AVIATION
MERIT BADGE
AT THE HILLER AVIATION MUSEUM

This workbook can help you but you still need to read the merit badge pamphlet.
This Workbook can help you organize your thoughts as you prepare to meet with your merit badge counselor.

Merit Badge Counselors may not require the use of this or any similar workbooks.
You still must satisfy your counselor that you can demonstrate each skill and have learned the information.
You should use the work space provided for each requirement to keep track of which requirements have been completed, and to make notes for discussing the item with your counselor, not for providing full and complete answers. If a requirement says that you must take an action using words such as "discuss", "show", "tell", "explain", "demonstrate", "identify", etc, that is what you must do. No one may add or subtract from the official requirements found on Scouting.org.

The requirements were last issued or revised in **2025** · This workbook was updated in **May 2025**

Name: _____ **Troop:** _____

1. AVIATION BASICS AND MECHANICS OF FLIGHT.

A. Define "aircraft".

_____

_____

_____

Describe three kinds of aircraft today, and their typical uses.

B. Provide a brief overview of the evolution of flight

and discuss three notable times in history important to aviation.

C. Explain the difference between a fixed wing and a rotary wing aircraft, and the benefits of each.

Fixed-Wing:

Rotary-Wing:

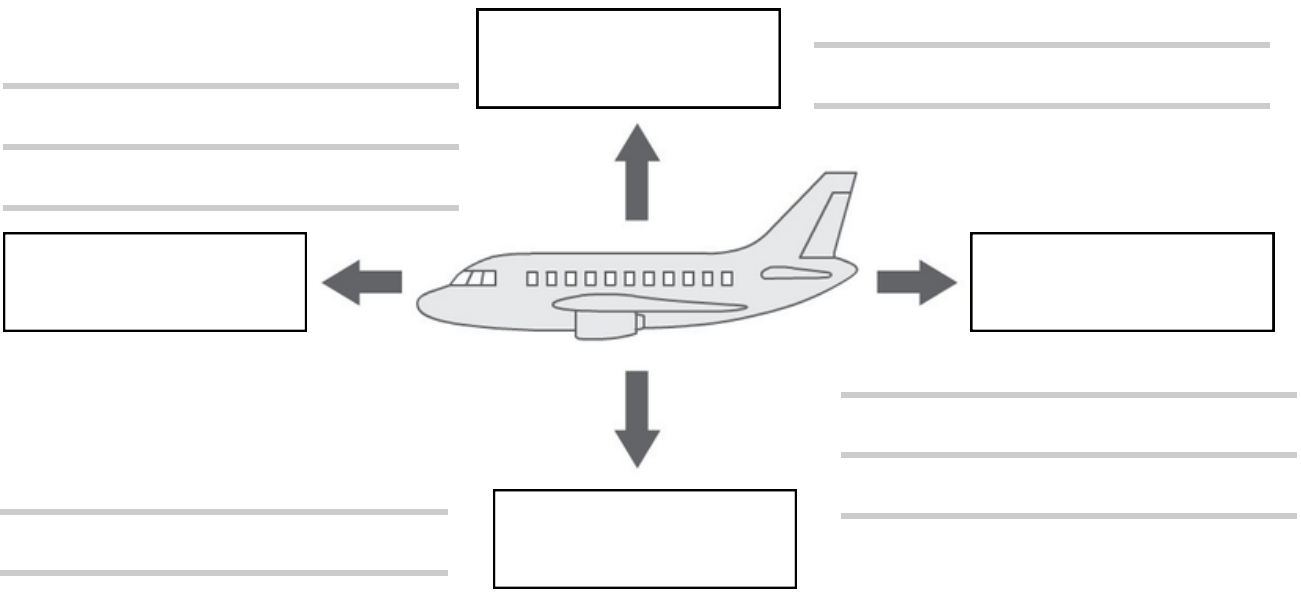
D. Explain the operation of piston, turbine, and jet engines.

Piston:

Turbine:

Jet:

E. Using a model aircraft, describe the four forces that act on an aircraft in flight.

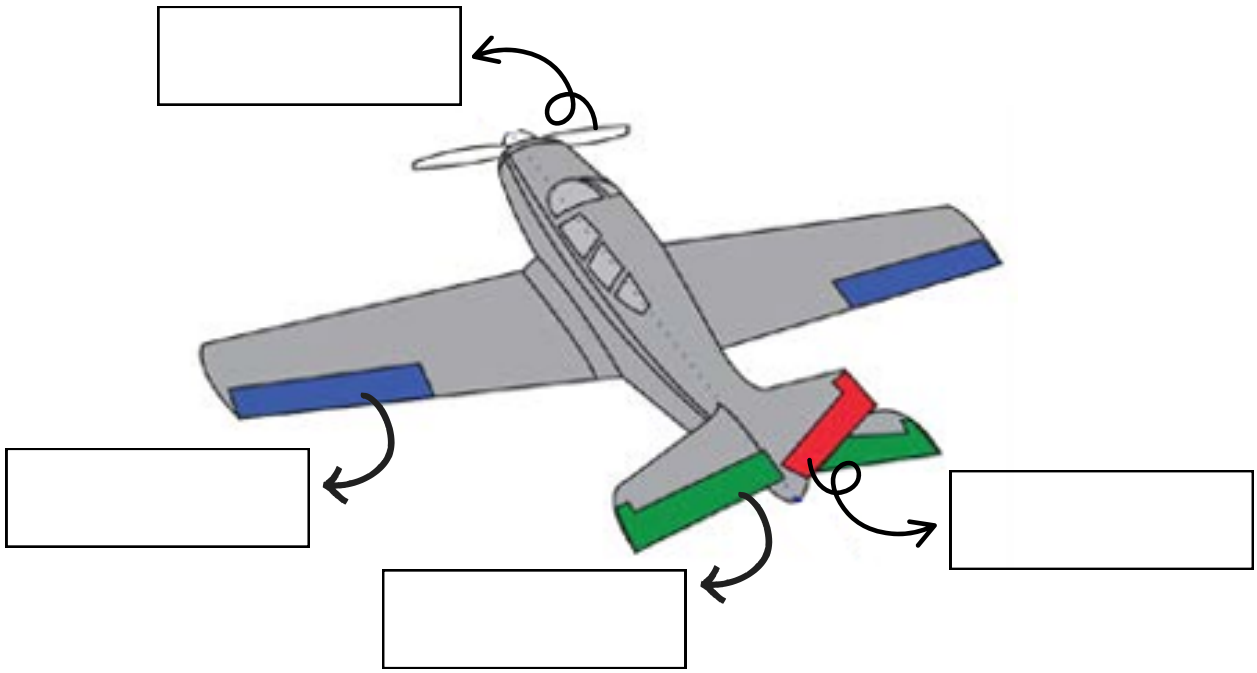


F. Explain how an airfoil generates lift, specifically noting Bernoulli's principle.

Airfoil:

Bernoulli's Principle:

G. Identify and describe the aerodynamic control surfaces on the aircraft of your choice, and explain how they operate to control its attitude and direction of flight.

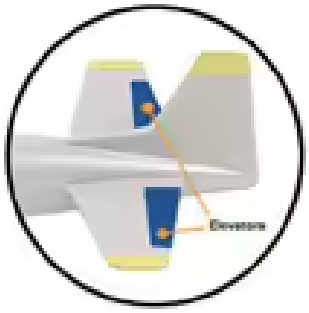


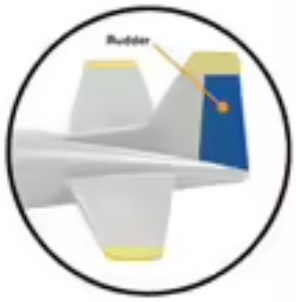
Ailerons:

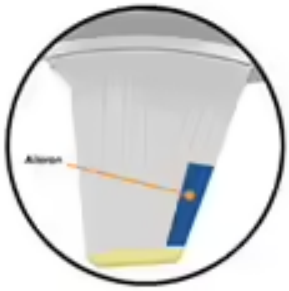
Elevators:

Propeller:

Rudder:







H. Explain the purposes and functions of the various instruments found in a typical single-engine aircraft: attitude indicator, heading indicator, altimeter, airspeed indicator, turn and bank indicator, vertical speed indicator, compass, navigation, communication, and engine performance indicators.

Attitude Indicator:

Heading Indicator:

Altimeter:

Airspeed Indicator:

Turn & Bank Indicator:

Vertical Speed Indicator:

Compass:

Navigation:

Communication:

Engine Performance Indicator:

2. PRINCIPLES OF FLIGHT

B. Build a rubber-band driven balsa wood airplane.

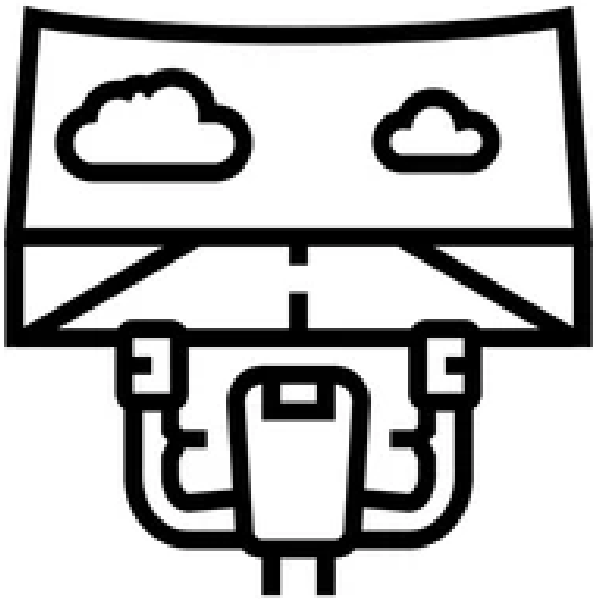
Fly the plane for 25 feet in a straight line, with a smooth landing.

3. FLIGHT OPERATIONS

A.Using a flight simulator software package, set a course and fly the headings you have established with a successful take-off and landing.

See next page for Flight Plan Worksheet.

Scouts will fly from SQL (San Carlos Airport) to SFO (San Francisco Airport) in the flight simulators.



Continue to next page...

NAME: _____

FLIGHT PLAN

SAN CARLOS TO SAN FRANCISCO

SQL TO SFO

CESSNA 172 / 177 PERFORMANCE TABLE

1 knot = 1 nautical mile (nm) per hour

Speed: Climb - 60 knots **or** _____ nm / min

Cruise - 120 knots **or** _____ nm / min

Fuel Burn: 12 gallons per hour

OR _____ gal / min

OR _____ min / gal

Fuel Carried: 24 gallons

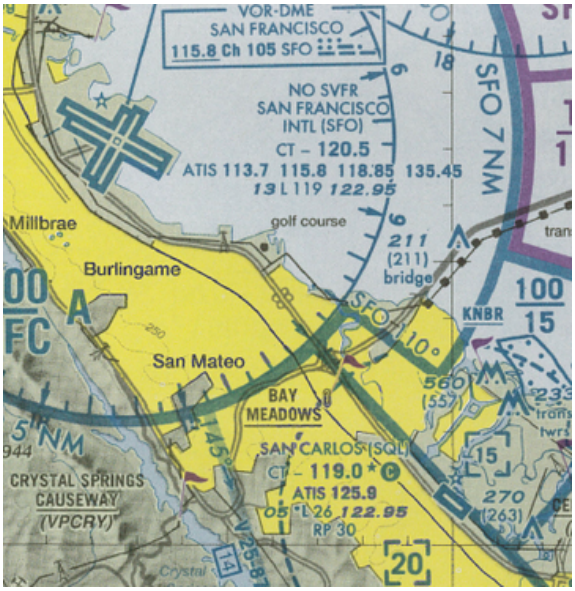
Endurance: _____ hours or _____ min

Range @ Cruise Speed: _____ nm

Rate of Climb: 500 feet / min

Ceiling: 11,000 feet

VFR CHART



Note: Make sure measurements are taken with the **Terminal Area Chart Nautical Miles** section of the navigational plotter.

FLIGHT PLAN - SQL TO SFO

1. DEPARTURE CLIMBING FROM SQL

A. Takeoff Runway Heading 300°

B. Time to climb 500': _____ min

C. Distance traveled:

_____ nm/min **x** _____ min **=** _____ nm

D. Draw course line on chart.

2. CLIMBING SQL TO SAN MATEO BRIDGE (WEST END)

A. Draw course line to bridge. 340°

B. Distance to bridge: _____ nm

C. Climb speed: _____ knots

D. Time to bridge: _____ min

E. Altitude at bridge: _____' Level off by 1,500'.

3. SAN MATEO BRIDGE (WEST) TO SFO

A. Draw course line to SFO. 290°

B. Distance to SFO: _____ nm

C. Cruise Airspeed: _____ knots

D. Time to SFO: _____ min

4. TOTALS

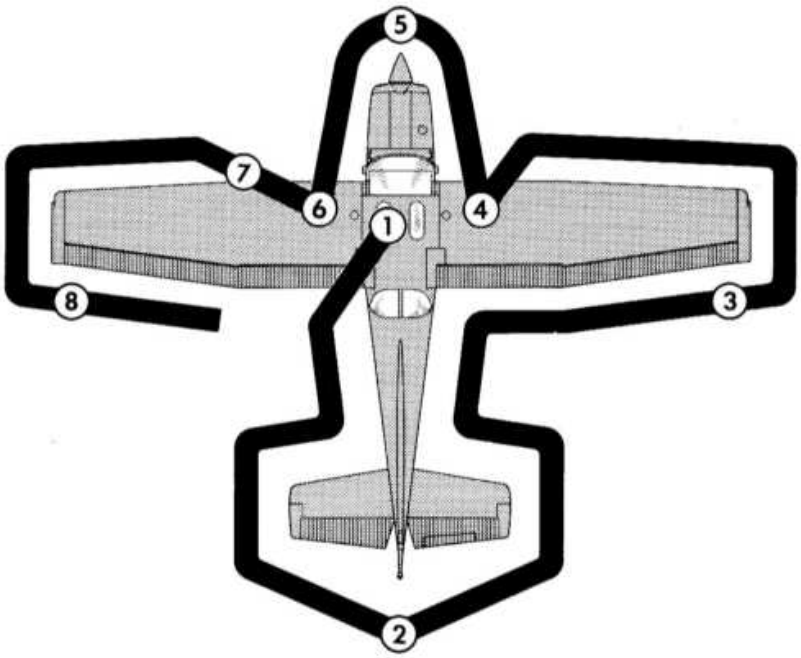
A. Total Distance = _____ nm
(1C + 2B + 3B)

B. Total Time = _____ min
(1B+ 2D + 3D)

C. Fuel Consumption = _____ gal

D. Is this flight safe? YES or NO

B. Under supervision, perform a preflight inspection of an aircraft.



#1: Left Fuselage

- Fuselage Smooth
- Antennae Intact

#2: Stabilizers

- Stabilizers Undamaged
- Rudder Movement
- Elevator Movement
- Cotter Pins
- White Navigation Light

#3: Right Fuselage

- Fuselage Smooth
- Antennae Intact
- Check Top Surface of Wing

#4: Right Wing

- Flap Rollers
- Aileron Movement & Hinges
- Green Navigation Light
- Right Main Landing Gear
- Right Fuel Drain
- FUEL QUANTITY

#5: Engine

- Oil Level (6 Quarts)
- Fuel Drain
- Propeller—Smooth, No Nicks
- Air Intake Open
- Nose Landing Gear
- Static Air Source (left side) Open

#6: Left Wing

- Stall Warning Horn Open
- Pitot Tube Uncovered and Unblocked
- Red Navigation Light
- Flap Rollers
- Aileron Movement & Hinges
- Left Landing Gear
- Left Fuel Drain
- FUEL QUANTITY

#7: Cockpit

- Fuel Selector: BOTH
- Altimeter: Field Elevation

4. AIRPORT OPERATIONS

D. Visit an aviation museum or attend an air show. Report on your impressions of the museum or show, and what you learned from the experience.

5. PERSONAL & PROFESSIONAL AVIATION OPPORTUNITIES.

A. Explain the following: the student pilot, the recreational pilot, the remote pilot, and the private pilot certificates.

Student Pilot:

Recreational Pilot:

Remote Pilot:

Private Pilot:

B. Describe the benefits of the instrument rating.

C. Explain the following: the commercial pilot certificate, the airline transport pilot certificate, and certified flight instructor (CFI).

Commercial Pilot:

Airline Transport Pilot:

Certified Flight Instructor:

D. Identify an Exploring Post and/or Civil Air Patrol facility in your area. Learn about their activities and membership requirements.

E. Identify three career opportunities that would use skills and knowledge in aviation. Pick one and research the training, education, certification requirements, experience, and expenses associated with entering the field. Research the prospects for employment, starting salary, advancement opportunities and career goals associated with this career. Discuss what you learned with your counselor and whether you might be interested in this career.

NOTES

NOTES

AVIATION MERIT BADGE

REQUIREMENTS FOR AVIATION MB

HILLER AVIATION MUSEUM

Always check www.scouting.org for the latest requirements.

1. Aviation Basics and Mechanics of Flight. Do the following:
   a. Define "aircraft". Describe three kinds of aircraft today, and their typical uses.
   b. Provide a brief overview of the evolution of flight, and discuss three notable times in history important to aviation.
   c. Explain the difference between a fixed wing and a rotary wing aircraft, and the benefits of each.
   d. Explain the operation of piston, turbine, and jet engines.
   e. Using a model aircraft, describe the four forces that act on an aircraft in flight.
   f. Explain how an airfoil generates lift, specifically noting Bernoulli's principle.
   g. Identify and describe the aerodynamic control surfaces on the aircraft of your choice, and explain how they operate to control its attitude and direction of flight.
   h. Explain the purposes and functions of the various instruments found in a typical single-engine aircraft: attitude indicator, heading indicator, altimeter, airspeed indicator, turn and bank indicator, vertical speed indicator, compass, navigation, communication, and engine performance indicators.
2. Principles of Flight. Do ONE of the following:
   a. Build a model FPG-9. Get others in your troop or patrol to make their own model, then organize a competition to test the precision of flight and landing of the models.
   b. Build a rubber-band driven balsa wood airplane. Fly the plane for 25 feet in a straight line, with a smooth landing.
   c. Build (or obtain) a fuel-driven or battery-powered electric model aircraft or drone. Obtain The Recreational UAS Safety Test (TRUST) certification, and fly the aircraft with a successful take-off and landing.
3. Flight Operations. Do TWO of the following:
   a. Using a flight simulator software package, set a course and fly the headings you have established with a successful take-off and landing.
   b. Under supervision, perform a preflight inspection of an aircraft.
   c. Observe and/or participate in an aircraft maintenance activity. Describe the maintenance schedule and requirements for an aircraft of your choice.
   d. Obtain and learn how to read an aeronautical chart. Measure a true course on the chart; correct it for magnetic variation, compass deviation, and wind drift to determine a navigational heading for an aircraft.
   e. With your parents or guardian's permission, take a discovery flight in an aircraft. Record the date, place, type of aircraft, and duration of flight. Report on your impressions of the flight.
4. Airport Operations. Do ONE of the following:
   - Visit an airport. After the visit, report on how the facilities are used, how runways are numbered, and how runways are determined to be "active."
   - Visit a Federal Aviation Administration facility: Airport Traffic Control Tower (ATCT), Terminal Radar Approach Control (TRACON), Air Route Traffic Control Center (ARTCC), or Flight Standards District Office (FSDO). Report on the operation and your impressions of the facility.
   - Visit a military aviation facility. Learn how that facility supports defense and/or civilian activities. Report on the operation and your impressions of the facility.
   - Visit an aviation museum or attend an air show. Report on your impressions of the museum or show, and what you learned from the experience.
5. Personal & Professional Aviation Opportunities. Do the following:
   - Explain the following: the student pilot, the recreational pilot, the remote pilot, and the private pilot certificates.
   - Describe the benefits of the instrument rating.
   - Explain the following: the commercial pilot certificate, the airline transport pilot certificate, and certified flight instructor (CFI).
   - Identify an Exploring Post and/or Civil Air Patrol facility in your area. Learn about their activities and membership requirements.
   - Identify three career opportunities that would use skills and knowledge in aviation. Pick one and research the training, education, certification requirements, experience, and expenses associated with entering the field. Research the prospects for employment, starting salary, advancement opportunities and career goals associated with this career. Discuss what you learned with your counselor and whether you might be interested in this career.

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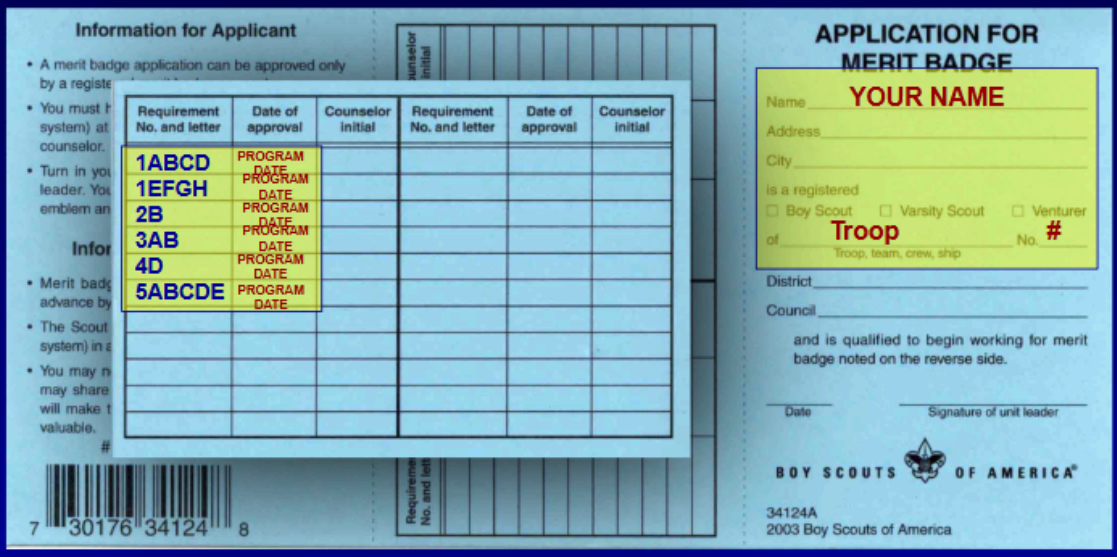
Fill out Blue Card as instructed.



At a minimum, all the highlighted sections should be filled out with your info or the included text.

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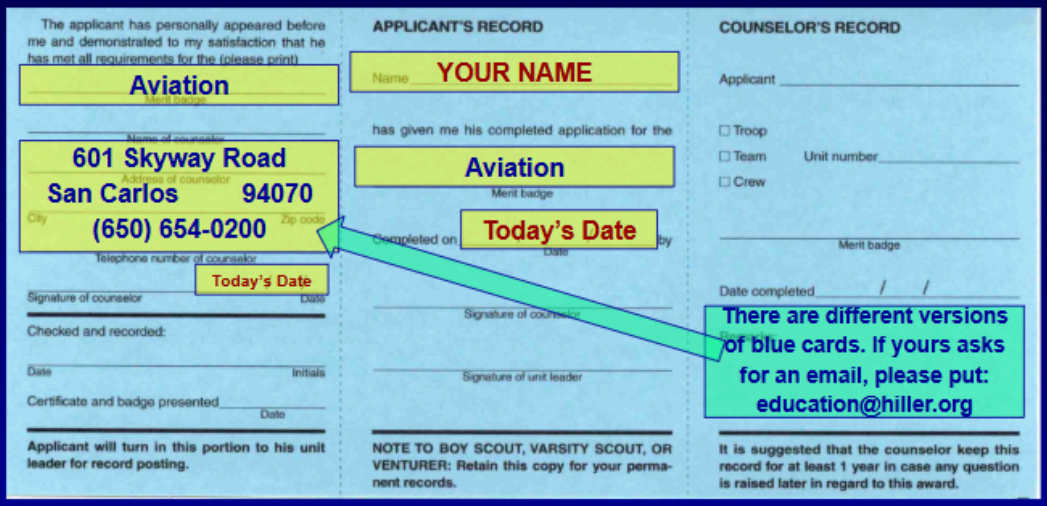

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The Merit Badge Counselor that endorses the card may be different from MBC who facilitated the program and did the initial requirement sign off. For this reason, please do not write in the Counselor name on the card.