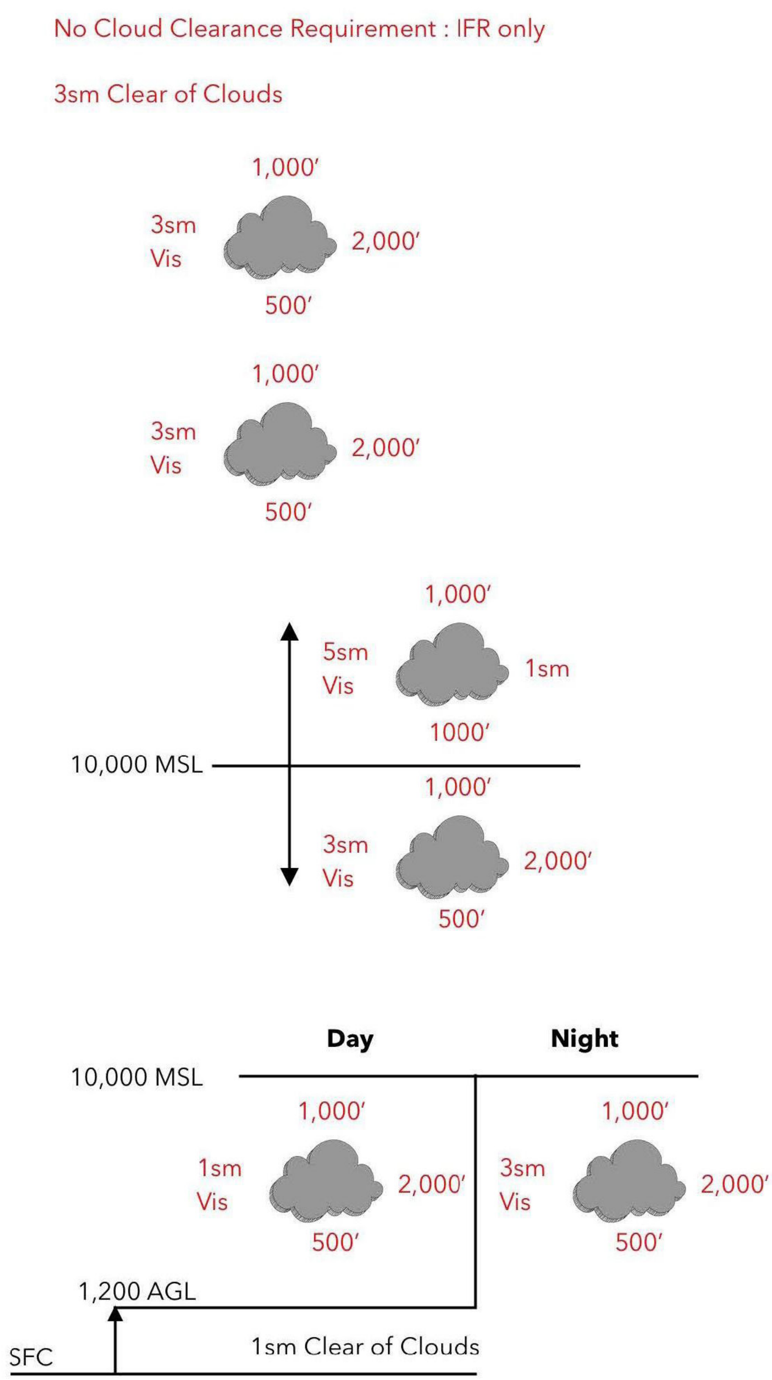
# Cloud Clearance and Visibility Requirements



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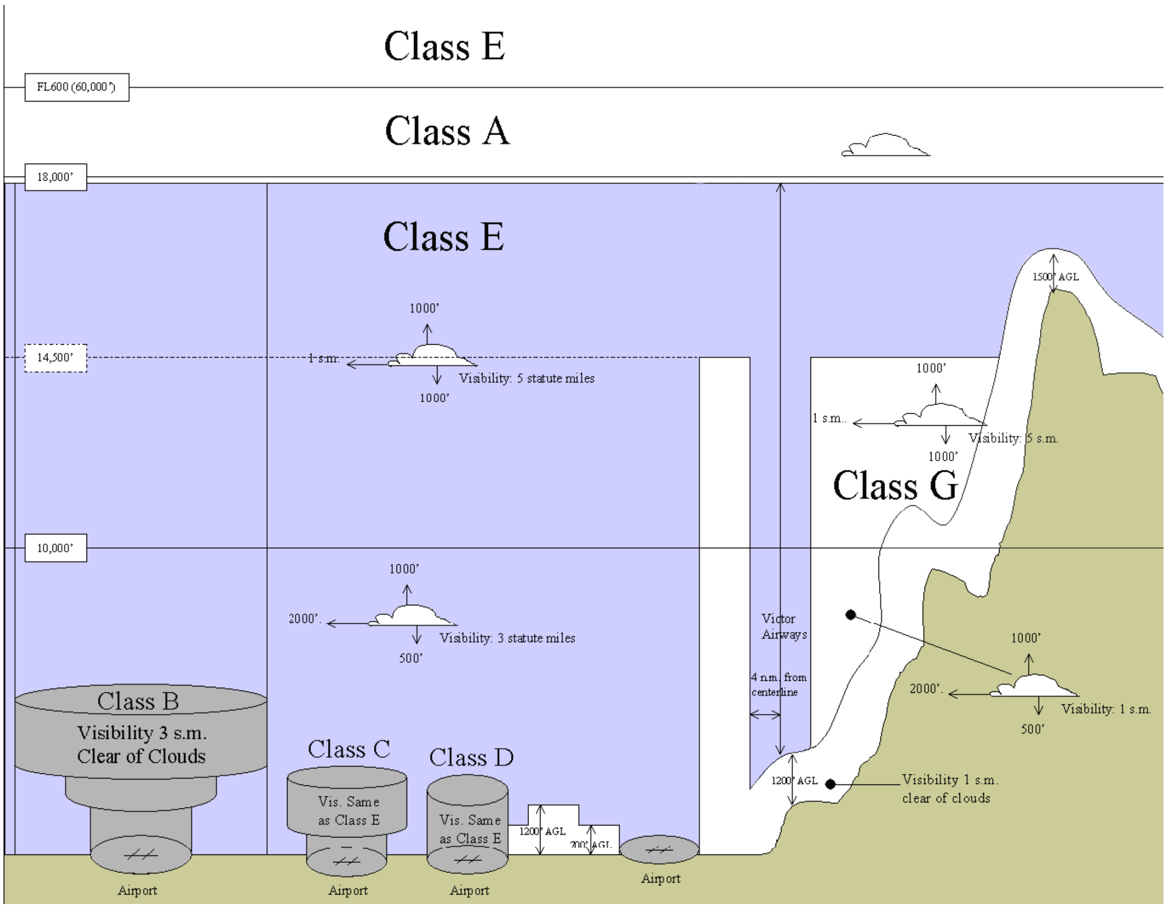

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**Special Use Airspace (SUA) & Other Airspace**

1. Prohibited Areas
    a. Entry not Allowed:
        i. Areas in Washington, D.C for example.
2. Restricted Areas
    a. Not allowed unless permission is received from the controlling agency:
    b. Permission is not required when the airspace is not activated.
3. Warning Area
    a. Contains the Same hazards as Restricted airspace, but is located in international territory.
        i. Located more than 3nm offshore.
        ii. Doesn't require permission but is not recommended.
4. Military Operations Area (MOA)
    a. Area of military activity that does not contain live firing:
        i. Can enter under VFR.
    b. Clearance is NOT needed:
        i. See and avoid.
5. Alert Areas
    a. Area of unusual activities & flight taining.
    b. Does not require permission to enter.
6. Controlled Firing Area
    a. Areas of operations which would be hazardous to non-participating aircraft, if not controlled.
        i. Not charted.
        ii. Spotters stop the firing any time an aircraft is near.

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**Other Airspace Areas**

1. National Security Area
    a. Areas where aircraft are asked to avoid due to the sensitivity of national security.
2. Airport Advisory Area
    a. Is described by an airport advisory program.
    b. Not charted.
3. Military Training Routes (MTR)
    a. Special low-level training routs for the military.
    b. Aircraft speeds can be in excess of 250 knots.
    c. Visual vs. instrument:
        i. IFR Military Training Routes (IR) – Operations on the routes are conducted in accordance with IFR regardless of weather conditions.
        ii. VFR Military Training Routes (VR) – Operations on these routes are conducted in accordance with VFR except flight visibility shall be 5 miles or more; and flight shall not be conducted below a ceiling of less than 3,000 feet AGL.
    d. Number system:
        i. MTRs with no segment about 1,500 feet AGL shall be identified by four number characters, e.g., IR1206, VR1207.
        ii. MTRs that include one or more segments above 1,500 feet AGL shall be identified by three number characters, e.g., IR206, VR207.
        iii. Alternate IR/VR routes or route segments are identified by using the basic / princi- pal route designation followed by a letter suffix, e.g., IR008A, VR10007B, etc.
4. Temporary Flight Restrictions (TFR)
    a. Generally, a NOTAM restriction that is:
        i. Prohibited.
        ii. Restricted.
        iii. National security.

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5. Parachute, Glider, Ultra-light
    a. The locations are shown by a glider symbol on an aeronautical chart.
6. Terminal Radar Service Area (TRSA)
    a. Class C radar services are available, but the airspace is non-regulatory.

**Presentation references:**

- VFR Sectional Chart for your area of operation.
- Pilot's Handbook of Aeronautical Knowledge: chapter 15.
- 14 CFR part 91
- AIM Chapter 3
- Commercial Pilot ACS: pg. 7

**Key points:**

- Airspace basics - A at altitude, B for Big cities, C, D for smaller airports, and E, G, "Every-where controlled" and "Golf - wild west rules".
- Basic VFR weather minimums, § 91.155.
- Equipment requirements and communication requirements vary with each airspace.
- Knowing which airspace to avoid, and which airspace(s) are okay to operate in (MOAs, etc.)

**Risk Management - Teach how to identify, assess, and mitigate risks encompassing the following:**

- Various classes and types of airspace.
- The potential ramifications of flying into restricted / prohibited airspaces.

**Questions for the student:**

1. Can you show me class E airspace on the sectional chart?
2. What are the weather minimums for class G airspace at night? Does it change with altitude?
3. What is a controlled firing range? Can you show it to me on the sectional chart?

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### Common errors:

- Failure to recognize where class G and class E airspace starts and ends based on it's position relative to the delineated magenta border.
- Failure to recognize difference between AGL and MSL altitudes in regards to airspace.
- Failure to recognize certain unique symbols for airspace and obstructions that aren't commonly used.
- Failure to read small notes about various specific procedures in different airspaces.

### Completion Standards

This lesson is complete when the student exhibits knowledge of the elements related to the National Airspace System by explaining:

1. Basic VFR weather minimums - for all classes of airspace.
2. Airspace classes - their operating rules, pilot certification, and airplane equipment requirements for the following:
    - Class A
    - Class B
    - Class C
    - Class D
    - Class E
    - Class G
3. Identify the requirements for operating in SUA or within a TFR. Identify and comply with SATR and SFRA operations, if applicable.

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# Performance and Limitations

## Objective

To understand how density and temperature affect airplane performance by using real time weather to determine predicted airplane performance by using each chart in the performance section of the POH by interpolating data and applying any notes to the end calculations.

## Motivation

Deciding what performance the airplane will have prior to a flight will help reduce or eliminate risks associated with terrain, usable runway, density and temperature on aircraft performance. Knowing the airplane's capabilities allows the pilot to make the right decisions.

## Presentation: 1:30 Hours

1. Explain the purpose of each chart in the POH Performance section.
2. Explain how to calculate Pressure altitude, (PA) and how it affects performance.
3. Explain how to get the Outside air temperature, (OAT), and how temperature affects performance.
4. Explain how to interpolate.
5. Using a METAR or other source calculate the following: Crosswind/headwind component. Short field take-off distance over a 50-foot obstacle. Accelerate-stop distance. Time speed distance to climb from 2000ft Pressure altitude (PA), to 6000ft PA. Calculate percentage power, True airspeed (TAS) and Fuel flow for a flight at 6000ft and 20 deg over standard temperature using 2400 RPM, and the compare the performance differences between both engines operating and one engine inoperative.
6. Calculate the maximum range, maximum endurance and short field landing distance over a 50-foot obstacle. Emphasize the notes area on the charts. For example, the Janitrol cabin heater used in many light twins (found in the nose nacelle) uses ~.5 gallons per hour when turned on.
7. Explain the difference between Calibrated airspeed, (CAS), Indicated airspeed, (IAS), True airspeed, (TAS), and ground speed, (GS.)
8. Show how to calculate density altitude.
9. Explain the effects of density and how to maximize performance at high density altitudes.
10. Show how to calculate TAS from CAS, PA and OAT. Show how to get the TAS for flight planning from the POH. (Cruise Performance Charts)

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11. Discuss why the same indicated airspeed should be used regardless of the altitude or density of the airport for takeoff and landing.

**Presentation References**

- AFM/POH: For your aircraft - Section 5: Performance.
- Pilot's Handbook of Aeronautical Knowledge: chapter 11.
- Airplane Flying Handbook: pg. 2-16
- Commercial Pilot ACS: pg. 8
- Youtube: AVWeb - Airplane Crash In-Cockpit Footage: Stinson 108-3
- Youtube: FAA - Mountain Flying & High Density Altitude in 57 Seconds
- NTSB Reports - Specifically, Stinson 108 Preliminary Report
- Personal anecdotes / stories

**Key points:**

- Performance calculations are varied in a twin between both engines operating and one engine inoperative climb performance.
- Recognition that not managing throttle / prop / mixture settings appropriately will result in a reduction in performance.
- Why some twins have an accelerate-go, but ours likely does not.

**Risk Management**

Teach how to identify, assess, and mitigate risks encompassing the following:

- Chance of losing engine and resultant loss of performance.
- Inaccurate use of manufacturer's performance charts, tables, and data.
- Exceeding airplane limitations.
- Possible differences between calculated performance and actual performance.

**Questions for the student:**

1. What is the accelerate stop distance for our airplane given today's conditions?
2. What acceptable margin of error will you add to that number? Why?
3. Given today's conditions if we had an engine failure could we still climb to a safe altitude and return to the field?

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## Common errors:

- Failure to correctly calculate the performance given a set of environmental conditions.
- Over-estimating fuel burn - results in bringing too much fuel.
- Under-estimating fuel burn - results in bringing not enough fuel.
- Hazardous pilot attitude - “invulnerability”

## Completion Standards

a. Compute the weight and balance, correct out-of-center of gravity (CG) loading errors and determine if the weight and balance remains within limits during all phases of flight.

b. Utilize the appropriate airplane manufacturer’s approved performance charts, tables, and data.

**(extra)**

This lesson is complete when the student demonstrates their ability to understand the effects of density and temperature on performance and can use the performance charts in the POH, including interpolation of data, and application of any notes using real world weather. The student will also be able to explain when CAS, IAS, TAS and GS are used in performance calculations and secondary flight controls.

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# Operation of Systems (A) - General

**Objective:**

To understand multi-engine airplane systems so the pilot can use and manage them as the needs arise during normal operations and emergencies.

**Motivation:**

Some multi-engine systems operate the opposite of their single-engine counterparts. As such, there are distinctions to be made between the two. As the pilot transitions into larger aircraft, almost all large aircraft have multiple engines, and the systems that come with that are more complicated.

**Presentation (30 minutes - in-depth: +1hr 25 minutes):**

1. Primary and Secondary flight controls - For this part of the lesson, reference the "*Operation of Systems (B) - Airplane Flight Controls - Task I: G(a,b)*" lesson plan (30 minutes).
2. Powerplant - Regarding whether the aircraft is considered "high performance" or not, each engine must be over 200hp. A combined 180 hp left and right engine would not be regarded as high performance because neither powerplant is over 200hp.
3. Powerplant - The Piper Seminole is one of a few training aircraft that has one engine (the right engine) counter-rotating. The goal of this is to prevent the existence of a critical engine. Some aircraft engines require a particular type of oil, or oil additive, as required by service bulletins.
4. Propeller - In all multi-engine aircraft with a propeller, the propeller will almost always be some form of variable pitch propeller. The most common type is a constant-speed propeller.
5. Propeller differences - Multi-engine propeller governors are plumbed opposite of single-engine propeller governors. Therefore, the propeller should feather if the engine loses oil pressure, as it helps minimize drag. The propeller material may vary. Common types are wood, aluminum, and composite.
6. Landing gear - Multi-engine aircraft can have different types of landing gear systems. Hydraulic, manual and electric motor driven are examples.
7. The Seminole and other light twins have an electric motor that operates a hydraulic power pack. This hydraulic pack retains hydraulic pressure, holding the landing gear up in the housing. Toggling the gear lever will release the hydraulic pressure while the electric motor works to extend the gear into position. In an emergency, the gear will free-fall due to gravity.

8. Fuel - The Fuel system in most multi-engine training aircraft, is usually comprised of the following:
    a. Two main wing tanks and auxiliary tanks.
    b. At least one fuel tank vent for each tank (either installed on the tank itself or via a vented fuel cap.)
    c. Engine-driven fuel pumps.
    d. Electrically driven boost pumps.
    e. Fuel quantity gauges for each tank.
    f. Fuel management controls (to switch tanks, cross-feed, and shut-off the fuel.)

Note: in larger aircraft, the fuel tanks are integral, meaning the aircraft must have a minimum amount of fuel in the tanks to maintain structural integrity.

9. Oil - Every aircraft is different in this regard, specifically in viscosity and quantity required.
10. The oil storage method varies from aircraft to aircraft - most are dry sump or wet sump. For example, the Piper Seminole’s Lycoming O-360 engine has a wet sump system.
11. Oil - Most new aircraft engines require 50-100 hours of break-in. During this time, mineral oil is run through the engine to intentionally seal o-rings and other components of the engine. After the break-in period, the oil is changed to a “W-100,” for example, with the W meaning “with additives.” - it is considered ashless dispersant at this point.
12. Hydraulics - Every aircraft is different. The size of the aircraft typically determines how involved hydraulics are in its systems. From small GA aircraft up to light jets, most only use hydraulics for the landing gear and the braking system. In these cases, an electric motor drives a hydraulic power pack, which holds the landing gear in place. Hydraulic fluid is also moved through the brake lines when pressure is applied to the brake pedals. Hydraulic fluid is used because it’s a virtually incompressible fluid.
13. Electrical - The electrical system is similar for most GA aircraft, consisting of the following components:
    a. Main/Primary bus.
    b. Avionics bus.
    c. Master contactor.
    d. Avionics contactor.
    e. Various relays and switches.

14. Avionics - Any aircraft could have a wide variety of avionics suites installed. Discuss these specific to your aircraft in a separate lesson.
15. Pitot-static, vacuum/pressure, and associated flight instruments - For this part of the lesson, reference the "*Operation of Systems (C) - Avionics, Pitot-static, vacuum/pressure, and associated flight instruments - Task I: G(g,h)*" lesson plan (40 minutes).
16. Environmental - Any aircraft could have a wide variety of environmental systems, and their associated controls installed. Discuss these specific to your aircraft in a separate lesson.
17. Deicing and anti-icing - For this part of the lesson, reference the "*Operation of Systems (D) - Deicing and anti-icing - Task I: G(j)*" lesson plan (15 minutes).
18. Oxygen system - Many light GA aircraft are NOT equipped with any type of Oxygen system, so Aviator's Oxygen may be used when necessary.

**Presentation references:**

- Commercial Pilot ACS pg. 9.
- CFI Bootcamp: Flight Instructor Lesson Plans / Instrument Flight Instructor Lesson Plans.
- AFM/POH - Section 7 (Systems).
- Pilot's Handbook of Aeronautical Knowledge, Chapters 6, 7, 8.

**Key points:**

- All systems are described in your aircraft's AFM/POH, section 7.
- Reference other lesson plans when necessary.
- The most common aircraft used for multi-engine training is the Piper Seminole.
- Depending on the system in question, multi-engine aircraft systems are vastly different from single-engine aircraft systems.

**Risk Management - Teach how to identify, assess, and mitigate risks encompassing the following:**

1. Failure to detect system malfunctions or failures.
2. Improper management of a system failure.
3. Failure to monitor and manage automated systems.

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**Questions for the student:**

1. When is a multi-engine airplane considered high-performance?
2. What are the main components of a multi-engine airplane's electrical system?
3. What are the primary and secondary flight controls on the airplane we are using?

**Common errors:**

- Lack of foundational systems knowledge.
- Lack of systems knowledge specific to the aircraft the student is using.
- Inability to discern when there is a system malfunction or failure.
- Having a rote memory response for a system (i.e., its diagram) but not understanding how it works.

**Completion Standards:**

1. The applicant must be able to operate at least three of the systems listed in this lesson.
2. The applicant must properly use the appropriate checklist(s) for the associated system, as recommended by the aircraft's manufacturer.

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# Operation of Systems (B) - Airplane Flight Control

## Objective

To gain an understanding of the way a pilot uses the flight controls to provide the necessary aerodynamic forces to maneuver the airplane around its three axes.

## Motivation

Every flight will involve the movement of the airplane using the primary and sometimes secondary flight controls. Understanding how each control works allows the pilot to know which control to use to maneuver the airplane in the desired direction.

## Presentation: 30 Minutes

1. Ailerons
2. Elevator (or stabilator)
3. Rudder

**Behavior of controls:**

At low airspeed, the controls usually feel soft and sluggish, and the aircraft responds slowly to control applications. At higher airspeeds, the controls become increasingly firm, and the airplanes response is more rapid.

Movement of any of the three primary flight control surfaces (ailerons, elevator or stabilator, or rudder), changes the affect the lift and drag, and allows a pilot to control the aircraft about its three axes of rotation.

**Ailerons - Controls roll.** A control wheel in the airplane can be turned left or right to cause the airplane to roll.

**Elevator - Controls pitch.** The control wheel can be pulled and pushed to cause the airplane to pitch up and down.

The airplane can have an elevator, which is a hinged control surface mounted at the rear of the horizontal stabilizer, or a stabilator which is a full flying horizontal stabilizer

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**Rudder -** Controls yaw: The foot pedals on the floor, under the instrument panel, can be pushed independently to cause yaw. The tops of the pedals also can be pushed for braking of the left and right wheel.

Effects of the left turning tendencies on flight control inputs and effectiveness.

## Secondary flight controls:

1. Flaps
2. Leading-edge devices
3. Trim

**Flaps:** increase the angle of attack from the leading edge of the wing to the trailing edge. Results in more lift and drag. The primary purpose of flaps is to increase the descent angle with- out in-creasing airspeed.

**Leading-edge devices:** Usually in the form of slats. These devices result in additional lift when deployed. They are mounted on the leading edge of a wing and are typically deployed downward.

**Trim:** Most typically a trim tab (Cessna) or an anti-servo tab (Piper). A trim tab is mounted on the elevator. Its position can be changed by moving a trim wheel in the cockpit. Trim tabs move oppo-site to the travel of the elevator. The trim tab provides aerodynamic forces to hold the elevator in place for a given airspeed. An anti-servo tab moves with the stabilizer to provide aerodynamic feel. Without an anti-servo tab, because the stabilator is large, the pilot would over control the airplane in pitch. The anti-servo tab can also be used for trim in the pitch axis.

## Completion Standards

The student will be able to describe the primary and secondary flight controls and explain how each control can be used to change the flight path of the airplane.

## Expanded Lesson Content

### Ailerons

Ailerons control roll about the longitudinal axis. Discuss adverse yaw.

### Elevator

The elevator controls pitch about the lateral axis.

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**Stabilator**
A stabilator is essentially a one-piece horizontal stabilizer that pivots from a central hinge point.

Because a stabilator pivots around a central hinge point, they are extremely sensitive to control inputs and aerodynamic loads. Anti-servo tabs are incorporated on the trailing edge. They deflect in the same direction as the stabilator. This results in an increase in the force required to move the stabilator, thus making it less prone to pilot-induced over- controlling.

**Rudder**
The rudder controls the movement of the aircraft about its vertical axis. Explain that to be coordinated the airplane's longitudinal axis must always be aligned with the flight path of the airplane.

## Secondary flight controls systems

- Flaps
- Leading Edge Devices
- Spoilers
- Trim Systems

**Flaps**

Flaps are attached to the trailing edge of the wing to increase both lift and induce drag for any given AOA. There are four common types of flaps:

- Plain
- Split
- Slotted
- Fowler

**Leading Edge Devices**

High-lift devices on the leading edge of the airfoil. The leading-edge devices are used to increase lift.

**Spoilers**

High-drag devices on the airfoil, are deployed to spoil the smooth airflow, reducing lift and increasing drag.

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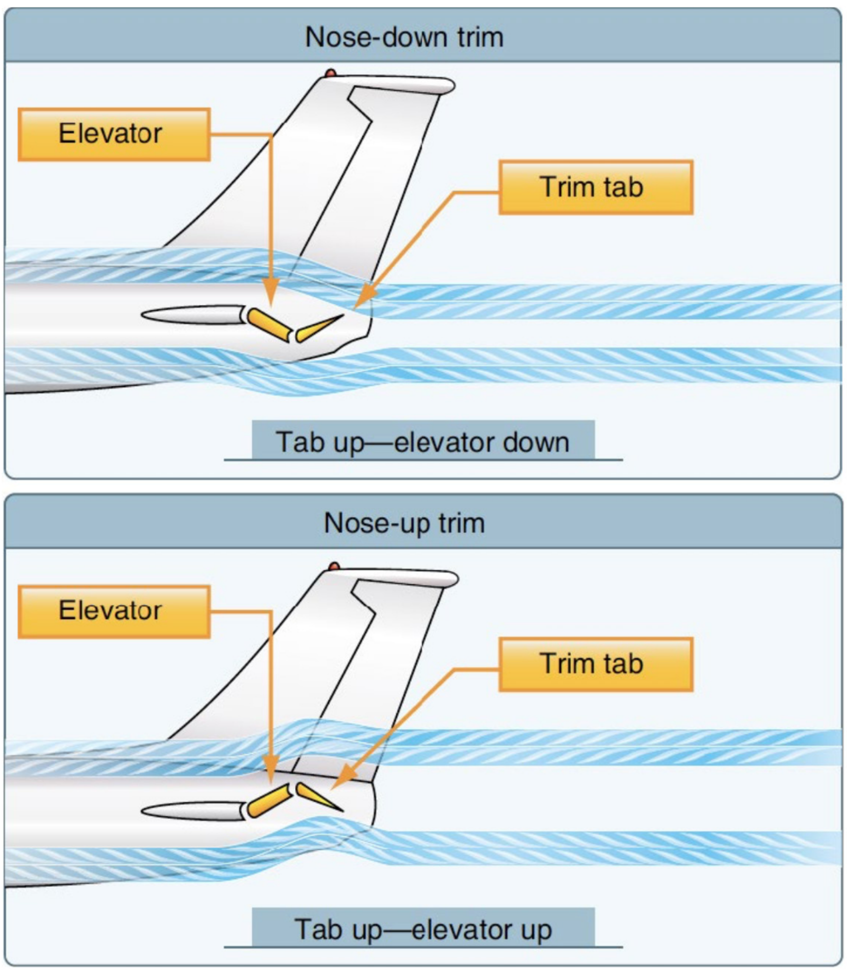
### Trim Systems

Trim systems are used to relieve the pilot of the need to maintain constant pressure on the flight controls. Common types of trim systems include trim tabs, balance tabs, anti-servo tabs, ground adjustable tabs, and an adjustable stabilizer.

### Trim Tabs




Pilots should normally establish the desired power, pitch attitude, and configuration first, and then trim the aircraft to relieve control pressures that may exist for that flight condition.

### Balance Tabs

The control forces may be excessively high in some aircraft, and, in order to decrease them, the manufacturer may use balance tabs. They look like trim tabs and are hinged in approximately the same places as trim tabs.

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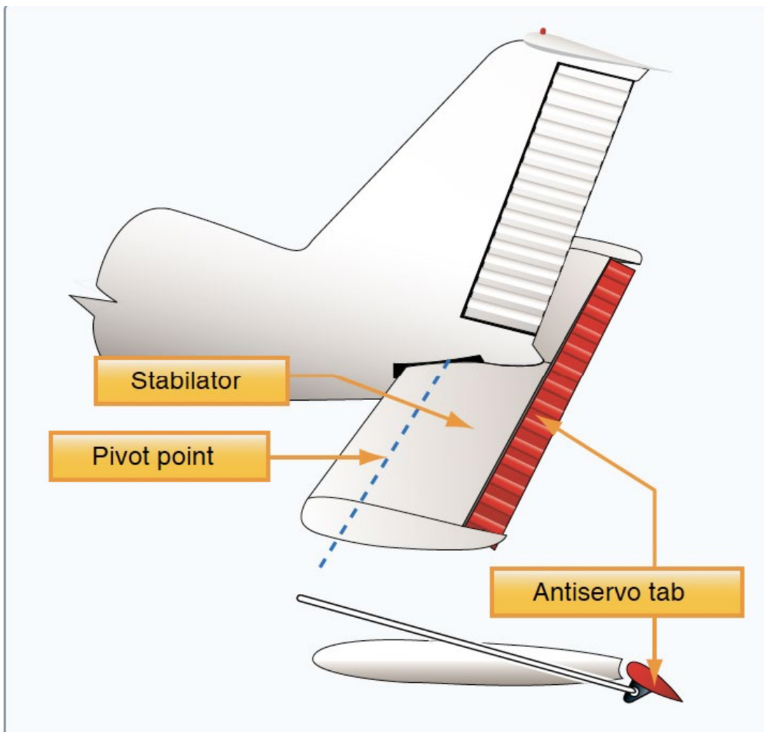
**Anti-servo Tabs**




Anti-servo tabs work in the same manner as balance tabs except, instead of moving in the opposite direction, they move in the same direction. In addition to decreasing the sensitivity of the stabilator, an anti-servo tab also functions as a trim device to relieve control pressure and maintain the stabilator in the desired position

**Ground Adjustable Tabs**

Many small aircraft have a non-movable metal trim tab on the rudder. This tab is bent in one direction or the other while on the ground to apply a trim force to the rudder while in flight.

**Adjustable Stabilizer**

Rather than using a movable tab on the trailing edge of the elevator, some aircraft have an adjustable stabilizer.

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# Operation of Systems (C) - Avionics, Pitot-static, vacuum/ pressure, and associated flight instruments

## OBJECTIVE

To understand the principles of operation of each flight instrument and navigation equipment and understand the possible failures of the instruments and what action can be taken.

## MOTIVATION

Understanding how instrument and equipment work allow the pilot to recognize the failure, take a corrective action and determine what other equipment and systems could be affected.

## PRESENTATION: 40 MINUTES

**Flight Instruments:**

1. Pressure Instruments:
   a. Altimeter – Sealed wafters (29.92" hg), case is vented to static pressure. Explain Errors (See back of lesson plan)
   b. VSI – Diaphragm is connected to static pressure, case connected through a small leak in the diaphragm – different pressures/different rate
   c. Airspeed indicator – Diaphragm connected to pitot tube – case connected to static pressure – as speed increases so does pitot pressure – static pressure in the case allows for a more accurate indication of speed. Explain errors (See back of lesson plan).
   d. Explain markings and limitations on the airspeed indicator.
   e. Magnetic compass – Not powered – Uses the principle of magnetism - Explain Dip error, turning and acceleration errors

2. Gyroscopic instruments:
   a. Work on the principle of rigidity in space – the faster it spins the more it stays in place. The gyro remains in the same spot and the instrument moves around the gyro.
   b. Attitude Indicator – Displays attitude in roll and pitch – explain instrument markings – Typically vacuum powered.
   c. Heading Indicator – Displays heading when instrument is adjusted to the compass

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d. heading. Precesses – 15 min readjustment to compass heading – Typically vacuum powered.

e. Turn coordinator – Uses both rigidity in space and precession to work. Shows rate of turn (Yaw) and rate of roll – Typically electrically powered. Inclinometer shows slip/skid.

3. EFIS equipped aircraft:

   a. Explain what a PFD, MFD, transponder and ADS-B are and how instruments and equipment are displayed in the EFIS system installed in the airplane.

   b. AHRS – Attitude, heading reference system – Replicates Attitude indicator, heading indicator and turn coordinator.

   c. Magnetometer – Detects lines of flux in three axis and displays the heading of the air-

   d. plane on the HSI part of the AHRS.

   e. ADC – Air data computer – Replicates Airspeed indicator, altimeter and vertical speed indicator – uses pitot and static ports and temperature probe information.

   f. EFIS equipped airplanes will have back up instruments – typically round gauge type.

   g. Some airplanes have EFIS back up instruments with its own battery.

**Navigation Equipment:**

1. Traditional navigation equipment:

   a. VOR – Very high frequency omni directional range. Works like a lighthouse – rotating antenna on the ground sweeps through 360 degrees. Receiver in the plane compares the signal at magnetic north to the signal as the antenna sweeps the airplane – determines the radial.

   b. Indicator – Displays: Course index, Omni bearing selector (OBS), Course deviation indicator (CDI), To/From flag, and unreliable signal flag. If used with an ILS, LNAV/VNAV or LPV systems, displays glideslope.

   c. DME – Distance measuring equipment – Radar transponder – Sends a pulse to the DME ground station with a random code embedded. DME ground station returns the signal to the correct aircraft due to the code. Time is converted to distance. Inherent error is slant range error. Measures a direct line to the station at an altitude. Example: 6000 ft over the station, DME reads 1nm.

   d. ILS – Instrument landing system. Localizer on the ground emits a signal with a different frequency for each side of the centerline. Localizer receiver in the airplane detects how much of each frequency it receives. Equal amounts of each frequency = centerline. Localizer indicator typically 2.5 degrees – full scale. Also includes a glideslope. Works in the same way as the localizer except the display is a CDI that goes up and down.

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b. Choose an emergency landing area away from congestion, but near public access.

2. Alternator failure:

   a. Attempt to re-set the alternator by re-seating the circuit breaker and by cycling the alternator side of the master switch.

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# Logbook Entries and Certificate Endorsements

## Objective:

The flight instructor applicant will be able to properly log the training time given and prepare the appropriate endorsements and logbook entries for the privileges of the flight instructor airplane multi-engine certificate.

## Motivation:

Holding a flight instructor airplane multiengine land certificate allows you to provide instruction, solo students, recommend pilots for practical and knowledge tests and provide aircraft authorizations such as a high-performance endorsement. These entries must be understood so that they are given correctly.

## Presentation (1:00hr):

1. Logbook entries are described in FAR 61.51 for both logging a flight and endorsing a logbook entry.
2. Commercially available logbooks contain at least the minimum the FAA requires and, in many cases, more. Required information is the following - FAR 61.51:
    a. Date.
    b. Airplane make/model.
    c. Registration of the airplane - N number.
    d. Takeoff and landing locations.
    e. Flight time.
    f. Conditions of flight - VFR, Simulated or actual instrument, Day, Night.
    g. The number of takeoffs and landings.
    h. PIC time.
    i. Instruction received.
    j. Instruction given.
    k. Remarks

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3. Instructors must sign the logbook or training record of the pilot in the following manner:
    a. Date.
    b. The instructor's signature.
    c. The instructor's certificate number and expiration.
    d. A description of the training given.
4. Details of logging PIC time:
    a. PIC time can only be logged when the pilot is rated in the airplane.
    b. The pilot must hold the category and class of said plane on their pilot certificate.
    c. Student pilots may only log PIC time when properly endorsed and flying solo (by themselves) in the airplane.
    d. For example, a pilot with airplane single-engine land may only log PIC time in a multi-engine airplane when they are endorsed for solo flight, FAR 61.31(d)(2) and are flying solo in the airplane.
5. Logbook entry minimum requirements - What actually has to be logged? The only instances where flight time must be recorded are basically any entries needed to prove the pilot is current and legally able to fly. Some examples follow:
    a. 24 calendar month flight review (or Bi-annual) - § 61.56.
    b. Any passenger carrying requirements - § 61.56.
    c. Aeronautical experience requirements for a rating the pilot is seeking.
6. To solo a student who does not hold a pilot certificate the student must:
    a. Hold a student pilot certificate.
    b. Hold a medical certificate or Basic Med (if qualified).
    c. Complete a pre-solo knowledge test, FAR 61.87(b), issued by the instructor authorizing the solo flight. This test must cover the following:
        i. Relevant areas of FAR part 61, 91.
        ii. The operating practices of the airspace where the solo will take place.
        iii. Flight characteristics and limitations of the airplane to be solo.
    d. Then, the instructor must review the incorrect responses on the written exam, and endorse the student's logbook according to AC 61-65H, A.3.

e. Complete the flight training required by 61.87(c)(1) and (2) and provide endorsements A.4 and A.6 with any limitations the instructor feels necessary.

f. Provide endorsements as appropriate for operating a complex, high-performance, or pressurized airplane - 61.31(e),(f), and (g.) Located in AC 61.65H - A.68, A.69, and A.70.

g. Cross-country training is addressed in 61.93. Endorsements are in AC 61-65H, A.9 is to certify the training has been completed. A.10 is to authorize each cross-country flight.

h. Additional endorsements for specific operations, like Class B, to solo to an airport more than 25nm are in the sample endorsements appendix under the student pilot section.

7. For an initial Private Pilot certificate with Airplane Multiengine Land, the following must be reviewed and completed:

   a. Eligibility - 61.103.

   b. Aeronautical knowledge - 61.105(b).

   c. Flight proficiency - 61.107(b)(2).

   d. Aeronautical experience - 61.109(b).

   e. Required if not exercising "performing the duties of PIC" or "PDPIC" with an authorized instructor on board:

      i. Endorsement to act as pilot in command of an aircraft in solo operations when the pilot does not hold an appropriate category/class rating - 61.31(d)(2).

      ii. NOTE: Pilots with certificates other than Student are not subject to the student pilot regulations or endorsements. This is a one-time endorsement in AC 61-65H - A.71.

   f. Endorsement for aeronautical knowledge and to take the knowledge test - AC 61-65H - A.32. NOTE: If a home study course was used, then the endorsement is A.82

   g. Endorsements for flight proficiency/practical test - AC 61-65H A.33, and A1. A2 is required only if the knowledge test score is less than 100%.

   h. Provide endorsements as appropriate for operating a complex, high-performance, or pressurized airplane - 61.31(e),(f), and (g). Located in AC 61.65H - A.68, A.69, and A.70.

8. For an initial Commercial Pilot certificate with Airplane Multiengine land, the following must be completed:

   a. Eligibility - 61.123

   b. Aeronautical knowledge - 61.125(b.)

c. Flight proficiency - 61.127(b)(2.)
d. Aeronautical experience - 61.129(b.)
e. Required if not exercising performing the duties of PIC with an authorized instructor on board. Endorsement to act as pilot in command of an aircraft in solo operations when the pilot does not hold an appropriate category/class rating - 61.31(d)(2). NOTE: Pilots with certificates other than Student are not subject to the student pilot regulations or endorsements. This is a one-time endorsement in AC 61-65H, A.71.
f. Endorsement for aeronautical knowledge and to take the knowledge test - AC 61-65H - A.34. NOTE: If a home study course was used, then the endorsement is A.82
g. Endorsements for flight proficiency/practical test - AC 61-65H A.35, and A1. A2 is required only if the knowledge test score is less than 100%.
h. Provide endorsements as appropriate for operating a complex, high-performance, or pressurized airplane - 61.31(e),(f), and (g.) Located in AC 61.65H - A.68, A.69, and A.70.

9. For the addition of an additional category or class rating at the same level (Private to Private, Commercial to Commercial, etc.), the following must be completed - 61.63:
    a. Eligibility - Specific to the grade and category/class.
    b. Aeronautical knowledge - 61.105(b), 61.125(b) as appropriate.
    c. Flight proficiency - 61.107(b)(2), 61.127(b)(2) as appropriate.
    d. Aeronautical experience - 61.109(b), 61.129(b) only applies to adding an additional category. For example, adding a class rating, multi-engine land does not require the aeronautical experience to be met.
    e. Endorsement to act as pilot in command of an aircraft in solo operations when the pilot does not hold an appropriate category/class rating - 61.31(d)(2). NOTE: Pilots with certificates other than Student are not subject to the student pilot regulations or endorsements. This is a one-time endorsement in AC 61-65H, A.71.
    f. Endorsement for additional category or class rating other than ATP. AC 61-65H, A.74, and A1. A2 is only required if a knowledge test was required by 61.63 and the score is less than 100%.
    g. Provide endorsements as appropriate for operating a complex, high-performance, or pressurized airplane - 61.31(e),(f), and (g.) Located in AC 61.65H - A.68, A.69, and A.70.

10. For an additional aircraft qualification, the following must be completed:
    a. The training for any of the following: Complex, High-Performance, Pressurized Aircraft,

or Tailwheel Aircraft defined in 61.31(e),(f),(g), and (i.) Located in AC 61.65H - A.68, A.69, A.70, and A.71.

11. The following is required for the satisfactory completion of a flight review:
    a. A minimum of one hour of ground instruction which includes a review of the general operating procedures.
    b. A minimum of one hour of flight training that proves that the pilot can safely exercise the privileges of their pilot certificate.
    c. A logbook endorsement - 61-65H, A.65.
    d. NOTE: No indication of unsatisfactory performance needs to be recorded.

12. Flight instructor records. Must keep for three years the following:
    a. Name and date of any person the instructor has authorized to solo.
    b. Name and result of any person recommended for a practical or knowledge test.

**Presentation references:**

- FAR/AIM pt. 61.
- AC 61-65H.
- Private Pilot Airplane Multi-Engine Land ACS.
- Commercial Pilot Airplane Multi-Engine Land ACS.

**Key points:**

- Recognition of the different types of “currency” and which apply to you.
- Not everything needs to be logged, only things that are required to keep you flying.
- Familiarity with AC 61-65.
- Breakdown of what’s required for every practical test: Eligibility, Aeronautical, Flight proficiency, Aeronautical experience, Written exam completed.

**Risk Management - Teach how to identify, assess, and mitigate risks encompassing the following:**

In this instance, the risks are mostly associated with legal concerns and PIC /Passenger safety. They are as follows:

- Fraudulent logging of PIC / SIC time - (SIC in a C-172)

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- Inadequate time logging - Not enough details in an entry.
- Ensuring you're legal when you wish to go fly.
- Difference between legal and safe - Instrument currency, for example.
- Fraudulent or expired endorsements.

**Questions for the student:**

1. When does a pilot need to take a knowledge test when adding an additional class rating to their pilot certificate at the same level (private-private, for example)? (61.63)
2. How can you solo a person in an airplane if they hold a private pilot certificate in a helicopter? (61.31(d)(2.)
3. What is required to endorse a person for completing a flight review? 61.57.
4. What is required to give a complex endorsement to a pilot? 61.31(e.)

**Common errors:**

- Not understanding where to start in the regulations when a person holds a pilot certificate with a different category or class and that pilot wants to add a different category or class at the same level.
- Not understanding how to solo a pilot who does not hold the appropriate category or class rating on their pilot certificate.
- Under what conditions a pilot is able log PIC time.

**Completion Standards:**

1. The applicant can provide the training and endorsements required to solo a student pilot in a multi-engine airplane.
2. The applicant can determine the training and endorsements required for an initial Private or Commercial pilot certificate in a multi-engine airplane.
3. The applicant can determine the training and endorsements required to add an additional category or class rating to an existing pilot certificate at the same level.
4. The applicant can determine the training and endorsements required to issue a complex, high-performance, pressurized aircraft or tailwheel authorization.
5. The applicant can determine the training endorsement required for the satisfactory completion of a flight review.

CFI Bootcamp
Flight Instructor Training

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6. The applicant can describe the flight instructor record keeping requirements.

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# Straight-and-Level Flight

## Objective

To maintain a constant altitude and constant direction while keeping the airplane coordinated.

## Motivation

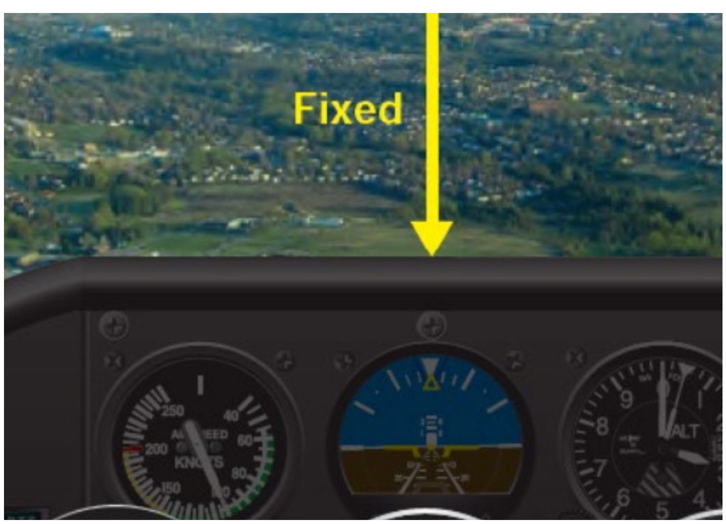
On most flights, the airplane spends the majority of the time in straight and level flight. This makes this maneuver an essential skill.

## Presentation (10min):

1. Definition - Constant altitude, constant direction, coordinated.
2. Setting the cowling 3 to 4 inches below the horizon - Constant Altitude.
3. Level horizon - No banking, equal spacing under left/right wingtips - Constant direction.
4. Not sliding left or right in the seat - Coordinated.
5. Altimeter = Altitude, Heading Indicator = Direction, Inclinometer = Coordination.
6. Trim to eliminate aerodynamic pressure - Set attitude then trim.

## Key Point:

- After setting the attitude - Cross check the altimeter so measures the results.
- The cowling won't be on the horizon in level flight - 4 inches below.



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## Questions for the Student:

1. How can you determine if the airplane is coordinated without using the inclinometer?
2. How can straight and level flight be verified?
3. How can straight and level flight be observed while looking outside?

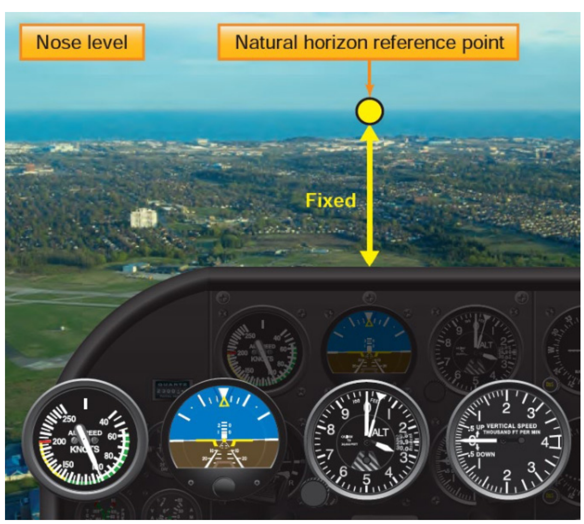
## Common Errors

- Failure to adequately clear the area.
- Failure to adequately anticipate the level-off.
- Failure to coordinate the flight controls.
- Failure to use visual cues and instrument indication in combination to achieve straight and level flight.
- Failure to scan for traffic.

## Completion Standards

At the end of this lesson, the student should understand the basic concepts of straight and level flight. The student should be able to perform this maneuver with the assistance of a flight instructor.

There are no required Airman Certification Standards (ACS) identified for straight and level flight. A proficient student pilot should be able to maintain altitude at +/- 100 feet and maintain a heading of +/- 10 degrees. Coordinated flight should be maintained. The pilot should also understand how to properly trim the airplane for straight and level flight.



# Level Turns

## Objective

To make a level turn at bank angles between 20 – 45 degrees while maintaining constant altitude, airspeed, and coordination.

## Motivation

Mastering this skill is part of a pilot's basic skills to control the airplane.

## Presentation (10min):

1. Aerodynamics of turning - VCL vs HCL, Load Factor, Need for additional lift.
2. Aileron controls bank angle. Relationship of the horizon to the cowling.
3. Elevator controls altitude - Needed to restore VCL. Measured with the ALT.
4. Throttle controls airspeed - Added elevator slows speed due to induced drag.
5. Rudder for coordination - Explain adverse yaw and rudder use in the turn.
6. If Yaw starts before bank established - SKID, Yaw opposite the turn - SLIP.
7. The pilot's outside view will be different between a right turn and a left turn.

## Key Points:

- Adverse yaw will be present during roll in and roll out. Stop it with rudder.
- Use Elevator to control altitude and power to control airspeed.
- The site picture from a left and right turn is different.

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## Questions for the Student:

8. How can a pilot compensate for adverse yaw?
9. Why is increased elevator back-pressure necessary to maintain altitude during a turn?
10. What is the primary flight control that controls the bank angle?

## Common Errors

- Failure to adequately clear the area before beginning the turn.
- Attempting to execute the turn solely by instrument reference.
- Attempting to lean, in relation to the turn, while turning, rather than sitting upright.
- Insufficient feel for the airplane as evidenced by the inability to detect slips/skids without reference to flight instruments.
- Fixating on the nose reference while excluding wingtip references.
- Holding unnecessary rudder in the turn.
- Gaining proficiency in turns in only one direction. (Usually the left)
- Failure to coordinate the use of throttle with other controls.
- Altitude gain/loss during the turn.

## Completion Standards

At the end of this lesson, the student should understand the basic concepts of medium bank turns. The student should be able to perform this maneuver with the assistance of a flight instructor. There are no required Airman Certification Standards identified for medium bank turns. A proficient student pilot should be able to maintain altitude at +/- 100 feet, bank angle +/- 5 degrees, and roll out on the desired heading within +/- 10 degrees. Coordinated flight should be maintained throughout.

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# Straight Climbs and Climbing Turns

## Objective:

To establish a climb at a constant airspeed and direction while keeping the airplane coordinated.

## Motivation:

Every flight involves a climb. As one of the four fundamentals of flying, mastering this skill is part of a pilot's basic skills to control the airplane.

## Presentation (10min):

1. Constant Airspeed or Rate? - Explain Vx and Vy.
2. Attitude - Cowling to horizon - Target Airspeed with pitch.
3. Sequence to start a climb - Power, Attitude, Trim.
4. Wings level with aileron, track straight ahead with rudder. ASI, ALT, HI, Ball.
5. Anticipate and correct for left-turning tendencies. - No side-to-side motion.

## Questions for the Student

1. What is the sequence for establishing a climb?
2. At full throttle, how can the climb airspeed be adjusted?
3. What is the definition of Vx and Vy?

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## Common Errors

- Failure to adequately clear the area
- Failure to adequately anticipate the level-off
- Failure to coordinate the flight controls
- Failure to use visual cues and instrument indication in combination to achieve straight and level flight.
- Failure to scan for traffic.

## Completion Standards

At the end of this lesson, the student should understand the basic concepts of normal climbs. The student should be able to perform this maneuver with the assistance of a flight instructor.

There are no required Airman Certification Standards (ACS) identified normal climbs. A proficient student pilot should be able to maintain airspeed +/- 10 knots and maintain a heading of +/- 10 degrees.

Coordinated flight should be maintained. The pilot should also understand how to properly trim the airplane for a constant airspeed climb.

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# Straight Descents and Descending Turns

## Objective:

To maintain a descent at a constant airspeed and constant direction to either an altitude or to a point on the ground while keeping the airplane coordinated.

## Motivation:

Every flight will have a descent. As one of the four fundamentals of flying, mastering this skill is part of a pilot's basic skills for controlling an airplane.

## Presentation (15min):

1. Constant airspeed or constant rate - Using the flight instruments ASI, VSI, ALT.
2. Reduction in power causes the airplane to keep the same trimmed airspeed, downwash is reduced, and a descent is started.
3. Relationship of the horizon to the cowling while descending.
4. The Point on the ground that isn't moving (where the airplane is going) and how to change it with faps, slipping, and power.
5. Sequence to start a descent: Power, Attitude, Trim - Pitch for airspeed, power for rate of descent. Maintain no side-to-side motion with rudder.
6. Describe descending to a point on the ground (aiming) vs descending to an altitude.

## Questions for the Student

1. How can a pilot determine where the airplane is aimed during a descent?
2. How can the pilot adjust airspeed during a descent?
3. What is the sequence to establish a descent?

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## Common Errors

- Failure to adequately clear the area.
- Inadequate back-elevator control during glide entry, resulting in too steep a glide.
- Failure to slow the airplane to the desired airspeed prior to lowering pitch attitude.
- Attempting to establish/maintain a descent solely by reference to flight instruments.
- Inability to sense changes in airspeed through sound and feel.
- Inability to stabilize the descent. (Chasing the airspeed indicator)
- Skidding or slipping during descending turns due to inadequate appreciation of the different rudder pressure requirements with and without power.

## Completion Standards

At the end of this lesson, the student should understand the basic concepts of normal descents. The student should be able to perform this maneuver with the assistance of a flight instructor. There are no required Airman Certification Standards (ACS) identified for normal descents. A proficient student pilot should be able to maintain airspeed at +/- 10 KIAS and maintain a heading of +/- 10 degrees. The pilot should be able to descend to a point on the ground using an appropriate combination of throttle and faps. Coordinated flight should be maintained. The pilot should also understand how to properly trim the airplane for a constant airspeed descent.

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# Rectangular Course

## Objective

To maintain a fixed distance from a rectangular course by compensating for wind drift.

## Motivation

These are the basic techniques to stop drift in the traffic pattern.

## Presentation (15min):

1. Determining wind direction and velocity - Dust, smoke, water, crops, wind circle.
2. The effects of wind on ground track and relation to a ground reference point.
3. Selection of features on the ground for the rectangular course, Adequate dimensions, (approx. 1nm legs), boundaries etc. Fly 1/4 to 1/2 mile from the boundaries and preselect emergency landing locations.
4. Entry/exit location, altitude (600-1000ft. AGL), and airspeed requirements of the maneuver.
5. (Below Va and slow enough to see wind drift)
6. The effects of bank angle and ground speed on rate and radius of turn. Relate this to each turn
7. and straight and level segment in the maneuver. (Demonstrate with a model airplane)
8. The relationship of rectangular course to the airport traffic pattern.

## Key Points:

- Determine the location and strength of the wind.
- Anticipate the crab or steepness of bank needed.
- Keep the airplane approximately 1/2 mile from the boundary of the course.

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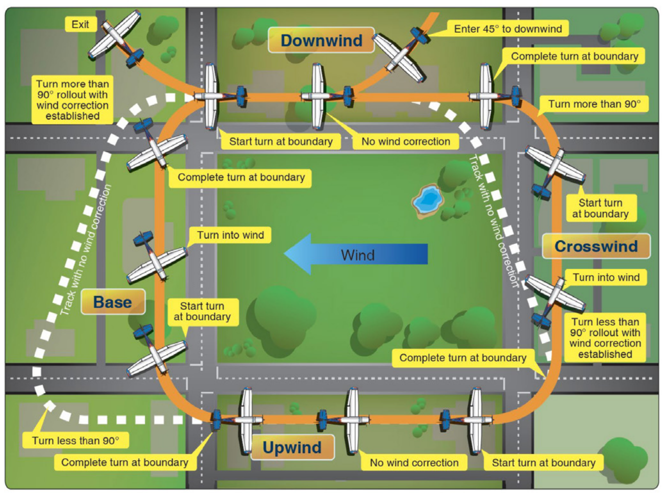
### Risk Management - Teach how to identify, assess and mitigate risks encompassing the folowing:

1. Collision avoidance, scanning, and obstacles.
2. Low altitude maneuvering.
3. Task management.
4. Failure to maintain aircraft control.
5. Failure to select a suitable emergency landing area.




### Questions for the Student:

1. In which turns will the greatest bank angle be required? Why?
2. On what legs will a crab be required to maintain ground track?
3. On the identified legs, which way will the airplane be crabbed?
4. What should the steepness of the bank be at each of the four corners?
5. How is the maneuver entered relative to the rectangular course legs?

### Common Errors

- Failure to adequately clear area.
- Failure to establish proper altitude prior to entry.
- Failure to establish proper wind correction angle, resulting in drift.

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- Gaining or losing altitude.
- Poor coordination. Slipping or skidding in turns.
- Abrupt control usage.
- Inability to divide attention between airplane control and maintaining ground track.
- Inadequate visual look out for other aircraft.

## Completion Standards

1. Determine the area is clear of terrain, obstacles, and other aircraft, and the aircraft will remain in the appropriate airspace.
2. Select a suitable ground reference.
3. Identify a suitable emergency landing area.
4. Plan the maneuver:
    a. Rectangular course: enter a left or right pattern, 600 to 1,000 feet above ground level (AGL) at an appropriate distance from the selected reference area, 45° to the downwind leg.
5. Apply adequate wind drift correction during straight and turning flight to maintain a constant ground track if around a rectangular reference area or to track a constant radius turn on each side of the selected reference line or a selected point.
6. Divide attention between airplane control, traffic avoidance and the ground track while maintaining coordinated flight.
7. Maintain altitude ±100 feet; maintain airspeed ±10 knots or as recommended by aircraft manufacturer to a safe maneuvering altitude.

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# S-Turns Across a Road

## Objective

To perform two opposite direction level 180 degree turns of equal radius across a road, with the wings becoming level when crossing the road.

## Motivation

This maneuver provides a greater understanding of wind correction during non-straight and level conditions.

## Presentation (15min):

1. Determine the wind direction and velocity - Dust, smoke, water, crops, wind circle.
2. Selection of a road perpendicular to the wind of adequate length. (Long enough to do at leasttwo 180 degree turns). Preselect emergency landing locations.
3. Define two half circles on each side of the road. Enter downwind first turn to the left (Steepest bank). The radius should be enough to allow the plane to be level just as it passes over the road.
4. Entry/exit location, altitude (600- 1000 ft. AGL), and airspeed requirements of the maneuver. (Below Va and slow enough to see wind drift)
5. Show effects of bank angle and ground speed on rate and radius of turn. Relate this to each turn and straight and level segment in the maneuver. Wings should just become level as the road is crossed. (Demonstrate with model airplane)
6. Where to exit the maneuver. (After at least two turns have been made)

## Key Points:

- The higher the ground speed, the greater the bank angle needed.
- Bank angle is used to produce the necessary wind-drift correction.
- Bank angle and roll rates will always be changing.

## Risk Management - Teach how to identify, assess and mitigate risks encompassing the folowing:

1. Collision avoidance, scanning, and obstacles.

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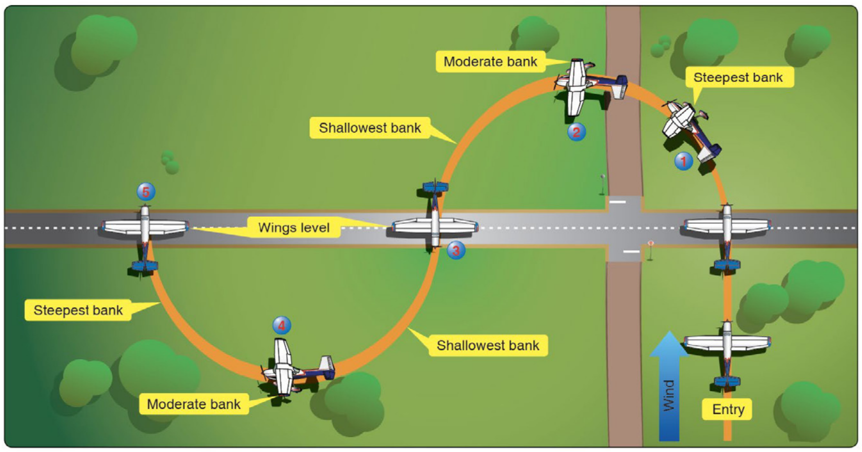
2. Low altitude maneuvering.
3. Task management.
4. Failure to maintain aircraft control.
5. Failure to select a suitable emergency landing area.




## Questions for the Student:

1. How long should the airplane be straight and level when reaching the road?
2. Is the required bank angle high or low when the ground speed is high?
3. In the diagram above, in which positions will the wind correction angle be greatest?
4. At what points during the maneuver will the bank angle and roll rates be highest?

## Common Errors

- Failure to adequately clear the area.
- Poor coordination.
- Gaining or losing altitude.
- Inability to visualize the half-circle ground tracks.
- Poor timing in beginning and recovering from turns.
- Faulty correction for drift.
- Inadequate visual lookout for other aircraft.

## Completion Standards

1. Determine the area is clear of terrain, obstacles, and other aircraft, and the aircraft, will remain in the appropriate airspace.
2. Select a suitable ground reference.
3. Identify a suitable emergency landing area.
4. Plan the maneuver.
5. Enter perpendicular to the selected reference line, 600 to 1,000 feet AGL at an appropriate distance from the selected reference area.
6. Apply adequate wind drift correction during straight and turning flight to track a constant radius turn on each side of the selected reference line or a selected point.
7. Reverse the turn directly over the selected reference line.
8. Divide attention between airplane control, traffic avoidance and the ground track while maintaining coordinated flight.
9. Maintain altitude ±100 feet; maintain airspeed ±10 knots or as recommended by aircraft manufacturer to a safe maneuvering altitude.

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# Turns Around a Point

## Objective

To maintain a fixed distance from a point on the ground during a 360-degree turn.

## Motivation

To gain a better understanding of wind drift while turning.

## Presentation (30min):

1. Determine the wind direction and velocity - Dust, smoke, water, crops, wind circle.
2. Selection of a pylon. (Point on the ground - easy to distinguish) Preselect emergency landing
3. locations.
4. Enter downwind first turn to the left (Steepest bank). The radius should be approximately 1/2 mile. The radius is determined by the bank used when turning downwind. If the wind is strong the maximum 45-degree bank angle sets the radius.
5. Entry/exit location, altitude (600 - 1000 ft. AGL), and airspeed requirements of the maneuver.
6. (Below Va and slow enough to see wind drift)
7. Show effects of bank angle and ground speed on rate and radius of turn. Point out that the wing will only be on the pylon when directly downwind or upwind. The plane will be crabbing by banking at other times so the wing will either be in front of or behind the pylon. (Demonstrate with model airplane)
8. Where to exit the maneuver. (Downwind the 360-degree turn has been made)

## Key Points:

- **Higher ground speed necessitates a steeper bank angle and a higher roll rate.**
- **The point on the ground is referred to as a “pylon”.**
- **The wing position in relation to the pylon will change throughout the maneuver.**

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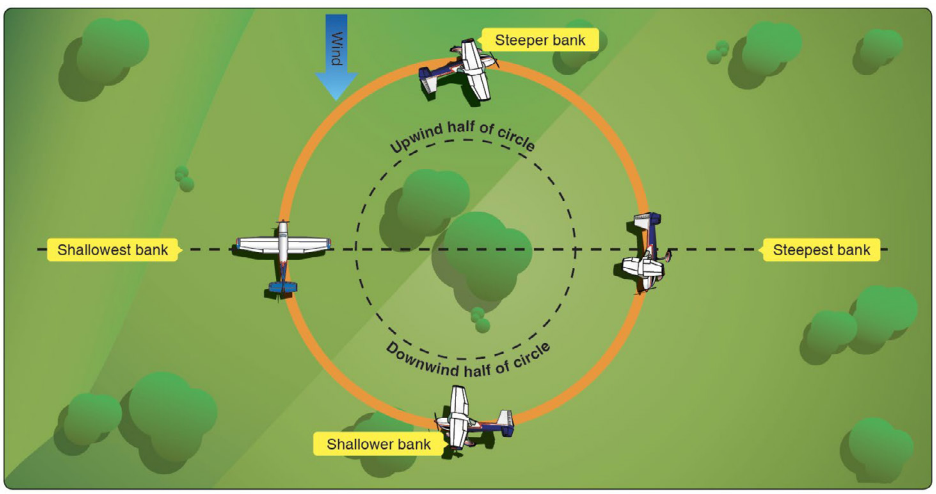
**Risk Management - Teach how to identify, assess and mitigate risks encompassing the folowing:**

1. Collision avoidance, scanning, and obstacles.
2. Low altitude maneuvering.
3. Task management.
4. Failure to maintain aircraft control.
5. Failure to select a suitable emergency landing area.




**Questions for the Student:**

1. At which point in the circle will the bank angle be the least steep? Why?
2. Where is the pilot's line of sight relative to the point on the ground throughout the maneuver?
3. Where in the turn will the wing be on the pylon?
4. What is the maximum bank angle that can be used during this maneuver?

**Common Errors**

- Failure to adequately clear area.
- Failure to establish appropriate bank angle upon entry.
- Failure to recognize wind drift.
- Excessive bank angle and/or inadequate wind correction angle on the downwind side of the circle, resulting in drift towards the reference point.

- Inadequate bank angle and/or excessive wind correction angle on the upwind side of the circle, resulting in drifting away from the reference point.
- Skidding turns when turning from downwind to crosswind.
- Slipping turns when turning from upwind to crosswind.
- Gaining or losing altitude.
- Inadequate visual lookout for other aircraft.
- Inability to direct attention outside the airplane while maintaining precise airplane control.

## Completion Standards

1. Determine the area is clear of terrain, obstacles, and other aircraft, and the aircraft will remain in the appropriate airspace.
2. Select a suitable ground reference.
3. Identify a suitable emergency landing area.
4. Plan the maneuver:
5. Enter a left or right pattern, 600 to 1,000 feet above ground level (AGL) at an appropriate distance from the selected reference area, 45° to the downwind leg.
6. Apply adequate wind drift correction during straight and turning flight to maintain a constant ground track if around a rectangular reference area or to track a constant radius turn on each side of the selected reference line or a selected point.
7. Divide attention between airplane control, traffic avoidance and the ground track while maintaining coordinated flight.
8. Maintain altitude ±100 feet; maintain airspeed ±10 knots or as recommended by aircraft manufacturer to a safe maneuvering altitude.

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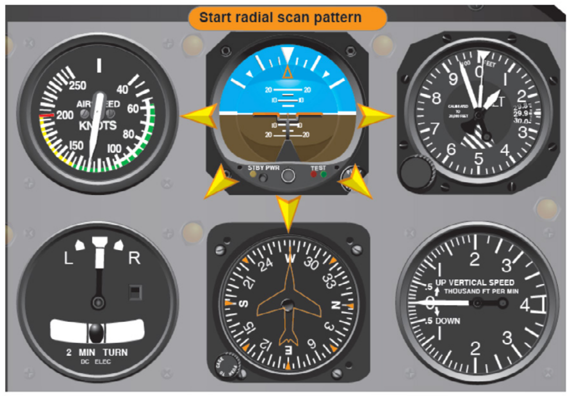
# Basic Instrument Maneuvers




## OBJECTIVE

To be able to control and maneuver the airplane around the three axes (Roll, Pitch and Yaw) by using the flight instruments.

## MOTIVATION

Being able to perform straight-and-level flight, climbs and descents at a constant airspeed, and especially turns to headings, is a vital set of skills necessary for any set of conditions. For example, unforecasted weather, runway issues, loss of radar or missed approaches are happening, and ATC requires you to climb to an altitude and enter a hold.

## PRESENTATION: 20 MINUTES

1. Flight instruments used in attitude instrument flight
2. Deciding on whether to you control and performance or primary and supporting method.
3. Instrument cross check – Scanning techniques:
    a. Selected radial cross check
    b. Inverted-V cross check
    c. Rectangular cross check
    d. Cross check errors – Omission and Fixation
4. Instrument interpretation

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a. Pilot decides if the instruments show the desired performance specific to the airplane. Example: Attitude indicator at 7 degrees pitch up in a 172 would be about 80 knots and 600 ft/min at sea level. In a jet this could be 250 knots and 2,500 ft/min at sea level.

5. Normal and abnormal instrument indications and operations.

## CONTROL AND PERFORMANCE METHOD

1. Aircraft performance is achieved by controlling the aircrafts attitude and power.
2. Control Instruments – Attitude Indicator and Power Instruments (Tach, MAP)
3. Performance Instruments – Indicate the actual performance of the aircraft via the altimeter, air-speed indicator and VSI.
4. Navigation Instruments – Indicate the position of the aircraft with reference to a fix. Can include – course indicators, range indicators, glideslope indicators and bearing pointers.
5. Procedure:
   a. Set an attitude and power that will deliver the performance you desire.
   b. Trim the airplane
   c. Cross-check to see that the airplanes performance is what is expected.
   d. Make throttle and attitude adjustments based upon the cross-check.

## PRIMARY AND SUPPORTING METHOD:

1. Instruments are grouped as they relate to control function and aircraft performance as pitch control, bank control, power control and trim.
2. The primary instrument for pitch control, bank control, power control and trim position is whichever instrument gives the most direct measurement of it. Altimeter for example, during straight and level flight for pitch, Heading Indicator for bank control, Airspeed indicator for power control.
3. Images for using Primary and Supporting method are shown in the Instrument Flying Handbook Chapter 7.

## RISK MANAGEMENT

4. Situations that affect physiology and degrade instrument cross-check.
5. Spatial disorientation and optical illusions.

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6. Flying unfamiliar airplanes or operating with unfamiliar flight display systems and avionics.

## COMPLETION STANDARDS

1. Maintain altitude +/-100 feet during level flight, selected headings +/-10 degrees, airspeed +/- 10 knots, and bank angles +/- 5 degrees during turns.
2. Use proper instrument cross-check and interpretation and apply the appropriate pitch, bank, power and turn corrections when applicable.

## RELATED IMAGES

**Round Gauge Flight Instruments - Typical**


**EFIS equipped airplane showing analog instrument replacements**

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**Cross Check Techniques:**

Radial Cross-Check

**Inverted-V Cross-Check**

**Rectangular Cross-Check**

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**Control and Performance Method:**
Pitch Instruments

**Bank Instruments**

Power Instruments

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**Trim Instruments**

**Control and Performance Method:**
Pitch Instruments


Climb entry for a constant airspeed climb

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## Stabilized climb at a constant airspeed


## Stabilized climb at a constant rate


## Level off at cruising airspeed

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## A Change of Airspeed During Turns

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# Recovery from Unusual Flight Attitudes


## OBJECTIVE

To be able to recognize when an airplane is in a dangerous attitude and return it to controlled flight.

## MOTIVATION

Recognizing an unusual attitude can prevent loss of aircraft control.

## PRESENTATION: (10min):

1. Unusual attitude definition: Any bank angle or nose high or nose low attitude not commanded for normal flight
2. Factors that can cause an unusual attitude:
    a. Physiological – Fatigue, boredom, stress
    b. System and equipment failures – Vacuum system, Electrical system, Individual instrument or equipment failures or malfunctions – Pitot/Static failures.
    c. Environmental factors – Turbulence, Icing, Heating/AC issues
3. Procedures for recovering from an unusual attitude:

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a. Nose-high:
   i. Lower the pitch attitude to the horizon.
   ii. Apply full throttle.
   iii. Level the wings.
b. Nose-low:
   i. Power: Idle.
   ii. Level the wings.
   iii. Raise the pitch attitude to the horizon.
c. Attitude indicator can topple – Use Airspeed Indicator, Altimeter, and Turn coordinator if the Attitude Indicator is not reliable or suspected to be unreliable.

## RISK MANAGEMENT

1. Situations that could lead to loss of control or unusual flight attitudes:
   a. Stress
   b. Task saturation
   c. Distractions
2. Failure to recognize an unusual flight attitude and follow the proper recovery procedure.
3. Exceeding the operating envelope during the recovery

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## COMPLETION STANDARDS

1. Use proper instrument cross-check and interpretation to identify and unusual attitude (including both nose-high and nose-low), and apply the appropriate pitch, bank, and power corrections, in the correct sequence, to return to a stabilized level flight attitude.

## RELATED IMAGES

Unusual Attitude – Nose-High


Unusual Attitude – Nose-Low

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