МОСКОВСКИЙ ГОСУДАРСТВЕННЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ ГРАЖДАНСКОЙ АВИАЦИИ

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ИНОСТРАННЫЙ ЯЗЫК

AVIONICS

ПОСОБИЕ
по английскому языку

для студентов I курса
специальности 25.05.03
очной формы обучения

Москва-2016
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Данное пособие издается в соответствии с рабочей программой учебной дисциплины «Иностранный язык» по Учебному плану для студентов I курса специальности 25.05.03 очной формы обучения.

Рассмотрено и одобрено на заседаниях кафедры 01.02.16 г. и методического совета 24.02.16 г.
UNIT 1

INTRODUCTION

Essential Vocabulary

avionic equipment – бортовое радиоэлектронное оборудование
cockpit – кабина экипажа
flight control system – система управления полетом
flight crew – летный экипаж
backup – дублирование
communication system – система связи
navigation system – навигационная система
anti-collision system – система предупреждения столкновений

Read and translate the following text:

The cockpit of an aircraft is an ideal location for avionic equipment including monitoring, control, weather, navigation, communication and anti-collision systems. The journalist Philip J.Klass was the founder of word “avionics”. Many modern avionic systems have their origins in World War II time developments. Autopilot systems that are fruitful today were started to help bomber planes fly steadily enough to hit precision targets from high altitudes. Radar was developed in Germany, the United Kingdom and the United States of America during that period. Modern avionics is essential portion of military aircraft spending.

Most modern helicopters now have budget splits of 60/40 in favour of avionics. The F15E and now retired F14 aircraft have almost 80 per cent of their budget spent on avionics. It’s the same for civilian market.

Flight control systems and new navigation needs brought on by tighter airspace have pushed up development costs. More accurate methods of controlling aircraft safety in this high restrictive airspace have been invented as more people begin to use planes as their primary method of transportation.

Pilots of modern advanced avionics aircraft must learn and practice backup procedures to maintain their skills and knowledge. Risk management principles require the flight crew to always have a backup or alternative plan and/or escape route. Advanced avionics aircraft relieve pilots of much of the minute-to-minute tedium of everyday flights but demand much more initial and recurrent training to retain the skills and knowledge necessary to respond adequately to failures and emergencies.
Although it may not be apparent at first sight it’s fair to say that a modern aircraft simply could not fly without the electronic systems that provide the crew with a means of controlling the aircraft.

The term “avionics” is derived from the combination of “aviation” and “electronics”. Avionics are the electronic systems used on aircraft, artificial satellites and spacecraft. Avionic systems include communications, navigation, the display and management of multiple systems and the hundreds of systems that are fitted to aircraft to perform individual functions.

Avionic systems are used in a wide variety of different applications ranging from flight control and instrumentation to navigation and communication. In fact, an aircraft that uses modern techniques could not even get off the ground without electronic systems that make it work. It was first used in the USA in the early 1950s and has since gained wide scale usage and acceptance.

The term “avionic system” or “avionic sub-system” is used to mean any system in the aircraft which is dependent on electronics for its operation although the system may contain electro-mechanical elements.

The avionics industry is a major multi-billion dollar industry world-wide and the avionic equipment on a modern military or civil aircraft can account for around 30% of the total cost of the aircraft.

The avionic systems are essential to enable the flight crew to carry out the aircraft mission safely and efficiently whether the mission is carrying passengers to their destination in the case of a civil airliner or, in the military case, intercepting a hostile aircraft attacking a ground target, reconnaissance or maritime patrol.

**Ex.1. Answer the following questions:**

1) What is an ideal location for avionic equipment?
2) Where do many modern avionic systems have their origins?
3) What do electronic systems provide the flight crew with?
4) What words is the term “avionics” derived from?
5) What systems are avionic ones?
6) Can an aircraft using modern techniques get off the ground without electronic systems? Why?
7) Some electronic systems or sub-systems contain electro-mechanical elements, don’t they?
8) What percentage of the aircraft total cost can avionic equipment account?
9) When are avionic systems especially essential?
Ex.2. Decide whether the following statements are true or false. If a statement is false, change it to make it true:
1) The journalist Philip J. Klass was the founder of the term “avionics”.
2) Autopilot systems were started to help civil aircraft carry passengers safely.
3) Pilots of modern advanced avionics aircraft needn’t learn and practice backup procedures.
4) Advanced avionics aircraft relieve pilots of much of minute-to-minute tedious of everyday flight.
5) Avionic system is any system in the aircraft which is dependent on electronics for its operation.

Ex.3. Find in the text English equivalents of the following word combinations:
бортовое радиоэлектронное оборудование; системы наблюдения и контроля; система метеонаблюдений; система предупреждения столкновений; большие высоты; современные вертолеты; системы управления полетом; методы безопасного управления полетом; сильно ограниченное воздушное пространство; процедуры дублирования; отказы и аварийные ситуации; средство управления самолетом; отображение и управление многочисленными системами; заставлять его (самолет) работать; зависимый от электроники; содержать электромеханические элементы; осуществлять свою миссию безопасно и эффективно; перевозить пассажиров к месту назначения.

Ex.4. Translate the following derivative groups:
- location - to locate - local - locally;
- equipment - to equip - equipped (part. II);
- communication - to communicate - communicative - communicator;
- to develop - developing (part. I) - developed (part. II) - development;
- control - to control - controlling (part. I) - controlled (part. II) - controller - controllable;
- safe - safely - safety;
- management - to manage - managing (part. I) - managed (part. II) - manager;
- flight - to fly - flying (part. I);
- to use - using (part. I) - used (part. II) - user - useless - useful - usage;
- to mean - means (n.) - meaning (n.) - meaningful - meaningless.

Ex.5. Choose correct definitions for the following words:
- fuselage, wing, tail unit, cockpit, cabin, avionics
  1) The place for pilots in the nose part of the fuselage.
2) The place for passengers in the central part of the fuselage.
3) The combination of electric, radio and electronic equipment.
4) The main structural body of an airplane.
5) The combination of stabilizing and controlling surfaces situated at the rear of an airplane.
6) The structural part supporting an airplane in the air by developing lift.

**Ex.6. Topics for discussion:**
1) Collect more facts and information about the first avionic systems, the origins of modern avionics and discuss them.
2) A man or a machine: who or what is more reliable.
3) Man and machine interaction.

**UNIT 2**

**BASIC FLIGHT INSTRUMENTS**

**Essential Vocabulary**

- flight instruments – пилотажные приборы
- heading – курс
- altitude – высота
- airspeed – воздушная скорость
- rate of turn – скорость разворота
- rate of climb (or descent) – скорость набора высоты (или снижения)
- attitude – пространственное положение самолета
- altimeter – высотомер
- attitude indicator – указатель пространственного положения
- magnetic compass – магнитный компас
- horizontal situation indicator – плановый навигационный индикатор
- bearing – азимут
- airspeed indicator – индикатор воздушной скорости
- vertical speed indicator – индикатор скорости набора высоты
- Pitot tube – приемник полного давления (трубка Пито)
- standby – запасной, резервный

**Read and translate the following text:**
Among the flight instruments fitted in any aircraft there are decisive ones that indicate the position and attitude of the aircraft. These flight instruments are very important to display information about:
- Heading
- Altitude
- Airspeed
- Rate of turn
- Rate of climb (or descent)
- Attitude (relative to the horizon).

Here we will talk in brief about the instruments that provide these indications:

**Altimeter** indicates the aircraft height (in feet or meters) above a reference level (usually mean sea level) by measuring the outside air pressure. To provide accurate readings the instrument is adjustable for local barometric pressure. In large aircraft a second standby altimeter is often available.

**Attitude indicator or artificial horizon** displays the aircraft attitude relative to the horizon. From this the pilot can tell whether the wings are level and if the aircraft nose is pointing above or below the horizon. This is a primary indicator for instrument flight and which is also useful in conditions of poor visibility. Pilots are trained to use other instruments in combination should this instrument or its power fail.

**Magnetic compass** indicates the aircraft heading relative to magnetic north. However, due to the inclination of earth magnetic field the instrument can be unreliable when turning, climbing, descending or accelerating. Because of this the Horizontal Situation Indicator is used. For accurate navigation it is necessary to correct the direction indicated in order to obtain the direction of true north or south (at the extreme ends of the earth axis of rotation).

**Horizontal Situation Indicator** (HSI) displays a plan view of the aircraft position showing its heading. Information used by HSI is derived from the compass and radio navigation equipment (VOR*) which provides accurate bearings using ground stations. In light aircraft the VOR receiver is often combined with the VHF** communication radio equipment but in larger aircraft a separate VOR receiver is fitted.

**Airspeed indicator** displays the speed of the aircraft (in knots) relative to the surrounding air. The instrument compares the ram-air pressure in the aircraft Pitot tube with static pressure. The indicated airspeed must be corrected for air density (which varies with altitude, temperature and humidity) and for wind conditions in order to obtain the speed over the ground.
**Vertical Speed Indicator** indicates rate of climb or descent (in feet per minute or meters per second) by sensing changes in air pressure.

**Pitot tube** is an instrument used to measure flow velocity of fluids, it’s used to determine the airspeed of the aircraft.

In this diagram we see how the Pitot tube works with the indicators to determine the airspeed and aircraft height.

Notes:*VOR – VHF Omnidirectional Range (всенаправленный маяк сверхвысокой частоты)*

**VHF – Very High Frequency (сверхвысокая частота)**

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**Ex.1. Answer the following questions:**

1) What do basic flight instruments display information about?
2) How does altimeter work?
3) What does attitude indicator display aircraft attitude relative to?
4) What is the second name for attitude indicator?
5) What does magnetic compass indicate?
6) Why can it be unreliable? What is used in this situation?
7) What does horizontal situation indicator (HSI) display?
8) Where is the information used by HSI derived from?
9) What does airspeed indicator display the speed of the aircraft relative to?
10) What parameters does the instrument compare?
11) How does vertical speed indicator work?
12) What is Pitot tube used for?

Ex.2. Decide whether the following statements are true or false. If a statement is false, change it to make it true:
1) Flight instruments that indicate the position and attitude of the aircraft are the most important ones.
2) To provide accurate readings altimeter is adjustable for local temperature.
3) Attitude indicator is a primary one for instruments flight but it’s useless in conditions of poor visibility.
4) Magnetic compass indicates the aircraft heading relative to magnetic south.
5) HSI displays a plan view of the aircraft position showing its heading.
6) The indicated airspeed must be corrected only for wind conditions in order to obtain the speed over the ground.
7) Vertical speed indicator indicates rate of climb or descent in kilometers.
8) Pitot tube is used to measure flow velocity of fluids and to determine the airspeed of an aircraft.

Ex.3. Find in the text English equivalents of the following words and word combinations:
пилотажные приборы; курс; высота; воздушная скорость; скорость разворота; скорость набора высоты (или снижения); пространственное положение самолета; относительно горизонта; высотомер; уровень моря; давление воздуха; чтобы обеспечить точные показания; резервный высотомер; указатель пространственного положения; крылья горизонтально расположены; нос выше или ниже линии горизонта; в условиях плохой видимости; отказ прибора; магнитный компас; магнитное поле земли; разворот; ускорение; плановый навигационный индикатор; радионавигационное оборудование; точные азимуты; наземные станции; связное радиооборудование; индикатор воздушной скорости; давление скоростного напора воздуха; приемник полного давления; плотность; влажность; индикатор скорости набора высоты.

Ex.4. Translate the following word combinations paying attention to Participle I and Participle II:
flight instruments displaying information – information displayed by flight instruments; altimeter indicating the altitude of an aircraft – the altitude of an aircraft indicated by altimeter; an instrument measuring air pressure – air pressure measured by an instrument; an engineer adjusting flight instruments – flight instruments
adjusted by an engineer; an instructor training pilots – pilots trained by an instructor; pilots using instruments in combination – instruments used by pilots; pilots correcting the instrument readings – the instrument readings corrected by pilots; horizontal situation indicator showing the heading – the heading showed by HSI; radio navigation equipment providing accurate bearings – accurate bearings provided by radio navigation equipment; surrounding air – an aircraft surrounded by air; an instrument comparing changes in air pressure – changes in air pressure compared by an instrument.

**Ex.5. Give the names of the instruments to the following definitions:**
1) The instrument indicating the aircraft heading relative to magnetic north.
2) The instrument indicating the aircraft height above the reference level by measuring the local air pressure.
3) The instrument displaying the aircraft attitude relative to the horizon.
4) The instrument indicating rate of climb or descent by sensing changes in air pressure.
5) The instrument displaying a plan view of the aircraft position showing its heading.
6) The instrument displaying the speed of the aircraft relative to the surrounding air.
7) The instrument used to determine the airspeed and height of an aircraft.

**Ex.6. Topics for discussion:**
1) Collect more facts and information about basic flight instruments and discuss them.
2) Instrument flight in conditions of poor visibility: is it safe or dangerous?
3) Does the necessity to invent new flight instruments exist?

**UNIT 3**

**ENVIRONMENTAL CONTROL SYSTEM**

**Essential Vocabulary**

in charge of – отвечающий за
payload – полезная нагрузка
air supply – подача воздуха
thermal control – термоконтроль
cabin pressurization – герметизация пассажирского салона
Read and translate the following text:

In general, Environmental Control System (ECS) refers to the equipment in charge of maintaining a comfortable close environment for a given payload (goods, living matter and people), i.e. keeping temperature and pressure within acceptable limits usually by circulating fluid for thermal control and life-support. ECS for aircraft in hostile environment is the most demanding one. ECS usually focuses on inside part of the aircraft, whereas the environmental control of the outer side is usually named Environmental Protection System (EPS).

ECS works in the aircraft to provide air supply, thermal control and cabin pressurization for the crew and passengers. Avionics cooling, fire suppression and smoke detection are also considered to be functions of an aircraft environmental control system.

EPS provides protection against external actions: ice, rain, high temperatures, low temperatures. Protection against very low temperatures in aircraft is needed to avoid ice forming and to avoid freezing of internal liquids (from fuel to sanitary water). Protection against unwanted organism invasion (micro-organisms, insects, rodents and reptiles) treated under ECS may be considered EPS too.

Ex.1. Answer the following questions:
1) What sort of equipment does environmental control system refer to?
2) How does ECS keep temperature and pressure within acceptable limits?
3) What does ECS usually focus on?
4) What system controls the outer side environment?
5) Are avionics cooling, fire suppression and smoke detection considered to be the functions of an aircraft environmental control system?

Ex.2. Decide whether the following statements are true or false. If a statement is false, change it to make it true:
1) ECS is in charge of keeping only temperature within acceptable limits.
2) ECS usually focuses on the environmental control of outer side.
3) ECS operates in an aircraft to provide air supply, thermal control and cabin pressurization for passengers.
4) Avionics cooling unit is also considered to be a part of an aircraft ECS.

Ex.3. Find in the text English equivalents of the following word combinations:
оборудование, отвечающее за поддержание комфортной окружающей среды; полезная нагрузка; поддержание температуры и давления в приемлемых границах; циркуляция жидкости; термоконтроль; поддержание жизнедеятельности; вредная окружающая среда; система защиты от воздействия окружающей среды; обеспечивать подачу воздуха и герметизацию салона; охлаждение бортового радиоэлектронного оборудования; пожаротушение; обнаружение задымления.

Ex.4. Make the following words negative with the help of prefixes and translate them:

dis-: comfort, close, advantage;
in-: accurate, active, formal, effective, different, dependent, efficiently;
ir-: relative, regular, responsible;
non-: digital, aggressive;
un-: comfortable, acceptable, usual, controllable, able, expected, safe, usable, necessary, important, available, reliable.

Ex.5. Topics for discussion:
1) Collect more facts and information about environmental control system and discuss them.
2) Which system is more important for safe flight: ECS or EPS? Compare their functions.

UNIT 4

CABIN PRESSURIZATION SYSTEM

Essential Vocabulary

cabin pressurization system – система герметизации салона
cabin pressure – давление в салоне
to pump – нагнетать (воздух)
compressor – компрессор
outflow valve – выпускной клапан
air cycle cooler – воздушный радиатор
overflow valve – перепускной клапан
fatigue – усталость (металлов)
ambient pressure – давление наружного воздуха
turbine engine – газотурбинный двигатель
Differential Pressure – разница давлений снаружи и внутри самолета относительно друг к другу
Cabin Altitude – атмосферное давление, поддерживаемое в салоне (равно давлению на земле)
Cruise altitude – крейсерская высота (полета)

Read and translate the following text:

Cabin pressurization system is the system which ensures the safety and comfort of passengers and crew by controlling the cabin pressure and exchanging air from the inside of the aircraft to the outside. This happens by pumping conditioned air into the cabin. This air usually bleeds from the engines at the compressor stage. The air is then cooled, humidified, mixed with recirculated air if necessary and distributed to the cabin by one or more environmental control systems. The cabin pressure is regulated by the outflow valve.

On most planes cabin pressurization begins as soon as the wheels leave the ground. The engines begin sucking in air from the outside and directing that air through a series of chambers. This heats the air and pressurizes it. Before the air can be forced into the cabin it must be cooled which happens in what is known as air cycle cooler. Air from this cooler flows constantly into the cabin through an overflow valve.

Aircraft engines become more efficient with increase in altitude burning less fuel for a given airspeed. In addition, the flight is smoother and the aircraft is less fatigued when it flies above weather and associated turbulence. The aircraft needs to be pressurized in order to be able to fly at high altitudes so that the crew and passengers can breathe without extra oxygen.

Most airplanes fly at 35000 feet (about 10668 meters) above sea level. The oxygen levels at that altitude are too thin to sustain life. In small airplanes particularly fighter jets used for military purposes pilots wear oxygen masks and pressurization helmets to counter the altitude. This is not usually a practical solution for commercial airliners.

On most aircraft the cabin and baggage compartments are contained within a closed unit which is capable of containing air under a pressure higher than ambient pressure outside the aircraft.

Bleed air from the turbine engines is used to pressurize the cabin and air is released from the cabin by an outflow valve. To manage the flow of air through the outflow valve a cabin pressure regulator is used so the pressure within the aircraft
can be increased or decreased as required either to maintain a set Differential Pressure or a set Cabin Altitude.

Differential Pressure is the difference between cabin pressure and atmospheric pressure.

Cabin Altitude is the cabin pressure expressed as an equivalent altitude above sea level.

In practice as an aircraft climbs the pressurization system will gradually increase the cabin altitude and the differential pressure at the same time for the comfort of the passengers. If the aircraft continues to climb once the maximum differential pressure is reached the differential pressure will be maintained while the cabin altitude climbs. The maximum cruise altitude will be limited by the need to keep the cabin altitude at or below 8000 feet.

Because of physiological problems caused by the low outside air pressure at high altitude to protect crew and passengers from the risk of these problems pressurization becomes necessary at altitude above 12500 feet (3800 m) to 14000 feet (4300 m) above sea level it also serves to generally increase passenger comfort.

**Ex.1. Answer the following questions:**

1) In what way does cabin pressurization system ensure safety and comfort of passengers and crew?
2) How does it happen?
3) When does cabin pressurization begin?
4) What must be done with the air before it is forced into the cabin?
5) Why do modern aircraft fly at very high altitudes?
6) Why is it necessary to pressurize aircraft?
7) Where are the cabin and baggage compartment contained on most aircraft? Why?
8) What is Differential Pressure?
9) What is Cabin Altitude?
10) At what altitude does pressurization become necessary?

**Ex.2. Decide whether the following statements are true or false. If a statement is false, change it to make it true:**

1) Cabin pressurization system ensures the safety and comfort of passengers and crew by controlling the cabin pressure and exchanging air from inside of the aircraft to the outside.
2) The air isn’t cooled and humidified before it is distributed to the cabin.
3) On most planes cabin pressurization begins when they are at high altitudes.
4) Aircraft engines become more efficient with increase in altitude.
5) Most airplanes fly at about 35000 feet above sea level. The oxygen levels at that altitude are enough to sustain life.
6) Bleed air from the turbine engines is used to pressurize the cabin.
7) The pressure within the aircraft can’t be increased or decreased as required.
8) Pressurization becomes necessary at 15000 feet altitude.

**Ex.3. Find in the text English equivalents of the following word combinations:**

обеспечивать безопасность и комфорт; путьем контроля давления в салоне; путем нагнетания кондиционированного воздуха в салон; на стадии компрессора; воздух охлаждается, увлажняется; одна или более систем жизнеобеспечения; регулируется выходным клапаном; герметизация салона; всасывать воздух из окружающей среды; ряд камер; воздушный радиатор; перепускной клапан; двигатели самолета; с набором высоты; сжигание меньшего количества топлива; связанная с этим турбулентность; над уровнем моря; дополнительный кислород; надевать кислородные маски; багажный отсек; содержаться в замкнутом пространстве; давление окружающей среды снаружи самолета; воздух, исходящий из газотурбинных двигателей; воздух выпускается из салона; регулятор давления в салоне; быть увеличенным или уменьшенным; по мере того, как самолет набирает высоту; поддерживать; максимальная крейсерская высота; чтобы защитить экипаж и пассажиров.

**Ex.4. Translate the following word combinations consisting of nouns:**

cabin pressurization system; passenger and crew safety and comfort; cabin pressure; compressor stage; control systems; combustion chamber; air cycle cooler; aircraft engines; flight crew; sea level; oxygen levels; fighter jets; military purposes; oxygen masks; pressurization helmets; baggage compartment; turbine engines; cabin pressure regulator; cabin altitude.

**Ex.5. Put the predicates of the following sentences in the Present Simple Tense Passive Voice:**

1) Cabin pressure (to control) by the cabin pressurization system.
2) Conditioned air (to pump) into the cabin.
3) Then the air (to cool, to humidify, to mix) with recirculated air and (to distribute) to the cabin.
4) The cabin pressure (to regulate) by outflow valve.
5) The aircraft (to pressurize) in order to be able to fly at high altitudes.
6) On most aircraft the cabin and baggage compartment (to contain) within a closed unit.

7) Bleed air from the engines (to use) to pressurize the cabin and (to release) from the cabin by an outflow valve.

8) The pressure within the aircraft can (to increase) or (to decrease).

9) The maximum cruise altitude (to limit) by the need to keep the cabin altitude at or below 8000 feet.

**Ex. 6. Topics for discussion:**

1) Collect more facts and information about cabin pressurization system and discuss them.

2) Discuss reasons for sudden decompression and the ways to solve the problem.

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**UNIT 5**

**AIR CONDITIONING SYSTEM**

**Essential Vocabulary**

- air conditioning system – система кондиционирования воздуха
- air conditioning pack – блок (агрегат) кондиционирования воздуха
- flow control valve – клапан регулирования потока
- by-pass valve – перепускной клапан
- controller – регулятор
- mixing unit – блок смешивания
- low-density air – воздух низкой плотности
- (outlet) duct – (выходной) канал
- air-to-air heat exchanger – воздухо-воздушный радиатор
- inlet scoop – входное отверстие воздушозаборника
- Electronic Centralized Aircraft Monitor – электронный централизованный монитор самолета
- outlet temperature – температура на выходе

**Read and translate the following text:**

Any aircraft must be equipped with an air conditioning (AC) and pressurization system to fly at high altitudes which provides a convenient environment for its passengers. The human body is unable to withstand the effects of a low-pressure
atmosphere that’s why air conditioning and pressurization system is a vital component of modern flight.

Aircraft AC systems are very similar on all modern airplanes. However, let’s mention a brief description of this system in the A320 Airbus.

The system basically comprises air conditioning packs, a pack flow control valve, a by-pass valve, pack controllers and a mixing unit. These components provide conditioned air via the following step by step process:

1. Outside air enters the airplane engine.
2. Compressors within the engine compress this low-density air.
3. Bleed air (hot compressed air from the compressor) is then transported via ducts to the AC packs.
4. Before entering the air conditioner units the bleed air passes through the pack flow control valve which regulates the flow of air entering the conditioning packs.
5. Within the AC unit two air-to-air exchanges are installed that supply outside air via a pack inlet scoop and the air exits through an outlet duct.
6. As the cold air exits from the conditioning pack it is mixed with warm air.
7. The desired air temperature is achieved by regulating the amount of hot air mixed with the cold conditioned air exiting from the packs through a by-pass valve.
8. The regulated air is then fed to a mixing unit which transports the air further on into the cabin and cockpit.
9. The by-pass valve, pack flow control valve, inlet scoop and outlet duct are all operated by and connected to a pack controller.

An ECAM (Electronic Centralized Aircraft Monitor) constantly measures these parameters of the air conditioning system: pack air flow, compressor outlet temperature, by-pass valve position and pack outlet temperature.

Ex.1. Answer the following questions:
1) Why must any aircraft be equipped with an air conditioning and pressurization system?
2) What atmosphere effects is a human body unable to withstand?
3) Are air conditioning systems similar on all modern airplanes?
4) What does air conditioning system basically comprise?
5) Where does outside air enter?
6) What do compressors do with low-density air?
7) Where is hot compressed air then transported to?
8) What component of the pack regulates the entering air flow?
9) What is the function of two air-to-air heat exchangers?
10) How is the desired air temperature achieved?
11) What unit transports the air into the cabin and cockpit?
12) What are a by-pass valve, a flow control valve, an inlet scoop and an outlet duct operated by and connected to?
13) What parameters of the air conditioning system does Electronic Centralized Aircraft Monitor constantly measure?

Ex.2. Decide whether the following statements are true or false. If a statement is false, change it to make it true:
1) The human body is able to withstand the effects of a low-pressure atmosphere so the air conditioning and pressurization system is not a vital component of modern flight.
2) Air conditioning systems are absolutely different on all modern airplanes.
3) The air conditioning system comprises air conditioning packs, a pack flow control valve, a by-pass valve, pack controllers and a mixing unit.
4) Parameters of the conditioning system aren’t measured during flight.

Ex.3. Find in the text English equivalents of the following word combinations:
- должен быть оборудован; система герметизации и кондиционирования воздуха; летать на больших высотах; обеспечивать подходящую окружающую среду для пассажиров; противостоять воздействию низкого атмосферного давления; жизненно важный компонент; быть похожим; включать в себя; блок (агрегат) кондиционирования воздуха; клапан регулирования потока; перепускной клапан; регуляторы; блок смешивания; пошаговый процесс; наружный воздух; поступать в двигатель самолета; сжимать воздух низкой плотности; отбираемый (от двигателя) воздух; транспортировать через каналы; воздухо-воздушные радиаторы установлены; входное отверстие воздухозаборника; выходной канал; смешиваться с теплым воздухом; требуемая температура воздуха достигается регулированием; электронный централизованный монитор самолета; постоянно измеряет параметры; воздушный поток в агрегате; температура (воздуха) на выходе из компрессора; положение перепускного клапана.

Ex.4. Translate the following sentences paying attention to the Infinitive:
1) To fly at high altitudes any aircraft must be equipped with an air conditioning and pressurization system.
2) First autopilot systems were developed to help bomber planes fly steadily enough to hit targets from high altitudes.

3) To maintain their skills and knowledge pilots of modern advanced avionics aircraft must learn and practice backup procedures.

4) To carry out its mission safely and efficiently any modern aircraft must be equipped with a lot of avionic systems.

5) Bleed air from the turbine engines is used to pressurize the cabin.

6) To protect crew and passengers from physiological problems caused by the low outside air pressure pressurization becomes necessary at altitudes above 12500 feet (3800m).

**Ex.6. Topics for discussion:**

1) Collect more facts and information about air conditioning systems and discuss them.

2) Describe how Electronic Centralized Aircraft Monitor works (and is used by pilots) during the flight. Discuss the importance of this unit for safe and efficient flight.

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**UNIT 6**

**FUEL SYSTEM**

**Essential Vocabulary**

- to enable - облегчать
- fuel - топливо
- to ensure - обеспечивать
- shutoff valve - топливный запорный клапан
- to utilize - использовать
- to load - грузить, отгружать
- to store - хранить, запасать
- to deliver - доставлять
- to maintain - поддерживать, обслуживать
- to provide - обеспечивать, предоставлять
- pump - насос
- location - положение
- to differ - отличать, различать
- weight - вес
- engine - двигатель
- to cause - вызывать, заставлять
- common - общий, распространённый
- to connect - соединять, связывать
to install - устанавливать, монтировать
strainer - фильтр
to deplete - исчерпывать, истощать
access - доступ
to feed - снабжать топливом
layout - план, проект
to manage - управлять
volume - объём
accuracy - точность
to observe - наблюдать, следить, замечать
estimate - оценка, исчисление

**Read and translate the following text:**

An aircraft Fuel System enables fuel to be loaded, stored, managed and delivered to the propulsion system of an aircraft and Fuel management systems are used to control, monitor and maintain fuel consumption and stock in any type of industry that uses transport, including railroad, water and air. A fuel management system helps to make the fuel calculations needed for in-flight decisions about diversions, potential routing and fuel stops. A fuel management system offers the advantage of precise fuel calculations based on distance, winds, time and fuel flow measured by other aircraft systems.

High performance aircraft fuel systems manage complex operations like highly accurate fuel measuring, weight, balance, fuel transfer between tanks and air-to-air and ground refueling for commercial, military and space applications. Aircraft usually have several fuel tanks and there are fuel transfers among these tanks along a flight. These transfers are controlled with valves and may follow several alternative paths.

This figure shows a typical fuel tank layout for a commercial aircraft. Wing structure is a common location for fuel storage and in many commercial transports additional tanks are located in the area between the wings. Longer range aircraft and business jets may have tail tanks and/or additional fuselage tanks. However, in most cases the fuselage is primarily the place for passengers, cargo, flight deck (cockpit) and avionic equipment. Military fighters are a special case and
while the wing space is used for fuel storage in these applications, almost any available space in the fuselage may be used for fuel.

**Types of Fuel Systems.** Fuel systems differ greatly from aircraft to aircraft due to the relative size and complexity of the aircraft in which they are installed. In the most basic form a fuel system will consist of a single gravity feed fuel tank with the associated fuel line connecting it to the aircraft engine. In a modern multi-engine passenger or cargo aircraft the fuel system is likely to consist of multiple fuel tanks which may be located in the wing or the fuselage (or both) and in some cases the empennage. Each tank will be equipped with internal fuel pumps and have the associated valves and plumbing to feed the engines, allow for refueling and defueling called pressure feed fuel system.

The weight of the fuel is a large percentage of an aircraft total weight and the balance of the aircraft in flight changes as the fuel is used. In small aircraft the fuel tanks are located near the center of gravity so the balance changes very little as the fuel is used. In large aircraft the fuel tanks are installed in every available location and fuel valves allow keeping the aircraft to balance by scheduling the use of fuel from various tanks.

**Gravity Feed Fuel System.**
High-wing aircraft with a fuel tank in each wing are common. With the tanks above the engine gravity is used to cause the fuel to flow to the engine fuel control mechanism. The space above the liquid fuel is vented to maintain atmospheric pressure on the fuel as the tank empties. The two tanks are also vented to each other to ensure equal pressure when both tanks feed the engine. A single screened outlet on each tank feeds lines that connect to either a fuel shutoff valve or multiposition selector valve. The shutoff valve has two positions: fuel ON and fuel OFF. If installed the selector valve provides four options: fuel shutoff to the engine, fuel feed from the right wing tank only, fuel feed from the left fuel tank only, fuel feed to the engine from both tanks simultaneously. The fuel flows by gravity from the wing tanks through the feed lines to the fuel selector valve. After passing through the selector valve the fuel flows through the strainer and then continues on to the carburetor. The vent lines are normally routed to the outside of the wing where the possibility of fuel siphoning is minimized.

**Pressure Feed Fuel System.** Low- and mid-wing single reciprocating engine
aircraft cannot utilize gravity-feed fuel systems because the fuel tanks are not located above the engine. Instead one or more pumps are used to move the fuel from the tanks to the engine. Each tank has a line from the screened outlet to a selector valve. However, fuel cannot be drawn from both tanks simultaneously; if the fuel is depleted in one tank, the pump would draw air from that tank instead of fuel from the full tank. Since fuel is not drawn from both tanks at the same time there is no need to connect the tank vent spaces together. Many large aircraft and aircraft with medium to high powered engines require a pressure feed fuel system regardless of fuel tank location because of the large volume of fuel that must be delivered to the engines at high pressure.

**Initial Fuel Estimate.** Many fuel management functions lack a fuel quantity sensor. Without access to this raw data of fuel quantity fuel management functions perform calculations using an initial fuel estimate that was provided by the pilot before the departure. It is important to make accurate estimates of initial fuel because the fuel management function uses this estimate in making predictions about fuel levels at future times during the flight. For example, if you overestimate the initial fuel by eight gallons and plan to land with seven gallons of reserve fuel, you could observe normal fuel indications from the fuel management system, yet experience fuel exhaustion before the end of the flight. The accuracy of the fuel calculations made by the fuel management function is only as good as the accuracy of the initial fuel estimate.

**Ex.1. Answer the following questions:**
1) What is the function of an aircraft Fuel System?
2) What are Fuel management systems used to?
3) What else do you know about a Fuel management system?
4) How many tanks do aircraft usually have?
5) How are fuel transfers controlled?
6) What complex operations do high performance aircraft fuel systems manage?
7) What is a common location for fuel storage?
8) Describe the most basic form of a fuel system.
9) What types of Fuel System do you know?
10) What is the difference between pressure Feed Fuel system and gravity Feed Fuel system?
11) What is the main operating principle of Gravity Feed Fuel System?
12) Why cannot low-and mid-wing aircraft utilize gravity feed fuel system?
13) Why is it important to make accurate estimates of initial fuel?

Ex.2. Give Russian equivalents of the following words and word combinations:

to monitor, Fuel management systems, diversion, fuel stops, to maintain, location, stock, tank, ground refueling, layout, business jets, avionics equipment, military fighters, to install, basic form, to connect, plumbing, balance, keeping, to vent, vent lines, departure, unit, to provide, reserve fuel, to observe.

Ex.3. Find in the text English equivalents of the following words and word combinations:

топливная система самолёта, расход топлива, преимущество точных расчётов топлива, возможная схема движения, перекачка топлива, высокая точность измерения топлива, клапан, система подачи топлива под давлением, верхняя подача топлива, исходная оценка топлива, необработанные данные количества топлива, устройство управления топливом, надтопливное пространство, механизм управления подачей топлива, снабжать топливом двигатель, подача самотёком, объединённый топливопровод, насос для подачи топлива, планирование, обеспечивать, многопозиционный клапан переключателя (селекторный клапан), одновременно, фильтр, использовать, исчерпывать, несмотря на, не хватает датчика подачи топлива, доступ, переоценивать, нормальные показания топлива.

Ex.4. Decide whether the following statements are true or false. If a statement is false, change it to make it true:

1) Fuel management systems are used to control and maintain fuel consumption and stock in aviation industry.
2) A fuel management system can't make the fuel calculations needed for in-flight decisions about diversions and potential routing.
3) Fuel systems differ greatly from aircraft to aircraft due to the relative size and complexity of the aircraft.
4) In a multi-engine passenger aircraft the fuel system is unlikely to consist of multiple fuel tanks which may be located in the wing or the fuselage.
5) Low-and mid-wing single reciprocating engine aircraft usually utilize gravity-feed fuel systems.
6) One pump is used to move the fuel from tanks to the engine.
7) Each tank has a line from the screened outlet to a selection valve.
8) Many large aircraft require a pressure feed fuel system.
9) Many fuel management functions have a fuel quantity sensor.
10) It is important to make accurate estimates of initial fuel because the fuel management function uses this estimate during the flight.

Ex.5. Join beginners and ends to make sentences:
1) An aircraft fuel system a) to allow the pilot to choose which tank feeds the engine.
2) A single-engine piston aircraft b) allows the crew to pump, manage and deliver fuel to the propulsion system.
3) Fuel systems differ greatly c) to a fuel control valve (usually known as the fuel selector).
4) Fuel is piped through fuel lines d) to act as a fuel shut-off valve.
5) This valve serves e) has a simple fuel system.
6) Many aircraft have f) due to different performance of the aircraft in which they are installed.
7) The first function is g) several functions.
8) The second function is h) the left tank and right tank selections available to the pilot.

Ex.6. Translate the following derivative groups:
- store - storage;
- complex - complexity - complexion;
- select - selector - selective;
- deliver - delivery - deliverance;
- depart - departure - department;
- accurate - accuracy - accurately.

Ex.7. Form nouns from the verbs below with the help of suffixes:
A. -tion, -sion:
to consume, to calculate, to divert, to decide, to operate, to locate, to install, to provide, to connect, to indicate, to estimate, to illustrate, to relate, to add, to deplete, to predict, to exhaust.
B. -ment, -ance, -ence:
to manage, to equip, to measure, to perform, to differ, to maintain, to ensure.

Ex.8. Complete the sentences:
1) Fuel management systems are....
2) Wing structure is....
3) The fuselage is....
4) In multi-engine passenger or cargo aircraft the fuel system is....
5) The weight of the fuel is....
**Ex.6. Topic for discussion:**
What do you know about Fuel management system and Types of Fuel System?

**UNIT 7**

**AUTOPilot SYSTEM**

**Essential Vocabulary**

- heading - курс, направление
- strain - напряжение, нагрузка
- fatigue - усталость, утомление
- knob - ручка, кнопка
- elevator - руль высоты
- rudder - руль направления
- amplifier - усилитель
- bank - крен
- pitch - наклон, (тангаж)
- Gyro - гироскоп
- Servo - серво система (следящая система)

**Read and translate the following text:**

The automatic pilot is a system of automatic controls which holds the aircraft on any selected magnetic heading and returns the aircraft to that heading when it is displaced from it. The automatic pilot also keeps the aircraft stabilized around its horizontal and lateral axes.

The purpose of autopilot system is primarily to reduce the strain, work and fatigue of controlling the aircraft during long flights. To do this the automatic pilot system performs many functions. It allows the pilot to maneuver the aircraft with a minimum of manual operations. While under automatic control the aircraft can be made to climb, turn and dive with small movements of the knobs on the autopilot controller. Autopilot systems provide for one, two or three axis control of the aircraft. Some autopilot systems control only the ailerons (one axis), others control ailerons and elevators or rudder (two axes). The three-axis system controls ailerons, elevators and rudder.

All autopilot systems contain the same basic components:
1. Gyro: to sense what the aircraft is doing.
2. Servo: to move the control surfaces.
3. An amplifier: to increase the strength of gyro signals enough to operate the servos.
4. A controller: to allow manual control of the aircraft through the autopilot system.

**Principle of operation.** The automatic pilot system flies the aircraft by using electrical signals developed in gyrosensing units. These units are connected to flight
instruments which indicate direction, rate-of-turn, bank or pitch. If the flight altitude or magnetic heading is changed, electrical signals are developed in the gyros. These signals are used to control the operation of servo units which convert electrical signals into mechanical force which moves the control surfaces (aileron and elevators or rudder) in response to corrective signals or pilot commands.

**Ex.1. Answer the following questions:**

1) What system is the automatic pilot?
2) What keeps the aircraft stabilized around its horizontal and lateral axes?
3) What is the purpose of autopilot system?
4) What functions does the automatic pilot system perform to do this?
5) What does the three-axis system control?
6) What basic components do all autopilot systems contain?
7) How does the automatic pilot system fly the aircraft?
8) What do flight instruments indicate?
9) What way are electrical signals developed in the gyros?
10) Why are these signals used to control the operation of servo units?

**Ex.3. Find in the text English equivalents of the following words and word combinations:**

вытеснять, маневрировать, элерон, чувствовать, перемещать, развивать, пилотажные приборы, превращать, пикирование, автоматический регулятор, команды пилота, главным образом, уменьшать (снижать), обеспечивать (предоставлять), содержать, высота полёта.

**Ex.4. Give Russian equivalents of the following words and word combinations:**

magnetic heading, to displace lateral axis, to reduce the strain and fatigue of controlling the aircraft, to perform many functions, manual operations, to climb, turn and dive, small movements of the knobs, the autopilot controller, to control elevators and rudders, to increase the strength of gyro signals, to indicate direction, bank and pitch, to convert electrical signals into mechanical force, to move the control surface.

**Ex.5. Decide whether the following statements are true or false. If a statement is false, change it to make it true:**

1) The automatic pilot holds the aircraft on any selected magnetic heading.
2) The automatic pilot also keeps the aircraft stabilized around its horizontal axis.
3) The purpose of autopilot system is to reduce the strain, work and fatigue of controlling the aircraft.
4) It allows the pilot to maneuver the aircraft with a minimum mechanical operations.
5) The one-axis system controls ailerons, elevators and rudder.
6) All autopilot systems contain two basic components: Gyro and Servo.
7) The automatic pilot system flies the aircraft by using electrical signals developed in gyro-sensing units.
8) Gyro-sensing units are connected to flight instruments which indicate direction.

**Ex.6. Complete the sentences:**
1) The automatic pilot is...
2) The purpose of autopilot system is...
3) All autopilot systems contain...
4) Electrical signals are used....

**Ex.7. There are answers to questions about the text. Write the questions:**
1) Around its horizontal and lateral axes.
2) During long flights.
3) By using electrical signals.
4) Ailerons, elevators, rudders.
5) Direction, rate-of-turn, bank or pitch.
6) In the gyros.
7) Mechanical force.
8) To control the operation of servo units.

**Ex.8. Fill in the gaps using prepositions:**
1. The automatic pilot keeps the aircraft stabilized ... its horizontal and lateral axes.
2. It allows the pilot to maneuver the aircraft ... a minimum ... manual operations.
3. The automatic pilot system flies the aircraft ... using electrical signals developed ... gyro-sensing units.
4. Mechanical force moves the control surface ... response ... corrective signals or pilot commands.
5. Autopilot systems provide ... one, two or three axis control ... the aircraft.

**Ex.9. Put the verbs in brackets in the correct form, Active or Passive Voice:**
1. Autopilot system (to reduce) the strain, work and fatigue of the controlling the aircraft.
2. The automatic pilot system (to perform) many functions.
3. If the magnetic heading (to change), electrical signals (to develop) in the gyros.
4. Gyro-sensing units (to connect) to flight instruments which indicate direction, rate-of-turn, bank or pitch.
5. Electrical signals (to use) to control the operation of servo units.
6. Servo units (to convert) electrical signals into mechanical force.
7. A system of automatic controls (to hold) the aircraft on any selected magnetic heading and (to return) the aircraft to that heading when it (to displace) from it.

**Ex.10. Translate the following derivative groups:**
- convert - converter - convertible - convertibility;
- control - controller - controllability;
- select - selector - selective - selectivity - selectively;
• perform - performance - performative - performer;
• move - movement - moveable - moveability;
• connect - connection - connective - connectedly;
• provide - provider - providence - provident - provision;
• amplify - amplifier - amplification;
• operate - operation - operator - operational;
• correct - corrective - correction - correctness - correctly.

Ex.11. Topic for discussion:
What do you know about Autopilot System?

Read and translate the text:
In 1931, American aviator Wiley Post flew his single-engine Lockheed Vega – the “Winnie Mae” - around the world in a record eight days, 15 hours and 51 minutes. Post had a navigator by the name of Harold Gatty to help him stay alert and fight fatigue on that historic flight. But when Post became the first person to fly solo around the world in 1933, he had to do everything without an extra pair of hands. The secret to his success, or at least one of his secrets, was a simple autopilot that steered the plane while he rested.

Today autopilots are sophisticated systems that perform the same duties as a highly trained pilot. In fact, for some in-flight routines and procedures, autopilots are even better than a pair of human hands. They don't just make flights smoother – they make them safer and more efficient.

UNIT 8

ELECTRICAL POWER SYSTEM

Essential Vocabulary

to transmit - передавать, посылать
to distribute - распределять, распространять
simplistic - упрощённый
to vary - изменять, меняться
tremendously - чрезвычайно
ability - способность, возможность
alternator - генератор переменного тока
battery - аккумулятор
lead-acid - свинцово-кислотный
to startup - запускать
failure - отказ, сбой, выход из строя
to undergo - подвергаться, испытывать
electric drives - электроприводы
availability - доступность, наличие
to increase - увеличивать, повышать
reliability - надёжность, безопасность работы (или действия) машины
to improve - улучшать
to reduce - сокращать, уменьшать

**Read and translate the following text:**

An aircraft Electrical System is a network of components that generate, transmit, distribute, utilize and store electrical energy. An electrical system is an essential component of all but the most simplistic of aircraft designs. The electrical system capacity and complexity varies tremendously between a light, piston powered, single engine aircraft and a modern, multiengine commercial jet aircraft. However, the electrical system for aircraft at both ends of the complexity spectrum shares many of the same basic components.

All aircraft electrical systems have components with the ability to generate electricity. Depending upon the aircraft generators or alternators are used to produce electricity. One of the uses of the generator output is to charge the aircraft battery(s). Batteries are normally either lead-acid or another type and are used for both aircraft startup and as an emergency source of power in the event of a generation or distribution system failure.

The Electrical Power Systems (EPS) in future more-electric aircrafts (MEA) will undergo significant changes. Many functions that used to be operated by pneumatic and mechanical power are being replaced by electric power due to recent advances in power electronics, electric drives, control electronics and microprocessors, improving the performance and the reliability of the aircraft EPS, reducing fuel consumption per passenger per mile and increasing the availability of the aircraft.

**Ex.1. Answer the following questions:**
1) Give the definition of an aircraft Electrical System.
2) What can you say about the electrical system capacity and complexity?
3) What components do all aircraft electrical system have?
4) What is used to produce electricity?
5) What is one of the uses of the generator output?
6) What type of batteries is used for both aircraft startup and as an emergency source of power?
7) Where will EPS undergo significant changes?
8) Why are many functions that used to be operated by hydraulic, pneumatic and mechanical power being replaced by electric power?

**Ex.2. Find in the text English equivalents of the following words and word combinations:**
использовать, хранить, существенный(основной) компонент, заряжать,
Ex.3. Give Russian equivalents of the following words and word combinations:
network, to distribute, capacity, piston powered, spectrum, to share, generator, output, in the event of, hydraulic, pneumatic, control electronics, to depend upon, significant changes, to improve the performance and reliability, to reduce fuel consumption, to increase the availability of the aircraft.

Ex.4. Decide whether the following statements are true or false. If a statement is false, change it to make it true:
1) An aircraft Electric System generates electric energy.
2) An electric system is an essential component of all but the most complex of aircraft design.
3) All aircraft electrical systems have components with the ability to generate electricity.
4) The electrical system capacity varies between single-engine and multi-engine aircraft.
5) Depending upon the aircraft alternators are used to produce electricity.
6) Only lead-acid batteries are used for aircraft startup.
7) EPS in future MEA will undergo significant changes.
8) Mechanical power is being replaced by electric power due to recent advances in power electronics.

Ex.5. Join beginners and ends to make sentences:
1) Aircraft electrical systems a) monitors electrical system performance.
2) Many aircraft flight instrument systems b) to provide power to the starter motor.
3) Aircraft electrical components operate on c) from alternator to generator.
4) Most aircraft engines d) to maintain battery power at max levels.
5) An aircraft electrical system e) consists of a battery, an alternator and regulators for these devices.
6) The alternator charges the battery f) and thus light the aircraft.
7) The alternator continues to work and recharge the battery g) just like in a car.
8) The primary function of the battery is h) provide power to generate AC generator (alternator) power.
9) Alternator provides current to battery i) generate, regulate and distribute electrical power throughout the aircraft.
10) Electric battery recharges during flight j) many different voltages both AC and DC.

11) Volt k) use electricity.

12) Ammeter l) is a measure of Electrical Power.

Ex. 7. Translate the sentences from English into Russian:
1. Electromagnetic Induction is the movement of electrons through wires (or conductors) to create electric current. 2. Battery provides Electric Power when Alternator or Generator is not available. 3. There are several types of Batteries. 4. The most common is Lead-Acid Battery. 5. Lead and Acid produce electrical charge. 6. Voltage regulator automatically maintains constant voltage level. 7. The basic functions of the electrical system components are to generate power, control electrical power, protect the electrical system, distribute electrical power throughout the aircraft.

Ex. 8. Topic for discussion:
What do you know about Electrical Power System?

UNIT 9
NIGHT VISION GOGGLES

Essential Vocabulary

windshield - лобовое стекло
view - вид, полезения
terrain - местность
situational awareness - осведомлённость о ситуации
to augment - увеличивать
intensification - усиление
to amplify - усиливать, увеличивать
readily - легко, с готовностью
eyepiece - окуляр
to emit - излучать, испускать
sensitivity - чувствительность, чуткость
to overpower - подавлять, пересиливать
compatibility - совместимость
to render - оказывать
to hamper - препятствовать, мешать
to enhance - усиливать, повышать, совершенствовать
obstacle avoidance - избегание (уклонение от) препятствий
green phosphor - зелёный люминофор

Read and translate the following text:
For safe and effective flight visual reference to the aviator’s outside world is essential. During the daylight hours and in visual meteorological conditions (VMC) the pilot relies heavily on the out-the-windshield view of the airspace and terrain for situational awareness. In addition, the pilot’s visual system is augmented by the avionics which provide navigation, mission, communication, flight control and aircraft systems information.

During nighttime VMC the pilot can improve the out-the-windshield view with the use of night vision goggles (NVGs). NVGs let the pilot see in the dark during VMC conditions. NVGs are electronic widgets that allow the pilot to see things at night when it is too dark to see things with the eyes alone. NVGs are light image intensification devices that amplify the night-ambient-illuminated scenes by a factor of $10^4$. For this application “light” includes visual light and near infrared. NVGs are miniature packaging of image intensifiers into a small, lightweight, helmet-mounted pair of goggles. With the NVGs the pilot views the outside scene as a green phosphor image displayed in the eyepieces.

NVGs do not work without compatible lighting! NVGs lighting compatibility is required for effective NVGs use by pilots. If the cockpit lighting is not compatible and it emits energy with spectral wavelengths within the sensitivity range of the night vision goggles, the lighting will be amplified by the NVGs and will overpower the amplification of the lower illumination in the outside visual scene. Compatibility can be defined as a lighting system that does not render the NVGs useless or hamper the crew’s visual tasks (with or without NVGs).

NVGs have application to civil aviation. The NVGs enhance night bad situation awareness and obstacle avoidance by allowing direct vision of the horizon, shadows, terrain and other aircraft. While NVGs were primarily developed for military applications civilian and commercial use of NVGs in aircraft, land vehicles and ships is growing. NVGs are being used in a variety of civilian situations requiring increased night viewing and safe night flying conditions. Emergency Medical Services (EMS) helicopters utilize NVGs for navigating into remote rescue sites. The forestry service uses NVGs not only to increase the safety in night fire-fighting operations but also to find hot spots not readily seen by the unaided eye.

**Ex.1. Answer the following questions:**

1) Why is visual reference to the aviator’s outside world essential?
2) What does the pilot rely on during the daylight hours and VMC?
3) What is the pilot’s visual system augmented by?
4) How can the pilot improve the out-the-windshield view during nighttime?
5) What lets the pilot see in the dark during VMC conditions?
6) What is the main function of NVGs?
7) How does the pilot view the outside scene with NVGs?
8) What is NVGs lighting compatibility required for?
9) How can compatibility be defined?
10) How do the NVGs enhance night bad situation awareness and obstacle avoidance?
11) Were NVGs primarily developed for military applications or for civilian and commercial use?
12) In what civil situations are NVGs being used?
13) What purposes do EMS helicopters and forestry service utilize NVGs for?

**Ex.2. Find in the text English equivalents of the following words and word combinations:**

местность, усилитель изображения, лёгкий, осведомлённость о ситуации, усиление, невооружённый глаз, препятствовать, совместимое освещение, мрак, увеличивать (расширять), без труда (легко), осматривать.

**Ex.3. Give Russian equivalents of the following words and word combinations:**

mission, widget, infrared, miniature packaging, to display, night-ambient – illuminated scenes, eyepiece, unaided eye, spectral wavelength, sensitivity, direct vision, to overpower, green phosphor.

**Ex.4. Decide whether the following statements are true or false. If a statement is false, change it to make it true:**

1) During the daylight hours the pilot relies on the out-the-windshield view of the airspace.
2) Visual reference to the aviator’s outside world is essential.
3) The pilot’s visual system is augmented by the avionics.
4) During nighttime VMC the pilot can improve the out-the-windshield view with the use of additional lighting.
5) NVGs let the pilot see in the daylight hours and in the dark during VMC conditions.
6) With the NVGs the pilot views the outside scene as a red phosphor image displayed in the eyepieces.
7) NVGs do not work without compatible lighting.
8) NVGs were primarily developed for civil aviation.

**Ex.5. Complete the sentences:**

1) NVGs are....
2) NVGs amplify....
3) With NVGs the pilot...
4) NVGs do not work....
5) NVGs lighting....
6) Compatibility can be defined as....
7) The NVGs enhance....
8) NVGs are being used....

**Ex.6. Translate the following derivative groups:**
- refer - reference - referable;
- essence - essential - essentially;
- view - vision - visional - visionally;
- rely - reliability - reliable;
- situation - situational;
- aware - awareness;
- add - addition - additional;
- augment - augmentation;
- intensify - intensification - intensifier;
- sense - sensitive - sensitivity;
- compatible - compatibility.

**Ex.7. Read and translate the text:**

What are Night Vision Goggles?

Night Vision Goggles (NVGs) consist of a lightweight binocular that is mounted to a flight helmet and powered by a low voltage battery pack. When used at night, NVGs provide the ability to see much further and with far greater clarity than with the naked eye. Night vision goggles operate by sensing even the smallest amount of existing natural and artificial light. Complicated electronics intensify this light by thousands of times to create a visible image. NVGs allow aircrews to view terrain, avoid obstacles and observe changing weather conditions previously hidden in the darkness.

Both the National Transportation Safety Board (NTSB) and the Federal Aviation Administration (FAA) are strongly encouraging the use of night vision goggles during emergency medical flights. Mercy Flight’s service area includes many areas of low illumination at night and the Great Lakes provide a rapidly changing weather environment for flying. NVGs enhance night flying safety with an increased ability to see and avoid obstacles and inclement weather.

**Ex.8. Topic for discussion:**
What do you know about NVGs?
Для заметок