**Helicopter Handbook**

This is a written notes about how to be a helicopter pilot. These notes are based on the Udemy course “Learn to fly Helicopters”.

To become a helicopter pilot, you need to take a ground lesson course. There are 2 books for reference.

1. Commercial Pilot and Flight Instructor (For Helicopter)

This book has all the practical test and standard (PTS) a pilot needs to know.

Things that examiners which quizzes you, areas such as helicopter hazards, maneuver, limits…etc. It also consists of instructor and examination information.

1. FAR (Federal Aviation Regulations)

This book consists of straight rules and regulations that a pilot needs to follow.

It also comes with a manual about Aeronautical information (for short AIM).

To become a helicopter pilot, according to your needs you need to take and pass relevant FAR (Federal Aviation Regulations) certificates. For instances there are certificates such as FAR141 which is when you learn helicopter in a local pilot school. Certificate FAR21 is the certificate about the procedures of products and parts for the helicopter.

# **Part 1 – Definitions and Abbreviations**

These sections will list all the most common used terms and abbreviations for aviation and helicopter, detailed definitions will be described below.

## **Terms**

* Aircraft
* Large aircraft
* Small aircraft
* Airplane
* Rotorcraft
* Helicopter
* Heliport
* Ceiling
* Class
* Ground Visibility
* IFR Conditions
* Main Rotor
* Major alteration or repair
* Minor alteration or repair
* Pilot in Command
* Rating

## **Abbreviations**

* ICAO
* AGL (Above Ground Level)
* ATC (Air Traffic Controller)
* ATS
* SFAR (Special Federal Aviation Regulations)

Below detailed describe the terms mentioned above.

### **Aircraft**

Aircraft is a general term that refers to any devices that can fly through the air, such as balloons, gliders helicopters and airplanes.

### **Large Aircraft**

Large Aircraft is a term that refers to aircraft that have a maximum certificated take off weight of more that 12,500 pounds. These are usually commercial transportation, military operations or scientific research.

Examples: Boeing 747, Airbus A380, Lockhead C-130 Hercules

### **Small Aircraft**

Small Aircraft is a term that refers to aircraft that have a maximum certificated take off weight of less than 12,500 pounds. These are usually used for personal or recreational purpose for training and instruction.

Examples: Cessna 172, Piper Cub and Beechcraft Bonanza

### **Airplane**

Airplane is a term that refers to fixed wing aircraft that uses wing to generate lift and jet engines or propeller engines to generate thrust. These are usually commercial transportation, military operations or scientific research.

Examples: Boeing 737, Airbus A320 and F-16 Fighting Falcon

### **Rotorcraft**

Rotorcraft is a term that refers to aircraft that uses rotating blades or rotor to generate lift, allow them to hover, take off and land vertically. These are usually used for transport, search and rescue or military operation.

Examples: Helicopters, autogyros and tiltrotors

### **Helicopter**

Helicopter is a term that refers to specific type of rotorcraft that uses one or more rotors to generate lift and a tail rotor to control **Yaw**. Usually used for transport, search and rescue or military operations.

Examples: Bell UH-1 Iroquois, Sikorsky UH-60 Black Hawk and Eurocopter EC135

**Yaw** can be thought as the helicopter’s nose. Yaw is the rotation of the helicopter around its vertical axis, which is perpendicular to the ground. Pilot can control the yaw by adjusting the pitch of the tail rotor blades, which changes the amount of thrust they produces. Pitch of the tail rotor blades is controlled by the anti-**torque** pedals in the cockpit the pedals are similar the rubber pedals in an airplane. By pushing the left pedal, the pilot increases the pitch of the tail rotor blades, which increases the thrust to the left and turns the helicopter nose to the left. By pushing the right pedal, the pilot decreases the pitch of the tail rotor blades, which decreases the thrust to the left and turns the helicopter to the right.

**Torque** is the force or power that makes something turn around a central point, especially in an engine.

### **Heliport**

A heliport is a small airport that is designed for helicopter and other types of vertical lift aircraft. It usually has one or more touchdown and lift off areas, which are flat surface where helicopters can land and take off. It can also have limited facilities, such as fuel, hangers or customs. It can be located in urban or rural areas.

Advantages of heliport:

* + Provide fast and convenient transportation especially congested on remote area.
  + Serve as a base for emergency services, such as police, fire or medical helicopters.
  + Support various activities such as tourism, business or military operations.

Disadvantages of heliport

* + Can be noisy and environmental pollution which can affect resident and wild life.
  + Pose some security risk, such as collision accident or sabotage.
  + Require strict regulation and standard such as airspace markings and lighting.

Different Types of Heliports

* + Surface Level heliport

A heliport located on the ground or on a water surface.

Examples: airports, hospital, hotels and parks

* + Elevated Heliport

A heliport that is located on a raised structure, such as building, bridge or a tower, it is usually located in urban area, where limited surface-level are not feasible.

* + Shipboard heliport

A heliport located on a ship, such as naval vessel, cruise, or an oil rig.

Usually used for marine operation, transport, rescue and defence.

* + Mobile heliport

A heliport that is not located on a fixed location, but can be moved or transport as needed. Can be a vehicle, a trailer, a container or a platform. Usually used for tempory operation, emergency purpose such as disaster, military, exploration.

### **Ceiling**

The term ceiling for aviation refers to the maximum altitude that an aircraft can reach under a set of conditions, as determined by its flight envelope. There are different types of ceiling such as service ceiling and absolute ceiling.

Service Ceiling

The service ceiling is the altitude at which the rate of climb drops below a prescribe value.

Absolute Ceiling

The absolute ceiling is the altitude at which the aircraft can no longer sustain level flight.

### **Class**

The term class for aviation means a classification of aircraft within a category having similar operating characteristic. For example: within the airplane category there are classes such as single engine, multi-engine, land and water. With the rotorcraft category there are classes such as helicopters and gyroplane. The class of an aircraft determines the requirements for pilot certifications and rating.

### **Ground Visibility**

Ground visibility is the visibility at the surface of the earth, as report by an accredited observer. It is usually measure by instruments, such as transmissometers or forward scatter meters. The value (RVR) runway visual range values, is collected from meters which are installed along the runway. RVR is the range which the pilot of an aircraft on the centre line of the runway. Ground visibility is the ability of pilot to see and avoid obstacles or other aircraft and the runway environment.

The values differences with different ground visibility requirements. For example: under Visual Flight Rules (VFR) is 5km during the day and 8km during at night. Under Instrument Flight Rules (IFR), the minimum ground visibility may vary from 180m to 3.2km, depending on the approach category and the runway lighting system.

Ground visibility is affected by weather phenomena, such as fog, cloud, haze and precipitation which reduce the transparency of the air, and scatter or absorb the light.

Fog can be very challenging for aviation as it can reduce the visibility to near zero and persists for hours and days. To cope with fog and other low visibility conditions, airports and aircrafts uses various technologies and procedures, such as Instrument Landing System (ILS), Low Visibility Procedures (LVP) and enhance Flight Vision System (FVS).

### **IFR Conditions (Instrument Flight Rules)**

IFR conditions for aviation are conditions in which the aircraft is flown and navigated by reference to the instruments on board, without relying on visual cues from the outside environment. IFR are a set of regulations that governs how pilot operates under low visibility situation, such as fog, rain or night. IFR conditions are define as having a ceiling (1000 feet/ 300 meters) or visibility horizontal distance at which an object can be seen, that is (5km).

Pilot who fly under IFR conditions must have IFR rating, which is an additional qualification that requires additional training. Pilot must file an IFR plan, which specify the route, altitude and expected time of arrival of the flight. They must also follow instructions and guidance of the Air Traffic Control (ATC) which provides them with the separation of other aircraft and terrain.

IFR flights use a variety of navigating airs, such as radio, beacons, GPS, and radar to determine their positions and directions. IFR conditions are more challenging than VFR conditions, which is the conditions in which the aircraft is flown and navigated by sight and landmarks, roads and other visual references. VFR conditions are defined as having a ceiling of (900 meters) and a visibility of at least (8km). Pilot who fly under VFR conditions must maintain certain distance from clouds and certain altitude above the ground. They must also avoid other aircraft and obstacles.

### **Main Rotor**

A helicopter rotor is the rotating part of a helicopter that generate lift and thrust. Allow the helicopter to fly and maneuver. It contains rotor blades attached to a control system. The rotor blades are long, narrow air foils with a high aspect ratio, designed to maintained drag and maximum lift.

There are 3 basic types of rotor system.

* + Rigid

The blades are fixed to the hub and do not flap or feather.

* + Semi-Rigid

One blad flaps up as the other flaps down allowing for balance.

* + Fully articulated

Each blade can move independently to flap, feather and level or lag to manage forces during flight.

The design of the rotor system is crucial for the helicopter’s performance, including it’s efficiency and ability to maneauver in various flight conditions.

### **Major alterations or repair for aviation**

It is the modification or restoration of an aircraft, aircraft engine or propeller that is not listed in the specification of the manufacture that might significantly affects the airworthiness of the product. Major alteration requires FAA approve data. A record FAA form 337 and a log book entry. Approval of major alteration or repair can be done by mechanic with an Inspection Authorization (IA).

Examples of major alteration or repair for aviation:

* + Changing the design or configuration of an aircraft, such as install new engine, wing or landing gear.
  + Replacing a major structure component, such as fuselage, spar or rib.
  + Replacing extensive damage, such as corrosion, cracks or deformation that affects the strength or performance of the aircraft.
  + Installing new modified equipment such as avionics, instrument or electrical systems that affect the flight characteristic or operational characteristic of the aircraft.

### **Minor alterations or repair for aviation**

Is the modification or restoration of an aircraft, aircraft engine, or propeller that has no appreciate effect on the weight, balance, structure, strength, reliability, operational characteristic that affects the airworthiness of the product.

Minor alteration or repair requires data that is acceptable to the FAA and a log book entry. The approval can be done by any licensed A&P mechanic.

Examples of minor alteration or repair for aviation:

* + Replacing standard parts, such as nuts, bolts, washers, rivets, cotter pins with the parts of the same design.
  + Replacing small dents, scratches, or cracks that do not impair the strength or performance of the aircraft.
  + Installing or removing equipment such as radios, instruments, or lights that do not affect the flight characteristic or operational characteristic of the aircraft.
  + Changing the colour or appearance of the aircraft such as painting, polishing or applying decais, as long as the original identification marks are preserved.

### **PIC (Pilot in Command)**

PIC is the person who has the final authority and responsibility for the operation and safety of an aircraft during the flight. PIC is the captain of a commercial and private aircraft. They are responsible for the aircraft and everyone on board. PIC must be qualified and trained to operate the specific type of aircraft being flown. They must follow the rules and regulations of the aviation authorities. PIC is also responsible for making decisions in case of emergency, such as weather, mechanic or medical issues. PIC is the highest ranking, usually seat on the left side of the cockpit. PIC can delegate some of their duties to the other crew members, but not their authority responsibility. PIC is the ultimate leader of the flight.

### **Rating**

A rating is a qualification that allows a pilot to fly a certain type of aircraft or perform certain type of operation. There are different types of ratings. Such as category ratings, class ratings and type ratings, depending on the level of training and skill level required.

A rating is usually added to a pilot’s license after completing additional flight training and passing a flight test or an endorsement. A rating expand a pilot’s abilities or opportunities in aviation, as well as enhance their safety and proficiency.

* + Category Ratings

A category rating is the broadest type of rating. It defines the type of aircraft a pilot can fly. Such as aeroplane, helicopter or an airship. A pilot must have at least on category rating on their license. They can add more by completing flight training and a flight test for each category.

* + Class Rating

A class rating is more specific type of ratings. It defines the class of aircraft within a category that a pilot can fly. Such as single engine aeroplane, multi-engine aeroplane, or single engine helicopter. A pilot must have at least one class of rating in their license. They can add more by completing flight training and a flight test or an endorsement for each class. For example: a pilot who has single engine aeroplane class can fly any single engine aeroplane that is not type rated.

* + Type Rating

Type rating is the most specialized type of rating. It defines a specific models or series of aircraft that requires additional training and skills to operate. Such as jet, turboprop or a complex system. A pilot must have a type rating on their license for each type related aircraft they want to fly. They can add more by completing flight training and flight test for each type. For example, a pilot who has Boeing 737 aircraft, as long as they have the appropriate category and class rating.