

МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ
ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ
«САМАРСКИЙ НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
УНИВЕРСИТЕТ ИМЕНИ АКАДЕМИКА С.П. КОРОЛЕВА»
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АНГЛИЙСКИЙ ЯЗЫК ДЛЯ СТУДЕНТОВ АВИАЦИОННОГО ПРОФИЛЯ

Рекомендовано редакционно-издательским советом федерального государственного автономного образовательного учреждения высшего образования «Самарский национальный исследовательский университет имени академика С. П. Королева» в качестве учебного пособия для обучающихся по основным образовательным программам высшего образования по направлениям подготовки 15.03.05 Конструкторско-технологическое обеспечение машиностроительных производств, 24.03.04 Авиастроение, 25.03.02 Техническая эксплуатация авиационных электросистем и пилотажно-навигационных комплексов, 27.03.02 Управление качеством и специальности 24.05.07 Самолёто- и вертолётостроение

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Пособие состоит из девяти модулей, каждый из которых содержит комплекс заданий, разработанный на основе аутентичных текстов, описывающих этапы развития авиации, компоненты летательного аппарата, принципы полета и этапы проектирования летательного аппарата. К каждому модулю детально разработаны задания лексико-грамматического характера, также творческие задания, имеется глоссарий, что в совокупности обеспечивает формирование способностей оперировать когнитивными ресурсами и предполагает развитие языковых навыков и переводческой техники.

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ВВЕДЕНИЕ

Пособие составлено в соответствии с требованиями программы по английскому языку. Языковой материал представлен в коммуникативной форме, большое внимание уделяется навыкам чтения, говорения и письма. Использована оригинальная литература по авиации.

Учебное пособие разработано на кафедре иностранных языков и русского как иностранного и предназначено для студентов 1 и 2 курсов института авиационной техники.

MODULE 1. HISTORY OF FLIGHT

Lead in

1. How much do you know about the history of aviation? Match the fact with the associated name and year.

Important First	Name	Year
First multi-engined aircraft	Amelia Earhart	1783
First successful heavier-than-air machine flight	Igor Sikorsky	1932
Around the World in Six Days	Jacques and Joseph Montgolfier	1913
First woman's transatlantic solo	Barrington Irving	1903
Youngest and first black pilot to fly solo around the world	Orville and Wilbur Wright	2007
First balloon flight	Don Muir and André Daemon	1982

Reading

1. Work in pairs. Compare modern airplanes and the ones that existed 100 years ago. Talk about the appearance, technical characteristics, materials used, etc. Use comparative adjectives.



A



B)

2. Match the phrases with their Russian equivalents.

- | | |
|-------------------------|--------------------------------------|
| 1) aviation development | a) ключевая мысль |
| 2) fundamental idea | b) летательный аппарат |
| 3) human flight | c) отвага |
| 4) flying device | d) развитие авиации |
| 5) movable wing | e) летчик-истребитель высшего класса |
| 6) glorious chapters | f) полет человека |
| 7) courage | g) регулярные рейсы |
| 8) fighter aces | h) подвижное крыло |

- 9) qualitative re-equipment i) выдающиеся страницы (в истории)
 10) regular service j) качественное переоборудование

3. Practice reading the following words.

fasten	[fa:sn]
wax	[wæks]
courage	['kʌrɪdʒ]
altitude	['æltɪtju:d]
astronautics	[,æstrə 'nɔ:tɪks]
weight	[weɪt]
qualitative	['kwɔlɪtətɪv]
piston engine	[pɪstn endʒɪn]
conquest	['kɒŋkwɛst]

4. Read the text about the history of human flight and say what the following names, numbers, places and dates mean.

Leonardo 2000 outer da Vinci space
North Icarus Pokryshkin 1832

Pole and Kozhedub

The History of Flight

1. The desire to fly was one of the oldest desires of man. But in old times people knew little about air and its nature.



2. The Greek philosopher Aristotle believed that air had weight and pressed on bodies which were in the air. One of the most famous Greek legends is the legend of Daedalus and Icarus who made wings and fastened them on with wax. Daedalus landed in safety. Icarus

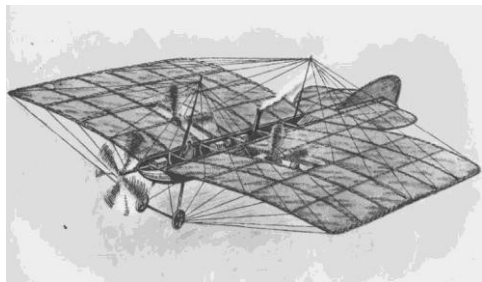
was not as careful as his father and he flew closer and closer to the Sun. The closer he was the hotter it became. The wax melted, his wings came off and he fell into the sea.

3. Later men of science like Galileo, Roger Bacon and Pascal came to conclusion that air was gas and that the higher you went the less its pressure was.

4. People who like to read books on aviation development may take interest in the book "On the Flight of Birds" by Leonardo da Vinci. That human flight is possible is the fundamental idea of the book. In the book the famous Italian artist and scientist recorded the first scientific principles of human flight. He found that the faster the flow of the air the greater the lift was. As a result of these studies he designed a flying device. In his device the pilot had to operate movable wings with the help of his arms and feet. But the machine did not fly.

5. In the course of many centuries scientists tried to make a flying device. But the development of a practical flying device on a really scientific basis began later.

The first flying machine man could control in the air appeared only in the 19-th century. And this first in the history of civilization plane was the one designed by Alexander Mozhaisky. It went up in the summer of 1832.



6. There are many glorious chapters in the history of flying in our country. There were the famous flights by the crews of V. Chkalov and M. Gromov, who flew their planes from the Soviet Union to the United States via the North Pole and will forever be considered models of courage and skill.

7. Devoted courage was displayed by our pilots in the Great Patriotic War. More than 2000 Soviet pilots won the title of Hero of the Soviet Union, and 69 won this award twice. Alexander Pokryshkin and Ivan Kozhedub, the famous fighter aces, became triple Heroes of the Soviet Union.



8. Following the glorious traditions of the

Soviet aviation our pilots are establishing new world records for altitude, range and speed. In our days, air forces have undergone a qualitative re-equipment. Air force equipment and armaments are being improved continually. Aviation has given birth to astronautics; it has provided the theoretical and practical bases for the conquest of outer space. The time is not far away when passenger aircraft will be doing regular service on space lines.

5. Match the words with their definitions. State their part of speech.

- | | |
|----------------|--|
| 1) Altitude | a) to get rid of something, and to put a new thing in their place |
| 2) to replace | b) the process of gaining control of something through great |
| 3) continually | c) the ability to do something well, usually as a result of experience and training |
| 4) skill | d) going through one place on the way to another place |
| 5) conquest | e) the height of a place or thing above sea level |
| 6) range | f) to experience something, especially something that is unpleasant but necessary |
| 7) record | g) without stopping |
| 8) via | h) the distance that a vehicle, especially a plane, can travel before it needs more fuel |

- 9) to undergo i) to make something better, or to become better
10) to improve j) the best achievement so far in a particular activity

6. Read the text again and answer the following questions.

1. According to Aristotle, why did air press on bodies?
2. What is the main idea of the book “On the Flight of Birds”?
3. Who was among the first scientists to believe that air was gas?
4. How did da Vinci’s flying device operate?
5. When was the first controllable flying device designed? Who designed it?
6. Why are the crews of V. Chkalov and M. Gromov famous?
7. What is the current stage of aviation development in Russia?

7. a) Read the text on balloons and fill in the gaps (1-6) with the missing information (a – f).

- a) the balloon went down
- b) filled them with smoke over a fire
- c) weather balloons are particularly used by meteorologists
- d) because they are forced to drift by the wind flow without any engine
- e) If they had not done it
- f) Rozier by name

The first hot air balloon

The earliest form of air transport was balloons, which are sometimes called “free balloons” (1) _____. This fact alone makes balloons not reliable enough for carrying people. The first balloons were made by Montgolfier brothers in the 18-th century. Etienne and Joseph Montgolfier took paper bags from their father, (2) _____ and watched them go up into the air.

After numerous experiments they were ready to show how their balloons worked. The brothers had constructed a bag thirty feet in diameter. That big bag was held over a fire. It was in the air for ten minutes and then as the air bag became cold (3) _____.

A month later a balloon was sent up with a Frenchman, (4)

_____. He stayed up in the air for twenty-five minutes at a height of about one hundred feet above the ground, and then came down saying that he had greatly enjoyed the view of the country.

In 1785 a Frenchman and an American crossed the English Channel in a balloon. When they had covered three quarters of the way the balloon began to go down. They threw everything they could overboard. (5)

_____, they would have never reached the French coast.

At present the scientists use the balloons mostly for obtaining information about atmosphere, its density and other scientific subjects; (6) _____. They carry instruments whose readings are automatically sent back to the ground by the radio.



b) Translate the text into Russian.

You should remember the following words and phrases!

weight	вес
land	приземлиться
safety	безопасность
pressure	давление
airflow	поток воздуха
lift	подъемная сила
wing	крыло
crew	экипаж
altitude	высота
range	дальность
speed	скорость
supersonic jet plane	сверхзвуковой реактивный самолет
a piston engine	поршневой двигатель
armaments	вооружение
drift	плыть по течению, сносить ветром
reliable	надежный
obtain information	получать информацию
density	плотность
carry instruments	нести измерительные приборы
readings	показания

Grammar

All nouns in the English language can be divided into two large groups: **countable** and **uncountable**. Countable nouns are nouns which can be counted, even if the number might be extraordinarily high (like counting all the people in the world).

Uncountable nouns are nouns which come in a state or quantity which is impossible to count. They are always considered to be singular.

1. Write the nouns from the box in the appropriate column of the table – *countable or uncountable*.

<i>information</i> <i>experiment</i> <i>device</i> <i>machine</i> <i>equipment</i> <i>wing</i> <i>wax</i>	
<i>air</i> <i>body</i> <i>gas</i> <i>idea</i> <i>principle</i> <i>flow</i> <i>pilot</i> <i>arm</i> <i>flight</i> <i>crew</i> <i>hero</i>	
<i>balloon</i> <i>courage</i> <i>record</i> <i>engine</i> <i>space</i> <i>smoke</i>	
COUNTABLE	UNCOUNTABLE

Countable nouns can be used with **a/an**, **the**, **some**, **any**, **(a) few**, and **many**. Uncountable nouns can be used with **the**, **some**, **any**, **(a) little**, and **much**.

2. Choose the right question phrase. Answer the questions.

	passengers can Sukhoi Superjet 100 seat?
	time do you need to fly from Moscow to New York?
How many/	engines does Airbus A380 have?
	money do you pay to buy a plane ticket from Samara to Moscow?
How much	people does the crew of TU-154 include?
	years has Boeing 777 been in service for?
	fuel can the Mil MI 1 helicopter carry?

3. Choose the correct variant.

- We are going to install new **equipment/equipments** in our laboratory.
- There are **many/much** engines displayed in the aircraft engine history museum.
- The stewardess gave us **an/some** information about the safety rules onboard.
- It's difficult to carry out an **experiment/experiments** without the necessary tools.
- There **is/are** some scientific principles recorded in the book.
- The pilot is looking for a **job/work** at the moment.
- He bought **a/some** wax to make **a/some** candle.
- Can you give me **a/some** money? I need **it/them** to pay for the extra luggage.

A lot (of) can go with both countable and uncountable nouns. However, it is mainly used in positive sentences. **Many/much** are more common in negative sentences and questions. It is OK to use **many** in positive sentences as well.

4. Fill in the gaps with many, much, little, few.

- a. The engineers are very busy these days. They have _____ free time.
- b. Neil Armstrong took _____ photos of the Moon surface.
- c. The experiment is over, so the researchers have _____ tasks to do.
- d. The airport was really crowded. There were too _____ people.
- e. We must hurry, we have _____ time.
- f. Space trips are very costly, so there are very _____ space tourists.
- g. He didn't go to the international conference, because he speaks _____ English.
- h. You need _____ smoke to make a hot air balloon go up in the air.
- j. We didn't have the necessary instruments, so we weren't able to obtain _____ information.

Little and **few** (without „a“) are negative ideas, meaning not enough. **A little** and **a few** are more positive, meaning a small amount or number, but enough. Compare:

- We have little money to carry out the research.
- We have a little money to carry out the research.

5. Some of the sentences need ‘a’. Put in ‘a’ where necessary. Put ‘OK’ if the sentence is already complete.

- a. The laboratory is not big, but there are few devices to work with.

- b. I can't conduct my experiment here, there is little equipment.
- c. We are proud of our fighter aces; they have broken few world records.
- d. We weren't so lucky; we had few problems during the experiment.
- e. There is little air in the room; we need to open a window.
- f. The library has few books on the history of human flight, we need more.
- g. He has little knowledge of the subject, you can ask him.
- h. The engineer from Germany spoke little English, I couldn't understand him.
- i. I need little help with my research. I'm stuck.
- j. Can you spare me few minutes?

Speaking

1. Work in groups. Think of the prospects of aviation development in the future. You may speak about the following:

- Types of aircraft
- Materials used
- Altitude, range, speed
- Operation conditions
- Engines
- Whatever idea you have



Use the following grammatical structures to talk about the future

... will definitely / definitely won't V

... will probably / probably won't V

... might V

MODULE 2 . TYPES OF AIRCRAFT

Lead in

1. Name the following types of aircraft.

GLIDER		BALLOON		BIPLANE		HELICOPTER		SEAPLANE		PARACHUTE		FIGHTER		DIRIGIBLE	
A		E													
B		F													
C		G													
D		H													

Reading

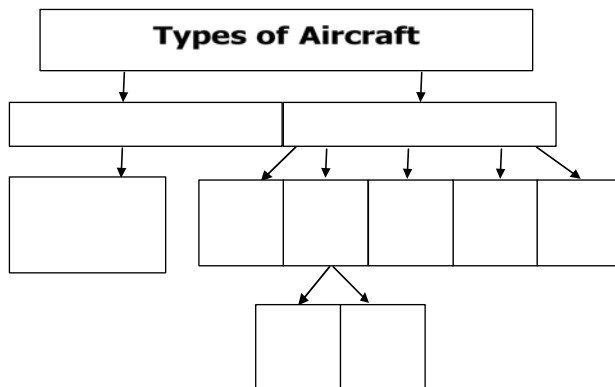
1. Match the phrases with their Russian equivalents.

- | | |
|-------------------------|---------------------------------------|
| 1) principle of flying | a) аэродинамическое действие |
| 2) aerodynamic action | b) крылатая ракета |
| 3) ballistic flight | c) вес самолета |
| 4) winged missile | d) принцип полета |
| 5) loss of height | e) полет по баллистической траектории |
| 6) controllable machine | f) подъемная сила |
| 7) lifting force | g) потеря высоты |
| 8) flying boat | h) гидроплан |
| 9) aircraft weight | i) управляемая машина |
| 10) seaplane | j) летающая лодка |

2. Practice reading the following words.

Aerodynamic	[, eərədaɪ'næmɪk]
Autogiro	[, ɔ:tə'dʒaɪrəʊ]
Encounter	[ɪn'kauntə]
Amphibian	[æm'fɪbɪən]
Height	[haɪt]
Biplane	[ˈbaɪpleɪn]
Boat hull	[bəʊt 'hʌl]
Fuselage	[ˈfju:zela:ʒ]
Exceed	[ɪksei:d]
Instead	[ɪn'sted]
Thus	[ðʌs]
Require	[rɪ'kwaɪə]

3. Read the text about types of aircraft. Fill in the diagram below.



Types of Aircraft

1. Modern heavier-than-air aircraft can be divided into two main classes according to the principle of flying: 1) aircraft flying due to aerodynamic action and 2) aircraft performing ballistic flight.

2. Aircraft that work on the first principle are gliders, airplanes, helicopters, autogiros and winged missiles. Ballistic rockets belong to the second class.



3. Gliders have no power plant and are supported in the air by up and down airstreams or airflows encountering the wing. A glider is lighter than an airplane and covers long distances with little loss of height.

4. Airplanes are controllable machines and have engines which give power for forward motion. The lifting force of airplanes is created by a wing itself while it is propelled by the thrust produced by the airscrew or by a jet engine. The arrangement and number of the wings subdivide airplanes into biplanes and monoplanes.

5. Many airplanes are equipped to take off water and land on water. Such airplanes are called flying boats if the boat hull replaces the airplane fuselage or seaplanes if floats take the place of wheels on a conventional land plane. If flying boats and seaplanes are also equipped with wheels for landing on the ground they are called amphibians.

6. At present VTOL and STOL aircraft are becoming popular but for vertical take-off it is necessary to produce the lift force exceeding the aircraft weight. The source of the lift is the energy developed by the propulsion system.

7. A helicopter differs from an airplane. The necessary lift force for a helicopter is produced by a rotor instead of wings. A helicopter has a fuselage but there is no conventional propeller in the nose. Instead, on the top it has rotor blades driven by an engine. The power of a helicopter engine is transmitted to the rotor which produces thrust for vertical take-off, hovering and forward propulsion. A helicopter is able to rise straight off the ground, fly forward, backward, sideward and descend vertically to the ground. Yet it has a few disadvantages. One of them is its inability to fly at high speed.

8. An autogiro is flying on the same principles, but the difference is that in addition to a rotor an autogiro has also a tractor/pusher airscrew. The power developed by the autogiro engine is transmitted to the airscrew while the rotor is freely revolving under the action of airflow, thus creating lifting force.



9. Ballistic rockets belong to the second class of aircraft. They do not require any lifting force produced by means of a wing. A rocket engine is to impart them the necessary energy for propulsion. Rocket engines mostly operate on liquid or solid fuels.

4. Say if the following statements are true or false. Correct the false ones.

a. Modern heavier-than-air aircraft are classified into two classes according to their flying principle.

- b. Airplanes fly due to up and down air stream.
- c. Gliders are equipped with an airscrew and a power plant.
- d. Airplanes can be fitted with floats to take off and land on water.
- e. In helicopters lifting force is produced by the wing itself.
- f. Helicopters can take off and land vertically.
- g. Autogiros and ballistic rockets fly on the same principles.
- h. Ballistic rockets do not produce lifting force by means of a wing.

5. Match the words with their definitions. State their part of speech.

- | | |
|-----------------|--|
| 1. conventional | a) to be greater than a number or amount |
| 2. to exceed | b) a plane with a single wing on each side |
| 3. to encounter | c) of the usual, traditional, or accepted type |
| 4. biplane | d) to give something |
| 5. monoplane | e) to experience or deal with something |
| 6. to require | f) the fact of not being able to do something |
| 7. to impart | h) to need someone or something |
| 8. inability | i) a plane with two sets of wings |

6. In the text, find 8 pairs of synonyms among the underlined words. Make the necessary changes.

- 1. to impart – to transmit _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____
- 6. _____

- 7. _____
- 8. _____

7. a) Read the text about helicopters and put the verbs in brackets into Active or Passive Voice in Present Simple or Past Simple.

A helicopter is a kind of flying machine or aircraft. A helicopter lifts up off of the ground and moves because of its rotors. A rotor has several small wings, called rotor blades that



(1) _____ (revolve) around a shaft. For that reason, helicopters (2) _____ (call) rotary-wing aircraft. A helicopter flies differently from an airplane. An airplane must move forward to stay in the air, but because the helicopter's rotor blades are always moving, the helicopter can hover above the ground. This allows them to land in places where an airplane cannot.

The first helicopters (3) _____ (build) by Frenchman Louis Breguet in 1935 and by German Henrich Focke in 1936. A Russian immigrant, Igor Sikorsky, (4) _____ (build) the first practical helicopter in America in 1939.

Helicopters are especially useful when there are disasters. Food packets, water, medicines and clothes (5) _____ (drop) from the air to people on the ground who cannot be reached by road. When people are injured, helicopters (6) _____ (carry) them to hospitals faster than an ambulance on the road. Helicopters (7) _____ (use) by the military, because they can move troops and equipment to places an airplane cannot take them. Attack helicopters act as attack aircraft carrying and shooting guns and missiles.

b) Translate the text into Russian

<i>You should remember the following words and phrases!</i>	
heavier-than-air aircraft	летательный аппарат тяжелее воздуха
to perform flight	совершать полет
helicopter	вертолет
autogiro	автожир
power plant	силовая установка
to propel	приводить в движение
thrust	тяга
airscrew	воздушный винт, пропеллер
arrangement	расположение
to take off	взлетать
wheel	колесо
VTOL (vertical take-off and landing)	ЛА вертикального взлета и посадки
STOL (short take-off and landing)	ЛА короткого взлета и посадки
propulsion system	винтомоторная установка
blade	лопасть
to transmit	передать
to hover	зависать в воздухе
to descend	снижаться
to revolve	вращаться
liquid or solid fuel	жидкое или твердое топливо
float	поплавок

Grammar

*Articles refer to nouns and stand before them. Articles can be **definite** (the) or **indefinite** (a/an). Sometimes articles are **omitted**. Study the following rules.*

Indefinite article <u>a/an</u>	Definite article <u>the</u>	Zero article
<ul style="list-style-type: none"> ✓ singular countable nouns only; ✓ when we talk about a thing for the first time; ✓ = any, one of; ✓ a job, a profession; ✓ with time expressions (once a year, twice a day) 	<ul style="list-style-type: none"> ✓ when we know which thing or person we mean; ✓ go to (the bank, the cinema...); ✓ =only one, unique <input type="checkbox"/> with superlative adjectives; ✓ the first, the second ...; <input type="checkbox"/> the same; ✓ nationalities (* the British, the Chinese) 	<ul style="list-style-type: none"> ✓ plural countable nouns and uncountable nouns in general; ✓ with a number (* Room 5, Flight 8562); ✓ have breakfast, lunch, dinner; ✓ go to bed /work/school/university ; ✓ go home/at home; ✓ with my/our/his...; <input type="checkbox"/> with this/that/ these/those...

1. Fill in the gaps with *a/an or the*.

- a. At ____ training airfield we saw ____ helicopter. ____ helicopter had rotor blades on ____ top.
- b. There isn't ____ airport near where I live. ____ nearest airport is 70 km away.
- c. There are flights to Prague twice ____ week.
- d. I'd like to study in this university. Has it got ____ science lab?

- e. What is ____ name of that lecturer we met yesterday?
- f. Our university has some of ____ best academic facilities in the region.
- g. My brother is ____ lab technician. He works four mornings ____ week.
- h. Our flight was delayed and we had to wait at ____ airport for three hours.
- i. Is there ____ bank in this Terminal?
- j. I'd like to speak to ____ manager, please.
- k. I've got ____ problem. Can you help me?
- l. I'm sorry; I didn't mean to do that. It was ____ mistake.
- m. Have you finished ____ report I asked you to do?
- n. My sister just got ____ job in ____ bank in Manchester.
- o. The campus is situated near ____ city centre.

2. Underline all nouns in the sentences. Decide which of them need an article.

- a) Where's your report? Can you give me copy?
- b) Speed limit in my city is 60 kilometers hour.
- c) Could you turn off light, please?
- d) Did you have good holiday? Yes, it was best holiday I've ever had.
- e) Amphibians are equipped with floats to land on water.
- f) Can you tell me where Room 26 is, please? – It's on second floor.
- g) Where did you have lunch? – We went to university cafeteria.
- h) Your sweater is same colour as mine.
- i) Gunpowder was invented by Chinese.
- j) Vegetarian is somebody who doesn't eat meat.

3. Choose the correct form, with or without the.

- a) I'm afraid of dogs / the dogs.
- b) Can you pass salt / the salt, please?
- c) Apples / the apples are good for your health.
- d) Look at apples / the apples on that tree! They are huge!

- e) We had a very nice meal. Vegetables / the vegetables were especially good.
- f) I like skiing / the skiing, but I'm not very good at it.
- g) Who are people / the people in this photograph?
- h) All books / the books on the top shelf belong to me.
- i) Don't stay in that hotel. It's very noisy and beds / the beds are uncomfortable.
- j) A pacifist is somebody who is against war / the war.
- k) First World War / The First World War lasted from 1914 until 1918.
- l) One of our biggest social problems is unemployment / the unemployment.
- m) Ron and Brenda got married but marriage / the marriage didn't last very long.
- n) The test wasn't very difficult. I answered all questions / the questions without difficulty.
- o) Don't sit on grass / the grass. It's wet after the rain.

Names with THE	Names without THE
✓ Oceans	✓ Continents
✓ Seas	✓ Countries (!!! but the USA, the UK, the Russian Federation)
✓ Rivers	✓ States, regions
✓ Canals	✓ Individual islands
✓ Groups of islands	✓ Cities, towns □ Individual mountains
✓ Mountain ranges	✓ Lakes
✓ The north/south/east/west (!!! but North America, West Africa...)	
✓ Deserts	✓ Airports
✓ Family names (The Simpsons)	✓ Companies

✓ Hotels/restaurants/bars	✓ Airlines
✓ Theatres/cinemas/museums	✓ Streets/roads/parks/squares
	✓ Universities

4. Some of the sentences are correct, but some need the (perhaps more than once). Correct the sentences where necessary.

- a) Everest was first climbed in 1953.
- b) Milan is in north of Italy.
- c) Africa is much larger than Europe.
- d) Last year I visited Mexico and United States.
- e) South of England is warmer than north.
- f) Portugal is in Western Europe.
- g) France and Britain are separated by Channel.
- h) Chicago is on Lake Michigan.
- j) The highest mountain in Africa is Kilimanjaro.
- k) Next year we are going skiing in Swiss Alps.
- l) United Kingdom consists of Great Britain and Northern Ireland.
- m) Seychelles are a group of islands in Indian Ocean.
- n) River Volga flows into Caspian Sea.
- o) Have you ever been to British Museum?
- p) Hyde Park is a very large park in London.
- q) Grand Hotel is in Baker Street.
- r) Taylors flew to New York from Gatwick Airport near London.
- s) Frank is a student at Liverpool University.
- t) If you're looking for a good pub, I would recommend Ship Inn.
- u) John works for IBM now. He used to work for British Telecom.

5. a) Read the following text and put a/an, the where necessary or leave the space empty (-).

A fixed-wing aircraft is ____ machine that can fly, but is heavier than ____ air. Fixed-wing aircraft are sometimes called just airplanes. All fixed wing aircraft have ____ wings. A glider is a fixed-wing aircraft that

does not have ____ engine. ____ first steam-powered unmanned fixed-wing aircraft, that weighed 9 lbs., was built by ____ man named John Stringfellow, in ____ Somerset, ____ England in 1848.

The first man who flew (took off, steered, and landed) ____ motor-powered fixed wing aircraft was Orville Wright in 1903 in ____ USA. Today, fixed wing aircraft fly between many cities all over ____ world, bringing ____ people and ____ cargo. Big cities usually have ____ international airport, which is ____ place where fixed-wing aircraft can land and take off safely. Some large cities like ____ New York City and ____ London have more than one airport. Two large makers of fixed-wing aircraft are ____ Airbus and ____ Boeing.

b) Translate the text into Russian.

Speaking

1. Work in pairs. Choose any type of aircraft from the Lead In section and find the information on when and where it was first built, how it was used back then and how it is used now. Share the information with the rest of the class.



MODULE 3. AIRPLANE COMPONENTS

Lead in

1. Share your air travel experience with the class.

- Have you ever travelled by plane? If yes, do you enjoy it?
- How old were you when you went on your first flight? Where did you go?
- What was the longest flight you have ever taken?



- What seat do you prefer: window, center or aisle?
- What do you do during the flight? Can you sleep?
- Do you like airplane food?
- What do you do when you experience turbulence?
- What documents do you need for an international flight?
- What do you have to do during take-off and landing?
- What items should not be included in your hand luggage?
- In your opinion, what are advantages and disadvantages of travelling by plane?

Reading

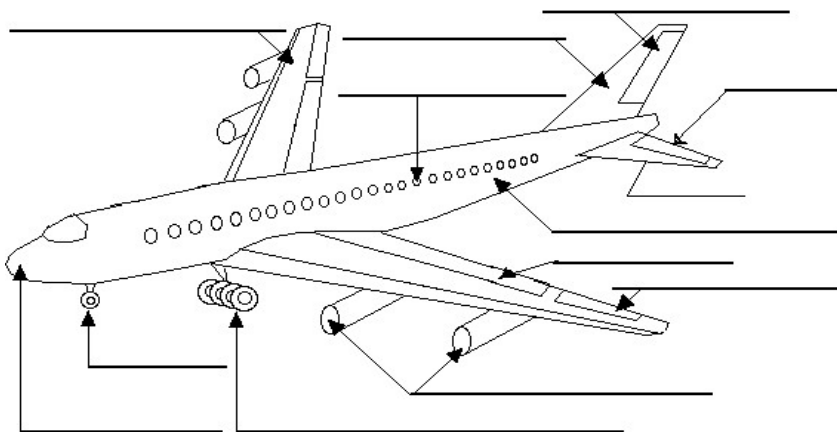
1. Match the phrases with their Russian equivalents.

- | | |
|--------------------------|-----------------------------|
| 1) structural unit | a) химическая реакция |
| 2) chemical reaction | b) приборная панель |
| 3) main body | c) подвижные детали |
| 4) instrument panel | d) структурный элемент |
| 5) passenger compartment | e) поверхность управления |
| 6) movable parts | f) основная часть, корпус |
| 7) vertical axis | g) необходимая устойчивость |
| 8) control surface | h) шасси |
| 9) landing gear | i) пассажирский салон |
| 10) necessary stability | j) вертикальная ось |

2. Practice reading the following words.

fuselage	['fju:zələʊz]
empennage	[em'penɪʒ]
gear	[gɪə]
chemical	['kemɪkəl]
accessories	[ək'sesərɪz]
rudder	['rʌdə]
hinge	[hɪndʒ]
longitudinal	[,lɒndʒɪ'tju:dməl]
lateral	['lætərəl]
strut	[strʌt]
tricycle	['traɪsɪkl]
undercarriage	['ʌndə,kæərɪdʒ]

3. Read the text about airplane components. Fill in the diagram below.



Airplane Components

1. An airplane consists of six principal structural units, namely, a power plant, a fuselage, a wing, a tail unit (or empennage), flight controls and a landing gear (undercarriage).

2. A power plant is a source of power. It provides power and propels an airplane. Nowadays there are many types of aircraft engines. These engines have one thing in common. The energy is derived from a chemical reaction which takes place inside the engine



itself. Nacelles are compartments housing a power plant or engine and its accessories. An engine is really the heart of an airplane.

3. A fuselage is the main body of an airplane which is divided into some cabins (compartments). A nose cabin is a pilot's cabin (cockpit). A



cockpit houses the crew, flight controls and flight instrument panels. The next section of the fuselage is a wing center-section. Passenger compartments are situated there. The rear part of the fuselage is designed for cargo rooms and for mounting a

tail unit on it.

4. A wing is the main lifting surface of sweptback shape. Its function is to support an aircraft in flight producing lifting force. There may be different arrangement, shapes and number of wings. At the trailing edge of a wing there are movable parts which are called ailerons, flaps and trimmer tabs (trimmers).



5. A tail unit (empennage) provides the necessary stability and consists of vertical and horizontal control surfaces. The vertical plane is called a fin. It has a movable part – a rudder. The horizontal plane is a stabilizer. The movable part at the trailing edge of a stabilizer is an elevator.

6. Three basic flight control surfaces are ailerons, elevators, and a rudder. They are hinged so to move and thus to deflect the air stream passing over there. Ailerons are located at the trailing edge and near the tips of wings. They control the motion of an plane about the longitudinal axis. Elevators are hinged to horizontal stabilizers and control the airplane movement up and down about the lateral axis. A rudder is hinged to a vertical stabilizer (fin), and it controls the movement of the airplane around the vertical axis.



7. A landing gear (undercarriage) carries the wheels on which an aircraft moves on the ground. Struts attach it to a fuselage. Two different arrangements of landing wheels are in use today. They are conventional

tricycle gears and the landing gear with a skid. A landing gear may be retractable and non-retractable.

4. Fill in the gaps in the following table as in the example.

Component	Function
Fuselage	to house the cockpit, passenger and cargo compartments
	to provide power for propulsion
Tail unit	
	to assist with take-off, landing and moving on the ground
Aileron	
Rudder	
	to control the airplane motion up and down about the lateral axis
Wing	
	to house the crew and the flight instrument panel
Nacelle	

5. Decide if the sentences are true or false. Correct the false ones.

1. A power plant produces lifting force.
2. The rear part of a fuselage is designed for a cockpit.
3. A landing gear is designed to help an airplane maneuver on the ground.

4. Ailerons, flaps and trimmers are located at the trailing edge of a wing.
5. Flight controls produce additional lifting force.
6. Empennage is mounted on the wing center-section.
7. A landing gear can also be called undercarriage.
8. A rudder and an elevator are movable parts of the wing.
9. A fin is a fixed horizontal plane.

6. a) Match the following words to make meaningful collocations. Use the dictionary if necessary.

upgraded
cruising
commercial

service
facilities
speed

jet
three-class
biggest
composite
tail
take-off

configuration
customer
airliner
weight
surfaces
materials

structural
turbofan
important

engines
units
requirements

b) Read the text about Airbus A380 and fill in the gaps with phrases from 6a).



The **Airbus A380** is a double-deck, wide-body, four-engine (1) _____ manufactured by the European aircraft company Airbus. It is the world's largest passenger airliner, and the airports at which it operates have (2) _____ to accommodate it. The A380 made its first flight on 27 April 2005 and entered (3) _____ in October 2007 with Singapore Airlines.

The A380's upper deck provides seating for 525 people in a typical (4) _____. The A380-800 has a range of 15,700 km, sufficient to fly nonstop from Dallas, USA to Sydney, Australia, and a (5) _____ of Mach 0.85.

As of December 2015, Airbus had received 319 firm orders and delivered 179 aircraft; Emirates is the (6) _____ with 140 on order and 72 delivered.

Major (7) _____ of the A380 are built in France, Germany, Spain, and the United Kingdom.

The A380 is available with two types of (8) _____, the Rolls-Royce Trent

900 (variants A380-841, -842 and -843F) or the Engine Alliance GP7000 (A380-861 and -863F). Noise reduction was an (9) _____ in the A380 design, and particularly affects engine design.

The A380's wing is sized for a maximum (10) _____ over 650 tons.

While most of the fuselage is aluminium, (11) _____ comprise more than 20% of the A380's airframe. Carbon-fiber reinforced plastic, glass-fiber reinforced plastic and quartz-fiber reinforced plastic are used extensively in wings, fuselage sections (such as the undercarriage and rear end of fuselage), (12) _____, and doors.

b) Translate the text into Russian

<i>You should remember the following words and phrases!</i>	
tail unit = empennage	хвостовое оперение
flight controls	средства управления полетом
landing gear = undercarriage	шасси
nacelle	гондола двигателя
cockpit	кабина пилота
wing center-section	центроплан
rear	задний
cargo	груз
to mount = to attach	крепить
sweptback	стреловидный
trailing edge	задняя кромка
aileron	элерон
flap	закрылок
trimmer tab	триммер
plane	плоскость
fin	киль
rudder	руль направления
stabilizer	стабилизатор
elevator	руль высоты
to hinge	крепить шарнирно
to deflect the air stream	отклонять воздушный поток
wing tip	законцовка крыла
longitudinal axis	продольная ось
lateral axis	поперечная ось
struts	стойки, подпорки
tricycle gear	трехопорное шасси
skid	хвостовая опора
retractable	втягивающийся, убирающийся

Grammar

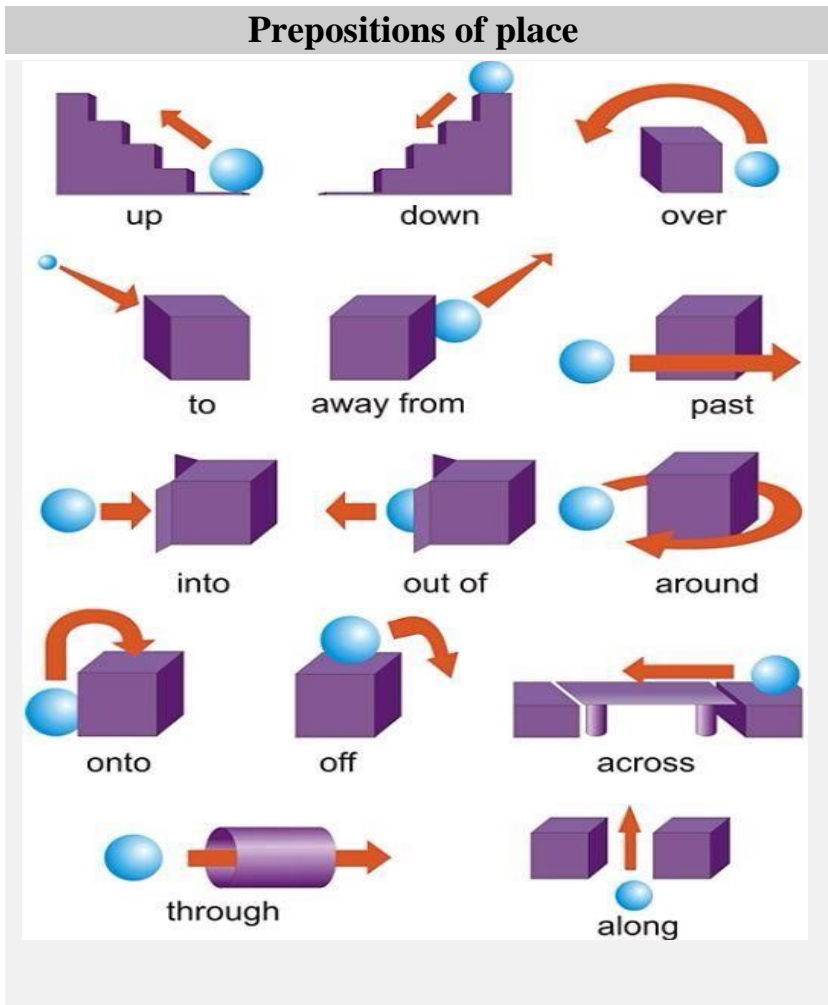
Prepositions are essential to sentences because they provide additional and necessary details. Prepositions are words that introduce information to the reader. This information can include where, when or why something takes place, or general descriptive information.

Prepositions of time	Preposition is not necessary
✓ At + clock time (at 8 am)	✓ Before last, this and next (last year, this week, next month)
✓ On + days of the week (on Tuesday)	✓ With speed and frequency expressions (1 million cycles a second, twenty pages a minute)
✓ On + dates (on 1 st July)	
✓ In + parts of the day (in the morning) – <u>but</u> at night	
✓ In + months and years (in August)	
✓ By + deadline (by 2020)	
✓ After	
✓ Before	
✓ During	
✓ Since + the moment when something started	
✓ For + the period of time	
✓ From ... till	

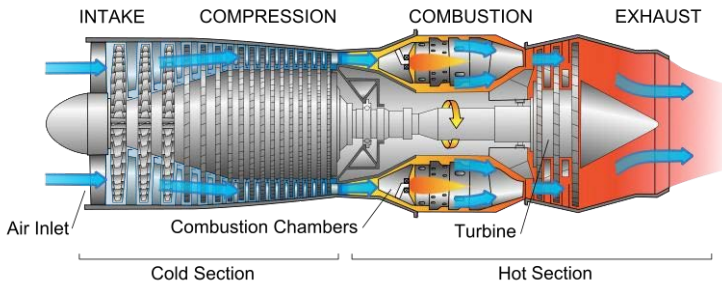
1. Five of the following sentences contain mistakes. Find and correct them.

- The report had been completed to the end of last month.
- These products have been on the market since nearly ten years.
- The meeting has been arranged for 16th April at 10 a.m.
- The results will be evaluated after the tests have been completed.

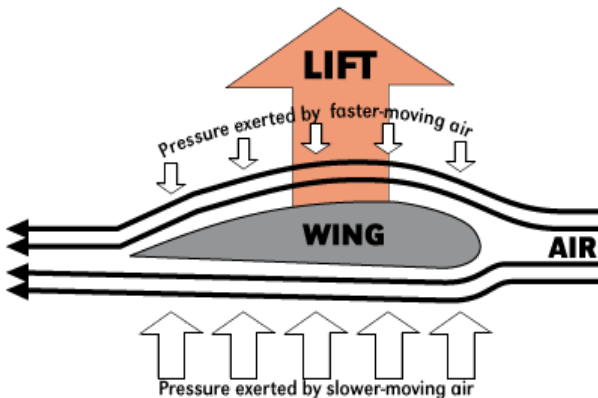
- e) We intend to continue production during the new machinery is installed.
- f) The road will be closed from 7 p.m. and 7 a.m.
- g) William E. Boeing started the Boeing company at 1910.
- h) During the 19th and 20th centuries great advances were made in treating illnesses.



1. a) Read the following text on airplane engines and aircraft wing and fill in the gaps with the necessary preposition of place.



A jet engine is the part of an aircraft which creates thrust, the force that propels planes forward. A jet engine utilizes fuel to run. An engine takes air (1) _____ the atmosphere (2) _____ the air intake and then passes it (3) _____ the compressor so that it can be in a small area. It then goes (4) _____ the combustion chamber of the engine. In the combustion chamber fuel is added to the air and ignited. This ignition creates a massive amount of heat energy. This heat energy is then pushed forcefully (5) _____ the only exit of the engine, which is the exhaust. As the gases come (6) _____ the engine, it thrusts the engine forward in the opposite direction with an equal force.



The shape of a wing is key to providing the most lift. There are many different types of shaped wings available depending on the role of an aircraft. For commercial aircraft, the top half of the wing is curved whereas the bottom half is flat. This means that the air (7) _____ the wing has to travel a longer distance in the same amount of time. This causes the air (8) _____ the wing to travel faster than the air (9) _____ the wing. This leads to pressure differences (10) _____ either side of the wing. The top half of the wing would experience a low pressure whereas underneath would experience high pressure. This generates lift, but of course this can only happen with speed which comes from the engines.

b) Translate the texts into Russian.

MODULE 4. AERODYNAMIC FORCES

Lead in

1. Match the beginning of the sentences to the ending.

1. Ailerons installed one to each wing	a) the airplane's tail goes up.
2. Flaps are used to control lift	b) the airplane's tail moves to the right.
3. If the pilot lowers the elevator,	c) at low speed for take-off and landing.
4. If the pilot moves the rudder to the left,	d) others in the wing.
5. Modern airliners use winglets	e) operate in opposite directions (one up and one down).
6. Some airplanes carry fuel in the fuselage,	f) used to slow an aircraft or make it descend.
7. Spoilers are small plates on the top portion of the wing	g) so that they can deflect.
8. Some airplane components are hinged	h) on the tips of the wing to reduce drag

Reading

1. Match the phrases with their Russian equivalents.

- | | |
|-------------------------------|--------------------------------|
| 1) upward force | a) сжатый воздух |
| 2) bottom surface | b) задняя кромка |
| 3) straight-and-level flight | c) прямой угол |
| 4) compressed air | d) сила, направленная вверх |
| 5) artificially created force | e) размер крыла |
| 6) right angle | f) нижняя плоскость |
| 7) forces of nature | g) прямой горизонтальный полет |
| 8) trailing edge | h) искусственно созданные силы |
| 9) aerodynamic forces | i) естественные силы |
| 10) size of the wing | j) аэродинамические силы |

2. Practice reading the following words.

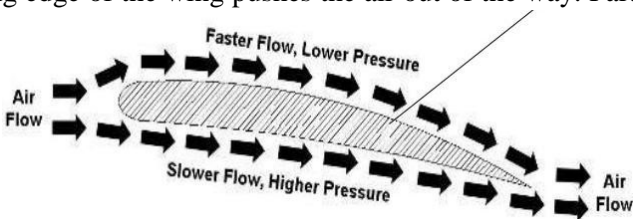
angle	['æŋgl]
rapidly	['ræpɪdli]
curved	['kɜ:vɪd]
thrust	[θrʌst]
inherent	[ɪn'herənt]
artificially	[,ɑ:tɪ'fɪʃəli]
accelerated	[ə'seləreɪtɪd]
inequality	[,ɪnɪ'kwɒləti]
climb	[klaɪm]
descent	[dɪ'sent]

3. Read the text about aerodynamic forces. Fill in the diagram below.

Aerodynamic Forces

1. An aircraft is able to rise into the air and to keep in the air because of the forces working on it. The motion itself maintains those forces.

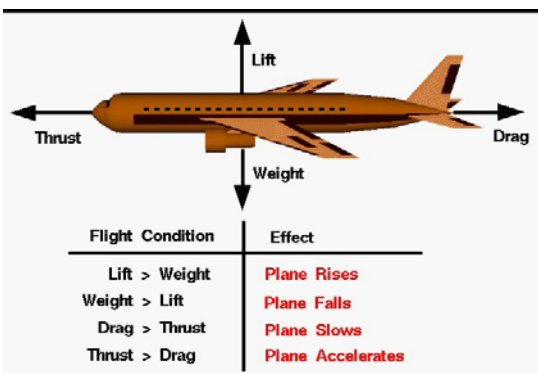
2. When moving in the air, an aircraft produces an upward force which is called lift and acts at right angle to the direction of the air stream. When moving the leading edge of the wing pushes the air out of the way. Part of this air flows rapidly over the wing and part of it flows under the wing, both parts joining behind the



trailing edge. The important thing is that due to the curved upper surface the air flowing over the wing travels faster than the air flowing under the more or less flat bottom surface. The air traveling across the top of the wing creates a reduced pressure on the upper surface. The air traveling along the bottom of the airfoil is slightly compressed and develops increased pressure. The difference in pressure between the air on the upper and lower surfaces of the wing produces lift.

The important thing is that due to the curved upper surface the air flowing over the wing travels faster than the air flowing under the more or less flat bottom surface. The air traveling across the top of the wing creates a reduced pressure on the upper surface. The air traveling along the bottom of the airfoil is slightly compressed and develops increased pressure. The difference in pressure between the air on the upper and lower surfaces of the wing produces lift.

3. To produce lift, an airplane wing must move through the air at high speed. This high speed is produced by a force of thrust which is acting in the direction of the airplane's motion. Both a propeller and a jet engine produce thrust.



4. Drag is the resistance an airplane meets in moving through the air. The faster an airplane moves, the greater drag will be.

5. In any position of flight an airplane is acted upon by four forces, the last being weight, or gravity, the downward acting force. Lift opposes weight and thrust opposes drag. Drag and weight are forces inherent in anything lifted from the earth and moved through the air. Thrust and lift are artificially created forces used to overcome the forces of nature and enable an airplane to fly. The engine-propeller combination is designed to produce thrust to overcome drag. A wing is designed to produce lift to overcome weight.

6. In straight-and-level unaccelerated flight, lift equals weight and thrust equals drag. Any inequality between lift and weight will result in the airplane entering a climb or descent. Any inequality between thrust and drag while maintaining straight-and-level flight will result in acceleration or deceleration until the two forces become balanced.

7. Lifting power and drag of a wing depend on the angle of attack, the shape and the size of the wing, density of the air and the speed of the flight.

4. Say if the following statements are true or false. Correct the false ones.

- a. The distance along the bottom of a wing is greater than the distance over the top of it.
- b. The air flowing over the top travels faster than the air flowing along the bottom of a wing.
- c. The faster a gas flows, the more pressure it creates.
- d. The pressure of the faster-flowing air on the bottom of a wing is less than that of the slower-moving air on the top.
- e. The increased pressure differential results in greater lift and thrust.
- f. Thrust and drag depend on the angle of attack.
- g. When thrust becomes more than drag, the airspeed decreases rapidly.
- h. Thrust pushes a plane forward overcoming the resistance of the air against the plane.

- i. The lift of an airplane acts vertically upwards and its weight – vertically downwards.
- j. The lift being equal to the weight, the airplane climbs; if the two forces are unequal the plane descends.

5. Read the following definitions and give the corresponding terms.

- a. The force that acts on an airplane wing in a direction perpendicular to the air stream.
- b. The resistance an airplane meets in moving through the air.
- c. A force producing a high speed of an airplane.
- d. A force with which a body tends toward the centre of the Earth.
- e. Blades fixed to a revolving shaft for driving an aircraft.
- f. A device which is capable of producing lift when it is moved through the air.

6. a) Give the opposites to these words.

a. fixed ≠	f. climb ≠
b. flat ≠	g. trailing ≠
c. reduced ≠	h. artificial ≠
d. rear ≠	i. acceleration ≠
e. horizontal ≠	j. upward ≠

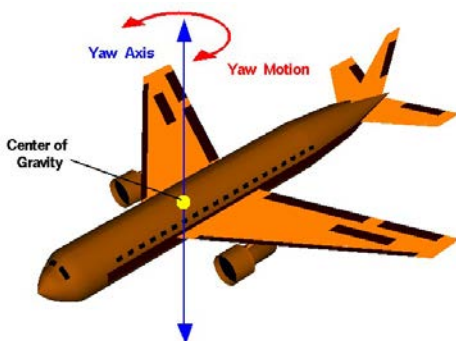
b) Fill in the gaps in these sentences with a suitable word from 6a.

- a. Drag and gravity are _____ forces.
- b. Cargo rooms are usually situated in the _____ part of the fuselage.
- c. A fin is a _____ plane of the tail unit; it has a _____ part – a rudder.
- d. Lift is a(n) _____ acting force produced by a wing.

- e. Flaps and ailerons are located on the _____ edge of the wing.
- f. The upper surface of a wing is _____, thus there is a _____ pressure area above it.

7. Read the text about airplane motion and translate it into Russian.

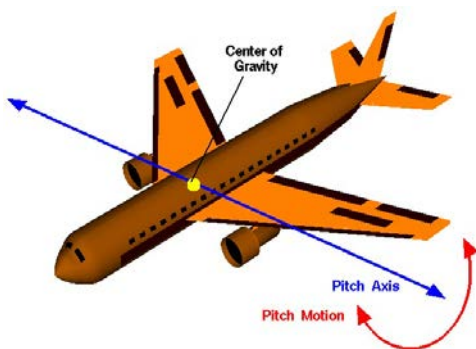
In flight, any aircraft will rotate about its center of gravity. We can define



a three dimensional coordinate system through the center of gravity with each axis of this coordinate system perpendicular to the other two axes. We can then define the orientation of an aircraft by the amount of rotation of the parts of an aircraft along these

principal axes. A **yaw axis**

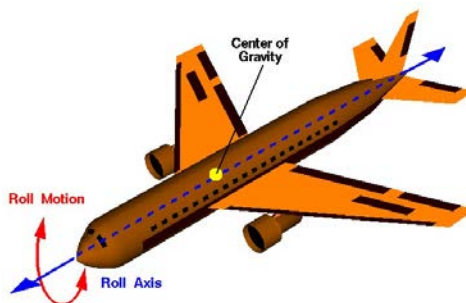
is perpendicular to the wings and lies in the plane of the aircraft centerline. A **yaw motion** is a side to side movement of the nose of an aircraft. Yawing motion is being caused by the deflection of the rudder of this aircraft. A rudder is a hinged section at the rear of a vertical stabilizer.



A **pitch axis** is perpendicular to the aircraft centerline and lies in the plane of the wings. A **pitch motion** is an up or down movement of the nose of an aircraft. Pitching motion is being caused by the deflection of an elevator of this aircraft. An elevator is a hinged section at the rear of

the horizontal stabilizer. There is usually an elevator on each horizontal stabilizer. Elevators work in pairs; when the right elevator goes up, the left elevator also goes up.

A **roll axis** lies along the aircraft centerline. A **roll motion** is an up and down movement of the wings of the aircraft. Rolling motion is caused by the deflection of ailerons of this aircraft. An aileron is a hinged section at the rear of each wing. Ailerons work in opposition; when the right aileron goes up, the left aileron goes down.



<i>You should remember the following words and phrases!</i>	
leading edge	передняя кромка
curved	изогнутый
flat	плоский
reduced pressure	пониженное давление
increased pressure	повышенное давление
airfoil	аэродинамическая поверхность
thrust	тяга
drag	лобовое сопротивление
resistance	устойчивость, сопротивление
gravity	сила тяжести, гравитация
inherent	присущий
to overcome	преодолевать, превосходить
to equal	быть равным, равняться
climb	набор высоты
descent	снижение

acceleration	ускорение
deceleration	замедление
angle of attack	угол атаки
density	плотность
to maintain	поддерживать

Grammar

A conditional sentence has two clauses: an ‘if’ clause and a main clause. There are four principal types of conditional sentences: conditional I, conditional II, conditional III and universal conditional.

	Main Clause	‘if’ Clause
Universal Conditional	Present Simple (do/does)	Present Simple (do/does)
Conditional I	will V	Present Simple (do/does)
Conditional II	would V	Past Simple (were/did)
Conditional III	would have V3	Past Perfect (had V3)

We use **conditional sentences** to talk about the relationship between events and their consequences.

**If our survey shows the possibility of oil (event), we will do some drilling (consequence).*

<u>Universal conditional</u>	a speaker indicates that the consequence always follows the event	(If the pilot lowers the elevator), [the airplane nose tilts down].
<u>Conditional I</u>	a speaker sees the event as a real possibility	(If a bird is sucked into an engine), [the engine will fail].
<u>Conditional II</u>	a speaker sees the event as a remote possibility	(If the fuel ran out in flight), [the battery would provide power].
<u>Conditional III</u>	a speaker recognizes the event as impossible as it refers to the past	[The plane wouldn't have crashed] (if the weather conditions hadn't been that bad).

NB!

if and only if	provided/providing(that) on conditionthat as long as
sth may or may not happen	in case (of) in the event that/of
if...not	unless

1. Match two parts to form conditional sentences. Identify the type.

1. If these tests produce positive results,	a) the accident would never have happened.
2. If rubber is cooled to -200° C,	b) download them onto your computer.
3. If safety measures had been followed,	c) we'd be able to do all the technical specifications in half the time.
4. If you want to study the files from the internet,	d) we could estimate the experimental error.
5. If we bought a new software package,	e) it would have taken nearly two months.
6. If you want to use this software package on more than one system,	f) it becomes brittle and will break.
7. If the cargo had been sent by sea,	g) we'll continue with clinical trials.
8. If we ran an additional test,	h) you'll have to get a site license.

2. Complete the sentences using the words in brackets.

a. The tests won't be continued unless (there/be/better safety measures).

b. He wouldn't have been injured if (he/follow/the correct procedures).

c. In the event of a collision, (the airbag/inflate).

d. If all vehicles were fitted with a catalytic converter, (there/be/less/pollution).

e. The reaction would be speeded up if (we/introduce/a catalyst).

f. If heat is applied, (the substance/decompose).

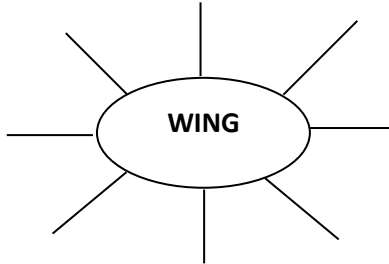
g. As long as disinfectant is used, (infections/not be/ pass on).

h. If iron is left in contact with air and water, (it/rust).

MODULE 5. WING

Lead in

1. *Brainstorm all possible terms related to the topic.*



2. *Before you read the text name the main functions of a wing, try to describe wing structure. Share your ideas with your groupmates.*

Reading

1. *Work in pairs. Compare wings of military and civil aircraft. Talk about similarity and difference and try to explain them; compare their appearance, materials used, technical characteristics, etc.*



a)



b)



c)



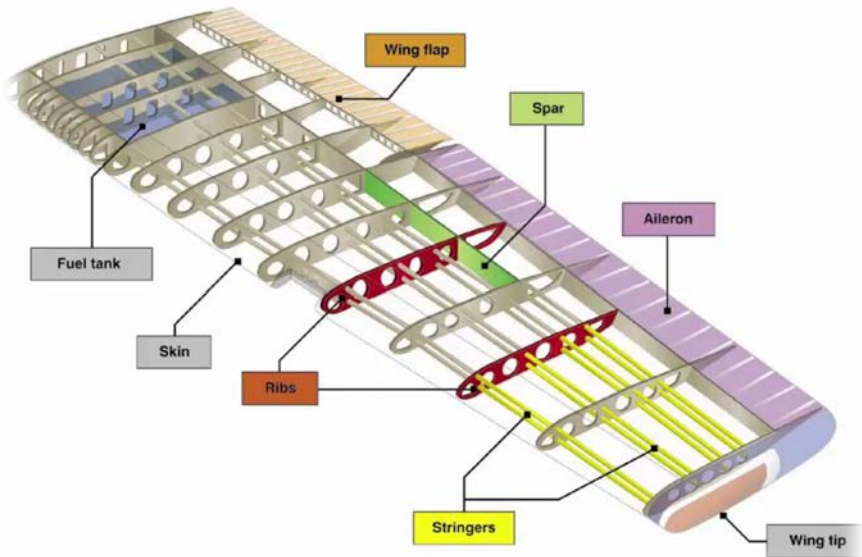
d)

2. Practice reading the following words.

surface	['sʌ:fɪs]
flap	[flæp]
fuel	[fju:əl]
chord	[kɔ:d]
sweptback	['swɛptbæk]

edge	[edʒ]
transverse	[trænz'vɜ:s]
spar	[spɑ:]
stringer	['strɪŋə]
spanwise	[ˈspænwaɪz]
torsion	['tɔ:ʃ(ə)n]

3. Look at the picture and try to guess the purposes of wing components. Give your reasons.



4. Read the text and write out the underlined words. Try to guess their meaning from the context. Compare your notes with your partners. Translate the text.

Wing

1. The main lifting surfaces of every airplane are wings. Wings are light structures, which extend out on each side of the body. Their function is to push downward on the air as a machine moves through it. This push or lift of the wings is the secret of the support of an airplane in the air.

2. A wing is divided into three sections: a wing root, an inter-mediate section and a wing tip. The front edge of a wing is called the leading edge and the rear one is called the trailing edge. There are some movable parts on the trailing edge of a wing. These are ailerons, flaps and trimmer tabs.

3. The primary function of a wing is to produce lift (lifting force) for flying. The secondary function is to house many vital parts of an aircraft, such as fuel tanks, control mechanisms and often engines and landing gear bays are arranged in the wing structure.

4. The distance from the wing tip on one side to the wing tip on the other side is called a span and the distance from the leading edge of the wing to the trailing edge is a chord.



a) Sweptback wing aircraft



b) Sweptforward wing aircraft

5. A shape of the wing is of great importance for an aircraft. There are different configurations of a wing. There are rectangular and elliptical wings, wings of trapezoidal form, straight, sweptback and sweptforward wings. There is also a delta wing form.

6. The wing structure consists of longitudinal structural members - spars, stringers and beams and of transverse elements — ribs. The wing structure is covered with a skin (or covering). According to the position in which the wing of a monoplane is fixed in relation to a fuselage an aircraft is called a low-wing monoplane, a mid-wing monoplane and a high-wing monoplane.

7. Aerodynamic loads on a wing produce bending, shear and torsion. A typical construction of a wing must resist these loads and usually consists of a thin sheet metal shell of airfoil shape, reinforced within by spanwise stiffeners and transverse ribs. Every component of an airplane must be so designed that it could carry its intended function.

8. Light weight is very important in an airplane structure because every pound of structural weight replaces a pound of payload. The wing structure is no exception in this respect. A stressed skin type of construction was adopted because it can be made light.

5. Define the main idea of paragraph 8. Find the supporting details that help to develop the main idea.

6. Complete the sentences with the best options.

1. There are some movable parts on the _____ of a wing.

a) leading edge b) trailing edge c) centre-section

2. The _____ structural members of a wing are spars, stringers and beams.

a) transverse b) covering c) longitudinal

3. The _____ a wing produces bending, shear and torsion.

a) weight of b) aerodynamic loads on c) structure of

4. Every pound of wing structural weight replaces a pound of _____ .

- a) payload b) power c) lifting force

5. The distance between wing tips is called a _____ .

- a) chord b) beam c) span

7. Match the terms with their definitions.

- | | |
|---|-----------------------|
| 1. In this type of construction the skin of an aircraft carries structural loads. | a. span |
| 2. This component of an airplane produces lifting force for flying. | b. skin |
| 3. They are longitudinal members of the wing structure. | c. stressed skin |
| 4. The distance between the chord wing tips. | d. chord |
| 5. It covers the wing structure. | e. wing |
| 6. It is a transverse element of beam the wing structure. | f. spar, stringer and |
| 7. Distance from the leading to edge of the wing. | g. rib the trailing |

8. Read the text again and decide if these statements are true or false.

1. There are two main functions of a wing – to produce lift and to house many vital parts of an aircraft.
2. Movable parts of a wing are located on the leading edge.
3. A span – it is the distance between wing tips.
4. Light weight is of no importance in an airplane structure.

5. Ribs are longitudinal members of the wing structure.
6. Spars, stringers and beams are spanwise stiffeners of the wing structure.
7. Skin is the covering of the wing structure and it can carry structural loads.

9. *These are the answers. What are the questions?*

1. – the wings.
2. – a wing root, an intermediate section and the wing tip.
3. – on the trailing edge.
4. – chord.
5. – longitudinal and transverse elements.

10. *Match the synonyms.*

A	B
wing	rear edge
front edge	bay
shape	engine
covering	airfoil
section	form
trailing edge	skin
power plant	leading edge

11. *Give the opposites to these words.*

a. to take off	f. reinforce
b. primary	g. downward
c. root	h. to push
d. leading	i. movable
e. different	j. transverse

12. Give the English equivalents to the words in the brackets.

1. A rib is a (поперечный) element of an airplane structure.
2. The main longitudinal structural members of the wing structure are – (лонжероны, стрингеры и балки).
3. A typical construction of a wing must resist (изгибу, сдвигу и кручению).
4. (Топливные баки), control mechanisms and very often (двигатели) and landing gear (отсеки) are arranged in the wing structure.

13. Use the prepositions in the box to complete the sentences.

from	with	into	in	of
on	to			

1. A wing is divided _____ three sections
2. There are some movable parts _____ the trailing edge of the wing.
3. Fuel tanks, control mechanisms and very often engines and landing gear bays are arranged _____ the wing structure.
4. The distance _____ the leading edge of a wing _____ the trailing edge is a chord.
5. The wing structure is covered _____ skin.
6. The wing structure consists _____ longitudinal and transverse elements.

14. Read the text and translate it into Russian

Wings

The wings support the weight of an aircraft in the air and so must have sufficient strength and stiffness to be able to do this. The strength and stiffness are determined by the thickness of a wing, the thickness and type of construction used depend on the speed requirements of an aircraft. The types of construction are: a biplane, a braced monoplane, and a cantilever monoplane

Biplane

Very few biplanes fly at more than 350 km/h in level flight and so air loads are low, which means that the truss type design is satisfactory. Wing spars, struts and bracing wires form a lattice girder of great rigidity, which is highly resistant to bending and twisting.



Braced Monoplane

This type of design is also used on low speed aircraft.

Cantilever Monoplane

Wings have to absorb the stresses due to lift and drag in flight and, if of cantilever design, their own weight when on the ground. This is achieved by building a wing around one or more main load bearing members known as spars. These are constructed so to absorb the downwards bending stresses when an aircraft is on the ground. However, when an aircraft is in flight a wing not only has to have the flexibility to bend upwards but also needs enough stiffness to resist torsional loads, which causes twisting.



<i>You should remember the following words and phrases!</i>	
wing	крыло
lifting force	подъёмная сила
wing root	корневая часть крыла
wing tip	законцовка крыла
leading edge	передняя кромка
trailing edge	задняя кромка
aileron	элерон
flap	закрылок
trimmer tab	триммер
to house	вмещать, содержать
fuel tank	топливный бак
control mechanism	механизм управления
landing gear bay	отсек для шасси
span	размах
chord	хорда
sweptback wing	крыло с прямой стреловидностью
sweptforward wing	крыло с обратной стреловидностью

spar	лонжерон крыла
stringer	стрингер
beam	балка
transverse	поперечный
rib	нервюра
skin	обшивка
bending	изгиб
shear	сдвиг, срез
torsion	кручение
to reinforce	подкреплять, усиливать
spanwise stiffener	продольный элемент жёсткости
payload	полезная нагрузка
stressed skin	работающая обшивка

Speaking

1. Look at the picture and predict what kind of aircraft it is. Explain why you think so. Discuss its advantages and disadvantages.



2. Watch the video "N9M Flying Wing returns to Flight" at <https://www.youtube.com/watch?v=B0gqSHva1IQ> and describe this aircraft. Pay attention to flight controls, fuselage, engines, etc.

3. Analyze a conventional wing and a flying wing. Compare them. Highlight their similarities and differences. Make a report to your group mates. The following expressions might be helpful:

- The object of this report is ...
- First of all I would like to
- It should be stressed ...
- In comparison with
- Summing up, I would like to ...

Grammar

The Infinitive is a non-finite verb form that denotes actions and combines features of a verb and a noun.

Meaning	The Infinitive form	
	Active voice	Passive voice
The Infinitive Infinitive Indefinite- expresses an action that is simultaneous with the predicate's action	to V to use	to be +Ved to be used
Infinitive Continuous – expresses a continuous action that is simultaneous with the predicate's action	to be +Ving to be using	_____
Infinitive Perfect – expresses the action preceding the predicate's action	to have + Ved to have used	to have been Ved to have been used
Infinitive Perfect Continuous - expresses a continuous action that has been performed for some time period preceding the predicate's action	to have been Ving to have been using	_____

Usage	Functions
1. as a noun a. before a verb b. after a link-verb c. after a verb	1. a. <i>To design</i> a new aircraft is an important task. (subject) b. Our aim is <i>to design</i> a new aircraft. (predicate nominative) c. They began <i>to design</i> a new aircraft. (part of verbal predicate)
2. as an adjective	2. They have the chance <i>to design</i> a new aircraft. (attribute)
3. as an adverb	3. They experimented <i>to design</i> a new device. (adverbial modifier)

1. Define the function of the Infinitive. Translate the sentences.

1. To develop a new spacecraft with a manipulator is not an easy task. 2. To design, construct and operate an aircraft control system is a great technological achievement. 3. One of the best ways to keep the car speed steady is to use a computer. 4. Experiments helped Mendeleev to discover the properties of new chemical elements. 5. A special electronic device signals the engine to stop. 6. Radar may control the brakes to avoid collisions with other cars. 7. High temperature alloys make it possible for jet engines to be operating under severe conditions for a long period. 8. Recently a radar to be mounted on cars has been developed. 9. To help helicopters and aircraft find the capsule, its upper part is covered with special paint, which can be detected by radar. 10. The radar detects the stationary objects ahead of the car to warn the driver about them and slow down the speed. 11. One of the ways to make planes as economical as possible is to lighten the aircraft by using new composite materials. 12. To be an ideal engineer is to have knowledge, to improve one's ability to analyze, synthesize and develop insight into one's field. 13. Automation makes it possible to obtain and develop new sources of energy. 14. One of the problems scientists are working at is to deliver payload to space stations by space elevators.

The Infinitive is often used as an attribute in a model **Noun + to V**. This model is translated as *future or necessary action*.

The device *to be used* has been carefully examined. – Прибор, который будет использоваться, тщательно проверен.

2. Translate the sentences.

1. Lasers to be placed on Earth satellites will transform solar radiation into laser beams.
2. Signals to be measured must be strong enough.
3. Industrial robots to be built perform certain tasks even better than a human being.
4. Noise and vibration are also the problems to be faced by designers of hypersonic craft.
5. There is one more problem to be studied – that of surface cooling.

3. Translate the sentences using the correct form of the Infinitive.

1. Конструкцию передней кромки крыла необходимо изменить, чтобы уменьшить лобовое сопротивление.
2. Наша задача – обеспечить безопасную и надёжную работу самолёта.
3. Необходимо устранить вибрацию и чрезмерный шум в двигателе.
4. Наконец-то были достигнуты хорошие результаты! Должно быть, они проверили все компоненты системы.
5. Аэродинамическая труба используется, чтобы оценить аэродинамику компонентов самолёта.
6. Существует множество явлений, который необходимо исследовать.
7. Слышишь шум? Эксперимент, должно быть, всё ещё продолжается.

8. Чтобы увеличить подъёмную силу самолёта при взлёте, пилот использует закрылки.
9. Авиакомпании уделяют большое внимание комфорту пассажиров, чтобы быть конкурентно способными на рынке.
10. Одна из проблем, которая должна быть решена в ближайшем будущем, это уменьшить шумовое загрязнение окружающей среды.

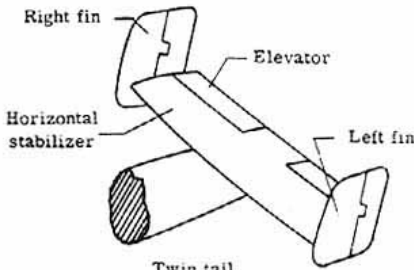
MODULE 6. TAIL GROUP

Lead in

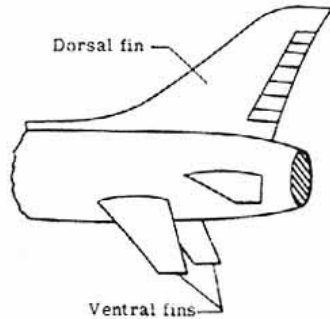
1. Look at these pictures. These are the types of a tail group. Try to predict what types of aircraft they belong to. Share your ideas with your partners.



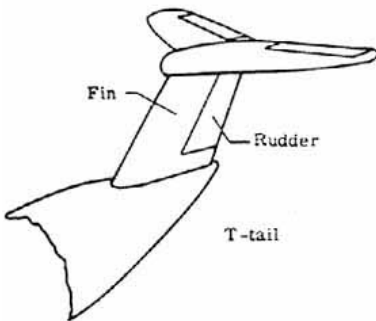
Standard tail



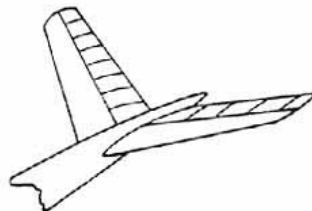
Twin tail



Ventral fins



T-tail



V-butterfly-tail

2. Before you read the text answer the following questions:

1. What are the movable parts of a tail unit intended for?
2. Is there any difference between tail groups of civil and military aircraft?

Reading

1. Read the text and match the English words with their Russian counterparts.

- | | |
|-----------------|-------------------------------|
| 1) elevator | a) руль направления |
| 2) fin | b) площадь компенсатора |
| 3) rudder | c) руль высоты |
| 4) tail plane | d) форкиль |
| 5) attitude | e) киль |
| 6) dorsal fin | f) пространственное положение |
| 7) precaution | g) стабилизатор |
| 8) balance area | h) предосторожность |

2. Practice reading the following words.

necessary	['nesəsəri]
tail	[teɪl]
empennage	[em'penɪʒ]
stabilizer	['steɪbəlaɪzə]
rudder	['rʌdə]
elevator	['elɪveɪtə]

fin	[fɪn]
hinge	[hɪndʒ]
altitude	['æltɪt(j)uːd]
starboard	['stɑːbɔːd]
auxiliary	[ɔːg'zɪlɪərɪ]
adjustable	[ə'dʒʌstəbl]
deflect	[dɪ'flekt]

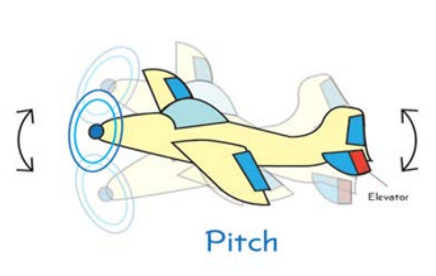
3. Read the text describing aircraft tail types and translate it.

Tail Group

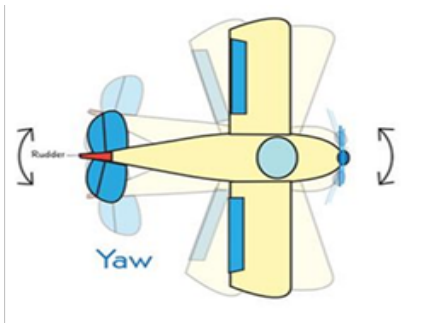
1. In order to provide the necessary stability, airplanes are fitted with a tail unit (a tail group, an empennage) which usually consists of horizontal tail surfaces – a stabilizer and elevators and vertical surfaces – a fin and a rudder. A stabilizer and a fin are fixed portions, an elevator and a rudder are movable.

2. A movable control surface called an elevator is hinged to the rear of a tail plane. It is intended to control the altitude of an aircraft in flight. It can be deflected upwards or downwards. Moving up an elevator reduces its angle of attack and creates a down load on a tail, which raises a nose of an aircraft.

3. In order to secure directional stability a fin is used which is a vertical fixed control surface at the rear of a fuselage. The action of the vertical surface is quite clear. Since it has a great lever arm from an airplane's center of gravity a vertical surface is able



to stabilize the directional motion of an aircraft. Directional control of an airplane is achieved by means of a rudder, which is a movable vertical surface hinged to the rear of a fin. It can be moved to right or left or retained in the neutral position in line with a fin.



4. When a pilot needs to change his flight direction towards the right, he moves a rudder to the right. The reaction of the stream on the surface produces a couple about the center of gravity and a nose of an aircraft is turned to starboard. If it is necessary for a pilot to control the altitude of an aircraft and cause a nose to rise or fall this is done by means of an elevator.

5. In addition to the principal control surfaces, there are some auxiliary ones such as trimmers, which represent small adjustable areas arranged near the trailing edges of the movable surfaces. They are used to produce constant control deflections to hold an airplane in a certain attitude of flight. They are adjustable from the cockpit. There is also a dorsal fin placed along the upper side of the aft portion of a fuselage.

6. On large fast airplanes, it is usually necessary to provide movable surfaces with some area called balance area. It reduces the hinge moment needed to deflect the surface. This is often required because the hinge moment increases with size and speed. This dynamic balancing is one of the precautions taken to avoid flutter.

7. Flutter is an uncontrolled oscillation that can occur on fixed surfaces, such as wings or on control surfaces such as ailerons or elevators. Flutter is caused by the interaction of aerodynamic forces, inertia forces and properties of the structure and it can lead to the catastrophic failure of the structure.

8. The structure of a tail plane as well as that of a wing consists of longitudinal and transverse structural elements called spars and ribs.

4. Match the given titles with the corresponding paragraphs. Watch out! There is an extra title.

1. balance area
2. tail unit arrangement
3. tail unit function
4. tail plane structure
5. elevator
6. dorsal fin
7. rudder
8. flutter
9. fin
10. trimmers

5. Which of the following sentences summarize the main idea of the paragraph 5 most accurately?

1. Trimmers are arranged near the trailing edges of the movable surfaces and adjustable from the cockpit.
2. Trimming tabs are necessary to produce constant control deflections to keep an airplane in a given attitude of flight.
3. Auxiliary surfaces are adjustable from the cockpit and produce additional lifting force.

6. Guess what it is:

- 1) This component of an aircraft provides the necessary stability.
- 2) The structure of a tail plane consists of these members.
- 3) It is used in a tail group to avoid flutter and violent vibration.
- 4) They are arranged near the trailing edges of the movable surfaces.
- 5) When a pilot needs to change the flight direction, he moves it to the right or left.
- 6) It is a vertical fixed surface of a tail unit.
- 7) It is used to produce constant control deflections.
- 8) This part of a tail group is to stabilize the directional motion of an airplane.

9) It is a horizontal movable plane. It can be deflected upwards and downwards.

10) This part of a tail group is placed along the upper side of the aft portion of a fuselage body.

11) These portions are used when a pilot wants the nose to rise or to fall.

12) This is used to reduce the hinge moment, which increases with size and speed.

7. In the text, find the definition of a flutter.

8. Fill in the gaps with the words from the box.

rudder	hinged	dorsal fin	altitude
auxiliary	stability	rear	trailing edges

1. Tail unit provides the necessary _____ of an airplane.

2. An elevator is _____ to the _____ of a tail plane.

3. Elevators control the _____ of an aircraft in flight.

4. _____ can be deflected to the right or to the left.

5. Trimmers are _____ surfaces arranged near the _____ of movable surfaces.

6. To avoid flutter _____ is used.

9. Work in pairs. Make up 5 "False" and 5 "True" statements and tell them your partner. "False" statements should be corrected.

10. Ask your group mates ten questions concerning the tail unit.

11. a. Check if you know the meaning of the following verbs.

To provide, to consist, to intend, to arrange, to hold, to control, to deflect, to reduce, to secure, to fit.

b. Find these words in the text and write out the words they collocate with.

c. Think of other nouns they can go with.

d. Give synonyms of the verbs from a).

12. In the text find the antonyms of the following words and make up your own word combinations with them.

fixed	
to increase	
main	
to promote	
irregular	
weak	

13. a) Read the text on tail units and fill in the gaps (1-8) with the missing information (a – h).

- a) fuel tanks
- b) trimmer tab
- c) trailing edge
- d) spars, ribs, stringers and skin
- e) horizontal surface
- f) rudder
- g) vertical stabilizer or fin
- h) elevators

Tail unit controls

A tail unit provides longitudinal and directional stability. Some aircraft have their longitudinal stability and control provided by foreplanes (canards).

A (1)....., which is known as a tailplane or horizontal stabilizer, provides longitudinal stability by generating upwards or downwards forces as required.

A vertical surface, (2).....generates sideways forces as required. Longitudinal control is provided by a (3) with directional control provided by a (4).....

A (5)..... is a small adjustable surface set into the (6).....of the main control surface. To maintain the primary control surface in its required position, the trimmer tab is moved in the opposite direction to the control surface, until the trimmer tab hinge moment balances the control surface hinge moment.

Structurally tail unit components are generally smaller versions of wings. They use (7)..... in their construction. On some aircraft, they are also designed to house (8)..... They also use the same basic materials i.e. aluminum alloys, composites with honeycomb structures or high density expanding foam being used for control surfaces, to provide greater stiffness at lower weight.

15. Translate the following word combinations into Russian:

- 1) rocket launch
- 2) aircraft maintenance
- 3) communication satellite
- 4) communication satellite launch
- 5) robot manipulator
- 6) weather radar antenna
- 7) combustion chamber pressure
- 8) landing gear bay
- 9) fixed oxygen system reservoir
- 10) extensive fatigue test programme

<i>You should remember the following words and phrases!</i>	
tail unit/ empennage	хвостовое оперение
stabilizer	стабилизатор
elevator	руль высоты
fin	киль
rudder	руль направления/поворота
to hinge	крепить шарнирно
to deflect	отклонять
directional control	управление по курсу
trimmer	триммер
adjustable	регулирующийся
dorsal fin	форкиль
balance area	площадь компенсатора
to reduce	уменьшать
hinge moment	шарнирный момент
flutter	флаттер

Grammar

Complex object is a combination of a pronoun in objective case or a noun in common case with the Infinitive. **Complex object** is a member of

a sentence. In this grammatical pattern, a noun or a pronoun is a person/thing that acts or is being acted upon. This action is expressed in the Infinitive.

We know **him to be** an aircraft engine designer. – Мы знаем, **что он конструктор авиационных двигателей.**

Complex object is translated into Russian as a subordinate clause with conjunctions **что, чтобы.**

Complex object is used after:

1. the verbs of assumption	to expect – ожидать , to think - думать, to believe – считать, полагать, to suppose – полагать, to consider – считать
2. the verbs expressing desire and to know - знать	to want – хотеть , to wish, to desire – желать, and some others.

Do not forget to use particle **to before the Infinitive!*

After the verbs to see, to watch, to notice, to observe particle **to is not used.*

He saw **the aircraft approach** the runway. – Он видел, **что самолёт приблизился к взлётно-посадочной полосе.**

**If the Perfect Infinitive is used, it means that the action expressed in it, precedes the action of the predicate expressed in the personal verb.*

We know **him to have translated** the text. – Мы знаем, **что он перевел текст.**

1. Translate the sentences.

1. The lecturer suppose them to know a lot about laws of physics.
2. We know him to wish to become an expert in aircraft designing.
3. Our chief designer considered us to have prepared a report on the wind tunnel tests.

4. We know aerodynamics to be a brunch of continuum mechanics.
5. We believe modern aircraft to be safe and reliable.
6. We consider action and reaction to be equal and opposite.
7. We suppose the calculations to be made before experiments.
8. We suppose them to have designed an innovation technique of using solar energy in aviation.
9. Any engineer knows lifting force to induce drag.
10. We know the first airplane to have been provided with a tail unit.

2. Give your comments on the usage of the Complex Object Construction.

1. Any pilot knows elevators to control altitude of flight.
2. We believe ailerons to have been used since the beginning of the 20th century.
3. We know aluminum to have changed aircraft engineering.
4. We want composite materials to substitute conventional alloys in aircraft engineering.
5. The experts watched the aircraft take off the runway.
6. We think this aircraft to move with constant velocity.
7. We know the rudder to change the direction of flight.
8. Aircraft designers expect future passenger transport to be supersonic aircraft.
9. Specialists suppose nanotechnology to be widespread in aircraft engineering.
10. We believe this engine to meet all requirements on exhaust gas emissions.

3. Insert the suitable verb forms. Mind the Infinitives in brackets.

1. We know Morse (to be) a painter by profession.
2. Scientists (to expect) laser to solve the problem of controlled thermonuclear reaction.
3. M. Faraday..... (to suppose) a beam of light to reverse its polarization as it passed through a magnetized crystal.
4. Designers expect dirigibles (to use) for exploration of new territories.
5. Scientists believe new laser devices (to use)widely in aircraft manufacture.
6. We know the first digital optical disks (to produce) in 1982 as disks for music.

Speaking

- 1. Prepare a 7-minute presentation about different types of tail units to your group mates. Compare tail unit designs of fighters, cargo airplanes and passenger liners.**

Writing

- 1. Translate the text in a written form.**

Flying controls are designed to ensure high controllability and maneuverability.

Primary flying controls are manually operated by a system of cables and rods. They are aerodynamically and mass-balanced.

Ailerons provide good response and ensure excellent handling characteristics throughout the flight modes. Ailerons and elevators are fitted with trim tabs and a rudder has a spring tab.

The rudder pedals are adjustable for leg length. A spring strut is fitted to interconnect the rudder and the aileron system so that each control will respond to the movement of the other.

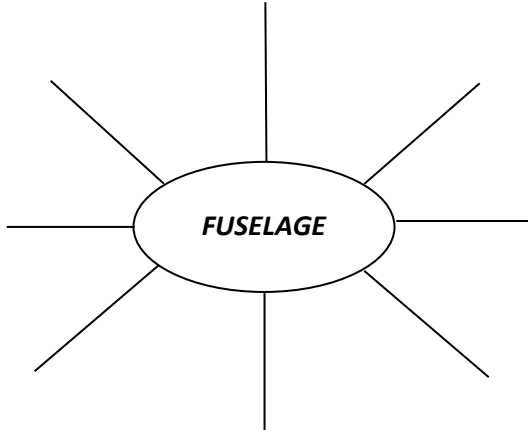
Double-slotted flaps are designed to move in an arc. They are actuated by the forward section of a double-acting jack, to 35° extension for landings. The intermediate selections are 10° take-off and 20° for approach.

Flaps are hydraulically operated, they provide low approach speed.

MODULE 7. FUSELAGE STRUCTURE

Lead in

1. Brainstorm all possible terms related to the topic.



2. Before you read the text, read the statements and agree or disagree with them and explain your viewpoint.

1. A fuselage is designed for housing passengers, equipment and cargo.
2. A fuselage structure is a monolithic structure made of aluminum alloy.
3. Composite materials are widely used in modern aircraft.

Reading

1. Practice reading the following words.

fuselage	['fju:zələ:ʒ]
payload	['peɪləʊd]
fuel	['fjuəl]

shear	[ʃiə]
torsion	[ˈtɔːʃən]
longitudinal	[ˌlɒndʒɪˈtjuːdɪnəl]
longeron	[ˈlɒndʒərən]
transverse	[trænzˈvɜːs]
monocoque	[ˈmɒnəkɒk]
stringer	[ˈstrɪŋə]
reinforce	[ˌriːmˈfɔːs]
bulkhead	[ˈbʌlkhed]
strength	[streŋθ]

2. Read the text and make a list of unfamiliar words. Compare them with your partner. In pairs try to guess the meaning of these words.

Fuselage Structure

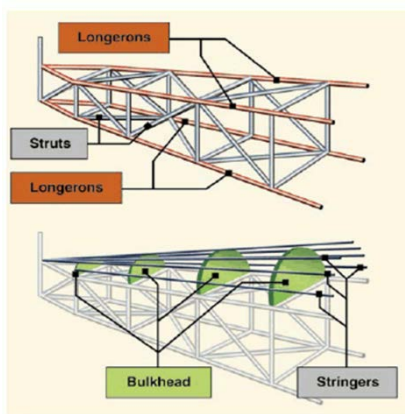
1. A fuselage is the main body of an aircraft. It usually serves the purposes of housing the crew, passengers and payload and of connecting a wing and a tail group. It may also carry fuel and support engines and a landing gear. Its structure is called upon to carry bending, shear and torsion loads due to all these functions.

2. The usual constructions of a fuselage consist of longitudinal members (longerons), transverse rings (frames/formers) and covering skin. The designer's problem is complicated by the presence of doors, windows, wheel wells, bomb bays, etc.

3. A fuselage construction may be broken down into two main classes:

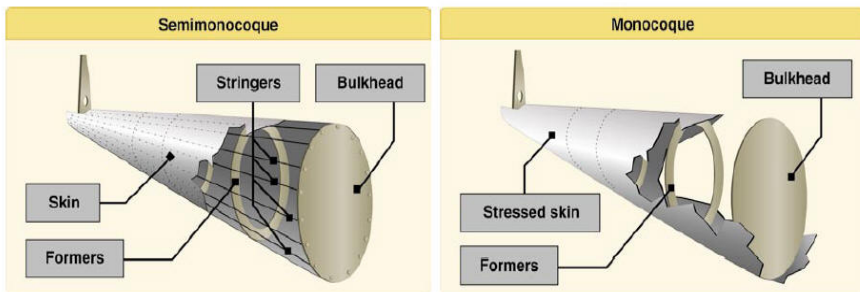
a truss type consisting of a welded tubular structure covered with a

skin and a girder type. The latter is divided into a monocoque type consisting of a strong outer skin from which a fuselage primarily derives

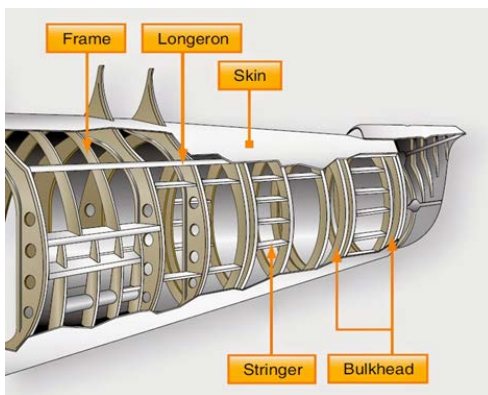


its strength, and a semi-monocoque type – a combination of a single shell structure with longerons and stringers to reinforce the skin.

4. A very common type of a fuselage is a monocoque type of construction, it is generally used for light aircraft. It is called so because it makes use of a single shell, which is sufficient to provide the necessary structural strength. A monocoque construction aims at concentrating structural materials towards the outer surfaces and the success of a stressed-skin fuselage depends upon the stiffness of the skin.



5. A semi-monocoque type is the most popular fuselage construction. It presents the same outside appearance but instead of relying entirely on the skin for strength incorporates longerons or stringers usually riveted to the skin and carrying the main portion of the load. Thus, it may be said that in a semi-monocoque fuselage longerons and skin mutually reinforce each other.



6. The main longitudinal members, longerons, provide the basis of the necessary strength to resist bending together with transverse frames, which are of a very light gauge metal. The whole structure is covered with a very light gauge skin riveted in position.

The longitudinal members in a semi-monocoque fuselage are held apart by bulkheads,

which give a fuselage its shape. Bulkheads are solid or semisolid frames placed where greater stresses are to occur or at any point in a fuselage, that requires special strength.

7. Skin is put on in long strips (or panels) riveted to each other and to stringers and bulkheads. Both monocoque and semi-monocoque type structures are referred to as stressed-skin construction.

8. A fuselage is generally built in three sections or assemblies: a nose, a center section and an aft section. When the assemblies are completed, they are joined to form an entire fuselage.

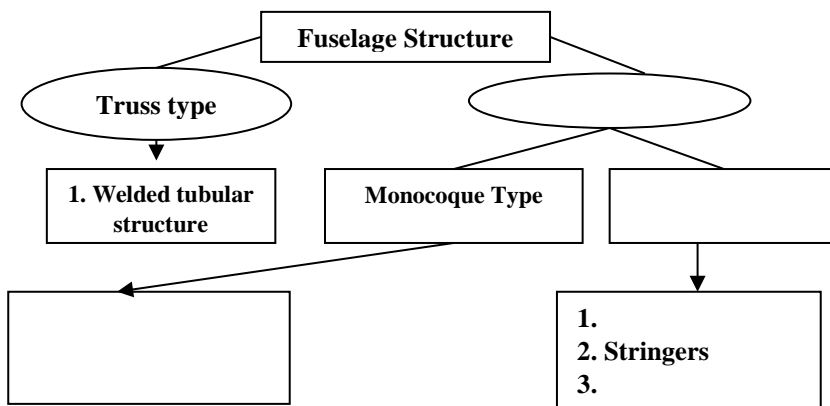
3. *Divide the text into logical parts. Think of a subtitle to each part.*

4. *Explain the difference between:*

- a) longerons and bulkheads
- b) monocoque and semi-monocoque fuselage

5. *Define the main idea of paragraph 6. Find supporting details that help to develop the main idea.*

6. *Fill in the diagram with missing information from the text.*



7. Look at the text again and answer the questions.

1. What can be housed inside a fuselage structure?
2. What loads act on a fuselage in flight?
3. What are the main members of a fuselage structure?
4. How is skin joined to stringers and formers?
5. What purposes are bulkheads used for?
6. What is the best material for an airplane fuselage?

8. Read the text and decide which word A, B, or C best fits each space. There is an example (0) at the beginning.

Longerons are (0)..... in a fuselage that are fitted (1)..... from nose to tail. They are often placed below the floor and take the main bending loads of an aircraft.

Frames are (2) structures that are open in their centre. They are designed to take the major loads and give an aircraft its shape.

Bulkheads are similar to frames but are usually (3) but may have access doors. They are also designed to give a fuselage its shape and take some of the main loads. Two of the major bulkheads in a transport aircraft are the front and rear bulkheads, which separate the pressurized and unpressurized areas.

There has to be means of separating a flight deck and a cabin from an engine. This is called a firewall. A firewall is required (4) the flight crew and passengers in the event of an engine fire. These are constructed using heat resistant stainless steel or titanium alloy. These materials have the ability (5) moderate temperatures for prolonged periods whilst also being able to withstand high temperatures for a short time. Titanium can be exposed to up to 3000°C for short periods.

Flight deck windows fitted to pressurized aircraft must withstand both the loads of pressurization and impact loads from birdstrikes. They are constructed from toughened glass panels (6) to each side of a clear vinyl interlayer. An electrically conducting coating, applied to the inside of the outer glass panel is used to heat the window. This prevents ice from forming and makes the window more resilient and able to withstand birdstrikes.

Aircraft doors may be side or top opening. When closed the (7) pressure holds the door shut and locking pins engage with the frame structure (8) that it cannot open in flight. They must be able to withstand the pressure (9) if an aircraft is pressurized. They must be easy to open in an (10) and usually have escape slides built into the construction of a door.

Some aircraft have freight doors in the side of a fuselage, these usually hinge upwards and open by means of an electric motor or hydraulic power pack.

0. A pins	B <u>beams</u>	C rivets
1. A longitudinally	B vertically	C transversely
2. A horizontal	B cranked	C vertical
3. A solid	B liquid	C soft
4. A to cover	B to save	C to protect
5. A to withstand	B to subject	C to maintain
6. A attached	B hinged	C covered
7. A ambient	B external	C internal
8. A to ensure	B to overcome	C to keep
9. A loads	B temperatures	C weights
10. A failure	B emergency	C brake

9. Match the synonyms. Watch out! There is an extra word in the column B.

A
cover
derive

B
pressure
strengthen

divide
reinforce
resist
bulkhead
bay
assembly
stress
house
unit

contain
split
frame
shield
withstand
obtain
compartment
basis

10. In the text, find the words with the meaning opposite to these words.

started	
flexible	
different	
broken	
insufficient	
weak	
simplify	
inner	

11. Give your own definitions for the words from the text.

1. crew _____
2. fuel _____
3. payload _____
4. wheel well _____
5. assembly _____
6. to rivet _____

7. aerodynamic load

12. Choose the best alternative to fill the gaps in these sentences.

1. The main _____ members, longerons, provide the basis of the fuselage strength.
a) transverse b) longitudinal c) solid
2. Both monocoque and semimonocoque fuselage structures are referred to as _____ construction.
a) monolithic b) welded c) stressed-skin
3. The designer's task is _____ by the presence doors, windows, wheel wells, etc.
a) complicated b) improved c) simplified
4. A _____ type fuselage consists of a welded tubular structure covered with skin.
a) monocoque b) girder c) truss
5. _____ are solid or semisolid members placed where greater stresses occur.
a) stringers b) bulkheads c) longerons
6. Longerons and stringers are _____ to the skin and they carry the main portion of the load.
a) welded b) bolted c) riveted

13. Translate the following word combinations into Russian:

- 1) flight data recorder
- 2) cockpit voice recorder
- 3) front pressure bulkhead
- 4) ice-protection measures
- 5) automatic system malfunction
- 6) emergency brake accumulator
- 7) audio warning system
- 8) extensive fatigue test programme
- 9) intensive multi-cycle airplane operation
- 10) fiber-reinforced rubber sheeting

<i>You should remember the following words and phrases!</i>	
to house	вмещать, содержать
payload	полезная нагрузка
bending	изгиб
shear	сдвиг, срез
torsion	кручение
longitudinal	продольный
transverse	поперечный
frame/former	рама
wheel well	ниша шасси
truss type	ферменный тип
girder type	балочный тип
monocoque fuselage	монококовый фюзеляж
semi-monocoque fuselage	полумонококовый фюзеляж
strength	прочность
stringer	стрингер
to reinforce	усиливать, подкреплять
skin	обшивка
stressed skin	работающая обшивка
bulkhead	шпангоут
to rivet	скреплять заклёпками
assembly	компоновка, сборка, блок

Grammar

Complex subject consists of a noun in common case or a pronoun in common case with the Infinitive (always with a particle **to**). **Complex subject** is translated into Russian starting with the predicate. Sometimes the conjunction **что** is required.

The following verbs can be used as a predicate:

<i>Passive Voice</i>	<i>Active Voice</i>	
considered known expected assumed to be + found believed supposed reported thought	prove seem happen appear turn out	likely unlikely to be + sure certain

These elements are known **to have been found** twenty years ago. – Известно, что эти элементы были открыты двадцать лет назад.

This substance seems **to possess** useful properties. – Кажется, это вещество обладает полезными свойствами.

Such engines are certain **to be** well suited for civil aircraft. – Несомненно, что такие двигатели хорошо подходят для гражданских самолетов.

1. Translate the sentences paying attention to Complex Subject.

1. Today's aircraft is expected to be replaced by a new model of hypersonic aircraft by the 2025.

2. Intensive research on optical-electronic computer is said to be going on in a number of companies.

3. A method for recording information on crystal by means of laser is known to have been developed by a Russian researcher.
4. Laser is known to be a device producing an intensive beam of light by amplifying radiation.
5. Inertia is stated to be the property of any object to resist changes in motion.
6. The gravitational forces are believed to hold the spacecraft on their orbits.
7. The designer proved to have tasted the new composite material for strength.
8. The unit turns out to function properly.
9. The aircraft happens to demonstrate high stability in supersonic flight.
10. The law is certain to explain severe vortices on the wing trailing edges.
11. S. P. Korolev is sure to be highly appreciated all over the world.
12. Sukhoi military aircraft are likely the most maneuverable fighters in the world.

2. Give your interpretation of the following sentences.

1. Our present-day life seems to be quite impossible without aircraft, spacecraft services
2. Nowadays, the principle of flight seems to be quite simple.
3. About 50 per cent of Lake Baikal water prove to have been polluted since the Baikal plant has begun its work.
4. Lasers appeared to be highly useful for solving the problem of controlled thermonuclear reaction and communication.
5. A system of Earth satellites appears to have solved the problem of transmitting the central TV programme to any part of the world.
6. Dirigibles are likely to be used for taking tourists to distant and beautiful places.
7. Private aircraft are likely to be used in our everyday life soon.
8. Nanomaterials are certain to bring about a new technological revolution in aircraft engineering.

3. Translate from Russian into English. Use Complex Subject at every sentence.

1. Известно, что воздух имеет вес и давит на тела, находящиеся в воздухе.
2. Оказалось, что летательный аппарат, спроектированный Да Винчи, не может взлететь.
3. Считается, что первый управляемый в воздухе самолёт был спроектирован Можайским.
4. Вероятно, что ракеты появились в Европе и Китае в одно и то же время.
5. Маловероятно, что люди поселятся на Марсе в ближайшие десять лет.

Speaking

1. *Work in a group. Imagine that your team is to design a new business airplane for 10 passengers. What type of fuselage suits this purpose best of all? Give your reasons. Compare different types of fuselage structure and give pros and cons of using your choice.*

Writing

1. *Translate the text in a written form.*

A semi-monocoque fuselage comprises a pressurized cabin and a flight deck with unpressurised nose and tail sections. Stringers, longerons and frames are made of aluminum alloy. Front and rear pressure bulkheads comprise flat webs reinforced with horizontal stiffeners providing a high degree of damage tolerance.

A passenger entry door has its own integral steps and is locked by six fail-safe bolts. Failure to lock by any of the bolts is signalled on the flight deck and the position of the bolts can be checked visually. Two overwing emergency exits are incorporated, one on each side of the cabin. Each exit is fitted with a quick release mechanism and can be opened from either inside or outside.

The nose equipment bay forward of the front pressure bulkhead houses avionics equipment, batteries and inverters and is accessed through two large hinged doors. A nose cone, housing a weather radar antenna, is removable and made of glass-reinforced plastic.

The rear equipment bay, aft of the rear pressure bulkhead, is accessed from the fuselage underside. This area accommodates a fixed oxygen system reservoir, a cockpit voice recorder, a flight data recorder, a water tank and an emergency locator transmitter.

MODULE 8. LANDING GEAR

Lead in

1. Give a definition to the term “landing gear”. Try to predict what performances the landing gear must have.

2. Match the keywords with their translations.

- | | |
|------------------|---------------------|
| 1. undercarriage | a. каркас |
| 2. take-off | b. шина |
| 3. landing | c. хвостовая опора |
| 4. oleo unit | d. масляный агрегат |
| 5. tyre | e. посадка |
| 6. nose over | f. шасси |
| 7. skid | g. капотировать |
| 8. framework | h. взлёт |

Reading

1. Practice reading the following words.

landing gear	[ˈlændɪŋ, ɡɪə]
undercarriage	[ˈʌndə, kærɪdʒ]
absorption	[əbˈzɔ:pʃn]
pneumatic	[nju:ˈmæɪtɪk]
tyre	[ˈtaɪə]
swivel	[ˈswɪvəl]
tricycle	[ˈtraɪsɪkl]
eliminate	[ɪˈlɪmɪneɪt]
hydraulic	[haɪˈdrɔ:lɪk]
nacelle	[nəˈsel]
plunger	[ˈplʌndʒə]
withstand	[wɪðˈstænd]
rough	[rʌf]

2. Read the text and write a brief heading for each paragraph.

Landing Gear

1. A landing gear (or undercarriage) is intended to support an airplane in proper location for take-off and landing and to provide shock absorption.



Shock is usually absorbed by a sort of pneumatic tyres and shock absorbing struts.

A landing gear usually consists of wheels carried either from a fuselage or from wings by a framework of hollow tubes called struts. In addition to these

main wheels, support is needed at the rear of a machine. This is a tail wheel (or skid) carried on a swiveling mounting.

2. Two different arrangements of landing wheels are in use today. They are conventional tricycle gears and a landing gear with a skid.

3. The first, the tricycle type, has the main wheels mounted slightly aft of the centre of gravity and the third wheel (the nose wheel) in front. The second type comprises two main wheels located slightly forward of the airplane's centre of gravity and a tail skid at the rear.

4. A tricycle landing gear of an aircraft consists of one nose leg and two main legs. A nose leg is mounted under the nose section of the fuselage. Main legs are installed under the wing or the fuselage symmetrically with respect to its centre line. A tricycle gear has many advantages. It simplifies landing, eliminates the danger of



Tricycle landing gear

nosing over and carries an airplane in normal take-off position. It permits an airplane to land and come to rest within a shorter distance.

5. Consequently, it is the rule today to employ retractable landing gear, which can be drawn up (or retracted) in flight into the wing or fuselage structure. Most high-speed airplanes have retractable landing gears. A retracting mechanism may be either mechanical, powered by electric motors, or hydraulic. Various linkages are employed to perform the retraction of wheels and struts into the fuselage, wing or nacelles.

6. After take-off, the nose leg is retracted into the well provided in the fuselage and the main legs are retracted into the well of special nacelles.



Landing gear with a skid

Landing gear legs have oleo-pneumatic shock absorbers. A shock strut is the major assembly of wheels. It consists of a shock absorber and other elements. A shock absorber comprises an outer steel tube with a welded top head, which attaches a plunger.

7. Landing wheels are fitted with large diameter low-pressure tyres, which allow an airplane to taxi over rough ground and assist in absorbing the shock of landing. The landing gear is designed to withstand the loads imposed by rough landings and fast taxing. It must also carry the breaking loads in a fully braked landing.

8. The design of a tail wheel is similar to that of main legs and usually consists of a single oleo unit. A tail wheel may be of a conductor type. When it is resting on the ground, it provides an electrical Earth contact and so prevents an aircraft and crew from damage through static electrical charges.

3. Complete the table according to the content of the text.

UNIT	FUNCTION
Landing gear	
Pneumatic tyre	
Shock-absorbing struts	
Tail skid	
Wheel well	

4. Define the main idea of paragraphs 4 and 8.

5. Complete the sentences below with the suitable words from the box.

main legs	oleo unit	support	provide
skid	nacelles	nose leg	

- The landing gear is designed to _____ an airplane on the ground and to _____ shock absorption.
- Tricycle landing gear consists of one _____ and two _____.
- After take-off main legs are retracted into special _____.
- A tail wheel consists of a single _____.
- The rear part of some airplanes is supported by a _____.

6. Ask questions to which the following sentences are answers.
Remember to use “wh-” words: why, what, where, when.

- tricycle landing gears and a landing gear with a skid.

- it simplifies landing and prevents nosing over.
- after take-off.
- into the well of special nacelles.
- large diameter low-pressure tyres.
- to protect an aircraft and crew from damage through static electrical charge.
- by a framework of hollow tubes called struts.

7. Give your own definitions for the words from the text.

tail skid	_____
tyre	_____
aircraft centre line	_____
landing gear well	_____
framework	_____
retractable landing gear	_____

8. Match the word in column A with the word in column B having a similar meaning. Be careful! There are some extra words in column B.

A	B
fit	linkage
strut	skid
rear	design
landing gear	maintain
intend	equip
support	back
tail wheel	leg
conventional	usual
	undercarriage
	provide

9. a) Check if you know the meaning of the following words.

To intend, to carry, to mount, to install, to employ, to perform, to attach, to withstand, to impose, to prevent.

b) Make up your own word combinations using these verbs.

10. Complete the missing part of the table.

Verb	Noun	Adjective (Participle)
		simple
absorb		
		arranged
	retraction	
mount		
	addition	
		conductive

11. Read the text and decide which word A, B, or C best fits each space. There is an example (0) at the beginning.

In common with most braking systems, aircraft wheel brakes (0) by using friction between a fixed surface and a moving one to bring an aircraft to rest, converting kinetic energy into heat energy. The amount of heat generated in stopping a large modern aircraft, is enormous, the problem of (1) this heat has been a challenge to aircraft (2) and scientists for years. As progress has been made in this direction, so aircraft have got faster and heavier and the problem worse.

The advent of reverse pitch on propeller driven aircraft and reverse (3) on jet engined aircraft, has provided a partial answer to the problem, but even with these, the need for normal braking still exists.

All modern aircraft now use plate brakes operated by hydraulic systems as their means of (4) or stopping. This system uses a series of fixed friction pads, one or more rotating plates, similar in principle to disc brakes on a car.

The number of friction pads and rotating plates that are used is a matter of design and wheel size, a light aircraft would be able to utilize a single plate disc brake whereas a typical (5) on a large aircraft would be a multi-plate unit.

The friction pads are made of an inorganic friction material and the plates of 'heavy' steel with a especially case hardened surface. It is this surface, which causes the plates to explode if covered with liquid fire extinguishant when they are red hot.

Carbon is also used for manufacturing brake units because it has much better heat absorbing and dissipating properties. Carbon brakes are also much (6) than equivalent steel units. The (7) is their increased cost and shorter life, so they tend to be fitted only to aircraft where the weight saving is worth the extra cost, long haul aircraft, for example.

An anti-skid system reduces the braking distance on both take-off and landing. An inoperative anti-skid system will increase the take-off and landing distances required.

0. A. <u>function</u>	B. support	C. provide
1. A. accumulating	B. utilizing	C. dissipating
2. A. passengers	B. pilots	C. designers
3. A. lift	B. thrust	C. drag
4. A. slowing down	B. accelerating	C. destroying
5. A. arrangement	B. organization	C. attachment
6. A. softer	B. heavier	C. lighter
7. A. disadvantage	B. advantage	C. harm

<i>You should remember the following words and phrases!</i>	
landing gear	шасси
pneumatic tyre	пневматическая шина
shock absorbing strut	амортизирующая стойка
framework	каркас, рама
skid	хвостовая опора
tricycle gear	трехопорное шасси
to eliminate	устранять
nosing over	капотирование
retractable	втягивающийся
nacelle	гондола
well	ниша, отсек
shock absorber	амортизатор
to withstand	выдержать
taxing	руление

Grammar

Participle is a non-finite verb form denoting action process. It combines properties of a verb, an adjective and an adverb.

Meaning	Forms	
Participle	Active voice	Passive voice
Participle I (Simple) expresses an action that is simultaneous with the predicate's action	Ving using	being Ved being used
Participle I (Perfect) expresses the action preceding the predicate's action	having Ved having used	having been Ved having been used
Participle II expresses the completed action with respect to the predicate's action	-----	Ved used

Participle I functions

Participle I Simple	Participle I Perfect
<p>Определение: левое – a moving object – движущийся предмет; правое – air targets flying – воздушные цели, летающие</p>	<p>В функции определения не употребляется. В этом случае переводится придаточным предложением.</p>

<p>Обстоятельство Переводится на русский язык деепричастием: Testing the engine we used new methods. – Испытывая двигатель, мы применили новые методы. Перед причастием в функции обстоятельства часто ставятся союзы when, while. В этом случае причастие переводится на русский язык:</p> <ol style="list-style-type: none"> 1) при + существительное 2) деепричастием 3) придаточным предложением <p>When testing the engine we used new methods.</p> <ol style="list-style-type: none"> 1. При испытании двигателя мы применили новые методы. 2) Испытывая двигатель, мы применили новые методы. 3) Когда мы испытывали двигатель, мы применили новые методы. 	<p>Обстоятельство Переводится на русский язык деепричастием: Having published his book about space exploration in 1895 Tsiolkovsky became known all over the world. – Опубликовав в 1895 году книгу об исследовании космоса, Циолковский стал известен всему миру</p>
<p>Когда мы испытывали двигатель, мы применили новые методы.</p> <p>Часть сказуемого в одном из продолженных времен (Continuous); признак данной функции – наличие формы to be перед причастием: The aircraft was flying at a supersonic speed. – Самолет летел на сверхзвуковой скорости.</p>	

Participle II functions

<p>Левое определение</p>	<p>an improved engine- усовершенствованный двигатель</p>
<p>Правое определение</p>	<p>The engine improved <u>by the designer</u> had excellent characteristics – Двигатель, усовершенствованный конструктором, имел превосходные характеристики.</p> <p>The engine improved had excellent characteristics. – Усовершенствованный двигатель имел отличные характеристики.</p>
<p>Обстоятельство</p>	<p>Часто в этой функции с причастием употребляются союзы when, while – когда; if - если; though, although - хотя. В этом случае причастие переводится на русский язык:</p> <ol style="list-style-type: none"> 1) при + существительное 2) деепричастием 3) придаточным предложением <p>When tested the instrument showed good results.</p> <ol style="list-style-type: none"> 1) При испытании прибор показал хорошие результаты. 2) Будучи испытанным, прибор показал хорошие результаты. 3) Когда прибор испытывали, он показал хорошие результаты.

Часть сказуемого	Perfect Tenses – has written – написал Passive Voice – was done – был сделан
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1. Translate the following sentences paying attention to the functions of Participles.

1. We need highly developed electronics and new materials to make supercomputers.
2. New alloys have appeared during the last decades, among them a magnesium-lithium alloy developed by our scientists.
3. We are carried by airplanes, trains and cars with built-in electronic devices.
4. New technologies reduce the number of workers needed.
5. Driving a car a man tries to keep steady speed and watch the car in front of him.
6. Having stated the laws of gravity Newton was able to explain the structure of the Universe.
7. Being more efficient than human beings computers are used more and more extensively.
8. Having been published in 1687 Newton's laws of motion are still the basis for research.
9. Being invented the digital technology solved the old problems of noise in signal transmission.
10. Having published his book about space exploration in 1895 Tsiolkovsky became known all over the world.

2. Translate the sentences into Russian.

1. The first engines appeared in the 17-th century and people began using them to operate factories, irrigate land, supply water to towns, etc.
2. The steam engine having been invented in 1825, a self-propelled vehicle was built.
3. After the German engineer N. Otto had invented the gasoline engine, the application of this engine in motor cars began in many countries.
4. We were demonstrated an operating engine.

5. Brakes having become more efficient, cars achieved greater reliability.
6. Having finished the experiments scientists started a series of new tests.
7. When frozen, water is a colourless solid known as ice.
8. The steering system used has been tested by the research engineers.
9. Metals being used in industry in the form of alloys have better properties than pure metals.
10. The results obtained were carefully studied.

3. Translate the sentences into English.

1. Читая книгу, он обычно делает заметки.
2. После того как он проанализировал результаты многих экспериментов, он сделал доклад на конференции.
3. Отвечая на вопросы, он сделал несколько ошибок.
4. Ответив на вопросы коллег, докладчик продолжил презентацию.
5. Являясь хорошим проводником электричества, медь широко используется в промышленности.

Speaking

- 1. You are a guide of the museum of aviation. Tell a group of the first-year students about different types of landing gears. The presentation is welcomed to support your excursion.***

Writing

- 1. Translate the text in a written form.***

This airplane has a hydraulically operated retractable tricycle landing gear with nosewheel steering. The port and starboard main gear assemblies each consists of a single wheel with an oleo-pneumatic shock absorber and a stub axle carrying a single wheel and tyre. Each leg is

attached to the wing spars and retracts inwards into a landing gear bay in the wing. A door is hinged to the wing outboard of each leg and covers the outer portion of the gear bay when the gear is retracted.

The nose gear leg consists of an oleo-pneumatic shock absorber attached to the forward pressure bulkhead, with two wheels mounted on a live axle. Mechanical linkage ensures that the nosewheel bay doors are in closed position except during gear travel.

The brakes on each main wheel consist of sintered iron plates operated hydraulically by a multi-piston assembly. Anti-skid units and automatic wear adjusters are fitted to ensure maximum braking efficiency under all conditions.

Extension of the landing gear in the event of hydraulic failure is achieved by using an emergency system operated by a hand pump from the flight deck.

MODULE 9. AIRCRAFT DESIGNING

Lead in

1. Give a definition of the term “aircraft designing”. Compare your definition with your partner.

2. Tick the words, which come to your mind when you think of aircraft designing. Explain reasons.

- 1) reliability
- 2) safety
- 3) assembly
- 4) test
- 5) professional skills
- 6) strength
- 7) freezing point
- 8) aerodynamics

3. Before reading the text answer the following questions.

1. What professional skills must an aircraft designer have?
2. What are the aspects of aircraft designing?

Reading

1. Practice reading the following words.

certain	['sɜ:tən]
consumption	[kən'sʌmpʃən]
freight	[fret]
efficiency	[ɪ'fɪ:ʃənsɪ]

sample	['sɑ:mpl]
collapse	[kə'læps]
fatigue	[fə'ti:g]
airworthiness	['eə,wɜ:ðnəs]
elaborate	[ɪ'læbərɪt]

2. Read the text to see whether your predictions were correct.

3. Read the text and match the English words with their Russian counterparts.

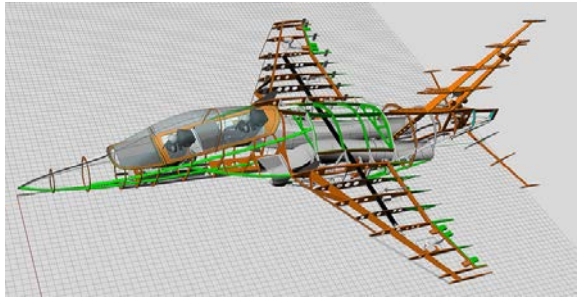
- | | |
|---------------------|--------------------------|
| 1) freight | a) усталостная прочность |
| 2) load | b) эффективность, КПД |
| 3) efficiency | c) испытание |
| 4) airworthiness | d) испытательная станция |
| 5) test | e) нагрузка |
| 6) sample | f) груз |
| 7) fatigue strength | g) образец |
| 8) test house | h) пригодность к полёту |

4. Scan the text and highlight the adjectives describing airplane designing. If you don't know their meaning you should consult a dictionary.

Aircraft Designing

1. There are two main things that make aircraft engineering difficult: the need to make every component as reliable as possible and the need to build everything as light as possible.

2. Given a certain power of engine and a certain fuel consumption, there is practical limit to the total weight of aircraft that can be made to fly. Out of



that, weight as much as possible is wanted for fuel, radio navigational instruments and, of course, for passengers or freight themselves. So, the structure of an aircraft has to be as small and light as safety and efficiency will allow. A designer must calculate the normal load that each part will bear. This specialist is called the “stress man”.

3. Stress man’s calculations go to a designer of the part, and he must make it as strong as the stress man says. One or two samples are always tested to prove that they are as strong as the designer intended. Each separate part is tested, then a whole assembly – for example, a whole wing, and finally the whole aircraft. When a new type of aircraft is being made normally only one of the first three made will be flown. Two will be destroyed on the ground in structural tests. The third one will be tested in the air.

4. Two kinds of ground tests are carried out. The first is to find the resistance to loading of the wings, tail, etc. until they reach their maximum load and collapse. The other test is for fatigue strength. Small loads are applied thousands of times. Each may be well as a single load, but many repetitions can result in collapse. When a plane has passed all the tests, it can get a government certificate of airworthiness without which it cannot fly.

5. Making working parts reliable is as difficult as making the structure strong enough. Flight controls, electrical equipment , etc. must not only be light in weight, but must work both at high altitudes where the temperature may be below freezing point and in the hot air in the tropics.

6. To solve all these problems the aircraft industry has a large number of research workers, with elaborate laboratories and test houses. Moreover, new materials to give the best strength in relation to weight are constantly being tested.

5. Choose the answer, which is the most corresponding with the text information:

1. The two main requirements of aircraft design are:
 - speed and passenger comfort
 - making things both light and reliable.
2. The maximum possible weight of an aircraft is determined by
 - the engine power
 - the number of passengers
3. The stress man's job is to calculate
 - how safe the plane is
 - how strong each part must be
4. The first three aircraft of a new type
 - do not fly
 - are used for testing purposes
5. All equipment in an aircraft must
 - work especially well at high temperature
 - work perfectly within a wide range of temperature
6. Certificates of airworthiness are given by
 - the aircraft industry
 - the government

7. Research workers

- are employed in large numbers by the aircraft industry
- do not need elaborate laboratories

8. New materials are

- too expensive to use in the aircraft industry
- put to a variety of tests

6. Insert the proper words from the box:

airworthiness	ground	tests	small
materials			
	samples	strong	light

1. One or two are always tested to prove that they are as as the designer intended.
2. Two kinds of strength tests are carried out.
3. The structure of an aircraft has to be as and as safety and efficiency will allow.
4. When a plane has passed all the it can get a government certificate of without which it cannot fly.
5. New to give the best strength in relation to weight are constantly being tested.

7. Divide the text into logical parts. Think of the subtitle to each part. Highlight the key words of each part.

8. Answer the questions:

1. What are the things making aircraft engineering difficult?
2. What is a practical limit to the total weight of aircraft?
3. Where and why do the stress man's calculations go?
4. Why are the samples tested?
5. How many aircraft of new type are destroyed in structural tests?

6. What types of ground strength tests are carried out?
7. Can an aircraft fly without government certificate of airworthiness?
8. What are the requirements for flight controls, electrical equipment, etc?
9. What must the working parts of the aircraft be?
10. What reason are the new materials being tested for?

9. Match the synonyms and make up word combinations using words from column B.

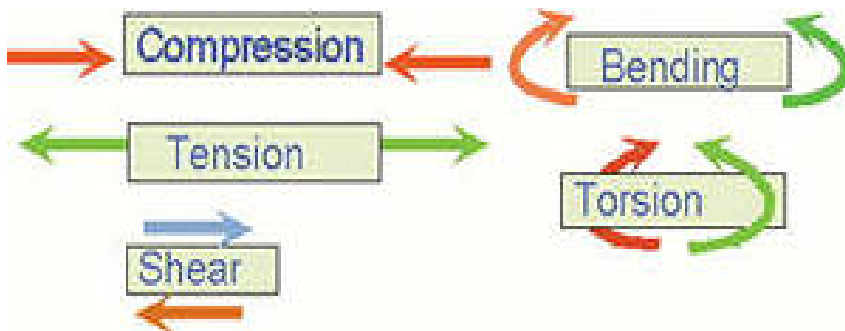
A	B
reliable	unit
aircraft	safe
difficult	destruction
engine	plane
consumption	cargo
freight	armature
sample	hard
assembly	use
resistance	power plant
collapse	opposition
equipment	pattern

10. Fill in the gaps with the suitable derivative of the word given in brackets.

1. The practical limit of the aircraft weight are a certain power of engine and a certain fuel ____ (consume).

2. The structure of an aircraft must be as small and light as ____ (safe) and efficiency will allow.
3. The stress man's ____ (calculate) go to the designer of the part.
4. In one of the ground tests the wings, tail and other units reach maximum load to find out the ____ (resist) to loading.
5. In the test for fatigue strength small loads are applied for thousands of times and many ____ (repeat) can result in collapse.

11. The stresses an airplane has to withstand in flight can be classified into five types. Match the pictures with the definitions.



- a) this type of stress is a result of two opposite longitudinal forces
- b) this type of stress is a result of two opposite twisting forces
- c) this type of stress is the opposite compression
- d) this force makes one surface of a substance move over another parallel surface
- e) movement that causes the formation of a curve

12. Look at these four pictures of aircraft and discuss the different materials you think you would find in them and why.



a



b



c



d

13. Read the text and decide which word A, B, or C best fits each space. There is an example (0) at the beginning.

As well as designing the structure, shape and size of a product, an aircraft designer must also specify the materials that it will be made of. The choice of (0) materials (1) on three main factors. These are suitability, availability and cost.

Modern aircraft are constructed mainly of aluminium and its alloys with smaller amounts of steel and titanium for the major structural components with composite materials used (2) for more lightly loaded structures.

Composite materials are made of at least two elements to produce a material with (3) that are different to those of the original elements. Nearly all composites consist of a bulk material, this is called the matrix and some form of reinforcement. This reinforcement is used mainly (4) the strength and stiffness of the matrix and is usually in a fiber form.

When the matrix is combined with reinforcing fibers such as glass, carbon and Kevlar exceptional properties can be obtained. The matrix will spread the load to the composite between each of the individual fibers and also (5) the fibers from damage.

These composites have good (6) to corrosion but their fatigue behavior is different to that of conventional metal alloys. Metal structures suffering fatigue retain their design strength up to a critical point after which failure occurs rapidly whereas composites lose their properties gradually.

Interest in composites for structural use continues to grow due to their high specific strength, specific stiffness and their ability to retain those properties at elevated temperatures. There are cost factors involved in the use of composites in aircraft. The manufacturing costs are high due to it being a labor intensive and often (7) process. These factors are outweighed by the reduced operating costs. Aircraft such as the Boeing Dreamliner are approximately 20% lighter and this gives a large (8) in fuel consumption.

0. A. <u>suitable</u>	B. conventional	C. strong
1. A. depends	B. provides	C. suits
2. A. restrictedly	B. readily	C. extensively
3. A. properties	B. quantities	C. performances
4. A. to stabilize	B. to reduce	C. to increase
5. A. protects	B. stops	C. covers
6. A. improvement	B. resistivity	C. resistance
7. A. hard	B. complex	C. simple
8. A. reduction	B. increase	C. improvement

<i>You should remember the following words and phrases!</i>	
power	мощность
freight	груз
stress man	инженер- прочнист
sample	образец, экземпляр
assembly	сборка, агрегат
structural test	испытание конструкции
fatigue strength	усталостная прочность
resistance	сопротивление
to destroy	разрушать
to result in	приводить к
airworthiness	годность к полетам
freezing point	точка замерзания
suitability	пригодность
availability	наличие
stiffness	жѐсткость
failure	повреждение, отказ

Grammar

Gerund is a non-finite verb form denoting action process. It combines properties of a verb and a noun.

	Active	Passive
Simple Gerund		
non-perfect verb form expressing an action that is simultaneous with the predicate's action or future action in relation to the predicate	Ving taking	being V₃ being taken

Perfect Gerund		
expresses the action preceding the predicate's action	<p>having V₃</p> <p>having taken</p>	<p>having been V₃</p> <p>having been taken</p>

Герундий может переводиться на русский язык существительным, инфинитивом, деепричастием и придаточным предложением.

I like his method of **teaching**. – Мне нравится его метод преподавания.

It's no use **talking** to him. – С ним бесполезно разговаривать.

He left without **saying** a word. – Он ушел, не сказав ни слова.

He was suspected of **keeping** something from us. – Его подозревали в том, что он что-то от нас скрывает.

Functions	Examples
<i>Subject</i>	<p>Measuring drag is necessary in many experiments. – Измерение лобового сопротивления необходимо при проведении многих экспериментов.</p>
<i>Part of predicate</i>	<p>His hobby is collecting aircraft mock-ups. – Его любимое занятие коллекционировать макеты самолётов.</p> <p>She stopped reading. – Она закончила читать.</p>

<i>Object</i>	He had to stop experimenting . – Он вынужден был прекратить экспериментирование . He succeeded in obtaining reliable results. – Ему удалось получить надежные результаты.
<i>Attribute</i>	There are several ways of producing electricity in space . – Имеется несколько способов производства электричества в космосе .
<i>Adverbial modifier</i> (always with a preposition)	After testing the engine they put down the results. – После испытания двигателя они записали результаты.

The Gerundial Construction

The Gerundial Construction consists of a noun (in common case or in possessive case) or a possessive pronoun, or a personal pronoun in objective case + Gerund. The Gerundial construction is often introduced using words *что, то, что, того, чтобы, чтобы*.

His taking part in the development of the new cooling system was of great help to us. – **То, что он принимал участие в разработке новой системы охлаждения**, было для нас большой помощью.

Kurchatov's having devoted all his life to nuclear physics is known to everybody. – **То, что Курчатов посвятил всю свою жизнь ядерной физике**, известно всем.

1. Translate the following sentences paying attention to the function of the Gerund.

1. On detecting danger on opposite course, the computer signals the pilot.

2. Detecting an object in front of a car in the dark is the purpose of the “night vision system”.
3. One of the main problems of a driver on the road is keeping the speed constant and watching the cars ahead.
4. A new device for monitoring and adjusting air pressure in landing gear tires has recently been developed.
5. Before starting an engine, one must examine it carefully.
6. Upon being heated the molecules begin moving very rapidly.
7. On graduating from the Moscow Higher Technical School S.P.Korolev began working in the field of rocket design.
8. Numerous methods have been developed for producing high-strength composite materials.
9. It is difficult to solve some of the present-day scientific and technological problems without using supercomputers.
10. There are some ways of obtaining aerodynamically “clean” wing.

2. Translate the following sentences paying attention to the prepositions before the Gerund. They are translated: in - *нпу*; on, upon - *но, после, нпу*; by – *нупем, носредством*; without - *без*.

1. In building new aircraft, engineers have to solve many different problems.
2. On examining the aircraft before flying, a pilot is to be sure that he will get to his destination without accidents.
3. By summing up the information about the speed and distance of various objects on the road, the computer detects all possible danger.

4. A superliner of a new kind will be capable of flying at five times above the speed of the sound.
5. The only way of overcoming the great air resistance at high velocities is flying higher.
6. At low speeds, the engine can use turbines for compressing the air before mixing it with fuel in the combustion chamber.
7. In flowing over the aircraft's surface, the fuel cools its skin.
8. On reaching its cruising speed the supersonic liner will fly at 100,000 feet above the Earth.
9. By using supercomputers, it is possible to avoid making mistakes in extremely complicated thermodynamic computations.
10. By using Global Positioning System, a pilot is able to make long flights on predetermined route without concentrating on weather conditions.

3. Translate the sentences with the Gerundial Construction.

1. Your working at the student design bureau helps you to know technical subjects better.
2. We know of Newton's having developed principles of mechanics.
3. That wind tunnel tests are the most important for improving aerodynamic qualities of any new aircraft is a well-known fact.
4. His being an experienced engineer was very important for our new project.
5. We insisted on its stabilizer being redesigned.

Speaking

1. *Imagine you are a supervisor of a trainee group. Tell them about aircraft designers and steps of aircraft designing. Presentation will make your description more interesting and easily understood.*

Writing

1. *Translate in a written form.*

There are many methods of joining materials but the common methods are:

- riveting • welding • bolting • bonding.

Riveting. This has been the most common way of joining materials and involves placing a rivet in a pre-drilled hole. The tail of the rivet is deformed and this clamps the material together. Rivets may be set by hand or by a power operated machine. All rivets are meant to be used in shear and have little strength in tension.

Welding. This is a process where the two metals are fused to become one. Fusion welding is where a gas flame is used to heat the metal and a filling material is used to fill the gaps. There are many other types of welding including forge, electric arc and spot welding, all of which have particular applications.

Bolting. This is employed where high shear or tensile loads are experienced. Most applications use steel bolts. These must be locked to make sure that they do not loosen in service. This may involve the use of locking wire, split pins or special nuts.

Adhesive Bonding. Adhesive bonding is one of the common methods used. A sheet of adhesive is placed between the two materials, heat is then applied to cure the adhesive which produces a strong bond. One advantage of this method is that compared to say riveted joints, it is easier to seal structures making it particularly useful for fuel tanks.

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