МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РФ

ГОСУДАРСТВЕННОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ
ВЫСШЕГО ПРОФЕССИОНАЛЬНОГО ОБРАЗОВАНИЯ
«САМАРСКИЙ ГОСУДАРСТВЕННЫЙ АЭРОКОСМИЧЕСКИЙ
УНИВЕРСИТЕТ имени академика С.П. КОРОЛЁВА
(НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ)»

О.Б. Салманова

РАЗВИТИЕ ПРОФЕССИОНАЛЬНЫХ КАЧЕСТВ СТУДЕНТОВ ТЕХНИЧЕСКИХ ВУЗОВ

(АНГЛИЙСКИЙ ЯЗЫК)

Утверждено Редакционно-издательским советом университета в качестве учебного пособия

САМАРА
Издательство СГАУ
2010

УДК 42
ББК СГАУ: 81.2
С164

Рецензенты: канд. филол. наук, проф. СГАКИ В. И. Трошкина,
ст. препод. каф. СГАУ М. В. Ивкина

Салманова О.Б.

С164 **Развитие профессиональных качеств студентов технических вузов:** учеб. пособие по англ. языку / сост. *О.Б. Салманова.* – Самара: Изд-во Самар. гос. аэрокосм. ун-та, 2010. – 88 с.: ил.

ISBN 978-5-7883-0811-1

Составлено в соответствии с требованиями программы по английскому языку, а также в рамках программы «English for Specific Purposes». Содержит тексты для чтения, пересказа, реферирования и аннотирования, лексико-грамматические упражнения, тестовые задания. Использована оригинальная литература по авиации и космонавтике.

Учебное пособие разработано на кафедре иностранных языков и предназначено для студентов 1 курса факультета самолетостроения.

УДК 42
ББК СГАУ:81.2

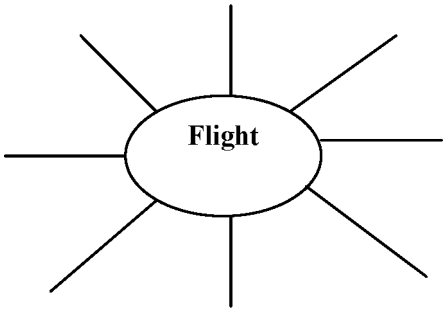
ISBN 978-5-7883-0811-1

UNIT 1

FROM THE HISTORY OF FLYING

Pre-reading

1. a) Brainstorm the words which come to your mind when you think of flight.



b) Choose those ones that may be related to the human flight and explain why you have chosen them.

2. Before you read the text try to answer the following questions. Shear your answers.

1) Why can airplanes fly? Is there any difference between flight of birds and airplanes?

2) What are the main forces acting on the aircraft in flight?

3) What types of the aircraft do you know?

3. Scan the text and try to guess the meaning of underlined words from the content of the text.

Reading

1. Read the text and highlight the key ideas of each paragraph.

FROM THE HISTORY OF FLYING

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

B. 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 so 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.

C. 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.

D. 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.

E. 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.

F. And this first in the history of civilization plane was the one designed by Alexander Mozhaisky. It went up in the summer of 1832.

J. 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.

H. 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.

I. 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 reequipment. New supersonic jet planes have replaced the piston-engined aircraft. 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 passengers aircraft will be doing regular service on space lines.

Comprehension Check

1. The text has 9 paragraphs. Which paragraph mentions the first controlled flying machine?

2. Which of the following sentences summarize the main idea of the paragraph *D*?

a) Human flight is possible due to moving wings.

b) Flight principle was known from the ancient Greeks.

c) Scientific principle of the human flight was recorded by Leonardo da Vinci.

d) Leonardo da Vinci predicted conquest of outer space.

3. In the text find the definition of the main scientific principle of human flight.

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

1. Who believed that air had weight?
2. Who wrote the book "On the Flight of Birds"?
3. What is the fundamental idea of the book "On the Flight of Birds"?
4. What did Leonardo da Vinci record in his book "On the Flight of Birds"?
5. When is the lift of the aircraft greater?
6. When did the first flying machine appear?
7. Who designed the first plane?

Vocabulary Focus

1. Work in pairs. Give the definitions of the following words and expressions.

Famous person, gas, lifting force, airplane, world record, range, passenger, supersonic plane.

2. a) In the text find the antonyms for the words in the box.

danger	lose	slower	the newest
impossible	irregular	moveless	impractical

b) Make up sentences with the words from the box.

3. Complete the sentences below with suitable words from the text.

1. Later men of science came to conclusion that the higher you went …. air pressure was.

a) the higher b) the more c) the little d) the less

2. Leonardo da Vinci discovered that ….. the flow of the air …… the lift was.

a) the faster, the less b) the faster, the greater c) the greater, the less

3. Supersonic jet planes have replaced …… .

a) helicopters b) piston-engined aircraft c) subsonic aircraft

4. Air force equipment and armaments are being ….. continually.

a) considered b) improved c) displayed d) controlled

Speaking

1. What are the facts you have learnt from the text? Share ideas with your partner.

2. Work in pairs. Imagine that one of you is a visitor of a museum of aviation and the other is a museum guide. Make up a dialog. You may need some more information. Conduct an investigation to find out some interesting facts.

Use the following expressions:

Excuse me, do you know ...

I could hardly imagine that ….

I didn't expect that ...

That's a very interesting question ...

Writing

1. Read the following words to form meaningful sentences.

1) speed/Russian/and/are/pilots/records/establishing/range/new/for/world/altitude.

2) air/on/has/bodies/and/presses/weight.

3) in/planes/replace/will/jet/future/spaceplanes/supersonic.

4) the/the/flow/the/of/faster/is/air/the/the/lift/greater.

5) da Vinci/the/principles/flight/of/Leonardo/human/first/recorded/scientific.

UNIT 2

PIONEER OF ROCKET ENGINEERING

Preparing to Read

1. You are taking part in the TV show How to Become a Millionaire? Choose the correct answer. Be careful with the proper names. Good luck!

1. The International Aviation Saloon MAKS annually takes place in:

a. Tsiolkovsky	c. Baikonur
b. Zhukovsky	d. Petropavlovsk-Kamchatsky

2. The theory of flight was invented by:

a. Daedalus and Icarus	c. Leonardo da Vinci
b. Brothers Wright	d. S.P. Korolyov

3. The first name and the patronymic of Korolyov are:

a. Sergey Petrovich	c. Sergey Pavlovich
b. Stepan Pavlovich	d. Stephan Pavlovich

4. Find the city not connected with the biography of Korolyov:

a. Moscow	c. Zhitomir
b. Kuibyshev	d. Vladimir

5. Korolyov S.P.was awarded with:

a. The Nobel Prize	c. The Pulitzerovs award
b. The honoured membership in Harvard	d. three Orders of Lenin

6. Korolyov S.P. was buried:

a. at his home town Zhitomir	c. his ashes are in the Moscow Museum of Cosmonautics
b. at Baikonur	d. at the Red Square near the Kremlin Wall

2. Read the following International words and try to guess their meaning. Discuss them with your partner. Check the pronunciation of these words in the dictionary.

System, sphere, cosmic, academician, aeromechanical, group, hero, prize, bureau, enthusiast, experimental, talent, rocket, organizer, ideas, spirit, satellite, industry, title.

Reading

1. Read the text and try to guess the meaning of underlined words from the content of the text.

S.P. KOROLYOV

Academician Sergey Korolyov was an outstanding Soviet scientist and designer of space-rocket systems during the Space Race between the United States and the Soviet Union in the 1950s and 1960s. The first artificial Earth satellites and spaceships in which man made his first cosmic flights were made under S.P. Korolyov's guidance.

Korolyov was born on January, the 12th 1907, in the city of Zhitomir into the family of a teacher. From 1927 he worked in the Aircraft industry. In 1930, without leaving his job, he graduated from the aeromechanic department of the Moscow Bauman Higher Technical School and finished a flyer's school the same year.

After acquaintance with Konstantin Tsiolkovsky and his ideas Korolyov became an enthusiast and one of the founders of space-rocketry engineering.

In 1933 the Group for Studying jet propulsion was organized with his participation, and they made the first experimental rockets. From then on he devoted himself entirely to developing Soviet space-rocketry engineering. Although trained as an aircraft designer, Korolyov's greatest strengths proved to be in design integration, organization and strategic planning.

A victim of Stalin's 1938 Great Purge, he was confined for almost six years, including some months in a Siberian gulag. Following his release, he became a rocket designer and a key figure in the development of the Soviet ICBM program. He was then appointed to lead the Soviet space program, overseeing the early successes of the Sputnik and Vostok projects. By the time he died unexpectedly in 1966, his plans to compete with America to be the first nation to land a man on the Moon had begun to be implemented.

Korolyov reared many leading scientists and engineers who are now working in research and design bureaus in the sphere of space-rocketry engineering.

S.P. Korolyov was a talented research worker, a brilliant organizer and a man of high spiritual qualities. In 1967 our university was named after academician S.P. Korolyov.

Sergey Korolyov's fruitful work earned him the gratitude of the people and he received high government awards. He was twice awarded the title of Hero of Socialist Labour, and received the Lenin Prize, and Orders and Medals of the Soviet Union.

Before his death, he was often referred to only as "Chief Designer", because his pivotal role in the Soviet space program had been held to be a state secret by the Politburo.

Comprehension Check

1. You are given answers. Make up questions. (all possible types).

a. The first artificial Earth satellites and spaceships.
b. After acquaintance with K. Tsiolkovsky and his ideas Korolyov became an enthusiast of space-rocketry engineering.
c. In 1933.
d. Yes, he was. He was a talented research worker.
e. Yes, it did. It earned him the gratitude of the people.
f. Yes, it was. It was named after academician S.P. Korolyov.

2. Agree or disagree with the statements using phrases.

(I am afraid that's wrong; you are quite right/ you are not right; that's not quite so; I think you are mistaken; as far as I know; I don't agree with you (I can't agree with you), according to the text.)

1. The first artificial Earth satellites and spaceships were made under Lomonosov's guidance.
2. S.P. Korolyov graduated from Samara State Aerospace University.
3. Korolyov devoted himself entirely to developing space-rocketry engineering.

4. S.P. Korolyov reared many leading scientists and engineers who we are proud of.

5. Our University was named after Konstantin Tsiolkovsky.

3. Complete the following sentences without consulting the text.

1. Korolyov was born … .
2. From 1927 he worked … .
3. After acquaintance with Tsiolkovsky … .
4. Korolyov was a talented … .
5. When mentioning the name of S.P. Korolyov we … .

Vocabulary Focus

1. Discuss with your classmates and check in the dictionary if all your translation guesses were correct.

2. Write out all the new words with the translation into your copy-book and prepare them for the dictation.

3. Give synonyms to the column "A" from the column "B".

"A"	"B"
1. to design	a. to take part
2. to launch	b. to meet somebody
3. to participate	c. to construct
4. to award	d. to start
5. associate	e. famous
6. outstanding	f. colleague
7. to devote oneself to	g. to reward
8. to get acquainted with	h. to give oneself to

Speaking

1. The names of Tsiolkovsky and Korolyov are closely connected in the view of their mutual interests and inventions. Make an oral 3-minute report on the biography and captivating ideas of Konstantin Tsiolkovsky.

UNIT 3

FROM THE HISTORY OF FLYING APPARATUS

Preparing to Read

1. Look through the pictures a-h very carefully. Do you know the names of each flying device? Name them. For the help look at the list, given below, but there are some extra models.

a) 

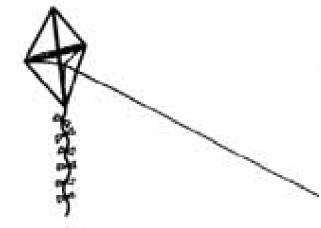
b) 

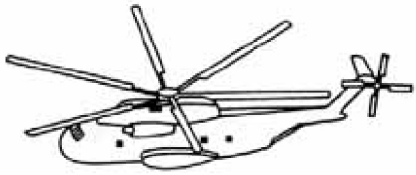
c) 

d) 

e) 

f) 

g) 

h) 

Flying boat, glider, biplane, kite, autogiro, balloon, airship, parachute, helicopter.

2. If you were a traveler and had at you disposal any passenger-carrying apparatus, by which one would you prefer to travel?

3. In groups of four, discuss pros and cons of the above apparatus. Provide reasoning. Use conventional formulae of agreement and disagreement. The verbs in the box might be helpful.

allow	enable	force	may	stop	faster	save
make it easier		make it more difficult		suffer from travel sickness		

Agreeing

- I quite agree.
- You're right.
- That's true.
- Absolutely!
- No doubt about it!
- That's just what I was thinking.

Disagreeing

- I don't agree.
- I don't think so.
- I wish I could agree, but …
- I'm not so sure (about that).
- I wouldn't say that.
- Wouldn't you say that …?

1. Answer the questions below.

1) How many meanings of the word *balloon* do you know?
2) Why were people, especially scientists interested in the composition of the atmosphere?
3) How do we call scientists studying the atmospheric phenomena?
4) Which countries are known to be the pioneers in early flights and atmosphere studies?

Reading

1. Read the text below. Think of a suitable title. Provide reasoning.

FROM THE HISTORY OF FLYING APPARATUS

The earliest form of air transport was balloons, which are sometimes called "free balloons" because they are forced to drift by the wind flow without any engine. This fact alone makes balloons not reliable enough for carrying people. If they were safer they would be used more for transportation, but at present the scientists use the balloons mostly for obtaining information about upper atmosphere, its density and other scientific

subjects. Weather balloons are particularly used by meteorologists. They carry instruments whose readings are automatically sent back to the ground by the radio. The position of the balloon is obtained by radar.

The first balloons were done by Montgolfier brothers in the 18-th century.

Etienne and Joseph Montgolfier lived in a little village in France where their father had a paper factory. The two brothers took paper bags from their father, filled them with smoke over a fire and watched them go up into the air.

After numerous experiments they were ready to show how their balloons worked. On the day of the flight people from different places came to the little village to see the spectacle. The brothers had constructed a bag some thirty feet in diameter. That big bag was held over a fire. When it was in the air for ten minutes and then as the air bag became cold the balloon went down.

The news about the experiment reached the king who wanted to see it himself. So on September 19, 1783 Montgolfier brothers repeated their experiment in the presence of the King and Queen of France. This time the balloon carried a cage with a sheep, a cock and a duck who were thus the first air travellers. The flight was successful. The balloon came down some distance off with the sheep, the cock and the duck unharmed.

If the animals could live through this men could risk too. A month later a balloon was sent up with a Frenchman, Rozier by name. 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.

A month later he and Arlandes made the first free balloon flight. Their friends who came to say good-bye to them were very sad as if the two men were going to certain death, but they went up several hundred feet, were carried by the wind over Paris and came down in safety.

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. If they had not done it, they would have never reached the French coast.

Comprehension Check

1. Check you knowledge on the history of the balloons. Do the following quiz and mark the statements as true (T) or false (F).

1	The earliest form of air transport was dirigible.	**T**	**F**	**8**	The first balloon was in the air for 15 minutes.	**T**	**F**
2	"Free balloons" are moving without any engine.	**T**	**F**	**9**	The first air travelers were domestic animals.	**T**	**F**
3	Balloons are reliable vehicles.	**T**	**F**	**10**	The first man lifted by the balloon was a Frenchman, Rozier by name.	**T**	**F**
4	Balloons are used for carrying people.	**T**	**F**	**11**	Rozier and Arlandes safely landed after the flight.	**T**	**F**
5	Weather balloons are used by meteorologists.	**T**	**F**	**12**	In 1785 an American crossed the English Channel in a balloon.	**T**	**F**
6	The first balloons were made in Germany.	**T**	**F**	**13**	The air travellers had certain trouble during their flight across the English Channel.	**T**	**F**
7	Montgolfier's father had a paper factory.	**T**	**F**	**14**	Balloons are widely used nowdays.	**T**	**F**

2. Compare your answers with those of your partner's.

3. Define the main idea of the first paragraph. Find the supporting details that help to develop the main idea.

4. Explain the meaning of the following words and word combinations from the text. Make use of a dictionary if necessary.

Particularly, village, smoke, numerous experiments, in the presence of, traveler, cock, unharmed, at a height of, to come down in safety.

5. Complete the following sentences using the content of the text.

1) "Free balloons" are forced to drift by …
2) This fact alone makes the balloons not …
3) If they were safer they would …
4) They carry instruments whose readings are …
5) Etienne and Joseph Montgolfier lived in …
6) After numerous experiments they were ready to …
7) The brothers had constructed a bag …
8) The news about the experiment reached …
9) The next time the balloon carried a cage with …
10) If the animals could live through this …
11) He stayed up in the air for twenty-five minutes …
12) A month later he and Arlandes made …

Speaking

1. You are going on a balloon flight. Tell who and what you would like to take with you. Follow the plan.

1. Place of Destination
2. Approximate Flight Duration
3. Membership
4. Food
5. Clothes
6. Any other things

UNIT 4
TYPES OF AIRCRAFT

Preparing to read

1. Name the aircraft you know. Describe them. Try to group them according to their principle of flying.

2. Match the keywords with their translations.

1. seaplane	a. воздушный винт
2. glider	b. амфибия
3. airplane	c. реактивный снаряд, ракета

4. helicopter	d. гидросамолёт
5. autogiro	e. силовая установка
6. missile	f. планер
7. airscrew	g. автожир
8. float	h. вертолёт
9. amphibian	i. поплавок
10. power plant	j. самолёт

Reading

1. Read the text and check whether your predictions in ex. 2 were correct.

2. Read the text and name the vehicles not mentioned at the beginning of the unit.

3. Read the text and write out the words and word combinations you don't know, try to guess their meaning from the context. Compare your notes with your partners.

TYPES OF AIRCRAFT

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

B. Aircraft of the first class are gliders, airplanes, helicopters, autogiros and winged missiles. Ballistic rockets belong to the second class.

C. Gliders have no power plant and are supported in the air by up and down air streams or air flows encountering the wing. The glider is lighter than the airplane and covers long distances with little loss of height. Thanks to them much of the early advance in aviation became possible. Now the gliders serve mostly for sport and training.

D. Airplanes are controllable machines and have engines which give power for forward motion. The lifting force of airplanes is created by the 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 the airplanes into the classification as follows:

1) the biplane which is a two wing plane with an upper and lower of wings;
2) the monoplane which is an airplane with wings in one level.

These are divided into four general types according to the wing position:

a) the mid wing monoplane with the wing secured midway between the top and bottom of the fuselage;

b) the high wing monoplane having the wing attached to the top of the fuselage;

c) the low wing monoplane with the wing attached to the bottom of the fuselage;

d) the parasol wing monoplane having its wing placed a short distance above the fuselage and attached to it by struts and braces.

E. 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.

F. 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. The following methods of vertical take-off are suggested now:

a) the direct application of power plant thrust,

b) the application of lifting properties of airfoil.

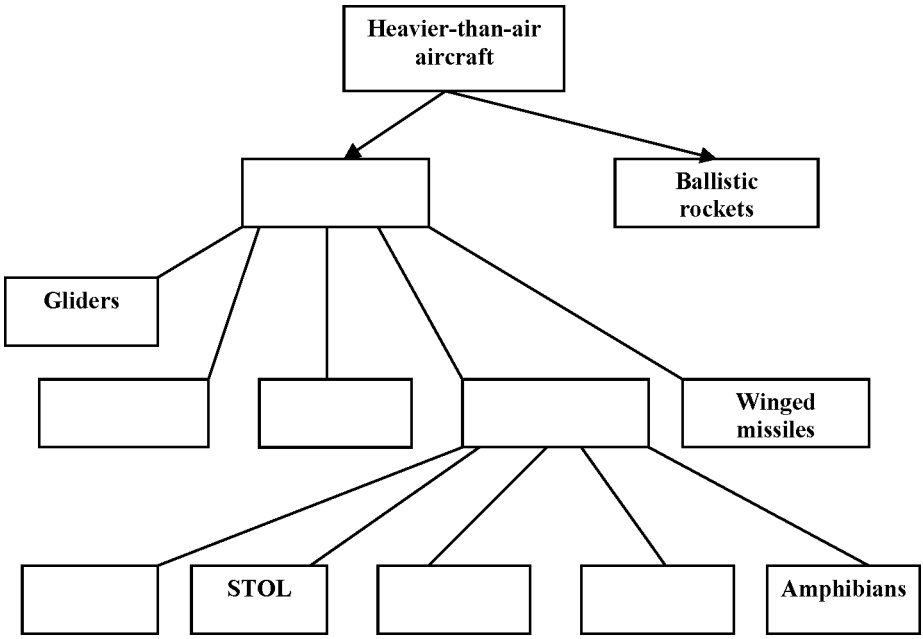
G. The helicopter largely differs from the airplane. The main thing that distinguishes a helicopter from an airplane is that the necessary lift force for helicopter is produced by a rotor instead of wings. The helicopter has a fuselage but there is no conventional propeller in the nose. Instead it has rotor blades on the top. The engine drives them. The power of a helicopter engine is transmitted to the rotor which produces the thrust for vertical take-off, hovering and forward propulsion. The 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.

H. The autogiro is flying on the same principles, but the difference is that in addition to a rotor the autogiro has also a tractor 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 the lifting force.

I. Ballistic rockets (missiles) belong to the second class of aircraft. They do not require any lifting force produced by means of a wing. The rocket engine is to impart them the necessary energy for propulsion. The rocket engines are mostly operated on liquid or solid fuels.

Comprehension Check

1. Fill in the diagram with missing information from the text.



2. The text has 9 paragraphs. Which paragraph mentions a) different landing devices; b) vehicle flying due to up and down air streams; c) vehicle able to hover in the air?

3. Read the text again and decide if these statements are true or false. Correct the false ones.

1. Modern heavier-than-air aircraft are classified into two classes according to their flying principle.
2. Airplanes fly due to up and down air stream.
3. Gliders are equipped with airscrew and power plant.
4. Airplanes can be fitted with floats to take off and land on water.
5. In helicopters lifting force is produced by the wing itself.
6. The helicopters can take off and land vertically.
7. The autogiros and ballistic rockets fly on the same principles.
8. Ballistic rockets do not produce lifting force by means of a wing.

4. Ask your partner ten questions about types of aircraft.

5. Explain the difference between:

a) airplanes and ballistic rockets
b) helicopters and autogiros
c) seaplanes and amphibians
d) helicopters and airplanes

Vocabulary Focus

1. Match the synonyms.

A	*B*
advance	wing
produce	mount
subdivide	vehicle
propel	progress
airfoil	move
attach	create
aircraft	classify

2. Make up all possible combinations with the verbs.

To divide, to support, to produce, to propel, to attach, to place, to create, to equip, to differ, to require.

3. Make up 5 sentences with the word combinations from ex. 2.

4. Work in pairs. Give the definitions of the following words and expressions.

Fuselage, glider, biplane, helicopter, amphibian aircraft, ballistic rocket, high wing monoplane.

5. Fill in the gaps with the words & expressions from the box.

wing position	engines	the autogiro
the parasol wing	flying boat	seaplanes
the wing itself	a rotor	
ballistic rockets	up and down airstreams	

1. Gliders are supported in the air by_____.

2. The lifting force of the wing is created by _____ when it moves through the air.

3. The monoplanes are divided into four types according to_____ .

4. _____ monoplane has its wing placed a short distance above the fuselage.

5. In _____ the boat hull replaces the airplane fuselage.

6. _____ are equipped with floats to take off water and land on water.

7. The helicopters produce lifting force by_____.

8. _____ is equipped with a tractor airscrew and a rotor.

9. The rocket engine provides energy for propulsion for_____.

10. In airplanes _____ supply power for forward motion.

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

1. Modern (летательные аппараты тяжелее воздуха) are divided into two classes according to the principle of flying.

2. The (планер) is lighter than the airplane.

3. Many airplanes are equipped (взлетать) from water and (садиться) on water.

4. At present (ЛА с вертикальным взлётом-посадкой) and (ЛА с укороченным взлётом-посадкой) aircraft are becoming popular.

5. The helicopter has a (фюзеляж) but there is no (обычный винт).

6. Helicopters have a few (недостатки).

7. Ballistic rockets do not require any lifting force produced (при помощи) a wing.

8. The power developed by the autogiro (двигатель) is (передавать) to the (воздушный винт).

Writing

1. Translate the text in a written form.

A "glider" is an unpowered aircraft. The most common types of glider are today used for sporting purposes. The design of these types enables them to climb using rising air. This has created the sport of gliding. Although many gliders do not have engines, there are some that use engines occasionally.

Early gliders had no cockpit and the pilot sat on a small seat located just ahead of the wing. They were usually launched from the tops of hills, though they are also capable of short hops across the ground while being towed

behind a vehicle. To enable gliders to soar more effectively, the designers minimized drag. Gliders now have very smooth, narrow fuselages and very long, narrow wings with a high aspect ratio.

The early gliders were made mainly of wood with metal fastenings, struts and control cables. New materials such as carbon-fiber, glass-fiber and Kevlar have since been used with computer-aided design to increase performance. Drag has also been minimized by more aerodynamic shapes and retractable undercarriages.

With each generation of materials and with the improvements in aerodynamics, the performance of gliders has increased. One measure of performance is the glide ratio. A ratio of 30:1 means that in smooth air a glider can travel forward 30 meters while only losing 1 meter of altitude.

Due to the critical role that aerodynamic efficiency plays in the performance of a glider, gliders often have state-of-the-art aerodynamic features. The wings of a modern glider have specially designed low-drag airfoil. After the wings' surfaces have been shaped by a mold to great accuracy, they are then highly polished. Vertical winglets at the ends of the wings are computer-designed to decrease drag and improve handling performance. Turbulator devices in the form of a zig-zag tape are used to direct laminar flow air into turbulent flow at a desired location on the wing. This flow control prevents the formation of laminar flow bubbles and ensures the absolute minimum drag. Bug-wipers may be installed to wipe the wings while in flight and remove insects that are disturbing the smooth flow of air over the wing.

Modern competition gliders are also designed to carry jettisonable water ballast (in the wings and sometimes in the vertical stabiliser). The extra weight provided by the water ballast is advantageous if the lift is likely to be strong, and may also be used to adjust the glider's center of mass. To avoid undue stress on the airframe, gliders must jettison any water ballast before landing.

Pilots can land accurately by controlling their rate of descent using spoilers, also known as air brakes. These are metal devices which extend from either the upper-wing surface or from both upper and lower surfaces, thereby destroying some lift and creating additional drag. A wheel-brake also enables a glider to be stopped after touchdown, which is particularly important in a short runway.

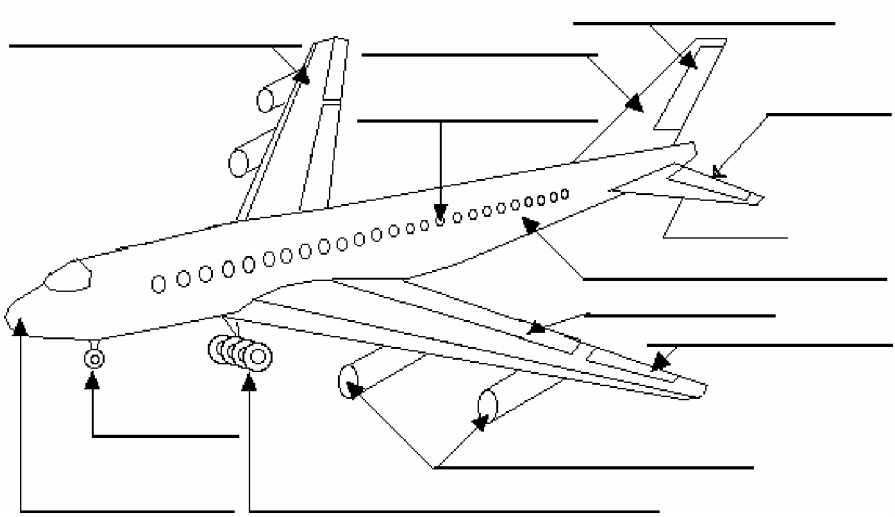
UNIT 5

AIRPLANE COMPONENTS

Preparing to Read

1. Airplanes have many applications in a variety of fields. Brainstorm as many uses of the airplane as possible.

2. Look at the picture of an airplane. Name the airplane components you know, share the terms with your partner.



Reading

1. Read the text and try to guess the meaning of underlined words from the content of the text.

AIRPLANE COMPONENTS

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

B. The power plant is a source of power. It provides power and propels the 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 the power plant or engine and its accessories. The engine is really the heart of the airplane.

C. The fuselage is the main body of the airplane which is divided into some cabins (compartments). A nose cabin is a pilot's cabin (cockpit). The cockpit houses the crew, the flight controls and flight instrument panels. The next section of the fuselage is a wing centre-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.

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

E. The 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 the stabilizer is an elevator.

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

J. The landing gear (undercarriage) carries the wheels on which the aircraft moves on the ground. Struts attach it to the fuselage. Two different arrangements of landing wheels are in use today. They are conventional tricycle gears and the landing gear with a skid. The landing gear may be retractable and non-retractable.

Comprehension Check

1. You have read the text. Fill in the picture with missing terms from the text.

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

Component	Function
	to develop the necessary supporting force
Fuselage	
	to change the attitude and direction of flight
Power plant	
Aileron	
	to control the airplane's movement up and down about the lateral axis
Cockpit	
	to house luggage and cargo
	to control the movement of the airplane around the vertical axis
Nacelle	
Landing gear	
	to provide stability of flight

3. Read the sentences and decide if they are true (T) or false (F). Correct the false ones.

1. Power plant produces lifting force.
2. The rear part of the fuselage is designed for the cockpit.
3. The landing gear is designed to assist the airplane maneuvering on the ground.
4. Ailerons, flaps and trimmers are located at the trailing edge of the wing.
5. Flight controls produce additional lifting force.
6. Empennage is mounted on the wing centre-section.

4. Answer the following questions:

1. What units does the airplane consist of?
2. The power plant is a source of power, isn't it?
3. What does the cockpit house?
4. Is the function of the wing to support the aircraft in flight?
5. Where are movable parts of the wing located? Name them.
6. Does the tail unit consist of a vertical stabilizer and rudder and horizontal stabilizer and elevators?
7. What components are responsible for airplane motion? Where are they located?
8. What is the function of the landing gear?

Vocabulary Focus

1. Match the words from *A* and *B*. Make as many combinations as possible.

A	*B*
Horizontal	Edge
Lifting	Compartment
Passenger	Surface
Sweptback	Unit
Trailing	Shape
Movable	Plant
Structural	Part
Power	Stabilizer

2. Find the words in the text that mean:

air flow (F); engine (B); surface (E); to locate (C); to hinge (J); energy (B); usual (J); form (D); compartment (C); wing (D).

3. Translate the words in brackets:

a) into Russian:

1. Силовая установка (provides) энергией.
2. (Nacelles) – это отсеки, вмещающие двигатель и его вспомогательные элементы.

3. Фюзеляж (contains) кабину пилота, пассажирский и багажный отсеки.

4. На задней кромке крыла располагаются (ailerons, flaps) и триммеры.

b) into English:

1. (Руль направления) is hinged to the vertical stabilizer.
2. The main landing gear (прикрепляются) by struts to the fuselage.
3. The wings are the main (подъёмные плоскости).
4. There are conventional (трёхопорное шасси) and the landing gear with a (хвостовой опорой).

Focus on Writing

1. Match the beginnings and the endings of the sentences:

1. The power plant provides power and	a. cargo rooms and for mounting a tail unit on it.
2. The ailerons are located at the trailing edge of the wing and	b. the movement of the airplane around the vertical axis.
3. The main function of the wing is	c. propels the airplane.
4. The energy is derived from a chemical reaction which	d. to support the aircraft in flight.
5. The rudder is hinged to the fin and it controls	e. takes place inside the engine itself.
6. The rear part of the fuselage is designed for….	f. control the motion of the airplane about the longitudinal axis.

Speaking

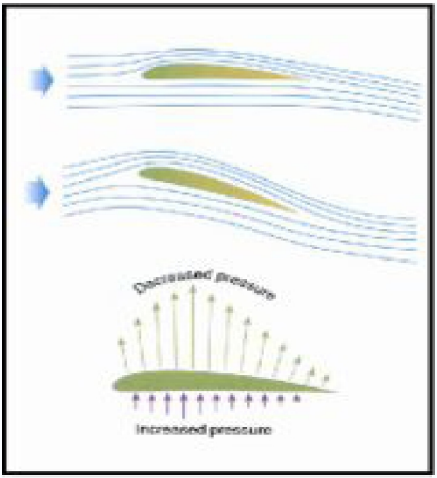
1. You know that the history of aircraft designing was very long and designers constructed amazing flying machines. Prepare a report about one of them to your group mates.

UNIT 6

AIRCRAFT AND SOME FACTS ABOUT THE FLIGHT

Preparing to Read

1. Look at the picture. What do you think this picture shows? Share your ideas with your partner.



2. Try to answer the following questions before you read the text.

1. What does the flight of every aircraft depend on?
2. What are the main forces acting on a flying body?

Reading

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

1. straight-and-level-flight	a. различие в подъёмной силе и весе
2. right angle	b. сжатый воздух
3. enter a climb	c. подъём и снижение
4. inequality of lift and weight	d. прямой угол
5. compressed air	e. прямолинейный горизонтальный полёт
6. air resistance	f. изогнутая поверхность
7. climb and descent	g. начать набор высоты
8. inherent ability	h. сопротивление воздуха

9. curved surface	i. искусственно созданные силы
10. artificially created forces	j. присущая способность

2. Read the text and check whether your answers were correct.

3. Read the text and write out the words you don't know, try to guess their meaning from the context. Compare your notes with your partners.

AIRCRAFT AND SOME FACTS ABOUT THE FLIGHT

A. The 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.

B. When moving in the air, the 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.

C. To produce lift, the 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.

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

E. In any position of flight the airplane is acted upon by four forces, the last being weight, or gravity, the downward acting force.

F. 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. The wing is designed to produce lift to overcome weight.

G. 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.

H. The lifting power and the 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.

Comprehension Check

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

2. In the text find the definition of lifting force and air resistance.

3. Complete the following sentences with suitable words from the text:

1. The aircraft is able to keep in the air because of …
2. It produces an upward force which …
3. Part of the air flows over the wing and …
4. The air flowing under the bottom of the wing travels …
5. The air moving across the top of the wing creates …
6. The difference in pressure between ….
7. To produce lift the wing must ….
8. A force of thrust acts …
9. The resistance the aeroplane meets …
10. The aeroplane is acted upon by …
11. Drag and weight are forces …
12. Thrust and lift are …
13. Thrust is produced by …
14. Inequality between lift and weight results in …
15. Inequality between thrust and drag results in …

4. These are the definitions. Guess the terms.

1. The force that acts on the airplane wing in a direction perpendicular to the air stream.
2. The resistance the airplane meets in moving through the air.
3. A force producing a high speed of the airplane.
4. A force with which a body tends toward the centre of the Earth.
5. Blades fixed to a revolving shaft for driving an aircraft.
6. A device which is capable of producing lift when it is moved through the air.

5. Agree or disagree with the statements. Use conventional formulae of agreement and disagreement.

Agreeing	Disagreeing
- Absolutely!	- I don't agree.
- You are right.	– I don't think so.
- That's true.	– I'm not sure …
- I quite agree.	– I wouldn't say that.

1. The distance along the bottom of the wing is greater than the distance over the top of it.

2. The air flowing over the top travels faster than the air flowing along the bottom of the wing.

3. The faster a gas flows, the more pressure it creates.

4. The pressure of the faster-flowing air on the bottom of the wing is less than that of the slower-moving air on the top.

5. The increased pressure differential results in greater lift and thrust.

6. The thrust and drag depend on the angle of attack.

7. When thrust becomes more than drag, the airspeed decreases rapidly.

8. The thrust pushes the plane forward overcoming the resistance of the air against the plane.

9. The lift of an airplane acts vertically upwards and its weight – vertically downwards.

10. The lift being equal to the weight, the airplane climbs; if the two forces are unequal the plane descends.

6. Answer the questions.

1. Why is the plane able to fly in the air?
2. What are the forces acting on it?
3. What happens in the air when an airfoil moves through it?
4. How does the air flow over and under the wing?
5. What does the air stream create on the top and bottom of the wing?
6. What does the pressure differential results in?
7. What condition is necessary for producing lift?
8. How may thrust be created?
9. What is the drag?
10. How do the four forces act? What is their nature?
11. What are the means of producing lift and thrust?
12. What does the straight-and-level flight mean?
13. What do the lift and drag depend on?

Vocabulary Focus

1. 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*
stream	decrease
travel	rear
airfoil	support
join	not curved
produce	move
straight	flow
maintain	operate
act	create
reduce	connect
artificial	aerodynamic surface
trailing	man-made
	leading
	increase

2. Match the antonyms.

A	*B*
lift	weight
thrust	slow
climb	backward
bottom	rear
flat	natural
upper	drag
fast	upward
artificial	descent
forward	lower
front	curved
downward	top

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

1. The aircraft rises into the air and keeps there because of _____.

a) wind b) light weight c) forces working on it

2. The air traveling across the top of the wing creates a _____ on the upper surface.

a) increased pressure b) reduced pressure c) reduced lift

3. Aircraft high speed is produced by a _____ that acts in the direction of airplane's motion.

a) force of thrust b) wing c) flight controls

4. _____ and _____ are artificially created forces.

a) lift, drag b) thrust, lift c) thrust, gravity

5) The engine-propeller combination is designed _____ .
a) to create lift b) to overcome drag c) to decrease weight

Focus on Writing

1. Translate the text in a written form.

High-Speed Flight Ranges

Transonic. When the speed of flight is less than the speed of sound the airplane is said to be in the transonic speed range. That is, it is in the region of speed of sound.

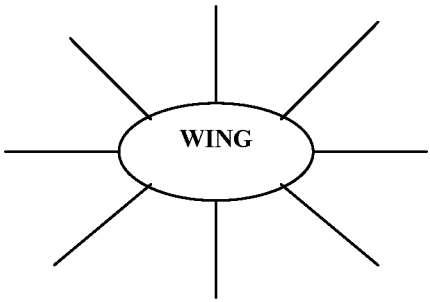
Supersonic. As flight speed increases further, a point is reached where the airflow over all parts of the aircraft is supersonic, or above the speed of sound. When this happens, the airplane is in the supersonic speed range.

Hypersonic. As a body moves through the air at high speeds, a short amount of time is required for the molecules of air to adjust themselves to the presence of the fast-moving body and to readjust themselves after the body has passed through them. This period of adjustment and readjustment is called the relaxation time. If a body is moving at a speed greater that the relaxation time, it can be classed as being in the hypersonic speed range.

UNIT 7
WING

Preparing to Read

1. Brainstorm all possible terms related to the topic.



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

Reading

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

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

WING

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

B. The wing is divided into three sections: a wing root, an inter-mediate section and a wing tip. The front edge of the 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 the wing. These are ailerons, flaps and trimmer tabs.

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

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

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

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

G. The aerodynamic loads on the 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.

H. 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. The stressed skin type of construction was adopted because it can be made light.

Comprehension Check

1. Define the main idea of paragraph H. Find the supporting details that help to develop the main idea.

2. Complete the sentences with the best options.

1. There are some movable parts on the _____ of the wing.
a) leading edge b) trailing edge c) centre-section
2. The _____ structural members of the wing are spars, stringers and beams.
a) transverse b) covering c) longitudinal
3. The _____ the wing produce 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 the _____.
a) chord b) beam c) span

3. Match the terms with their definitions.

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

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

1. There are two main functions of the wing – to produce lift and to house many vital parts of the aircraft.
2. Movable parts of the wing are located on the leading edge.
3. Span - it is a distance between the 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.

5. 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.

Vocabulary Focus

1. Match the synonyms.

A	*B*
Wing	Rear edge
Front edge	Bay
Shape	Engine
Covering	Airfoil
Section	Form
Trailing edge	Skin
Power plant	Leading edge

2. Match the antonyms.

A	*B*
Leading	Secondary
Take off	Fixed

Primary	Weaken
Root	Trailing
Different	Landing
Reinforce	Tip
Transverse	Similar
Movable	Longitudinal

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

1. Rib is a (поперечный) element of a wing structure.
2. The main longitudinal structural members of the wing structure are – (лонжероны, стрингеры и балки).
3. A typical construction of the 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.

4. Translate into English the following words and word combinations.

Работающая обшивка, гондола шасси, низкоплан, среднеплан, высокоплан, изгибающая нагрузка, корневая часть крыла, закрылок, отсек шасси, механизм управления, продольный элемент жёсткости, форма крыла, напряжение.

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

from	with	into	in	of	on	to

1. The 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 the wing ___ the trailing edge is the chord.
5. The wing structure is covered _____ skin.
6. The wing structure consists ___ longitudinal and transverse elements.

Writing

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

2. Translate the text in a written form.

Flying wing is the generic designation given for a fixed-wing aircraft configuration which is capable of stable, controllable flight without the aid of lifting surfaces other than the main wing itself, that is, without auxiliary surfaces such as "tails" and "canards".

In it strictest sense, the **Flying Wing** also lacks a fuselage, or has only a rudimentary fuselage 'pod' barely extending from the wing itself. In this layout, most of the payload is transported inside the main wing, the latter comprising most of its structural volume. A pure flying wing also lacks any vertical stabilizers, although some aircraft commonly known as 'flying wings' have a vertical tail fin, vertical tail surfaces or a set of vertical stabilizers on the back part of their wings to help their stability in turns.

The less restrictive designation of "tailless aircraft" includes the flying wing aircraft, but also all aircraft without stabilizers or canards, but with a full-length payload bearing fuselage, such as delta aircraft.

Historically, the flying wing has been defended by many as potentially the most efficient aircraft configuration from the point of view of aerodynamics and structural weight. Such a notion usually comes from the idea that the absence of any aircraft components other than the wing should naturally provide those benefits. On the other hand, the aircraft's wing should be able to provide flight stability and control "by itself", a requirement which in principle imposes additional constraints to the wing design problem. Therefore, the expected gains in weight and drag reduction may be partially or wholly negated due to design compromises needed to provide stability and control.

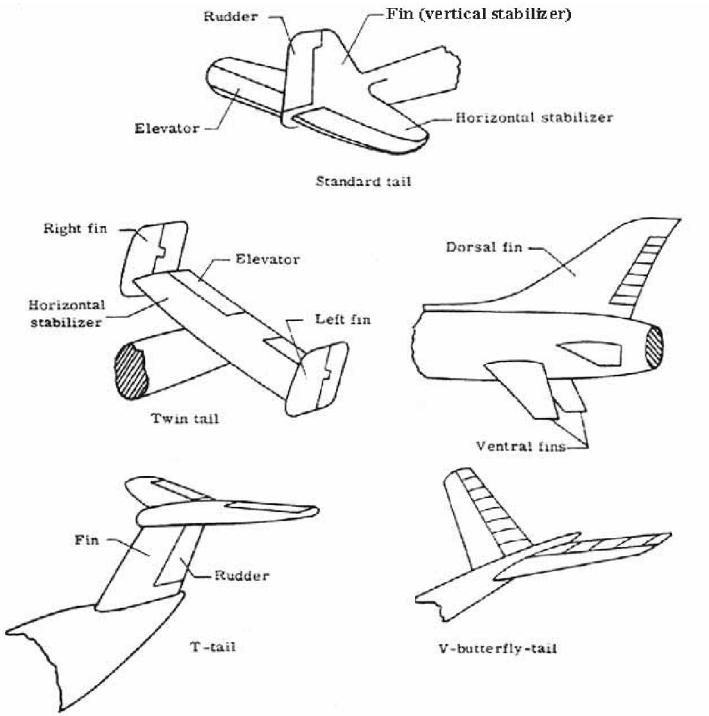
Speaking

1. Analyse conventional wing and flying wing. Compare them. Highlight their similarity and difference. 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 …
- Summimg up, I would like to …

UNIT 8
TAIL GROUP

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



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

1. What are the movable parts of the tail unit intended for?
2. Is there any difference between the 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

THE TAIL GROUP

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

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

C. In order to secure directional stability the fin is used which is the vertical fixed control surface at the rear of the fuselage. The action of the vertical surface is quite clear. Since it has a great lever arm from the airplane's centre of gravity the vertical surface is able to stabilize the directional motion of the plane. Directional control of the airplane is achieved by means of the rudder, which is a movable vertical surface hinged to the rear of the fin. It can be moved to right or left or retained in the neutral position in line with the fin.

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

E. In addition to the principal control surfaces there are some auxiliary ones such as trimming tabs (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 the airplane in a certain attitude of flight. They are adjustable from the cockpit.

F. There is also a dorsal fin placed along the upper side of the aft portion of the fuselage body.

G. On large fast airplanes it is usually necessary to provide the 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, a violent vibration of a wing or control surface.

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

Comprehension Check

1. 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) lifting force
9) trimmers

2. Guess what it is:

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

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

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

11. These portions are used when the pilot is to cause the nose to rise or to fall.

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

3. In the text find the definition of *flutter*.

4. Fill in the gaps using the following words from the box.

rudder	hinged	dynamic balancing
altitude	auxiliary	stability
rear		trailing edges

1. Tail unit provides the necessary _____ of an airplane.
2. An elevator is _____ to the _____ of the tail plane.
3. Elevators control the _____ of the aircraft in flight.
4. _____ can be deflected to the right or to the left.
5. Trimmers are _____ surfaces arranged near the _____ of the movable surfaces.
6. To avoid flutter _____ is used.

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

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

Vocabulary Focus

1. 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 with.

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

c) Think of other nouns they can go with.

d) Give synonyms of the verbs from *a)*.

2. 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.

3. Translate from English into Russian.

Оснащать хвостовым оперением, отклонять вверх или вниз, достигается посредством руля высоты, вспомогательная плоскость, шарнирный момент, избегать флаттера, правый борт ЛА, положение самолёта в воздухе.

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

along	of	at	from	in	of	with

1. Trimmers are used to produce constant control deflections to hold the airplane ____ a certain attitude ____ flight.
2. The dorsal fin is placed ____ the upper side ___ the fuselage body.
3. In order to provide the necessary stability airplanes are fitted ____ a tail unit.
4. Fin is a vertical control surface __ the rear of the fuselage.
5. Trimmers are adjustable ___ the cockpit.

Writing

1. Match the beginnings and the endings of the sentences.

1. In order to provide the necessary stability …	a) along the upper side of the aft portion of the fuselage body.
2. The dynamic balancing is one of the precautions taken….	b) he moves the rudder to the right.
3. Directional control of the airplane is achieved ….	c) to produce constant control deflections.
4. The structure of the tail unit consists of	d) airplanes are fitted with a tail unit.
5. A movable control surface called an elevator is …	e) this is done by means of the elevator.
6. When the pilot needs to change his flight direction to the right…	f) to avoid flutter, a violent vibration of a wing or control surface.

7. Dorsal fin is placed …	g) by means of the rudder, which is a movable vertical surface.
8. Balance areas reduce the hinge moment	h) to right or left or retained in the neutral position in line with the fin.
9. Trimmers represent small adjustable areas arranged …	i) hinged to the rear of the stabilizer.
10. If the pilot needs to cause the nose to rise or fall ….	j) needed to deflect surface.
11. Trimmers are used ….	k) longitudinal and transverse structural elements called spars and ribs.
12. Rudder is hinged to the rear of the fin and can be moved …	l) near the trailing edges of the movable surfaces.

2. Translate in a written form matching with the picture.

In aircraft, a **V-tail** (sometimes called a "butterfly tail") is an unconventional arrangement of the tail control surfaces that replaces the traditional fin and horizontal surfaces with two surfaces set in a V-shaped configuration when viewed from the front or rear of the aircraft. The rear of each surface is hinged, and these movable sections combine the tasks of the elevators and rudder. The V-tail has not been a popular choice for aircraft manufacturers.

With fewer surfaces than a conventional tail, the V-tail is lighter and produces less drag. The air flowing over the tail surfaces is also likely to be less turbulent. A V-tail tends to reflect radar at an angle that reduces the return signal, making the aircraft harder to detect. This is an advantage for military aircraft.

Combining the pitch and yaw controls is difficult and requires a more complex control system. The V-tail arrangement also places greater stress on the rear fuselage when pitching and yawing.

In aircraft a **T-tail** is an arrangement of the tail control surfaces with the horizontal surfaces (tailplane and elevators) mounted to the top of the fin, rather than the more common location on the fuselage at the base of the fin. The resulting arrangement looks like a T when viewed from the front or back.

There are pros and cons to this arrangement.

The tailplane surfaces are kept well out of the airflow behind the wing, giving smoother flow, more predictable design characteristics.

The effective distance between wing and tailplane can be increased without a significant increase in the weight of the aircraft.

The tail surfaces are mounted well out of the way of the rear fuselage, permitting this site to be used for the aircraft's engines. This is why the T-tail arrangement is also commonly found on airliners with rear-mounted engines.

The fin must be made considerably stronger and stiffer to support the forces generated by the tailplane. Unless expensive composite materials are used, this inevitably makes it heavier as well.

Speaking

1. Work in groups. You are involved in developing of a new airplane. You are responsible for the tail group. Find out some additional information for your topic.

UNIT 9
THE FUSELAGE STRUCTURE

Pre-Reading

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

Reading

1. 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.

THE FUSELAGE STRUCTURE

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

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

C. A fuselage construction may be broken down into two main classes: the truss type consists of a welded tubular structure covered with skin and a girder type. The latter is divided into the monocoque type consisting of a strong outer skin from which the fuselage primarily derives its strength, and the semimonocoque type – the combination of a single shell structure with longerons and stringers to reinforce the skin.

D. A very common type of a fuselage is the monocoque type of construction. It is called so because it makes use of a single shell which is sufficient to provide the necessary structural strength. Monocoque construction aims at concentrating the structural material towards the outer surfaces and the success of stressed-skin fuselage depends upon the stiffness of the skin.

E. The semimonocoque 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 the longerons and the skin mutually reinforce each other.

F. 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 transverse frames are rolled in channel or similar shape and spaced at intervals along the fuselage. The whole structure is covered with a very light gauge skin riveted in position. The longitudinal members in a semimonocoque fuselage are held apart by bulkheads, which give the fuselage its shape. Bulkheads are solid or semisolid frames placed where the greater stresses are to occur or at any point in the fuselage that requires special strength.

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

H. The fuselage is generally built in three sections or assemblies: the nose, the centre section and the aft section. When the assemblies are completed they are joined to form the entire fuselage.

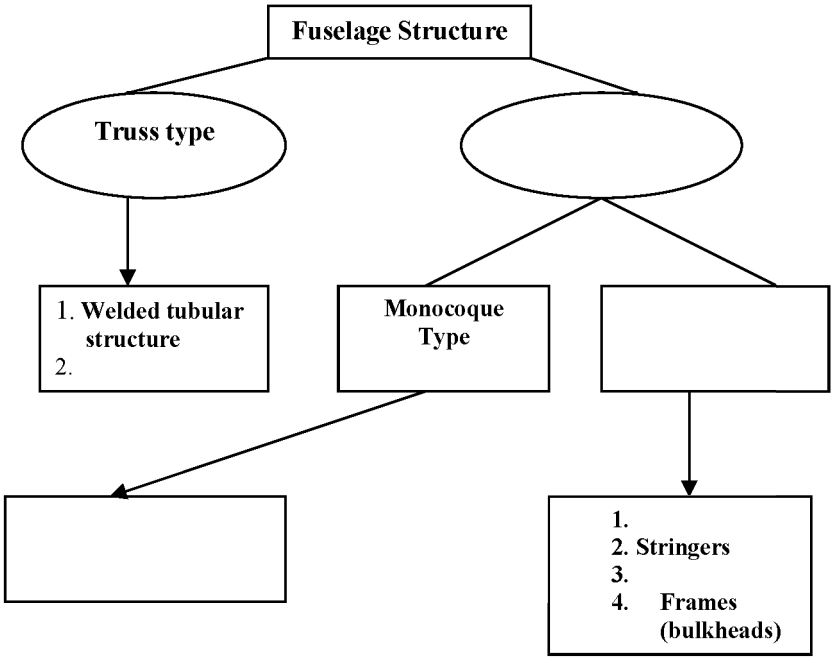
Comprehension Check

1. Divide the text into logical parts. Think of the subtitle to each part.

2. Explain the difference between:
a) longerons and bulkheads
b) monocoque and semimonocoque fuselage

3. Define the main idea of paragraph *F*. Find the supporting details that help to develop the main idea.

4. Fill in the diagram with missing information from the text.



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

1. What can be housed inside the fuselage structure?
2. What loads act on the fuselage in flight?
3. What are the main members of the fuselage structure?
4. How is the skin joined to the stringers and formers?
5. What purposes are the bulkheads used for?
6. What is the best material for the airplane fuselage?
7. What complicates designer's task?
8. What is the function of the stressed skin?

6. Read these definitions and remember them.

Longeron – a main longitudinal member of the fuselage

Rivet – a metal pin that is inserted into holes in larger parts to be joined, and then compressed to produce a permanent fastening

Skin – a material which covers the structure of an airplane

Airframe – the basis structure of a plane, including fuselage, wings and so on.

Bulkhead – an upright partition that serves to divide the airplane into compartments and to provide structural strength.

Stringer – a longitudinal member that shapes and strengthens the skin.

Vocabulary Focus

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

Crew, fuel, payload, wheel well, assembly, to rivet, aerodynamic load.

2. a) Check if you know the meaning of the following verbs.

To space, to resist, to reinforce, to rely, to depend, to divide, to cover, to derive.

b) Think of other nouns they can go with. Make up your own sentences with the verbs from *a).*

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

A	*B*
cover	pressure
derive	strengthen
divide	contain
reinforce	split
resist	frame
bulkhead	shield
bay	withstand
assembly	obtain
stress	compartment
house	basis
	unit

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

Started; flexible; different; insufficient; weak; simplify; inner.

5. 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 the 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 of doors, windows, wheel wells, etc.
a) complicated b) improved c) simplified
4. The _____ 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

Speaking

1. Work in group. Imagine that your team is to design a new business airplane for 10 passengers. What type of fuselage answers 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 in a written form.

Three Axes of an Airplane

An aircraft can rotate around three axes which are perpendicular to each other and intersect at the plane's center of gravity (CG). To control the position and direction a pilot must be able to control rotation about each of them.

Vertical axis. The vertical axis passes through the plane from top to bottom. Rotation about this axis is called yaw. Yaw changes the direction the aircraft nose to the left or right. By using the rudder the pilot can cause the airplane to yaw to either side.

Longitudinal axis. The longitudinal axis passes through the plane from nose to tail. Rotation about this axis is called bank or roll. Bank changes the orientation of the aircraft's wing with respect to the downward force of gravity. The pilot changes bank angle by increasing the lift on one wing and decreasing it on the other. This differential lift causes bank rotation around the longitudinal axis. The ailerons are the primary control of bank.

Lateral axis. The lateral axis passes through the plane from wingtip to wingtip. Rotation about this axis is called pitch. The nose and the tail surfaces of the airplane can move up and down around the lateral axis. The pilot can use the elevators to raise or lower the nose of the airplane.

UNIT 10
POWER PLANT

Preparing to Read

1. Work in pairs. Give a definition of a power plant. Suggest various areas of application for power plants.

2. Write down 10 words that may be related to the topic.

Reading

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

1. piston	a. воздушный винт
2. connecting rod	b. цилиндр
3. propeller	c. транспортное средство
4. heat exchanger	d. шатун
5. crankshaft	e. ракетное топливо
6. exhaust	f. поршень
7. vehicle	g. коленчатый вал
8. cylinder	h. теплообменник
9. propellant	i. выхлоп

POWER PLANT

A. One of the most essential parts of any known airplane is its power plant. The aircraft power plant must be more reliable than a power plant used for any other purposes because heavier-than-air machines maintain flight only as long as the power plant functions properly.

B. For the first forty years of powered flight the piston engine was used almost exclusively as it could produce power enough to develop a higher speed compared with other types of engine then existing.

C. Nowadays there are many types of engines in use for various purposes. These engines have one thing in common. The energy is derived from a chemical reaction which takes place inside the engine itself. Therefore all the engines used in aircraft can be classed as internal combustion engines. In general, internal combustion engines may be divided into piston and jet engines.

D. The term "internal combustion piston engines" refers to engines in which air and gasoline are burnt inside the metal cylinders and which drive a rotating crankshaft by means of a piston and connecting rods. Since much heat is produced when the gasoline mixture burns or explodes, some means must be provided to carry away the excessive heat. According to the cooling system employed the piston engines may be classed as air-cooled and liquid-cooled engines.

E. The conventional piston engines are not suitable for speeds in excess of 500 miles per hour because of propeller limitations. It was necessary to develop power plants without propellers in order to drive airplanes at

sonic and supersonic speeds. The modem trend in aircraft power plants is towards jet propulsion primarily because of the increased speeds and great heights possible with jet engines.

F. The term "jet engine" refers to any jet-propulsion device which utilizes air from the atmosphere and together with the combustion of a fuel produces the jet for propulsion. The operating principle is to induct air into the unit, to increase its pressure, to heat it to a high temperature by the combustion of a fuel and then eject the heated air with a high velocity.

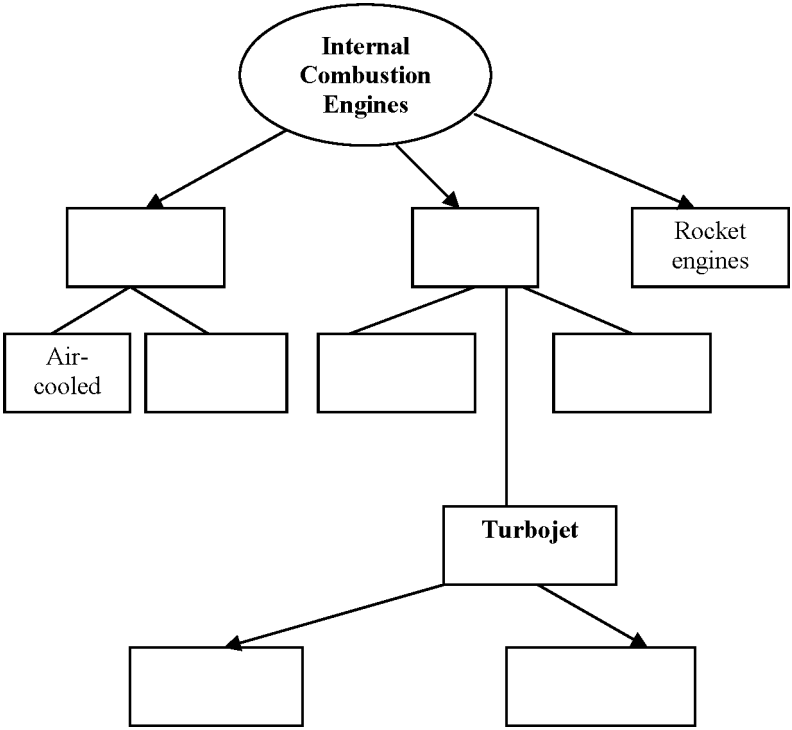
G. Thermal jet engines may be classified into three main groups: the ramjet, the pulsejet, and the turbojet. A number of subdivisions and variations can be made to these main types. For example, jet engines may have a propeller. The combination of a turbine and a propeller is known as a turboprop. The combination of a turbine and a fan is a turbofan engine.

H. The other device that operates on jet principle is the rocket. Rocket engine is a device which is a form jet engine in which all propellants forming the propulsive jet are within the vehicle itself. This is the essential difference between the rocket engine and the turbojets, which rely on atmospheric air to provide its exhaust mass. When used in a vacuum the rocket engine can maintain its thrust as well, and so provide a possible means of propulsion for interplanetary vehicles. Another characteristic of the rocket engine is its ability to provide very high thrust for the small size and weight of a vehicle.

I. The range of jet-propelled planes and rockets is limited by one thing - the weight of fuel that has to be carried. That limitation disappears when the fuel is atomic energy. The problem is to use atomic energy as a source of power. Two of the main problems connected with the use of atomic energy in aircraft are the design of efficient heat exchanger and the development of light shielding material to protect the crew from radiation.

2. Read the text again and write down the words you don't know. Guess the meaning of the words. Compare them with your partner. If you couldn't guess, consult a dictionary.

3. Fill in the diagram with missing information from the text.



Comprehension Check

1. The text has nine paragraphs A-I. Which paragraph mentions:
a) future power plants; b) operating principle of a jet engine c) classification of jet engines.

2. Define the main idea of paragraph A. Find the supporting details that help to develop the main idea.

3. Explain the difference between:
a) piston engine and jet engine
b) rocket engine and jet engine

4. Match the terms with their definitions.

1. In this type of engine energy is derived from a chemical reaction which takes place inside the engine.	a. jet engine
2. This is the combination of a turbine and a propeller.	b. piston engine

3. This type of engine contains propellant components within the vehicle itself.	c. turboprop engine
4. In this type of engine a piston and connecting rods drive a rotating crankshaft.	d. turbofan engine
5. In this type of engine heated air is ejected with a high velocity producing thrust.	e. internal combustion engine
6. This type of engine combines the turbine and the fan.	f. rocket engine

5. Explain the terms in your own words.

Supersonic speed, excessive heat, heat exchanger, vacuum, cooling system.

6. Answer the following questions.

1. What is the most essential part of any airplane?
2. Why were the piston engines almost exclusively used for the first forty years of powered flight?
3. What engines does the term "internal combustion engine" refer to?
4. What is the jet propulsion device?
5. What device can provide interplanetary travel?
6. What is the main limitation for interplanetary travel?
7. What are the main problems connected with using of atomic energy as a source of power?

Vocabulary Focus

1. Match words in A with words B to form the word combinations.

A	B
maintain	speed
jet	engine
exhaust	vehicle
interplanetary	rod
shielding	reaction
operating	flight
sonic	principle
connecting	mass
chemical	material
reliable	propulsion

2. Translate into English.

Отводить избыточное тепло, прямоточный воздушно-реактивный двигатель, защитить экипаж, ограничение, существенное отличие, ЛА тяжелее воздуха, топливная смесь, приводить в движение самолёт, защитный материал.

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

1. The aircraft power plant must be (надёжный).
2. It was needed an airplane possessing (высокие лётные качества).
3. Piston engines are classified according to the (система охлаждения) as (с воздушным охлаждением) and (жидкостным охлаждением) engines.
4. The (традиционный) piston engines are not suitable for speeds in excess of 500 mph.
5. A rocket engine can provide a possible (средство) for interplanetary (транспортное средство).
6. The problem is to use atomic energy as a (источник энергии).
7. One of the main problems is the design of efficient (теплообменник).

4. In the text highlight the words and phrases which mean the same as these phrases.

Safe, to support (A); to obtain, aim (C); operate (D); restriction, airscrew (E); fuel, aircraft (H).

Writing

1. Translate the text in a written form.

Solar sail is a form of spacecraft propulsion using large membrane mirrors. Radiation pressure is small and decreases by the square of the distance from the sun, but unlike rockets, solar sails require no fuel. Although the thrust is small, it continues as long as the sun shines and the sail is deployed.

Solar collectors, temperature-control panels and sun shades are occasionally used as expedient solar sails, to help ordinary spacecraft and satellites make minor corrections to their attitude and orbit without using fuel. This conserves fuel that would otherwise be used for maneuvering and attitude control.

The science of solar sails is well-proven, but the technology to manage large solar sails is still undeveloped. Mission planners are not yet willing to

risk multimillion dollar missions on unproven solar sail unfolding and steering mechanisms. This neglect has inspired some enthusiasts to attempt private development of the technology, such as the Cosmos 1.

The concept was first proposed by German astronomer Johannes Kepler in the seventeenth century. It was again proposed by Friedrich Zander in the late 1920s and gradually refined over the decades.

Speaking

1. You are to prepare a report for student's scientific conference. Proposed topics are:

a) modern trends in aircraft engines

b) spacecraft power plants

In your report you should compare different types of power plants, highlight their advantages and disadvantages, analyze their conformity with purposes of the aircraft. Conduct an investigation to find out some more information.

UNIT 11
THE LANDING GEAR

Preparing to Read

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

THE LANDING GEAR

A. The landing gear (or undercarriage) is intended to support the airplane in proper location for take-off and landing and to provide the shock absorption. The shock is usually absorbed by a sort of pneumatic tyres and shock-absorbing struts. The landing gear usually consists of a pair of wheels carried either from the fuselage or from the wings by a framework of hollow tubes called struts. In addition to these main wheels a support is needed at the rear of a machine. This is a tail wheel (or skid) carried on a swivelling mounting.

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

C. 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.

D. The tricycle landing gear of the aircraft consists of one nose leg and two main legs. The nose leg is mounted under the nose section of the fuselage. The main legs are installed under the wing or the fuselage symmetrically with respect to its centre line. Tricycle gear has many advantages. It simplifies landing, eliminates the danger of nosing over and carries the airplane in normal take-off position. It permits an airplane to land and come to rest within a shorter distance.

E. 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. The 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.

F. 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. The landing gear legs have oleo-pneumatic shock absorbers. The shock absorber comprises an outer steel tube with a welded top head which attaches a plunger.

G. The landing wheels are fitted with large diameter low-pressure tyres which allow the airplane to taxi over rough ground and also 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 braking loads in a fully braked landing.

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

Comprehension Check

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

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

2. Define the main idea of paragraphs *D* and *H*.

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

main legs	oleo unit	to support	to provide
skid		nacelles	nose leg

1. The landing gear is designed _____ the airplane on the ground and _____ the shock absorption.
2. Tricycle landing gear consists of one _____ and two _____.
3. After take-off main legs are retracted into special ____.

4. The tail wheel consists of a single _____.
5. The rear part of some airplanes is supported by the _____.

4. Ask questions to which the following sentences are answers. Remember to use "wh" words: why, what, where, when.

- tricycle landing gears and the 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 the aircraft and crew from damage through static electrical charge.
- by a framework of hollow tubes called struts.

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

Tail skid, low-pressure tyre, aircraft centre line, landing gear well, framework, retractable landing gear.

Vocabulary Focus

1. 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

2. Find in the text antonyms of the following words.

Fixed (A); similar (B); add, complicate (D); straight (G); different, result in, repair (H).

3. 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.

4. Complete the missing part of the table.

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

Writing

1. Match the beginnings and the endings of the sentences.

1. The shock is usually absorbed by …	a) eliminates danger of nosing over.
2. Landing gear with a skid comprises two main wheels located ….	b) prevents the aircraft and crew from damage through static electrical charges.
3. Tricycle landing gear simplifies landing and …..	c) pneumatic tyres and shock absorbing struts.
4. The landing wheels are fitted with…	d) slightly forward of the airplane's centre of gravity and a tail skid at the rear.
5. The tail wheel provides electrical contact and so ….	e) large diameter low-pressure tyres.

Speaking

1. You are a guide of the museum of aviation. Tell a group of the first-year students about different types of landing gear. You may need some more information.

UNIT 12

HELICOPTERS

Preparing to Read

1. Look at the picture and fill in the table. Compare the information from table with your partner.

Helicopter and Airplane	
Similarity	**Difference**

2. Helicopters have many applications in a variety of fields. Brainstorm as many uses of the helicopter as possible.

Reading

1. Read the text to see whether your ideas were correct.

2. Read the text and write out the words and word combinations you don't know, try to guess their meaning from the context. Compare your notes with your partners.

HELICOPTERS

A. Rotary wing aircraft (helicopters) are made to fly by fast-turning blades, or rotors. These aircraft can land in a small space, take off without running along the ground, and hover in the air.

B. The helicopter is a rotary wing aircraft. It depends in flight on the lift generated by one or more rotors. Rotating blades send the airflow downward thus creating lift. It enables the helicopter to take off and land vertically.

C. Besides its main, or lift rotor, the helicopter usually has an auxiliary, or tail rotor. This is a small rotor mounted at the tail to counteract the torque of the main rotor. The tail rotor diverts some part of engine power and lowers the powerplant efficiency.

D. As an aircraft, the primary advantages of the helicopter are due to the rotor blades that revolve through the air, providing lift without requiring the aircraft to move forward the way an airplane does. The lift from the rotor also allows the helicopter to hover in one area for extended periods of time. It is also able to load and unload without actually landing due to hovering capability and special loading equipment. This is one of the greatest advantages as compared to fixed-wing aircraft.

E. Heavy fuel consumption, restricted range and speed make the helicopter impractical for long range transportation. Even the best helicopter makes have an endurance not exceeding 3-4 hours. Among the disadvantages – vibration and noise generated by the rotors.

F. At present helicopters are extensively used for military and peaceful purposes and a result of that there is a great variety of helicopter types and designs.

G. One of the most unusual commercial uses of helicopters is the aerial crane or skycrane. As aerial cranes, helicopters carry loads connected to long cables or slings in order to place heavy equipment such as transmission towers and large air conditioning units on the tops of tall buildings or when an item must be raised up in a remote area, such as a radio tower raised on the top of a hill or mountain, far from the nearest road.

H. Aerial firefighting (or water bombing) is a method to combat wildfires that often uses helicopters. Helicopters may be fitted with tanks or carry buckets or deliver firefighters. Buckets are usually filled by submerging in lakes, rivers, reservoirs, or portable tanks. Helicopters are also used to resupply firefighters on the ground with tools, food, water and other supplies.

I. Helicopters are often used as an air ambulance for emergency medical assistance in situations where either a traditional ambulance cannot easily or quickly reach the scene or when a patient needs to be transported at a distance where air transportation is most practical. Air ambulance crews are supplied with equipment that enables them to provide medical treatment to a critically injured or ill patient.

J. Police departments and other law enforcement agencies use helicopters to search for and pursue suspects. Since helicopters can achieve a unique aerial view and don't need to negotiate ground obstacles, they are often used in conjunction with police on the ground to report on suspects' locations and movements. They are often mounted with lighting and heat-sensing equipment for night pursuits.

K. Military forces use helicopters to conduct aerial attacks on ground targets. Such helicopters are fitted with missile launchers and miniguns. Militaries also use transport helicopters to ferry troops in and out of constrained combat zones where the lack of an airstrip would make transport via fixed-wing aircraft impossible.

Comprehension Check

1. In the text find the main function of a) the main rotor b) the tail rotor.

2. Find in the text pros and cons of using a helicopter.

3. Match the given titles with the corresponding paragraphs. Whatch out! There is an extra title.

1. Civil helicopters
2. Military helicopters
3. Helicopter advantages
4. Tail rotor
5. Creating lift
6. Helicopter features
7. Air ambulance
8. Use of helicopters
9. Helicopter disadvantages
10. Aerial crane
11. Aerial firefighting
12. Helicopters help police.

4. Give your own definitions for the words from the box.

hovering flight	aerial crane	fuel tank	rotor blade;
loading equipment		fuel consumption	

5. Read the text again and decide if these statements are true or false. Correct the false ones.

1. Helicopters are fixed-wing aircraft.
2. Rotating blades send the air stream downward thus creating lift.
3. Helicopters can operate only from well prepared runways.
4. Helicopters are able to load and unload without landing.
5. Helicopters are used for military and peaceful purposes.
6. Function of the tail rotor is to produce additional lifting force.
7. Helicopters can carry loads by means of slings.

6. Look at the text and ask 15 questions to the text.

Vocabulary Focus

1. Match words in A with words B to form the word combinations.

A	B
create	range
take off	consumption
rotating	attack
counteract	lift
loading	blades
fuel	equipment
long	vertically
aerial	torque

2. Make up sentences using word combinations from ex.1.

3. Match the synonyms.

A	B
helicopter	equip
mount	create
airstrip	runway
traditional	rotary-wing aircraft
restrict	conventional
auxiliary	limit
disadvantage	additional
generate	drawback

4. Fill in the table with the proper part of speech derived from the word given.

Noun	Verb	Adjective (Participle)
		counteractive
rotation		
		equipped
	consume	
building		
treatment		
		achieved
transport		

Writing

1. Translate in a written form.

Contra-rotating rotors are rotorcraft configurations with a pair or more of large horizontal rotors turning in opposite directions to counteract the effects of torque on the aircraft without relying on an antitorque tail rotor. Primarily, there are three common configurations that utilize the contra-rotating effect to benefit the rotorcraft; **tandem rotors** are two rotors with one mounted behind the other, **coaxial rotors** are two rotors that are mounted one above the other with the same axis, and **intermeshing rotors** are two rotors that are mounted close to each other at enough angle to allow the rotors to intermesh over the top of the aircraft.

Tandem rotors are two horizontal main rotor assemblies mounted one behind the other with the rear rotor mounted slightly higher than the front rotor. Tandem rotors achieve pitch attitude changes to accelerate and decelerate the helicopter through a process called differential collective pitch. To pitch forward and accelerate, the rear rotor increases collective pitch, raising the tail and the front rotor decreases collective pitch, simultaneously dipping the nose. Yaw control is developed through opposing cyclic pitch in each rotor; to pivot right, the front rotor tilts right and the rear rotor tilts left, and to pivot left, the front rotor tilts left and the rear rotor tilts right.

Coaxial rotors are a pair of rotors turning in opposite directions, but mounted on a mast, with the same axis of rotation, one above the other. The advantage of the coaxial rotor is that, in forward flight, the lift provided by the advancing halves of each rotor compensates for the retreating half of the

other, eliminating one of the key effects of dissymmetry of lift; retreating blade stall. However, other design considerations plague coaxial rotors. There is an increased mechanical complexity of the rotor system because it requires linkages and swashplates for two rotor systems.

Intermeshing rotors on a helicopter are a set of two rotors turning in opposite directions, with each rotor mast mounted on the helicopter with a slight angle to the other so that the blades intermesh without colliding. Intermeshing rotors have high stability and powerful lifting capability.

Speaking

1. You are to organize transportation of a scientific expedition to the impassable forest. What kind of aircraft will you choose? Give your reasons. Tell your partners about your choice.

UNIT 13
THE AIRPLANE DESIGNERS

Preparing to Read

1. Give a definition of the term "airplane designer". Compare your definition with your partner.

2. Tick the words which come to your mind when you think of the airplane designing.

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

3. Before you read the text answer the following questions.

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

Reading

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

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

1. freight	a. усталостная прочность
2. load	b. продуктивность, 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

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

THE AIRPLANE DESIGNERS

A. 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.

B. 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 the aircraft has to be as small and light as safety and efficiency will allow. The designer must calculate the normal load that each part will bear. This specialist is called the "stress man".

C. The stress man's calculations go to the 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 airplane. When a new type of airplane 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.

D. 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.

E. Making the working parts reliable is as difficult as making the structure strong enough. The flying controls, the 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.

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

Comprehension Check

1. 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 airplanes 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

2. 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 designer intended.
2. Two kinds of …. strength tests are carried out.
3. The structure of the 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.

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

4. In the text find the definition of a stress man.

5. Answer the questions:
1. What are the things which make 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 airplanes of new type are destroyed in structural tests?
6. What types of ground strength tests are carried out?
7. Can the airplane fly without government certificate of airworthiness?
8. What are the requirements for the flying controls, the electrical equipment, etc?
9. What must the working parts of the aircraft be?
10. What reason are the new materials being tested for?

Vocabulary Focus

1. 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

2. Find these verbs in the text and write out the words collocate with.

To make, to build, to allow, to calculate, to test, to prove, to separate, to destroy, to result in, to apply.

3. 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 the 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.

Speaking

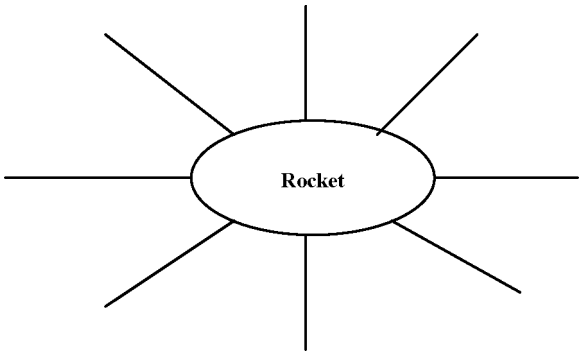
1. Imagine you are a supervisor of a trainee group. Tell them about plane makers and steps of aircraft designing.

UNIT 14

ROCKETS

Preparing to Read

1. Look at the picture and brainstorm all possible terms related to the topic.



2. Work in pairs. Give a definition of the term "rocket". Suggest various areas of application for rockets.

3. Before you read the text, look at these sentences and agree or disagree with them and explain your viewpoint.

1. A rocket is a vehicle designed to leave Earth's atmosphere and operate beyond the surface of the Earth in outer space.

2. Rockets use air-breathing engines.
3. Rockets may have some stages.
4. Rockets can move with the speed much higher than the speed of sound.

Reading

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

1. booster	a. окислитель
2. oxidizer	b. уравнение
3. satellite	c. космический корабль
4. equation	d. момент выгорания топлива
5. propellant	e. вакуум
6. nozzle	f. искусственный спутник Земли
7. spacecraft	g. ракетное топливо
8. vacuum	h. ракета-носитель
9. burn-out time	i. сопло

2. Read the text and check whether your predictions were correct.

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

ROCKETS

A. A rocket is a vehicle which obtains thrust by the reaction to the ejection of fast moving fluid from within a rocket engine.

B. Rockets are used for fireworks and weaponry, as launch vehicles for artificial satellites, and for human spaceflight and exploration of other planets. While they are inefficient for low speed use, they are, compared to other propulsion systems, very lightweight, powerful and can achieve extremely high speeds.

C. In 1903, high school mathematics teacher Konstantin Tsiolkovsky (1857-1935) published the first serious scientific work on space travel. The Tsiolkovsky rocket equation—the principle that governs rocket propulsion—is named in his honor. Tsiolkovsky proposed to use liquid oxygen and liquid hydrogen as a nearly optimal propellant pair and determined that staged and clustered rockets increase the overall mass efficiency would dramatically increase range.

D. Most current rockets are chemically powered rockets. A chemical rocket engine can use gas propellant, solid propellant, liquid propellant, or a

hybrid mixture of both solid and liquid. A chemical reaction is initiated between the fuel and the oxidizer in the combustion chamber, and the resultant hot gases accelerate out of a nozzle (or nozzles) at the rear end of the rocket. The acceleration of these gases through the engine exerts force (thrust) on the combustion chamber and nozzle, propelling the vehicle.

E. Due to their high exhaust velocity (Mach ~10) rockets are particularly useful when very high speeds are required, such as orbital speed (Mach 25). Rockets remain the only way to launch spacecraft into orbit. They are also used to rapidly accelerate spacecraft when they change orbits or de-orbit for landing. There are many different types of rockets.

F. A multistage rocket is the most popular, it uses two or more stages, each of which contains its own engines and propellant. A stacked stage is mounted on top of another stage; a parallel stage is attached next to another stage. Two stage rockets are quite common, but rockets with as many as five separate stages have been successfully launched.

G. By jettisoning stages when they run out of propellant, the mass of the remaining rocket is decreased. This staging allows the thrust of the remaining stages to more easily accelerate the rocket to its final speed and height.

H. In stacked staging schemes, the first stage is at the bottom and is usually the largest, the second stage is above it and is usually the next largest. Subsequent upper stages are above those. In parallel staging schemes solid or liquid rocket boosters are used to assist with lift-off.

I. The main reason for multi-stage rockets and boosters is that once the fuel is burnt, the space and structure which contained it and the motors themselves are useless and only add weight to the vehicle which slows down its future acceleration. By dropping the stages which are no longer useful, the rocket lightens itself. When a stage drops off, the rest of the rocket is still travelling near to the speed that the whole assembly reached at burn-out time. This means that it needs less total fuel to reach a given velocity and/or altitude.

J. An advantage is that each stage can use a different type of rocket motor, with each stage/motor tuned for the conditions in which it will operate. Thus the lower stage motors are designed for use at atmospheric pressure, while the upper stages can use motors suited to near vacuum conditions.

Comprehension Check

1. In the text find the definition of: a) rocket; b) multistage rocket; c) rocket equation.

2. Explain the difference between stacked staging scheme and parallel staging scheme.

3. Define the main idea of paragraphs *D* and *I*. Find supporting details that help to develop the main idea.

4. Complete the sentences with the best option.

1. A rocket is a vehicle which obtains ____ by the reaction to the ejection of fast moving fluid from within a rocket engine.

a) lifting force b) thrust c) power

2. A chemical reaction in a chemical rocket is initiated between the fuel and the oxidizer _____ .

a) in the nozzle b) in the vehicle c) in the combustion chamber

3. When the stages run out of propellant they are jettisoned _____ the rocket.

a) to accelerate b) to assist with lift-off c) to slow down

4. Rockets are particularly useful _____ .

a) because of light weight b) at high altitudes c) at very high speeds

5. In stacked staging schemes the first stage is _____ and is usually the largest, the second stage is above it.

a) at the top b) at the bottom c) not dropped off

5. Work in group. Ask your partners questions concerning the contents of the text.

Vocabulary Focus

1. a) Match the synonyms.

A	B
vehicle	booster
fluid	engine
launch vehicle	aircraft
artificial	fuel
govern	begin
obtain	liquid
propellant	man made
initiate	get
motor	control

b) Make up your own sentences with the words from the column B.

2. In the text find the words with the meaning opposite to these phrases.

Efficient , heavy (B); solid, to decrease (C); deceleration (D); to separate, unusual (F); previous, to prevent (H).

3. a) Make sure that you know the meaning of the following verbs.

To obtain, to explore, to compare, to achieve, to propose, to determine, to exert, to require, to mount.

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

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

Combustion chamber, rocket stage, propellant, booster, vacuum, exhaust velocity, orbit.

5. Fill in the table with the proper part of speech derived from the word given.

Verb	Noun	Adjective (Participle)
		ejected
explore		
	propulsion	
	achievement	
		equal
	determination	
		initiated
	acceleration	
attach		
	container	

Speaking

1. In small groups summarize the main idea of the text and make a short report for your group mates.

2. The history of rockets goes back to the 13th century. People have developed a lot of original designs for different purposes. You are to

prepare a report on the subject for your group mates. Find out some additional information for your topic.

Writing

1. Translate the text in a written form.

A spacecraft is a vehicle designed to leave Earth's atmosphere and operate beyond the surface of the Earth in outer space. Spacecraft may either be unmanned or manned. Spacecraft are designed for a variety of missions which may include communications, earth observation, meteorology, navigation, planetary exploration, space tourism and space warfare. The term spacecraft is also used to describe artificial satellites.

A spacecraft is a system made up of various subsystems, dependent upon mission profile. Spacecraft subsystems may include: attitude determination and control, guidance, navigation, and control, communications, command and data handling, power, thermal control, propulsion, structures, and payload. Manned spacecraft have the additional requirement of providing life support to the crew. Though not being part of the spacecraft itself, the launch vehicle is used to place a spacecraft in orbit.

Spacecraft must be engineered to withstand launch loads imparted by the launch vehicle, and must have a point of attachment for all the other subsystems. Depending upon mission profile, the structural subsystem might need to withstand loads imparted by entry into the atmosphere of another planetary body, and landing on the surface of another planetary body.

Spacecraft need an attitude control subsystem in order that they may be correctly oriented in space and respond to external torques and forces properly. The attitude control subsystem consists of sensors and actuators.

Guidance refers to the calculation of the commands needed to steer the spacecraft where it is desired to be. Navigation means determining a spacecraft's orbital elements or position. Control means adjusting the path of the spacecraft to meet mission requirements.

The communications subsystem, sometimes called the Telemetry, Tracking, and Control subsystem serves as an interface between the spacecraft and the ground system, or between the spacecraft and other spacecraft. The communication subsystem receives telecommands from the ground subsystem, and transmits telemetry from the spacecraft.

Spacecraft need an electrical power generation and distribution subsystem for powering the various spacecraft subsystems. For spacecraft near the Sun, solar panels are frequently used to generate electrical power. Spacecraft designed to operate in more distant locations, for example Jupiter, might employ a Radioisotope Thermoelectric Generator to generate electrical power.

Electrical power is sent through power conditioning equipment before it passes through a power distribution unit over an electrical bus to other spacecraft components. Batteries are typically connected to the bus via a battery charge regulator, and the batteries are used to provide electrical power during periods when primary power is not available, for example when a Low Earth Orbit (LEO) spacecraft is eclipsed by the Earth.

Spacecraft must be engineered to withstand transit through the Earth's atmosphere and the space environment. They must operate in a vacuum with temperatures potentially ranging across hundreds of degrees Celsius. Depending on mission profile, spacecraft may also need to operate on the surface of another planetary body.

Spacecraft may or may not have a propulsion subsystem, depending upon whether or not the mission profile calls for propulsion. Typically though, LEO spacecraft include a propulsion subsystem for altitude adjustments and inclination adjustment maneuvers. Components of a conventional propulsion subsystem include fuel, tankage, valves, pipes, and thrusters.

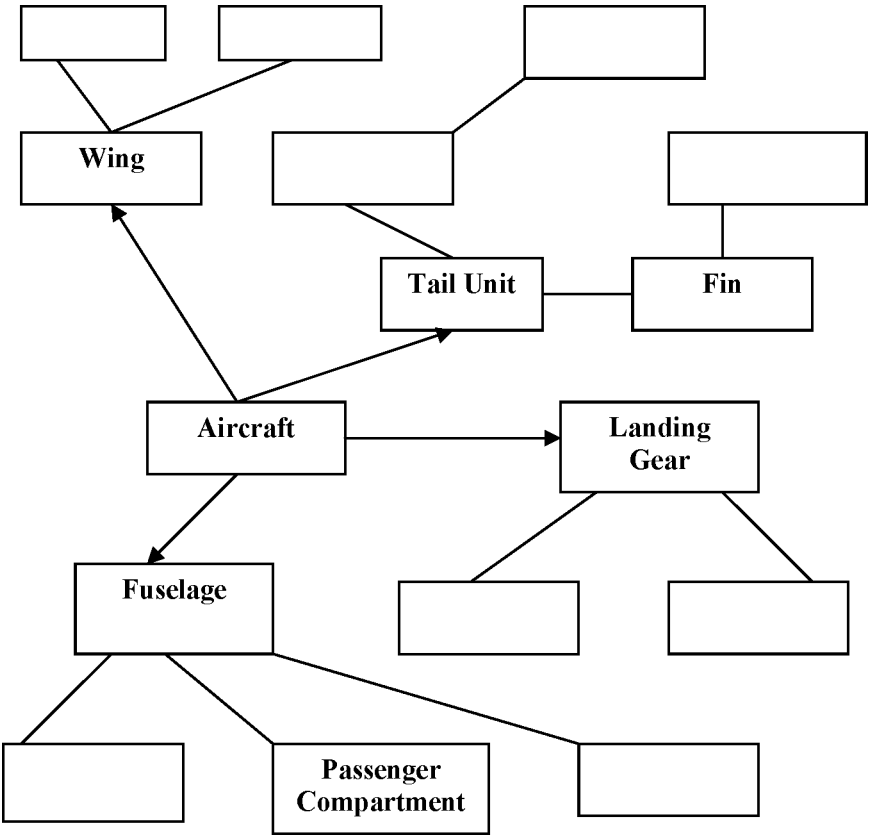
The ground system is also vital to the operation of the spacecraft. Typical components of a ground system in use during normal operations include a mission operation facility where the flight operation team conducts the operations of the spacecraft, a data processing and storage facility, ground stations to radiate signals to and receive signals from the spacecraft, and a voice and data communications network to connect all mission elements.

FINAL TEST

1. Look at these words for parts of a plane.

ailerons	main strut	rudder	stabilizer	flaps
elevators	cockpit	cargo room		nose gear

Now fill in the "word tree" below by putting a term in each box. Some words are filled in for you. Try to give some kind of organization to the tree.



SUPPLEMENTARY READING

A NEW ERA FOR AIRCRAFT

Aviation experts expect that today's aircraft will be replaced with some new form of supersonic transport. A 21st century hypersonic aircraft may open a new age of aircraft design.

The designers of this country displayed the project of such a supersonic passenger liner among the prospective models at the Aerospace Salon held on the old Le Bourget airfield in Paris. An elongated fuselage with a sharp nose and without a horizontal stabilizer makes it look more like a rocket. The speed matches the looks. This plane will fly at a speed five to six times above the speed of sound, e.g. it will cover the distance between Tokyo and Moscow in less than two hours. The diameter of the fuselage will be 4 meters and the overall length - 100 meters, with the cabin accommodating 300 passengers. The future super planes of such a class will have no windows, but the passengers can enjoy watching the panorama of the Earth on the TV monitor at the front of the cabin. They will fly so fast that ordinary aircraft windows would make the structure too weak to withstand the stresses at such a speed. At high velocities the air resistance in the lower atmosphere is so great that the skin is heated to very high temperature, the only way out is to fly higher. Therefore, airliners' routes will mainly lie in the stratosphere.

In general, to build a reliable hypersonic plane one has to overcome a whole set of technological and scientific difficulties. Apart from creating highly economical combined engines and heat-insulating materials designers have to make such an amount of thermodynamic computations that can't be performed without using supercomputers. One of the ways to make planes as economical as possible is lightening the aircraft by substituting new composite materials for conventional metal alloys. Accounting for less than 5 per cent of the overall aircraft weight, the percentage of composite material parts will exceed 25 per cent in new generation models. An extensive use of new materials combined with better aerodynamics and engines will allow increasing fuel efficiency by one-third.

Because of the extreme temperatures generated by atmosphere friction, a hypersonic aircraft will also require complicated cooling measures. One possibility is using cryogenic fuels, such as liquid hydrogen, as both coolants

and propellants. The fuel flowing through the aircraft's skin would cool the surfaces as it vaporizes before being injected into combustion chamber.

In addition, specialists in many countries are currently working on new propeller engines considered much more economical and less noisy than jets. The only disadvantage is that propeller planes fly slower than jet planes. However, it has recently been announced that specialists succeeded in solving this problem. A s a result a ventilator engine with a propeller of ten fiber-glass blades has been built, each being five meters long. It will be mounted in the experimental passenger plane.

Notes to the Text:
1. Le Bourget airfield - аэропорт Ле Бурже
2. the looks - внешний вид
3. heat-insulating materials - теплоизолирующие материалы
4. accounting for - составляя
5. coolant - охлаждающая жидкость

TU-154

The Tu-154 was developed to meet the Aeroflot requirement for a new aircraft to replace the jet-powered Tu-104, plus the Antonov An-10 and Ilyushin Il-18 turboprops. The requirement required economic efficiency on routes from 500 to 3500 km, higher speed than the Tu-104, 50% more passenger capacity, and the ability to operate from runways as short as 2300 meters with low pavement loads.

The Tu-154 first flew on October 4, 1968.

In 1988 modified Tu-154 (dubbed Tu-155 and Tu-156) successfully flew on liquid hydrogen and in 1989 on liquified natural gas used as a fuel in its engines.

The Tu-154 is powered by three rear-mounted low-bypass turbofan engines. All Tu-154 aircraft models have a high thrust-to-weight ratio, this gives them superior performance, although at the expense of poorer fuel efficiency, which became an important factor as the fuel costs grew.

Like the Tupolev Tu-134, the Tu-154 has a wing swept back at 35 degrees at the quarter-chord line. The Tu-154 has an oversized landing gear

enabling it to land on runways with low permissible pavement loadings. The aircraft has two six-wheel main bogies fitted with large low-pressure tyres which retract into pods extending from the trailing edges of the wings, plus a two-wheel nose gear unit. Shock absorbers provide smooth ride on the bumpy airfields.

The passenger cabin accommodates 128 passengers in two-class layout and 164 passengers in single-class layout, and up to 180 passengers in high-density layout.

The plane's avionics suite, for the first time in the Soviet Union, is built to Western airworthiness standards and includes an NVU-B3 doppler navigation system, a triple autopilot, an autothrottle, a Doppler drift and speed measure system (DISS), "Kurs-MP" radio navigation suite and others. Modern upgrades normally include a TCAS, GPS and other modern systems. About 900 of Tu-154s have been built, 500 of which are still in service. Many variants of this airliner have been built.

The **Tu-154M** is the deeply upgraded version, which first flew in 1982 and entered mass production in 1984. It uses more fuel-efficient Soloviev D-30KU-154 turbofans. Together with significant aerodynamic refinement, this led to much lower fuel consumption and therefore longer range. The aircraft has new double-slotted (instead of tripple-slotted) flaps, with an extra 36-degree position (in addition to existing 15, 28 and 45-degree positions on older versions), which allows reduction of noise on approach. It also has a relocated auxiliary power unit and numerous other improvements.

IL-96

The **Ilyushin Il-96** is a four-engined long-range widebody airliner, which incorporates advanced achievements in Russian and foreign aerospace technology. The IL-96-300 aircraft is designed by Ilyushin Aviation Complex. The aircraft is powered by four turbofan two-shaft Aviadvigatel PS-90 engines.

The Ilyushin Il-96 is a shortened, long-range, and advanced technology development of Russia's first widebody airliner, the Ilyushin Il-86. Its fuselage is about 4m shorter than that of the IL-86. The airframe is made with

a new type high-purity aluminium alloy as well as titanium and steel alloys. Quite extensive use is made of composite materials. The upper and lower surfaces of the wing leading edge and the trailing edge, aft of the rear spar are made of honeycomb panels.

It features supercritical wings fitted with winglets, a glass cockpit, and a fly-by-wire control system. It was first flown in 1988 and certificated in 1992.

The IL-96-300 aircraft equipped with modern Russian made avionics which includes six multi functional color-LCD displays, electro remote management system, inertial navigation system, collision air avoidance system and satellite navigation equipment, and equipment permitting executes flights in RVSM conditions. It allows operating the airplane with two crew members. The avionics correspond to modern requirements on international routes in Europe and North America.

The Il-96-300 has a passenger cabin layout for 262 seats, 18 seats with pitch equal to 54 inches plus 244 seats with pitch equal to 32 inches. Galleys are positioned on the upper deck, 18 containers LD-3 and crew rest room are positioned on the lower deck. There is also stipulated a converting of this layout to the 289 seats layout by changing seats in the business class section from 18 to 44 with seats pitch of 34".

UNIT 1

From the History of flying

1. wing – крыло
2. safety – безопасность
3. pressure – давление
4. scientific – научный
5. flow – поток, течь
6. lift (lifting force) – подъёмная сила
7. device – устройство, агрегат
8. development – разработка, развитие
9. control – управление, управлять
10. plane – плоскость, самолёт
11. flight – полёт
12. crew – экипаж
13. altitude – высота
14. range – дальность, диапазон
15. speed – скорость
16. supersonic jet plane – сверхзвуковой реактивный самолёт
17. piston-engined aircraft – самолёт с поршневым двигателем
18. equip, equipment – оборудовать, оборудование
19. armament – вооружение

UNIT 2

Pioneer of Rocket Engineering

1. designer – конструктор
2. artificial – искусственный
3. satellite – спутник
4. spaceship – космический корабль
5. guidance – руководство
6. to graduate from – заканчивать учебное заведение
7. acquaintance – знакомство
8. jet propulsion – реактивное движение
9. participation – участие
10. release – освобождение
11. to appoint – назначать
12. unexpectedly – неожиданно, внезапно
13. to implement – осуществлять
14. gratitude – признательность
15. fruitful – плодотворный

UNIT 3

From the History of Flying Apparatus

1. to force – вынуждать, заставлять
2. to drift – сноситься ветром
3. engine – двигатель
4. balloon – воздушный шар
5. transportation – перевозка
6. scientist – учёный
7. to obtain – достигать
8. radar – радар
9. readings – данные
10. flight – полёт
11. air – воздух
12. distance – расстояние
13. to reach – достигать

UNIT 4

Types of aircraft

1. glider – планер
2. airplane – самолёт
3. helicopter – вертолёт
4. autogiro – автожир
5. missile – реактивный снаряд, ракета
6. power plant – силовая установка

7. air stream – воздушный поток
8. air flow – воздушный поток
9. advance – успех, прогресс
10. engine – двигатель
11. lift (lifting force) – подъёмная сила
12. to propel – двигать, толкать
13. thrust – тяга
14. jet engine – реактивный двигатель
15. arrangement – компоновка, расположение
16. biplane – биплан
17. monoplane - моноплан
18. mid wing monoplane – среднеплан
19. high wing monoplane – высокоплан
20. low wing monoplane – низкоплан
21. fuselage – фюзеляж
22. to attach – прикреплять
23. strut – стойка
24. brace – подкос
25. to take off – взлетать
26. to land - приземляться
27. flying boat – летающая лодка
28. seaplane – гидросамолёт
29. conventional – традиционный, обычный
30. amphibian – амфибия
31. airfoil – аэродинамическая плоскость
32. rotor – несущий винт вертолёта
33. blade – лопасть
34. tractor airscrew – тянущий воздушный винт
35. fuel – топливо

UNIT 5

Airplane Components

1. tail unit (empennage) – хвостовое оперение
2. flight controls – средства управления полётом
3. landing gear (undercarriage) – шасси
4. to propel – двигать
5. nacelle – гондола
6. compartment – отсек, кабина
7. accessories – вспомогательное оборудование
8. cockpit – кабина пилота
9. wing centre-section – центроплан
10. to design – проектировать
11. cargo room – грузовой отсек
12. sweptback – стреловидный
13. trailing edge – задняя кромка
14. aileron – элерон
15. flap – закрылок
16. trimmer tab – триммер
17. fin – киль
18. plane – плоскость, самолёт
19. rudder – руль поворота
20. stabilizer – стабилизатор
21. elevator – руль высоты
22. to hinge – крепить шарнирно
23. to deflect – отклонять
24. wing tip – законцовка крыла
25. longitudinal axis – продольная ось
26. lateral axis – боковая (поперечная) ось
27. attach – прикреплять
28. tricycle gear – трехопорное шасси
29. skid – хвостовая опора
30. retractable – втягивающийся

UNIT 6

Aircraft and some facts about the flight

1. aircraft – летательный аппарат
2. force – сила
3. leading edge – передняя кромка
4. trailing edge – задняя кромка
5. to reduce – уменьшать
6. to compress – сжимать
7. to increase – увеличивать
8. thrust – тяга
9. drag – лобовое сопротивление
10. gravity – сила тяжести
11. to overcome – преодолевать
12. to design – проектировать
13. straight-and-level flight – горизонтальный полёт
14. to result in – приводить к
15. climb – набор высоты
16. descent – снижение

UNIT 7

THE WING

1. wing root – корневая часть крыла
2. to house – вмещать, содержать
3. fuel tank – топливный бак
4. control mechanism – механизм управления
5. bay – отсек, ниша
6. span – размах
7. chord – хорда
8. sweptback wing – стреловидное крыло
9. sweptforward wing – крыло с обратной стреловидностью
10. spar – лонжерон крыла
11. stringer – стрингер
12. beam – балка
13. transverse – поперечный
14. rib – нервюра, ребро
15. skin – обшивка
16. bending – изгиб
17. shear – срез, сдвиг
18. torsion – кручение
19. to reinforce – усиливать
20. spanwise stiffener – продольный элемент жёсткости
21. payload – полезная нагрузка
22. stressed skin – работающая обшивка

UNIT 8

The Tail Group

1. to fit –оснащать, устанавливать
2. tail unit (empennage) – хвостовое оперение
3. stabilizer – стабилизатор
4. elevator – руль высоты
5. fin – киль
6. rudder – руль направления
7. to hinge – крепить шарнирно
8. attitude – пространственная ориентация ЛА
9. directional stability – устойчивость на курсе
10. directional control – управление по курсу
11. auxiliary – вспомогательный
12. adjustable – регулируемый
13. dorsal fin – форкиль
14. balance area – площадь компенсатора
15. hinge moment – шарнирный момент
16. flutter – флаттер

17. dynamic balancing – динамическая балансировка
18. movable – подвижный
19. to avoid – избегать

UNIT 9

The Fuselage Structure

1. landing gear – шасси
2. longerone – лонжерон
3. frame – рама, каркас
4. wheel well – ниша шасси
5. bay – отсек, ниша
6. truss type – ферменный тип
7. to weld – сваривать
8. girder type – балочный тип
9. monocoque type – монококовый тип фюзеляжа
10. semimonocoque type – полумонококовый тип фюзеляжа
11. stringer – стрингер
12. longeron – лонжерон
13. stressed-skin fuselage – фюзеляж с работающей обшивкой
14. stiffness – жёсткость
15. to rivet – клепать
16. bulkhead – шпангоут
17. stress – нагрузка
18. assembly – агрегат, сборка
19. to join – соединять
20. light gauge metal – лёгкий листовой металл

UNIT 10

The Power Plant

1. essential – существенный, неотъемлемый
2. power plant – силовая установка
3. reliable – надёжный
4. to maintain – поддерживать
5. powered flight – полёт с работающим двигателем
6. to derive – получать, извлекать
7. internal combustion engine – двигатель внутреннего сгорания
8. piston engine – поршневой двигатель
9. jet engine – реактивный двигатель
10. crankshaft – коленчатый вал
11. connecting rod – шатун
12. sonic – звуковой
13. supersonic – сверхзвуковой
14. pressure – давление
15. ramjet – прямоточный воздушно-реактивный двигатель
16. pulsejet – пульсирующий воздушно-реактивный двигатель
17. turbojet – турбореактивный двигатель
18. turboprop – турбовинтовой двигатель
19. turbofan – турбовентиляторный двигатель
20. propellant – ракетное топливо
21. jet – реактивная струя
22. exhaust – выхлоп
23. heat exchanger – теплообменник

UNIT 11

The Landing Gear

1. landing gear (undercarriage) – шасси
2. take off – взлёт
3. landing – посадка
4. shock – удар
5. to absorb – поглощать

6. pneumatic tyre – пневматическая шина
7. shock-absorbing strut – амортизирующая стойка
8. framework – каркас
9. strut – стойка
10. tail wheel (skid) – хвостовое колесо, опора
11. tricycle landing gear – трёхопорное шасси
12. nose leg – носовая стойка
13. main leg – основная стойка
14. to nose over – капотировать
15. retractable landing gear – втягивающееся шасси
16. linkage – соединение
17. nacelle – гондола
18. swiveling mounting – шарнирное крепление
19. to withstand – выдерживать
20. fully braked landing – остановка с полным торможением
21. to prevent – предотвращать
22. to damage – повреждать
23. electrical charge – электрический заряд

UNIT 12

Helicopters

1. rotary wing aircraft (helicopter) – вертолёт
2. rotor – несущий винт вертолёта
3. blade – лопасть
4. to hover – зависать
5. auxiliary – вспомогательный
6. tail rotor – рулевой винт
7. to counteract – противодействовать
8. power plant efficiency – КПД силовой установки
9. advantage (disadvantage) – преимущество (недостаток)
10. to revolve – вращаться
11. fuel consumption – расход топлива
12. range – дальность
13. aerial crane – воздушный кран
14. sling – подвешивать, строп
15. to search – искать
16. airstrip – взлётно-посадочная полоса

UNIT 13

The Airplane Designers

1. fuel - топливо
2. radio navigational instruments – радио-навигационное оборудование
3. freight – груз
4. safety – безопасность
5. load – груз
6. to bear – выдерживать нагрузку
7. stress man – инженер по расчёту на прочность
8. sample – образец
9. to test – испытывать
10. to prove – доказать, подтвердить
11. to destroy – разрушать
12. resistance – сопротивление
13. fatigue strength – усталостная прочность
14. to result in – приводить к
15. to result from – вытекать из
16. collapse – разрушаться
17. airworthiness – пригодность к полёту

18. freezing point – температура замерзания

UNIT 14

Rockets

1. vehicle – транспортное средство
2. missile – реактивный снаряд, ракета
3. to eject – извергать, выталкивать
4. launch vehicle – средство выведения на орбиту
5. satellite – спутник
6. equation – уравнение
7. propellant – ракетное топливо
8. oxidizer – окислитель
9. combustion chamber – камера сгорания
10. nozzle – сопло
11. exhaust – выхлоп
12. to launch – производить пуск
13. spacecraft – космический корабль
14. multistage rocket – многоступенчатая ракета
15. stacked scheme – многоярусная схема
16. to attach – крепить
17. to jettison – отбрасывать
18. booster – ракета-носитель
19. lift-off – старт космического корабля
20. burn-out time – момент выгорания топлива
21. altitude – высота
22. condition – состояние, условие

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

1. www.aircraftdesign.com
2. www.nationmaster.com/encyclopedia/Space-Shuttle
3. Поваляева, Н.П. Обучение чтению литературы по специальности «Летательные аппараты»: учебные задания по англ. языку / Н.П. Поваляева, Н.Г. Степнова. – Самара: Самар. гос. аэрокосм. ун-т, 2003.

Учебное издание

Салманова Ольга Борисовна

РАЗВИТИЕ ПРОФЕССИОНАЛЬНЫХ КАЧЕСТВ СТУДЕНТОВ ТЕХНИЧЕСКИХ ВУЗОВ
(АНГЛИЙСКИЙ ЯЗЫК)

Учебное пособие

Подписано в печать 18.11.2010. Формат 60x84 1/16.
Бумага офсетная. Печать офсетная. Печ. л. 5,5.
Тираж 100 экз. Заказ .

Самарский государственный аэрокосмический университет.
443086, Самара, Московское шоссе, 34.

Изд-во Самарского государственного аэрокосмического университета.
443086, Самара, Московское шоссе, 34.