МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ

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АННОТИРОВАНИЕ И РЕФЕРИРОВАНИЕ ТЕКСТОВ ПО АВИАЦИОННОЙ ТЕМАТИКЕ

(АНГЛИЙСКИЙ ЯЗЫК)

Часть 1

Утверждено Редакционно-издательским советом университета в качестве методических указаний

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Данные методические указания предназначены для студентов 1 и 2 курсов I – III факультетов. Целью данных методических указаний является развитие и совершенствование навыков чтения аннотирования и реферирования текстов по авиационной тематике.

Работа содержит аутентичные тексты на английском языке по актуальным проблемам современной авиации из оригинальных источников.

Обширные тематические материалы и система заданий дают студентам возможность совершенствовать речевую компетентность на английском языке, развивать логическое мышление и анализировать информацию.

UNIT 1

AN-12

Vocabulary

Turboprop, cantilever, double-slotted flap, stressed skin, dihedral tip panel, pressurized compartment, engine shutdown.

The AN-12 cargo turboprop aircraft was developed in 1957 by Antonov Design Bureau for medium- and long-haul cargo operations. The An-12 is configured as a cantilever metal monoplane with high-mounted wing, elevated fuselage tail, single-fin tail and retractable three-strut landing gear with steering nose wheel. The landing gear wheels with low-pressure tires permit to operate the aircraft from the unpaved airfields.

Four AI-20 turboprops are mounted on the wings furnished with double-slotted flaps. The aircraft fuselage is of a circular semi-monocoque type with smooth stressed skin. The aircraft half-wings are mounted with negative angle of dihedral for better lateral dynamic stability, decreasing influence of emergency engine shutdowns and wind gusts on the aircraft lateral-directional dynamics. The pressurized compartments for crew and personnel accompanying equipment in flight are located in front of the cargo cabin. The fuselage tail accommodates the pressurized back-seat compartment for observation gunner. The non-pressurized cargo cabin is equipped with ventilation and heating system, tie-down points, cargo ramps, handling winch and 2300 kg capacity monorail hoist. The An-12 aircraft fuselage with elevated tail and big cargo door provides for convenient conditions of large-size cargo handling and parachute dropping. The 2.5t capacity airborne cargo handling device and quick-release transporter facilitate and accelerate loading, mooring and unloading operations. The loading of large-size equipment is made through cargo door with ramp in the rear part of fuselage. The cargo cabin is not pressurized and equipped with individual oxygen supply system.

The flight-control and navigation equipment includes a compass system, autopilot, short-range radionavigation system equipment, electronic system of instrument landing, automatic radio direction finder (RDF), radio altimeter, navigation system. The radio communication is provided by HF and VHP radio sets, aircraft interphone system, emergency radio set.

2760 знаков

I. Read the text and answer the questions.

1. What kind of aircraft is the AN-12?
2. What are the main structural features of this aircraft?
3. What provides operation of the AN-12 from unpaved airfields?
4. What compartments are pressurized and why?
5. What provides large-size cargo handling and parachute dropping?

II. Make up a summary of the text.

UNIT 2

AN-24

Vocabulary

Auxiliary power plant, nacelle, double-slotted flap, wing root, ventral fin, hydraulically-retractable three-strut landing gear, ram, cockpit, rivet joint, adhesive-bonded joint, integral fuel tank, engine air intakes cowling.

The aircraft was developed in mid-sixties. It is powered by AI-24 jet-prop engines. The performed tests and aircraft operation revealed that it is featured with a good stability and easy controllability, capable to continue one engine inoperative takeoff. AN -24 is equipped with RU-19A300 auxiliary power plant of 800 kgf-thrust mounted in the RH turboprop nacelle. This engine improves the aircraft take-off performance.

An-24 is configured as a cantilever monoplane with high-mounted wing equipped with extended Fouler flaps. The double-slotted flaps are externally fitted at the engine nacelle and single-slotted flaps are installed at the wing root. The tail unit has a traditional design; aircraft is completed with a ventral fin. The aircraft is provided with reliable wing and tail unit anti-icing systems. The fuselage is of a semi-monocoque type.

The hydraulically-retractable three-strut landing gear has double wheels at each strut, steerable nose wheels, providing pressure inside tires to be adjusted on the ground. The landing gear construction and mechanical design ensure its extension by gravity or by ram air even if any system fails. The main landing gear struts are installed in the engine nacelles and are retracted against ram air into special compartments. The nose wheel is installed at the fuselage front end and is retracted into compartment under the cockpit. The nose strut is a pedal-controlled unit that significantly improves the aircraft mobility on the ground. The landing gear wheels with low-pressure tires allow landing at wet unpaved aerodromes.

The adhesive bonded joints were for the first time applied for An-24 in the practice of world aircraft construction. More than 67% of rivet joints were replaced with adhesive-bonded joints that resulted in the increased structure fatigue, considerable labor performance saving and production cost reduction.

The aircraft wing consists of centre-section, two middle sections and two tip sections. The wing middle sections are fitted with double-slotted flaps, while the centre-section is fitted with single-slotted flaps. Each root aileron is fitted with a trimmer and balance tab. The centre-section incorporates four soft fuel tanks; the middle section chambers are made as pressurized integral fuel tanks.

The aircraft is equipped with communication aids and all facilities required for day and night flights in adverse meteorological conditions any season of the year. The aircraft altitude equipment produces and maintains pressure and air temperature required for the crew and passengers normal vital activity when flying at high altitudes.

In icing conditions the wing leading edge, tail unit and engine air intakes cowlings are heated with hot air taken from the engine compressors. The propellers, cockpit windshields, pitots, batteries containers are provided with electrical heating.

If required, An-24 can be easily converted either to a cargo-passenger or cargo version. An-24 aircraft is one of the best world examples of aircrafts for its reliability and operating life.

2620 знаков.

I. Read the text and answer the questions.

1. What kind of engines is An-24 equipped with?
2. What is the configuration of the landing gear?
3. Where are the single- and double-slotted flaps located?
4. What kind of fuel tanks are used in this airplane?
5. What provides comfortable conditions for crew and passengers?

NOTES:
Pitot = Pitot gage = трубка Пито, питометр

II. Read the text and write a brief heading for each paragraph.
III. Translate the second and the third paragraphs in a written form.
IV. Make up a summary of the text.

UNIT 3

Mi-8 Transport Helicopter

Vocabulary: helicopter, winch, fuel tank, blade, mode, pneumatic failure alarm system, turboshaft engine, bearing.

The Mi-8 Transport Helicopter is the most massively produced helicopter in the world. In the Soviet Union there were developed more than 50 various modifications of this helicopter and built approximately 12 000 helicopters including 3 600 built for export. These helicopters are still built at Mil Moscow Helicopter Plant, Kazan Helicopter Plant and Ulan-Ude Aviation Plant. The Mi-8 Transport Helicopters took part in a great number of military conflicts all around the world. At the moment Mi-8 with its various modifications are operated in over 50 countries of the world including some NATO countries.

Development of the Mi-8 Helicopter began at the beginning of 60-ties. Helicopter's name as Mi is shortened its general designer's surname. This helicopter was intended to replace the outdated and lighter Mi-4 helicopter. First prototype of the Mi-8 with a 4-blade rotor was tested in 1962. Tests showed that prototype has a number of disadvantages and after its improvement in 1963 tests began of the second machine with a 5-blade rotor. Tests showed that this new transport helicopter had 2.5-fold better weightlifting and 1.4-fold higher speed comparing with the Mi-4. This version was adopted and its serial production started in 1965.

The Mi-8T is a base version of the transport helicopter available in civil and military versions. Its cockpit accommodates three crew members - commander, navigator, and flight mechanic. The cockpit can be armored (military version). The helicopter has external hardpoints for external armament such as aviation missiles, bombs and a slung load. A slung load is up to 3 000 kg.

Helicopter's landing-transport equipment can be used to load light towed combat material and armament with winches and for people rescuing from the ground or from the sea by an electrically operated 200 kg capacity hoist. The cabin has cargo tie-down points on the floor. Ramps are provided for loading light vehicles.

Fuel is carried in two flexible internal and external fuel tanks (1870l capacity both). Range of flight with normal load is 465 km. However the fuel capacity can be increased up to 3700l for 950 km flying range. The Mi-8 "Hip" uses aviation kerosene.

Helicopter has a transmission scheme very similar to the Mi-4. Fuselage is constructed from aluminum plates. Main and torque rotors have 5 and 3 blades consequently. The main rotor features hollow blades made from pressed high quality aluminum alloy. Spars are fitted with icing prevention system heating elements operated in automatic or manual modes. All main rotor blades are fitted with pneumatic failure alarm system.

The Mi-8 "Hip" Transport Helicopter is powered by two Klimov TVZ-117 type turboshaft engines. Engine air intake deflectors prevent ingestion of dust. It is also fitted with electricity generator, hydraulic pumps, cooling fan. The Mi-8 Helicopter engines are ignited by starter motor which can be used as additional electricity source. In case of one of the main engine failures during flight the other main engine power is increased. One engine power is enough to keep horizontal flight without loosing altitude. This feature determines high helicopter flight safety and reliability.

Helicopter has a three bearing fixed chassis fitted with wheels. Both rear bearings have absorbing devices. The Mi-8 "Hip" is fitted with fire prevention, icing prevention, air conditioning systems.

Protection system contains exhaust gas spreading, infrared trap launching, and infrared beam impulse generation systems to counteract against enemy guided missiles based on infrared guidance. Helicopter is fitted with explosion resistant foam filled fuel tanks.

Navigation, piloting, and radio equipment allows to make flights at any day or night time and meteorological conditions. Piloting control system is duplicated and based on hydraulic mechanisms. Helicopter is fitted with a four-channel autopilot stabilizing the helicopter in 4 flight coordinates - axis and height, course, alteration, and speed.

3400 знаков.

I. Read the text and answer the questions.

1. What kind of helicopter is the Mi-8?
2. What kind of rotor was chosen and why?
3. How many crew members can fly the helicopter?
4. What equipment is used lo load and transport cargo?
5. What are the main structural features of the helicopter?
6. What kind of engines is the helicopter powered by?
7. What systems is the helicopter fitted with?

II. Translate two last paragraphs of the text in a written form.

III. Make up a summary of the text.

UNIT 4

The Airbus A320

Vocabulary: narrow-body airliner, fly-by-wire flight control, low-wing cantilever monoplane, turbofan engine, retractable tricycle landing gear, flight deck.

The Airbus A320 family is a short-to-medium range narrow-body commercial passenger jet airliners manufactured by Airbus.

The A320 was launched in March 1984, first flew on 22 February 1987, and was first delivered in 1988.

A narrow-body Airbus of a comparable size to the successful Boeing 727 could offer advanced technology, improved operating economics and various passenger capacities. The digital technology in the A320 would herald a two-generation technological leap over the all-analogue Boeing 727. The A320 was targeted at the global fleet replacement requirements for the 727 and early variants of the 737.

After the oil price rises of the 1970s, Airbus needed to minimise the trip fuel costs of the A320. Airbus incorporated advanced features including fly-by-wire flight control, composite primary structures, centre-of-gravity control using fuel, glass cockpit (EFIS) and a two-person flight deck. The end result was that the A320 consumed 50% less fuel than the 727. According to a study cited by the Stockholm Environmental Institute, the A320 burns 11,608 kilograms of jet fuel flying between Los Angeles and New York City, which is about 77.4 kilograms per passenger in an A320 with 150 seats.

The Airbus A320 family are low-wing cantilever monoplanes with a conventional tail unit with a single fin and rudder. They have a retractable tricycle landing gear and are powered by two wing mounted turbofan engines.

Compared to other airliners of the same class, the A320 features a wider single-aisle cabin of 155.5 inches (3.95 m) outside diameter, and larger overhead bins, along with fly-by-wire technology. In addition, the aircraft has a spacious cargo hold equipped with large doors to assist in expedient loading and unloading of goods.

The A320 features an ECAM (Electronic Centralized Aircraft Monitor) which gives the flight crew information about all the systems of the aircraft. With the exception of the very earliest A320s, most can be upgraded to the latest avionics standards, keeping the aircraft advanced even after two decades in service.

The flight deck is equipped with EFIS with side stick controllers. At the time of the aircraft's introduction the behavior of the fly-by-wire system was a new experience for many pilots.

Three suppliers provide turbofan engines for the A320 series: CFM International with their CFM56, International Aero Engines, offering the V2500 and Pratt & Whitney.

The first fully digital fly-by-wire flight control system in a civil airliner.

Fully glass cockpit rather than the hybrid versions found in aircraft such as the A310, Boeing 757 and Boeing 767.

The first narrow body airliner with a significant amount of the structure made from composites.

The ECAM (Electronic Centralized Aircraft Monitoring) concept, which is included in all Airbus aircraft produced after the A320. This system constantly displays information concerning the aircraft's engines, as well as other key systems such as flight controls, pneumatics and hydraulics, to the pilots on the two LCD displays in the centre of the flight deck. ECAM also provides automatic warning of system failures and displays an electronic checklist to assist in handling the failure.

2700 знаков

I. Read the text and answer the questions.

1. What are the advantages of the A320 in comparison with the Boeing 727 and 737?
2. What provides more comfortable conditions for the passengers of the A320?
3. What are the functions of the Electronic Centralized Aircraft Monitoring system?

II. Which paragraph provides information about airplane structure? Translate it in a written form.

III. Make up a summary of the text.

UNIT 5

Tu-334 - forward to the future

Many passengers are interested in the matter what AC they will fly in the nearest future. Really, that good and safe AC TU-134 and TU-154 gradually inferior on their technical characteristics should be changed. It is possible to purchase an old Boeing or Airbus but what for should we support the foreign producers when the new AC for short and medium range is creating now? It is more comfortable and safe than the other AC of this modification and the main reason is that this AC is a Russian one. The name of the firstling of new Russia's aviation industry is TU-334.

The history of this AC began in 1985 when the Ministry of Civil Aviation of the USSR expressed the wish to obtain AC of 100 seats to change TU-134 in future. The construction of the AC was charged to the Tupolev design bureau because they had an experience in creation of the similar AC.

It was the first time when they decided to join 2 projects together TU-204 and TU-334. It was done in order to avoid further operational problems. There was nothing like this in Russia before. The construction of a fuselage, navigation system and the other units were similar but TU-334 had a little shorter fuselage. The new AC should be more comfortable than the old versions because nowadays the air companies pay great attention to passenger comfort. Moreover this AC should comply with all the noise restrictions. The AC should be fitted out with the most modern equipment. The crew cabin of TU-334 is like the traffic control console. In pilots' disposal there are several monitors that can show different information about the flight from the map to the fuel quantity instead of a great number of compasses, speedometers and altimeters. TU-334 is one of the first Russian AC equipped with the number of crew members reduced to two people: the captain and the co-pilot. The duties of navigator, flight engineer and radio operator are performed by the technique. The equipment does not allow the people to make a mistake because the computer controls every pilot action.

The weather is not the barrier for TU-334. It can take off and land in poor visibility when the cloud ceiling is less than 10 meters.

The first flight of the TU334 took place in 1999. From this time this AC flies all over the world surprising the visitors of aviation salons with its low noise characteristics. Really taking off of this AC is practically noiseless.

Several modifications were worked out on the basis of main project. They differ from each other in seat capacity, in range and in engine model. There are several modifications with Rolls-Royce engines. It means that foreign companies will also purchase TU-334 because it is not inferior to Boeing -717, and the price of TU-334 is only a half of the Boeing's price. And it does not mean that our AC is worse than Boeing. Our engineers can save on everything except the passenger comfort and safety.

First of all this economy is based on the similarity of the different AC types. Now all the world aviation enterprises do the same but Tupolev bureau does it in better way.

In 1996 the Tupolev bureau created a project of transport regional AC TU230. The new AC is practically the copy of TU-334. The 75% of the main units for the both AC are similar. What does it mean? It means that in 10 years we will be able to forget about the delays on technical reasons because it will be easy to change any unit.

And there will be more comforts and conveniences for the passengers because the seats in TU-334 are wider and there is extra space for legs. Also there will be the system of video monitors which allow the passengers to watch movies and video clips. This AC attracts attention of VIP-companies which operate business flights. The Tupolev bureau suggested the VIP-layout of TU-334 with wide seats, comfortable sofas with a study and a shower with computers and telephones. It will be mobile office in the sky. By the words, the cost of this office will not exceed the 30 million dollars but for the west analogues you should pay 100 million dollars.

3300 знаков

I. Read the text and summarize the main idea of each paragraph.

II. Read the text and answer the question. What provides low cost of this airplane?

III. Make up a summary of the text.

UNIT 6

Su-27

Vocabulary: leading edge extension, ventral fin, guide vanes, starboard.

The Su-27's basic design is aerodynamically similar to the MiG-29, but it is substantially larger. It is a very large aircraft, and to minimize its weight its structure has a high percentage of titanium (about 30%, more than any of its contemporaries). No composite materials were used. The swept wing blends into the fuselage at the leading edge extensions and is essentially a delta although the tips are cropped for wingtip missile rails or ECM pods. The Su-27 is not a true delta, however, because it retains conventional tailplanes, with two vertical tailfins outboard of the engines, supplemented by two fold-down ventral fins for additional lateral stability.

The Su-27's Lyulka AL-31F turbofan engines are widely spaced, both for safety reasons and to ensure laminar airflow through the intakes. The space between the engines also provides additional lift, reducing wing loading. Movable guide vanes in the intakes allow Mach 2+ speeds, and help to maintain engine airflow at high alpha. A mesh screen over each intake prevents debris from being drawn into the engines during take-off.

The Su-27 had the Soviet Union's first operational fly-by-wire control system, developed based on Sukhoi OKB experience in the Sukhoi T-4 bomber project. Combined with relatively low wing loading and powerful basic flight controls, it makes for an exceptionally agile aircraft, controllable even at very low speeds and high angles of attack. At air shows the aircraft has demonstrated its maneuverability with a Cobra (Pugachev's Cobra) or dynamic deceleration - briefly sustained level flight at a 120° angle of attack. Thrust vectoring has also been tested, allowing the fighter to perform sharp turns with almost no radius, incorporate vertical somersaults into level motion and limited nose-up hovering.

In addition to its considerable agility, the Su-27 uses its substantial internal volume for a large internal fuel capacity. In an overload configuration for maximum range, it can carry 9,400 kg (20,700 lb) of internal fuel, although its maneuverability with that load is limited, and normal load is 5,270 kg (11,620 lb).

The Su-27 is armed with a single 30 mm GSh-30-1 cannon in the starboard wing root, and has up to 10 hardpoints for missiles and other weapons. Its standard missile armament for air-to-air combat is a mixture of Vympel R-73, Vympel R-27 weapons, the latter including extended range

and IR guided models. More advanced Flanker variants may also carry Vympel R-77 missiles.

The Su-27 has a high-contrast tuneable HUD and a helmet-mounted sight capability, which, coupled with the R-73 missile and the plane's superb agility make it one of the world's best dogfighter aircraft.

The radar proved to be a major developmental problem for the Su-27. The original Soviet requirement was very ambitious, demanding a multi-target engagement capability and 200 km range against "bombers".

To achieve this at a reasonable weight, the design team came up with radar using electronic scanning for elevation and mechanical scanning for azimuth. Unfortunately, it proved too much for the Soviet microelectronics industry in the 1970s to achieve, and by 1982, the original Myesch program had to be abandoned and a less capable alternative array was selected.

2700 знаков

I. Read the text and answer the questions.

1. What makes this aircraft lighter?
2. What provides additional lifting force?
3. What provides high range of the aircraft?

II. Translate the second paragraph in a written form.

III. Read the text and entitle each paragraph of the text.

IV. Make up a summary of the text.

UNIT 7

Su-30

Vocabulary: airframe, avionics, canard fore-plane, thrust vectoring control, twin-finned aircraft, fairing, tail beam, head-up display, redundancy, ejection seat, high-lift devices, flaperon, afterburning thrust, life span,

The Su-SOMKI was jointly designed by Russia's Sukhoi and India's Hindustan Aeronautics Limited. The aircraft airframe is a development of the Russian Su-27 while most of the avionics were developed by India.

The aircraft featured many modifications over the Su-27 and the Su-30MK variant. These included canard fore-planes, 2-dimensional thrust

vectoring control (TVC), and a range of avionics complex from Russia, France, Israel and India which includes display, navigation, targeting and electronic warfare systems.

The Su-30MKI is a highly integrated twin-finned aircraft. The airframe is constructed of titanium and high-strength aluminium alloys. The engine nacelles are fitted with fairings to provide a continuous streamlined profile between the nacelles and the tail beams. The fins and horizontal tail consoles are attached to tail beams. The central beam section between the engine nacelles consists of the equipment compartment, fuel tank and the brake parachute container. The fuselage nose part is of semi-monocoque construction and includes cockpit, radar compartments and the avionics bay.

MK3, a further development of MKI variant, will integrate avionic systems being developed for the Indo-Russian Fifth Generation Fighter Aircraft program.

The displays include a head-up display consisting of bicubic phase conjugated holographic displays and seven liquid crystal multifunction displays, six 127 mm x 127 mm and one 152 mm x 152 mm. Flight information is displayed on four LCD displays which include one for piloting and navigation, a tactical situation indicator, and two for display systems information including operating modes and overall operation status. The rear cockpit is fitted with a larger monochromatic screen display for the air-to-surface missile guidance.

The aircraft has a fly-by-wire (FBW) with quadruple redundancy. Depending on the flight conditions, signals from the control stick transmitter will be coupled to the remote control amplifiers. These signals are combined with feedback signals fed by acceleration sensors and rate gyros. The resultant control signals are coupled to the high-speed electro-hydraulic actuators of the elevators, rudders and the canard. The output signals are compared and, if the difference is significant, the faulty channel is disconnected. FBW is based on a stall warning and barrier mechanism which prevents development of aircraft stalls through a dramatic increase in the control stick pressure. This allows a pilot to effectively control the aircraft without running the risk of reaching the limit values of angle of attack and acceleration. Although the maximum angle of attack is limited by the canards the FBW acts as an additional safety mechanism.

The aircraft is fitted with a satellite navigation system, which permits it to make flights in all weather, day and night. The navigation complex includes the high accuracy SAGEM Sigma-95 integrated global positioning system and laser gyroscope inertial navigation system.

The crew is provided with zero-zero KD-36DM ejection seats. The rear seat is raised for better visibility. The cockpit is provided with containers to store food and water reserves, a waste disposal system and extra oxygen bottles. The KD-36DM ejection seat is inclined at 30°, to help the pilot resist aircraft accelerations in air combat.

Su-30MKI aerodynamic configuration is an unstable longitudinal triplane. The canard increases the aircraft lifting ability and deflects automatically to allow high angle-of-attack flights allowing it to perform Pugachev Cobra. The integral aerodynamic configuration combined with thrust vectoring results in extreme maneuverability, taking off and landing characteristics. This high agility allows rapid deployment of weapons in any direction. The canard assists in controlling aircraft at high angles-of-attack and bringing it to a level flight condition. The wing will have high-lift devices featured as deflecting leading edges, and flaperons acting as flaps and ailerons.

The forward facing N011M Bars is a powerful integrated passive electronically scanned array radar. The N011M is a digital multi-mode dual frequency band radar. The N011M can function in air-to-air and air-to-land/sea mode simultaneously with a high-precision laser-inertial or GPS navigation system. It is equipped with a modern digital weapons control system as well as anti-jamming features. N011M has a 350 km search range and a maximum 200 km tracking range, and 60 km in the rear hemisphere. The radar can track 15 air targets and engage 4 simultaneously. These targets can even include cruise missiles and motionless helicopters. The Su-30MKI can function as a mini-AWACS as a director or command post for other aircraft.

OLS-30 laser-optical locator system to include is used in conjunction with the helmet mounted sighting system. The OLS-30 is a combined IRST/LR device using a broad waveband sensor. Detection range is up to 90 km, whilst the laser ranger is effective to 3.5 km. Targets are displayed on the same LCD display as the radar.

The Su-30MKI is powered by the two AI-31FP turbofans. Each AI-31FP is rated at 12,500 kgf of full afterburning thrust. Two AL-31FP by-pass thrust-vectoring turbojet reheated engines (25,000 kgf full afterburning thrust) ensure a 2M horizontal flight speed and a rate of climb of 230 m/s. The mean time between overhaul for the AL-31 FP is given at 1,000 hours with a full-life span of 3,000 hours. The titanium nozzle has a mean time between overhaul of 500 hours. AI-31FP builds on the AI-37FU with the capability to vector in 2 planes. The TVC nozzles of the Su-30MKI are

mounted 32 degrees outward to longitudinal engine axis (i.e. in the horizontal plane) and can be deflected ±15 degrees in the vertical plane. This produces a cork-screw effect and thus enhancing the turning capability of the aircraft. There is no strain-gauge engine control stick to change the engine thrust in the cockpit, rather just a conventional engine throttle control lever. The pilot controls the aircraft with the help of a standard control stick. On the pilot's right there is a switch which is turned on for performing difficult maneuvers. After the switch-over, the computer determines the level of use of aerodynamic surfaces and swiveling nozzles and their required deflection angles.

The Su-30MKI has a range of 5,000 km with internal fuel which ensures a 4.5 hour combat mission. Also, it has an in-flight refueling probe that retracts beside the cockpit during normal operation. The air refueling system increases the flight duration up to 10 hours with a range of 8,000 km at a cruise height of 11 to 13 km.

5800 знаков.

UNIT 8

MiG-31 FOXHOUND

Vocabulary: interceptor, moderate-swept wings, all-moving tailplane, air intake, pylon, afterburner, missile.

1. The Mig-31 Foxhound is a substantially improved derivative of the Mjg-25 Foxbat. The Mig-31 is an all weather two-seat interceptor with advanced digital avionics and with a tapered moderate-swept wings, all-swept twin-fin tail unit and all-moving tailplane. The MiG-31 airframe is an all-metal monoplane with lateral air intakes. Provision is made for installation of two underwing fuel tanks with a total capacity of 5,000 liters.

2. The most capable Russian air defense interceptor aircraft, the FOXHOUND has a multiple-target engagement capability and was the first Soviet fighter to have a true look-down, shoot-down capability. The N007 Zaslon radar was the first electronically scanned phased array radar to enter service in the world. It could scan 200 km forward and track 10 targets simultaneously. This radar could also track and engage target flying behind and below the aircraft. The Zaslon antenna is of the fixed type, instead of

being mechanically directed the radar beam is moved electronically. This allows the full fuselage diameter to be used for the antenna, a considerable advantage since antenna diameter and effective operating range are directly related. Electronic steering of the radar beam is faster than can be performed mechanically, and it is also more accurate. All signal processing is digital.

3. The radar ensures simultaneous search and attack of several targets using long-range missiles and makes possible to interact within a group. The MiG-31 interceptor-fighter can intercept air targets in all weather conditions, day and night and in continuous and discontinuous field of control and guidance commands (solo and in group), or regardless target defensive maneuvers.

4. The aircraft avionics enables the use of missiles with radar- and IR-homing heads. The FOXHOUND carries the long-range air-to-air missiles, and can engage 4 different targets simultaneously with the M-9.

5. The airframe was extensively redesigned for supersonic flight at low altitude, with the welded nickel steel content reduced from the Mig-25's 80% to 49%, with 16% titanium, 33% aluminium alloy and 2% composites. The wings of the aircraft are high-mounted and swept-back with square tips and a negative slant. There are four underwing pylons. There are two turbofan engines in the fuselage. The aircraft is powered by two D-30F6 turbofans developing a takeoff thrust of 15,500 kgf each. The mixed-flow turbofan is fitted with an afterburner and fully-variable flapped jet nozzle. The new Soloviev D-30F6 engine was specified for the MiG-31 in order to improve range, the key performance parameter for which an improvement over the MiG-25 was demanded. There are rectangular and diagonal cut air intakes on the sides of the fuselage. The exhausts extend beyond the tail plane. The fuselage is rectangular from the intakes to the exhausts and has a long, sharp nose. The aircraft has a bubble canopy. The tail fins are back-tapered with angular tips and canted outward. The stabilizers are swept-back and tapered and mid- to low-mounted on the body.

6. Two specialized MiG-31Ds were built in 1987 as carriers for an antisatellite missile, in imitation of a contemporary US program that used a McDonnell Douglas F-15. These two Foxhounds featured triangular "webbed feet" wing endplate fins, like those fitted to some MiG-25 prototypes, in this case intended to provide improved flight stability at high altitudes for missile launches. A single large missile was to be carried under the fuselage, and a special upward-looking radar and associated intercept fire-control system was to be fitted to production machines.

7. The Mig-31M is an improved version of the basic Mig-31. The key to the MiG-31 M's effectiveness is the SBI-16 Zaslon fixed phased array antenna radar which is said to be the world's most powerful fighter radar. The cockpits were upgraded in the Mig-31M with a number of Cathode Ray Tubes (CRT) and an increased number of missiles.

8. The MiG-31E export model provides facilities for vectoring up to three fighters, types MiG-21-93, MiG-23, MiG-25, MiG-29, Su-27 to ensure a covert attack. A group of four MiG-31E fighter-interceptors is capable of interchanging data in the automatic mode on presence of air targets in the zone up to 800 km wide. MiG-31E fighter-interceptor is designed for interception and destruction of aerial targets flying at altitudes of 50 to 28 000m in front and rear hemispheres including those under normal and adverse weather conditions, the target maneuvering and enemy deploying active and passive countermeasures.

9. Aerial targets can be intercepted by a single MiG-31E aircraft or by a group of up to 4 MiG-31E aircraft. Interception can be performed with the aid of guidance by ground automated control system or autonomously with optimum target distribution among the members of the group.

4000 знаков.

I. Read the text and answer the questions.

1. What kind of aircraft is the MiG-31?
2. What are the main structural features of the MiD-31?
3. Why was new D-30F6 engine chosen for the MiG-31?
4. What provides high interceptor efficiency of the MiG-31?

II. Translate the 5th paragraph of the text in a written form.

III. Make up a summary of the text.

UNIT 9

F-22 Raptor

Vocabulary: fighter, stealth technology, airframe, maintenance, pitch axis thrust vectoring, compressor stall, augmented thrust, nozzle, canopy, stabilator.

The Lockheed Martin/Boeing F-22 Raptor is a single seat, twin-engine fifth-generation fighter aircraft that uses stealth technology. It was designed primarily as an air superiority fighter, but has additional capabilities that include ground attack, electronic warfare, and signals intelligence roles. Lockheed Martin Aeronautics is the prime contractor and is responsible for the majority of the airframe, weapon systems and final assembly of the F-22. Program partner Boeing Integrated Defense Systems provides the wings, aft fuselage, avionics integration, and all of the pilot and maintenance training systems.

Lockheed Martin claims that the Raptor's combination of stealth, speed, agility, precision and situational awareness, combined with air-to-air air and air-to-ground combat capabilities, makes it the best overall fighter in the world today.

The F-22 Raptor is a fifth generation fighter that is considered a fourth-generation stealth aircraft. Its dual afterburning Pratt & Whitney F119-PW-100 turbofans incorporate pitch axis thrust vectoring, with a range of ±20 degrees. The maximum thrust is classified, though most sources place it at about 35,000 lbf (156 kN) per engine. Maximum speed, without external weapons, is estimated to be Mach 1.82 in supercruise mode. The absence of variable intake ramps generally limits speeds to approximately Mach 2.0. Such ramps would be used to prevent engine surge resulting in a compressor stall, but the intake itself may be designed to prevent this.

The true top speed of the F-22 is unknown to the general public. The ability of the airframe to withstand the stress and heat is a further key factor, especially in an aircraft using as many composites as the F-22. However, while some aircraft are faster on paper, the internal carriage of its standard combat load allows the aircraft to reach comparatively higher performance with a heavy load over other modern aircraft due to its lack of drag from external stores. It is one of only a handful of aircraft that can sustain supersonic flight without the use of afterburner augmented thrust (and its associated high fuel consumption). This ability is now termed supercruise. This allows the aircraft to hit time-critical, fleeting or mobile targets that a subsonic aircraft would not have the speed to reach and an afterburner dependent aircraft would not have the fuel to reach.

The F-22 is highly maneuverable, at both supersonic and subsonic speeds. It is extremely departure-resistant, enabling it to remain controllable at extreme pilot inputs. The Raptor's thrust vectoring nozzles allow the aircraft to turn tightly, and perform extremely high alpha (angle of attack) maneuvers such as the Herbst maneuver ,Pugachev's Cobra, and the Kulbit.

The F-22 is also capable of maintaining a constant angle of attack of over 60°, yet still having some control of roll.

The F-22 cockpit is a glass cockpit design without any traditional analog flight instruments and represents a marked improvement on the cockpit design of previous advanced aircraft. The leading features of the F-22 cockpit include simple and rapid start-up, highly developed HMI, light helmet, large anthropometric accommodation and highly integrated warning system. Other main features include large single-piece canopy, side stick and improved life support systems.

All internal displays are designed to be used with night vision goggles because the aircraft lacks optical or IR vision devices.

The YF-22A prototype and production F-22A are sometimes confused in pictures, often at angles where is difficult to see certain features. Several small design changes were made from the YF-22 to the F-22A. Swept-back angle on the wing's leading edge was decreased from 48 degrees to 42 degrees, while the vertical stabilizer area was decreased 20%. To improve pilot visibility, the canopy was moved forward 7 inches (178 mm) and the engine intakes were moved rearward 14 inches (356 mm). The shape of the wing and stabilator trailing edges was refined to improve aerodynamics, strength, and stealth characteristics. Also, the vertical stabilizer was shifted rearward. The airframe also features three internal weapons bays on the bottom and sides of the fuselage.

3600 знаков.

I. Read the text and answer the questions.

1. Why is F-22 considered one of the best fighters today?
2. What limits speed of the F-22 to M2?
3. What are the disadvantages of using composites in the F-22 airframe?
4. What are the main features of the F-22 cockpit?

II. Make up a summary of the text.

UNIT 10

T-50 Golden Eagle

The T-50 Golden Eagle is a supersonic advanced jet trainer. Lockheed Martin Aeronautics is providing technical expertise in all aspects of the program and is responsible for developing the T-50 avionics system, flight control system and wings.

The T-50 has the maneuverability, endurance and advanced systems to prepare future pilots to fly current and next-generation fighters like advanced F-16s, the F-22 and the Joint Strike Fighter. These same characteristics give it an excellent capability as a lead-in fighter trainer and potential light-combat aircraft in many air forces.

There is a very real problem emerging in the fighter community today. The aircraft currently used to train fighter pilots started production in the 1950s and 1960s and are approaching the limit of their service life. Age and attrition as well as widening gaps between past and current technologies are creating concern in many fighter communities around the world.

Because 4th generation fighters today are more complex and capable than ever before, fighter pilots must be properly trained to operate their aircraft at the maximum envelop to fully utilize fighter capability during combat.

The T-50 is designed as an advanced trainer for fighter pilots selected to fly world's 4th and 5th generation fighter aircraft. It is the highest efficiency training system because it provides trainee pilots rapid transition to a modern fighter environment utilizing the latest advancement in aviation technology. T-50 can also function as a Light Combat Aircraft for the defense of national borders. T-50 is designed for high performance, the T-50 features digital fly-by-wire for precision aircraft handling, relaxed static stability to improve maneuverability, variable camber wing with strakes to maximize the lift to drag ratio and improve directional stability, and tandem seating for superior visibility, and efficient turbo fan engine utilizing proven technology for maximum reliability and safety, and advanced nav-attack sensor for multi-role mission, and the onboard oxygen generating system. T-50 is the only advanced trainer for the 4th and 5th generation fighter.

The T-50 has a maximum take off gross weight of 26,400lbs, and empty weight is 14,200lbs. The engine provides 17,700lbs of thrust giving the aircraft the maximum speed of 1.4 Mach. The aircraft load factor is ranged between -3 and + g. The T-50 service ceiling is 48,000fts and airframe has a

structural life over 8,000 hrs. The T-50 is powered by GE-F404 engine. A high performance engine combines the latest technology and engine reliability and safety. It features full authority digital engine control: rapid throttle response without throttle restrictions and automatic engine monitoring with excellent stall free operation and no visible smoke.

The T-50 advanced cockpit features the bubble canopy and tandem seating for superior outer vision. It has a head-up display with excellent field of view for displaying flight information. Two large color multi-function displays for displaying mission and aircraft data as well as weapon selection and control for the light combat aircraft variant.

The T-50 is the first trainer to employ electronic fly-by-wire and digital flight control for precision maneuvering. The digital flight controls are triple redundant and triplex digital flight control provides multi-mode control laws and a flight envelop limit.

As an advanced jet trainer, the T-50 is used to train pilots on basic cockpit operation, maneuvering and situation awareness.

The T-50 is a total training system. Classroom training provides students with basic theory and operation of the aircraft and mission. The ground base training system is a computer assisted learning tool designed to transit the classroom instruction into practical flying skills. The simulator is used to emulate the aircraft cockpit and flying profile. Trainees using the simulator can transfer their flying mission back to the ground base training system for mission playback to analyze their performance. The trainees are then taken into aircraft for flight training. Basic aircraft instrument and handling are taught along with advanced tactical and new operational skills and weapon delivery.

3600 знаков.

I. Read the text and answer the questions.

1. What kind of aircraft is the T-50?
2. What is the main function of the T-50?
3. What provides high performances of the T-50?
4. What are the main features of the T-50 engines?
5. What provides precision maneuvering of the T-50?

II. Translate the 5th paragraph of the text.

III. Make up a summary of the text.

UNIT 11

Concorde – first supersonic passenger aircraft

Vocabulary: fly-by-wire flight control system, bypass ratio, inlet, shock wave, ramp, pitch, bank, elevon, anti-lock braking system, lift-to-drag-ratio, long-haul flight, streamlined design.

Concorde was an ogival delta-winged aircraft with four powerful Olympus engines based on those originally developed for strategic bomber. The engines were jointly built by Rolls-Royce and SNECMA. Concorde was the first civil airliner to have an analogue fly-by-wire flight control system. It also employed a lowering nose section for visibility on approach. These and other features permitted Concorde to have an average cruise speed of Mach 2.02 with a maximum cruise altitude of 18,300 meters, more than twice the speed of conventional aircraft. The average landing speed was a relatively high 298 km/h (185 mph, 160 knots).

To be economically viable, Concorde needed to be able to fly reasonably long distances, and this required high efficiency. For optimum supersonic flight, the engines needed to have a small frontal cross-sectional area to minimize drag and a low bypass ratio to give a high, supersonic exhaust speed. Turbojets were thus the best choice of engines. The more efficient and quieter high bypass turbofan engines such as used on Boeing 747s could not be used. The engine chosen was the twin spool Rolls-Royce/Snecma Olympus 593.

The inlet design for Concorde engines was critical. All conventional jet engines can intake air at only around Mach 0.5; therefore the air needs to be slowed from the Mach 2.0 airspeed that enters the engine inlet. In particular, Concorde needed to control the shock waves that this reduction in speed would avoid damage to the engines. This was done by a pair of ramps and an auxiliary flap, whose position was moved during flight to slow the air down. The ramps were at the top of the engine compartment and moved down and the auxiliary flap moved both up and down allowing air to flow in or out. During takeoff, when the engine air demand was high, the ramps were flat at the top and the auxiliary flap was in, allowing more air to enter the engine. As the aircraft approached Mach 0.7, the flap closed; at Mach 1.3, the ramps came into effect, removing air from the engines which was then used in the pressurization of the cabin. At Mach 2.0, the ramps covered half their total

possible distance. They also helped reduce the work done by the compressors as they did not only compress the air but also increase the air temperature.

Due to jet engines being highly inefficient at low speeds, Concorde burned two tones of fuel taxiing to the runway. To conserve fuel only the two outer engines were run after landing. The thrust from two engines was sufficient for taxiing to the ramp due to low aircraft weight upon landing at its destination.

When any aircraft passes the critical Mach of that particular airframe, the centre of pressure shifts rearwards. This causes a pitch down force on the aircraft, as the centre of gravity remains where it was. The engineers designed the wings in a specific manner to reduce this shift. However, there was still a shift of about 2 meters. This could have been countered by the use of trim controls, but at such high speeds this would have caused a dramatic increase in the drag on the aircraft. Instead, the distribution of fuel along the aircraft was shifted during acceleration and deceleration to move the centre of gravity, effectively acting as an auxiliary trim control.

Due to the high speeds at which Concorde traveled, large forces were applied to the aircraft structure during banks and turns. This caused twisting and distortion of the aircraft structure. This was resolved by the neutralization of the outboard elevons at high speeds. Only the innermost elevons, which are attached to the strongest area of the wings, are active at high speed.

Due to a relatively high average takeoff speed of 250 mph (400 km/h), Concorde needed good brakes. Concorde brakes were one of the first major users of anti-lock braking systems, which stop the wheels from locking when fully applied, allowing greater deceleration and control during braking, particularly in wet conditions.

The brakes were carbon-based and could bring Concorde, weighing up to 185 tons (188 tones) and traveling at 190 mph (305 km/h), to a stop from an aborted takeoff within one mile (1600 m). This braking manoeuvre brought the brakes to temperatures of 300 °C to 500 °C, requiring several hours for cooling.

Concorde needed to travel between London and New York or Washington nonstop, and to achieve this the designers gave Concorde the greatest range of any supersonic aircraft at the time (since beaten by the Tu-160). This was achieved by a combination of careful development of the engines to make them highly efficient at supersonic speeds, by very careful design of the wing shape to give a good lift-to-drag-ratio, by having a

relatively modest payload, a high fuel capacity, and by moving the fuel to trim the aircraft without introducing any additional drag.

Nevertheless, soon after Concorde began flying, a Concorde "B" design was produced with more powerful engines with slightly bigger fuel capacity and slightly larger wings with improved aerodynamic performance at all speeds. This would have given 500 km greater range even with greater payload. This was cancelled due to poor sales of Concorde.

The high altitude at which Concorde cruised meant passengers received almost twice the flux of extra-terrestrial ionizing radiation as those traveling on a conventional long-haul flight. Because of the proportionally reduced flight time, however, the overall equivalent dose was less than a conventional flight over the same distance. Unusual solar activity led to an increase in incident radiation, so the flight deck had a radiometer and an instrument to measure the rate of decrease of radiation. If the level was too high, Concorde descended to below 47,000 feet (14,000 m).

Concorde's famous drooping nose was a compromise between the need for a streamlined design to reduce drag and increase aerodynamic efficiency in flight and the need for the pilot to see properly during taxi, takeoff, and landing operations. A delta-wing aircraft takes off and lands with a high angle of attack (a high nose angle) compared to subsonic aircraft, due to the way the delta wing generates lift. The pointed nose would obstruct the pilots' view of taxiways and runways, so Concorde's nose was designed to allow for different positioning for different operations.

5300 знаков

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

II. Read the text and answer the questions.

1. Why was the lowering nose section used in Concorde design?
2. What were the main requirements for Concorde engines?
3. What was the main disadvantage of applied engine?
4. What measures were assumed to prevent aircraft structure from twisting and distortion during banks and turns?
5. What protected passengers from ionizing radiation?

III. Make up a summary of the text.

UNIT 12

Energia-Buran Reusable Space System

Vocabulary: launch vehicle, artificial Earth satellite, pneudraulic system, liftoff, controllable engine thrust, reusable.

Launch vehicle Energia being developed as a part of the Energia-Buran Reusable Space System is a versatile heavy-lift launch vehicle capable to deliver large payloads up to 100t to orbits and near-Earth space. Mass of payloads delivered to: low orbits of artificial Earth satellite - up to 100 t, the geostationary orbit - up to 20 t, the lunar mission trajectory - up to 32 t.

The LV Energia propulsion unit consists of four 4-chamber oxygen-kerosene engines RD-170 and four 1-chamber oxygen-hydrogen engines RD-0120 on the core stage II and pneudraulic systems for their operation. Engines RD-170 specially designed for LV Energia are of unsurpassed performance and have no analogs abroad.

All engines are ignited at a liftoff with the engines of stage II ignited ahead of the first stage engines. During this period a diagnostics system is executing final checkouts and serves out a "permission" to ignite the first stage engines thus preventing from the LV liftoff with a faulty engine. Wide spectra of controllable engine thrust and oxidizer-fuel mass relation enable to implement the best parameters of the LV motion and synchronous depletion of fuel tanks. In the ascent phase, LV is controlled and stabilized through a thrust vector deflection of engines of stages I and II in two planes. For this, the engine gimbals and high precision vernier thrusters are provided.

The LV Energia autonomous control system based on the onboard computer system ensures a high accuracy of launching to a prescribed area and great capabilities to recover from contingency situations including a failure of one engine of LV. A high degree of automation allowed to consider many potential contingencies. In other words, 500 contingency situations were transformed to contingency situations incorporated in the design. In the most critical contingencies, the automatics brings and keeps the LV in a safety state till a proper solution is made.

A fire/explosion detection system serves to enhance safety of operations performed at the launch site and to warn against the LV in-flight explosion when accidental leakage of oxygen and hydrogen from the core stage occurs. The LV engines emergency protection system monitors parameters of engines in the process of their ignition and operation and allows to shutdown

an accidental engine before its shutdown. Under certain conditions an opposite engine functioning normally is also shut down. All this prevents from an accident propagation aboard the LV and allows to continue a controlled flight.

The most notable among design solutions is stage I. In compliance with the technical assignment, The Energia-Buran Space System should be reusable and employed no less than in 10 missions. As a result of comprehensive studies, a parachute rocket system was selected for the core stage recovery after its separation from LV. To return and reuse the core stage was a complex scientific-engineering task assumed to be solved successfully, as experimental development was progressing. Stages A to be subjected to flight tests within the LV were not provided with recovery capabilities and only certain systems were used for recovery verification.

To implement the Energia-Buran program, it was decided to develop a versatile complex "Stand-Start", modify and re-equip the launch site previously developed under the N1-L3 program, develop an Orbiter launch complex, and to foresee backup runways to be used for the Orbiter unplanned landing. In addition, to deliver and assemble the Energia-Buran system, hoisting-transportation devices have been developed, manufactured and mounted, transportation roads have been improved and newly build.

3100 знаков

Учебное издание

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