МИНИСТЕРСТВО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

САМАРСКИЙ ГОСУДАРСТВЕННЫЙ АЭРОКОСМИЧЕСКИЙ УНИВЕРСИТЕТ имени академика С.П. КОРОЛЕВА

Методические указания по теме «КОНСТРУКЦИЯ И ЭКСПЛУАТАЦИЯ ЛЕТАТЕЛЬНЫХ АППАРАТОВ»

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Рецензия

на методические указания по теме «Конструкция и эксплуатация летательных аппаратов».

Данные методические указания предназначены для студентов 2 курса факультета эксплуатации летательных аппаратов.

Методические указания состоят из 7 разделов, направленных на совершенствование навыков перевода научно-технической литературы, устной речи, аннотирования и реферирования. Каждый раздел, посвященный определённому аспекту конструкции и эксплуатации летательных аппаратов и двигателей, содержит текст для изучающего чтения, снабженный словарем, и систему упражнений, целью которых является усвоение и закрепление терминологической лексики по теме, повторение наиболее сложных грамматических явлений, содержащихся в тексте, перевод которых может вызвать определённые трудности при работе с текстовым материалом.

Текст также сопровождается системой упражнений, предусматривающих развитие навыков устной речи на основе обсуждения тематического материала, навыков аннотирования и реферирования.

Вся система упражнений отличается разнообразными типами упражнений, способствующих дальнейшему развитию и совершенствованию основных речевых навыков и умений студентов.

Следует отметить актуальность текстов, подобранных из оригинальных источников научно-технической литературы авиационного профиля.

Организация материала в пособии способствует подготовке студентов к чтению оригинальной литературы по специальности.

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ББК

Методические указания по теме «Конструкция и эксплуатация летательных аппаратов»:/ Самарский государственный аэрокосмический университет; Сост. Н.Ф. Кочанова, С.А. Луценко. Самара, 2003.

Целью данных методических указаний является развитие и совершенствование навыков перевода научно-технической литературы по специальности, устной речи, аннотирования и реферирования.

Каждый раздел пособия содержит текст, снабженный словарем, предназначенный для изучающего чтения, и комплекс упражнений, направленных на усвоение терминологической лексики по теме, повторение наиболее сложных грамматических явлений, на развитие навыков устной речи на основе обсуждения тематического материала и навыков аннотирования и реферирования.

При подборе текстов использовались оригинальные периодические издания авиационного профиля.

Текстовый материал и система упражнений, представленные в пособии, способствуют подготовке студентов к чтению оригинальной литературы по специальности.

Предназначены для студентов 2 курса факультета эксплуатации летательных аппаратов.

Печатаются по решению редакционно-издательского совета Самарского государственного аэрокосмического университета имени академика С.П.Королева.

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Unit 1 Maintenance Training

I. Read the words and memorize them.

1. airworthy – готовый, пригодный к полету.
2. Bypass engine – двухконтурный ТРД.
3. To deteriorate – ухудшаться, изнашиваться, портиться.
4. Deviation – отклонение.
5. To enhance – улучшать, усиливать.
6. To fix a problem – решить проблему.
   To fix – отремонтировать.
7. fly-by-wire – система электродистанционного управления.
8. line maintenance – текущее обслуживание.
9. to maintain – поддерживать, осуществлять техническое обслуживание.
10. To monitor –контролировать, наблюдать.
11. Positioning – определение местонахождения, ориентация.
    Global positioning system – всемирная система определения местонахождения.
12. omnerange – всенаправленный (маяк)
13. proficiency – мастерство, совершенное владение профессией.
14. Saving – экономия.
15. Sophisticated – сложный.
16. To swap – заменить, обменивать.
17. Troubleshooting – выявление и устранение неисправностей.

II. Read the international words, try to guess their meanings.

Human, periodical, monitor, mechanic, occupy, occupation, condition, modification, diagnosis, effective, instrument, reflect, to maximize, investment, emphasis, general, to focus, to realize, authorities, manufacturer.

III. Analyse structure of the following words.

Deteriorate- deterioration; throughout; airworthy –airworthiness; depend – dependent; airframe; avionics; employ- employer –employee; costly; replaceable; performance; non- monitored; unnecessary; troubleshooting; update.

IV. Translate attributive phrases:

Aviation maintenance technicians; industry's key position of importance; overhaul and maintenance standards; today's sophisticated avionics; airplane modification; line replaceable units, omni-range radio navigation equipment; instrument landing system; instrument landing system radio navigation equipment; high by-pass engine; vision system navigation equipment; flight management system; transport –type electrical repair, composite materials repair.

V. Maintenance Training

Strange though it may seem, machinery deteriorates and "dies" just as human beings fall ill and die – and in just the same way, machines can be treated by 'diagnostic engineers' using techniques similar to those used by doctors to detect deteriorations in the health of human beings.

Throughout its operating life each aircraft will be inspected periodically, its health will be monitored and remedies will be found for each deviation from its model condition.

It is the task of the operator to plan and perform the maintenance, it is the task of the manufacturer to advise how to do the maintenance and it is the task of the Government to ensure that the maintenance standards it has prescribed are carried out in practice.

With a continued success of aviation dependent on a safe, airworthy fleet of aircraft, aviation mechanics occupy one of the industry's key positions of importance. To do their job properly, though, aviation maintenance technicians (AMTs) need the proper training to meet the overhaul and maintenance standards of today's sophisticated avionics and airframes.

An AMT is defined as any person who works to maintain an aircraft, aerospace vehicle or component thereof in an airworthy condition. AMTs perform a variety of tasks including line maintenance, heavy (base) maintenance, airframe modification and other major repairs, engine maintenance and component maintenance.

It has become obvious that training results not only in proficiency, but in saving of both time and money. As technicians become more skilled at diagnosing maintenance problems, they become more efficient and more cost effective to their employers.

Aircraft on the ground (A.O.G.) is kept to a minimum, which maximizes the operator's investment in expensive new aircraft. Costly expenditures for unnecessary swapping of line replaceable units (LRUs) are drastically reduced. Over time, proper maintenance training can pay for itself through gains in efficiency and performance provided to flight operations.

Maintenance training is evolving from an emphasis on 1960s-era technologies –non-bypass turbine engines, electromechanical instruments, non-monitored systems, and very high frequency omni-range and instrument landing systems (VOR/ILS) radio navigation equipment –to modern technologies. Those technologies include very high bypass engines, electronic instrumentation (glass cockpits), fly-by-wire, computer monitoring and testing for all systems, global positioning system and enhanced vision systems navigation equipment linked by flight management systems. Besides, training programs are now being updated to concentrate on learning troubleshooting technology rather than line maintenance. The additional time should be given to learning transport-type electrical, electronic, power-plant, sheet-metal and composite materials repair. Troubleshooting skills, which teach mechanics to solve and fix problems rather than to swap LRUs should be given special attention.

VI. Make up word combinations using words from groups A and B.

A. computer, special, aerospace, to meet, major, proper, maintenance, to fall, human, key, fly, bypass, navigation, diagnostic, to perform, airworthy, line, composite, to fix, vision, heavy.

B. Repairs, attention, maintenance, monitoring, engine, condition, by-wire, vehicle, a problem, system, being, engineer, standards, training, ill, position, equipment, material.

VII. Find in text A:

a) words with similar meanings to these:

1. to discover
2. to cheek; aim; guarantee
3. important; correct, appropriate, to keep
4. clear, evident; replacement; considerably
5. to develop; to modernize

b) words with opposite meanings to these:

1. different
2. simple; minor
3. cheap; slightly; to increase
4. low; take-off; to exclude; to separate

VIII. Complete the sentences with the words from the text.

1. The task of the maintenance technician is to detect all …. from the model condition of the aircraft.
2. To meet … of today's aircraft technicians need proper training.
3. A maintenance technician should have special knowledge and skills in order to … an aircraft in an … condition.
4. With good training maintenance technicians become more skilled in … and therefore they become more … to their employers.
5. It is clear that proper training will … through gains in aircraft performance and reliability.
6. Training programs should concentrate on learning troubleshooting technology rather than on … .
7. … teaches mechanics to solve and fix problems rather than … line replaceable units.

IX. Paragraph study.

a) In paragraph 1 and 2 explain the meanings and functions of pronouns ‘those’, ‘its’ and ‘it’.

b) In paragraphs 2 and 3 find all Infinitives and define their functions.

c) In paragraphs 4 analyze all ing-forms.

X. Try to explain the following terms in English.

Deviation; airworthy (or airworthiness); avionics; line maintenance; aircraft performance; fly-by-wire.

XI. a) Define the main idea in each paragraph.

c) Write a summary of Text A. The following phrases might be useful.

The text covers the problem of …

The article carries material about …

The paragraph deals with …

General/special attention is given to …

It is interesting to note that …

The information presented is of interest to …

XII. Read text B and answer the questions.

1. How can you define troubleshooting?
2. Why do mechanics often take the simple way out by replacing the LRU?
3. Why is replacing the LRUs a simpler way out than troubleshooting?
4. Why do you think troubleshooting is regarded as a more efficient technology?

Text B Troubleshooting

Troubleshooting has become one of the most important fields of maintenance training. It can be defined as a logic process of examining the possible chain of events that caused a malfunction and determining a solution to the problem. It is

regarded as a more efficient alternative to blindly swapping line replaceable units when a fault surfaces.

The current situation in general and in commuter aviation in particular is that mechanics have a tendency to be focused on line maintenance instead of troubleshooting. Very often the line mechanic is under pressure from the authorities trying to keep to schedule and get the aircraft off the ground. Without actually understanding the cause of the delay, the mechanic takes the simple way out by replacing the LRU. But the ability to realize what a problem is and then fix it in a relatively short time is often more important than the ability to physically do maintenance (as mechanics put it, you can always get someone to turn the wrench).

Troubleshooting techniques can be used in every instance of aircraft maintenance. For example, if a pilot receives no indication that the landing gear is down and locked, the mechanic must determine whether the problem is mechanical, hydraulic or an indication problem. Or, when the pilot tries to start the engine and it won't rotate, the mechanic must determine if the problem is in the starter or something between the switch and the starter.

Learning the proper techniques of troubleshooting can be extremely cost effective for operators and airlines.

Notes: 1. Commuter – местный, самолет местных воздушных линий.
2. wrench – гаечный ключ.

XIII. In Text B try to replace as many words as possible with the words close in meaning.

XV. Additional Text.

It will provide an overview of some of the skills that can be developed through training at some overhaul and maintenance schools. Technical training may take from six weeks to a few years depending on the specialty you select. The instruction and the on-the-job training may prepare you for many civillian careers.

Aircraft Maintenance Specialist

You'll perform inspection, maintenance, and functional checks on aircraft and installed support equipment. Working with other specialists, you'll determine and accomplish maintenance actions required to correct malfunctions.

Aircraft Structural Maintenance Specialist.

Maintenance of aircraft structure includes fabricating and modifying the metal structures, repairing plastic, fiberglass, composites and bonded honeycomb. In this capacity you'll use chemical tests to determine metal identity. Other responsibilities include removing corrosion by mechanical and chemical procedure, applying protective coatings and caring for both the equipment and the hazardous materials used in this position.

Aircraft Electrical Systems Specialist

Using test equipment and publications, you'll inspect, troubleshoot, install and maintain aircraft electrical systems, components, subsystems, and test equipment. You'll be responsible for repairing and modifying everything electrical from the nosewheel steering to the antiskid amplifiers.

Aerospace Propulsion Specialist

In this specialty you will inspect, repair, disassemble, install, assemble, service, test and modify propulsion equipment. You'll be involved in field level repair, intermediate maintenance and engine buildup.

Flight Engineer Specialist

Flight Engineer Specialists perform visual inspections according to the flight manual. You will operate and monitor engine and aircraft systems controls, panels, and indicators. Your duties will include computing and applying aircraft weight, balance, and performance data.

Aircraft Pneudraulic Systems Specialist.

Aircraft pneudraulic systems include everything from pumps to brakes to the flying boom assembly. Your job will be to check for air, inert gas, or fluid leaks, other signs of wear and tear and then repair as needed. You'll also maintain inflight refueling components and associated ground equipment pneudraulic components.

Nondestructive Inspection Technician

If you're interested in all aspects of nondestructive inspection, from determination of test method to preparation of fluids and parts, right through to performance and evaluation of tests this specialty may be right for you. You'll operate and maintain test equipment including ultrasonic and radiographic. And your responsibilities will include maintaining darkroom equipment such as filmholders, lead screen and film storage facilities.

Unit 2 Routine Maintenance

I. Read the words and memorize them.

1. Accomplish – совершать, выполнять.
2. adjustment – настройка, регулирование, наладка.
3. Appliance – установка, устройство.
4. Booster pump –накачивающая, подкачивающая помпа, насос.
5. To carry out – выполнять, проводить.
6. Cover – крышка, покрытие, чехол.
   blank cover – заглушка.
7. exhaust – выхлоп, выпуск, истощение, выхлопная труба.
8. Feather –флюгировать винт, изменять шаг винта.
9. Fitting – соединение, прикрепление.
   Attachment fitting – крепежный узел.
10. intake – воздухозаборник.
11. Leakage – утечка.
12. Link – связь, звено.
13. Nacelle – гондола двигателя.
14. Pipeline – трубопровод.
15. Premature – преждевременный.
16. Serviceability – эксплуатационная надежность.
17. Wear – износ.

II. a) Prefixes are used to change the meanings of the words. Translate the words with prefixes pre-, post-, re-.

preflight, predetermine, premature;

postflight, postgraduate, postglacial;

reconstruct, reuse, refuel.

b) Add more examples with these prefixes using the words below.

take-off, organize, school, write, launch, dinner, build, heat, war, charge, consider, name, human, arrange, assembly.

III. Define to what part of speech the following words belong. Translate the words.

add-addition- additional-additionally; join-joint; rely-reliable-unreliable-reliability; attach-attachment; apply-application-appliance-applicable; leak-leakage; serve-service-serviceability; ready-readiness; thorough-thoroughly; complete-completion-completely; adjust-adjustment; assemble-assembly-disassembly.

IV. Translate attributive phrases:

Engine performance report; maintenance operations, routine maintenance operations, aircraft preflight maintenance procedures; aircraft fuselage skin; engine nacelle; engine fuel system; control system; cable links; engine control system cable links; booster pump; fuel booster pump; fire fighting system.

V. Instructions in maintenance guides or manuals are often given in Imperative Mood. Similar ideas can be expressed by modal structures

A. Compare and translate:

1. Inspect wheels for cracks. Wheels are to be inspected for cracks.
2. Note oil pressure and temperature. Oil pressure and temperature should be noted.
3. Make sure that all blank covers are removed. Mechanics must make sure that all blank covers are removed.

B. make the following sentences with modal verbs imperative.

1. Fuel tanks are to be checked for leakage.
2. Proper functioning of lighting system should be checked.
3. All the control cables, tubes and pulleys must be inspected for security and lubrication.
4. You should examine general condition of the tail wheel assembly.
5. Special attention should be paid to examining the cause of a malfunction.

VI. Translate the text "Useful Terms".

Useful Terms.

Overhaul. The term 'overhaul' shall mean the disassembly of an aircraft, engine, propeller, or appliance to an extent necessary for complete inspections or check or each part, the replacement, repair, adjustment,of such part of parts as are found upon inspections or check to require replacement, repair, and the reassembly or such aircraft, engine, propeller, or appliance.

Check. The term 'check' shall mean the procedure necessary to determine the operating conditions of a mechanism, component or part of an aircraft, engine, propeller, or appliance, by measurement or operation, or both.

Inspection. The term 'inspection' shall mean a visual examination to determine the condition of an aircraft, engine, propeller, or appliance of any component or part.

Routine maintenance (check). 'Routine' checks covering specified items are made at the end of the trip or at completion or several trips.

Base maintenance (check). 'Base' maintenance covering all items on routine checks and additional item will be accomplished at certain periods. These checks may be performed at stations having special equipment or material necessary and where personnel are available.

On-condition (station) maintenance will cover all items reported on pilot's airplane and engine performance report. It is to be accomplished at stations where trips originate and maintenance personnel are bases.

VII. An Example of Routine Maintenance.

The routine maintenance operations carried out on the aircraft provide for its reliable operation and readiness for flight; besides they guard the main joints, units and instruments against premature wear.

The routine maintenance operations include:

1. Preflight maintenance.
2. Maintenance at short- time parking.
3. Postflight maintenance performed every 25-30 flying hours.
4. Periodic maintenance performed every 100-110 and 500 ±100, 50 flying hours.

Aircraft preflight maintenance operations are performed just prior to flight with a view to checking the systems and separate units to determine their readiness for flight. Check the fuselage skin and engine nacelles for condition, see that blank covers are removed from the engines and aircraft; inspect the pipelines of the fuel system in nacelles; check the quantity of fuel, oil, hydraulic fluid and water. Test the engines and check operation of the electrical, radio and special equipment and serviceability of the systems.

Maintenance operations at short-time parking are performed with a view of preparing the aircraft for further flight. In this case, refuel the aircraft, inspect the propeller, the engine intakes and exhaust pipes. Clean the passenger cabin, wardrobe and baggage compartments. Inspect the fuselage skin, doors, hatches, landing lights and navigation lights.

During postflight maintenance operations inspect the power plant: the engines, propeller, and turbogenerator.

Install in place all the blank covers, clean the skin, landing gear, cabins, and toilet room. Inspect thoroughly the pipelines of the fuel, oil and hydraulic systems, the attachment fittings of the engines, and turbogenerator, condition of the fuel booster pumps, attachment of the hydraulic and oil tanks. Examine the units of the fire-fighting equipment and check the filters of the systems.

Every 100+-10 and 500+-100(50) flying hours check additionally condition of the engine intakes and exhaust pipes, check the fuel system for leakage. Check condition of the engine control system cable links; test the engines with the propellers fully feathered, check the automatic and manual feathering systems. Check the electric wiring for condition, the electrical equipment for condition. Examine the antenne, check the condition and attachment of the radio and special equipment; check all the instruments and units for serviceability.

VIII. Find in the text synonyms to the words below.

Protect from, procedure, to carry out, work, airworthiness, before carefully, connection, undercarriage.

IX. Complete the sentences with the words from the text.

1. Aircraft preflight maintenance procedures are … to determine its … for flight.
2. The … of the fuel, oil and hydraulic systems must be inspected thoroughly.
3. The condition of engine … are checked every 100+-10 flying hours.
4. The fuel system should be checked for … .
5. Check operation of the electrical, radio and special equipment and … of the system.
6. In case of short-time … maintenance procedures include inspection of propellers, engine intakes and …. .

X. Give English equivalents to the following words and word-combinations. Work as fast as possible.

1. надежность работы,
2. готовность к полету,
3. предполетное техническое обслуживание,
4. кратковременная стоянка,
5. обшивка фюзеляжа,
6. преждевременный износ,
7. топливная система двигателя,
8. проверьте действие электрического оборудования,
9. эксплуатационная надежность,
10. посадочные фары,
11. проверьте состояние воздухозаборников.
12. Количество топлива
13. заглушки
14. Изменение шага винта
15. Состояние электропроводки
16. С целью подготовить самолет
17. Выхлопная труба
18. Крепежный узел
19. (до)заправить самолет
20. Отдельные узлы

XI. Add any suitable words to make up word-combinations

a) objects after verbs

1. to park -
2. to test -
3. to prepare -
4. to include -
5. to carry out -
7. to check –
8. to clean –
9. to install –
10. to inspect –
11. to remove –

6. to determine - 12. to perform –

b) attributes before nouns

1. – pipe 7. –plant
2. – equipment 8. – intakes
3. – cabin 9. – fluid
4. – maintenance 10. – hours
5. – system 11. – nacelle
6. – attachment 12. – fittings

XII. Answer the questions without looking into the text.

1. What do the routine maintenance operations include?
2. What is the aim of aircraft preflight maintenance?
3. What do preflight maintenance operations include?
4. What are maintenance operations at short-time parking performed for?
5. What maintenance procedures are carried out at short-time parking?
6. What operations are included in postflight maintenance?
7. How often is it performed?
8. How often are other routine maintenance procedures performed?
9. What kind of maintenance described in the text is the most thorough and detailed?

XIII. Speak about.

1. Preflight maintenance procedures.
2. Maintenance at short-time parking.
3. Postflight maintenance procedures.
4. Period icmaintenance.

Unit 3 Wing Structure

I. Read the words and memorize them.

1. airfoil- аэродинамическая поверхность, крыло
2. approach- 1. приближение, подход.2. заход на посадку
3. bank- крен, вираж, кренить.
4. bending- изгиб.
5. to extend- простираться, расширять.
6. fore-and-aft direction- направление вперед и назад.
7. fuselage stub- стыковой узел фюзеляжа.
8. to glide- скользить.
9. impact- удар, воздействие.
10. lever- рычаг.
    leverage- соотношение плеч рычага, работа рычага.
11. obstruction- препятствие.
12. plane- плоскость.
    port plane- левая консоль.
    starboard plane- правая консоль.
13. to preserve- сохранять, предохранять.
14. rigid- жесткий.
15. roll- I. 1. вращение вокруг продольной оси, крен. 2. пробег, разбег.II. 1. вращаться вокруг продольной оси. 2. катиться.
16. section- 1. сечение. 2. секция, часть

wing central section- центроплан

cross-section поперечное сечение.

17. shear- сдвиг.
18. slat- предкрылок.
19. slot- щель.
20. split- расщеплять, раскалывать, разделенный.

split flap- простой щиток.

21. to subject – подвергать.

22. tilt- наклон, отклонение.
23. torsion- кручение.
24. track- путь, рельсовый путь, направляющая.
25. to withstand- выдерживать, противостоять.

II. Read the international words, try to guess their meanings.

To deform, normal, integral, inertia, to assemble, condition, contour, separate, to start, structure, to correct, section, stress, to resist, special, neutral, elevator, passage, permanently.

III. Word structure.

A. Define the root of each word.

Rearward, outward; resistance, pressure, outboard, suitable, leverage, linkage, width, strengthen, exceptional.

B. To the words below add any suitable suffixes or \and prefixes to form new words.

Arrange, divide, move, relate, construct, place.

IV. Look through the terms below.

A. Make sure that you remember them.

Aileron, angle of attack, to attach, auxiliary, drag, fitting, flap, to hinge, damage, to increase, to reduce, longitudinal, transverse, landing, spar, rib, wing tip, trailing, edge, leading edge, to support, surface, streamline, to require, replacement, weight, load, to retract the landing gear, unit.

B. Use these words in the sentences of your own.

V. Match up the words from groups A and B with similar meaning and opposite meanings.

A. Airfoil, preserve, backward, firm, stream, roll, due to, end, manual, strike, reduce, starboard, required, repair, endure, often, integral, enormous, permanent.

B. Tip, increase, automatic, wing, port, damage, protect, separate, constant, rigid, flow, frequent, because of, rearward, withstand, bank, impact, small, necessary.

VI. Fill in the gaps with the words “span” or “chord”

When looking down at the airplane, one sees the … . The … is the distance from one wing to the other. The … is the distance between the leading and trailing edges. The … of subsonic speed airplane wings is usually between five and ten times as long as the … . A wing with a large … in comparison to the … has less resistance to motion through the air (drag) than does a wing with a small … in comparison to the … .

VII. Translate the following word combinations.

It must be firmly attached to; inertia stresses; under all conditions; sectional contour of the wing; to fit snugly; the required strength; the air load is carried back through the ribs; in neutral; retracted position; auxiliary controls; steep angle; to make an approach; to maintain proper air flow; without stalling.

VIII. Wing Construction

The main supporting surface of any type of aircraft is the wing. The wing extends outward from each side of the fuselage, and must therefore be strongly constructed to withstand the enormous leverage involved in supporting that weight in flight. It must also be firmly attached to the fuselage so that its own weight will not deform it through the impact of landing. This means that the wing must be rigidly supported vertically, and, in addition, must be designed to resist inertia stresses in a fore- and – aft direction due to starting and stopping, and the pressure and rearward drag of the air in flight. Furthermore, since the wing is an airfoil of special section, it must be constructed so as to preserve that cross-sectional shape under all normal, and some exceptional, conditions. The two main supports of the wing, then, are the longitudinal (located spanwise), and the transverse (located chordwise) structures. The longitudinal structure consists of one or more beams, called spars. The transverse units, which follow the sectional contour of the wing, are called ribs. The skin is a part of basic wing structure, carrying part of the wing stresses. Cantiliver wings are generally of stressed-skin type. The wings of an airplane are not made in one single piece from one wing tip to the other. The usual method of construction is to build the

wings in three main sections, namely, the centre section which extends across the fuselage and projects outwards at each side, the port main plane and the starboard main plane. The centre section may be built as an integral part of the fuselage or it may be a separate unit, but in the latter case, when it is assembled to the fuselage, the two parts will fit snugly together as though they have been built as one unit. The outer main planes will be further subdivided into main planes proper, ailerons, flaps and wing tips. On most airplanes, wings, the tips are small units bolted to the outer ends of the outboard panels. This construction provides an easy method of correcting damage which would otherwise frequently require the replacement of large wing panels. Wherever wing sections are bolted to each other or to fuselage stubs, metal terminal fittings are used to provide the required strength.

Ailerons. The method of construction used in the main planes proper is usually continued in the ailerons.

The principal member in normal aileron design is the spar. Since this is subjected not only to bending and shear loads, but also to torsion, a tube is particularly suitable. The torsion applied to it by the operating lever is resisted by the air load on the surface, which is carried back through the ribs. The ribs are pressed from alluminium alloy and are attached to the spar by means of long bolts.

Wing Flaps. Relatively large airfoils hinged to the trailing edge of the wings near the fuselage are called “wing flaps”. Three general types are described below.

(1) The plain type when in neutral appears almost to be a part of the wing itself, but hinged so it can be moved downward as desired.

(2) In the split trailing edge type, the lower half of the trailing edge of the wing is hinged so that the flap can be lowered. The upper half may also be hinged, so that it can be raised to increase drag without increasing the lift.

(3) The Fowler flap is an arrangement by which the lower part of the trailing edge of the wing rolls back on a track. This movement increases the effective width of the wing and lowers the trailing edge about 40° below its retracted position.

Operation. Most flaps are operated by the main hydraulic system, which is used also to retract the landing gear and to perform other functions. A few flaps are electrically

or manually operated. Auxiliary controls, manually, operated, are usually added for use in emergencies. Linkages between the controls and flaps are of the same types and require the same inspections and service as those used on other movable surfaces. Flaps increase the drag and the lift of airplane wings. Increased drag permits the airplane to dive or glide at a steep angle without the excessive increase in speed which would otherwise occur. Thus, airplanes equipped with flaps may land more easily on a field where they must make an approach over obstructions. Increased lift also permits the airplane to land at lower speed than is normally possible.

Slots. Some airplanes have an air passage between the leading edge of the wing and a slat attached to the wing by brackets; some have a passage built permanently into the leading edge of the wing; and some have a passage which is opened automatically, as a section of the leading edge rolls forward on a track when the airplane tilts upward at a steep angle. These passages are called slots. The air stream which flows through this slot when the airplane has a high angle of attack helps to maintain proper flow of air above the wings. This in turn makes it possible for an airplane with slots to fly at a steeper angle of attack without stalling than would otherwise be possible. Slots also permit an airplane moving slowly as it approaches a landing on a small field to reduce speed still more without going into a complete stall when the nose is slightly tilted up.

IX. Add any suitable words to the words below to make up word combinations:

A. Verb+noun	B. Adjective+noun	C. Noun-of+noun
To withstand-	-controls	method of –
To support -	-edge	replacement of –
To resist -	- flap	type of –
To correct -	- surface	part of –
To increase -	- angle	cross-section of-
To retract -	- position	angle of –
To reduce -	- field	half of –
To maintain-		flow of-

X. Give English equivalents to the following word combinations.

Направление вперед и назад; поперечное сечение крыла; правая /левая консоль; удар при посадке; форма сечения; при всех условиях; расположенных по размаху крыла; продольный элемент конструкции; нагрузки на крыло; выступает наружу; собственно основные несущие поверхности; стыковой узел фюзеляжа; подвергается изгибающей/скручивающей нагрузке; задвинутое/убранное положение; в аварийной /чрезвычайной обстановке; крутой угол; чрезмерное увеличение скорости; отклоняется вверх; без срыва потока; в свою очередь.

XI. Complete the sentences with the words from the text.

1. The wing must be strongly constructed … the enormous leverage.
2. The … units, which follow … of the wing are called ribs.
3. … extends across the fuselage and projects … at each side.
4. If the centre section is a … unit, it must fit … into the fuselage as though the two parts have been built as … .
5. … are usually small units bolted to the outer ends of the wings which provides an easy method of correcting …
6. Since the spar is … to bending, … and … loads, a tube seems to be the best solution.
7. The torsion applied to the aileron by the operating … is … by the air load on the surface.
8. In the … trailing edge … the lower half of the trailing edge is … and thus the flap can be … .
9. Flaps permit an easier landing on a field where airplanes have to make an … over … .
10. Permanent or automatically opened air passages in the … of the wing are called … .

XII. Paragraph study.

1. Paragraph 1 is difficult to read because it is very long. What is the subject discussed in it? Try to break it down into smaller topics and accordingly divide the paragraph into smaller parts. Suggest headings for them.
2. In the passage "Ailerons" find all Passive structures and translate them.
3. In "Wing Flaps" define the functions of the Infinitive and Participle II in the sentence (1).
4. In this paragraph find the words "which", "same", "those", "otherwise", "thus". What words or ideas do they refer to?
5. Analyze the first and the last sentences in paragraph "Slots".

XIII. Arrange the following sentences to make up a meaningful text. Pay special attention to the words this, these, that, therefore.

1. That movement is called rolling if it is used during straight flight, and banking if it is applied in a turn.
2. Like the elevators in the tail, they are hinged 10 that the back or trailing edge can be moved up and down.
3. In flight it causes one half of the wing to rise and the other to fall.
4. Built into each end of the wing is a long rectangular section extending to the tip.
5. Banking is necessary in making turns to prevent skidding.
6. These two ailerons are so connected to the controls that when one turns down, the other turns up.
7. Therefore the plane tilts about its longitudinal axis.
8. These are the ailerons.

XIV. Give definitions for the following terms.

Cross-section, spar, rib, wing centre section, tips, fuselage stub, lever, split trailing edge flap, slat.

XV. Speak about:

a) Basic wing structure.

b) The usual method of wing construction.

c) Control surfaces.

d) Structure and operation of ailerons.

e) Types of flaps and their operation.

f) Slots.

Unit 4. Inspection and Maintenance of Aeroplane Units.

I. Read and memorize the following words:

to arrest –остановить, задержать

chafing stript – полоса или прокладка для предохранения от истирания

cowling – обтекатель, капот

clamp – зажим, скоба

to distort – деформировать(ся)

drain hole – дренажное отверстие

to dent – делать вмятину, зазубривать

evidence – свидетельство, подтверждение; данные признаки

fairing – обтекатель, обтекаемая обшивка

failure – выход из строя, отказ, порча

injury - порча, повреждение

to mar – ударить, повредить; портить

rigid – жесткий; твердый; неподвижный, неподвижно закрепленный

rough – неровный, шероховатый; резкий

security – безопасность, надежность

spray – струя

thoroughly – основательно, тщательно

violent – сильный, интенсивный; резкий

to warp – коробиться

welded joints –сварные швы

wrinkle – складка, морщина

II. Read the following international words and try to guess their meaning.

condition, accumulate, structure, indicate, vibration, inspection, arrest, extremely, personnel, special, prevent, stationary

III. Translate the derivatives and define to what parts of speech they belong.

1. to corrode – corroded - corrosion;
2. evidence – evident – evidently;

3. to indicate – indicator - indication;
4. extreme – extremely – extremity;
5. to investigate – investigation – investigative – investigator;
6. to attach –attached –attachment;
7. to protect – protective – protection;
8. to move – movement – movable;
9. practice – practical – practicable – practicability – practicality –practically;
10. excess – excessive – excessively;
11. to join – joint – jointly;
12. to place – to replace – to displace – place – placement – replacement – replaceable – displacement;
13. to vary – varied – variety – various;
14. safe – safely – safety

IV. Match up

1. the synonyms

a) inspection, injury, similar, covering, to occur, permanent, to accumulate, to indicate, thoroughly, to arrest, to permit;

b) to happen, to point out, examination, to allow, same, to store, coating, to stop, carefully, damage, constant;

2. the antonyms

a) internal, to break, weak, to distort, loose, landing, rough, to loosen, rapid, intact, dangerous;

b) violent, rigid, smooth, external, to create, safe to tighten, take off, slow, to straighten, damaged

V. Translate the sentences paying attention to the modal verbs. Define the voice of the predicate.

1. Quantum mechanics as part of a basic course in physics can no longer be avoided by the serious engineer.

2. The process can be easily simulated in laboratory; no matter how peculiar its mechanism may seem to a non-specialist.
3. He must check up the data, or the results will be wrong.
4. Energy can be classified into mechanical, heat and chemical kinds of energy.
5. Each metal possesses certain distinct combinations of properties that may be varied for specific applications by alloying it with relatively small amounts of other metals.
6. The properties of this element must be described in detail.
7. This machine can be built today by any of a number of capable manufacturers.
8. You should carry out this experiment using the technique developed in our laboratory.
9. This phenomenon cannot be observed in nature.
10. The condition of this installation must be thoroughly investigated.

VI. Translate the sentences. Define the function of the infinitives and participles.

1. When broken the unit should be replaced immediately.
2. If not properly tightened bolts will allow movements.
3. A great number of experiments had to be made to study the properties of the substance.
4. It is to be assumed that the results obtained will influence greatly the development of this promising branch of physics.
5. It was as recently as December 1937 that the first flight of radio-controlled airplane using automatic landing techniques was accomplished.
6. A pilot flying under condition of unknown wind direction or force should use every radio aid and navigational facilities to determine accurately his position.
7. Knowing the landing speed and the load it is possible to calculate the wing area that will be necessary.
8. There are many things to be taken into consideration when designing a spaceship.
9. The air flowing over and under a wing causes the pressure to be less than atmospheric on the upper side of the wing.

10. For combustion to be rapid the fuel and oxidant must be quickly mixed.

VII. Read and translate the text carefully.

Inspection and Maintenance of Aeroplane Units.

Wings

Skin, and, Protective Coating.

In, the inspection of wings, fuselages, and similar structures, it is very important to watch for evidence of corroded or cracked skin, and injuries to protective coating.

1. Since corrosion is most likely to occur in pockets and corners on the inside where water or salt spray may accumulate, drain holes must always be kept open. Internal members may also be broken or distorted and weakened as the result of unusually violent maneouvres, extremely rough air, or hard landings. Buckled or displaced covering, loosened rivets, etc, may indicate internal failure. Parallel wrinkles may indicate warped frame members. In case such external conditions develop, the condition of the internal structure must be thoroughly investigated and repairs made if necessary.
2. Small cracks leading away from rivets frequently occur in the metal covering. They are usually caused by vibration. As a temporary means of arresting the development of such cracks small holes are drilled at the extremities or just beyond. Permanent repair is made by patching. Since the aluminum-alloy sheet used for covering is very springy and hard to bend, it is likely to crack if one tries to straighten sections that are bent or dented.
3. Aluminum-alloy surfaces from which the protective coating has been chipped, scratched, or worn, thus exposing the metal, should be recoated at once, since corrosion develops very rapidly.

Engine Mounts. Cracked, bent, or broken members of engine mounts are extremely dangerous and, without exception, must be repaired or replaced by the personnel authorized to do such work before the airplane is again permitted to be flown. Cracks are most likely to occur at welded joints and if small, may be very difficult to discern through the protective coating. This is especially true if the structure is not kept

thoroughly clean. Special care must be exercised in inspecting for such cracks. If not properly tightened, mounting clamps and bolts will allow movement of the mount, with consequent rapid wear of the bolts, elongation of bolt holes, and serious vibration. When damaged protective coatings should be retouched promptly to prevent the rusting of exposed promptly to prevent the rusting of exposed steel surfaces.

Cowling and Fairing. Care must be exercised in the handling of all cowling or fairing so that it will not be bent or broken. Many pieces, especially long strips or large sections, are not sufficiently rigid to support their weight unaided. Smaller parts, although formed so they are rigid as a unit, may be constructed of light gage material which is easily damaged. Cracks and dents will be repaired as on other sheet metal parts. All attachment devices must be kept in working condition and replaced at the first sign of looseness or excessive wear. The finish of cowling or fairing must be kept intact, and if marred during assembly should be retouched as soon as practicable. Where motion is necessary between pieces of installed cowling, chafing strips of fabric or fiber are used. These should be renewed whenever wear might permit metal parts to rub together.

The various items which require special attention in inspection and maintenance of movable surfaces are

Security. The security of attachment of movable surfaces must be checked periodically. Such parts loosen more readily than those which are stationary. Bolts on hinges, as well as those on the rollers and tracks, must be secured and safetied. All such units also have full, free movement to perform the service required.

Condition of Surfaces. The frames of these surfaces must be kept free from corrosion, breaks, and warping. Metal surfaces must be checked for cracks, loose rivets, etc.

VIII. Give English equivalents of the following words and phrases.

способ задержать; дренажное отверстие следует держать открытым; может указывать на внутреннюю неисправность; важно следить за признаками коррозии; временный способ задержать распространение таких трещин; без исключения; возникать на сварных швах; если не закреплены надлежащим

образом; чтобы предотвратить ржавление открытых стальных поверхностей; достаточно жесткий; безопасность крепления.

IX. Complete the following sentences in Russian and then translate them into English.

1. Внутренние компоненты могут быть также разрушены или деформированы и ослаблены в результате...
2. В случае, если создаются такие внешние условия, состояние внутренней конструкции...
3. Поскольку лист из алюминиевого сплава, использующийся для покрытия, очень упругий...
4. Треснутые, изогнутые или сломанные компоненты рам крепления двигателя представляют собой чрезвычайную опасность и, без исключения...
5. При повреждении защитные покрытия следует...
6. Все устройства крепления должны содержаться...
7. Там, где необходимо движение между частями установленного обтекателя...

X. Agree or disagree with the statements. Correct the wrong statements.

1. Corrosion is unlikely to occur in pockets and corners on the inside where water or salt spray may accumulate and it is not necessary to keep drain holes open.
2. Small cracks caused by vibration frequently occur in the metal covering.
3. Aluminum-alloy surfaces from which the protective coating has been chipped, scratched, or worn should be recoated at once.
4. If properly tightened mounting clamps and bolts will not allow movement of the mount with consequent rapid wear of the bolts elongation of bolt holes and serious vibration.
5. The finish of cowling or fairing need not be kept intact and should not be retouched if marred.
6. There is no necessity to check periodically the security of attachment of movable surfaces.
7. The frames of the surfaces must be kept free from corrosion, breaks, and warping.

XI. Answer the questions.

1. What is essential in inspecting the wing?
2. Where does corrosion often occur?
3. Why should the operator keep drain holes open?
4. What may cause failure of internal structure?
5. What can serve as an evidence of internal failure?
6. What are cracks in the metal covering caused by?
7. What is one of the means of arresting the development of cracks?
8. Why must special care be exercised in inspecting engine mounts for cracks?
9. What are the requirements of cowling and fairing handling?
10. Why should mounting clamps and bolts be well tightened?
11. Which items require special attention in inspection and maintenance of movable surfaces?

XII. Find in the text and translate the sentences containing the following grammatical forms:

a) Modal Verbs;
b) Infinitive and Participles. Define their function in the selected sentences.

XIII. Translate into English.

1. Эти расстояния возможно измерить с большой точностью.
2. Необходимо было провести большое число экспериментов, чтобы изучить свойства этого вещества.
3. Наша задача заключалась в том, чтобы определить скорость реакции.
4. Дистанционное управление необходимо использовать при управлении этими устройствами.
5. Космонавт может выполнять все необходимые операции, связанные с осуществлением связи с Землей и управлением полетом, не покидая своего кресла.

6. Электрический мотор-устройство, применяемое для преобразования электрической энергии в механическую.
7. С этим веществом необходимо обращаться с большой осторожностью.
8. Обсуждая свойства верхних слоев атмосферы, ученые отметили ряд важных аспектов, которые невозможно исследовать без помощи космических летательных аппаратов.

XIV. Represent the following points in the form of a brief report:

1. Inspection of wings.
2. Inspection of engine mounts.
3. Inspection of cowling and fairing.

XV. Write a summary of the text.

Unit 5 Fuselage

I. Read and memorize the following words:

accessible - доступный

to complicate –усложнять

engine mount (ing) – рама крепления двигателя, моторама

excrescence - нарост

fail-safe design – прочная конструкция (надежная при отказе некоторых элементов)

fatigue – усталость (металлов)

hatchway – люк

obstruction - препятствие

payload – полезная нагрузка (коммерческий груз)

to pierce– пронзать, пробивать

plywood – фанера

to rely on (upon) – полагаться на

reinforced shell –усиленная обшивка

robust – крепкий, прочный

similar – подобный

torque - крутящий (вращающий) момент

tubing – система труб

weight penalty – ухудшение весовых характеристик

II. Read the following international words and guess their meanings.

passenger, pilot, construction, portion, adequate, corrosion, centre, object, reaction, machine, function.

III. Form derivatives with the help of the suffixes. Translate them.

1. nouns from the following verbs with

the suffixes – a) – tion (-ation)

b) - sion

Model: a) to direct – direction; b) to preclude – preclusion

a) to locate; to combine; to construct; to add; to inspect; to protect; to obstruct; to consider;
b) to provide; to divide; to corrode; to decide.

2. adjectives with the suffixes – a) – able
   b) - ible

Model: a) to change - changeable;
   b) to respond – responsible;

a) to adjust; to allow; to move; to steer; to vary; to replace; to remark;
b) access; to permit; to reverse; to admit; to compress; to sense; to convert.

3. adverbs from the following adjectives with the suffix – ly

vertical; satisfactory; similar; separate; different; various; easy.

IV. Translate the words formed by conversion. Use some of them in your own sentences.

design – to design; cause – to cause; control – to control; pipe – to pipe; load – to load; store – to store; pilot – to pilot; shape – to shape; seat – to seat; damage – to damage; space – to space; bank –to bank; separate – to separate.

V. Match up

1. the synonyms:

a) to include, cargo, entire, formidable, damage, to achieve, rigid, to fulful, obstruction, accessible, requirement, penalty;
b) injury, to accomplish, demand, whole, obstacle, to contain, available, freight, loss, huge, stiff, to obtain.

2. the antonyms:

a) difference, safety, occupied, to leave, vital, to store, separated, rear, to attach, strong, to transmit, replaceable;
b) front, to stay, fixed, to lose, similarity, weak, danger, to disconnect, vacant, unimportant, to receive, connected.

VI. Translate the sentences. Define the function of the infinitive.

1. The large transport planes have rows of seats to carry many passengers.
2. The forward end of a one – engined airplane is designed to carry an engine.
3. Refrigeration units are used in airplanes to cool air.
4. Tsiolkovsky was the first to approach the problem of jet propulsion scientifically and to prove the possibility of utilizing a jet – propelled vehicle for interplanetary communications.
5. This research airplane is designed to fly at more than 3,600 mph and to reach heights of up to 100 miles.
6. To fly day after day in high – speed airplanes the pilot must be mentally and physically fit.
7. The activities involved in various space programs are believed to have created a revolution in scientific research and technological development.
8. To find the answers to these questions and many others a number of research rockets were sent into space.
9. To provide a uniform internal temperature inside, the generator the engineers designed a special thermal control device.
10. Overheating of the engine is to be avoided.
11. The differences observed are too small to be considered.
12. The space environment between 200 and 1,000 km from the surface of the Earth can be considered safe enough to establish stable orbits for the various types of space vehicles.
13. Engines of the carrier rocket must have sufficient power to launch the satellite into the Earth's orbit.
14. To imagine modern science without optical instruments is absolutely impossible.

VII. Read and translate the text.

Fuselage.

The fuselage of all airplanes is similar in design and location. The main differences are the size and the use for which the airplane is designed. A small, light aircraft has a

fuselage to carry one or two passengers, including the pilot, and a few pounds of baggage, which make up the entire payload of the airplane. The large transport planes have rows of seats arranged to carry many passengers with room in the front of the fuselage for baggage, radio equipment, etc. In this type of airplanes the pilot, and copilot are far forward in the fuselage in a separate compartment from the passengers. The fuselage of cargo- carrying airplanes has large spaces in which cargo may be stored. In light airplanes the fuselage may be made of welded steel tubing covered with fabric, a wooden framework covered with light plywood, a combination of metal and plywood, or of wood and fabric.

Fuselages of most present-day airplanes are of all-metal construction, often of the monocoque design. The monocoque design relies largely on the strength of skin or shell to carry various loads. This design may be divided into three classes- monocoque, semimonocoque and reinforced shell. Different portions of the same fuselage may belong to any of these classes.

The purely structural effort required to design a large, highly pressurized fuselage with numerous cut - outs for windows and doors is a formidable one. To make adequate provision against catastrophic failure from fatigue and corrosion on the one hand and from external damage caused by “foreign” objects such as propeller or turbine blades on the other hand further complicates the task.

The trend today is to make a fuselage of fail-safe design wherein structural safety is provided by the multi-load path concept, and to achieve this safety for as low a weight penalty as possible.

The Functions of the Fuselage

In the case of one-engined aircraft the forward end is designed to carry an engine. In multi-engined aircraft the forward end of the fuselage may be occupied by navigational instruments and the navigator himself.

As an engine mounting the structure must be extremely rigid and capable of withstanding the thrust and torque reaction of the power unit in addition to its weight vertically, and sideways when the machine is banked over.

The engine mounting should be easily replaceable, a condition which has additional importance when two or more different types of engines might be in use. Not only must it fulfil these requirements and carry the engines satisfactorily, but it must also do it in such a way as to leave all the vital parts easily accessible. All the engine equipment, such as filters, controls, fuel, oil and water pipes must be so attached as to give the possibility of inspection.

The engine mounting is separated from the fuselage proper by a fireproof bulkhead of thin asbestos board sandwiched between aluminium sheets.

The centre portion is known to act as a bridge between the engine loads in front and the tail loads behind.

Through this centre section the whole weight of the aircraft must be carried to the main planes when in flight and to the undercarriage when landing. This part of the fuselage is the nerve and brain centre of the whole machine. In it are contained the pilot and all controls, the passengers and cargo if a commercial machine.

The outside which acts also as a weather protection to the people and goods carried in the machine will be pierced with cockpit openings, doors, windows and different hatchways. The rear end of the fuselage must carry the tail and transmit its loads to meet their reactions forward. These loads will be vertical from the tail plane and elevator, horizontal and torsional from the fin and rudder.

Finally the fuselage as a whole must be a streamlined shape with fair lines from front to rear, and without excrescences, hollows or other obstructions to the air flow. Such are the functions of the fuselage.

Turning now to its qualities the first consideration appears to be that it must be weight. But weight is not everything. The structure must be strong, rigid and robust.

VIII. Make up English – Russian pairs of the word combinations equivalent in meaning.

1. adequate provision against	1. внешнее повреждение
2. formidable task	2. программа конструкторских работ
3. catastrophic failure	3.соотвествующая мера

	предосторожности
4. external damage	4. выдерживая осевое давление и реактивный момент
5. structural safety	5. без выступов, впадин или других препятствий
6. multi-load path concept	6. грандиозная задача
7. withstanding the thrust and torque reaction	7. ухудшение весовых характеристик
8. structural effort	8. катастрофический отказ
9. weight penalty	9. надежность конструкции
10.without excrescences, hollows or other obstructions	10. Закон распределения нагрузок

IX. Fill in the blanks with the proper words.

1. The fuselage of all airplanes... in design and location.
2. Fuselages of most present-day airplanes are of... .
3. The monocoque design... on the strength of skin.
4. The engine mount is separated from the fuselage by a fireproof... .
5. The fuselage as a whole must be of a... shape.
6. Engine mounting must have all the vital parts easily... .
7. All the engine equipment must be so... as to give the possibility for... .

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all-metal construction, relies, is similar, attached, streamlined, accessible, inspection, bulkhead

X. Choose the right form from the forms given in brackets.

1. The size and the use for which the airplane (designed, is designed) differ one fuselage from the other.
2. The fuselage of cargo-carrying airplanes (have, has) large spaces in which cargo may (be stored, stored).

3. Structural safety of a fuselage of fail-safe design (provided, is provided) by the multiload path concept.
4. The forward end of the fuselage (designed, is designed) to carry an engine in one-engined aircraft.
5. The engine mounting (separates, is separated, separated) from the fuselage by a fireproof bulkhead.
6. The centre section of the fuselage (contained, is contained, contains) the pilot and all controls, the passengers and cargo if a commercial machine.
7. The rear end of the fuselage must (carries, be carried, carry) the tail and transmit its loads to meet their reactions forward.

XI. Say if the following statements are true or false. Correct the wrong statements.

1. The fuselage of all airplanes is similar in design and location differing only in the size and the use for which the airplane is designed.
2. The large transport planes are designed to carry many passengers and have room in the front of the fuselage for baggage, radio equipment, etc.
3. In light airplanes the fuselage may be made only of wood or metal.
4. The strength of skin is unimportant in the monocoque design of the fuselage.
5. The present- day trend is to make a fuselage of fail-safe design wherein structural safety is provided by the multi-load path concept.
6. The engine mounting should be fixed because only one type of an engine is usually used.
7. The centre section of the fuselage is the nerve and brain centre of the whole machine acting as a bridge between the engine loads in front and the tail loads behind.
8. Such parameters as the shape and weight of the fuselage are not to be considered while designing an aircraft.

XII. Answer the questions.

1. What makes up the entire payload of a light aircraft?

2. What is the fuselage of a light plane made of?
3. What kind of fuselage do most of the present-day airplanes have?
4. What does the monocoque design rely upon?
5. What classes of the monocoque design are known?
6. Why is it difficult to design a large highly pressurized fuselage?
7. What is the modern trend in design of the fuselage?
8. What is the function of the forward end in one-engined aircraft?
9. What is the function of the forward end in multi- engined aircraft?
10. Why must the engine mounting structure be extremely rigid?
11. How must all the engine equipment be attached?
12. How is the engine mounting separated from the fuselage proper?
13. What is called "the nerve and brain centre"?
14. What loads act at the rear end of the fuselage?
15. What is the shape of fuselage?
16. What qualities must the fuselage possess?

XIII. Match up the terms with the corresponding definitions.

1.Corrosion	1. The main body of the airplane containing the cockpit, passenger and baggage compartments.
2. Fatigue	2. The force per unit area acting on a surface
3. Skin	3. Surface chemical action, especially on metals, by action of moisture, air, or chemicals
4. Pressure	4. One of the most essential parts of the airplane developing power for propelling the airplane.
5. The fuselage	5. The final covering of the fuselage carrying various loads
6. The power plant	6. The deterioration of metals owing to

repeated stresses above a certain
critical value, it is accompanied by
changes in the crystalline structure
of the metal

XIV. Find in the text the following grammatical forms:

a) Modal verbs;

b) The infinitive. Define its functions.

XV. Make up a plan of the text and render its main ideas according to your plan.

XVI. Compose a summary of the text.

Unit 6 Cockpit and Cabins

I. Read and memorize the following words:

to catch v. – зажимать, зацеплять

catch n. – защелка, запор

convenient – удобный

emergency release – рычаг аварийного сброса (открытия)

enclosure – закрытое отверстие (окна, двери)

flashlight - ручной электрический фонарь, сигнальный огонь

to foul – засорять, загрязнять

hazard – опасность

installation – установка, сборка, монтаж

jamming – заедание, заклинивание, зажимание

latch – защелка, замок, задвижка

padding – набивка, грунтовка

to prevent – предотвращать

projection – выступ, выдающаяся часть

seam – шов

shock cord – резиновый амортизационный шнур

strap – ремень, лямка, завязка

tension – натяжение, напряжение

web – ткань

webbing – тканевый материал, лента, тесьма

windshield – смотровое стекло

II. Read the international words and guess their meaning

inspection, object, microphone, baggage, ballast, individual, section, minimize, condition, interval

III. Form nouns from the following verbs. Translate them.

To install, to inspect, to vibrate, to project, to correct, to apply, to operate, to equip, to attach, to adjust.

IV. Find the roots of the following words, translate the words.

a) properly, securely, periodically, positively, easily, correctly, regularly, immediately
b) jamming, holding, resulting, clothing, loading, fitting, webbing, moving, weakening
c) maintenance, emergency, cleanliness, safety, occupant
d) careful, technical, excessive, defective

V. Make up pairs of

1. synonyms

a) to adjust, strain, loose, operation, entire, proper, adjustment, periodic, hazard, to secure, attempt
b) appropriate, regular, attachment, danger, performance, to attach, whole, unfastened, effort, fit, tension

2. antonyms

a) order, to allow, to minimize, moving, to result from, regularly, to include, to raise, excessive, to install, careful
b) stationary, to exclude, disorder, to remove, to forbid, seldom, to maximize, careless, to result in, insufficient, to lower

VI. Translate the sentences into Russian

1. Proper installation of equipment is important in the inspection and maintenance of an airplane.
2. Flashlights should never be allowed on the floor of the cockpit.
3. They may create a serious hazard by jamming the flight controls.
4. Extra length of microphone cords should be coiled and taped to a convenient part of the airplane.

5. The, metal frames holding the windshields and windows must be kept free from corrosion and cracks.
6. The padding about the individual sections of glass or composition material should be maintained properly.
7. All locks, catches and hinges must be securely attached.
8. A damaged seat should be replaced.
9. The tension of the shock cord must be adjusted to raise the seat easily when the release is operated.
10. A weight of 500 pounds must be lifted from the floor gently to prevent impact loading.

VII. Read and translate the text.

Cockpit and Cabins

Visual Check. Cleanliness, order, and proper installation of equipment are important in the inspection and maintenance of an airplane. Loose objects such as tools microphones, or flashlights should never be allowed on the floor of the cockpit. They may create a serious hazard by jamming the flight controls. Extra length of microphone cords or similar equipment should be coiled and taped to a convenient part of the airplane so that they cannot foul the controls. Regular checks should be made to see that the data and map cases in the cockpit contain the required Technical Orders and maps. Before take-off the cockpit, baggage and tool compartments must be checked to see that all contents are properly secured so that they cannot damage the airplane during manoeuvers. When ballast is used a check must be made to see that it is properly located and securely fastened.

Enclosures, Windshield, and Windows. The metal frames holding the windshields and windows of enclosures must be kept free from corrosion and cracks. The padding about the individual sections of glass or composition material should be maintained properly in order to minimize cracks resulting from vibration.

Doors. Door locks must latch positively and lock or unlock easily. All locks, catches and hinges must be securely attached. The operation of the emergency release must

be checked periodically and correction made if it does not work properly. All moving parts are to be oiled lightly at regular intervals.

Seats and Safety Belts. Seats should be inspected regularly for cracks or sharp projections which might catch or tear the clothing of the occupant. If a damaged seat cannot be repaired, it should be removed and replaced.

1. When a seat is installed, its attachment and all fittings must be securely fastened. The adjustment must operate easily and positively. The tension of the shock cord must be adjusted to raise the seat easily when the release is operated. Periodic inspection is required to keep all these parts in good operating condition, inspection includes a careful test of the shock cord as directed in Technical Orders.
2. When a safety belt is installed it must be checked to see that webbing, straps, buckles, seams, etc, are in good condition; that the attachments are secure; that it is adjusted correctly; and that the release operates properly. This inspection is repeated at regular intervals.
3. All safety belts must be given a regular weight test. Each type is tested while web and leather parts are adjusted to their greatest length. During the test, a weight of 500 pounds must be lifted from the floor gently to prevent impact loading-that is excessive stress due to sudden application of a force-and lowered immediately to prevent unnecessary strain on the material of which the belt is made. No attempts should be made to tear the stitching or webbing of a belt by hand. If any part is found to be defective or deteriorated, or if it shows any evidence of weakening or failure during the test the entire belt will be replaced.

VIII. Make up English-Russian pairs of the phrases equivalent in meaning

1. all contents are properly secured	1. любое доказательство ослабления и повреждения
2. securely fastened	2. Композиционные материалы
3. to prevent impact loading	3. Хорошее рабочее состояние
4. excessive stress	4. Прочно зацепленный
5. web and leather parts	5. Тщательная проверка

	амортизационного шнура
6. to be defective or deteriorated	6. Предотвратить ударную нагрузку
7. good operating conditions	7. Тканевые и кожаные части
8. any evidence of weakening and failure	8. Все содержимое надежно заперто
9. composition materials	9. Избыточное напряжение
10. a careful test of the shock cord	10. Быть неисправным или изношенным

IX. Fill in the blanks with the proper words

1. Before take-off the..., baggage and tool... must be checked.
2. The padding about the individual sections of glass or composition materials should be... properly.
3. The operation of the... release must be... periodically.
4. The adjustment must... easily and positively.
5. This inspection is repeated at... intervals.
6. All... belts must be given a regular weight....
7. Doors locks must latch....
8. All moving parts are to be... lightly.

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test, positively, cockpit, checked, emergency, oiled, maintained, compartments, safety, operate, regular

X. Agree or disagree with the following statements. Correct the wrong statements.

1. Cleanliness, order, and proper installation of equipment are unimportant in the inspection and maintenance of an airplane.

2. Before take-off the cockpit, baggage and tool compartments must be checked to see that all contents are properly secured so that they cannot damage the airplane during manoeuvers.
3. It is unnecessary to check the operation of the emergence release and make correction if it does not work properly.
4. When a seat is installed its attachment and all fittings may be allowed to be loose.
5. The inspection of a safety belt is repeated at regular intervals.
6. Weight tests of all safety belts are conducted very rarely.
7. If any part is found to be defective or deteriorated the entire belt must be replaced.

XI. Put each word from the first group together with a suitable word from the second.

1) loose, to foul, proper, to create, regular, to result from, emergency, to keep free, to operate, safety, periodic, to prevent
2) a serious hazard, intervals, object, from corrosion and cracks, installation, unnecessary strain, the controls, inspection, vibration, easily and positively, release, belt.

XII. Give answers to the following questions

1. What is important in the inspection and maintenance of the aircraft?
2. What may create a serious hazard?
3. What must be checked before a take – off and why?
4. What must be kept free from corrosion and cracks?
5. How must all locks, catches and hinges be attached?
6. Must the operation of the emergency release be checked periodically?
7. Why should seats be inspected?
8. What is done with the seat if it cannot be repaired?
9. What must be checked when safety belts are installed?
10. How is a regular weight test of a safety belt conducted?
11. When is the entire belt replaced?

XIII. Find in the text the following grammatical forms

a) Modal verbs, explain their application;

b) the infinitive, define its functions.

XIV. Translate the sentences into English using the vocabulary of the lesson.

1. Правильная установка оборудования очень важна при осмотре самолета.
2. Незакрепленные предметы, такие как электрические фонари, микрофоны и т.д. могут представлять серьезную опасность для приборов и экипажа.
3. Металлические рамы окон и ветрового стекла должны оберегаться от ржавчины и трещин.
4. Трещины в результате вибрации должны быть сведены до минимума.
5. Все замки, запоры и петли должны быть надежно прикреплены.
6. Периодически должно проверяться действие рычага аварийного сброса.
7. Все движущиеся части должны слегка смазываться.
8. Трещины или острые выступы сидений могут зацепить одежду пассажира.
9. Если поврежденное сидение нельзя починить, его следует убрать и заменить другим.
10. Осмотр привязных ремней проводится регулярно.
11. Чтобы предотвратить ударную нагрузку, груз следует поднимать очень осторожно.
12. Если привязной ремень ослабел или порвался во время испытания, его следует заменить.

XV. Retell the text concentrating on the most important points in the inspection and maintenance of an airplane.

XVI. **Write a summary of the text.**

Unit 7. The Future

I. Read and memorize the following words:

formidable - значительный; громадный, огромный

afford – давать, предоставлять; позволять; доставлять

dethrone - свергать с престола; развенчивать

expensive – дорогой, дорогостоящий

ensure – обеспечивать, гарантировать

issue – спорный вопрос, проблема

substantial – существенный, важный, значительный

breakneck: at (a) ~ pace (или speed) сломя голову, с головокружительной быстротой

permeate – проникать, распространяться

mainstream - основное направление, главная линия

recognition – узнавание; опознание

influential – влиятельный, важный

schedule – намечать; планировать

lurk – оставаться незамеченным

averse – нерасположенный, неохотный

incentive – побуждение, стимул

yielb – производить, давать (плоды, доход)

tolerant – терпимый; допустимый; выносливый

ownership – собственность, владение

II. Read the international words and guess their meaning.

Commercial, aerospace, industry, product, protection, resources, microelectronics, operation, service, configuration, passenger, technology.

III. Give the initial words of the following derivatives.

Prediction, reinforced, affordability, finally, environmental, contribution, scientific, reduction, unmanned, acceptable, successful, reasonable, promising.

IV. Translate the words formed by conversion. Use some of them in your own sentences.

Advance - to advance; face - to face; challenge – to challenge; cost – to cost; design - to design; manufacture - to manufacture; force - to force; influence - to influence; equal - to equal; approach - to approach; a potential - potential.

V. Match up the words which are similar in meaning

a) development, to suggest, challenge, to tackle, formidable, research, to exploit, opportunity, to transform, shape, substantial, reason, aim, application
b) issue, immense, to offer, investigation, to solve, improvement, chance, to employ, form, to change, cause, use, significant, purpose.

VI. Read the text carefully. Try to understand all details.

The Future

A prediction: the commercial airliner of the future will be supersonic, hydrocarbon-fuelled and human-crewed; while the combat aircraft of the future will be hypersonic, hydrogen- fuelled and human-supervised. The question: when exactly will that future materialise? Probably not as soon as the pace of technological development over the first century of aviation would suggest. Why? Because the industry that has advanced from doped fabric and bracing wire to reinforced plastic and fly-by-wire in just over 90 years faces formidable challenges as it enters the 21st century.

The first of those challenges is cost, or perhaps value would be a better word - or affordability. The aerospace industry is finally coming to terms with the fact that its products are too expensive. So, by the end of the first century of aviation performance has been dethroned and cost crowned king.

The second challenge is environmental, and involves ensuring that aerospace makes its contribution to protection of the earth's environment. Tackling emissions and noise issues is likely to consume a substantial part of the commercial aviation industry's research resources over the early years of the 21st century.

The third challenge lies in exploiting information technology. The breakneck pace of commercial microelectronics development is only just beginning to make itself felt in aerospace, and ultimately will permeate every aspect of the industry; from design, through manufacture to the operation of civil and military air and space vehicles.

Tackling cost and environmental challenges will also present the industry with its greatest opportunities, as it will force aerospace deeper into the mainstream of commercial technology development. Rapidly evolving commercial products and processes are already transforming the way aircraft are designed and manufactured, and they promise to change aerospace vehicles beyond recognition.

Today, it is fairly easy to predict the shape of aviation in the first quarter of the 21st century because, the aircraft that will be most influential are already in design or under development.

These include the Airbus Industrie A3 XX large airliner, the Lockheed Martin/Boeing F-22 fighter and the Bell 609 civil tilt-rotor - all scheduled to enter service in the first few years of the 21st century. Another is the Joint Strike Fighter (JSF), which is planned to become operational around 2010.

The technological choices that these aircraft represent will set the tone for the opening years of the 21st century. Advances lurking in laboratories are unlikely to influence aviation much before the second quarter of the 21st century.

And the reason is risk; the aerospace industry has become as risk-averse as it is cost - conscious, because risk equals cost.

New technologies must now "buy" their way on to programmes, and risk reduction has become the name of the game.

The second- generation supersonic airliner is unlikely now to enter service before 2025, although a supersonic business jet could become available earlier. Developing a smaller less technically challenging and more environmentally acceptable aircraft could pave the way for certification of a supersonic airliner.

Work now under way at Dassault and Gulfstream cannot be expected to yield an operational supersonic business aircraft before 2010, but the issues of airport noise, sonic boom and high-altitude emissions are less with a smaller aircraft and successful

development of a supersonic business jet would certainly reduce the risk attached to certificating a supersonic airliner.

By 2025 it would be reasonable to expect to see a new generation of subsonic transports, beyond the A3XX. Likely concepts include ultra-high capacity and global-range aircraft that would appeal equally to commercial and military customers. Potential configurations include blended wing/body and joined-wing designs, already being studied. The aim of both layouts is to reduce drag by using a very high aspect-ratio wing, and a key enabling technology is composite primary structure.

Work is already under way on new manufacturing technologies, such as stitched composites that would produce strong, light, damage-tolerant airframes, but the risk is still too great to expect their application to large passenger- carrying transports much before 2020. There are also other promising technologies that still have to be demonstrated, such as active aerodynamic and structural control to suppress flutter in a very high aspect-ratio wing.

Other drag reduction technologies, such as passive and active laminar flow control, could find earlier application in subsonic transports, possibly in later versions of existing and already planned aircraft. Technology development work is well under way, but cost remains the issue. As long as fuel prices remain low, the incentive to reduce airframe drag will be limited.

The same applies to advancing commercial engine technology, where the emphasis today is on reducing cost of ownership. A greater focus on reducing noise and emissions can be expected in the early years of the 21st century. This could result in a renewed drive to reduce fuel consumption substantially. Pratt & Whitney is already showing the way with development of its PW 8000 very-high-bypass turbofan, which is planned to be available after 2005.

Post-reading.

I. **Give Russian equivalents of the following words and phrases.**

Hydrocarbon-fuelled; human-supervised; the pace of technological development; reinforced plastic and fly-by-wire; the commercial aviation industry's research

resources; the civil tilt-rotor; reusable launch vehicle; ultra-high capacity and global range aircraft; blended wing/body and joined-wing designs; composite primary structure.

II. Give English equivalents of the following phrases.

На водородном топливе, пилотируемый экипажем, громадные проблемы, делает свой вклад в проблему защиты окружающей среды на земле; головокружительно быстрое развитие коммерческой микроэлектроники; обещают изменить авиакосмические аппараты до неузнаваемости; передовые разработки, таящиеся в лабораториях, беспилотный военный летательный аппарат, сверхзвуковой авиалайнер второго поколения, крыло с очень большим удлинением.

III. Find in the text aviation terms and give their Russian equivalents.

IV. Say whether the following statements are true or false. Correct the wrong statements.

1. The future in aviation technology will materialise not as soon as the pace of technological development over the first century of aviation would suggest.
2. The aviation industry doesn't face any challenges as it enters the 21st century.
3. Rapidly evolving commercial products and processes are already transforming the way aircraft are designed and manufactured.
4. Today, it is impossible to predict the shape of aviation at the beginning of the 21st century.
5. Affordable access to space is one of the most important technologies for the 21st century, and it presents no risk.
6. The second-generation supersonic airliner is likely to enter service in the first years of the 21st century.
7. Work is already under way on new manufacturing technologies, such as stitched composites, that would produce strong, light, damage-tolerant airframes.

V. Answer the questions

1. What features will aircraft of the 21st century have?
2. What promises to change aerospace vehicles beyond recognition in the 21st century?
3. What aircraft will dominate in the first quarter of the 21st century?
4. What vehicles are planned to be developed?
5. What layouts, designs, manufacturing technologies are under development for future aircraft?

VI. Speak about formidable challenges which the aerospace industry faces on entering the 21st century.

VII. Compose a summary of the article.

VIII. Describe an aircraft of the future as you imagine it.