Jeppesen Private Pilot Notes

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Contents

Abstract

希望我能順利考上培訓機師。

A note made based on LaTeX template by Victoria Hernández Yepes, organizing what I learned from studying *Jeppesen Private Pilot*. I am writing this note because when I was studying, I felt a little disorganized with my notes and knowledge, hope this helps.

1 Discovering Aviation

A Pilot Training

- Pilot training is regulated by an agency called the Federal Aviation Administration (FAA), which is the government agency that oversees and enforces FARs.
- Federal Aviation Regulations (FARs) are the rules that govern aviation in the United States by FAA.
- Student pilot certificate + Medical certificate = Required to fly solo.
- The *minimum* requirements in FAR part 61 for a private pilot certificate are 40 hours of flight time, including 20 hours of flight training from an authorized instructor and 10 hours of solo flight time.
- If you are under Part 141, the minimum requirements are 35 hours of flight time, including 20 hours of flight training from an authorized instructor and 5 hours of solo flight time.
- The average time to get a private pilot certificate is 65-75 hours.
- The flight lesson is consists of five parts:
  1. Weather briefing
  2. Pre-flight discussion
  3. Pre-flight inspection
  4. Maneuver introduction and review (flight)
  5. Post-flight debriefing
- The training course is divided into three stages:
  1. Pre-solo stage, including the first solo flight
  2. Cross-country stage, including solo and dual cross-country flights
  3. Practical test preparation, including solo and dual review, and the checkride
- Pirvate pilot can share equally the operating expenses of a flight with passengers.

- Aircraft categories: Airplane, rotorcraft, glider, lighter-than-air, powered-lift, powered parachute, and weight-shift-control.
- Flight review every 24 months is required to maintain the private pilot certificate.

B Aviation Opportunities

- For a instrument rating, you must have at least 40 hours of actual or simulated instrument time, including 15 hours of instrument flight training from an authorized instructor.
- For a commercial pilot certificate, you must have at least 250 hours of flight time, including a minimum of 100 hours of PIC time and 50 hours of cross-country time, additionally 10 hours in a plane with retractable landing gear, flaps and a controllable pitch propeller.
- For an airline transport pilot certificate, you must be at least 23 years old and have at least 1500 hours of flight time, including 250 hours of PIC time, 500 hours of cross-country time, 100 hours of night time, and 75 hours of instrument time.

C Introduction to Human Factors

There are human factors in approximately 75% of aviation accidents. And there are tow main subject areas to reduce human errors: Single-Pilot Resource Management (SRM) and Aviation Physiology.

1. **Single-Pilot Resource Management (SRM)** is the art of managing all the resources available to a pilot, including human, hardware, and information.

   (1) **Aeronautical Decision Making (ADM)**: The process of evaluating a situation and making a decision based on the information available. The ADM process consists of recognize a change, define the problem, choose a course of action, implement the decision, and evaluate the outcome. And the following is the FAA's DECIDE model for reference, there are many similar ones:

      1. **Detect** the fact that a change has occurred.
      2. **Estimate** the need to counter or react to the change.
      3. **Choose** a desirable outcome for the success of the flight.
      4. **Identify** actions which could successfully control the change.
      5. **Do** the necessary action to adapt to the change.

6. **Evaluate** the effect of the action.

(2) **Risk Management**: The process of identifying hazards, assessing the risks, and taking steps to eliminate or reduce the risks.

(3) **Task Management**: Involves planing and priortizing tasks, identifying and using resources, and managing distractions.

- While planning and priortizing tasks, you can prepare for high workload periods while low workload times.
- The resources you can use including resources from the aircraft, and outside the aircraft.
- Checklists are valuable resources to help you manage tasks.
- Use a do-list when you have time to complete each step and in the correct order is critical, usually in abnormal procedure.
- Use a flow pattern with normal procedures, it guides you through the cockpit in a logical sequence. Use it when the checklist sequence is not critical. But still, use the checklist to verify the flow after.
- Emergency chcklist are critical tasks you have to perform immediately with memory without checking the checklist when specific emergency occurs, but still, verify the checklist after.

(4) **Situational Awareness**: It is the accurate perceptions of the operational and environmental factors that affect flight safety before, during, and after the flight. It is the understanding of the current situation and the ability to project future status.

- Briefing is a way to maintain situational awareness. Standard briefings includes a passenger briefing, a takeoff briefing, and a before-landing briefing.
- Mind complacency.

(5) **Controlled Flight Into Terrain (CFIT) awareness**: CFIT normal results from a combination of issuses including weather, unfamiliar environment, nonstandard procedures, breakdown or lack of communication, etc.

(6) **Automation Management**: It can reduce the workload and increase situational awareness if you are familiar with the systems on the aircraft.

- It is important to thoroughly understand the avionics on the aircraft before you are flying, and plan ahead to program the equipments during the low workload periods.

- It's important to interpret the current state of the automation system and recognize when it is operation in a different mode than expected. Monitor the current mode, anticipate the next mode, and verify the mode changes as expected.

2. **Aviation Physiology**: The study of how the body functions during flight.

   (1) **Physicality**: Mind not to go scuba diving within 24 hours before ascending 8,000ft.

   (2) **Stress**: It can be defined as the body's response to physical or mental demands or pressures. It can be positive or negative. A certain amount of stress keeps you alert and prevents complacency, but as it exceeds, it can lead to decrease in performance, shown in Figure 1.

Figure 1: The relation between stress and performance.

   (3) **Drugs**: Ask the doctor before taking any drugs, even over-the-counter drugs.

   (4) **Illness**: If feeling ill, ask yourself:

      1. What illness is it?
      2. Is it side effects of some drug?
      3. Can I fly safely?

2 Airplane Systems

An introduction of the systems on airplane, including the basic parts of the aircraft, the functions of the basic parts, how things work out for the systems.

A Airplanes

In this section, we are discussing the basics of an aircraft, including the parts of an aircraft, and the documents needed for an aircraft to fly.
Basic parts of aircraft includes the powerplant, fuselage, wings, landing gear and empennage.
And the required documents are mentioned are POH, AFM, and Airworthiness Certificate.

1. **Powerplant**: The powerplant of smaller aircraft involves the engine and the propeller. And there are accessories connect to the engine that powers the elctrical systems on the aircraft.

2. **Fuselage**: At the very begining, the aircraft structure is using *open truss* sturcture, which can be identified easily by eye, later on, designers are trying to improve the aerodynamics of the aircraft, so they make the structure enclosed, which is known as the *monocoque* structure. But there are still some short points of the structure, such as it can't tolerate dents or deformation of the skin. Thus, the *semi-monocoque* structure is developed, which is adding a substructure under the monocoque structure to improve the rigidity of the aircraft.

3. **Wings**: The main essential parts of the wings are the ailerons and the flaps.

   (1) **Ailerons**: The ailerons are located on the *outside* portion of each wing. It is used to control the aircraft in the roll axis. The corresponding rolling direction of the aircraft relative to the ailerons' position are shown in Figure 2.
   Control: Turn the yoke to the left, the aircraft tilts left, turn it right, the aircraft tilts right.

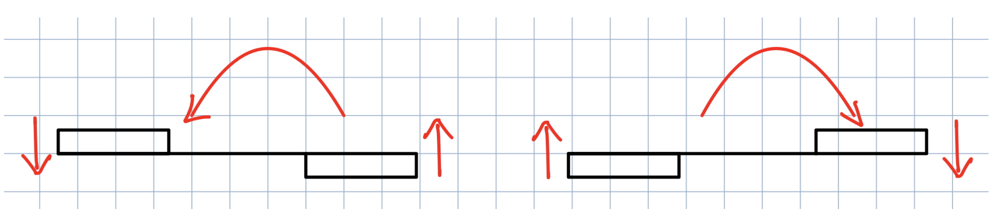

Figure 2: The relation between aileron positions and the aircraft roll direction.

(2) **Flaps**: The flaps are located on the *inside* portion of each wing. It is used to increase the aircraft lift during takeoff and landing. During cruising, the flaps are retracted with the wing to reduce drag.

4. **Landing Gear**: A landing gear with a rear-mounted wheel is called *conventional landing gear*, which are called tailwheel aircraft. A plane with a *nose gear* is called a tricycle gear aircraft. The brake control is located on the top of the rudder pedals, which can be used for turning the aircraft more efficiently on the ground.

5. **Empennage**: The empennage is consists of two main parts: the horizontal stabilizer and the vertical stabilizer. The control surfaces on the empennage are the elevator and the rudder. The control surfaces on empennage are quite straight forward: the side you move the control surface to, the aircraft nose moves to the same direction.

   (1) **Elevator**: It is used to control the aircraft in the pitch axis. And the corresponding pitching direction of the aircraft relative to the elevator's position are shown in Figure 3.
   Control: Pull the yoke towards you, the elevator goes up, the aircraft pitches up (nose up), push the yoke away from you, the elevator goes down, the aircraft pitches down (nose down).

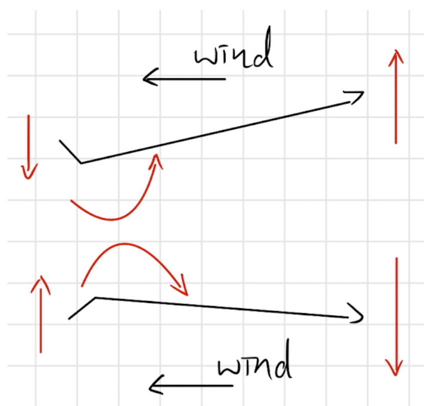

Figure 3: The relation between elevator positions and the aircraft pitch direction.

   (2) **Rudder**: It is used to control the aircraft in the yaw axis. And the corresponding yawing direction of the aircraft relative to the rudder's position are shown in Figure 4.
   Control: Step on the left rudder pedal, the rudder goes left, the aircraft yaws left(nose left), step on the right rudder pedal, the rudder goes right, the aircraft yaws right(nose right).

   (3) **Trim**: The trim can be adjusted by the trim wheel on the yoke. It's like an elevator on the elevator, it can help minimize the workload by moving the control surface aerodynamically to a desired position.

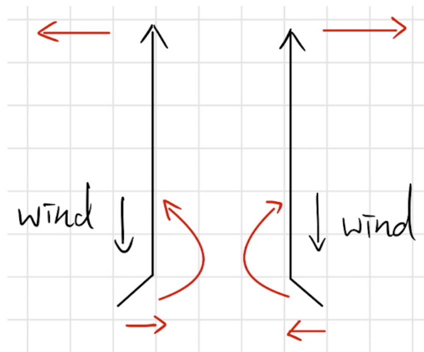

Figure 4: The relation between rudder positions and the aircraft yaw direction.

We have finished the basic parts on an aircraft, now let's talk about the documents you'll find on an aircraft, and the documents you need to fly an aircraft.

1. **Pilot Operating Handbook**: It is the document that contains all the information about the aircraft, including the limitations, procedures, and performance data.

2. **FAA approved Airplane Flight Manual**: It is the document that contains the information about the aircraft that is specific to an individual aircraft, including the limitations, procedures, and performance data. To satisfy the regulations, the POH for most aircraft is designated as the AFM also.

3. **Pilot's Information Manual**: While the POH and AFM are normally with the aircraft, the PIM is published for the pilot.

4. **Airworthiness Certificate**: It is the document that certifies that the aircraft is airworthy and meets the requirements of the FAA. It must be visible.

Manitenance and Inspections: Must perform an annual inspection every year, and a 100-hour inspection if the aircraft is used for hire.

Airworthiness Directive: Two types of ADs, Emergency ADs and Normal ADs. Emergency ADs are issued when an unsafe condition exists that requires immediate action. Normal ADs are issued when an unsafe condition exists that requires action within a specified time.

The minimum equipment required for VFR day flight: A TOMATO FLAMES, Airspeed indicator, Tachometer, Oil pressure gauge, Manifold pressure gauge, Altimeter, Temperature gauge, Oil temperature gauge, Fuel gauge, Landing gear position indicator, Anti-collision lights, Magnetic compass, ELT, Safety belts.

Minimum Equipment list (MEL): It is a list of equipment that can be inoperative for a specific flight. The MEL is specific to each aircraft and is approved by the FAA.

Kinds of Operations Equipment List: Normally in the limitation section of the AFM, it lists the equipment required for different kinds of operations, such as day VFR, night VFR, IFR, etc.
Before flights, question yourself: 1. Do you satisfy airworthiness regulations? 2. Day or night VFR are you going to perform?

B The Powerplant and Related Systems

In this section, we'll find out how the powerplant and the related systems on the aircraft works, including the engine, the induction system, the oil system, the exhaust and the propeller.

1. **Engine**: There are mainly two types of engines: reciprocating engines and turbine engines. We are going to talk about mainly the reciprocating engine here.

    - The four strokes of reciprocating engines are intake, compress, ignite (combustion), and exhaust.

      Figure 5: The four-stroke operating cycle. Figure 2-29 in the book.

      Jeppesen Sanderson, Inc., Private Pilot, 8th, 2018

    - The events in turbine engines that converts fuel to thrust are essentially the same as in reciprocating engines, but the processes are done simultaneously. Shown in Figure 6.

Figure 6: The four-stroke operating cycle of a turbine engine.
On the start of next page under Figure 2-29 in the book.

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2. **Induction Systems**: The induction system is used to control the air intake of the engine. There are two controls in the cockpit, the throttle and the mixture control. The throttle controls the amount of fuel-air mixture that enters the engine, and the mixture control controls the ratio of fuel to air in the mixture.

3. **Carburetor**: The carburetor is used to mix the fuel and air before entering the combustion chamber. It works based on the principle of pressure differential. Air enters the carburetor through an air filter and passes through a venturi, which is a narrow throat in the carburetor. As the air passes through the venturi, its velocity increases and its pressure decreases. This pressure differential draws fuel from the float chamber into the airstream, where it mixes with the air.

The throttle valve controls the amount of fuel-air mixture that enters the engine, and the mixture control adjusts the ratio of fuel to air.

- Carburetor ice can form due to the temperature drop caused by fuel vaporization and the decrease in air pressure in the venturi. This ice can restrict the flow of the fuel-air mixture to the engine, leading to a loss of power. To prevent carburetor ice, pilots use carburetor heat, which is a system that directs hot air into the carburetor to melt the ice.
- The mixture control is set to FULL RICH on the ground. And during the climb after take off, the fuel/air ratio will become richer, because the fuel remains the same but the air becomes thinner. So the mixture control should be adjusted to LEAN to prevent the engine from running too rich, which can make the engine temperature drop and engine roughness.
- During the descent, the fuel/air ratio will become leaner, because the air becomes thicker but the fuel remains the same. So the mixture control should be adjusted to RICH to prevent the engine from running too lean, which can lead to rise in engine temperature.
- While using carburetor heat → air density drops → mixture becomes richer → slightly drop on RPM. Don't use it when full power needed.

4. **Fuel Injection System**: The fuel is not vaporized until it is sprayed directly into the engine intake. It is generally better than carburetor because it can provide a more precise fuel-air mixture, and it is less likely to form carburetor ice.

5. **Supercharger and Turbocharger**: Both are used to increase the power output of the engine by compressing the air that enters the engine. The supercharger is driven by the engine-driven pump, while the turbocharger is driven by the exhaust gases and more efficient.

6. **Ignition System**: A magneto is a self-contained unit that generates its own electrical power. There are two magnetos on most aircraft engines, and each magneto provides a spark to one set of spark plugs. The magneto is independent of the aircraft's electrical system, so it can provide a spark even if the aircraft's electrical system fails.

   - During the pretakeoff check, you can switch the ignition switch from BOTH to L and BOTH to R to check if each magneto is working properly. There might be a small decrease in engine RPM which is normal, but for other informations, check the POH.
   - Remember to switch off the ignition switch after the engine is shut down to prevent the engine from starting accidentally, because it can still start even with electrics off. If OFF

and still starts, might be duue to the a disconnected ground wire of ignition switch, move the mixture to the idle cutoff position to stop the engine in the case.

7. **Abnormal Combustion**: There are two types of abnormal combustion: preignition and detonation.

    - Preignition is the ignition of the fuel-air mixture before the spark plug fires, usually caused by heat spot in cylinder.
    - Detonation is an uncontrolled, explosive ignition, which caused excessive temperature and pressure. It can lead to failure of engine parts, or overheating in less severe scenarios. Possible causes are high RPM with low airspeed, or use engine over 75% power at lean mixture. To solve this, retard the throttle.
    - Preignition and detonation can occur simultaneously.

8. **Fuel Systems**: Fuel-pump system is used aircrafts with fuel injection systems to provide sufficient pressure for the injector nozzles. There is an electric pump independent from the engine driven pump, which is used when the fuel pressure isn't enough and when starting the engine.

    - Primer is used to pump fuel directly into the intake system before engine start. Can be found in most gravity-feed systems and some fuel-pump systems.
    - There are vents on the wings which enable the airpressure inside and outside the fuel tanks to be the same. And there are also overflow drain on the fuel tanks to prevent the rupture of tanks due to fuel expansion on hot days.
    - Visually check the fuel quantity before each flight and not solely believe in fuel gauges.
    - Fuel strainer removes water and other contaminants from the fuel before it enters the engine. Because the contaminants are heavier than the fuel, it settle in a sump at the bottom of the strainer. Generally recommand to drain the fuel drainer before each flight.
    - Ground the plane while refueling to prevent static electricity from igniting the fuel vapors.

9. **Oil Systems**: There are dry-sump system and wet-sump system. The dry-sump system uses an external oil tank to store the oil, while the wet-sump system stores the oil in the engine crankcase. In most light planes, they use the wet-sump system.

10. **Cooling System**: The cooling system in most aircraft is air-cooled. It is less efficient during low air speed with high power. Conversely, during hight air speed and low power stage, such as

descent, there can be excessive cooling. To prevent this, there are cowl flaps to control the amount of air that enters the engine compartment.

11. **Exhaust System**: The exhaust system is not just used to remove the exhaust gases from the engine. The exhaust gases are also used to heat the cabin in some aircraft. Might be aware with the smell, if you smell engine exhaust, turn the cabin heat off and open the windows or fresh air vent to prevent excessive CO.

12. **Propeller**: It converts rotational power into thrust, propelling the aircraft through the air. There are two types of propellers: fixed-pitch and variable-pitch. Figure 7 shows a general view of the propeller, where the section near the center uses a low-speed airfoil, and the section near the tip uses a high-speed airfoil due to the higher speed.

    Figure 7: The cross sections of the propeller. Figure 2-58 in the book.

    Jeppesen Sanderson, Inc., Private Pilot, 8th, 2018

    - On a fixed-pitch propeller, the pitch is set during the manufacturing process and cannot be changed. Proppeller with a low blade angle is known as a climb propeller, and one with a high blade angle is known as a cruise propeller.
    - A constant-speed propeller, which is more efficient, got two controls on power, the throttle, and the propeller control. You can combine a low blade angle and high RPM on climb, while using higher blade angle and lower RPM while cruising.
    - Mind propeller hazards, avoid engine running while boarding.

13. **Full Authority Digital Engine Control (FADEC)**: Is a computer that manages things about the engine. You just have to set the power, and the computer does the rest for you.

14. **Alternator**: The alternator on aicraft generates AC, and will be converted to DC before used.

    - The ammeter indicates if the aircraft battery is charging or not, when it's on the positive side, the battery is charging, while on the negative side, it's discharging.
    - The loadmeter indicates the load of the alternator, but does not indicate if the battery is charging or not.

C Flight Instruments

In this section, we are going to discuss the basic flight instruments and how it works, while introducing some circumstances we might encounter with the instruments while piloting an aircraft. The flight instruments that we can see in the cockpit is in Figure 8.

Figure 8: The flight instruments. Figure 2-70 in the book.

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The instruments can be divided into two groups: the pitot-static instruments and the gyroscopic instruments. The pitot-static instruments includes airspeed indicator, altimeter, and vertical speed indicator. The gyroscopic instruments includes attitude indicator, turn coordinator, and heading indicator.
The standard lapse rates are 2°C per 1,000ft, and 1 inch Hg per 1,000ft.

1. **Airspeed Indicator**: It is comparing the static pressure and the ram air pressure to determine the airspeed. And there are different kinds of airspeeds, including indicated airspeed, calibrated airspeed, true airspeed, and groundspeed.

   The V-speeds below are the airspeeds that are marked on the airspeed indicator.

   Flap V_{S0} : the lower of white line
   Normal V_{S1} : the lower of green line
   V_{FE} : the higher of white line
   Caution V_{NO} : the higher of green line & the lower of yellow line
   V_{NE} : the end of yellow & the red line

Figure 9: The air speed indicator. Figure 2-75 in the book.

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