

Fabrication Shop	by Gerald Bovitz	5 hours+
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Fabricating an airplane requires as much planning, precision, and attention to detail as replacing a hip or mending a broken limb, because the consequences of sloppy work can be dire. In *Young Aviators* students are introduced to various hand and machine tools and techniques needed and turn a flat sheet of Aluminum into a finished wing component.

Basic Metalworking Techniques

Grain

Laying out & cutting parts

Scratches & deburring

Bending Aluminum sheet

Forming Aluminum angle

Drilling holes

Riveting Practices

Hole sizes & preparation

Solid rivets

Pulled rivets

Flush rivets -Countersinking & Dimpling

Riveting Tools for the Main Spar

Cutting Rib Blanks

Forming Wing Ribs

Main Spar Assembly

Leading Edge

Main Spar Caps

Wing Rib Installation

Main Spar Web

Forward Wing Ribs

Forward Wing Skin

Physics of Airplanes	by Seán G. Dwyer	1 hours
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Using a Cause & Effect approach, the goal is to have students see/ touch / feel various laws of physics that are important for how airplanes are controlled, balanced, and achieve lift.

Newton's 1st, 2nd, and 3rd laws of Motion

Principle of the Lever

Bernoulli's Principle

Coanda Effect

Airplane control surfaces

Aircraft weight & balance

Atmospheric pressure & air density

Chemistry & History of Aviation	by Seán G. Dwyer	1 hours
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The goal of the class is twofold: (a) Introduce students to the gas laws of chemistry used by the first manned flights and which later helped cause the Industrial Revolution, and (b) Surprise the students with how much aviation preceded the Wright brothers.

- Montgolfier brothers' Hot Air Balloon (1783)
- Jacques Charles' Hydrogen Balloon (1783)
- Ben Franklin's letters after witnessing the first successful flights by man (1783)
- Ideal Gas Laws - Boyle's, Charles', and Avogadro's Laws
- Blanchard's & Jennings' Flight Across English Channel (1785)
- Henri Gide's Steam Powered Airship (1852)
- Thadeus Lowe and the Union Army Balloon Corps (1863)
- 1st Zeppelin flight (1900) & largest aircraft in history - Hindenburg (1937)

Navigation by the Ancients	by Seán G. Dwyer	1 hours
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The goal of the class is to show how math can be both useful and interesting. The class seeks to evoke a sense of adventure by combining a Discovery Channel approach to history with a touch of Indiana Jones.

- Dead Reckoning at Battle of Midway (1942) and by Columbus (1492)
- Understanding the Globe - Latitude/ Longitude / Analemma / Tropics / Poles
- Geometry and Polaris - Introduction to Astral Navigation
- Eratosthenes' determination of Earth's circumference 200 BC using the Sun
- Error of Columbus and the United States of Columbia America
- Navigation Tools - Sextant, Astrolabe, Quadrant, Celtic Cross, Cross-staff
- Measuring speed at sea before watches, clocks, and GPS
- Using stars to find way home from pub in UK or back to carrier off Viet Nam
- Role of Time in Determining Longitude - Why Britannia ruled the waves
- Ptolomy Vs. Galileo and the cost of assuming that consensus is science

Weather - Cause & Effect	by Seán G. Dwyer	1 hours
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The goal is to ensure that Young Aviators alumni do not display the ignorance of the causes of seasons seen in a graduation day survey taken at Harvard University. Applied geography and astronomy, combined with math, illustrate the causes of seasons, climate, currents, winds.

- Summer, Winter, Spring, Fall and Earth's tilted axis of rotation
- Trade Winds and Earth's 1,000 mph rotation speed at the Equator
- Why deserts at 30°N and 30°S and seasonality of Monsoon Winds
- Ocean currents, Gulf Stream, Atlantic (Heat) Conveyor

Ice Ages & Eccentricity/Obliquity/Precession in the Milankovitch Cycles
Ice core studies and why Native Americans never invented the wheel

Weight & Balance	by Seán G. Dwyer	1 hours
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Working with the lever principles, students explore methods to compute balance for general aviation aircraft, with real world conditions.

Aerodynamic Principles	by Eddy Huffman	1 hour
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Airfoil definition
Interaction of wing (airfoil) and air
Airfoil cord and camber
Relative wind
Angle of attack
How the pilot controls angle of attack
Stalls
High lift devices
Axes of flight - how control movement
Center of gravity vs center of lift
Stability
Trim

Fundamentals of Flight	by Eddy Huffman	1 hour
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Straight and Level
Turns
Climbs
Descents
Traffic Pattern
Takeoffs
Landings
 Normal
 Short field
 Cross wind
Maneuvers
 Stalls
 Steep turns
 Ground reference maneuvers

Human Factors	By Eddy Huffman	1 hours
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Physiology
 Respiration
 Partial pressure of oxygen
 Hypoxia
 Theory
 Prevention
 Symptoms
 Remedies
 Vision
 Night vision
 Blind spot
 Scanning techniques
 Workload management
 Plan
 Prioritize
 Sequence
 Distinguish between Critical Task and Pressing Task
 Fatigue
 Decision making
 Situational awareness
 E.g. Eastern 1011 crash in Everglades

Principles of Navigation	by Steve Rehwinkel	1 hour
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1. How Meteorology (weather) affects navigation (this ties the 2 classes together)
2. Explanation of course vs. heading
3. Crosswind effects on an aircraft in flight (affects the aircraft by speed, not size)
4. Explain the origin of nav charts (Lambert Conformal Conic Projection)
5. Navigation chart symbols
6. Use of a plotter (draw a course line & make basic measurements)
7. Explain the various classes of airspace
8. Show how to use online flight planning software i.e: AOPA Flight Planning Guide

9. Handout of add'l reference material & web sites.

Intro to Meteorology	by Steve Rehwinkel	1 hour
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1. Explain climate vs. weather
2. What makes weather?
 - a. World is covered by air
 - b. Air moves (Coriolis force), warms & gathers moisture
 - c. When air warms it rises
 - d. When air rises it cools
 - e. When air cools, it loses its ability to hold moisture
 - f. Precipitation falls (rain, snow, sleet, hail)
3. Types of fronts & their basic characteristics
4. Thunderstorm components
 - a. Source of moisture
 - b. Unstable air (turbulence)
 - c. Lifting force
 - i. Front
 - ii. Thermals
 - iii. Orographic
5. Thunderstorm characteristics
 - a. Cumulonimbus clouds
 - b. Lightning & thunder
 - c. Wind
 - i. Wind shear
 - ii. Gust front
 - d. Hail
 - e. Tornados

Flight Training Overview	by Ken Kaebisch + flight instructors	5 hours flight time, 10 hours of instruction
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MONDAY-AIRCRAFT

Objectives:

- Familiarize the student with the training airplane, its operating characteristics, cockpit controls, and the instruments,
- preflight and post flight procedures,
- The use of checklists,
- Safety precautions to be followed.

New Content:

1. Preflight briefing
2. Use of checklists
3. Preflight inspection - by instructor
4. Engine starting Taxiing
5. Before-takeoff check
6. Normal and crosswind takeoff and climb
7. Sightseeing
8. Effect and use of primary flight controls and trim
9. Collision avoidance procedures
10. Normal and crosswind approach
11. Pattern
12. Landing procedure
13. After-landing procedures

14. Parking and securing the airplane

Post Flight Critique

TUESDAY-AIRCRAFT

Objectives:

1. Radio communications
2. Airport and runway markings
3. Traffic patterns (rectangular course)
4. Pitch and power settings-get known result (airspeed, climb, descent)
5. Trimming
6. Climbs and climbing turns
7. Turns to headings (rule of thumb for roll out)
8. Descents and descending turns
9. Level off from climbs and descents (rule of thumb for level off)
10. Torque effects
11. Adverse aileron yaw
12. Flaps -airspeed - pitch
13. Power off glide (stability)

WEDNESDAY - AIRCRAFT

Objectives

1. Maneuvering during slow flight
2. Power off stalls-enter from straight flight
3. Power on stalls-enter from straight flight
4. Take off and landings.

Post Flight Critique

THURSDAY - AIRCRAFT

Objectives

1. Steep Turns
2. Rectangular Course
3. S-Turns
4. Turns around a point
5. Slips
6. Engine out glides

Post Flight Critique

FRIDAY-AIRCRAFT

Objectives

1. Fly VOR course plotted on sectional chart to another airport.
2. Soft and short field landings and take offs (grass at BUU)(short at C89)(at the discretion of the instructor)
3. Return to Racine Airport. (final sightseeing on the return flight)

Flight Simulator	flight instructors	5 hours / 1 everyday
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Day 1: Controls, Instruments, Horizon	flight instructors	1 hour
Day 2: Slow Flight, Stall, Takeoff & Land	flight instructors	1 hour
Day 3: Turns, Wind, Pilotage, VOR	flight instructors	1 hour

Day 4: Crosswind, Lost, Emergency Land	flight instructors	1 hour
Day 5: Cross Country Flight of Choosing	flight instructors	1 hour