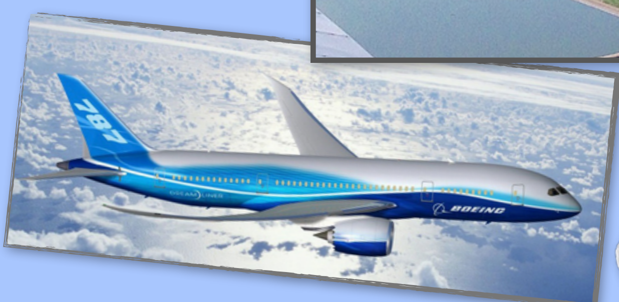
GHOST SQUADRON

CAF



Aviation Merit Badge

WORKBOOK

March 2017

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AVIATION

REQUIREMENTS:

1.Do the following:
   A. Describe how aviation has affected our world.
   B. Define "aircraft." Describe some kinds of aircraft in use today. Explain the operation of piston, turboprop, and jet engines.
   C. List at least 10 uses of aircraft.

2. Do the following:
   A. Point out on a model plane the forces that act on an airplane in flight.
   B. Applying Bernoulli's Principle, explain how an airfoil generates lift, how the primary control surfaces (ailerons, elevator and rudder) affect the aircraft's attitude, and how a propeller produces thrust.

3. Show how the control surfaces of an airplane are used for takeoff, straight climb, level turn, climbing turn, descending turn, straight descent, and landing.

4. Identify the following aircraft instruments and explain the purposes of each: attitude indicator, altimeter, airspeed indicator, compass, turn and bank indicator, tachometer, oil pressure gauge, and temperature gauge.

5. Explain the differences in the operation of piston, turbojet, turboprop, and turbofan engines.

6. Tell six rules of safety to follow around airplanes and airports.

7. Do **TWO** of the following:
   a. Take a flight in an aircraft. Record the date, place, type of aircraft, duration of flight, and your impressions of the flight.
   b. On a map mark a route for an imaginary air trip of at least 3,000 miles. Start from the commercial airport nearest your home. Travel using three or more different airlines. From timetables, decide when you will get to and leave from all connecting points.
   c. Visit a modern airport. After the visit, tell how the facilities are used.
   d. Under supervision, perform a preflight inspection of a light plane.
   e. Learn how to read an aeronautical chart. Measure a true course on the chart. Correct it for magnetic variation, compass deviation, and wind drift. Arrive at a compass heading.
   f. Build and fly a fuel-driven model airplane. Describe safety rules for building and flying model airplanes. Tell safety rules for use of glue, paint, dope, and plastics.
   g. Find out what job opportunities there are in aviation. Describe the qualifications and working conditions of one job in which you are interested. Tell what it offers for reaching your goal in life.

What Are Aircraft?

The term, aircraft, is pretty broad and covers nearly everything that enables man to fly in the air (manned flight in craft lighter than or heavier than air.) It means anything that navigates through the air and carries man (manned flight); aircraft may be heavier or lighter than air. Therefore the term includes balloons and dirigibles, as well as airplanes, gliders, and sailplanes. (Missiles, rockets, and spacecraft traveling into outer space are not included, since they are designed to fly outside the earth's atmosphere or an envelope of air.)

Here are some of the kinds of aircraft in use today:

Commercial airliners, Air cargo planes, Military bombers and fighters, Military supply transports, Helicopters, Light pleasure planes of various types, Planes owned by corporations to transport executives, Sailplanes, Balloons for exploration of the atmosphere, Amphibians, Seaplanes,

CH-47F CHINOOK IN IRAQ (US ARMY)

VTOL (Vertical Take-Off/Landing), STOL (Short Take-Off/Landing, Stunt planes, Crop Dusters, Blimps - and even Drone Aircraft. You are probably aware of many of these types.

HOW AN AIRPLANE CAN FLY

You know from school science classes that the earth is covered by an "ocean" of air called the atmosphere. You probably also have learned (and experienced) that anything with mass/weight will fall toward earth if nothing opposes the gravitational force. So then, how can an airplane get into the air and stay there?

The basic answer has to do with the forces acting upon the airplane. Those are:

GRAVITY *(*Weight) ------The Downward-acting force
LIFT -----------------------The Upward-acting force
THRUST -------------------The Forward-acting force
DRAG ---------------------The Backward-acting force (Air resistance)

Two of these forces are quite easy to understand. You know from experience how **Gravity** or weight works, especially when you try to stand up or jump off of a higher object since the force of gravity will pull you toward the ground. And you know of **Drag**, or air-resistance, from the feeling of pedaling your bike into the wind or sticking your hand out of car window while moving.

The other two forces we discuss here, **Lift** and **Thrust** are the keys to flight. These are the forces designer consider so as to overcome the Drag and Gravity forces. **Thrust** is the force that pulls or pushes the airplane forward and is created by an engine/motor of a variety of designs. **Lift** is created by the design of the wing so that air pressure flowing over the top of the wing is less than that below the wing - thus causing an upward force. The combination of Thrust and Lift then pull the airplane forward and lift it off the ground.

Science of Flight

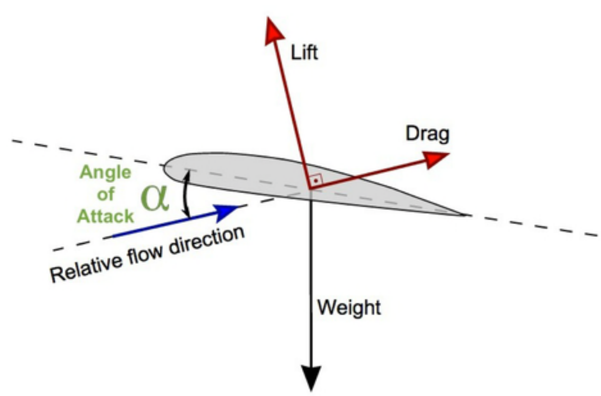
In the 1700s a Swiss scientist named Daniel Bernoulli discovered that any fluid (liquid or air) reacts when the speed of the fluid changes. He found that the pressure of the fluid decreases at the point where the speed increases. For example, if you direct a fluid through a pipe in which the pipe diameter decreases, the speed of the fluid will increase - and the pressure will decrease at the narrow point. An airfoil uses this principle to create lower pressure across its upper side relative to the pressure on the lower side. Airplanes use airfoils in their **wings, horizontal stabilizers, elevators, vertical stabilizers, rudders** and **propellers.**

As the airfoil moves through the fluid called air, the air must move faster to travel across the upper curved surface than the air that travels across the lower flat surface. This creates a lower air pressure above the wing and results in **Lift.** This is the simplest definition of flight dynamics and many other factors play a role in modern flight theory, but for our purposes this will suffice.

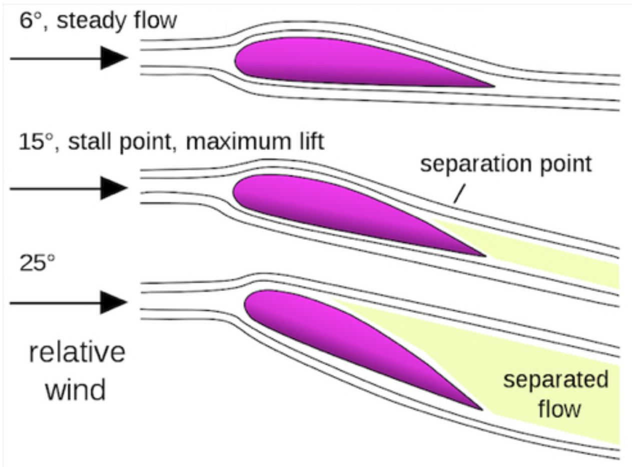
You can demonstrate this principle yourself by putting your hand out of the window into the air as your car moves along. Hold your hand edgewise and you can feel the pressure trying to raise your hand and arm. As you tilt your hand upward and downward you experience the different forces that occur as you change the angle.

Airfoils in Action

When a wing is tilted upward it will produce greater lift - we call this "increasing the **Angle of Attack,"** which is the angle between the airfoil's leading edge and the Relative Wind.



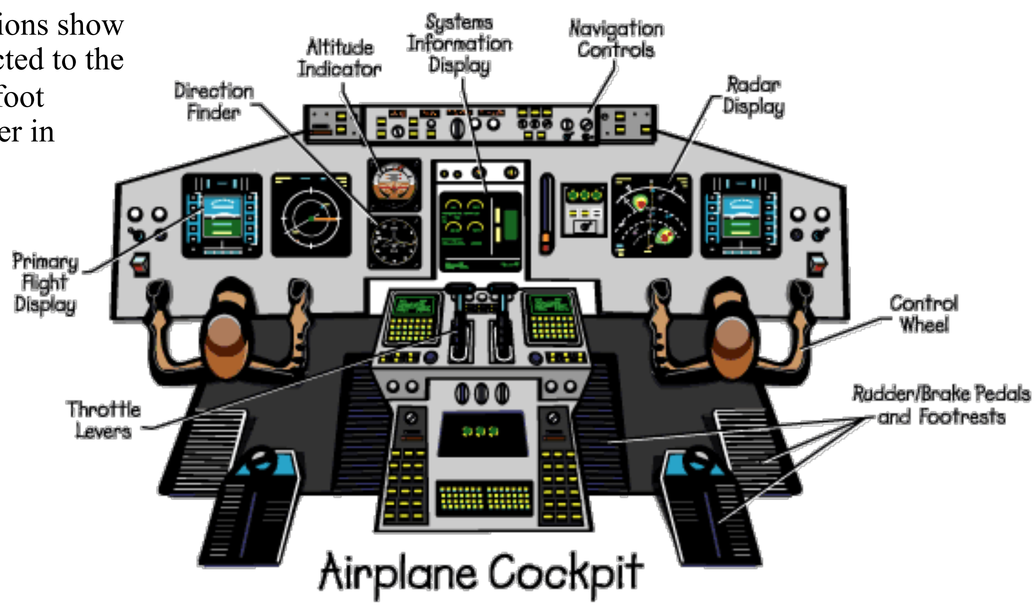
As that AoA increases, the lift (and the drag) will also increase - up to a limit. At somewhere around 18° to 20° AoA, the airflow can no longer flow smoothly over the upper wing surface and *separation* begins to occur.



We call this condition a ***STALL*** and the wing no longer produces enough lift to support the aircraft weight. Depending on the aircraft orientation and balance, the airplane will begin to descend, perhaps backwards, and perhaps with a roll or yaw that can enter a ***SPIN*** (a rotational semi-controlled or uncontrolled descent.)

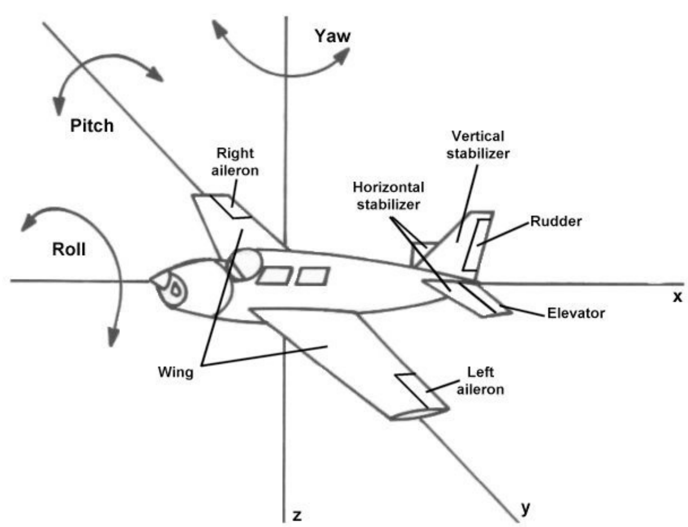
FLYING THE PLANE

Now that we know what makes a wing fly, let's discuss how the pilot controls the airplane by adjusting the many airfoils on the airplane. Increasing or decreasing airspeed and moving one or more of the airfoils (**Horizontal Stabilizer, Elevators, Vertical Stabilizer, Rudder, Wings and Ailerons**.) When the movable surface are adjusted the airflow over the surfaces changes which then changes the **attitude** or direction of the aircraft. These illustrations show how the airfoils are connected to the stick or wheel, the rudder foot pedals, and the throttle lever in the cockpit.



Control Wheel or Stick

The Stick or Yoke can be moved in all directions and that movement changes the positions of the ailerons and elevators. Moving the stick or wheel to the right moves the right aileron up and the opposite aileron down, changing the lift on the two wings, and causing the airplane to **roll** right.



If the pilot presses the control wheel forward, the elevators move downward. This increases the lift, provided by the horizontal tail assembly, and forces the tail upward, making the plane's nose drop. If the pilot pulls back on the wheel, the elevators turn upward, decreasing the tail assembly's lift. This, the plane's tail is forced down and the nose if forced up. The rudder is moved on the tail fin by means of a linkage to the rudder pedals in the cockpit. The pilot controls its movement by pressing the rudder pedals with his feet. In this requirement, you are asked to show how these control surfaces are operated to maneuver a plane. You can demonstrate this by actually working a plane's controls on the ground if one is available to you. If it is not, you may show your counselor how it is done by using a model plane or by showing the positions with hand motions. As we discuss how the control surfaces work, we are ignoring the throttle, which is a very important factor in maneuvering. Fork example, if he wanted to climb, the pilot would not merely pull back on the wheel to lower the plane's tail and rise the nose. If he only did that, the drag would be rapidly increased and the wing would lose considerable lift. And so, at the same time that he pulls back on the wheel the pilot opens the throttle to gain more speed. This keeps the lift power high and helps the plane climb. But for purposes of this requirement, we will talk about maneuvering without reference to the throttle.

Pitch

Yaw

Maneuvering the Plane

Here is how it is done:

Takeoff-Elevators down to lift the tail; ailerons level and rudder centered. AS the tail comes up, level the elevators. When flying speed is reached, pull back on the wheel to lift the nose.

Straight Climb-When the plane is a few feet off the ground, the control surfaces are leveled until speed increases. AS the plane goes faster, the pilot begins climbing by pulling back on the wheel. This puts the elevators in an up position: pushes the tail down; the nose up. *Level Turn*-Turns are made by the ailerons and rudder working together. The pilot (if he is making a level turn to the left) turns the control wheel to the left and presses the left rudder pedal. The left aileron goes up, the right one down, and the rudder goes to the left. This forces the plane into a banking left turn in level flight. After establishing the degree of the bank, the controls are returned to "neutral" position. The plane will then continue to turn until the pilot moves the controls in the opposite direction of the turn to return the plane to level flight, straight ahead. *Climbing Turn*-To climb, the pilot must pull back on the wheel, forcing the plane's tail down and the nose up. Therefore, to make a climbing turn, he combines this movement with those of turning. For a climbing left turn, he would ease the control wheel to the left and back, and press the left rudder pedal. At that point, the left aileron would be up, helping lower the wing; the right one down, helping raise the wing; the rudder to the left, and the elevators up. *Descending Turn*-Position of the control surfaces for a descending turn is the same as for any other turn, except that the elevators are down and the power is reduced. This forces the plan's tail up and nose down. You reduce power-unless you want to build up speed. *Straight Descent*– To descend on a straight course, the pilot has all control surfaces level except for the elevators. They are down and consequently the plan's tail is up and the nose down. *Landing*-As the plane nears the ground, the pilot reduces power and pulls back on the control wheel to slow the glide. When the wheels are just aboveground, the control wheel is all the way back, stalling the plane. This decreases the speed and the plane lands on the two main wheels.

FLYING BY INSTRUMENTS

The first aviators flew "by the seat of their pants." That is, they reacted to what they could see out of the open cockpit and what their feeling of weight or weightlessness told them about whether the plane was climbing or descending.

As planes became faster and night flying became common, seat-of-the-pants flying was no longer safe. The pilot found that his senses could not always be trusted. And so, instruments were developed to show the pilot his plan's altitude, whether it was climbing or descending, turning or flying straight, in level flight or banking, and whether he was really flying a true course.

In a small private plane, the instrument panel is not much more complicated than the dashboard of your family's car. But, in a modern airliner or a military plane, there will be instruments in front of the pilot, at his feet, and over his head. Each tells him something he needs to know about the position and condition of his plane.

In this requirement you are asked to identify the main aircraft instruments-the ones that will be found on every airplane. With them, a pilot could fly entirely without looking out the windshield except for takeoff and landing-assuming, of course, that he is at the proper altitude and is in radio communication with the ground so that he is not flying a collision course with another plane.

Most flying today is done by a combination of reference to instruments and visual observation. The pilot is constantly checking both his instruments and what his eyes tell him about the plane's position.

The first five instruments mentioned in the requirement-the attitude indicator, altimeter, airspeed indicator, compass, and turn and bank indicator-tell the pilot what he needs to know about his altitude, speed, direction, and attitude. The last three-tachometer, oil-pressure gauge, and temperature gauge-tell him how his engine is operating. Let's look at the five flight instruments first.

Attitude Indicator

The attitude indicator, or gyro horizon, allows the pilot to get an immediate picture of the plane's attitude. This instrument operates on the "rigidity in space" principle. The plane of rotation of the gyro wheel is horizontal and maintains this position, with the airplane (and instrument case) being moved about it.

Attached to the gyro is a face with a contrasting horizon line on it. This line represents the actual horizon. A miniature airplane attached to the case moves with respect to this artificial horizon precisely as the real plane moves with the real horizon.

Altimeter

This is one of the most important instruments in the plane. The pilot must know at all times how high he is flying so that he can clear mountains and man and made obstructions like television towers, and avoid collisions with other aircraft by staying at heights called for by air traffic rules and airport directions.

The altimeter is simply a barometer that measures the air pressure and converts the reading into altitude. You will remember that atmospheric pressure gets lower the higher you go in the air. Since this is so, if we compare a barometer reading on the ground to one at 10,000 feet, the reading will be much lower at the higher level. The altimeter is designed to make this comparison and then change the measurement into feet so that the pilot will so that the pilot will know how high he is above his takeoff point or above a flight service station along his route which gives him a new barometer reading.

The altimeter has a knob for adjusting the instrument to take into account changes in barometric pressure at different points of his flight as reported by weather stations.

Airspeed Indicator

This instrument tells the pilot how fast he is traveling in relation to the air around his plane. Like the altimeter, the airspeed indicator works by measuring air pressure. But, the pressure it measures is the impact the plane has on the air. In other words, the airspeed indicator indicates how hard the particles of air are hitting the instrument as the plane moves through the air. This impact is translated into speed and miles per hour or knots.

First, as you know, the magnetic pole is not at the North Pole, or exact top of the earth. Rather it is some 1300 miles away. This fact leads to variations in determining true headings. Secondly, the United Sates is not uniformly magnetized; in some areas, the compass may vary many degrees from the magnetic pole. And, finally, the metal and electric equipment within an aircraft leads to compass deviations with which the pilot much be familiar.

In big planes, there may be other instruments that tell the pilot whether he is on course and give more consistent direction and are easier to read that a magnetic compass. A radio compass is also sometimes used. This is simply a device for pointing to or from a radio station instead of the North Pole. Two main types of compasses are magnetic and gyro. The magnetic compass works just like your own scout compass. The gyro compass uses a gyroscope to keep the course and is adjusted to correspond with the magnetic compass indication after a short period of level flight.

Turn and Bank Indicator

Is actually two instruments in one. It's purpose is to tell the pilot when he is turning and how well he is executing the turn, whether he has to much or to little bank for the rate of turn. They may also check for coordination and balance in straight and level flight. The turn needle always deflect in the direction of the turn and indicates the rate at which the aircraft is turning about it's vertical axis. There are two type of turn and bank instruments in use today: a 4-minute turn needle and a 2-minute needle. The 4-minute needle was developed for use in high speed aircraft. With the needle deflected one needle width, the instrument measures a turn of 1 1/2 degrees per second.

Tachometer

If you've ever looked at the dashboard of a sports car, you may have seen a tachometer. It's purpose is to tell the driver of the car exactly how fast his engine is running.

In a plane, it has two main purposes: to show the pilot whether he is flying at the recommended engine speed for a particular maneuver, and to tell him whether his engine operating normally. The airplane's designer might have determined that the best cruising speed for the engine is 2300 revolutions per minute (rpm), so the pilot would set his throttle accordingly when he wanted to cruise. The designer would also have recommended a certain number of rpm for the motor for climbing and descending.

The tachometer also tells the pilot something about the condition of the engine. If, when the pilot is preparing for flight, he finds that with the throttle open all the way the tachometer reads only 1800 rpm when it should read 2400, then he can be pretty sure something is wrong with his engine.

Oil Pressure Gauge

This gauge does the same thing as the one in a car. It shows the pilot the pressure of the oil in the engine, and this tells him a great deal of the health of the engine. Dropping oil pressure is a sure sign of engine trouble.

Oil-Temperature Gauge

This instrument is another indicator of the engine's health. It simply measures the temperature of oil and thus shows whether the engine is running well or is too warm or too cold. In some planes, the gauge is included on the same dial as the oil-pressure gauge.

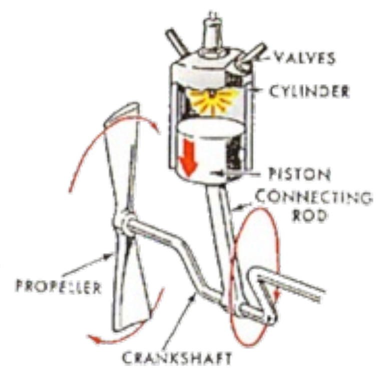
POWER FOR FLIGHT

The great advantage of flight over other means of transportation is speed and the history of aviation is the story of man's quest to go faster and faster.

Today's automobiles would have left the Wright brothers' flying machine far behind, but today's planes-and rockets-fly at speeds that Wilbur and Orville Wright would have found unbelievable. Supersonic transports which will be flying soon are expected to cruise at nearly three times the speed of sound. And tomorrow's space vehicles will travel routinely at ten times the speed of sound.

The Wright brothers used a very efficient, four-cylinder piton engine they built themselves. And until the latter years of World War II in the middle 1940's, the piston-type engine drove all the airplanes. By the early 1950's jet engines dominated new military aircraft and soon began to power most airliners. But there is still a place for the piston engine in aviation, particularly, in small private planes.

The Piston Engine



The piston engine or reciprocating, internal –combustion engine is similar in operation to the engine in your family ar. See illustration. A mixture of gasoline and air in a ratio of about 15 pounds of air to 1 pound of gasoline, is compressed by a piston. When this compressed mixture is ignited by an electric spark, the resulting gases expand very rapidly and force the piston to move away from the end of the cylinder in which it is enclosed. This downward motion of the piston is transferred to a connecting rod, which, in turn, transmits a rotary motion to a crankshaft. The rotating crankshaft turns the propeller and forces the piston back to the top of the cylinder. An exhaust valve at the top or head of the cylinder opens to let out the burned gases. Then this valve closes and another valve-the intake valve-opens to let in a fresh mixture of air and gasoline. These valves are operated by a system of gears and cams so that they open and close at the correct time. Each complete movement of a piston in one direction is a stroke. The whole series of actions between the admission of gasoline and air and the exhaustion of the burned gases is called a cycle. The main aircraft engines use a four-stroke cycle, so called because there are four strokes of the piston in each cycle. The crankshaft makes two complete revolutions for each four-stroke cycle. Each cylinder in an engine fires once for every two revolutions of the crankshaft. The power strokes in the various cylinders are timed to keep the crankshaft turning smoothly. A propeller converts the power of the engine into the thrust which pulls an airplane rapidly through the air.

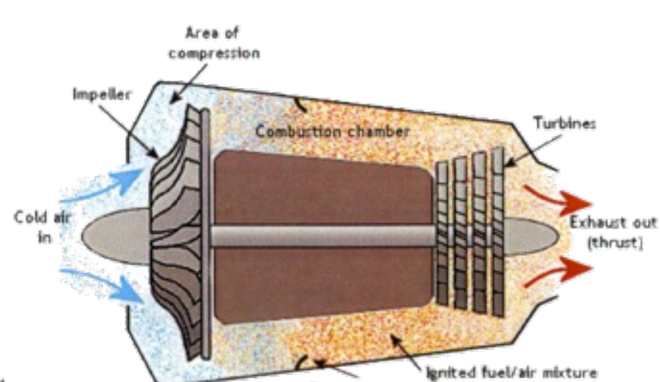
Jet Engines

Jet engines and rockets both operate on Newton's law, creating a thrust which pushes the craft through the air or outer space. The difference between them is that jet engines require air and rockets do not. Rockets carry their own oxygen for the combustion of the gases which create the thrust, and thus they are suited for voyages to come in the far reaches of space. In jets, a stream of air and burning gases flows through the engine and is ejected at a speed much greater than it entered. Most jet engines use rotating compressors and turbines to compress the gases and operate the moving parts. When the gases are compressed by scooping air from the atmosphere without compressors or turbines, the engine is called a ramjet. There are four kinds of jet engines: Turbojet, Turboprop, Ramjet, and Turbofan.

Let's take a close look at them one at a time.

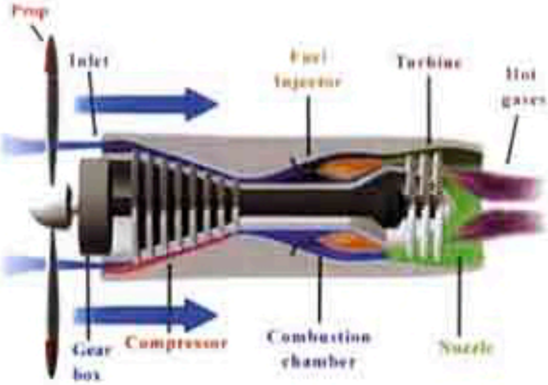
Turbojet

In a turbojet engine, the air comes in through an inlet and is compressed by the rotating blades of a compressor. It is then heated to tremendous temperatures by being mixed with the fuel (usually kerosene) in a combustion chamber. The expanding gases travel through a rotating turbine and out the tail, creating a giant thrust. The turbine turns the compressor, which usually is mounted on the same shaft. The turbine does not contribute to the engine's thrust.



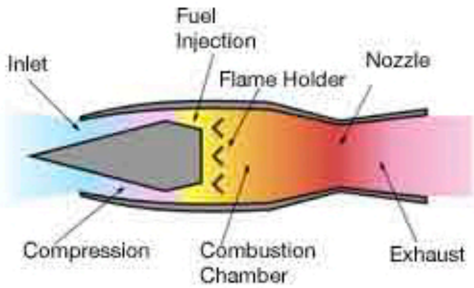
Turboprop

This is a variation of the turbojet. Some of the shaft power of the turbojet engine is used to turn a propeller, just like those on piston-driven aircraft. The turboprop engine is particularly useful in commercial aviation, because the propeller gives a large thrust for takeoff. It can also be reversed easily and quickly for landing at slower speeds than other types of jet aircraft. Turboprops get most of their thrust from the propellers, but they also are propelled by the exhaust gases. This added thrust is especially important at high altitudes and high speeds. The turboprop engine is the slowest of the jet types.



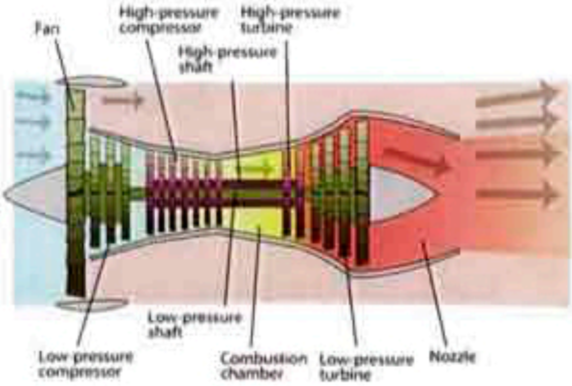
Ramjet

The ramjet engine is the simplest power plant ever devised. The compressor and turbine are eliminated altogether, and it has no moving parts. It is also the fastest of the jet engines. The air inlet on a ramjet is so designed that the plane's forward speed alone compresses the air. It goes into a combustion chamber where it is mixed with fuel and the expanding gases go directly out the tail, creating a tremendous thrust. Ramjets have one defect; They cannot start the craft by themselves. Usually, ramjets are sent on their way by a rocket or some other device. They can be designed to operate from slightly over Mach 1 (the speed of sound, or somewhat over 740mph) to mach 4 or 5.



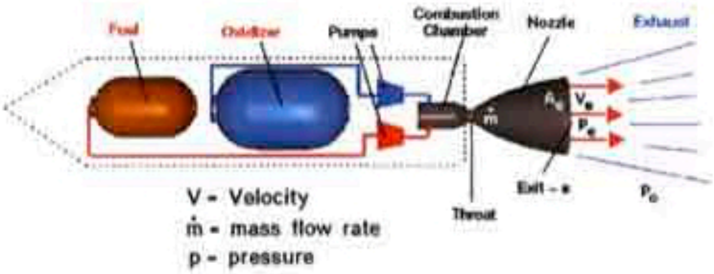
Turbofan

Turbofan engines are similar to turbojets except that they have larger rotating blades enclosed in a metal cowling. And in the turbofan, a separate portion of the compressor provides an air stream which bypasses the combustion chamber. The turbofan engine has greater thrust for its weight then the turbojet.



Rockets

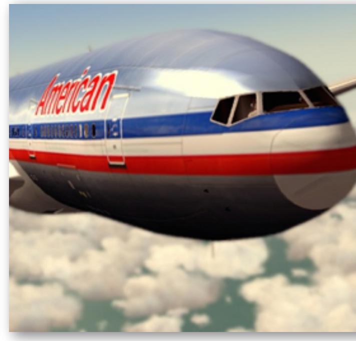
Rockets were used as fireworks and weapons of war by the Chinese at least 1000 years ago, but modern development of rockets began less than 50 years ago. The rocket engine is used in space flights because it carries its own oxygen. Jet engines require air and cannot be used in outer space. Rocket engines also can be used in the air, and, in fact, the sound barrier was broken for the first time in 1947 by a rocket-propelled plane. But rockets are mainly important now as propulsion for man's reach out into space. Rockets are usually classified as either liquid-propellant or solid-propellant. The giant rockets which lift our astronauts into space are liquid-propellant rockets. They burn a fuel based on kerosene, and their oxygen in liquid form is carried in tanks separated from the fuel. The solid-propellant rockets may have either separate compartments for fuel and oxidizer or the two may be combined in one chemical. Research is being done on two other types of rocket propulsion which hold promise for the future. One is ion propulsion in which the "fuel" Is a metal, possibly cesium or mercury. The molecules of the fuel are given an electric charge; that is, they are ionized. These ions are accelerated to very high velocities by means of an electrical field through the tail of the rocket, creating the thrust. The problem in developing rockets is that a very large and heavy generator is needed to ionize the fuel. The other type now under study is the atomic rocket. Its energy would be provided by heat from the nuclear fission working on a liquid propellant, possibly liquid hydrogen. If you want to learn more about rockets and man's future in outer space, you will want to try to earn the Space Exploration merit badge.



Aviation Careers

Pilots
There are many ways to make a living as a pilot, from a flight instructor to a military pilot to a commercial airline pilot.

Airports
A variety of aviation careers are associated directly with airport operations.



Airlines
Find a career in one of the largest employing industries out there today.

Aircraft Manufacturing
From small single-engine personal aircraft all the way to gigantic transports, you could be building the airplanes of tomorrow.

Air Traffic Control
Providing information to pilots to ensure the safe and orderly flow of air traffic at airports and in our skies.

Government Careers
Many opportunities are available not only with the FAA, NTSB, and NASA, but also with state and local governments.

Pilot Certification

The FAA offers a progression of pilot certificates or licenses. Each license has varying experience and knowledge requirements and has varying privileges and limitations.

Student pilot

A student pilot certificate is issued by an aviation medical examiner (AME) at the time of the student's first medical examination. For operations not requiring a medical certificate a student pilot certificate can be issued by an FAA inspector or an FAA-designated pilot examiner. The student pilot certificate is only required when exercising solo flight privileges. To qualify for a Student Pilot certificate, an applicant must be at least 16 years of age (14 for glider or balloon)

Sport pilot

The Sport Pilot certificate was created to lower the barriers of entry into aviation and make flying more affordable and accessible. The sport pilot certificate offers limited privileges mainly for recreational use. It is the only powered aircraft certificate that does not require a medical certificate; a valid vehicle driver's license can be used as proof of medical competence provided the prospective pilot was not rejected for their last Airman Medical Certificate. To qualify for the Sport pilot certificate, an applicant must be at least 16 years of age (14 for glider or balloon)

Recreational pilot

The recreational pilot certificate requires less training and offers fewer privileges than the private pilot certificate. It was originally created for flying small single-engine planes for personal enjoyment; the newer Sport Pilot certificate overlaps this need and is easier to get, but the recreational certificate allows access to larger single-engine aircraft, and instructor endorsements are available to recreational pilots that are not applicable to sport pilots, such as flying at night or cross-country. To qualify for the Recreational pilot certificate, an applicant must be at least 17 years of age.

Private pilot

The private pilot certificate is the certificate held by the majority of active pilots. It allows command of any aircraft (subject to appropriate ratings) for any non-commercial purpose, and gives almost unlimited authority to fly under visual flight rules (VFR). Passengers may be carried and flight in furtherance of a business is permitted; however, a private pilot may not be compensated in any way for services as a pilot, although passengers can pay a pro rata share of flight expenses, such as fuel or rental costs. Private pilots may also operate charity flights, subject to certain restrictions, and may participate in similar activities, such as Angel Flight, Civil Air Patrol and many others. To qualify for the Recreational pilot certificate, an applicant must be at least 17 years of age (16 for glider or balloon.)

Commercial pilot

A commercial pilot may be compensated for flying. Training for the certificate focuses on a better understanding of aircraft systems and a higher standard of airmanship. The commercial certificate itself does not allow a pilot to fly in instrument meteorological conditions.

Instrument Rating

An instrument rating is required to fly under instrument flight rules. Instrument ratings are issued for a specific category of aircraft; a pilot certified to fly an airplane under IFR has an Instrument Airplane rating.

Airline transport pilot

An airline transport pilot ("ATP") is tested to the highest level of piloting ability. The certificate is a prerequisite for acting as a flight crew-member in scheduled airline operations. Minimum pilot experience is 1,500 hours of flight time (1200 for Helicopters), 500 hours of cross-country flight time, 100 hours of night flight time, and 75 hours instrument operations time (simulated or actual). Other requirements include being 23 years of age, an instrument rating, a rigorous written examination, and being of good moral character.

Aviation

Merit Badge Workbook

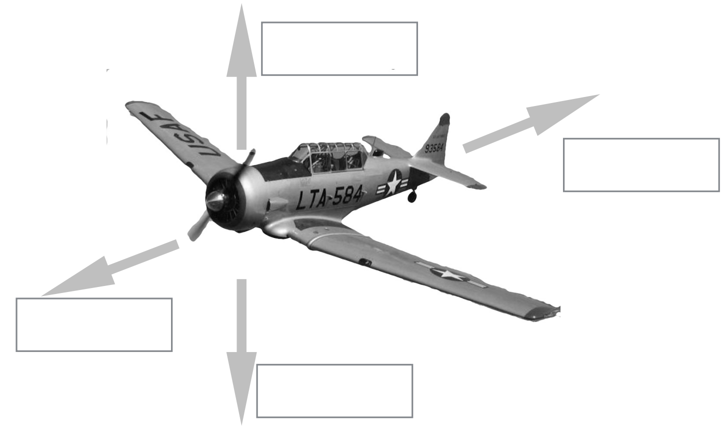
This workbook can help you but you still need to read the official BSA merit badge pamphlet. The work space provided for each requirement should be used by the Scout to make notes for discussing the item with his counselor, not for providing the full and complete answers. Each Scout must do each requirement.
No one may add or subtract from the official requirements found in ***Boy Scout Requirements*** (Pub. 33216 – SKU 619576). The requirements were last issued or revised in 2014 • This workbook was updated in March 2017.

Define Aircraft

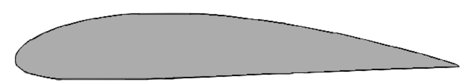
Describe Some Uses for Aircraft Today

	KIND	DESCRIPTION
1		
2	.	
3		
4		
5		

List the Forces That Act On An Airplane In Flight



Explain with this airfoil diagram how lift is generated:



Describe how a propeller produces thrust:

Describe how the control surfaces of an airplane are used for takeoff, straight climb, level turn, climbing turn, descending turn, straight descent, and landing.				
	AILERONS	ELEVATOR	RUDDER	FLAPS
TAKEOFF				
STRAIGHT CLIMB				
LEVEL TURN				
CLIMBING TURN				
DESCENDING TURN				
STRAIGHT DESCENT				
LANDING				

Describe the use of the Following Instruments		
1	ALTIMETER	
2	AIRSPEED IND.	
3	TACHOMETER	
4	COMPASS	
5	ATTITUDE IND.	

Use An Aeronautical Chart	
1	Plot a Course On The Chart
2	Correct the Course for magnetic variation, compass deviation, and wind drift.to determine a compass heading.

Describe How Runways Are Numbered

List 4 types of Pilot Certificates	
1	
2	
3	
4	

List 6 possible Aviation Careers	
1	
2	
3	
4	

Accomplish the Following Tasks	
1	Perform a Supervised Preflight of an Aircraft.
3	Visit an Airport and Learn what Facilities are there.
4	Visit an Aircraft Museum or Attend an Air Show

UTAH WING

NOTES






GHOST SQUADRON

CAF

COMMEMORATIVE
AIR FORCE

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