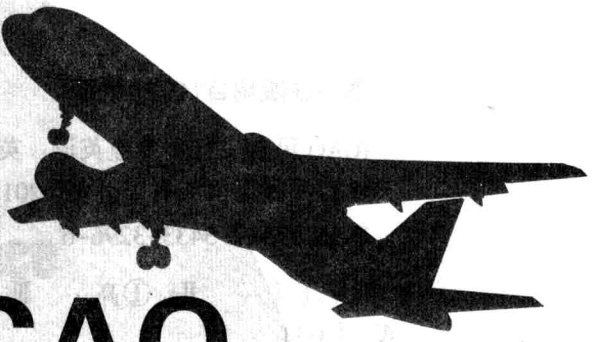
ICAO
民航飞行员专业英语

高培新　主编

ICAO AVIATION ENGLISH FOR CIVIL PILOTS

天津出版传媒集团
天津科技翻译出版有限公司



ICAO
民航飞行员专业英语

ICAO
AVIATION ENGLISH FOR CIVIL PILOTS

主　编　高培新

副主编　焦红卫　邢琳琳

天津出版传媒集团

天津科技翻译出版有限公司

图书在版编目(CIP)数据

ICAO民航飞行员专业英语：英文 / 高培新主编. —天津：天津科技翻译出版有限公司，2013. 9

ISBN 978-7-5433-3296-6

Ⅰ. ①Ⅰ… Ⅱ. ①高… Ⅲ. ①民用航空-英语-教材 Ⅳ. ①H31

中国版本图书馆CIP数据核字（2013）第215365号

出　　版：天津科技翻译出版有限公司
出 版 人：刘 庆
地　　址：天津市南开区白堤路244号
邮政编码：300192
电　　话：022-87894896
传　　真：022-87895650
网　　址：www.tsttpc.com
印　　刷：天津泰宇印务有限公司
发　　行：全国新华书店
版本记录：787×1092　16开本　12.5印张　200千字
2013年9月第1版　2013年9月第1次印刷
定价：40.00元

Preface

The *ICAO Aviation English for Civil Pilots* provides basic knowledge that is essential for civil pilots. This book introduces civil pilots to the broad spectrum of aviation knowledge that will be needed as they progress in their pilot training. It represents an extended and thoroughly revised version of a collection of lecture notes on flight theories and other concerning topics, of which are the basic knowledge required by International Civil Aviation Organization (ICAO).

This book focuses on the basic knowledge of flight, including aircraft structure, principles of flight, aerodynamics of flight, flight controls, engine systems, flight planning, airplane performance, airport management, airspace, human factors, flight security concerns, etc. This book intends to explore the basic information of aeronautical knowledge of flight and form a solid foundation for the civil pilots' future study. It requires the pilots to master the following aspects: master the aircraft structure and principles of flight; get a general idea of aerodynamics of flight, flight controls, flight instruments and aircraft systems; understand flight menus and other documents; generalize the basic information of the engine systems; ensure the security factors concerning to flight; guarantee the correct operation of navigation.

Although the book does not cover all the aspects related to theory study and flight training, it really contains the main parts concerning about flight. Not only does it help the civil pilots acquire the basic knowledge of flight, but also it improves the civil pilots' comprehensive English capability. Aviation English is a huge area, and no treatment of it can claim to be comprehensive. Hopefully, this book can be helpful for cultivating talented civil pilots.

Finally, I would like to extend sincere thanks to my colleagues and friends who have offered me plenty of enlightening ideas and files. Particularly, special thanks to my family, including my parents, my wife and my child, who have given me constant help and support.

Due to the limited knowledge of the writers, errors may occur in the preparation of this book. Corrections and suggestions are always appreciated.

The Author

July 2013

Contents

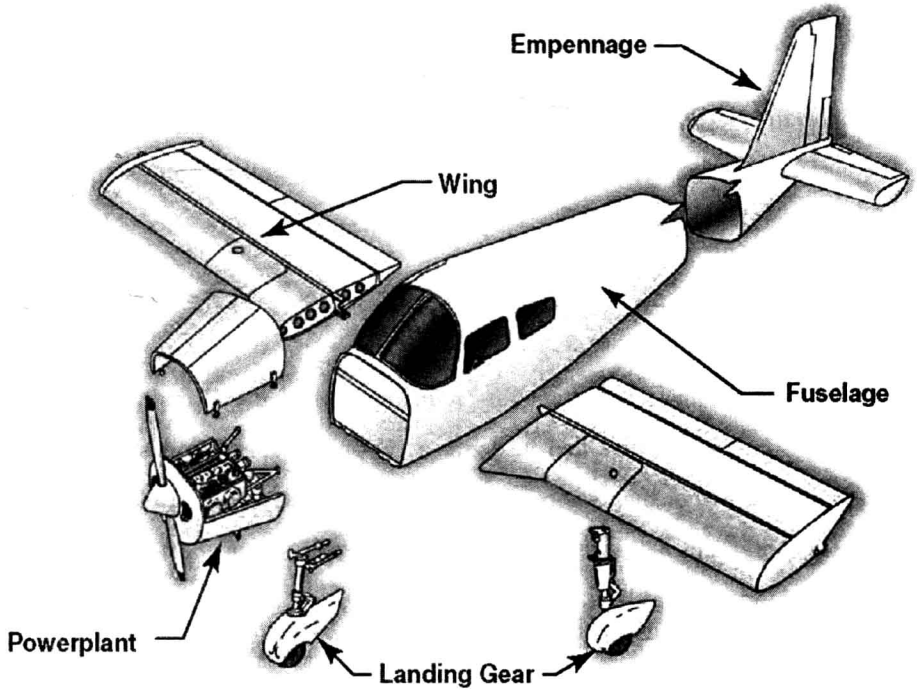
Chapter Six Background Information

Chapter Seven Auxiliary Files

Chapter One
Airplane Components and Flight Principles

Section One Airplane Components

Although airplanes are designed for different kinds of purposes, the general components found on every airplane share the same characteristics. Most airplane structures mainly include fuselage, empennage, cockpit, landing gear and wing.



I. The Main Components of Airplane ▶▶

Fuselage

The fuselage is the main body section of an aircraft that holds crew and passengers or cargoes. In a single-engine aircraft it usually contains an engine, although in some amphibious aircraft the single engine is mounted on a pylon attached to the fuselage which in turn is used as a floating hull. The fuselage also serves to position control and stabilization surfaces in specific relationships to lifting surfaces, required for aircraft stability and maneuverability. The fuselage is designed to be as small as possible for performance reasons yet spacious enough for comfort.

The fuselage is the main body structure to which all other components are attached. The fuselage contains the cockpit or flight deck, passenger compartment and cargo compartment. While wings produce most of the lift, the fuselage also produces a little. A bulky fuselage can also produce a lot of drag. For this reason, a fuselage is streamlined to decrease the drag. We usually think of a streamlined sports car as being sleek and compact—it does not present a bulky obstacle to the oncoming wind. A streamlined fuselage has the same attributes. It has a sharp or rounded nose with sleek, tapered body so that the air can flow smoothly around it.

The fuselage is generally a long tube shape. The wheels of a plane are called the landing gear. There are two main wheels on either side of the plane fuselage. Then there is one more wheel near the front of the plane. The brakes for the wheels are similar to the brakes for cars. They are operated by pedals, one for each wheel. Most landing gear can be folded into the fuselage during the flight and opened for landing.

Wings

The wings are the most important lift-producing part of the aircraft. Wings vary in design depending upon the aircraft type and its purpose. Most airplanes are designed so that the outer tips of the wings are higher than where the wings are attached to the fuselage. This upward angle is called the dihedral and helps keep the airplane from rolling unexpectedly during flight. Wings also carry the fuel for the airplane.

The wings are shaped with smooth surfaces. There is a curve to the wings which helps push the air over the top more quickly than it goes under the wing. As the wing moves, the air

flowing over the top has farther to go and it moves faster than the air underneath the wing. So the air pressure above the wing is less than that below it. This produces the upward lift. The shape of the wings determines how fast and high the plane can fly. Wings are called airfoils.

The wings are airfoils attached to each side of the fuselage and are the main lifting surfaces that support the airplane in flight. There are numerous wing designs, sizes, and shapes used by the various manufacturers. Each fulfills a certain need with respect to the expected performance for the particular airplane. Wings may be attached at the top, middle, or lower portion of the fuselage. These designs are referred to as high-, mid-, and low-wing, respectively. The number of wings can also vary. Airplanes with a single set of wings are referred to as monoplanes, while those with two sets are called biplanes. Many high-wing airplanes have external braces, or wing struts, which transmit the flight and landing loads through the struts to the main fuselage structure. Since the wing struts are usually attached approximately halfway out on the wing, this type of wing structure is called semi-cantilever. A few high-wing and most low-wing airplanes have a full cantilever wing designed to carry the loads without external struts.

Empennage

The empennage or tail assembly provides stability and control for the aircraft. The empennage is composed of two main parts: the vertical stabilizer (fin) to which the rudder is attached; and the horizontal stabilizer to which the elevators are attached. These stabilizers of the airplane help to keep the airplane pointed into the wind. When the tail end of the airplane tries to swing to either side, the wind pushes against the tail surfaces, returning it to its proper place. The rudder and elevators allow the pilot to control the yaw and pitch motion of the airplane, respectively.

The tail at the rear of the plane provides stability. The fin is the vertical part of the tail. The rudder at the back of the plane moves left and right to control the left or right movement of the plane. The elevators are found at the rear of the plane. They can be raised or lowered to change the direction of the plane's nose. The plane will go up or down depending on the direction of that the elevators are moved.

The empennage is the rear part of the aircraft. Usually it includes the stabilizers, rudder and elevator as many other components. In fighter jets it may be constructed around the exhaust nozzle, as in some three-engine airplanes (with the third engine in the fuselage). In commercial

aircrafts the empennage is built from the cabin pressure-cone and may contain the Flight Data Recorder (black box), Cockpit Voice Recorder and the pressure out-flow valve.

Cockpit

A cockpit or flight deck is the area usually near the front of an aircraft, from which a pilot controls the aircraft. Most modern cockpits are enclosed, except on some small aircraft, and cockpits on large airliners are also physically separated from the cabin. From the cockpit an aircraft is controlled on the ground and in the air.

The cockpit of an aircraft contains flight instruments on an instrument panel, and the controls that enable the pilot to fly the aircraft. In most airliners, a door separates the cockpit from the passenger compartment. After the September 11, 2001 terrorist attacks, all major airlines fortified the cockpit against access by hijackers.

On an airliner, the cockpit is usually referred to as the flight deck. This term derives from its use by the RAF for the separate and upper platform in large flying boats where the pilot and co-pilot sit.

Control Surfaces

Aircraft flight control surfaces allow a pilot to adjust and control the aircraft's flight attitude. Development of an effective set of flight controls was a critical advance in the development of aircraft. Early efforts at fixed-wing aircraft design succeeded in generating sufficient lift to get the aircraft off the ground, but once aloft, the aircraft proved uncontrollable, often with disastrous results. The development of effective flight controls is what allowed stable flight. This article describes the control surfaces used on a fixed-wing aircraft of conventional design. Other fixed-wing aircraft configurations may use different control surfaces but the basic principles remain. The controls (stick and rudder) for rotary wing aircraft (helicopter or auto-gyro) accomplish the same motions about the three axes of rotation, but manipulate the rotating flight controls (main rotor disk and tail rotor disk) in a completely different manner.

Ailerons

On the trailing edge of the wing are two sets of movable surfaces. Those farthest from the center of the airplane are called ailerons.

The ailerons move when you turn the control wheel or move the control stick side by side. They move in opposite directions, one going up while the other going down.

The ailerons are hinged on the wings and move downward to push the air down and make the wings tilt up. This moves the plane to the side and helps it turn during the flight. After landing, the spoilers are used like air brakes to reduce any remaining lift and slow down the airplane.

Ailerons are moving surfaces usually placed near the tips of the wings. The function of an aileron is simple, by moving upwards or downwards it modifies the angle of attack of that section of the wing, sinking or lifting it. This change in the aerodynamic is due to the modification of relative curve of the airfoil. Note that ailerons are complementary, so if one moves the other will move on the other direction in the same proportion. This improves the effect as one wing is lifted and the other sunk. Ailerons control the X-axis or roll movement of the aircraft.

Ailerons are controlled by the pilot form the cockpit, with the lateral axis of the joystick. To make coordinated turns the movement must be combined with rudder in the same direction. In some planes (delta-wing airplanes) ailerons are just divided elevators, being possible to use the same surface as aileron or elevator.

Flaps

The hinged control surfaces are used to steer and control the airplane. The flaps and ailerons are connected to the backside of the wings. The flaps slide back and down to increase the surface of the wing area. They also tilt down to increase the curve of the wing. The slats move out from the front of the wings to make the wing space larger. This helps to increase the lifting force of the wing at slower speeds like takeoff and landing.

Flaps are hinged surfaces mounted on the trailing edges of the wings of a fixed-wing aircraft to reduce the speed at which an aircraft can be safely flown and to increase the angle of descent

for landing. They shorten takeoff and landing distances. Flaps do this by lowering the stall speed and increasing the drag.

Extending flaps increases the camber or curvature of the wing, raising the maximum lift coefficient—or the lift a wing can generate. This allows the aircraft to generate as much lift as possible but at a lower speed, reducing the stalling speed of the aircraft, or the minimum speed at which the aircraft will maintain flight. Extending flaps increases drag which can be beneficial during approach and landing because it slows the aircraft. On some aircraft a useful side effect of flap deployment is a decrease in aircraft pitch angle which improves the pilot's view of the runway over the nose of the aircraft during landing; however the flaps may also cause pitch up, depending on the type of flap and the location of the wing.

There are many different types of flaps in use, with the specific choice depending on the size, speed and complexity of the aircraft on which they are to be used, as well as the era in which the aircraft was designed. Plain flaps, slotted flaps, and Fowler flaps are the most common. Kruger flaps are positioned on the leading edge of the wings and are used on many jet airliners.

Rudder

The vertical stabilizer functions with the same principle as a wing does, but being symmetrical. It is a main control surface of airplanes (fix-wing aircrafts). Obviously, it has a vertical position, usually in the tail of the aircraft. There can be multiple vertical stabilizers (in large aircrafts usually).

The vertical stabilizer has a moving part which is called rudder. This acts as an aileron does in the wing. When it is moved to one or the other side it produces a pressure difference over the stabilizer since its movement is equal to change the angle of attack of this "wing".

The rudder controls the Y-axis or yaw of the plane and is controlled from the cockpit with the pedals. In a coordinated turn, rudder and ailerons must be coordinated, but you can use rudder only to "slide" the aircraft.

Elevator

The horizontal stabilizer is the main control surface of the aircraft, mainly of airplanes

(fixed-wing aircraft). It functions as a wing does, creating a second point of lift along the fuselage which provides stability to the aircraft in the Z-axis. Its function is not to provide more lift but to control the pitch of the aircraft (by modifying the angle of attack of the wing). This is thanks to a moving part or parts called elevators, which act like an aileron, and are controlled by the longitudinal axis of the joystick or wheel.

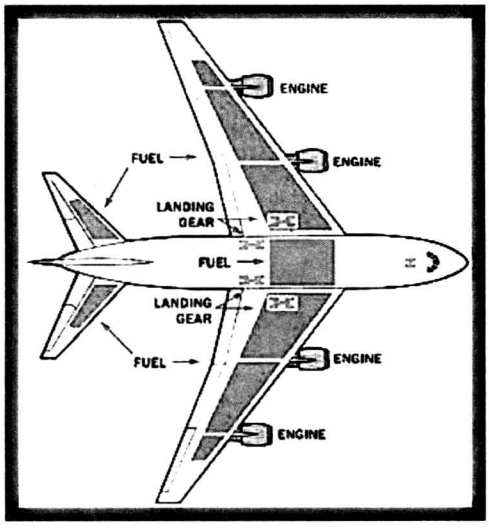
Obviously, the horizontal stabilizer has a horizontal position, usually in the tail of the aircraft. It can be on the top of the vertical stabilizer (T-tail aircraft), or divided in two parts crossing the vertical stabilizer. Some horizontal stabilizers have no elevators but are a whole elevator (mainly in gliders, since it has a better aerodynamic performance). In Canard-configuration planes, the horizontal stabilizer is positioned not in the tail but in the nose of the aircraft (note that its movement to reduce or increase pitch will be inverted from the one it does when it's placed in the tail).

Sometimes, elevators are mixed with rudders in the same control surface, creating V-tail aircrafts. It also can be combined with ailerons, mainly in delta-wing planes.

Other Components

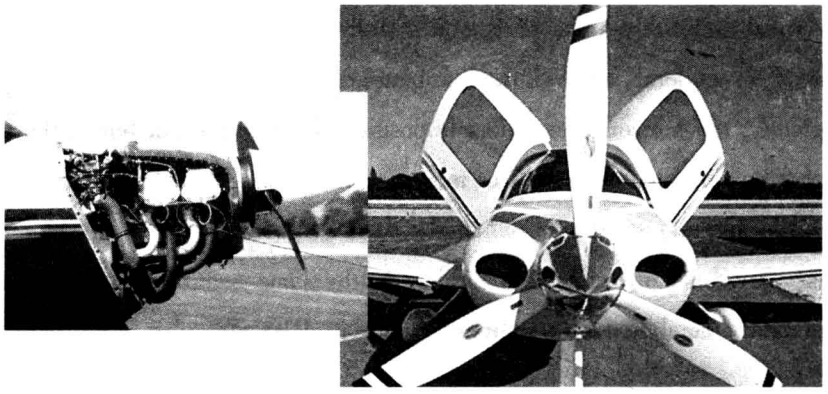
Fuel Tanks

On most airplanes, the wings contain the fuel tanks. This is both structurally efficient and practical. The weight of the fuel is distributed along the structure that is doing the lifting, and it leaves the rest of the airframe available for other things, like people and cargo.



Propeller

A propeller is a type of fan that transmits power by converting rotational motion into thrust. A pressure difference is produced between the forward and rear surfaces of the airfoil-shaped blade, and a fluid (such as air or water) is accelerated behind the blade. Propeller dynamics can be modeled by both Bernoulli's principle and Newton's third law. A marine propeller is sometimes colloquially known as a screw propeller or screw.



Landing Gear

Landing gear is the undercarriage of an airplane. Early airplanes had two main wheels under the fuselage or wings and a smaller wheel under the tail, which was called conventional landing gear. Today most airplanes are designed with the main wheels farther aft on the fuselage or wings and with a nose wheel rather than a tail wheel, which is the tricycle configuration.

Tricycle gear airplanes are easier to control on the ground, especially during the landing.

The landing gear on an airplane is either fixed or retractable. Fixed gear is cheaper, easier to maintain, and foolproof.

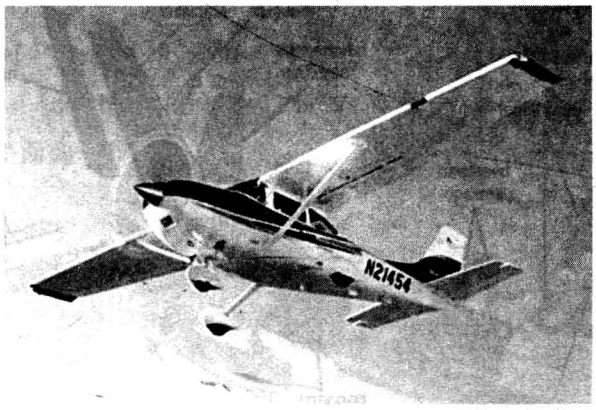
Aerodynamically, a retractable gear is preferable because with the wheels and struts placed inside the wing or fuselage, there is less interference with the airflow.

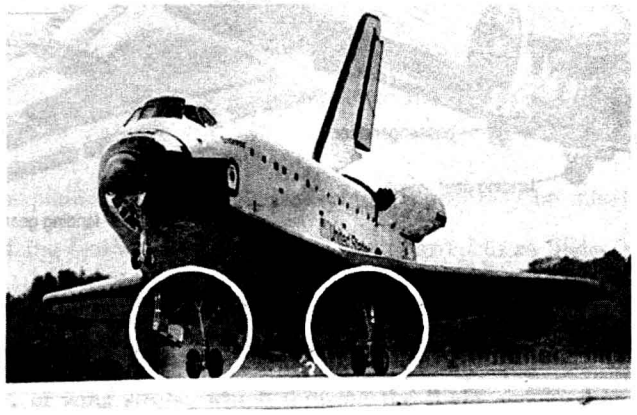
Landing gear usually includes wheels equipped with shock absorbers for solid ground, but some aircrafts are equipped with skis for snow or floats for water, and/or skids or pontoons (helicopters).

The undercarriage is a relatively heavy part of the vehicle, which can be as much as 7% of the takeoff weight, but more typically is 4%-5%.

Wheeled undercarriages normally come in two types: conventional or "tail-dragger"

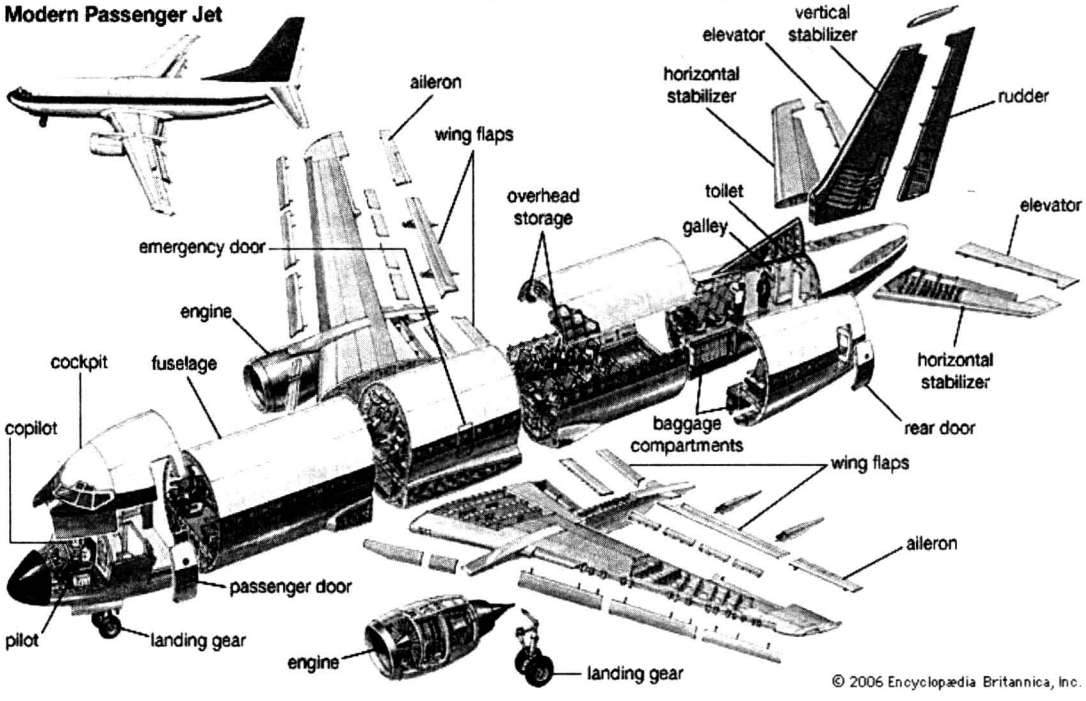
undercarriage, where there are two main wheels towards the front of the aircraft and a single, much smaller, wheel or skid at the rear; and tricycle undercarriage where there are two main wheels (or wheel assemblies) under the wings and a third smaller wheel in the nose. The tail-dragger arrangement was common during the early propeller era, as it allows more room for propeller clearance. Most modern aircrafts have tricycle undercarriages. Tail-draggers are considered harder to land and take off (because the arrangement is unstable, i.e. a small deviation from straight-line travel is naturally amplified by the greater drag of the main wheel which has moved farther away from the plane's centre of gravity due to the deviation), and usually require special pilot training. Sometimes a small tail wheel or skid is added to aircraft with tricycle undercarriage, in case of tail strikes during take-off. The Concorde, for instance, had a retractable tail "bumper" wheel, as delta winged aircraft need a high angle when taking off. The Boeing 727 also has a retractable tail bumper. Some aircrafts with retractable conventional landing gear have a fixed tail-wheel, which generates minimal drag (since most of the airflow past the tail-wheel has been blanketed by the fuselage) and even improves yaw stability in some cases.





II. Questions for Discussion ▶▶

1. What are the main components of an airplane?
2. What parts can you find on the wing section?
3. What is an empennage composed of?
4. What are the basic control surfaces?
5. How is an aileron/rudder/elevator controlled?
6. How are the landing gears arranged?
7. Where is the fuel tank located?
8. What is the engine cowl used for?
9. What is the function of propeller?
10. Analyze the following picture about modern passenger jet and try to explain the main parts.



III. New Words and Phrases ▶▶

component [kəm'pəunənt] *n.* 成分,零件
airframe ['ɛəfreim] *n.* 机身
feature ['fi:tʃə] *n.* 产品特点,特征
fuselage ['fju:zilɑ:ʒ] *n.* (飞机的)机身
empennage ['empənidʒ] *n.* 尾部,尾翼
tail assembly 尾翼
move downward 向下移动
aileron ['eilərɔn] *n.* 副翼
flap [flæp] *n.* 襟翼
parallel to 平行于,与……平行
performance [pə'fɔ:məns] *n.* 性能
configuration [kən,figju'reiʃən] *n.* 配置,结构,外形
channel ['tʃænəl] *n.* 通道
dihedral [dai'hi:drəl] *adj.* 二面的,有两个平面的
horizontal [,hɔri'zɔntəl] *adj.* 水平的,地平线的
protective [prə'tektiv] *adj.* 防护的
undercarriage ['ʌndə,kæridʒ] *n.* 飞机起落架,着陆装置
foolproof ['fu:l,pr:f] *adj.* 十分简单的,傻瓜式的
interference with 干涉,妨碍,打扰
tricycle landing gear 三轮式起落架
propeller [prə'pelə] *n.* 螺旋桨
stabilator ['stæbileitə] *n.* 安定面,安定升降舵,全动平尾
windshield ['wind,ʃi:ld] *n.* 挡风玻璃
engine ['endʒin] *n.* 引擎,发动机
vertical stabilizer 垂直尾翼
wing strut 翼支柱

IV. Supplementary Reading ▶▶

Passage One

The wings are airfoils attached to each side of the fuselage and are the main lifting surfaces that support the airplane in flight. There are numerous wing designs, sizes, and shapes used by the various manufacturers. Each fulfills a certain need with respect to the expected performance for the particular airplane.

How the wing produces lift is explained in subsequent chapters. Wings may be attached at the top, middle, or lower portion of the fuselage. These designs are referred to as high-, mid-, and low-wing, respectively. The number of wings can also vary. Airplanes with a single set of wings are referred to as monoplanes, while those with two sets are called biplanes. Many high-wing airplanes have external braces, or wing struts, which transmit the flight and landing loads