THE COMPLETE CFI BINDER

FOR INITIAL FLIGHT INSTRUCTOR CERTIFICATION

CESSNA 172-RG

1

PREFACE

INTRODUCTION

WELCOME TO THE COMPLETE CFI BINDER

This publication was engineered for flight instructor applicants, current aviation instructors, and even airline pilots who instruct on the side. The Complete CFI Binder contains all essential study material for every testable subject area found in the FAA Certification Standards. The Complete CFI Binder Series contains the essential teaching and study material for every single testable subject area in the CFI course.

The Complete CFI Binder Series is comprised of the individual lesson plans required by the CFI FAA Certification Standards. Each lesson plan contains all the source material required to study and teach each lesson to both the FAA Examiner and your future students. All content needed to study and teach is built directly inside The Complete CFI Binder. Having all source material located within one single CFI Binder eliminates the need for additional study resources and the act of conducting your own individual research to build your own CFI Binder. Everything that a CFI applicant would need is at your fingertips.

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2

FUNDAMENTALS OF INSTRUCTION

LESSON PLAN

ATTENTION

I HAVE A PROBLEM STUDENT... HE JUST DOESN'T GET IT! I have tried to teach him in every way that I know how to teach, but he just isn't making any progress. I remember when I studied FOI there were a bunch of methods that I could use to help me thought this.

MOTIVATION

I'M A PILOT... FOI is totally not my cup of tea! WHY DO I NEED TO LEARN THIS? FOI is one of the most important pieces of the CFI Course. The FOI lesson teaches a CFI applicant many important facets of the teaching world. These are key areas of operation that aren't developed as a pilot unless you've taken teaching courses in your past.

OBJECTIVE OVERVIEW

The Fundamentals of Instruction lesson exists to present the instructor applicant with new information that places a primary emphasis on how to teach and how learning occurs. At the completion of the FOI's lesson, the applicant shall demonstrate that he or she has instructional knowledge on the areas of operation listed within this lesson plan.

LESSON CONTENT

LESSON PLAN

HUMAN BEHAVIOR

Definition of Human Behavior

Definition of Learning

- Personality Types
- Compatibility
- Instructor and Student Relationship

Human Needs and Motivation

- Maslow's Hierarchy of Needs

Human Nature and Motivation

- Douglas McGregor's Theories

Human Factors that Inhibit Learning

- Defense Mechanisms

Emotional Reactions

- Anxiety
- Normal Reactions to Stress
- Abnormal Reactions to Stress
- Instructor Actions Regarding Seriously Abnormal Students

EFFECTIVE COMMUNICATION

Basic Elements of Communication

- Source
- Symbols
- Receiver

Effective Instructor/Student Communication

- Abilities
- Attitudes
- Experiences

Barriers to Effective Communication

- Lack of Common Experience
- Confusion Between Symbols and Symbolized Object
- Overuse of Abstractions

LESSON PLAN

- Interference

Developing Communication Skills
- Role Playing
- Instructional Communication
- Listening
- Questioning
- Instructional Enhancement

THE LEARNING PROCESS

What is Learning

Learning Theory
- Behaviorism
- Cognitive Theory
- Information Processing Theory Information
- Constructivism
- Higher Order Thinking Skills - (HOTS)
- Scenario-Based Training - (SBT)

How we Perceive the Environment
- Sight - 75% Usage
- Hearing - 13% Usage
- Touch - 6% Usage
- Taste - 3% Usage
- Smell - 3% Usage

Factors that Affect Perceptions
- Physical Organism
- Goals and Values
- Self-Concept
- Time and Opportunity (Basic Need)
- Element of Threat

Insights

Acquiring Knowledge
- Memorization
- Understanding
- Application

Thorndike's Laws of Learning
- Readiness
- Effect
- Exercise
- Primacy
- Intensity
- Recency

Domains of Learning
- Cognitive Domain - The Basic Levels of Learning - (Thinking)
- Affective Domain - (Feeling)
- Psycho-Motor Domain - (Doing)

Characteristics of Learning
- Purposeful
- Result of Experience
- Multifaceted
- Active Process

Learning Styles
- Visual
- Auditory
- Kinesthetic Learners

Hemispheric Dominance
- Holistic/Serialist Theory

Acquiring Skill Knowledge
- Cognitive State
- Associative Stage
- Automatic Response

Learning Plateaus

Types of Practice
- Deliberate
- Blocked
- Random

Over-Learning of Knowledge

Multitasking
- Importance
- Attention Switching
- Simultaneous Performance
- Distractions and Interruptions
- Fixation and Inattention
- Scenario-Based Training - (SBT)

Errors
- Slip - (An Error of Action)
- Mistake - (An Error of Thought)

LESSON PLAN

Motivation

Maintaining Motivation
- Rewarding Success
- Present New Challenges
- Drop in Motivation

The Memory System
- Sensory Register
- Short Term Memory - (STM)

Information Retention

Forgetting
- Retrieval Failure
- Fading
- Interference
- Repression/Suppression

Threats Preventing Memory Retention

Retention of Learning
- Praise Stimulates Learning
- Recall is Promoted by Association
- Favorable Attitudes Aid Retention
- Learning with All Senses is Most Effective
- Meaningful Repetitions Aid Recall
- Mnemonics

Transfer of Learning
- Habit Formation
- How Understanding Affects Memory
- Sources of Knowledge

Building Blocks of Learning
- Extraneous Periods of Instruction
- Student Confidence
- The Blocks
- Training

THE TEACHING PROCESS

Teaching Defined

Essential Teaching Skills
- People Skills
- Subject Matter Expert
- Management Skills
- Assessment Skills
- Instructor's Code of Conduct

Course of Training

Lesson Preparation
- Overall Objective
- Decision Based Objective
- Performance Based Objectives
- Standards

Presentation and Lesson Organization
- Introduction
- Attention
- Motivation
- Overview
- Conclusion

Training Delivery Methods
- The Lecture
- The Discussion
- Guided Discussion
- E-Learning
- Computer Assisted Learning
- Flight Simulator
- Cooperative or Group Learning
- Demonstration-Performance Method
- Drill and Practice Method

Problem Based Learning
- Higher Order Thinking Skills - (HOTS)
- Scenario Based Training - (SBT)
- Case Study Method

Instructional Aid Theory

Enhanced Training Materials

Key Definitions
- Course of Training
- Curriculum
- Training Course Outline
- Syllabus

Steps of the Teaching Process
- Preparation
- Presentation

LESSON PLAN

- Application
- Review and Evaluation

ASSESSMENT & CRITIQUE

Purpose of Assessment

Characteristics of Effective Assessment

- Objective
- Flexible
- Acceptable
- Comprehensive
- Constructive
- Organized
- Thoughtful
- Specific

Written Assessment Characteristics

- Reliability
- Validity
- Usability
- Objectivity
- Comprehensiveness
- Discrimination

Types of Assessment

- Written Assessment
- Authentic Assessment
- Collaborative Assessment

Critique and Oral Assessment

- Instructor/Student Critique
- Student-Led Critique
- Small Group Critique
- Individual Student Critique by Another Student
- Self Critique
- Written Critique
- Oral Assessment

Characteristics of Effective Questions

- Objective Questions
- Types of Questions to Avoid
- Answering Questions

RESPONSIBILITIES & PROFESSIONALISM

Flight Instructor Responsibilities

- Helping Students Learn
- Maintaining Student Interest
- Providing Adequate Instruction
- Determining Adequate Standards of Performance
- Emphasizing the Positive
- Minimizing Student Frustration

Instructional Responsibilities

- Adventure
- Physiological Student Obstacles
- Ensuring Proper Skill Set

Required Special Emphasis Areas

Aviator's Code of Conduct

Safety and Accident Prevention

Professionalism

Characteristics of a Good CFI

- Sincerity
- Acceptance of the Student
- Personal Appearance and Habits
- Demeanor
- Proper Language

Evaluation of Student Ability

- Demonstrated Ability
- Keeping the Student Informed
- Correction of Student Error

Professional Development

CFI Accountability Regarding Flight Exams

- Knowledge Tests
- Practical Tests

TECHNIQUES OF INSTRUCTION

Learning Obstacles During Flight Training

- Unfair Treatment
- Impatience
- Worry or Lack of Interest
- Physical Issues

LESSON PLAN

Demonstration/Performance Training
- Explanation Phase
- Demonstration Phase
- Student Performance/Instructor Supervision
- Evaluation Phase

Telling Doing Technique of Instruction
- Instructor Tells - Instructor Does
- Student Tells - Instructor Does
- Student Tells - Student Does
- Student Does - Instructor Evaluates

Positive Exchange of Flight Controls

Sterile Cockpit Rules

Usage of Distractions

Integrated Flight Instruction
- Developing Habit Patterns
- Operating Efficiency
- Procedures
- See and Avoid
- Accident Statistics

Assessment of Piloting Ability
- Demonstrated Ability
- Post-Flight
- First Solo
- Pre-Solo Debrief
- Correction of Student Error
- Pilot Supervision
- Dealing With Normal Challenges
- Visualization
- Practice Landings
- Practical Test Recommendation

Aeronautical Decision Making

The Decision Making Process
- Define the Problem
- Choose a Course of Action
- Implement the Decision and Evaluate the Outcome

Factors Affecting Decision Making
- Stress Management
- Recognizing Hazardous Attitudes

Use of Resources
- Internal
- External
- Workload Management

RISK MANAGEMENT

Defining Risk Management
- Risk
- Hazard
- Safety

Principles of Risk Management
- Accept No Unnecessary Risk
- Make Risk Decisions At Appropriate Level
- Accept Risk Only When Benefits Outweigh The Costs
- Integrate Risk Management Into Planning At All Levels

Risk Management Process
- Step 1 - Identify the Hazard
- Step 2 - Assess the Risk
- Step 3 - Analyze Risk Control Measures
- Step 4 - Make Control Decisions
- Step 5 - Implement Risk Controls
- Step 6 - Supervise and Review

Implementing the Risk Management Process
- Apply Steps in Sequence
- Maintain a Balance in the Process
- Apply the Process in a Cycle
- Involve People in the Process

Levels of Risk
- Risk Level Measurements By Assessing Risk
- Risk Management Models
- Likelihood of an Event
- Severity of an Event

Mitigating Risk
- IMSAFE Checklist
- PAVE Checklist

LESSON PLAN

Three P-Model for Pilots
The 5-P Checklist

Situational Awareness

What is it
Obstacles to Maintaining Awareness
Operational Considerations

PLANNING INSTRUCTIONAL ACTIVITY

Develop Objectives and Standards for a Training Course

Objectives
Standards
Overall Objective

Theory of the Building Blocks of Learning

Requirements for Developing a Training Syllabus

Using a Training Syllabus

Purpose of a Lesson Plan

Characteristics of a Lesson Plan

Unity
Content
Scope
Practicality
Flexibility
Instructional Steps

Developing a Scenario Based Lesson

FOI STUDY GUIDE OUTLINE

SCHEDULE

Each Lesson: Discussion 1:30

Each Lesson: Questions 0:30

STUDENT ACTIONS

Take Notes

Ask Questions

INSTRUCTOR ACTIONS

Teach the Student the Required Material

Evaluate the Student

EQUIPMENT

Whiteboard

Aeronautical Information Manual (AIM)

Aviation Instructor Handbook

COMPLETION STANDARDS

To determine that the applicant exhibits adequate instructional knowledge of the elements which relate to the content which is taught in this lesson.

REFERENCES

FAA-H-8083-9A - Aviation Instructor Handbook

IMAGE CREDIT FOR THIS CHAPTER

FAA-H-8083-9A - Aviation Instructor Handbook

FAA - Washington, DC

HUMAN BEHAVIOR

DEFINITION OF HUMAN BEHAVIOR

The study of Human Behavior is an attempt to explain how and why humans function the way that they do.

DEFINITION OF LEARNING

Learning is the acquisition of knowledge or understanding of a subject or skill through education, experience, practice, or study; ***a change of behavior results from learning***.

PERSONALITY TYPES

As instructors, we must determine what type of personality our student has, so that we can communicate and effectively teach the student; therefore, each student will have a different learning style.

COMPATIBILITY

Students whose learning styles are compatible with the teaching styles of an instructor tend to retain information longer, apply it more effectively, learn more, and have a more positive attitude toward the course in general.

INSTRUCTOR AND STUDENT RELATIONSHIP

The student must accept the instructor, if the student does not accept the instructor, learning cannot take place.

HUMAN NEEDS AND MOTIVATION

Human needs are things all humans require for normal growth and development. When acquiring a new student, it is vital to understand WHY they want to learn to fly. This way the instructor can properly meet the teaching needs of each student's personal aviation goals.

MASLOW'S HIERARCHY OF NEEDS

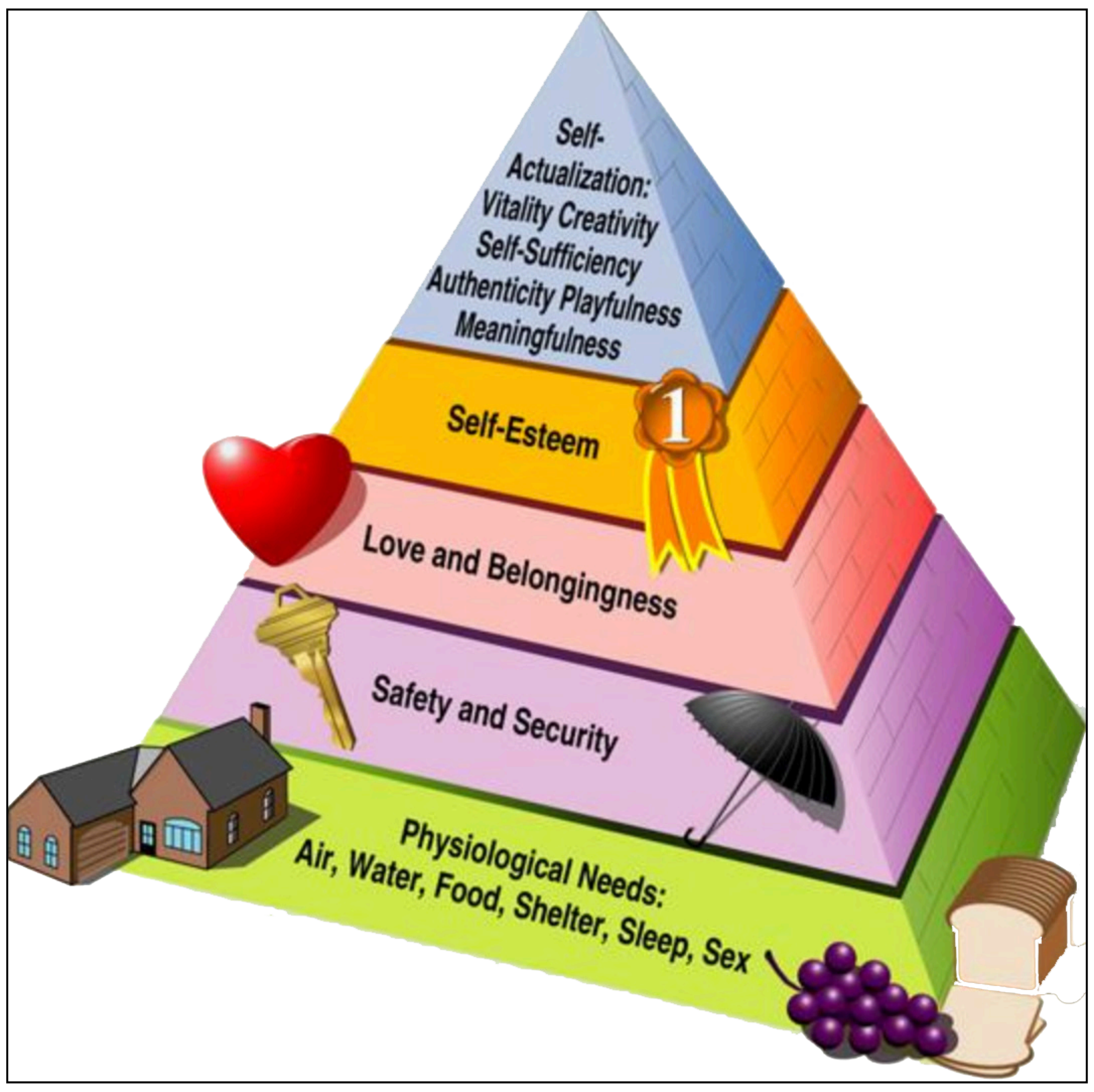
PHYSIOLOGICAL

These are biological needs, and consist of the need for air, food, water, and maintenance of the human body. Unless these biological needs are met, a person cannot concentrate on learning.

SECURITY

Humans have the need to feel safe. Security needs are about keeping oneself from harm. If a student does not feel safe, he or she cannot concentrate on learning.

Figure 2.2.1 Maslow's Hierarchy



Credit: FAA-H-8083-9 (Aviation Instructors Handbook)

BELONGING

When individuals are physically comfortable and do not feel threatened, they seek to satisfy their social needs of belonging. Instructors should make every effort to help new students feel at ease and should reinforce their decision to pursue a career or hobby in aviation.

HUMAN BEHAVIOR

ESTEEM

Humans have a need for a stable, firmly based, high level of self-respect and respect from others. High self-esteem results in self-confidence, independence, achievement, competence, and knowledge.

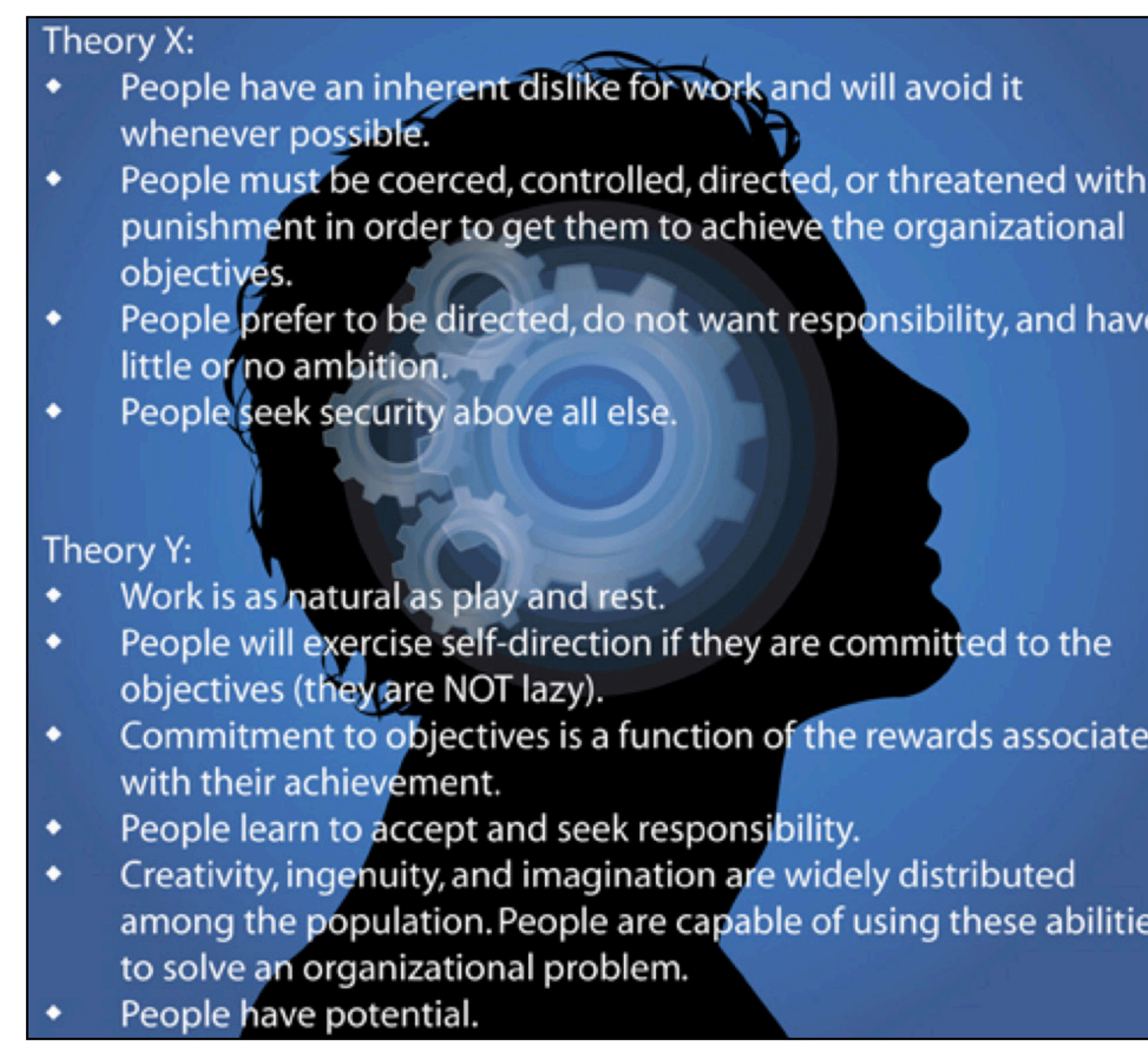
SELF-ACTUALIZATION

A person's desire for self-fulfillment. The need to be and do what the individual feels he or she was born to do.

HUMAN NATURE AND MOTIVATION

Human nature refers to the general psychological characteristics, feelings, and behavioral traits shared by all humans.

Figure 2.2.2 McGregor's Theory X and Theory Y



Credit: FAA-H-8083-9 (Aviation Instructors Handbook)

DOUGLAS MCGREGOR'S THEORIES

THEORY (X)

Theory X assumes that management's role is to coerce and control employees because people need control and direction. They have an inherent dislike for work, avoid it whenever possible, and must be coerced, controlled, directed, or threatened with punishment in order to get them to achieve the objectives.

THEORY (Y)

Work is as natural as play and rest. The average person does not inherently dislike work. Depending on conditions, work may be a source of satisfaction and, if so, it is performed voluntarily.

HUMAN FACTORS THAT INHIBIT LEARNING

DEFENSE MECHANISMS

Are exhibited subconsciously, and do not occur on purpose. They tend to distort, transform, or can otherwise falsify reality.

REPRESSION

A person locks away uncomfortable thoughts into inaccessible areas of the unconscious mind.

If a person cannot mentally handle a situation, he or she may choose to pretend like it didn't happen or in other words, repress the event. The individual will hope that he or she will forget the event, and not have to deal with it at all. ***A student pilot may have a repressed fear of flying that inhibits his or her ability to learn to fly.***

DENIAL

The refusal to accept an external reality because it is too threatening. The process of "minimizing" a situation, or playing it down.

HUMAN BEHAVIOR

COMPENSATION
The process of psychologically counterbalancing perceived weaknesses by emphasizing the individuals strength in other areas. A student will often attempt to disguise the presence of a weak or undesirable quality by emphasizing a more positive one. *Switching attention from one task to another.*

PROJECTION
An individual places his or her own unacceptable impulses onto someone else. *Often blaming someone or something else for the outcome.*

RATIONALIZATION
Subconscious technique for justifying actions that otherwise would be unacceptable. *Making an attempt to accept why something has happened, and mentally talking your self into acceptance.*

REACTION FORMATION
Caused by a person "believing" something that isn't a reality, because the persons true thoughts or feelings about the topic causes them anxiety. The person may say or do something, but do the total opposite when the opportunity presents itself.

FANTASY
Fantasy occurs when a student engages in daydreams about how things should be, rather than doing anything about how things actually are. The student uses his or her imagination to escape from reality into a fictitious world — typically a world of success or pleasure.

DISPLACEMENT
Results in the unconscious shift of emotion, affect, or desire, from the original object to a more acceptable, less threatening substitute; violent behavior, or physical violence can be associated with displacement.

EMOTIONAL REACTIONS

ANXIETY
Anxiety is a feeling of worry, nervousness, or unease, often about something that is going to happen. Normally, an event with an uncertain outcome.

Anxiety can be good or bad. Anxiety before a check-ride, can encourage study. But too much anxiety, can potentially have adverse effects.

Anxiety can be countered by reinforcing the students' enjoyment of flying and by teaching them to cope with their fears. An effective technique is to treat fears as a normal reaction, rather than ignoring them.

NORMAL REACTIONS TO STRESS
Normal individuals begin to respond rapidly and exactly, within the limits of their experience and training. The affected individual thinks rationally, acts rapidly, and is extremely sensitive to all aspects of the surroundings.

3

AEROMEDICAL FACTORS

LESSON PLAN

ATTENTION

I FEEL STRANGE... SOMETHING JUST DOESN'T FEEL RIGHT. I am flying west of Aspen, Colorado at 16,500′ MSL in a Cirrus SR-22TN and I am using supplemental oxygen. I think maybe I may be suffering from Hypoxic Hypoxia. Learning about Aeromedical Factors is critical to safe operation of the aircraft and perhaps even your survival.

MOTIVATION

At 16,500′ MSL while flying over the rockies on your way to Las Vegas, Nevada. You are flying in hard IMC at night, IFR. You're using Supplemental O2, but you just don't feel right. You realize that you are definitely starting to feel the affects of Hypoxic Hypoxia. You know this because you just finished reviewing Aeromedical Factors and were able to quickly identify the symptoms of Hypoxia. Realizing there is a problem with the O2 system. You descend to a lower altitude and land, saving the day.

OBJECTIVE OVERVIEW

The objective of this lesson is to explain the effects and/or various factors that affect the body while in flight, and how to recognize and properly manage these events.

LESSON CONTENT

LESSON PLAN

MEDICAL CERTIFICATION

Aviation Medical Examiner - (AME)
- Apply For The FAA Medical

Statement of Demonstrated Ability - (SODA)

Useful Information To Know

Quick Reference Regs

Various Types of Medical Certificates
- Certificate Validity

FAA Basic Med
- Basic Requirements
- Revoked, Suspended, or Withdrawn Medical Certificates
- Limitations
- Ongoing Eligibility Requirements

Helpful Aopa Links

STUDENT PILOT CERTIFICATE

Integrated Airman Certification & Rating Application (IACRA)
- Student Pilot Certificate Application
- Medical/Certificate Endorsement Changes

DANGERS OF HYPOXIA

What Is Hypoxia
- Hypoxic Hypoxia
- Hypemic Hypoxia
- Stagnant Hypoxia
- Histotoxic Hypoxia
- Fulminating Hypoxia

Symptoms of Hypoxia

Ways to Treat Hypoxia

LESSON PLAN

Time of Useful Consciousness

HYPERVENTILATION

What is Hyperventilation
Common Symptoms
Treating Hyperventilation

SENSORY SYSTEMS OF THE BODY

Primary Sensory Systems
The Visual System
The Vestibular System
The Somatosensory System

SPATIAL DISORIENTATION

Spatial Disorientation Training

Preventing Spatial Disorientation

Types of Unusual Attitudes
Climbing while Accelerating
Climbing while Turning
Diving while Turning
Tilting to the Left or Right
Reversal of Motion
Diving or Rolling Beyond the Vertical Plane

VESTIBULAR AND OPTICAL ILLUSIONS

Vestibular Illusions
The Leans
Coriolis Illusion
Graveyard Spin
Graveyard Spiral
Somatogravic Illusion

Optical Illusions
Water Refraction
Haze
Fog
Featureless Terrain Illusion
Ground Lighting Illusions

Visual Illusions
Empty-Field Myopia
Autokinesis
False Horizon

Types of Runway Illusions
Width Illusion
Slope Illusion

MIDDLE EAR AND SINUS PROBLEMS

Illness + The Free Gas Law

Ear Block

Middle Ear Problems
During a Climb
During a Descent

Sinus Block

Good Information to Know

MOTION SICKNESS & CO POISONING

Motion Sickness
"Vestibular Disorientation"

CO Poisoning
Why CO Poisoning is Deadly

Supplemental Oxygen Requirements

STRESS, FATIGUE AND DEHYDRATION

Three Types of Stress
Physical
Physiological
Psychological

Types of Fatigue
Acute
Chronic

DEHYDRATION

IMPORTANCE OF SLEEP

Why is Sleep Important
NREM Sleep
REM Sleep

Stages of Sleep

LESSON PLAN

Stage I
Stage II
Stage III
Stage IV

Napping and Sleep Inertia

Why Do We Sleep

Homeostatic Influence
Circadian Rhythm

DRUGS & ALCOHOL (IMSAFE)

Drugs

Alcohol

Information You Should Know

DECOMPRESSION SICKNESS (DCS)

Causes of DCS

Type I (Non-Life Threatening)
Type II (Life Threatening)

Scuba Diving Waiting Period

At or Below PALT of 8,000'
At or Above PALT of 8,000'
Dive with a Controlled Ascent

SCHEDULE

Discussion: 1:30

Questions: 0:30

STUDENT ACTIONS

Take Notes Ask Questions

INSTRUCTOR ACTIONS

Teach The Student The Required Material

Evaluate The Student

EQUIPMENT

Whiteboard

Student Pilot Certificate & Medical Examples

COMPLETION STANDARDS

Upon lesson completion, the student should have adequate knowledge on the various factors that pose a safety risk in-flight, and should know how to mitigate such risks. The student will also be able to determine whether or not, they are fit for flight.

REFERENCES

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

FAA-H-8083-3B - Airplane Flying Handbook

Aeronautical Information Manual

IMAGE CREDIT FOR THIS CHAPTER

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

FAA-H-8083-3B - Airplane Flying Handbook

http://encyclopedia.lubopitko-bg.com

MEDICAL CERTIFICATION

AVIATION MEDICAL EXAMINER - (AME)

Each airman exercising the privileges of flight (excluding a CFI who is providing instruction to an already certificated pilot) must hold some type of Medical Certificate.

APPLY FOR THE FAA MEDICAL

Obtaining a Medical Certificate is serious business. **Being DENIED for a Medical Certificate is a potentially life-impacting event.** Before encouraging a student to "Go Get the Medical" a caring and courteous instructor will have a discussion with the applicant to ensure that they do not have any major roadblocks, which could potentially prevent the student from obtaining the Medical Certificate.

- **Find an AME to obtain a Medical Certificate by visiting the FAA website.**
- **Visit the FAA MedExpress Website to apply for the Medical Certificate.**
- Have a look at the FAQ's listed on the FAA website which can help a Student Pilot through the seemingly complicated process of obtaining their first Medical Certificate.

STATEMENT OF DEMONSTRATED ABILITY - (SODA)

Having a medical problem is not always a GAME OVER event. In certain cases, it may be possible to obtain a Statement of Demonstrated Ability (SODA) Waiver.

This waiver may be granted to a person who does not meet the applicable standards of FAR Part 67. The SODA can be withdrawn, at the discretion of the Federal Air Surgeon, at any time.

USEFUL INFORMATION TO KNOW

- A Flight Instructor does not need a Medical Certificate to provide instruction to a student, provided the instructor is NOT acting a Pilot-In-Command of the aircraft. ***An example: Providing a Private Pilot with CFII Instruction.***
- A CFI needs a minimum of a 3rd Class Medical to act as Pilot-In-Command.
- A LSA Pilot does NOT need a Medical, a Driver License (DL) is used in lieu of a Medical Certificate.
- If an applicant was recently denied for a Medical Certificate. They cannot fly under FAA BasicMed, nor can they use their Driver License in lieu of the medical for a Sport Pilot Cert.

QUICK REFERENCE REGS

- **FAR §67** - This part prescribes the medical standards and certification procedures for issuing medical certificates for airmen and for remaining eligible for a medical certificate.
- **FAR §61.23** - Medical Certifications: Requirements and Duration.

VARIOUS TYPES OF MEDICAL CERTIFICATES

There are several different types of traditional Medical Certificates that are issued based on the type of flying

MEDICAL CERTIFICATION

privileges the pilot will exercise. Typically, a Student Pilot will obtain a Third Class Certificate from his or her AME to be afforded Solo privileges, then Private Pilot Privileges (once the practical has been passed).

CERTIFICATE VALIDITY

It's important to remember that when an FAA Medical Certificate expires. The certificate never changes. The only thing that changes are the privileges which are allowed to be exercised. ***Reference FAR Part §61.23 for more details.***

	MEDICAL TYPE	AIRMAN AGE	PRIVILEGES	EXPIRATION
MEDICAL CERTIFICATES	FIRST CLASS	UNDER 40	ATP	12 MONTHS
		OVER 40	ATP	6 MONTHS
		ANY AGE	COMMERCIAL	12 MONTHS
		UNDER 40	PRIVATE / RECREATIONAL	60 MONTHS
		OVER 40	PRIVATE / RECREATIONAL	24 MONTHS
	SECOND CLASS	ANY AGE	COMMERCIAL	12 MONTHS
		UNDER 40	PRIVATE / RECREATIONAL	60 MONTHS
		OVER 40	PRIVATE / RECREATIONAL	24 MONTHS
	THIRD CLASS	UNDER 40	PRIVATE / RECREATIONAL	60 MONTHS
		OVER 40	PRIVATE / RECREATIONAL	24 MONTHS
	FAA BASIC MED	HAVE OR HAVE HELD MEDICAL AFTER 15 JULY 2006	PRIVATE / RECREATIONAL	48 MONTHS (24 MONTHS TRAINING)

FAA BASIC MED

Third Class Medical Reform was signed into law on July 15, 2016. On January 10, 2017 the FAA published a final rule, based on the legislation, setting May 1 as the effective date.

BASIC REQUIREMENTS

You must have previously been issued an FAA Medical Certificate from an authorized AME. Even if it has expired (assuming that it has not lapsed more than 10 years before July 15, 2016).

REVOKED, SUSPENDED, OR WITHDRAWN MEDICAL CERTIFICATES

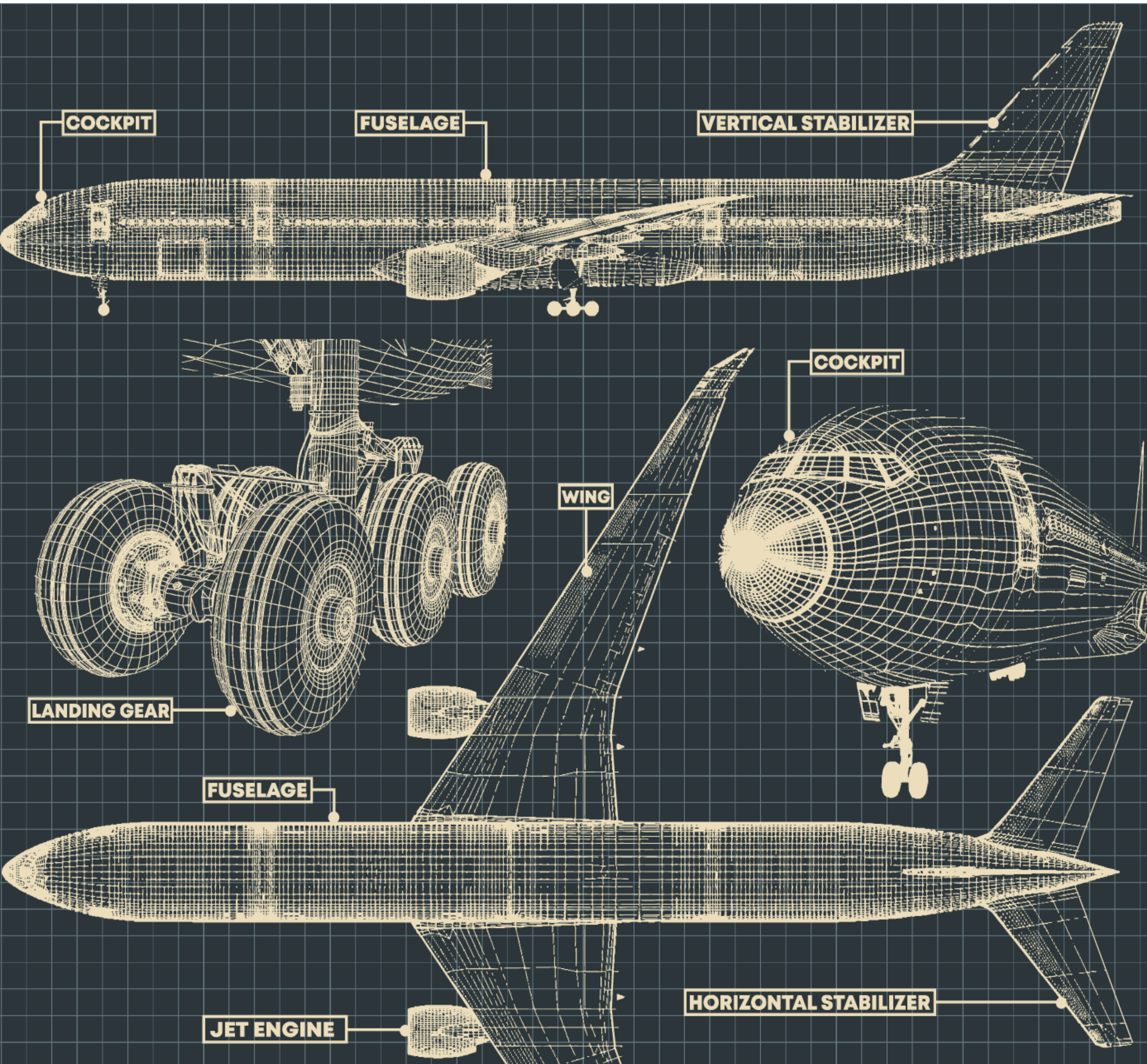
Pilots whose most recent medical certificate has been revoked, suspended, or withdrawn, had his or her most recent application denied, or authorization for special issuance withdrawn, will need to obtain a new medical certificate before they can operate under BasicMed.

LIMITATIONS

FAA Basic Med allows pilots flying under the new rules to operate "covered aircraft" defined as having **MGTOW of not more than 6,000 pounds** and are authorized to carry not more than **6 occupants** which are operated while carrying up to five passengers in addition to the pilot in command, at altitudes up to **18,000 feet MSL** and at an airspeed of up to **250 KIAS**.

6

PRINCIPLES OF FLIGHT



LESSON PLAN

ATTENTION

It's a hot day mid summer. You've decided to take three of your friends flying in a Cessna 172-R with a 160 HP Engine. You topped off the tanks and were barely overweight. You take off and fly for about an hour. It gets hotter and the plane just doesn't want to climb very well. You head back to the airport and enter the Traffic Pattern at 6,800′ MSL. As you make the base-to-final turn. You get uncoordinated and the airplane stalls.

MOTIVATION

In the scenario mentioned above. We can see how quickly things can go wrong. Knowing how to fix these problems with only seconds to make a decision is absolutely essential. It can be... Life or Death... In the Principles of Flight lesson. You will be taught some of the most basic, yet fundamental aerodynamic principles.

OBJECTIVE OVERVIEW

To acquire knowledge of the fundamental physical laws governing the forces acting on an aircraft in flight, and what affect these natural laws and forces have on performance characteristics.

LESSON CONTENT

LESSON PLAN

LIFT THEORY PRODUCTION

The Lift Equation

The Four Forces of Flight

- Lift
- Weight
- Thrust
- Drag

How an Airplane Turns

Bank vs Rate of Turn

- The Slip
- The Skid

Rate of Turn

Radius of Turn

Non-Compressible Aerodynamics - Low Speed

- Subsonic to Mach 0.30

Compressible Aerodynamics - High Speed

- Transonic Mach 0.80 to 1.20
- Supersonic Mach 1.0 Plus
- Hypersonic

GROUND EFFECT AND TIP VORTICES

Ground Effect Explained

Wingtip Vortices

AIRFOIL DESIGN

Description of an Airfoil

Airfoil Planform

Aspect Ratio

- High Aspect Ratio
- Low Aspect Ratio

Taper Ratio

Elliptical Wing

LESSON PLAN

Rectangular Wing

Swept Wing
- Critical Mach Number
- Shock Wave
- Spanwise Flow

Pressure Differential
- Negative Pressure (Low)
- Positive Pressure (High)

Center of Pressure
- High Angle of Attack
- Low Angle of Attack

General Definitions
- Wing Camber
- Leading Edge
- Trailing Edge
- Relative Wind
- Chord Line
- Mean Aerodynamic Chord
- Static Point
- Center of Pressure (CP)
- Angle of Attack (AOA)
- Angle of Incidence

LOW-ALTITUDE AERODYNAMIC STALLS

Aerodynamic Stall Defined
- Stall Development
- Stall Occurrence
- Visual Evidence

HIGH-ALTITUDE AERODYNAMIC STALLS

What is Different from a Low Altitude Stall
- Thinner Air
- Lower Indicated Airspeed
- Higher True Airspeed

The Total Drag Curve

Maximum Altitude
- Maximum Certified Altitude (Structural)
- Thrust Limited Altitude (Thrust)
- Buffet or Maneuver Limited Altitude (aerodynamic)

Mach Number Defined

Critical Mach Number
- Speed of Sound Decreases with Cold Air

Coffin Corner

Mach Tuck

Resources for Further Study

SPINS - AN UNCOORDINATED STALL

What is a Spin

Cross-Controlled Stall

Spin Recovery Procedure

LOAD FACTOR AND AIRCRAFT DESIGN

Effects of Load factor

Maneuvering Speed - (VA)

Axis of the Aircraft
- Lateral Axis - (Pitch)
- Longitudinal Axis - (Roll)
- Vertical Axis - (Yaw)
- Center of Gravity

STABILITY AND CONTROLLABILITY

Aircraft Stability

Design Compromise

Longitudinal Stability
- Stability About the Lateral Axis (Pitch)
- Maintaining Aircraft Balance

Lateral Stability
- Stability About the Longitudinal Axis (Roll)

Directional Stability
- Stability About the Vertical Axis (Yaw)

LEFT TURNING TENDENCIES

Torque Effect
- Involves Newton's Third Law

Spiraling Slipstream

LESSON PLAN

Gyroscopic Precession

P-Factor

SCHEDULE

Discussion: 1:30

Questions: 0:30

STUDENT ACTIONS

Take Notes

Ask Questions

INSTRUCTOR ACTIONS

Teach the Student the Required Material

Evaluate the Student

EQUIPMENT

Model Airplane

Whiteboard

COMPLETION STANDARDS

The lesson is complete when the student demonstrates an understanding of the forces acting on an aircraft, both in flight, and on the ground.

The student should be able to discuss the structure of the atmosphere, theories in the production of lift, airfoil design, and wingtip vortices.

REFERENCES

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

FAA-H-8083-3B - Airplane Flying Handbook

Aeronautical Information Manual

IMAGE CREDIT FOR THIS CHAPTER

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

LIFT THEORY PRODUCTION

NON-COMPRESSIBLE AERODYNAMICS - LOW SPEED

SUBSONIC TO MACH 0.30

- An incompressible flow is a flow in which density is constant in both time and space. Effects of compressibility are more significant at speeds close to or above the speed of sound.

COMPRESSIBLE AERODYNAMICS - HIGH SPEED

TRANSONIC MACH 0.80 TO 1.20

- Transonic Mach refers to a range of velocities just below and above the local speed of sound (generally taken as Mach 0.80–1.20).
- It is defined as the range of speeds between the critical Mach number, when some parts of the airflow over an aircraft become supersonic, and a higher speed, typically near Mach 1.20, when all of the airflow is supersonic. Between these speeds, some of the airflow is supersonic, and some is not.

SUPERSONIC MACH 1.0 PLUS

- Supersonic Mach involves flow speeds greater than the speed of sound. Supersonic flow behaves very differently than subsonic flow. Fluids react to differences in pressure. Pressure changes are how a fluid is "told" to respond to its environment.
- Because sound is in fact an infinitesimal pressure difference propagating through a fluid, the speed of sound in that fluid can be considered the fastest speed that "information" can travel in the flow. This difference most obviously manifests itself in the case of a fluid striking an object. In front of that object, the fluid builds up a stagnation pressure as the impact with the object brings the moving fluid to rest.
- In fluid traveling at subsonic speed, this pressure disturbance can propagate upstream, changing the flow pattern ahead of the object and giving the impression that the fluid "knows" the object is there and is avoiding it.
- When the fluid finally strikes the object, it is forced to change its properties – temperature, density, pressure, and Mach number—in an extremely violent and irreversible fashion called a shock wave.

Figure 6.2.6 Shell Oil Video

Shell Oil - Transonic Flight
This video aids in the understanding of High-Speed Aerodynamics in the Transonic Regime. Video by Shell Oil. Can be found on You Tube at:
https://youtu.be/bELu-if5ckU?t=45s

HYPERSONIC

- In aerodynamics, hypersonic speeds are speeds that are highly supersonic.
- In the 1970s, the term generally came to refer to speeds of Mach 5 (5 times the speed of sound) and above. The hypersonic regime is a subset of the supersonic regime.
- Hypersonic flow is characterized by high temperature flow behind a shock wave, viscous interaction, and chemical dissociation of gas.

AIRFOIL DESIGN

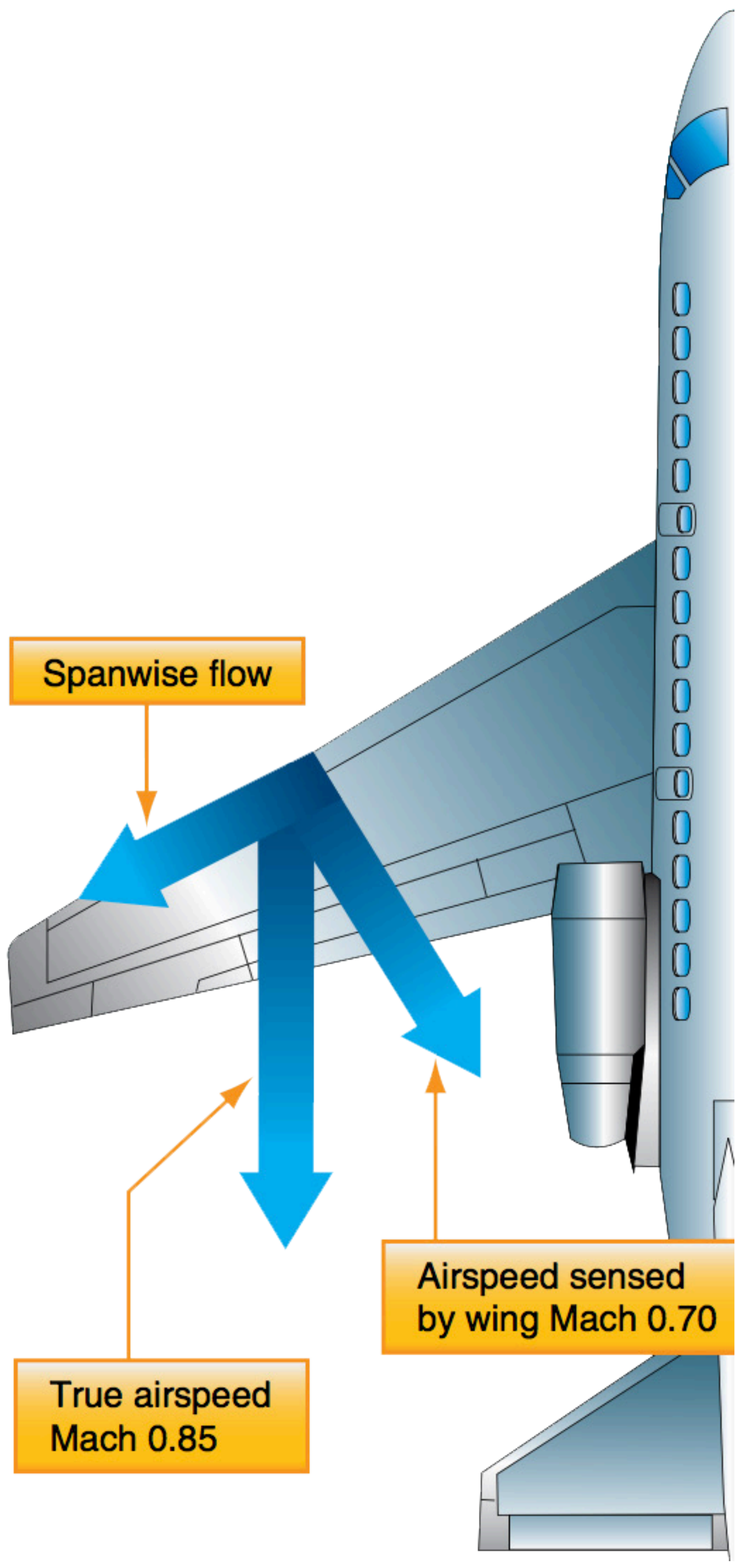
RECTANGULAR WING

The rectangular wing has a tendency to stall first at the wing root and provides adequate stall warning, adequate aileron effectiveness, and is usually quite stable. **It is, therefore, favored in the design of low cost, low speed airplanes.**

SWEPT WING

The primary purpose of a swept-back wing is to reduce the Critical Mach Number. This becomes especially important when flying at close to supersonic speeds (Mach .80 and above). Even though the aircraft may be traveling at say, Mach .80. The air accelerating over the wings can reach supersonic speeds above Mach 1.

Figure 6.4.2 Swept Wing



Credit: FAA-H-8083-25B (PHAK)

CRITICAL MACH NUMBER

The Critical Mach Number is the speed where air flowing over the wing first reaches Mach 1. *Watch the video by **Shell Oil** on Transonic Flight for a better understanding of the importance of ^{M}CRIT and Supersonic Airflow.*

SHOCK WAVE

As air slows down below Mach 1, a shock wave forms, as these air waves are moving at sonic speeds. This means that the pressure waves are unable to move forward through the supersonic airflow being generated by the wings. So they build up into a large shock wave (or pressure wave).

The shock wave creates a massive amount of drag. A pressure boundary is formed, which depletes energy from the airflow, causing more drag. The airflow can lose enough energy that airflow separation can occur.

SPANWISE FLOW

Swept wings prevent wave drag by delaying the onset of supersonic flow. This is accomplished by reducing the amount of air acceleration over the wing.

On a traditional rectangular wing aircraft, all airflow over the wing travels parallel to the aircraft's chord line. However, on a swept wing aircraft, only some of the air flows parallel to the chord line. The other part flows perpendicular to the chord line; this perpendicular flow is called spanwise flow.

Only the air flowing parallel to the chord line will accelerate. So, by reducing the amount of air flowing parallel to the chord line, acceleration is reduced, thus delaying the Critical Mach Number. ***A disadvantage is that the wingtips will stall before the wing-root.***

LOW-ALTITUDE AERODYNAMIC STALLS

AERODYNAMIC STALL DEFINED

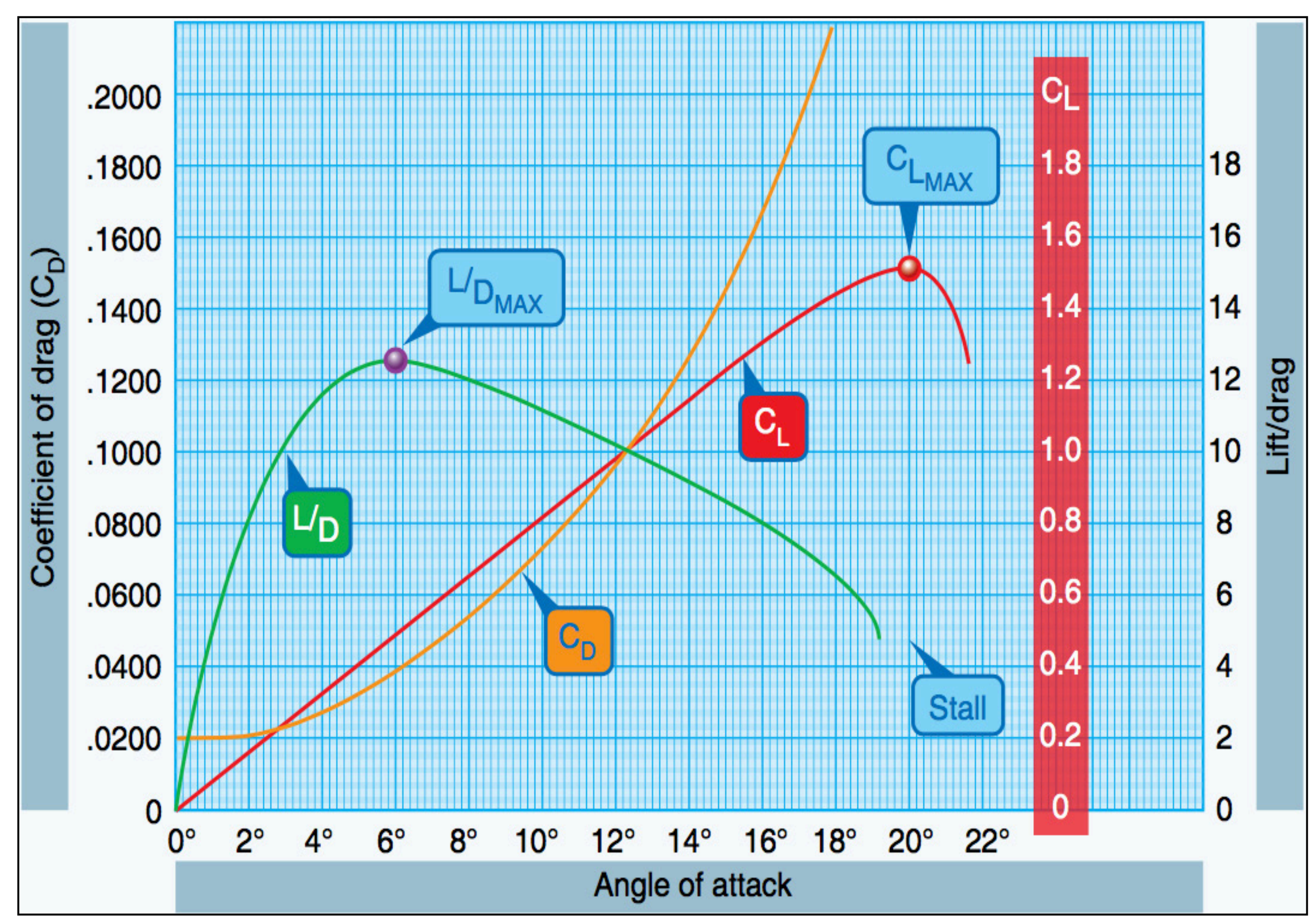
An aerodynamic stall can be defined as a condition that occurs when an increase in the angle of attack will result in a decrease in the CL. As a result, the Critical Angle of Attack is exceeded and the wing can no longer produce lift.

STALL DEVELOPMENT

A stall will occur any time the Critical Angle of Attack is exceeded on a wing. The following items can and will contribute to inducing an initial stall or even a secondary stall:

- Reduction in Airspeed.
- Increase in Load Factor.
- Increase in AOA (Exceeding Critical AOA).

Figure 6.5.2L/D Chart



Credit: FAA-H-8083-25B (PHAK)

STALL OCCURRENCE

When flying under normal conditions, the boundary layer on the wing will separate near the trailing edge of the airfoil. However, when the AOA exceeds approximately 18° - 20° (known as CL-MAX), the air-stream can no longer stay attached to the wing to produce lift.

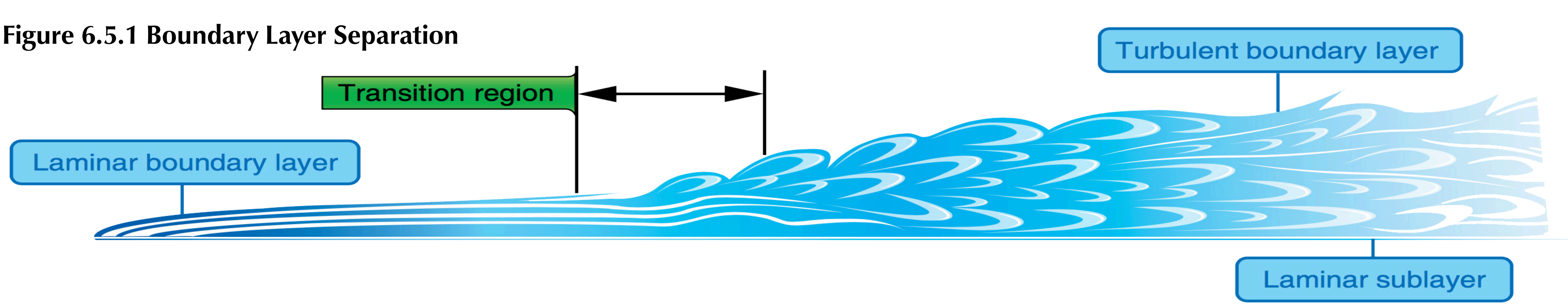
Past the Critical AOA. The airflow beings to tear off the wing, which causes the stall. At this point, identifying the stall impending stall can be identified by a buffet, stall horn, or the aircraft's inability to continue normal flight.

- The speed of the air-stream is moving too slow over the wing.
- The speed of the air-stream is moving too fast over the wing (High Speed Aerodynamics).
- The Critical Angle of Attack of the wing has been exceeded. This is the point at which lift can no longer be created.

VISUAL EVIDENCE

When looking at an L/D chart, which indicates degrees of angle of attack, boundary layer separation occurs in a straight line between 18° and 20° of AOA on the CL curve.

Figure 6.5.1 Boundary Layer Separation



Credit: FAA-H-8083-9A (Aviation Instructors Handbook)

HIGH-ALTITUDE AERODYNAMIC STALLS

WHAT IS DIFFERENT FROM A LOW ALTITUDE STALL

THINNER AIR

As an aircraft ascends into the flight levels. The air becomes much thinner or less-dense above. At lower altitudes, the air is much thicker, or more-dense. At lower altitudes, the aircraft is much more responsive than at higher altitudes, because of the thicker air.

At these higher altitudes, because of the thinner air. The engines (assuming turbo-fan) produce less thrust, the wing produces less lift, the flight controls are less-effective to pilot input, the aircraft is slower to accelerate, and slower to climb.

LOWER INDICATED AIRSPEED

As you climb higher into the troposphere, indicated airspeed decreases significantly (in comparison to true airspeed). Because flight control effectiveness is a function of Indicated Airspeed (actual air moving over the controls) the pilot will experience an overall decrease in aircraft responsiveness.

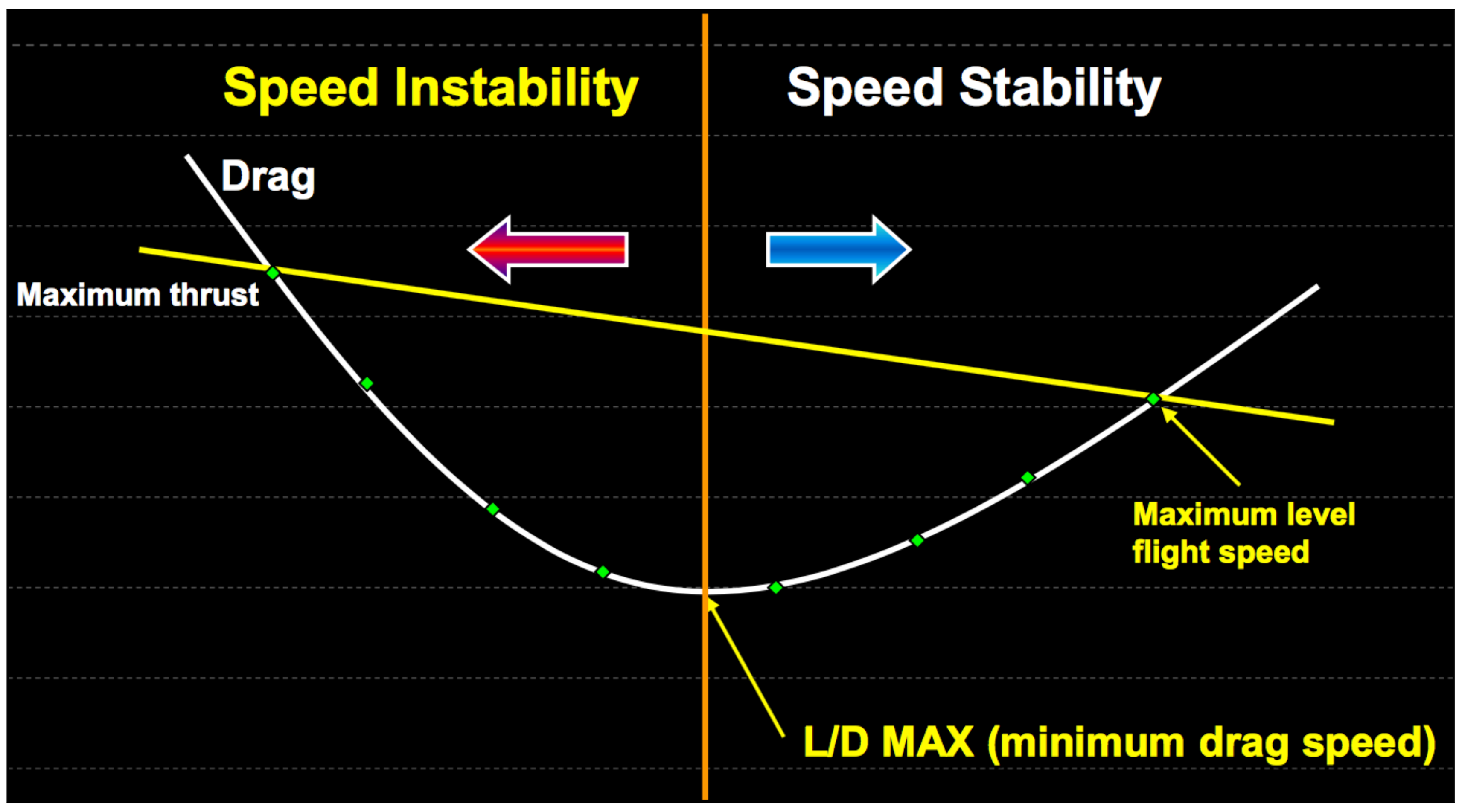
HIGHER TRUE AIRSPEED

Indicated Airspeed is reduced substantially at higher altitudes. True Airspeed does the opposite. True Airspeed increases with altitude. Which is why at high altitudes, you may be indicating 250 KIAS but be doing 440 KTAS.

THE TOTAL DRAG CURVE

The total drag curve has two primary components. Induced Drag and Parasite Drag. They play a major role in High-Altitude Aerodynamics.

Figure 6.6.1 Drag Curve



Credit: FAA.GOV

- Induced drag is a by-product of lift. It's greatest at low speeds and high angles of attack.
- Conversely, Parasite Drag increases proportionately to the square of the aircraft speed. Total drag at any given speed is the sum of these two components.
- Minimum drag occurs where Induced and Parasite Drag intersect (L/D MAX). The speed at which these two types of drag intersect is called Minimum Drag Speed (^{V}IMD) and will vary as a function of aircraft weight.
- To fly slower than ^{V}IMD requires a greater Angle of Attack (AOA) and a greater increase in thrust to compensate for the increase in drag caused by the increased Angle of Attack. AOA can be increased to a point where there is insufficient thrust available to maintain level flight, or until reaching the wing's Critical Angle of Attack (which ever comes first).
- Conversely, increasing speed above ^{V}IMD requires a reduction in the AOA to maintain level flight. More thrust is required to offset the increase in parasitic drag produced due to the additional speed required to enable the wing to generate the equivalent amount of lift at a lower AOA. At speeds above ^{V}IMD, the aircraft is in stable flight. At speeds below ^{V}IMD the aircraft is in unstable flight (nearing the back side of the power curve).

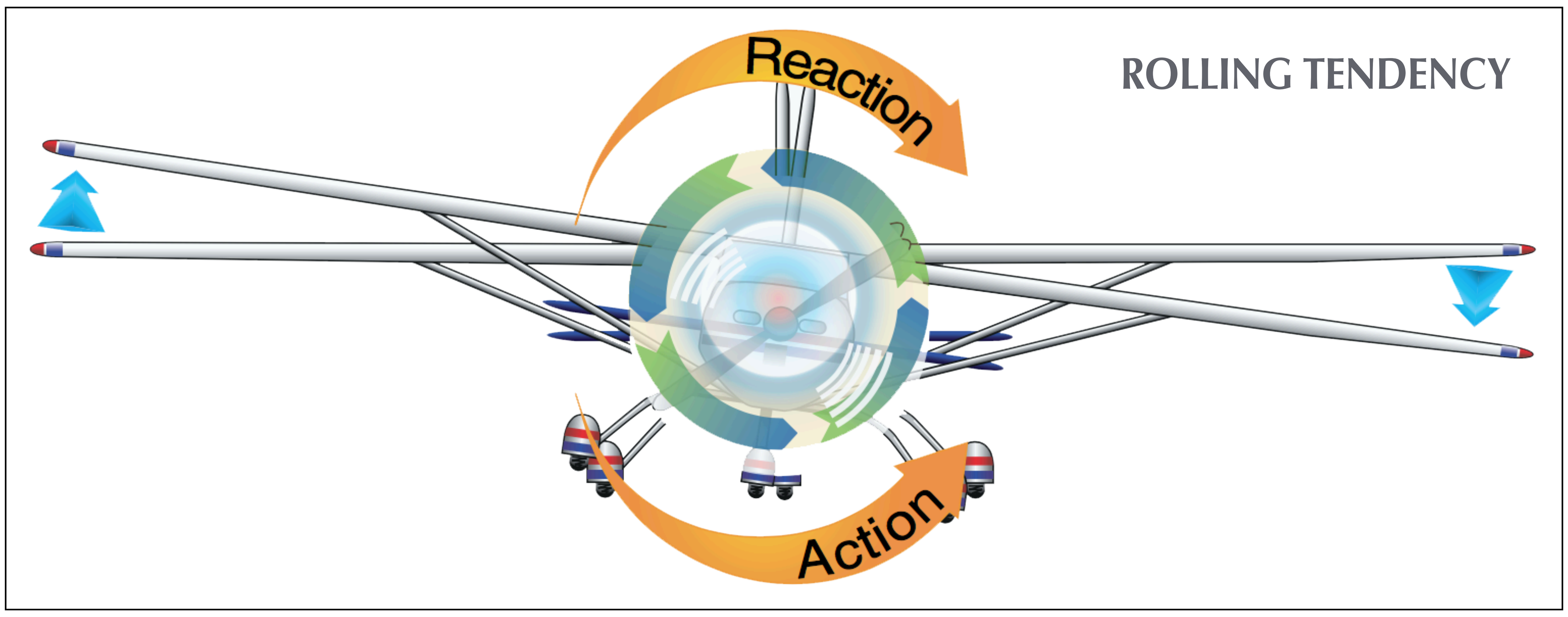
LEFT TURNING TENDENCIES

TORQUE EFFECT

INVOLVES NEWTON'S THIRD LAW

- **When the propeller turns one direction, the aircraft will roll in the opposite direction.**
- Most propellers turn to the right, causing the airplane to turn left. Manufacturers build in compensation for torque (usually in the engine mount), but the turning tendency is still felt in a climb.
- During the takeoff roll the right-turning direction of your engine and propeller forces the left side of the aircraft downward toward the runway. When the left side of the aircraft is forced downward onto the runway, the left tire has more friction with the ground than the right tire, thus turning the aircraft to turn left.

Figure 6.10.1 Torque Effect

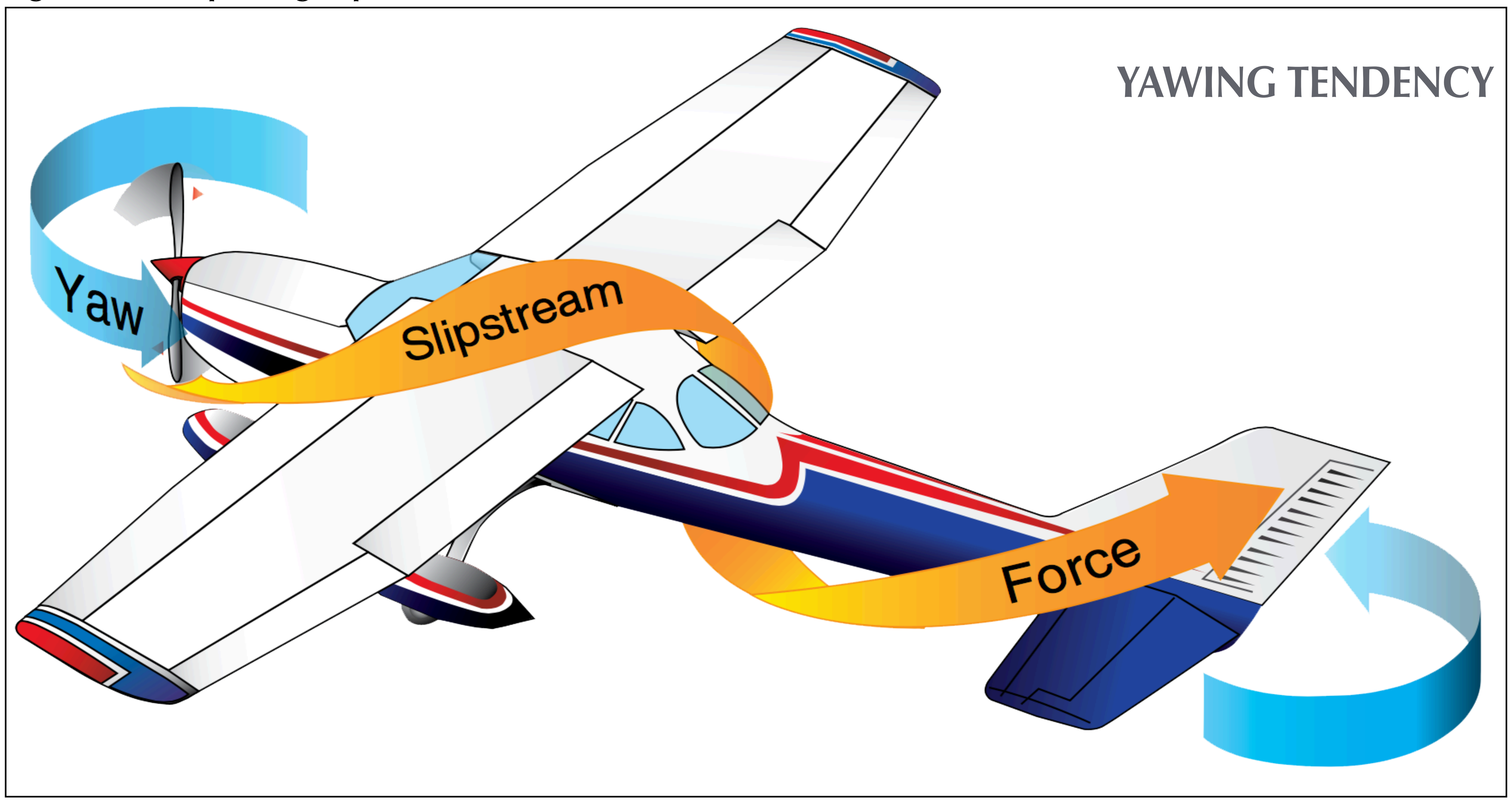


Credit: FAA-H-8083-25B (PHAK)

SPIRALING SLIPSTREAM

- **Wind blown aft by the propeller spirals around the aircraft, then strikes the left side of the vertical stabilizer.**
- This causes the tail to swing right and the nose to yaw left. A climb compresses the spiral causing it to be felt to a greater degree.

Figure 6.10.2 Spiraling Slipstream

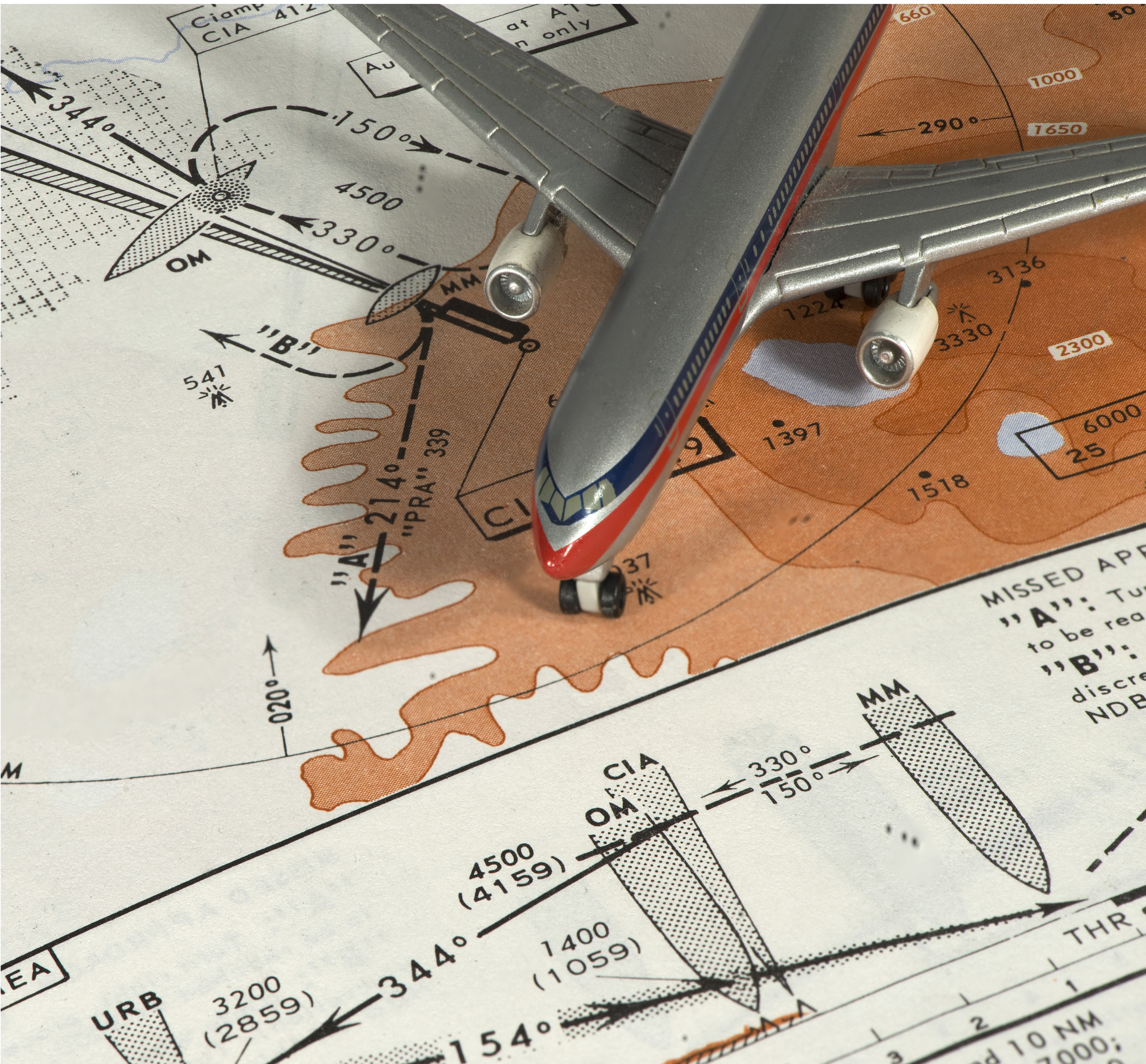


Credit: FAA-H-8083-25B (PHAK)

9

DIVERGENT™ AEROSPACE

NAVIGATION & FLIGHT PLANNING



LESSON PLAN

ATTENTION

You're hanging out with some friends and they ask you how a pilot navigates in the sky. They say they've always wondered how that worked. They ask you some pretty intricate questions on how to identify points in the air. But you don't know... Admittedly, you're pretty embarrassed.

MOTIVATION

Your friends were expecting a pretty nerdy pilot answer to the question they asked you, but instead, they got no answer at all. Your priority is now to get home to study about proper pilot navigation techniques so that you can impress your friends the next time you see them.

OBJECTIVE OVERVIEW

In this lesson, you'll learn the fundamentals of aerial navigation and detailed knowledge of the VFR Navigation Charts that are used to find your way around the sky and basic cross-country flight planning terms and techniques.

LESSON CONTENT

LESSON PLAN

NAVIGATION TERMS

Basic Navigation Overview

- Magnetic Variation
- Magnetic Deviation
- Lines of Longitude
- Lines of Latitude
- Isogonic Lines
- Agonic Lines
- True Course (TC)
- Compass Heading (CH)
- True Heading (TH)
- Magnetic North (MN)
- True North (TN)
- Course
- Heading
- Track
- Drift Angle
- Wind Correction Angle (WCA)
- Airspeed
- Ground Speed (GS)
- Time Zone Basics
- Basic Calculations

VFR AERONAUTICAL CHARTS

VFR Sectional Chart

- Purpose
- Details Provided
- Revision Cycle

VFR Terminal Area Chart – (TAC)

- Purpose
- Details Provided
- Revision Cycle

VFR Flyway Chart – (FLY)

- Purpose
- Availability
- Revision Cycle

World Aeronautical Chart – (WAC)

- Purpose

LESSON PLAN

Availability
Revision Cycle

FLIGHT PLANNING

Basic Cross-Country Planning Steps

Mark the Course on the Sectional
Select Easy to Identify Checkpoints
Know Your VFR Chart Symbology
Evaluate The Airspace
Select a Correct VFR Cruising Altitude (FAR §91.159)
Obstacle Clearance
Get a Legal Weather Brief
Consider Winds Aloft
Interpreting Ground References
Determine Ground Speed
Comply With Pre-Flight Action – (FAR §91.103)

Computing the Flight Plan

Plot the Course
Calculate Airspeed – (CAS) + (TAS)
Get Aircraft POH and E6B Flight Computer
Determine Course Heading – (CH)
Determine Ground Speed, Time, and Fuel Burn
File the Flight Plan
ICAO Form FAA 7233-4 Overview

PILOTAGE & DEAD RECKONING

Pilotage

Checkpoint Selection
Boundary Point Selection

Dead Reckoning

Basic Calculations

RADIO NAVIGATION

General Overview

VHF Omni-Directional Range - (VOR)

VOR General
Types of VOR Stations
Reverse Sensing
Basic Flying Technique
Distance Measuring Equipment - (DME)
VOR Radial Intercept Tips
Choosing an Intercept Angle

Non-Directional Radio Beacon – (NDB)

Automatic Direction Finder – (ADF)
Homing vs. Tracking

DIVERTING TO AN ALTERNATE

Reasons to Execute a Diversion

What to Consider

Fastest Way to Determine New Heading

After Established on a New Heading

LOST PROCEDURES

The 5 C's of Being Lost

Climb
Communicate
Confess
Comply
Conserve

Emergency Situation

FILING A FLIGHT PLAN

Importance of Filing

Filing and Activating
After Filing

Search and Rescue Operations

30 Min to +1 Hour After Being Overdue
ETA +2 Hours After Being Overdue
ETA +3 Hours After Being Overdue

Be On The Safe Side - Always Do the Following-

Basic Flying Technique

Distance Measuring Equipment - (DME)
VOR Radial Intercept Tips
Choosing an Intercept Angle

Non-Directional Radio Beacon – (NDB)

LESSON PLAN

Automatic Direction Finder – (ADF)
Homing vs. Tracking

DIVERTING TO AN ALTERNATE

Reasons to Execute a Diversion

What to Consider

Fastest Way to Determine New Heading

After Established on a New Heading

LOST PROCEDURES

The 5 C's of Being Lost
Climb
Communicate
Confess
Comply
Conserve

Emergency Situation

FILING A FLIGHT PLAN

Importance of Filing
Filing and Activating
After Filing

Search and Rescue Operations
30 Min to +1 Hour After Being Overdue
ETA +2 Hours After Being Overdue
ETA +3 Hours After Being Overdue

Be On The Safe Side - Always Do the Following

SCHEDULE

Discussion 1:30 - Per/Lesson **(2 Lessons are Required for Full Completion)

Questions 0:30 - Per/Lesson

STUDENT ACTIONS

Take Notes

Ask Questions

INSTRUCTOR ACTIONS

Teach The Student The Required Material

Evaluate The Student

EQUIPMENT

Whiteboard

Sectional Chart

TAC Chart

Flight Log Form

E6B Flight Computer (Electronic or Whiz Wheel)

Plotter

Flight Plan Form

iPad & ForeFlight Program

COMPLETION STANDARDS

The student should be able to explain the material taught in this lesson and be able to accurately plan a cross-country flight to an airport with minimal assistance from the instructor.

REFERENCES

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

IMAGE CREDIT FOR THIS CHAPTER

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

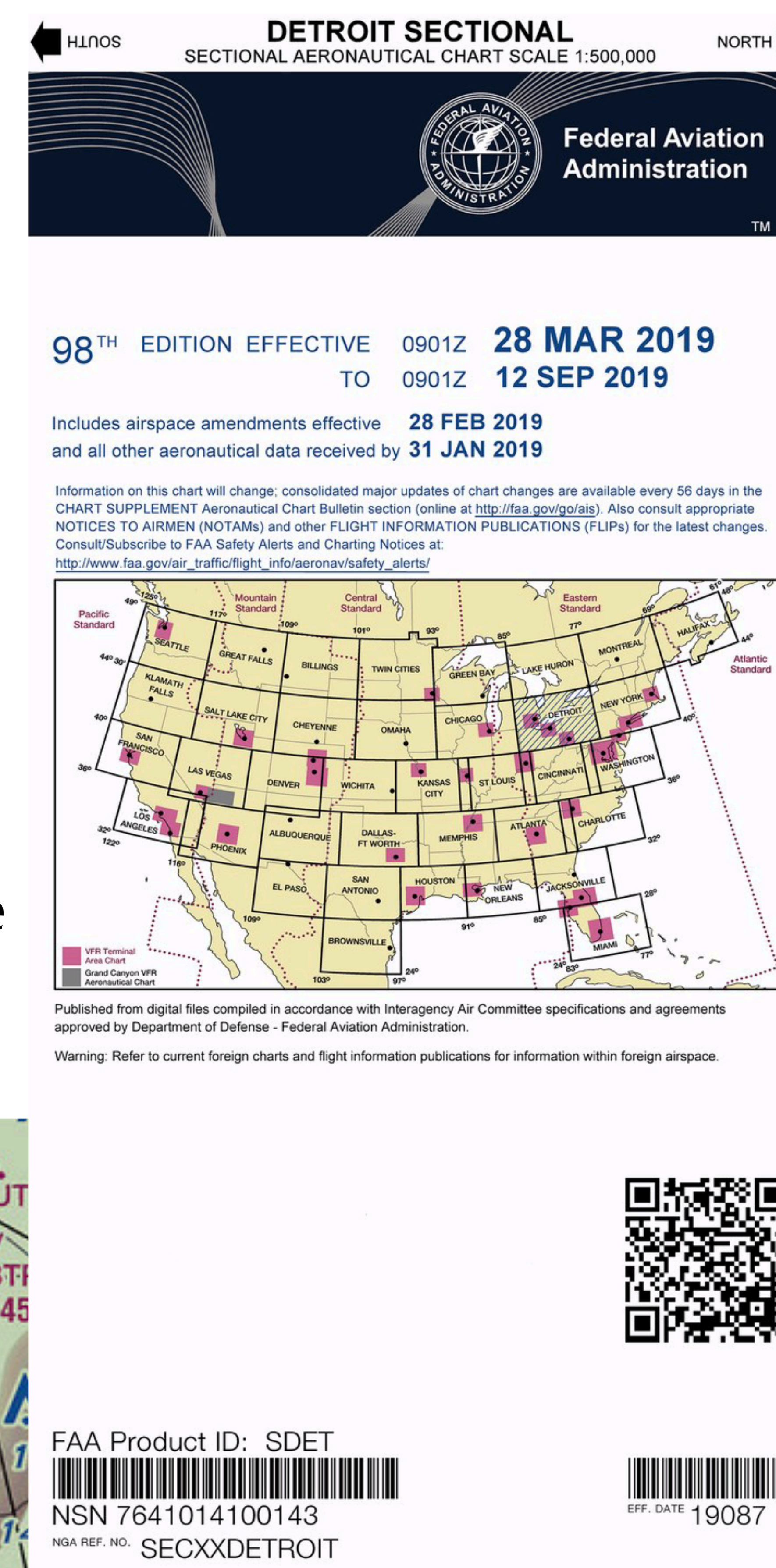
FAA - Washington, DC

VFR AERONAUTICAL CHARTS

VFR SECTIONAL CHART

PURPOSE

- The VFR Sectional is the most common chart used for VFR Navigation.
- It's used for low level flying (mostly GA) and provides a detailed representation of objects, cities, towns, terrain, water features, etc...
- It has a scale of 1:500,000 (1 inch = 6.86 NM or approximately 8 SM). This scale allows for more detailed information to be displayed on the chart.



DETAILS PROVIDED

- Airport Data
- Navigational Aids
- Airspace
- Topography

REVISION CYCLE

The VFR Sectional chart is revised on a semi-annual basis. With exception to some areas outside the conterminous United States where they are revised annually.

VFR AERONAUTICAL CHARTS

VFR FLYWAY CHART – (FLY)

PURPOSE

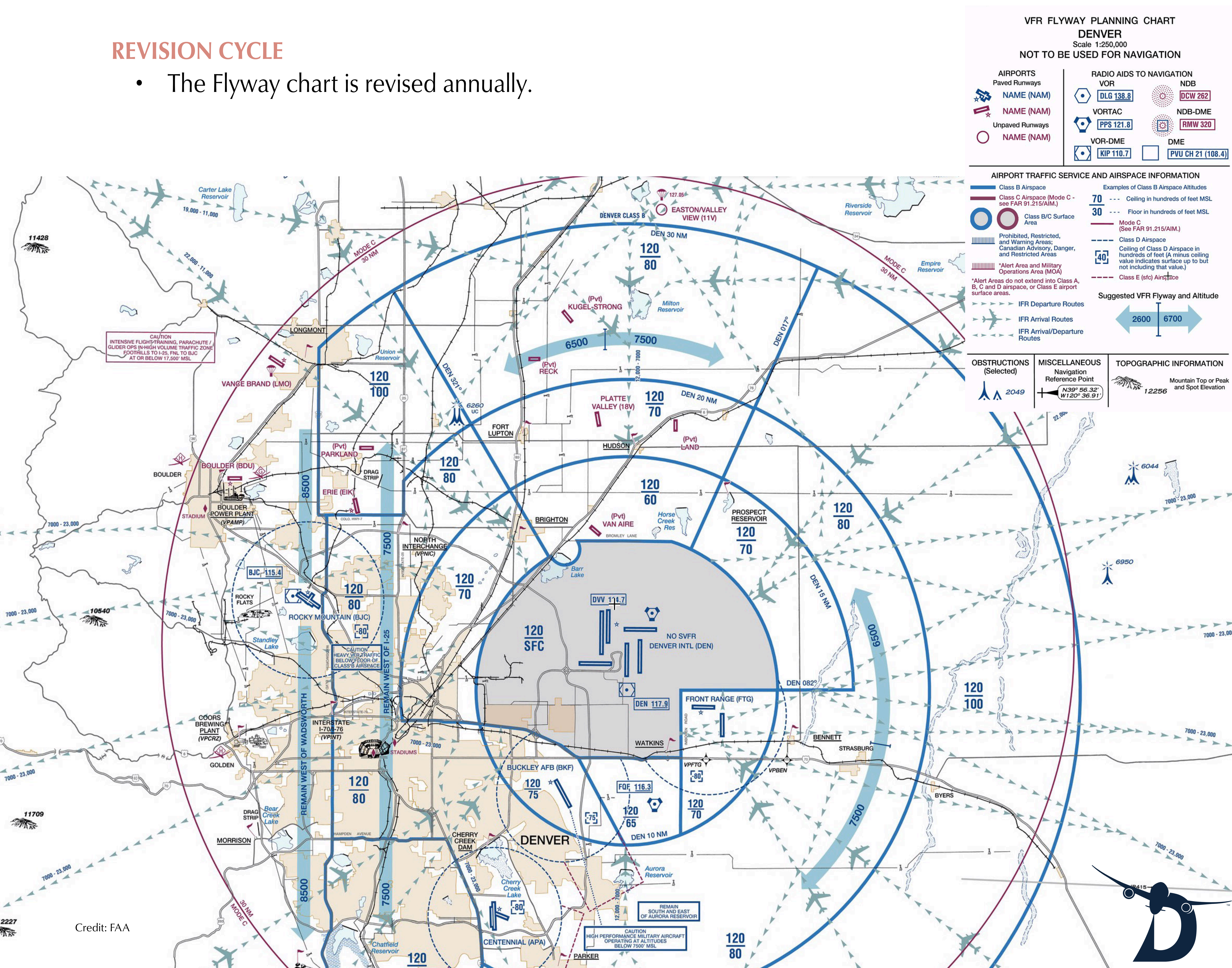
- The VFR Flyway Chart depicts flight paths and altitudes recommended for use to bypass areas heavily traversed by large turbine-powered aircraft.
- VFR Flyway Planning charts are designed to keep you out of Bravo Airspace, and for use in conjunction with TACs; they're not to be used for navigation.
- It has a scale of 1:250,000 **(1 inch = 3.43 NM or approximately 4 SM)**, ground references on these charts provide a guide for visual orientation.

AVAILABILITY

- The Flyway chart is available for the following airports: Baltimore-Washington, Charlotte, Chicago, Cincinnati, Dallas-Ft. Worth, Denver, Detroit, Houston, Las Vegas, Los Angeles, Miami, Orlando, Phoenix, St. Louis, Salt Lake City, San Diego, San Francisco and Seattle Terminal Area Charts (TAC).

REVISION CYCLE

- The Flyway chart is revised annually.



Credit: FAA

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FEDERAL AVIATION REGULATIONS

LESSON PLAN

ATTENTION

You got your first job flying a PC-12 for a small 135 air carrier. This is the first time you've ever been in an airplane that was capable of exceeding speed limits outlined in FAR §91.117. You're operating VFR underneath Class B Airspace doing 230 KIAS.

MOTIVATION

You're flying along and suddenly ATC queries you and asks your speed. You reply, 230 KIAS. Next, ATC is asking you to take down a phone number... A proper regulations lesson is paramount when you're first learning to fly. Remember the law of primacy. You'll always remember what you were taught first.

OBJECTIVE OVERVIEW

To determine that the applicant exhibits instructional knowledge of the elements related to the Code of Federal Regulations and related publications by describing regulations and publications that are produced by the FAA..

LESSON CONTENT

LESSON PLAN

REGULATION OVERVIEW

Introduction To FAA Regulations

- Subchapter A
- Subchapter B
- Subchapter C - Aircraft
- Subchapter D - Airman
- Subchapter E - Airspace
- Subchapter F - Air Traffic & General Operating Rules
- Subchapter G - Air Carrier Ops for Compensation or Hire, Certification and Ops
- Subchapter H - Schools and Other Certificated Agencies

TSA Certification For Flight Schools - 49 CFR TSA 1552

- Subpart A - Flight Training for Aliens & Other Designated Individuals
- Subpart B - Flight School Security Awareness Training

PART §43 - AIRCRAFT MAINTENANCE

Preventative Maintenance, Rebuilding and Alteration

- §43.2 - What Defines and Overhaul and Rebuild
- §43.3 - Define Who Can Perform Maintenance
- §43.5 - Return to Service
- §43.7 - Persons Authorized to Return an Aircraft to Service
- §43.9 - What Goes Into Maintenance Records
- Appendix A
- Appendix D
- Appendix E
- Appendix F

PART §61 - AIRMAN CERTIFICATION

LESSON PLAN

Certification: Pilots, Flight Instructors and Ground Instructors
Subpart Overview

Subpart A - General

Subpart B - Aircraft Ratings and Pilot Authorizations

Subpart C - Student Pilots

Subpart D - Recreational Pilots

Subpart E - Private Pilots

Subpart F - Commercial Pilots

Subpart G - Airline Transport Pilots

Subpart H - Flight Instructors

Subpart I - Ground Instructors

Subpart J - Sport Pilots

PART §67 - MEDICAL STANDARDS

Medical Standards and Certification
Subpart Overview

Subpart A - General

Subpart B — First-Class Airman Medical Certificate

Subpart C — Second-Class Airman Medical Certificate

Subpart D — Third-Class Airman Medical Certificate

Subpart E — Certification Procedures

PART §91 - AIR TRAFFIC RULES

General Operating And Flight Rules
Subpart Overview

Subpart A - General
§91.3 - Responsibility and Authority of the PIC
§91.5 - Pilot In Command of Aircraft Requiring More Than One Required Pilot
§91.7 - Civil Aircraft Airworthiness
§91.9 - Marking and Placarding Requirements
§91.13 - Careless or Reckless Operation
§91.15 - Dropping Objects
§91.17 - Alcohol
§91.19 - Carriage of Illegal Substances
§91.21 - Portable Electronic Devices - IFR Operations
§91.25 - Aviation Safety Reporting Program (NASA Reporting)

Subpart B - Flight Rules
§91.103 - Pre-Flight Action
§91.105 - Stations and Seatbelt
§91.107 - Seat Belts
§91.109 - Simulated Instrument Flight
§91.111 - Formation Flight
§91.113 - Right of Way
§91.117 - Aircraft Speed Limits
§91.119 - Minimum Safe Altitude
§91.121 - Altimeter Settings
§91.123 - Compliance with ATC Instructions
§91.125 - Light Gun Signals
§91.126 - Class G Operations
§91.127 - Class E Operations
§91.129 - Class D Operations
§91.130 - Class C Operations
§91.131 - Class B Airspace
§91.133 - Restricted and Prohibited Areas
§91.135 - Class A Operations
§91.137 Through §91.145 - NOTAMS & TFRs

Visual Flight Rules
§91.151 - Fuel Requirements
§91.153 - VFR Flight Plan Records
§91.155 - Basic VFR Weather Minimums
§91.157 - Special VFR
§91.159 - VFR Cruising Altitudes
§91.161 - Special Awareness Training (Flt Ops Within 60NM of Washington DCA VOR

SUBPART C - Equipment, Instrument, And Certificate Requirements
§91.203 - Required Certificates

LESSON PLAN

§91.205 - Minimum Equipment
§91.207 - Emergency Locater Transmitter (ELT)
§91.209 - Aircraft Lights
§91.211 - Supplemental Oxygen
§91.213 - Inoperative Equipment and Instruments
§91.215 - Transponders
§91.225 - Automatic Dependent Surveillance-Broadcast (ADS-B) Out Requirements

SUBPART D – Special Flight Operations

§91.303 - Aerobatic Flight
§91.309 - Glider Towing
§91.319 - Experimental Aircraft
§91.325 - Primary Category Aircraft

SUBPART E – Maintenance, Preventive Maintenance, and Alterations

§91.403 - General
§91.405 - Required Maintenance
§91.407 - Operations After Maintenance
§91.409 Through §91.413 - Required Inspections
FAR §91.421 - Rebuilt Engine

NTSB 830 - NOTIFICATIONS & REPORTING

Title 49 CFR §830 NTSB Overview

Subpart Overview

§830.2 - Definitions

Accident
Fatal Injury
Incident
Operation
Serious Injury
Substantial Injury

§830.5 - Immediate Notification Requirements

§830.6 – Information To Be Given In Report

§830.10 – Preservation of Crash Site

§830.15 - Reporting Requirements

RELATED FAA PUBLICATIONS

Chart Supplement

Aeronautical Information Manual - (AIM)

AIM Table of Contents

FAA Advisory Circular - (AC)

Notices to Airman - (NOTAM)

NOTAM (D) - Distant
NOTAM (FDC) - Flight Data Center
Pointer NOTAMs
Special Activity Airspace - (SAA) NOTAMS
Military NOTAMs

Decoding NOTAMS

Notices To Airman Publication - (NTAP)

First Section
Second Section

Practical Test Standards - (PTS)

Airman Certification Standards - (ACS)

Pilots Operating Handbook- (POH)

Standard POH Section Outline

AIRCRAFT INTERCEPT PROCEDURES

SCHEDULE

Discussion 1:30

Questions 0:30

STUDENT ACTIONS

Take Notes

Ask Questions

INSTRUCTOR ACTIONS

Teach The Student The Required Material

Evaluate The Student

LESSON PLAN

EQUIPMENT

Whiteboard

FAR/AIM

COMPLETION STANDARDS

Student should be able to accurately describing the following:

Availability and method of revision of 14 CFR parts §1, §61, §91, and NTSB part §830 by describing:

Purpose, General Content

Availability of flight information publications, advisory circulars, practical test standards, pilot operating

Handbooks, and FAA-approved airplane flight manuals by describing:

Availability, Purpose, General content.

REFERENCES

14 CFR Part §1, §43, §61, §91

Aeronautical Information Manual

FAA-H-8083-3 - Airplane Flying Handbook

POH/AFM

IMAGE CREDIT FOR THIS CHAPTER

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

FAA - Washington, DC

REGULATION OVERVIEW

INTRODUCTION TO FAA REGULATIONS

The regulations that are set fourth in this chapter have been created by the Federal Aviation Administration (FAA). These regulations govern all aviation activity in the United States of America. ***We have included a summary the most relevant items in each subchapter below.***

- TITLE 14 OF THE CODE OF FEDERAL REGULATIONS (CFR) COVERS AERONAUTICS & SPACE.

TITLE	VOLUME	CHAPTER	PARTS	REGULATORY ENTITY
TITLE 14 AERONAUTICS & SPACE	1	I	1-59	FEDERAL AVIATION ADMINISTRATION, DEPARTMENT OF TRANSPORTATION
	2		60-109	
	3		110-199	
	4	II	200-399	OFFICE OF THE SECRETARY, DEPARTMENT OF TRANSPORTATION (AVIATION PROCEEDINGS)
		III	400-1199	COMMERCIAL SPACE TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION, DEPARTMENT OF TRANSPORTATION
	5	V	1200-1299	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)
		VI	400-1199	AIR TRANSPORTATION SYSTEM STABILIZATION

This parts portion of this table has been hyperlinked to direct you to the relevant sections listed above. Click the parts to go to eCFR.

SUBCHAPTER A

Definitions, abbreviations, general requirements, and safety management systems (SMS).

SUBCHAPTER B

Procedural rules and general rule-making procedures.

SUBCHAPTER C - AIRCRAFT

- PART 39 - AIRWORTHINESS DIRECTIVES.
- PART 43 - PREVENTATIVE MAINTENANCE, REBUILDING AND ALTERATION.
- PART 45 - IDENTIFICATION AND REGISTRATION MARKINGS.
- PART 47 - AIRCRAFT REGISTRATION.

SUBCHAPTER D - AIRMAN

- PART 60 - FLIGHT SIMULATION TRAINING DEVICES, QUALIFICATION, AND USE.
- PART 61 - CERTIFICATION: PILOTS, FLIGHT INSTRUCTORS AND GROUND INSTRUCTORS.
- PART 67 - MEDICAL STANDARDS AND CERTIFICATION.
- PART 68 - REQUIREMENTS FOR OPERATING SMALL AIRCRAFT WITHOUT A MEDICAL CERTIFICATE.

DIVERGENT™ AEROSPACE

NATIONAL AIRSPACE SYSTEM

LESSON PLAN

ATTENTION

You got your first job flying a PC-12 for a small 135 air carrier. This is the first time you've ever been in an airplane that was capable of exceeding speed limits outlined in FAR §91.117. You're operating VFR underneath Class B Airspace doing 230 KIAS.

MOTIVATION

You're flying along and suddenly ATC queries you and asks your speed. You reply, 230 KIAS. Next, ATC is asking you to take down a phone number... A proper regulations lesson is paramount when you're first learning to fly. Remember the law of primacy. You'll always remember what you were taught first.

OBJECTIVE OVERVIEW

The student will learn essential information that is needed in order to competently and safely operate in the National Airspace System.

LESSON CONTENT

LESSON PLAN

AIRSPACE QUICK REFERENCE CHART
- Basic VFR Weather Minimums
- Basic Entry Requirements

CLASS A AIRSPACE - CONTROLLED
- Class A Explained
  - Dimensions
  - More Detailed Information
  - Speed Limit

CLASS B AIRSPACE - CONTROLLED
- Class B Explained
  - Requirements to Enter
  - Dimensions and Depiction
  - Requirements to Enter
  - Basic Weather Minimums
  - Speed Restrictions
  - VFR Corridor
  - Services Provided to Other VFR Aircraft
  - Aircraft Without a Transponder
  - Mode-C Failure
- Examples of Class B Airspace

CLASS C AIRSPACE - CONTROLLED
- Class C Explained
  - Requirements to Enter
  - Dimensions and Depiction
  - Procedural Outer Area - Not Charted
  - Airspeed Limitations
  - Weather Minimums
  - Satellite or Secondary Airports
  - VFR Services Provided
- Examples of Class C Airspace

CLASS D AIRSPACE - CONTROLLED
- Class D Explained
  - Requirements to Enter

LESSON PLAN

Dimensions and Depiction
Terminal Radar Service Area - (TRSA)
Airspeed Restrictions
Services Provided to VFR Aircraft
Weather Minimums

Examples of Class D Airspace

CLASS E AIRSPACE - CONTROLLED

Class E Explained

Dimensions and Depiction
Class E Vertical Limits
Requirements to Enter
Airspeed Restrictions
Weather Minimums
ATC Services Provided

The Blue Zipper Line

Types of Class E Airspace

SFC Area Designated for an Airport
Extension to Surface Area
Airspace Used for Transition
En-Route Domestic Areas
Federal Airways - I.E. (V229)
Offshore Airspace Areas

CLASS G AIRSPACE - UNCONTROLLED

Class G Explained

Dimensions and Depiction
Minimum Requirements to Enter
ATC Services Provided
Airspeed Restrictions
Weather Minimums

Ground Visibility Versus Flight Visibility

SPECIAL USE AIRSPACE - (SUA)

Prohibited Area

Restricted Area

Active
Inactive

Warning Area

National Security Area

Military Operations Area

Alert Area

Controlled Firing Area

Graphical Depiction of SUA

Temporary Flight Restriction

Parachute Jump or Glider Operations

Military Training Routes

OTHER AIRSPACE

Published VFR Routes

VFR Flyway
VFR Corridor
Class B Airspace - Transition Routes
Special Air Traffic Rules - SATR

Airport Advisory Area

Flight Information Region - (FIR)

SCHEDULE

Discussion 2:00

Questions 0:30

STUDENT ACTIONS

Take Notes

Ask Questions

INSTRUCTOR ACTIONS

Teach The Student The Required Material

Evaluate The Student

EQUIPMENT

Whiteboard

AIM

LESSON PLAN

COMPLETION STANDARDS

To determine that the student exhibits knowledge of the elements of the national airspace system by describing: Basic VFR weather minimums for all classes of airspace, operating rules, pilot certification, and airplane equipment requirements for all types of airspace.

REFERENCES

FAA-H-8083-25 Pilot's Handbook of Aeronautical Knowledge Chapter 13

FAA-H-8083-15A Instrument Flying Handbook Chapter 8

Aeronautical Information Manual (AIM) Chapter 3

IMAGE CREDIT FOR THIS CHAPTER

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

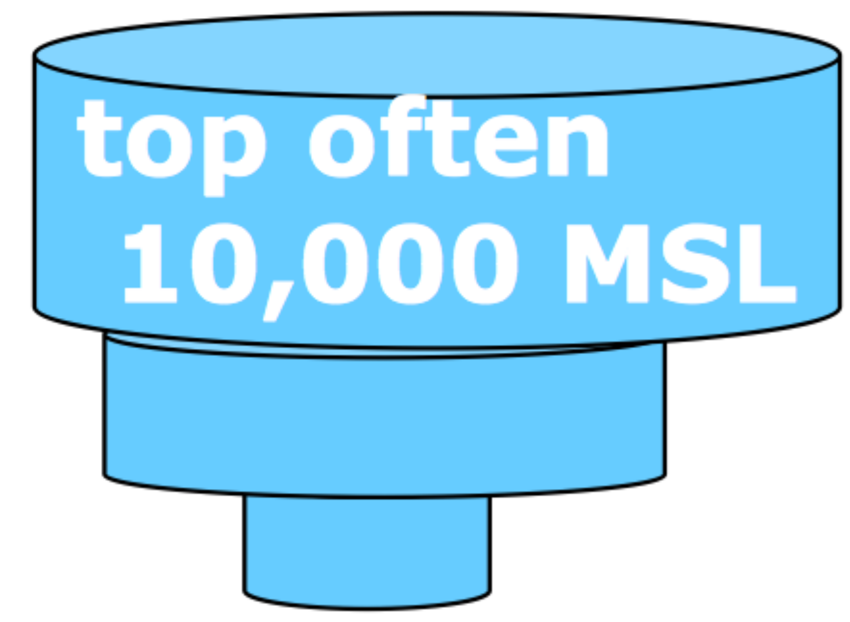
FAA - Washington, DC

CLASS B AIRSPACE - CONTROLLED

CLASS B EXPLAINED

Class B Airspace generally surrounds the nations busiest airports in terms of IFR operations and quantity of passenger carriage. It closely resembles an upside-down wedding cake (in most cases), and requires special entry procedures. **Class B Airspace is heavily controlled and contains both IFR and VFR traffic.**

Figure 13.4.1 Depiction of Class B



REQUIREMENTS TO ENTER

- The pilot must have a **minimum** of a **Private Pilot Certificate** to enter.
- Or, a student pilot certificate if a private pilot certificate is being sought.
- An individual endorsement is required from a flight instructor for each Class B Airspace traversed.

Restrictions on Student Pilot Operations	
No person may takeoff or land a civil aircraft at the following primary airports within Class B Airspace unless that PIC holds at least a Private Cert.	
Andrews AFB, MD	Los Angeles Intl. Airport, CA
Atlanta Hartsfield Airport, GA	Miami Intl. Airport, FL
Boston Logan Airport, MA	Newark Intl. Airport, NJ
Chicago O'Hare Intl. Airport, IL	New York Kennedy Airport, NY
Dallas/Fort Worth Intl. Airport, TX	New York La Guardia Airport, NY
Washington National Airport, DC	San Francisco Intl. Airport, CA
FAR §91.131(b)(2) Λ Appendix D, Section 4 of Part §91	

DIMENSIONS AND DEPICTION

- Generally extends to **6,000′ AGL** - (which can vary based on geography).
- The lateral dimensions are depicted by **SOLID BLUE RINGS** on the sectional.
- Layout normally resembles an upside-down wedding cake with two or more layers.
- Class B **Airspace is custom** tailored for each airport, so dimensions will vary.
- The airspace is always surrounded by a **MAGENTA 30 NM MODE C RING (Vail)**.
- The magenta veil will always be centered around a VOR on the airfield.
- **MODE C IS REQUIRED** within the Mode C Vail.
- **ALTITUDE** is shown in **FRACTION FORM - I.E. SFC/25** (hundreds of feet MSL)
- [-80] Means "does not include that altitude."

REQUIREMENTS TO ENTER

- The aircraft must have a radio for two-way communication.
- Aircraft must be equipped with a Mode C Transponder.
- Must be cleared into the airspace if operating under VFR.
- *Example - N26FAA, is cleared into the Denver Class B, Maintain VFR.*

CLASS B AIRSPACE - CONTROLLED

BASIC WEATHER MINIMUMS

Weather minimums are more relaxed in Class B Airspace because ATC is keeping a close watch on all aircraft in the airspace. Approach and departure control transition aircraft into and out of the airspace, and tower controllers sequence them for takeoff and landing.

VISIBILITY	CLOUD CLEARANCE
3 SM	Clear of Clouds

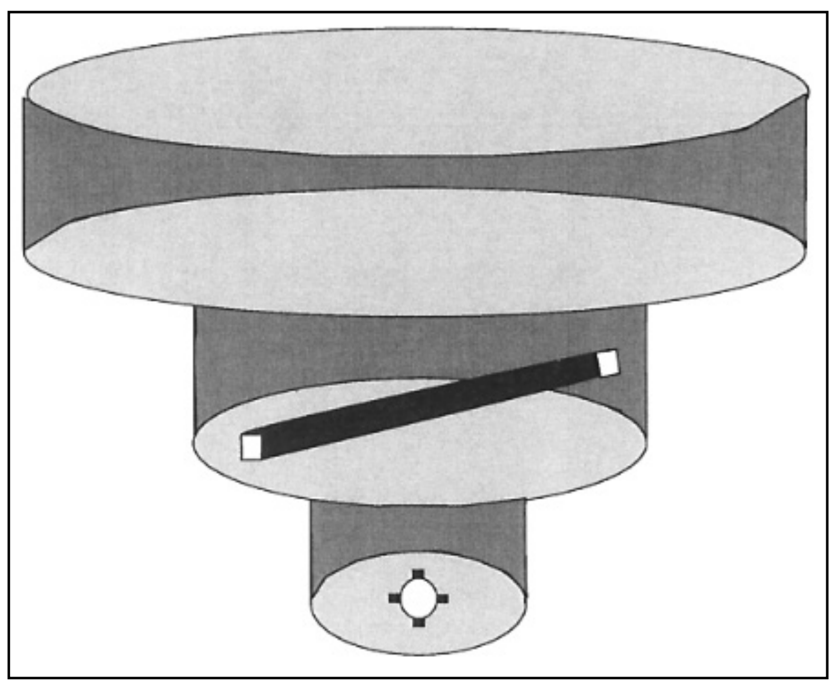
SVFR DAY	SVFR NIGHT
1 SM - Clear of Clouds	Must be IFR Rated and the aircraft must be IFR Certified and Equipped.
SVFR will likely not be authorized in Class B Airspace.	

SPEED RESTRICTIONS

- **FAR §91.117 states that you cannot exceed 250 KIAS below 10,000′ in the USA.**
- While inside of Class B Airspace, **the maximum speed limit is 250 KIAS**.
- **Above 10,000 feet′, inside of Class B Airspace, it would be permissible to operate at a speed greater than 250 KIAS.** Scenarios like this only exist in geographic areas like Denver, CO where the Class B Airspace ceiling is 12,000′ MSL (due to elevated terrain).
- **Under Class B shelf areas, and inside the VFR Corridor, 200 KIAS is the maximum speed limit.**

VFR CORRIDOR

Figure 13.4.2 VFR Corridor



- A VFR corridor is defined as airspace through Class B Airspace, with defined vertical and lateral boundaries, in which aircraft may operate without an ATC clearance or communication with air traffic control.
- The only one that currently exists in the United States surrounds LAX.
- **122.750 MHz is the communication frequency to use during transition.**

SERVICES PROVIDED TO OTHER VFR AIRCRAFT

SEPARATION AND SEQUENCING

All VFR aircraft are separated from other VFR or IFR aircraft that weigh 19,000 pounds or less by a minimum of the following -

- **Target Resolution**: is a process to ensure that correlated radar targets do not touch. 500 feet of vertical separation, or by visual separation is provided.
- **Separation**: VFR aircraft are separated from all other VFR and/or IFR aircraft that weigh more than 19,000 and turbojets by no less than: 1 & 1/2 miles lateral separation, or 500 feet vertical separation, or by visual separation.

CLASS B AIRSPACE - CONTROLLED

AIRCRAFT WITHOUT A TRANSPONDER

It is permissible to traverse the airspace without a transponder. However, prior to doing so. You must contact the controlling agency a minimum of 1-hour prior to arrival for permission.

MODE-C FAILURE

If a Mode C failure should occur while operating within the 30NM Mode C Veil. You should notify ATC of the failure. ATC **may** require you to SQUAWK *7600* for safety reasons.

EXAMPLES OF CLASS B AIRSPACE

Included below are samples of different Class B Airport's. Both Denver, and Pittsburgh have been custom tailored to the airport, and geographic location.

Figure 13.4.3 Denver, CO (Class B Airspace)

Figure 13.4.4 Pittsburgh, PA (Class B Airspace)

Images Hyperlinked: Click to view larger.

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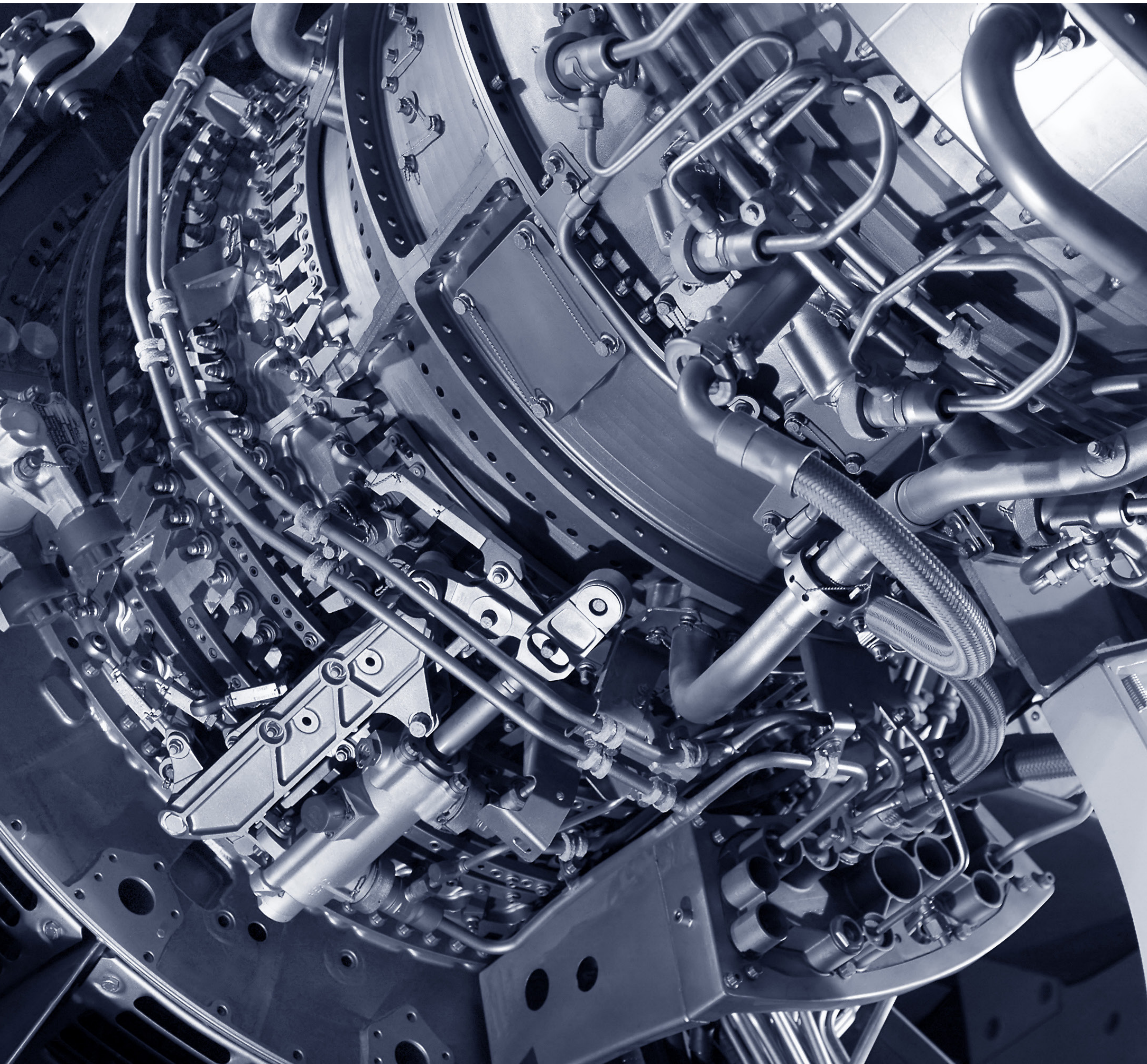
CESSNA 172-RG AIRCRAFT SYSTEMS



LESSON PLAN

ATTENTION

BANG! PARTIAL LOSS OF ENGINE POWER! We're at 6,900' MSL in the traffic pattern. What do we do now? Learning the systems of the Cessna 172-RG Aircraft are critical for the safe operation of the aircraft and possibly even your survival during an emergency.

MOTIVATION

At 6,900' MSL in the traffic pattern. You realize the mixture was not leaned properly and the engine is suffering from Detonation and maybe even Pre-Ignition. This has resulted in a partial loss of engine power. You immediately adjusted the mixture and knew what to do because you recently had an Aircraft Systems Ground Lesson! You saved the day! Flying is fun. However, it can be dangerous if the pilot of the aircraft does know have the essential knowledge required to operate said aircraft.

OBJECTIVE OVERVIEW

This lesson contains an in-depth examination of all critical systems that allow the aircraft to fly. At the conclusion of this lesson, the student will absorb, cultivate and develop the fundamental knowledge required to understand the safe operation of systems related to the Cessna 172 Retractable Gear aircraft.

LESSON CONTENT

LESSON PLAN

FLIGHT CONTROL SYSTEM

Primary Flight Controls
- Ailerons
- Elevator
- Rudder

Secondary Flight Controls
- Flap System
- Trim System

POWER PLANT SYSTEM

Aircraft Engine

Induction System
- Carburetor
- Carburetor Ice
- Carburetor Heat

Engine Indication System

Dual Ignition System
- Two Magnetos
- Ignition System Failures

Wet Sump Oil System
- Types of Oil
- Oil System Abnormalities

Engine Cooling System
- Cold (Low) Engine Temperature
- Hot (High) Engine Temperature

Exhaust System
- Carbon Monoxide
- EGT Probe

Starter System

The Combustion System

Non-Favorable Engine Conditions
- Detonation

LESSON PLAN

Pre-Ignition

Supplemental Engine Type Training

Fuel Injection System
Turbocharger

CONSTANT SPEED PROPELLER

General Propeller Overview

Propeller Type and Diameter
Propeller Components
Propeller Principles

Prop Control - Forward | Low Pitch - High RPM

Prop Control - Backward | High Pitch - Low RPM

Over Speed | Engine Speeds Up

Under Speed | Engine Slows Down

On Speed

GRAVITY-FED FUEL SYSTEM

Fuel System Overview

Fuel Tank Capacity
Drain Sumps
Fuel Grade

Fuel System Components

Fuel Primer
Aux Boost Pump
Engine Driven Pump
Integral Fuel Tanks
Fuel Selector Valve
Fuel Strainer and Sump Drains

ELECTRICAL SYSTEM

Electrical System Design

Major System Components

Battery
Master Switch
Alternator Control Unit
Circuit Breakers
Primary Bus Bar
Avionics Bus Bar
Ground Service Plug Receptacle

Aircraft Lighting System

Exterior Aircraft Lights

Basic Electrical Definitions

Volt
Amp
Alternator
Generator

HYDRAULIC SYSTEM

Retractable Landing Gear

Power Pack
System Pressure
System Operation Overview
Emergency Hand Pump
Indication Switches

Aircraft Brake System

Tire Pressure

Hydraulic System Schematic

PITOT STATIC SYSTEM

Pitot Tube

Measures Dynamic Pressure

Static Port

Measures Static Pressure

Alternate Static Source

Pitot Static System Blockage

Blocked Pitot System
Blocked Static System

PITOT STATIC FLIGHT INSTRUMENTS

The Altimeter

Purpose
Functionality
Operation
Instrument Check
Altimetry Error

LESSON PLAN

Types of Altitude
Mountain Operations

Vertical Speed Indicator - (VSI)
Purpose
Functionality
Accuracy
Instrument Check

Airspeed Indicator - (ASI)
Purpose
Functionality
Instrument Check
Types of Airspeed
Airspeed Indicator Markings

VACUUM SYSTEM

Vacuum System Basics

Engine Driven Vacuum System

Vacuum System Instruments

Gyroscopic Principles
General Overview
Rigidity In Space
Precession

Turn Coordinator
Purpose
Functionality
Inclinometer
Instrument Check

Attitude Indicator
Purpose
Functionality
Limitations
Instrument Check

Heading Indicator
Purpose
Functionality
Limitations
Instrument Check

MAGNETIC COMPASS

Magnetic Principles
North and South Magnetic Poles
Earth's Magnetic Field
Lines of Magnetic Flux
True North and South
Magnetic North and South

Magnetic Compass Construction
Compass Card Orientation
Fluid Type
Compass Card Markings
Magnetized Bar Locations
Compensator Screws
Deviation Card
Lubber Line
Magnet Orientation

Compass Errors
Variation
Deviation
Oscillation Error
Acceleration Error - ANDS
Magnetic Dip Error
Lead and Lag Error - (Northerly Turning Error)

SCHEDULE

Discussion 2:00

Questions 0:15

STUDENT ACTIONS

Take Notes

Ask Questions

INSTRUCTOR ACTIONS

Teach The Student The Required Material

Evaluate The Student

LESSON PLAN

EQUIPMENT

Whiteboard

Aircraft POH/AFM

Pilot's Handbook of Aeronautical Knowledge

COMPLETION STANDARDS

At the end of the lesson, the student should have the required knowledge to discuss general aircraft systems, and aircraft systems specific to the Cessna 172RG.

The student should have accurate knowledge on all items included in the content.

REFERENCES

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

Aircraft POH/AFM

IMAGE CREDIT FOR THIS CHAPTER

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

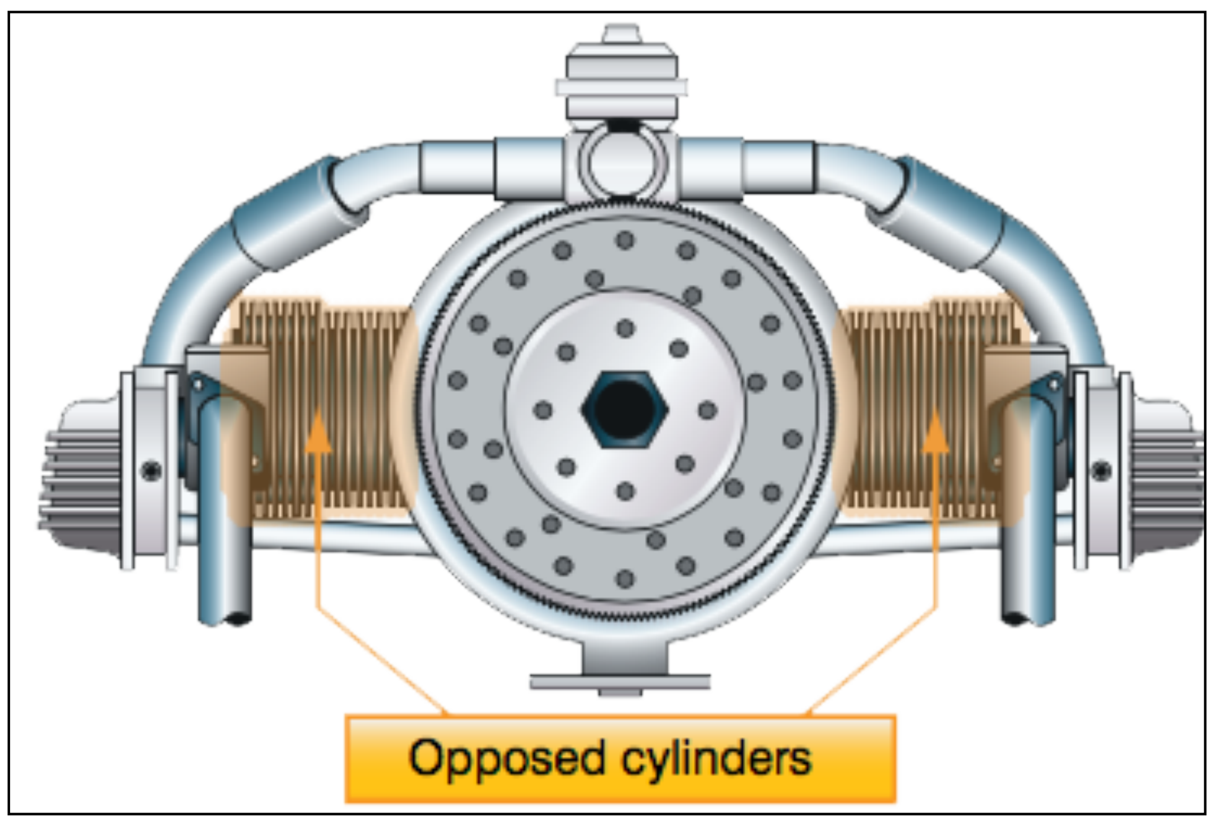
Piper Aircraft Company - Vero Beach, Florida

McCauley Propeller Systems - Wichita, Kansas

POWER PLANT SYSTEM

AIRCRAFT ENGINE

Figure 18.3.1 Aircraft Engine



Credit: FAA-H-8083-25B (PHAK)

LYCOMING - (Manufacturer)

O-360-F1A6 (Model Number)

4 CYL 180 HP ENGINE; Direct Drive, Horizontally Opposed, Naturally Aspirated and Carbureted. 2700 RPM Maximum.

O - OPPOSED

I - FUEL INJECTION

361 - CUBIC INCHES of DISPLACEMENT

The more displacement an engine has, the more power it can produce.

INDUCTION SYSTEM

CARBURETOR

The Carburetor mixes fuel and air into a combustible mixture, then delivers it to the cylinders.

It works by allowing outside air to flow through an air filter, which then flows into the Carburetor through a Venturi. As air flows through the Venturi, an area of low pressure is created. Thus causing fuel to flow through the discharge nozzle and into the air stream where it is atomized and mixed with the air flowing through the Venturi.

The float inside the Carburetor sits on the fuel. As the fuel level changes, a needle valve (which controls mixture) attached to the float meters the fuel by opening and closing. When the fuel level in the chamber rises, the mixture needle valve closes, subsequently shutting off the fuel flow to the Carburetor.

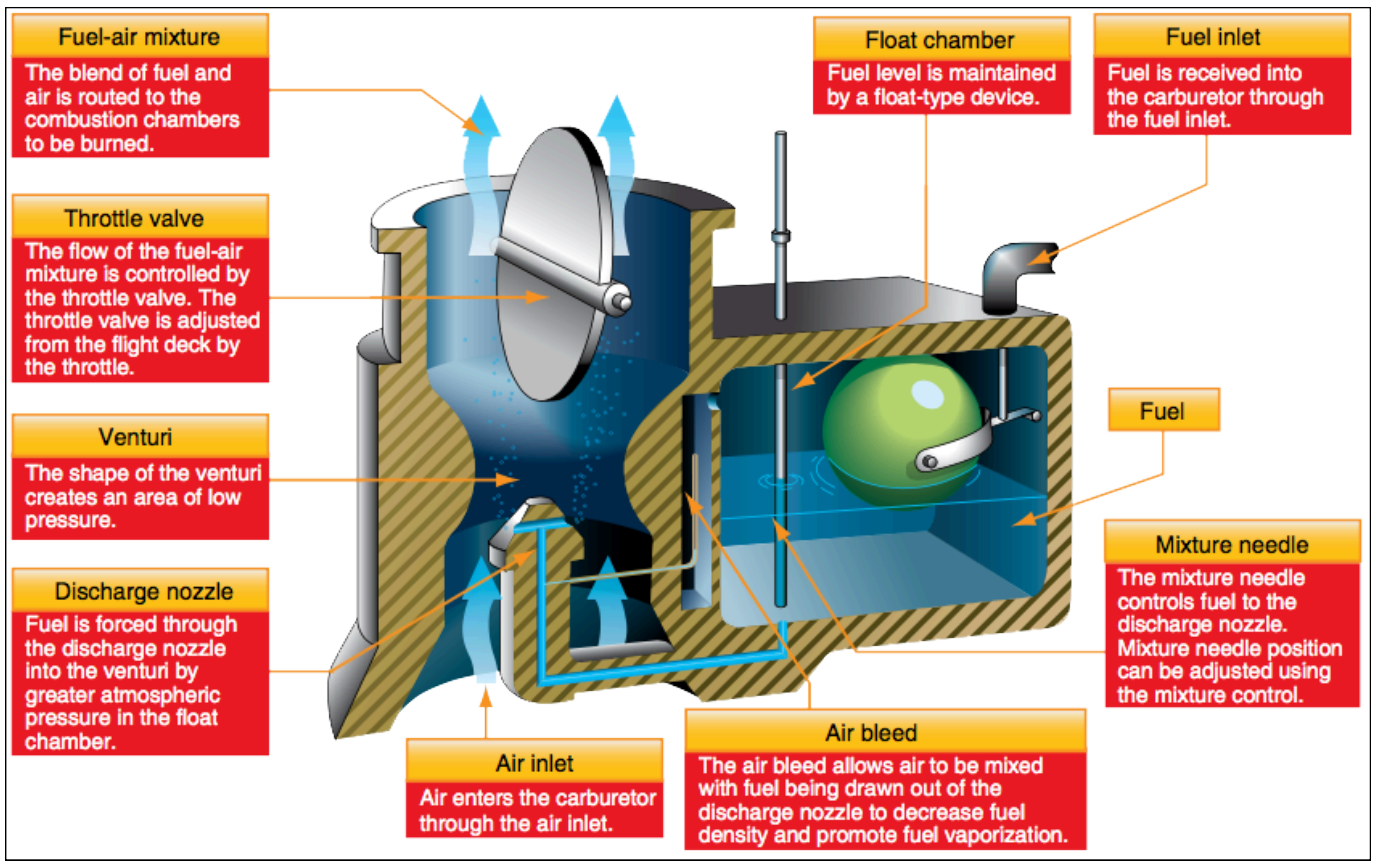
THE THROTTLE

The throttle controls the throttle valve, and the total fuel air mixture.

THE MIXTURE

The Mixture controls the amount of fuel delivered to the discharge nozzle.

Figure 18.3.2 Float-Type Carburetor



Credit: FAA-H-8083-25B (PHAK)

GYROSCOPIC FLIGHT INSTRUMENTS

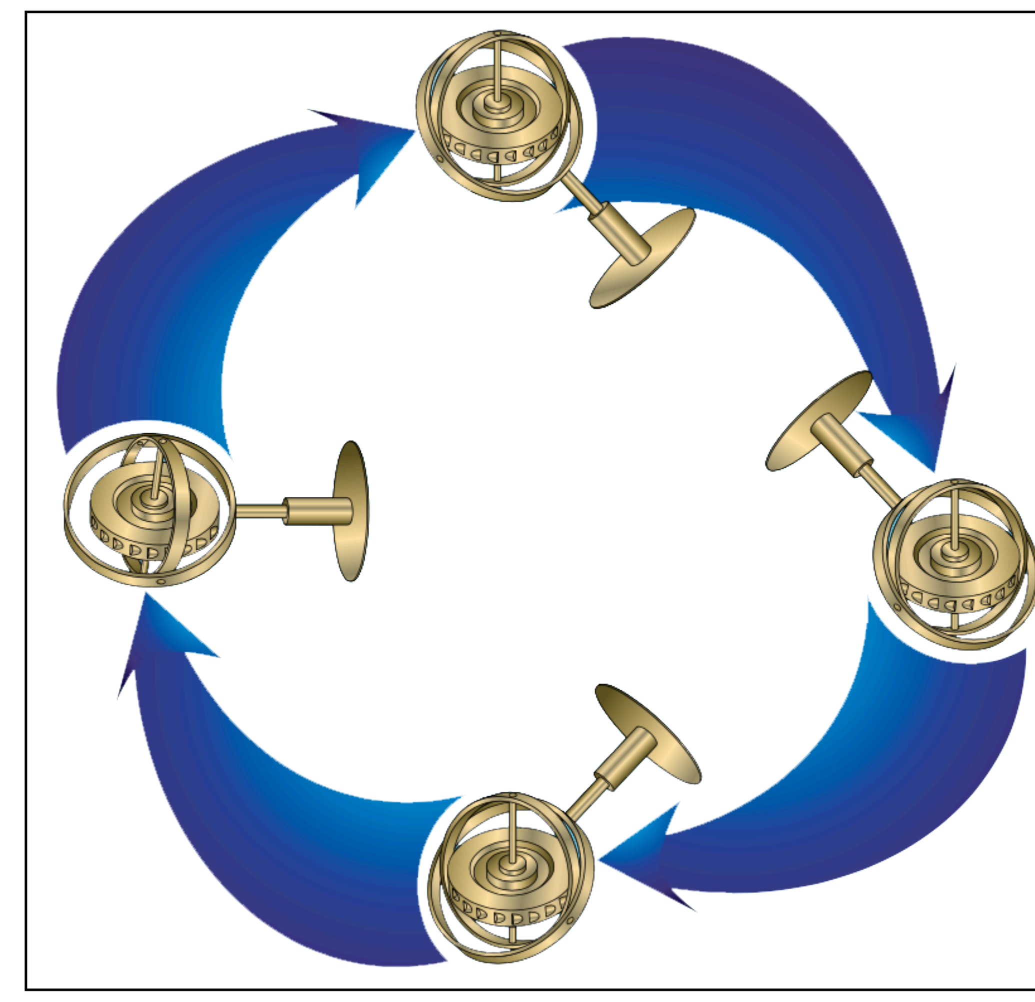
GYROSCOPIC PRINCIPLES

GENERAL OVERVIEW

The Turn Coordinator, Heading Indicator, and Attitude Indicator are all instruments that use a gyroscope. Any spinning object exhibits gyroscopic principles. A wheel or rotor intended to utilize these principles is called a gyroscope. It can be mounted in two different ways, but it depends on which property the gyro will make use of.

- A free-mounted gyroscope is free to rotate in any direction about its center of gravity. It has three planes of movement. The rotor is free to rotate in any plane relative to the base, and is balanced so that when the gyro is at rest, it remains in the same position in which it was placed.
- A restricted or semi-rigid mounted gyro is mounted so that one of the planes of freedom is held fixed in relation to the base.

Figure 18.11.1 Rigidity in Space

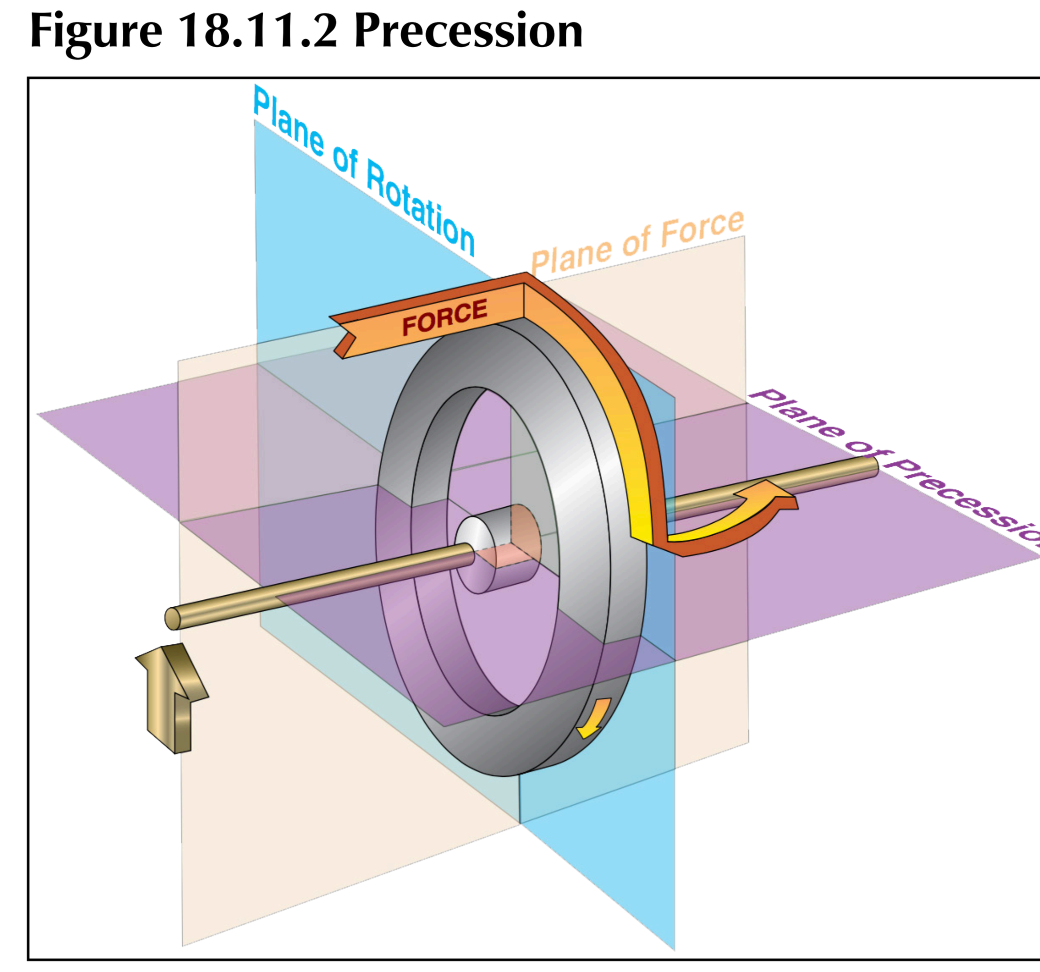


Credit: FAA-H-8083-25B (PHAK)

RIGIDITY IN SPACE

Refers to the principle that a Gyroscope remains in a fixed position in the airplane in which it is spinning. As a wheel spins faster, it becomes increasingly more stable in it's plane of rotation.

Figure 18.11.2 Precession

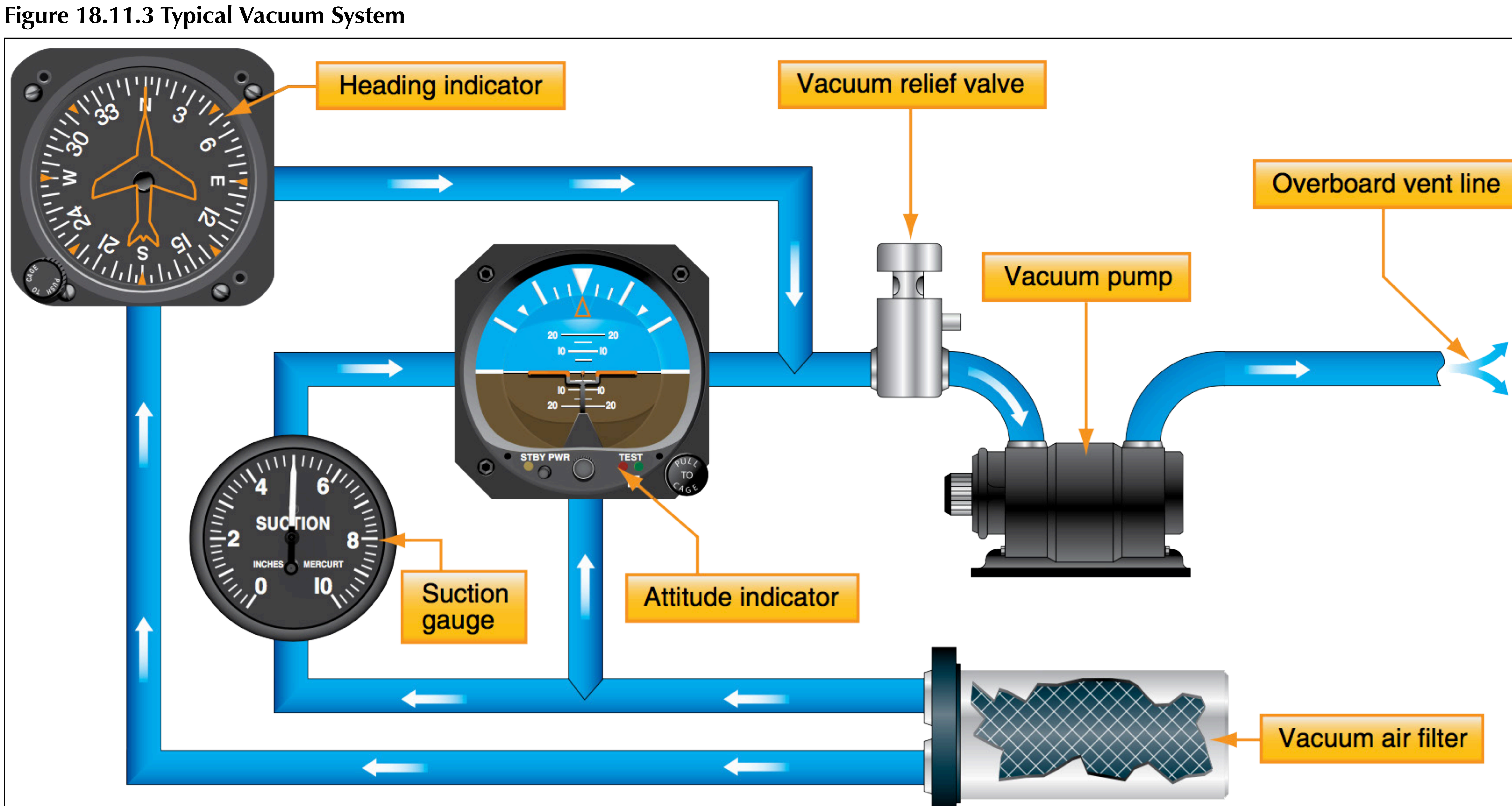


Credit: FAA-H-8083-25B (PHAK)

PRECESSION

The tilting or turning of a Gyro in response to deflective force. The reaction to this force does not occur at the point at which it was applied; rather, it occurs at a point that is 90° later in the direction of rotation.

Figure 18.11.3 Typical Vacuum System



Credit: FAA-H-8083-25B (PHAK)

23

AIRPORT OPERATIONS

THE AIRPORT TRAFFIC PATTERN

BEFORE LANDING CHECK

- The before landing check should be accomplished as a FLOW backed up with a checklist.
- The flow should cover important items needed for landing.
- Things like fuel selector position, seat belts, landing lights, landing gear, etc.

MAINTAINING PROPER SPACING

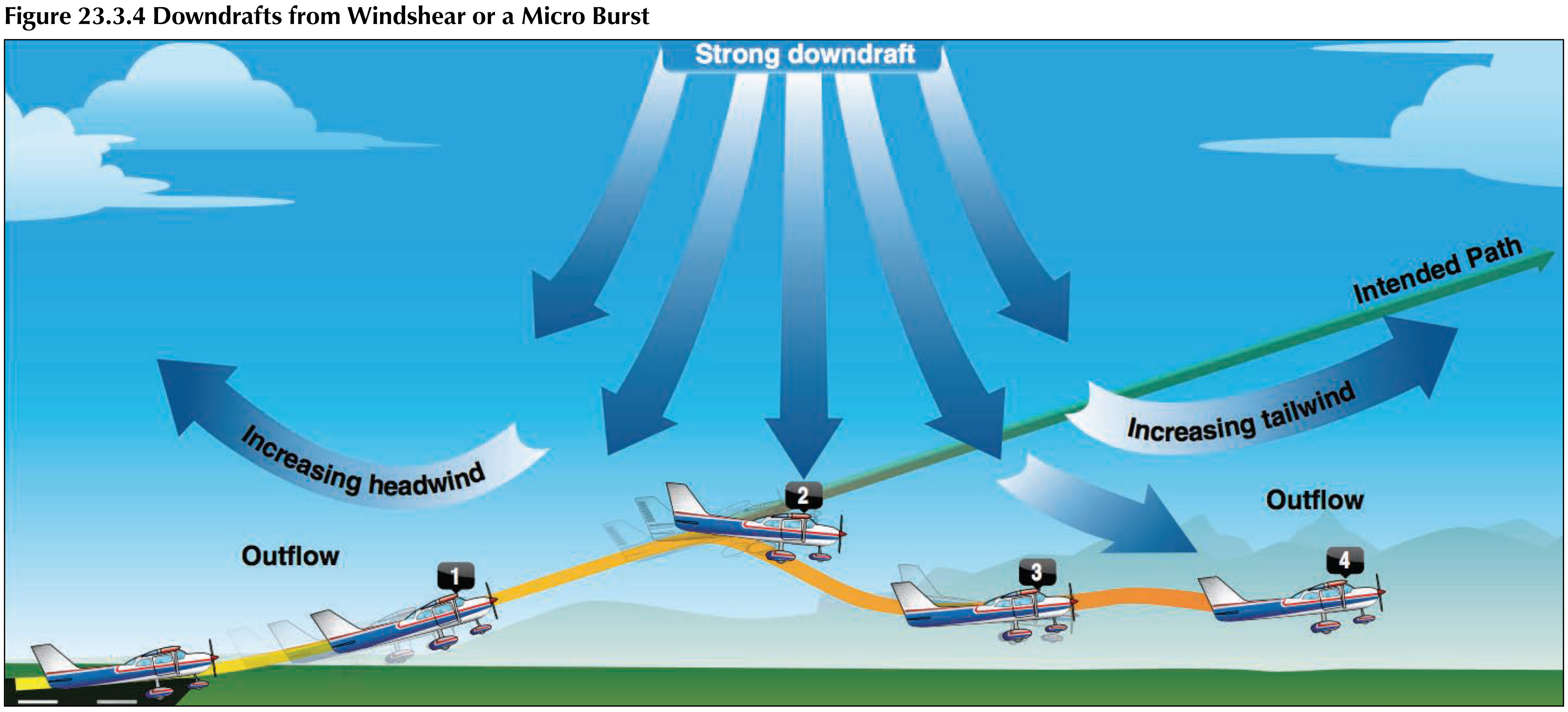
- In the pattern, you should always be cognizant of your airspeed.
- If you fly faster than the aircraft in front of you, a go-around may be required due to improper spacing.
- Always know where other aircraft are, maintain visual separation and an appropriate airspeed.

When another aircraft is on final, you should wait until you pass this aircraft, prior to beginning your base turn. The PIC is responsible for seeing and avoiding.

WINDSHEAR PREVENTION

- Avoid windshear at all times! Very serious stuff...
- If the aircraft encounters windshear, an escape maneuver should be executed immediately. The pilot may not realize what has happened until it's too late.
- You'll first experience an initial slight performance increase, followed by an additional increase in performance, (headwind). Followed by a gradual decrease in performance, then a severe decrease in performance (tailwind).
- **Note that in some cases, escaping windshear may be impossible.**

Figure 23.3.4 Downdrafts from Windshear or a Micro Burst



Credit: FAA-H-8083-25B (PHAK)

STANDARD AIRPORT MARKINGS

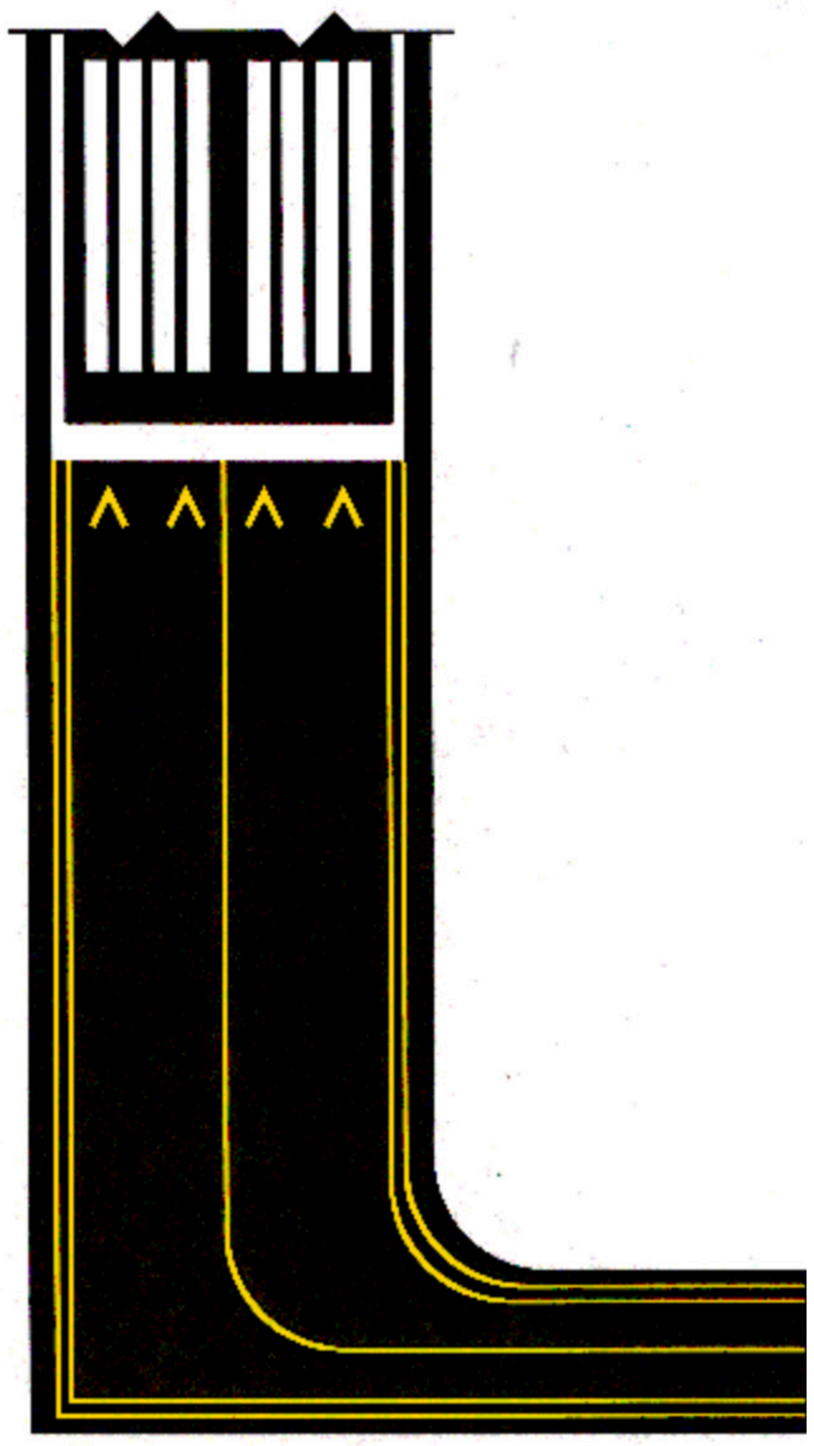
RUNWAY THRESHOLD MARKINGS

Identifies the beginning of the runway for landing.
There are 8 Longitudinal Stripes of uniform dimensions, placed about the centerline. The threshold can be displaced or relocated, and the number of stripes is related to Runway Width.

DISPLACED THRESHOLD

A displaced threshold is an a point on the runway other than the designated beginning. This area can be used for taxing, takeoff, and **landing roll-out ONLY**.

Figure 23.4.3 Displaced Threshold



IDENTIFICATION

10′ wide, white threshold bar located across runway at displaced threshold. White arrow heads, located across runway, just prior to threshold bar. White arrows, down the centerline between runway and displaced threshold.

DEMARCATION BAR

Delineates the displaced threshold from a blast-pad, stop-way, or taxiway prior to the runway. The demarcation bar is normally 3′ wide with yellow markings.

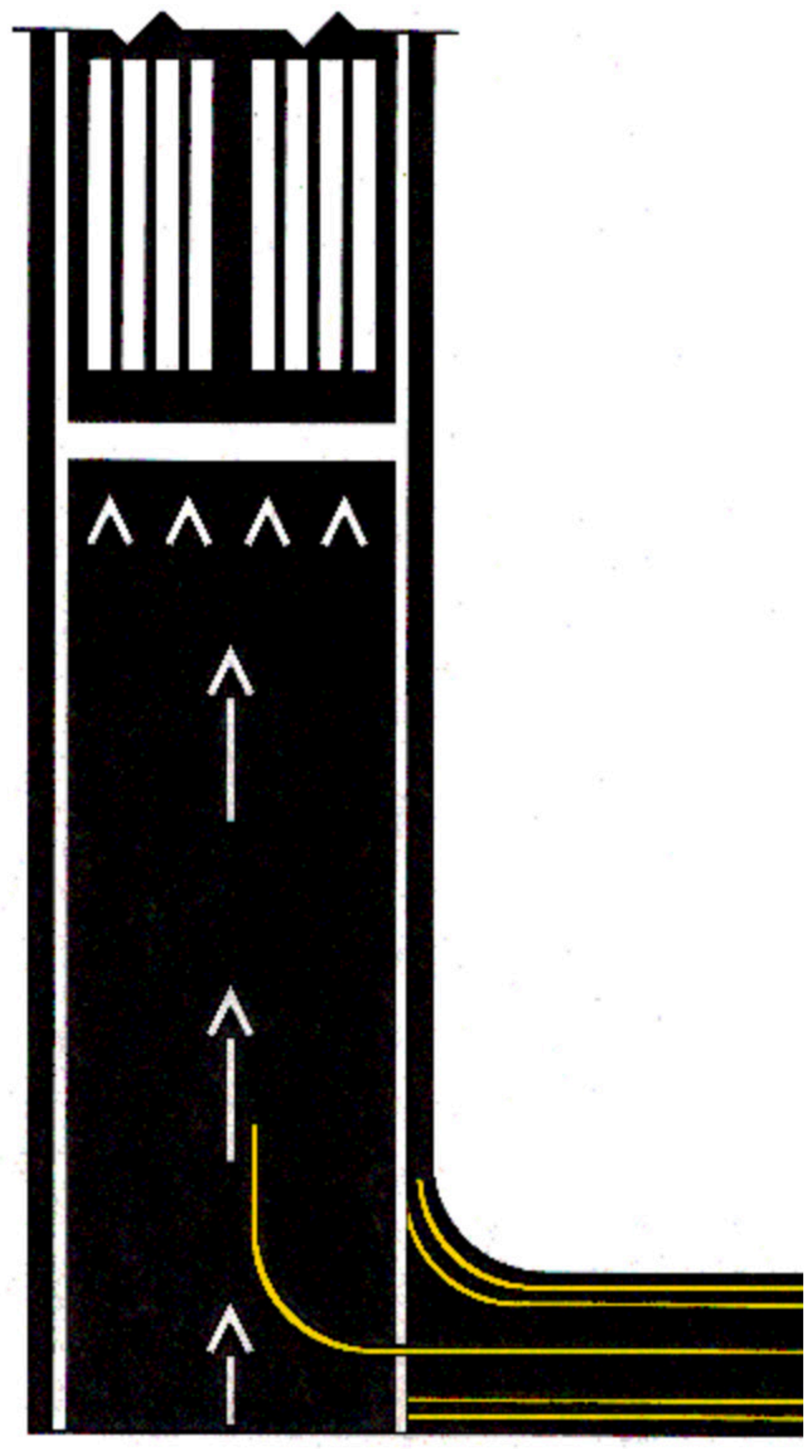
CHEVRONS

Chevrons show areas aligned with the runway that are unusable for taxi, takeoff or landing. They're marked by yellow arrows.

RELOCATED THRESHOLD

Construction or other activities require the threshold to be relocated. NOTAMs should be issued identifying the portion of runway is closed. **I.E. NOTAM - (10/28 W 900 CLSD)**

Figure 23.4.4 Relocated Threshold



IDENTIFICATION

Identification can vary, as the duration of the relocation can vary.

The common practice is to use 10′ wide, white threshold bar across runway which would indicate that there is a relocated threshold.

Runway lights between the old and new threshold will not be illuminated. Runway markings in this area may or may not be showing.

BLAST PAD/STOP WAY AREA

An area where a propeller or jet blast can dissipate without creating a hazard. A Stop-way is paved in to provide space to decelerate, in event of an aborted takeoff. **Normally indicated by chevrons.**

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PERFORMANCE MANEUVERS

STEEP TURNS

PURPOSE AND OBJECTIVE

Steep turns are a performance maneuver, which consists of two 360° turns in opposite directions using a 45º bank angle for private students and a 50º bank angle for commercial students.

The purpose of the maneuver is to develop the smoothness, coordination, orientation, division of attention, and control techniques necessary for the execution of maximum performance turns when the airplane is near its performance limits.

PREFERRED CONFIGURATION

CONFIGURATION FOR THE C-172RG CUTLASS			CONFIG. MAY VARY WITH DALT
Wing Flaps: 0°	Cowl Flaps: Open	Carb Heat: Off	Gear: Up
Manifold Pressure: 18" to 20" (or as required)		Propeller: 2,400 RPM	
Airspeed: Maintain V_A (90 KIAS)		MGTOW: V_A (106 KIAS)	

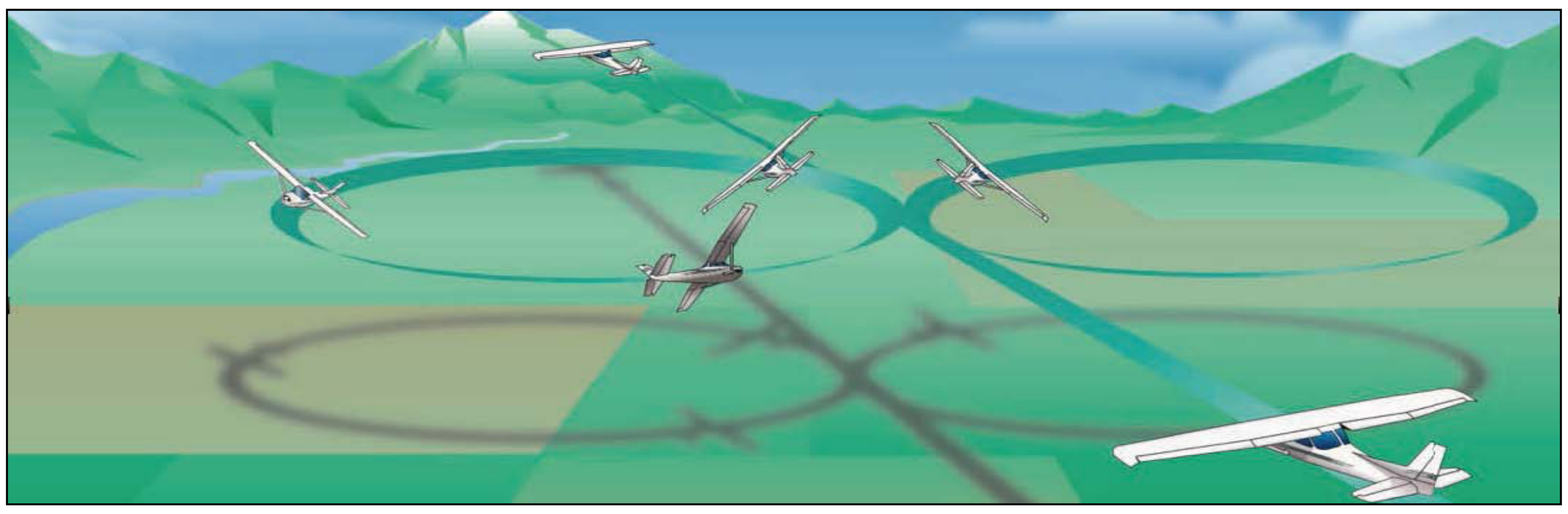
MANEUVER SETUP

- **Maneuvering Altitude - Maintain a minimum of 1,500′ AGL**, and execute clearing turns.
- **Select** an outside **reference**, then note your entry heading and altitude.
- **Establish** a **bank angle** of between **45º** for a private student, or **50º** for a commercial student.

MANEUVER EXECUTION

- Simultaneously **apply back elevator pressure** and **add power** to maintain altitude ± 100′.
- Always **trim to relieve control pressures** and maintain coordination.
- Ensure that you are scanning for traffic while you're flying the maneuver.
- **Anticipate the roll-out** by leading approximately 20º (half bank angle) to original heading ± 10º.
- Upon completion of the first 360º turn, immediately roll into the second 360º turn in the opposite direction.

Figure 28.2.1 Steep Turns



Credit: FAA-H-8083-3B (AFH)

MANEUVER TIPS

- Upon entering the bank, add a few spins of nose-up trim. Doing so will help you maintain altitude. Adjust power as required throughout the maneuver.
- If you find yourself getting high or low, take out some bank to remove or replace altitude. *A perfect turn will end with slight turbulence as you hit your own wake.*

STEEP TURNS

OVERBANKING TENANCY

- This maneuver produces an overbanking tendency. It's primarily caused by additional lift on the outside, or raised wing.
- Because the outside wing is traveling faster than the inside wing, it will produce more lift, and the airplane will tend to roll beyond the desired bank angle.
- **The pilot must be aware of this phenomenon and correct it.**

SCHEDULE

Pre-Flight Discussion: 0:15

In-Flight Lesson: 1:30

Post-Flight Critique: 0:15

EQUIPMENT

Airplane Flying Handbook for Visual Aids

White Board

STUDENT ACTIONS

Take Notes

Ask Questions

Safely Demonstrate Maneuver

INSTRUCTOR ACTIONS

Demonstrate Maneuver

Evaluate The Student

COMMON ERRORS

Failure to clear area, excessive pitch change during entry or recovery, starting recovery prematurely.

Failure to stop the turn on a precise heading, excessive rudder during recovery, resulting in skidding.

Inadequate power management, poor coordination, gaining altitude in right turns or losing altitude in left turns.

Failure to maintain a constant bank angle, disorientation, attempting to perform maneuver by instrument reference instead of visual, failure to scan for traffic during the maneuver.

FAA PERFORMANCE STANDARDS

For convenience the completion standards to successfully execute this maneuver have been included in the **hyperlinks** below.

You must have an internet connection to view and download them.

Flight Instructor Standards

Commercial Pilot Standards

Private Pilot Standards

REFERENCES

FAA-H-8083-3B - Airplane Flying Handbook, Chapter 9.