

**Самарский Государственный Аэрокосмический Университет  
Имени академика С.П. Королева**

**Кафедра: Иностранных языков**

**САМОЛЕТОСТРОЕНИЕ**

**Самара 2000**

Составители: Н.Ф. Качанова, Е.Е. Марухина

Самолетостроение: Лабораторные работы по английскому языку /  
Самарский Государственный Аэрокосмический Университет;  
Составители: Н.Ф. Качанова, Е.Е.Марухина. Самара, 2000 \*\*стр.

Лабораторные работы предназначены для студентов 1-2 курсов III и V факультетов. Каждая лабораторная работа включает в себя текст и ряд упражнений по развитию навыков устной речи. Лабораторные работы предусматривают работу над материалом с использованием ТСО в лингафонном кабинете. Выполнены на кафедре “Иностранные языки”.

Печатаются по решению редакционно-издательского совета  
Самарского Государственного Авиационного Университета  
имени академика С.П. Королева

Рецензент

## Лабораторная работа

### “Компоненты самолета.”

1.1 Прослушайте и прочтите текст.

#### AIRPLANE COMPONENTS

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

The power plant is a source of power. It provides power and propels the aeroplane. Nacelles are compartments housing the power plant or engine and its accessories. The engine is really the heart of the airplane.

The fuselage is the main body of the airplane and contains the pilot's compartment (cockpit) and passenger and baggage compartments. The cockpit houses the crew, the flight controls and flight instrument panels.

The wings are the mains lifting surfaces of sweptback shape. Their' function Is to support the aircraft in flight. At the trailing edge of the wing there are movable parts which are called ailerons, flaps and trimmer tabs.

The tail unit (empennage) consists of a vertical stabilizer and rudder and the horizontal stabiliser and elevators.

Three basic flight control surfaces are the ailerons, the elevators, and the rudder. 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 stabilizer 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.

The main landing gear (undercarriage) carries the wheels on which the aircraft moves on the ground. Struts and braces attach it to the fuselage. The landing gear may be retractable and non-retractable.

1.2. Составьте словосочетания из данных слов. Переведите.

Model: axis — lateral axis

- 1) Edge, 2) Unit, 3) Plant, 4) Passenger, 5) Shape, 6) Parts, 7) Stabilizer,  
8) Surface.
- 1) Horizontal, 2) Lifting, 3) Compartment, 4) Sweptback, 5) Trailing,  
6) Movable, 7) structural, 8) Power.

1.3 Переведите слова в скобках:

а/ на русский язык:

1. Силовая установка (Provides) энергией.
2. (Nacelles) - это отсеки, вмещающие двигатель и его вспомогательные элементы.
3. Фюзеляж (Contains) кабину пилота, пассажирский и багажный отсеки.

б/ на английский язык:

1. (Руль направления) Is hinged to the vertical stabiliser.
2. The main landing gear (прикрепляется) by struts and braces to the fuselage.
3. The wings are the main lifting (ПЛОСКОСТИ).

1.4. Ответьте на следующие вопросы:

1. What unit does the airplane consists 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? 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?

### 1.5. Диалог.

Student A. - The airplane, you know, consists of six main components. Name all of them, please.

Student B. - Oh, sure. I know them. They are the power plant, the fuselage, the wings, the tail unit, the controls, and the landing gear.

Student A. - We study all principal airplane structural units, and we are taught that the heart of the plane is its engine. That's right, it provides power and propels the plane

Student B. - And what do you think of the fuselage? Isn't it very important, too?

Student A. - It is. Because it houses the crew, passengers, instruments, controls, and besides, it is the central body of the aeroplane.

Student B. - I see, you know the lesson well. And what is the principal part, which produces the lift?

Student A. - You means the wings. Of course, they are supporting and lifting surfaces of the aeroplane.

-And what components are responsible for airplane motion?

Student B. - The controls are, I think. They include rudder, elevators, and ailerons.

-And what provides stability and control of the aero plane?

Student A. - To my mind, it is the tail unit, which provides stability and control.

Student B. - And don't forget of the landing gear, it is rather important, too, it supports the airplane on the ground, doesn't it?

Student A. - Yes, it does. I see you know the plane components well.

1.6. Прослушайте текст снова. Попробуйте пересказать его. Дайте определение всех основных частей самолета.

1. The power plant. It is the heart of the airplane. Its function is to provide power and propel the airplane.
2. The fuselage is the central body of the aeroplane. It houses all the passengers, crew, cargo and equipment.
3. The wings are supporting and lifting surfaces of the aeroplane. The function of the wings is to produce lift and support the aeroplane in the air.
4. The tail unit provides stability and control of the aeroplane. Hence its function is to provide stability and control of the aeroplane.
5. The controls. Three basic flight control surfaces are the ailerons, the elevators, and the rudder. They provide the control of the airplane about longitudinal, lateral and vertical axis.
6. The landing gear is a structure, which supports the aeroplane on the ground. Its function is to support the plane on the ground and to reduce shocks of landing.

## Лабораторная работа “Вертолеты.”

2.1. Прослушайте, повторите и запомните следующие слова:

1. Rotary wing – несущее крыло
2. Fixed wing – неподвижное крыло
3. Propulsion system – витомоторная группа
4. Drive system – несущий и толкающий винты с приводной системой
5. Blade – лопасть, лопатка
6. Aircraft – вертолет
7. Advantage - преимущество
8. Disadvantages, limitation - недостаток, ограничение
9. As compared - по сравнению
10. Inaccuracy (accuracy) - неточность /точность/
11. Due to - благодаря
12. As a result - в результате
13. Performance - лётные данные, характеристики
14. Sero - ноль
15. Payload - полезный груз
16. Independence - независимость
17. Inaccessible (accessible) - недоступный/доступный/

2.2. Прослушайте и прочтите вслух следующие слова:

а/ с ударением на первом слоге;

Copters, system, runway, operate, hover, rotary, aero, area, accurate, military, accuracy.

б/ с ударением на втором слоге;

Propulsion, advantage, compared, extensively, dependence, accessible, vibration.

2.3. Прослушайте чтение каждого предложения, повторите его за диктором и постараитесь понять его содержание со слуха:

- 1) Helicopters are called rotary-wing aircraft.
- 2) There is a great variety of helicopter type and designs.
- 3) Rotor blades send the airstream downward thus creating lift.
- 4) Helicopters can move in any direction.
- 5) Hovering in the air is the greatest advantage of helicopters.
- 6) Their speeds amount from zero to more than 300 kmph.

2.4. Подберите английские эквиваленты:

- |                     |                   |
|---------------------|-------------------|
| 1. несущее крыло    | 1. Tail propeller |
| 2. лопасть          | 2. To hover       |
| 3. висеть в воздухе | 3. Rotary wing    |
| 4. хвостовой винт   | 4. Blade          |
| 5. лётные данные    | 5. Advantage      |
| 6. полезный груз    | 6. Performance    |
| 7. преимущество     | 7. Payload        |

2.5. Сгруппируйте слова, противоположные по значению:

- |               |                 |
|---------------|-----------------|
| 1. To load    | 1. Horizontal   |
| 2. Vertical   | 2. Downward     |
| 3. Upward     | 3. To unload    |
| 4. civil      | 4. disadvantage |
| 5. movable    | 5. independence |
| 6. advantage  | 6. military     |
| 7. dependence | 7. fixed        |

2.6. Подберите термины к словосочетаниям:

- |  |                           |
|--|---------------------------|
| 1. an aircraft with rotarywing capable<br>to hover in the air                                | 1. an operator            |
| 2. an aircraft with wings attached<br>to the fuselage  | 2. a propulsion system    |
| 3. an aircraft with high speeds<br>short take-off and landing capabilities                   | 3. a fixed-wing aircraft  |
| 4. a member of the helicopter's crew attending<br>to loading, observation, photography etc.  | 4. a civil helicopter     |
| 5. a system consisting of the engine, rotary-wing,<br>drive system and main tail propellers. | 5. a rotary-wing aircraft |
| 6. helicopters used for a variety<br>of peaceful purposes, aircraft.                         | 6. a high-performance     |

2.7. Прочтите и переведите:

- |    |                        |    |                          |
|----|------------------------|----|--------------------------|
| a) | 1. in any direction    | b) | 1. before flight         |
|    | 2. in the air          |    | 2. before landing        |
|    | 3. in the category     |    | 3. after starting engine |
|    | 4. in the cargo cabin  |    | 4. after cooling engine  |
|    | 5. in hovering .flight |    | 5. after loading         |
|    | 6. in areas            |    | 6. after hovering        |

2.8. Прослушайте текст и постараитесь понять его содержание:

### HELICOPTERS

Helicopters or as they are often called copters are rotarywing aircraft while conventional airplanes are fixed-wing aircraft.

Propulsion system of a helicopter consists of the engine, rotary-wing and drive system, the main horizontal or/and vertical tail propellers which cause the helicopter to fly. Rotating blades send the airflow (airstream) downward thus creating lift. It enables the helicopter (aircraft) to take off and land vertically. The helicopter needs no runways. It can operate from small unprepared areas. It's also able to load and unload without actually landing due to (because of) its hovering capability and special loading equipment. This is one of its greatest advantages as compared to fixed-wing planes.

As for some of its disadvantages we mark its slow speed inaccuracy due to its vibration as well as noise generated by the rotors.

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

Helicopters are capable of high performances. Speeds for rotary craft range from zero (in hovering flight) to more than 300 kmph. They can reach 5,500 m (10,000 feet) above the ground but normally they operate at ground level. Payload of large helicopters amounts to 50 tons.

The crew necessary for operation consists of the pilot alone or two-three or more members pilot and copilot who does the navigation's duties, board engineer and an operator. So in all the cases the advantage of the helicopter namely its independence from airfields allows it to reach and do the work in areas inaccessible for fixed-wing aircraft.

2.9. Ответьте на вопросы:

- 1) Are helicopters rotary-wing aircraft?
- 2) Do conventional airplanes have fixed wings?
- 3) Can helicopters take off and land vertically?
- 4) Can helicopters move in any direction?
- 5) Can they operate from small unprepared areas?
- 6) Is a helicopter able to load or unload without landing?
- 7) Is it a great advantage?
- 8) Is the speed of helicopters high?
- 9) What is the range of copters?
- 10) What level do they normally operate at?
- 11) What crew can a helicopter have?
- 12) Are copters divided into civil and military?
- 13) Helicopters are effective machines, aren't they?

2.10. Задайте вопросы с данными вопросительными словами:

- 1) Helicopters are rotary-wing aircraft. (what kind of?)
- 2) Rotating blades send the airstream downward. (where?)
- 3) Helicopters can land and take off vertically. (How?)
- 4) Copters normally operate at ground level. (at what?)
- 5) There are civil and military helicopters. (what kind?)
- 6) Copters can operate from small unprepared areas. (from what?)

2.11. Исправьте утверждения, если они не соответствуют действительности:

- 1) Helicopters are fixed-wing aircraft, aren't they?
- 2) Rotating blades send the air stream upward, thus creating lift.
- 3) Helicopters can operate only from concrete runway.
- 4) Copters are able to load and unload without actually landing.
- 5) Rotary-wing aircraft are characterized by supersonic speeds.
- 6) Helicopters' propulsion system differ from that of the conventional aircraft.
- 7) Only a crew of six can operate a helicopter.

2.12. Перескажите текст "Вертолёты".

## **Лабораторная работа** **“The A, B, C, D health Check-up.”**

3.1. Прослушайте, повторите и запомните следующие слова:

1. To subject to – подвергать чему-либо
2. Airframe – каркас
3. To occur – происходить, случаться
4. Intermediate – промежуточный, средний
5. Access panel – крышка смотрового люка, смотровая панель
6. Fluid servicing – заправка гидравлической системы
7. Lubrication – смазка
8. To remove – снять, убрать
9. To undertake – предпринять, совершать
10. Prevention – предотвращение, предупреждение
11. To return – вернуть
12. Appearance – внешний вид
13. Thorough – тщательный
14. Refurbish – восстанавливать, обновлять

3.2. Прочтите и переведите следующие слова:

а) интернациональные

Inspection, variation, avionics, condition, approximately, detail, portion, corrosion, ulterior, to determine, examination, term

б) сложные

Lifetime, narrowbody, airframe, manhours, half-life, halfway

3.3. Переведите производные

To move - remove, vary - variation - variant- variable, determine - determination lubricate - lubrication - lubricant serve - service - servicing take - undertake prevent - prevention

3.4. Подберите английские эквиваленты

- |                         |   |
|-------------------------|---|
| 1. Narrowbody jet       | 1. Первоначальное состояние             |
| 2. To subject           | 2. Предупреждение коррозии              |
| 3. General condition    | 3. Подвергать                           |
| 4. Corrosion prevention | 4. Заправка гидравлической системы      |
| 5. Fluid servicing      | 5. Общее состояние                      |
| 6. Original condition   | 6. Внешний вид самолета                 |
| 7. Aircraft appearance  | 7. Реактивный самолет с узким фюзеляжем |

3.5. Прослушайте текст, постараитесь понять его содержание

In its lifetime a new narrowbody jet's airframe and engines should be subjected to the following routine checks with some variations in times:

A - check occurs about every 150-flight hour and is a primary examination of the airframe, avionics, engines, and accessories to determine the general condition of the aircraft. The aircraft may be on the ground for eight hours and require about 60 manhours of work.

B - check occurs about every 700 flight hours and is an intermediate inspection- It includes selected operational checks, fluid servicing and some lubrication tasks. It will include an A - Check. The aircraft is on the ground for about eight hours and requires approximately 200 manhours of work.

C - check occurs about every 3.000 flight hours and is a detailed inspection of the airframe, engines and accessories. Some access panels will be removed and the areas inspected. Heavy lubrication will be undertaken on this inspection. Generally *ibis* check includes a portion of the corrosion protection programme. Aircraft appearance work will also be done. This type of inspection will include an A - Check and a B - Check. The aircraft will be on the ground for 72 hours and will utilize about 3.000 manhours.

D - check or heavy maintenance check-, occurs about every 20.000 flight hours, it is a major overhaul which returns the aircraft to its original (or zero-rated) condition to the extent possible. It comprises a thorough examination of the entire aircraft. The interior is completely removed along with many

components. What cannot be removed is inspected and refurbished in place. When the temi half-life is used, it generally means halfway between D - checks. The aircraft is on the ground for about 30 days and will require approximately 20.000 manhours of maintenance.

3.6. Составьте словосочетания из данных слов:

- a) Check, condition, inspection, panel, prevention, servicing, examination
- b) Original, fluid, routine, access, detailed, corrosion, intermediate, primary, general

3.7. Соедините части предложений:

- |   |  |
|---|--|
| 1. What cannot be removed ...                                   | 1. ... To original condition                                 |
| 2. Some access panels ...                                       | 2. ... Is inspected and refurbish m place                    |
| 3. It is a major overhaul<br>whichreturns the aircraft...       | 3. ... Will be undertaken on this inspection                 |
| 4. C - check occurs about every<br>3000 flight hours and is ... | 4. ... a primary examination of the aircraft                 |
| 5. Heavy lubrication ...  | 5. ... will be removed and the areas inspected               |
| 6. A new narrowbody jet's airframe<br>and engines ...           | 6. ... a detailed inspection of the<br>aircraft              |
| 7. A - check occurs about<br>every 150 flight hours and is ...  | 7. ... will be subjected to the<br>following routine checks. |

3.8. Вспомните предложения, в которых употреблены следующие слова и словосочетания:

Fluid servicing, will be subjected to, to determine the general condition, intermediate inspection, half-life, a detailed inspection, 200 manhows of work, a major overhaul.

3.9. Ответьте на вопросы к тексту

- 1. What is the most frequent check to which the aircraft is subjected?
- 2. Which of the checks is the most detailed and complete?
- 3. What procedures does the A - check, B - check, C - check, D - check include?
- 4. Which of the checks includes a portion of the corrosion prevention programme?
- 5. How many types of routine checks are described m the text?

**Лабораторная работа**  
**“Эксплуатация самолетов.”**

4.1. Прослушайте и повторите следующие слова и выражения:

- 1. Accident - несчастный случай
- 2. To foresee - предвидеть
- 3. Objective - цель
- 4. Technique(s) - технология, технические приёмы
- 5. Vital - /жизненно/ важный
- 6. Eddy currents - вихревые токи
- 7. Fatigue - усталость
- 8. Flaw detection - дефектоскопия
- 9. Fuel servicing - заправка топливом
- 10. Mooring - крепление
- 11. Non-destructive testing - испытание без разрушения
- 12. Overhaul period - межремонтный период
- 13. Tolearant - устойчивый, выносливый
- 14. Towing - буксировка

4.2. Прочтите, переведите следующие слова:

Standard, effective, practical, period, organization, critical, problem, type, component, procedure, operation, corrosion, inspection, examination, general, routine.

4.3. Подберите эквиваленты:

- |                    |                        |
|--------------------|------------------------|
| 1. Overhaul period | 1. важный              |
| 2. Towing          | 2. крепление           |
| 3. Fatigue         | 3. несчастный случай   |
| 4. Vital           | 4. межремонтный период |
| 5. To foresee      | 5. усталость           |
| 6. Accident        | 6. устойчивый          |
| 7. Mooring         | 7. буксировка          |
| 8. Tolerant        | 8. предвидеть          |

4.4. Переведите производные:

Accident - accidental

To foresee - unforeseen

Probable - probability

To tolerate - tolerant - tolerance

To vary - variety; to guide - guidance.

4.5. Подберите синонимы:

- |                |            |
|----------------|------------|
| 1. possible    | various    |
| 2. different   | common     |
| 3. period      | injury     |
| 4. general     | important  |
| 5. vital       | purpose    |
| 6. damage      | interval   |
| 7. discover    | probable   |
| 8. objective   | production |
| 9. manufacture | defect     |

4.6. Прослушайте, переведите текст:

High standard maintenance of aircraft in service is a vital task of every airline, because this is the only way to provide passengers' safety and a long life of the aircraft and its various components.

A practical guidance for effective maintenance aimed at continued safe operation of an aircraft is usually provided by the manufacturers.

However there are general procedures performed on all types of aircraft. These procedures include different types of examination, fuel and oil servicing, hydraulic system charging, aircraft mooring and covering in case of parking, aircraft towing, operation and maintenance of an engine and its accessories.

All types of examination must be performed at definite service periods. Inspections, checks (station checks, routine checks, fast checks) and over hauls are common types of examining aircraft.

The probability of failure increases significantly with the age of the aircraft. Consequently, the older the aircraft, the shorter overhaul periods.

It's the task of a designer to make aircraft tolerant to fatigue corrosion and accidental damage. But still an aircraft enters service with all the problems that were unforeseen by the designers and with all possible defects built-in during manufacture. Inspection procedures must be effective in discovering these defects before they become critical. Inspection technique plays a vital role in it. A great variety of non-destructive techniques are now available, namely radiography, ultrasonic techniques, eddy current flaw detection. The advantage of these methods is that they allow the inspection of structures without disassembly.

All maintenance procedures are aimed at preserving the aircraft failure tolerance and at preventing the failures which cannot be tolerated.

4.7. Составьте словосочетания из следующих групп слов /группы "а" и "б"/, переведите их:

- a) practical, safe, overhaul, critical, inspection, unforeseen, routine, fuel, hydraulic, ultrasonic;  
6) consumption, charging, defects, problems, system, operation, check, guidance, periods, techniques.

4.8. Подберите термины к определениям:

- 1) Weakness in metals due to prolonged stress.
- 2) Cables chains etc. by which aircraft are secured.
- 3) The process of pulling the aircraft along by a cable or chain.

- 4) Measures aimed at keeping aircraft in good working order.
- 5) Method(s) of doing something expertly.
- 6) Visual examination of an aircraft or its components.

4.9. Ответьте на вопросы:

- 1) Who provides a practical guidance for effective maintenance of an aircraft?
- 2) What maintenance procedures are typical of all types of aircraft?
- 3) How does the probability of failure depend on the age of an aircraft?
- 4) What are the common types of aircraft examination?
- 5) What non-destructive methods do you know?
- 6) What is the advantage of non-destructive methods.

4.10. Прочтите текст, догадайтесь о значении подчёркнутых слов. Переведите текст.

#### AIRCRAFT TOWING

The aircraft can be towed by "a tractor or truck with the aid of "bowing appliances at a speed of not over 2 5 kmph. The aircraft can be towed either with the nose or tail forward.

To tow the aircraft with the nose forward, use is made of a towing bar which is secured to the nose gear unit.

During towing, a mechanic controls the brakes in the cockpit; one man walks beside the towing bar and two men walk at the wing tips.

To tow the aircraft with the tail forward use is made of a towing cable which is fastened to the main shock struts. Towing is performed at a minimum speed of the towing vehicle. Two men support the towing cables, two men walk at the wing tips and two men control the nose leg wheels.

4.11. Расскажите о целях и способах технического обслуживания самолётов.

### Лабораторная работа “Hydraulics.”

5.1. Прослушайте, повторите и запомните: следующие слова:

1. To actuate - приводить в движение
2. To subject - подвергать
3. To remain - оставаться
4. Viscosity - вязкость, тягучесть
5. Internal - внутренний
6. To prevent - предотвращать, препятствовать
7. To define - определять
8. Detonation - повреждение, износ
9. To ignite - воспламенять
10. Combustion - горение

5.2. Прочтите и догадайтесь о значении следующих слов:

Oxidation, momentarily, various, gasoline, to afreet, selection, resistance, container, stability, direction, volume, mineral oil, vegetable oil.

5.3. Сгруппируйте слова, противоположные по значению:

Low, hot, compressible, slowly, at rest, broad, internal.  
In motion, incompressible, high, external, cold, quickly, narrow.

5.4. Переведите производные:

Press- pressure - compressible - incompressible  
Transmit - transmission  
Resist - resistance  
Select - selection  
Deteriorate - deterioration

Ignite - ignition

Exceed - exceeding – exceed

Dingly desire - desirable

5.5. Подберите английские эквиваленты:

- |                                   |                                |
|-----------------------------------|--------------------------------|
| 1) оказывать одинаковое давление  | 1) branch of science           |
| 2) крайне важно                   | 2) to deal with the properties |
| 3) закон гласит                   | 3) exceedingly important       |
| 4) изучать свойства               | 4) sufficient quantity         |
| 5) ограниченное количество        | 5) presently in use жидкости   |
| 6) раздел науки                   | 6) confined body of fluid      |
| 7) достаточное количество         | 7) to exert equal pressure     |
| 8) используется в настоящее время | 8) the law states              |

5.6. Прослушайте текст и постараитесь понять его содержание.

### Hydraulics

Hydraulics is that branch of science, which deals with the properties of liquids and how they can be used to do work. One of the most important properties of a liquid to be used in a hydraulic system is its viscosity. Viscosity is the internal resistance of a fluid, which tends to prevent it from flowing. A liquid, such as gasoline, has a low viscosity, and tar has a high viscosity and flows slowly. The viscosity of a liquid is affected by changes in temperature. A liquid flows more easily when hot than when cold. A good hydraulic fluid will have a low viscosity at all temperatures. Chemical stability is also exceedingly important in the selection of a hydraulic fluid. It is defined as the liquid's ability to resist oxidation and deterioration for long periods.

Flash point is the temperature at which a liquid gives off vapor in sufficient quantity to ignite momentarily. A high flash point is desirable for hydraulic fluid because it provides a good resistance to combustion.

Liquids are used in hydraulic systems primarily to transmit and distribute forces to the various units to be actuated. Liquids are able to do this because they are almost incompressible. This means that the volume of a given quantity of a liquid will remain constant even though it is subjected to high pressure.

Many different liquids have been tested for use in hydraulic systems. The liquids that are presently in use include mineral oil, vegetable oil and phosphate esters. The basic principle of hydraulics is expressed in Pascal's Law, formulated by Blaise Pascale, a French mathematician, in the 17 century. This law states that a confined body of fluid exerts equal pressure at every point and in every direction in the fluid, and it acts at right angles to the enclosing walls of the container, with any increase in the pressure.

Примечания к тексту:

- 1) Tar - деготь, смола
- 2) Flashpoint - точка воспламенения
- 3) Phosphate ester - сложный эфир

5.7. Вспомните предложения, в которых употребляются следующие слова и словосочетания:

Properties, to transmit forces, remain constant, viscosity, gasoline, chemical stability, to ignite momentarily, hydraulic systems.

5.8. Подберите термины к словосочетаниям:

- |   |                    |
|---|--------------------|
| 1) The internal resistance of a fluid<br>to prevent it from which tends flowing.                              | flashpoint         |
| 2) The liquid's ability to resist oxidation<br>and deterioration for long periods.                            | hydraulics         |
| 3) The branch of science which deals with the<br>properties of liquids and how they can be<br>used to do work | chemical stability |
| 4) The temperature at which a liquid gives off<br>vapor in sufficient quantity to ignite momentarily          | viscosity          |

5.9. Составьте словосочетания из данных слов:

Model: systems - hydraulic systems

- 1) Liquids, 2) fluid, 3) stability, 4) quantity, 5) oil, 6) principle, 7) pressure.
- a) Basic, b) hydraulic, c) equal, d) chemical, e) mineral, f) sufficient,
- g) incompressible.

5.10. Исправьте утверждения, если они не соответствуют действительности.

- 1) A liquid flows less easily when cold than when hot.
- 2) A liquid such as gasoline has a high viscosity and flows slowly.
- 3) A high flash point prevents fluid from good resistance to combustion.
- 4) A good hydraulic fluid will have a low viscosity at high temperatures.
- 5) Mineral oil is the only liquid presently in use in hydraulic systems.
- 6) Liquids are used in hydraulic systems to provide a good resistance to combustion.

5.11. Ответьте на вопросы:

- 1) What is hydraulics?
- 2) What are the most important properties of liquids?
- 3) What is viscosity?
- 4) How does the temeratures affect the viscosoty of a liquid?
- 5) What is chemical stability?
- 6) What flashpoint is desirable for hydraulic fluid?
- 7) What liquids are presently in use in hydraulic systems?
- 8) What is the basic principle of hydraulics?

5.12. Прочтите текст, догадайтесь о значении подчеркнутых слов.

Переведите текст.

The word hydraulics is a derivative of the Greek words "Hydro"- meaning water and "aulis"- meaning tube or pipe. Originally, the science of hydraulics covered the physical behavior of water at rest and in motion. This dates back several thousand years ago when water wheels, dams and sluice gates were first used to control the flow of water for domestic use and irrigation. Use has broadened its meaning to include the physical behavior of all liquids, this includes that area of hydraulics in which confined liquids are used under controlled pressure to do work. This area of hydraulics is sometimes referred to as "power hydraulics".

5.13. Какую информацию из текста можно включить в рассказ о гидравлике.

5.14. Расскажите о том, что представляет собой гидравлика.

### **Лабораторная работа “Inspection and maintenanceof hydraulic system.”**

6.1. Прослушайте, повторите и запомните следующие слова.

1. Fitting - соединение
2. Leak - утечка
3. Damage - повреждение, авария
4. Crack - трещина
5. Scratch - царапина
6. Dent - выбоина, впадина, вмятина
7. Approved - испытанный, проверенный
8. Heel of a bend - изгиб
9. To replace - заменять
10. To repair - ремонтировать

6.2. Прочтите и догадайтесь о значении следующих слов:

To inspect, regular, interval, extensive, line, to localize, section, defect, diameter, manufacturer, technician, specification.

6.3. Сгруппируйте слова противоположные по значению:

Entirely, regular, extensive, to obtain, available, irregular, partially, small, to give, unavailable.

6.4. Переведите производные:

To inspect - inspection

Care - careful - carefully

To place - to replace - replaced - replacement

Locals - localize - localized

Permit - permissible

Thick - thickness

6.5. Подберите английские эквиваленты:

1. Треснутий диффузор

1. In the heel of the bend

2. на изгибе

2. At regular intervals

3. Руководство по эксплуатации .

3. Tube wall thickness

4. Через определенный промежуток времени

4. Cracked flare

5. Разболтанное (незатянутое) соединение

5. Severe die marks

6. Толщина стенки трубы

6. Loose mounting

7. Maintenance manual

6.6. Прослушайте текст и постараитесь понять его содержание.

#### Inspection and Maintenance of Hydraulic Systems

Lines and fittings should be inspected carefully at regular intervals for leaks, damage, loose mounting, cracks, scratches, dents and other damage. Assemblies with damage should either be replaced entirely or repaired. If extensive damage exists, the entire line should be replaced. If the damage is localized, it is permissible to cut out the damaged section and insert a new section with the approved fittings.

The following defects are not acceptable for metal lines.

1. Cracked flare or sleeve.
2. Scratches or nicks greater than 10% of the tube wall thickness or in the heel of the bend.
3. Severe die marks, seams, or splits.
4. A dent of more than 20 per cent of the tube diameter or in the heel of a bend.

It is of the utmost importance that damaged assemblies be replaced with the proper material.

Specifications can be obtained from the manufacturer's maintenance manual. If these are not available, it is the technician's responsibility to see that the standards set by the manufacturer are rigidly followed.

6.7. Вспомните предложения, в которых употреблялись следующие слова и словосочетания:

inspected carefully, assemblies with damage, to cut out the damaged section, proper material, maintenance manual.

6.8. Составьте словосочетания из данных слов:

Model: systems - hydraulic systems

- |              |              |
|--------------|--------------|
| 1. Intervals | 6. Sleeve    |
| 2. Mounting  | 7. Thickness |
| 3. Damage    | 8. Marks     |
| 4. Defect    | 9. Diameter  |
| 5. Flare     | 10. Manual   |

Maintenance, localized, acceptable, tube, die, loose, cracked, regular, extensive, wall.

6.9. Исправьте утверждения, если они не соответствуют действительности:

1. Lines and fittings should be sometimes inspected for leaks, damage, and cracks.
2. Assemblies with damage should be at once cut out and replaced with the approved fittings.
3. Some defects are acceptable for metal lines.
4. It is of the utmost importance that damaged assemblies be replaced with the proper material.
5. It is the pilot's responsibility to see that the standards set by the manufacturer are rigidly followed.

6.10. Ответьте на вопросы.

1. What for should the lines and fittings be inspected?
2. What should be done with damaged assemblies?
3. What defects are not acceptable for metal lines?
4. What is of the utmost importance in inspection and maintenance of hydraulic systems?
5. Who is responsible for the strict following of the manufacturer's maintenance manual?

6.11. Расскажите по-английски об осмотре и эксплуатации гидравлических систем.

### **Лабораторная работа** **“Early development of aviation electronics.”**

7.1. Прослушайте и запомните следующие слова:

1. flight instruments -авиационные приборы
2. early stage -начальная стадия
3. a visible horizon -видимый авиагоризонт
4. sufficient-достаточный
5. endurance -срок службы, долговечность
6. distant weather condition - погодные условия
7. capacity-способность
8. zero-visibility -отсутствие видимости
9. departure -отправление, отклонение
10. destination - место назначения
11. sensitive - чувствительный
12. gyroscope - гироскоп
13. frequency - частота
14. transmission - передача
15. landing guidance system - система управления посадкой

7.2. Переведите следующие интернациональные слова:

Method, navigation, pilot, instruments, radio, sensitive, systems, evolutionary process, to stabilize, gyroscope, miniature, symbolic, parallel.

7.3. Переведите производные:

1. Require - requirement - required
2. Develop - developing - developed - development
3. Satisfy -satisfactory - satisfaction
4. Equip - equipment
5. Rely - reliable - reliability
6. Receive - receiver - reception

7.4. Дайте эквиваленты к следующим словам:

Importance	приёмник
Equipment	развитие
Development	гироскоп
Sufficient	оборудование
Capacity	появляться
Appear	важность
Artificial	включать

Receiver	достаточный
Involve	развитие

### 7.5. Early development of aviation electronics

Like the development of airplane, the development of flight instruments and aircraft navigation equipment has been an evolutionary process.

In early stages of aviation history, pilots and their aircraft required calm winds for flight.

Then, as aircraft technology developed, a visible horizon was sufficient for safe night.

But as the endurance of aircraft increased the importance of distant weather conditions also increased and more advanced equipment was required.

The ability to fly in all types of weather and primarily the capacity for zero-visibility flying- was a necessity.

Zero - visibility flying requires three navigation systems of instruments.

First, there must be a way of aligning the aircraft with the horizon.

The second requirement for zero-visibility flying is a reliable method of measuring altitude.

The third requirement is a method of navigation that does not involve ground contact from the departure point to the destination point.

The first requirement for zero-visibility flight is met by the artificial horizon, an instrument (with a blue and brown disk) that is stabilized by a gyroscope.

The disk appears as a miniature horizon and a pilot aligns a small symbolic aircraft so that it is parallel to the artificial horizon.

The sensitive altimeter satisfies the second requirement. A low-frequency radio transmission and an aircraft-mounted receiver satisfy the third requirement.

The first instrument take-off, flight, and landing were made in 1928 with the aid of this equipment- the artificial horizon, a sensitive altimeter, and a radio landing guidance system.

### 7.6. Закончите предложения:

1. In the early stages of aviation history...
2. But as the endurance of aircraft increased...
3. The second requirement for zero-visibility...
4. The sensitive altimeter satisfies...
5. The first instrument take-off, flight and landing were made...
6. The disk appears as a miniature horizon...

### 7.7. Исправьте утверждения, если они не соответствуют действительности:

1. The development of flight instruments and aircraft navigation equipment has not been an evolutionary process.
2. When the endurance of aircraft increased the importance of distant weather conditions decreased.
3. Zero-visibility flying requires six navigation systems of instruments.
4. The third requirement is a method of navigation that involves ground contact from the departure point to the destination point.
5. The sensitive altimeter does not satisfy the second requirement.
7. The first instrument take-off, flight, and landing were made in 1960.

### 7.8. Ответьте на вопросы:

1. What kind of process is the development of flight instruments?
2. What weather conditions were necessary for flight in the early stages of aviation?
3. What systems of instruments does zero-visibility flying require?
4. What kind of instrument is the artificial horizon? How does it work?
5. What is the function of the altimeter?
6. What instruments provide navigation without ground contact from departure point to destination point?
7. When was the first instrument flight made?
8. What instruments did the airplane carry during the first instrument flight?

## **Лабораторная работа “Navigational systems.”**

### **8.1 Words to be learned**

- 1 landmark – ориентир
- 2 dead-reckoning navigation – навигация счислением и прокладкой пути
- 3 sophisticated – сложный
- 4 propagation – распространение
- 5 homing beacon – пеленговый (приводной) радиомаяк
- 6 omnidirectional – всенаправленный
- 7 NDV – now-directional beacru – ненаправленный маяк
- 8 loop antenna – рамочная антенна
- 9 null – равносильная зона луча, нуль
- 10 flight path – траектория полета
- 11 ADF – automatic direction fiudrev – автоматический радиокомпас
- 12 LORAN – long range aid to navigation – радионавигационная система дальнего действия
- 13 bearing – пеленг, азимут, направление
- 14 to measure – измерять
- 15 VHF – very high frequency - очень высокая частота
- 16 VOR – very high frequency omni directional radio range – всенаправленный УКВ-радио-маяк
- 17 DME – distance measuring eqipment – радиодальномер
- 18 TACAN – tactical air navigation sistem - радионавигационная система

8.2 Read and translate international words, bearing in mind that their meanings in English and Russian can be different.

Location, navigation, familiar, ocean, military, transmission, course, position, characteristics, portion, indicator, record, territory, compass, relative.

### **8.3 Combine two words to make compound words.**

Air	Reckoning
Lend	Speed
Air	Horee
Dead	Frequency
Work	Port
Low	Mark

### **8.4 Translate.**

- Transmit – trasmiher – transmission  
Propagate – propugation  
Relate – relative – relatively – relation  
Rely – reliable  
Receive – receiver  
Equip – equipment  
Improve – improvement

8.5 The most elementary form of aircraft navigation is where the pilot looks down from his cockpit at familiar landmarks and guides his aircraft from one landmark to another. If the territory is not familiar he will need at least a map. Another “historical” method of navigation is based on a record of the movement of the aircraft from a known point. This method is referred to as dead-reckoning navigation. The only devices the pilot uses in this case are a compass, a clock, and airspeed indicator, a forecast wind and a map.

As the aviation technology developed more sophisticated navigational aids became necessary. The very first attempts at radio navigation involved low-frequency radio propagation. The simplest method of low-frequency navigation is the homing beacon – simple transmitters will an omnidirectional antenna.

After many years of advancement in still used large numbers especially in smaller airports because it is relatively inexpensive.

Now frequency beacon stations are provided for both aeronautical and marine navigation and are assigned to frequencies between 190 kHz and 500 kHz. The lower the radio frequency, the less it is affected by ionospheric propagation. For this reason beacon transmitters are assigned to relatively low frequencies.

Pilots to receive signals from a beacon station use a radio direction finder. A simple radio direction finder consists of a receiver and a loop antenna. To fly by beacons which is called homing, the pilot would turn the aircraft until the direction of flight was parallel to the direction of the null. He would then maintain the course by adjusting the aircraft flight path to maintain the null. Early direction finders had a loop antenna, which was rotated manually. Later a motorized antenna was used which made the direction finder completely automatic (ADF). With a few improvements and some modernized characteristics ADFs remain very reliable and are widely used.

Another navigational device using low frequency portion of radio spectrum is long-range radio navigation system (LORAN) which enables to define the position of the aircraft. These systems are intended for long-range navigation especially over oceans or large, sparsely inhabited areas.

The workhorse of navigation systems especially for general aviation is of course the very high frequency (VHF) omni-range system or the VOR system. The VOR system is more than a basic beacon. When equipped with a VOR receiver, the bearing from the VOR station to the aircraft can be determined. This information can be used to set a course to the VOR station.

Two other forms of VHF radio navigation aid are often placed at VOR station location, to be used with the VOR transmission. These are DME, or distance measuring equipment and a military navigation system called TACAN. The combined facility is called VORTAC station. A VORTAC station or VOR/DME station can provide both bearing and distance information and can be used to determine the aircraft position.

#### 8.6 Match the parts of the sentences.

- |   |  |
|---|--|
| 1. As the aviation technology developed...        | ...he will need at least a map.  |
| 2. If the territory is not familiar...            | ...the bearing from the VOR station to the aircraft can be determined. |
| 3. The very first attempts of radio navigation... | ...more sophisticated navigational aids were necessary.                |
| 4. When equipped with a VOR receiver...           | ...involved low frequency radio propagation.                           |

#### 8.7 Arrange the ..... of the plan in a correct order.

1. The first radio navigational aids.
2. VOR system.
3. Early methods of navigation.
4. Fly-by beacon installation.
5. Combined VOR facilities.
6. Long range navigation system.

#### 8.8 Retell the text according to the plan you made up in the previous exercise.

### **Лабораторная работа** **“Landing systems.”**

#### 9.1. Прослушайте, повторите, постарайтесь запомнить следующие слова:

1. approach - заход на посадку, приближение
2. precision approach - заход на посадку по приборам
3. heading - направление, курс ЛА
4. homing - наведение, привод (на радиостанцию)
5. absolute altitude - истинная высота
6. glide path - глиссада
7. sufficient - достаточный
8. ILS -instrument landing system
9. localizer - курсовой радиомаяк(посадочной системы)
10. positioning - управление положением, установка

11. glide slope - глиссада, наклон глиссады
12. beacon - радиомаяк, маяк
13. guidance - наведение, управление
14. deviation - отклонение
15. approach centerline - осевая линия полосы подхода
16. accuracy - точность
17. obstruction - препятствие
18. roll-out - послепосадочный пробег
19. ceiling - потолок, предельная высота.

9.2. Прочтите интернациональные слова, обратите внимание на их произношение и значение:  
 System, modem, function, indication, absolute, atmosphere, accuracy, basic, position, instrument,  
 category, effect, autopilot, automatic.

9.3. Переведите словосочетания:

Poor visibility condition, high - level flight, glide path control, sensitive altimeter, to measure atmospheric pressure, equipment accuracy, altitude information, homing function, absolute altitude, automatic control equipment, vertical glide path control.

9.4. Составьте словосочетания из слов групп а) и б):

- a) Control, poor, precision, landing, atmospheric, horizontal, approach, safe, electronic, glide.
- b) Visibility, system, slope, guidance, loading, equipment, approach, pressure, control, centerline.

9.5. Подберите слова, близкие по значению:

- a) Precision, bad, include, guidance, altitude, instrument, supply, part, indicate.
- b) Component, equipment, hight, accuracy, show, control, accuracy, show, control, poor, provide, involve.

9.5. Прослушайте, прочтите и переведите текст:

#### LANDING SYSTEMS

Modem landing systems must be able to provide precision approach and safe landing in any weather, even when visibility is poor. In addition to heading information and a homing function, the landing system must supply an indication of absolute altitude and control of the glide path of the aircraft. Altitude is controlled during a high - level flight with a sensitive altimeter, which provides altitude information through measuring atmospheric pressure. Its accuracy is not sufficient for glide path control to very low altitude, which is vital in poor visibility conditions. For this purpose an electronic landing system including both horizontal and vertical control is used. The system is called an instrument landing system, or ILS, and consists of three basic components: a localizer for horizontal positioning, a glide slope for vertical glide path control, and beacons for homing and for position determination. The localizer provides precision horizontal guidance for approach and indicates deviation from the approach centerline. The glide slope system is the altitude - controlling part of the instrument landing system.

There are three categories that indicate the overall accuracy of ILS installations. The overall accuracy involves the location, the effect of obstructions, the length, and position of the runway and the accuracy of equipment.

Systems of Category I are the least accurate and provide safe for visibility of about 800m and a 60m ceiling. A Category II system provides safe landing for visibility of about 360m and 30m ceiling.

Systems of Category III provide safe landings for conditions from 200m visibility and 15m ceiling to zero - zero conditions. In overall category II landings an autopilot must be used. In Category III landings, not only must automatic control equipment, but rollout and taxiing must be under electronic control.

9.6. Дайте английские эквиваленты следующих словосочетаний:

инструментальная система посадки –

условия плохой видимости –

измерение атмосферного давления –

чувствительный высотомер –

отклонение от осевой линии полосы подхода –

точность прибора –

наклон глиссады –

послепосадочный пробег-  
полет на большой высоте-  
информация о курсе ЛА-  
управление горизонтальным положением-

9.7. Объясните по-английски следующие понятия, термины:

1. Precision approach-
2. Absolute altitude-
3. Altimeter-
4. Glide Path-
5. Instrument landing system-
6. Aircraft ceiling-

9.8. Ответьте на вопросы:

1. What are the requirements to a modern landing system?
2. What are the functions of a landing system?
3. Why do you think the accuracy of an altimeter is not sufficient for glide path control?
4. What are a modern landing system called?
5. What does the ILS consists of?
6. What are the function of a localizer?
7. What factors are included in the overall accuracy of ILS?
8. According to what characteristic are the ILS installations divided into 3 categories?

9.9. Прочтите дополнительный текст. Скажите, какой из вопросов предыдущего упражнения этот поясняет:

Altitude information during relatively high-level flight is supplied by a sensitive aneroid altimeter, which provides this information through the process of atmosphere pressure measurement. The altimeter must be set with the sea level atmospheric pressure to account for weather related variations. That is why its accuracy is not sufficient to provide glide path control to very low altitudes.

9.10. Расскажите тему: «Landing Systems.»

### **Лабораторная работа “Radar systems.”**

10.1. Прослушайте и повторите следующие слова:

1. Beyond - за пределами;
2. To monitor - контролировать, направлять;
3. Ranging - измерение(определение) дальности(удаления);
4. Warfare - боевые действия;
5. To propagate - распространяться;
6. To encounter - встретить;
7. To reflect - отражать;
8. To elapse - проходить(о времени);
9. Coverage area - зона действия;
10. Dot - точка;
11. Network - сеть;
12. Beam - луч, пучок;
13. Transparent - прозрачный;
14. Frequency - частота;
15. Identify - достоверность, опознание зд. принадлежность;
16. Radar - radio detection and ranging - радиолокация;
17. PPI - plan position indicator - индикатор кругового обзора;
18. IFR - instrument flight rules - правила полетов по приборам;

10.2. Прочтите следующие интернациональные слова, обратите внимание на их произношение и значение:

Condition, extremely, basic principle, object, reflect, transmission, proportional, signal, azimuth, intensified, type, position, indicator, instrument, echo.

10.3. Переведите однокоренные слова:

Visible - invisible - visibility - television.

Transmit - transmitter - transmittable transmission.

Cover - coverage - discover - discovery - discoverer.

Direct - directly - direction - directional.

Reflect - reflection - reflector - reflective.

Portion - proportion - proportional.

Detect - detection - detector.

10.4. Подберите близкие по значению слова, постарайтесь объяснить различия в их значениях.

Monitor	observe
Encounter	very
Target	location
Point	control
Follow	part
Position	aim
Important	point
Portion	vital
Extremely	meet

10.5. Переведите следующие словосочетания:

Poor visibility, beyond a visible distance, by means of, commonly known, reflected signal, return signal, directly proportional, elapsed time, radar coverage area, throughout the world, instrument flight, air traffic control center.

#### 10.6. Radar Systems

The positions of aircraft under condition of poor visibility or beyond a visible distance are monitored by means of radio detection and ranging, commonly known as radar. Radar was developed during the Second World War and became an extremely important tool for air travel and air warfare. The basic principle of radar is simple. Short pulses of radio energy are transmitted from a directional antenna and propagate from it. If the radio energy encounters an object» some of the energy is reflected back to the transmitter. These reflected signals can be detected . The amount of time that elapses between the transmission and the reception of the return signal is directly proportional to the distance from the ground station to the reflector. This the distance to the target can be determined by measurement of the elapsed time. The location of all targets in the radar coverage area can be determined by rotating the radar antenna through the entire  $360^{\circ}$  of azimuth. All- the signal returns are shown on a round display as intensified dots with the radar antenna at the center. This type of display is called plan position indicator(PPI). Throughtout the world, aircraft operating under instrument flight rules (or IFR) are observed and monitored by means of a network of radar stations. Air traffic control centres can follow the flight of an aircraft along airways as the aircraft moves from the coverage area of one radar station to that of another one. One disadvantage of the radar system is that all objects illuminated by the radar beam and not transparent to the radar frequency will produce an echo. Although the position of an aircraft can be known the identity of the aircraft cannot be known.

#### Additional text.

There are some important characteristics of the target and the transmitted pulse that will allow the signal to be reflected. The objects to be detected by the radar should be reflective to radio waves. Unlike visible light, a large portion of which is reflected by practically any object, radio waves pass through many materials such as transparent and thus virtually invisible. The higher the radio frequency, the less likely it is that the material will be transparent. It is therefore vital for successful detection that the wave lengths of the radio waves used for radar be relatively short.

10.7. Закончите предложения:

1. Short pulses of radio energy are transmitted...
2. Radar was developed during...
3. Thus the distance to the target can be determined...
4. The location of all targets...
5. If the radio energy encounters an object...

10.8. Ответьте на вопросы:

1. How are the positions of aircraft under conditions of poor visibility monitored?
2. When was radar developed?
3. How are short pulses of radio energy transmitted?
4. When is some of the energy reflected back to the transmitter?
5. What can be determined by measurement of the elapsed time?
6. What is called PPI?
7. What is the main disadvantage of the radar system?
8. How are instrument flight rules observed?