Самарский Государственный Аэрокосмический Университет имени академика С.П. Королева

Обучение чтению литературы по специальности “Летательные аппараты”

Учебные задания по английскому языку

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Учебные задания составлены в соответствии с требованиями программы по английскому языку для неязыковых вузов и содержат тексты по теме “Летательные аппараты”, взятые из оригинальных английских и американских источников и адаптации не подвергались, были только сокращены.
Учебные задания предназначены для студентов II курса I факультета аэрокосмического университета и направлены на закрепление умений и навыков чтения, перевода и аннотирования научно-технической литературы.

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Unit 1

Text A. 21st Century Aircraft: Flying Wings and High-Speed Civil Transports.

I. Read and memorize the following words and word combinations.

1. viable – жизнеспособный
2. cross-section – поперечное сечение, поперечный разрез, профиль
3. constraint – ограничение
4. to anticipate – ожидать, предвидеть
5. boom – гул, шум; гудение sonic boom – звуковой удар
6. impact – толчок, импульс; влияние, воздействие
7. to droop – наклоняться, опускаться
8. windshield – лобовое стекло
9. appealing – привлекательный
10. to embed – вставлять, вделывать; заделывать (во что-л)
11. terminal – аэровокзал
12. hyper – laminar flow – гиперламинарное течение
13. riblet – нервюрка
14. to distribute – распределять; распространять
15. boundary layer – пограничный слой
16. to foresee (foresaw, foreseen) – предвидеть
17. fiber – волокно
18. adversely – неблагоприятно, вредно; враждебно
19. high-bypass engine – двигатель с большой степенью двухконтурности
20. bypass air – воздух второго контура двигателя
21. to emerge - появляться, возникать
22. avionics – авиационная радиоэлектроника, бортовое радиоэлектронное оборудование
23. software – программное обеспечение для ЭВМ
24. to yield – производить, приносить, давать (плоды, доход)

II. Read the international words and guess their meaning.
Economically, operation, general, comfort, aerodynamics, emission, potential, specific, evacuation, integration, typically, stability

III. Find the roots of the following words and translate them.
Competitor, reduction, consumption, distribution, deformation, improvement, requirement, visibility, reliability, maintenance, shortage, redesigned, reasonable, achievable, applicable, foreseeable

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

Seat – to seat; limit – to limit; route – to route$; boom – to boom; challenge – to challenge; flow – to flow; droop – to droop; cause – to cause; purchase – to purchase; couple – to couple; approach – to approach

V. Match up

1. the synonyms

a) goal, constraint, requirement, competitor, to keep, to seek, appealing, to obtain, feature, to mount, to affect, sufficient, to foresee, to cope with

b) to maintain, to gain, restriction, to manage, purpose, to install, rival, to influence, to look for, demand, property, attractive, to anticipate, adequate

2. the antonyms

a) efficient, supersonic, reduction, drag, to agree, movable, adverse, to droop, synthetic, drawback, variable, to deform, flexible, generation

b) thrust, constant, advantage, subsonic, to rise, natural, increase, consumption, friendly, to smooth, inefficient, rigid, fixed, to disagree

VI. Translate the sentences paying attention to the forms of Subjunctive Mood.

1. To maintain an aircraft hydraulic system in good order it is essential that a means of operation on the ground be provided.
2. It is necessary that an aircraft engine should function properly at a wide range of speeds, atmospheric conditions and altitudes.
3. Much of today's scientific research requires the solving of difficult mathematical problems some of which would require years to solve by the usual methods.
4. By reduction in jet velocity it would appear to be possible to increase the propulsive efficiency for a given rocket.
5. It should be understood that these diagrams have been calculated for a particular case. Other cases would give different results.
6. In some calculations the air is treated as if it had no viscosity.
7. Neutrons, do not occur in nature and if they did we could not accelerate them since they carry no electric change.
8. It is highly probable that the gravity minimum would be found in the same direction should more information be available.
9. If the object were moving with respect to the air there would be a dynamic pressure acting on it.
10. If the first satellite had been placed into a much higher orbit it would have been of far less use, as the point of greatest interest is the manner in which its movement is affected by drag.
11. The space station might be a way- station on the road to the other planets and a rocket reaching it could fuel up again and continue its flight.

VII. Translate the sentences into English

1. Если бы не их помощь, мы бы не рассчитали оптимальные условия процесса.

2. Многие технические задачи никогда не были бы решены, если бы не появились ЭВМ.
3. Желательно, чтобы все измерения были бы сделаны очень точно.
4. Он предложил, чтобы эксперимент с жидким ракетным топливом был бы продолжен.
5. Без солнца не было бы света, тепла и никакого вида энергии.
6. Человечество получило бы огромное количество дешевой энергии, если бы была успешно решена проблема использования солнечной энергии.
7. Во многих случаях воздух можно рассматривать так, как будто он является идеальной жидкостью.
8. Не было бы запущено ни одного спутника без развития современной науки и электронных технологий, чтобы обеспечить необходимое управление и связь.

VIII. Read and translate the text. Try to understand all details.

21st Century Aircraft: Flying Wings and High-Speed Civil Transports.

When Airbus Industrie looks to the 21st century, it is determined to see its A3XX double-decker become a strong competitor to Boeing 747 early on. Meanwhile, futurists at Aerospatiale Matra are looking beyond – to a new supersonic transport that could be flying by 2015 followed by a 1, 000 – seat flying wing as early as 2020.

To be economically viable, a supersonic transport would need twice the capacity of the Concorde and much more efficient operation. The general goal is a 50 % reduction in fuel consumption. To provide reasonable comfort for the passengers, the aircraft would need a greater cross-section than Concorde which would add drag. Still, if enough improvements can be made in aerodynamics and engine power, the goals are achievable.

But the big questions are whether the market is there for supersonic flight, and what the environmental constraints will be? European manufacturers are concerned that regulatory restrictions on noise and emissions are potential "show-stoppers".

Designers anticipate the requirement to cut aircraft noise for all aircraft to 18dB below Stage Three limits by 2015. Sonic booms would still limit supersonic flight to transoceanic routes.

The other big concern is emissions. That has been a hot topic for high-altitude flights, but scientists do not agree on the impact on the environment. Engine manufacturers are seeking more efficient and environmentally friendly designs. Aerospatiale Matra is checking some ideas out, but for now they are just concepts. There still is not a suitable engine available for a high-speed civil transport.

Production expenses will also have to be cut to meet the cost targets for supersonic flight. While new materials could help, qualifying them generally takes 10 years.

Aerospatiale Matra discusses a few specific design features for a next-generation supersonic transport. One is the nose, which will probably be fixed to save weight and complexity, not movable like the Concorde's. Designers gave

Concorde a nose that could be drooped to improve pilots' visibility at the high angle of attack needed for landing. Instead of that, the next supersonic transport may rely on synthetic vision, and might not even have a pilot's windshield, according to the design team.

Even more radical is Aerospatiale Matra's flying wing-or Aile Volante. The company believes it could be flying by 2020 carrying 800-1,000 passengers. While the carrying capacity makes the concept appealing, there are huge technical challenges. This high-capacity aircraft would have no fuselage and the cabin would be embedded in its thick wings. A great deal of preliminary design work has been done but important work remains in structures, controls, safety and evacuation of passengers and integration of the engines and airframe.

Some new technology will also be needed to meet the challenges posed by the designers of 10% weight reduction, 20% drag reduction and 30% specific fuel consumption improvement compared with Concorde.

What is more, terminal facilities would have to be modified or redesigned also to accommodate this aircraft. If the wing-span grows to 100 meters, the aircraft may even have to have folding outer wings for operating on taxiways and approaching gate areas. For aerodynamic gains, researchers will first look at subsonic improvement and then see what's possible in supersonic. It is likely that hyper-laminar flow will be needed and it will probably be obtained by sucking air in at the leading edge of the wings.

While improving lift is necessary, reducing drag is much more important according to the future projects team. One passive technique being considered is riblets first used on some America's Cup sailboats. Airframe riblets might cut drag by 15%, but the difficulty is keeping the riblets clean.

The large size of the flying wing means its structure will be more flexible than today's aircraft, making control laws used for flight control on today's conventional aircraft no longer applicable. It is expected to use more distributed controls and active flight controls, which would integrate aerodynamics and structure. Aircraft may even have variable geometry for different flight conditions.

While conventional controls typically add drag, the use of blown air techniques to improve the boundary layer and the use of wing deformation, might reduce drag while controlling the aircraft.

More use of composites is foreseen in future aircraft. The orientation of the fibers can be used to control the properties of composites, so that very small controls could be used to cause deformation of the composites, and thus control the aircraft. Lots of sensors on the wing, and lots of actuators, may be used to deform the structure. Deformation may very well be better for aerodynamic optimization than the controls used today.

On a flying wing, the question of where to locate 6-8 engines poses special problems. Engines mounted on top of the wing make access for maintenance difficult. Engines on the wing trailing edge add a lot of weight aft and could adversely affect the center of gravity. And since the engine manufacturers are considering very- high – bypass engines for efficiency – with ratios of 13:1 – 14:1 – another concern is interference between the bypass air and the wing/fuselage.

For all of Airbus future aircraft there will be a greater emphasis on cost reduction than improving fuel consumption. Driving the emphasis on purchase price is the low cost of fuel today coupled with optimism about stability for the foreseeable future. At some point fuel shortages will occur and prices will rise. But designers think that's too far in the future to expend money now looking for technology solutions and other fuel sources. Eventually hydrogen could emerge as a fuel source, but that is probably 40 years away. As for drawbacks of hydrogen, it is the large volume needed to store it.

Another general trend for future aircraft, in Aerospatiale Matra's view will be more use of electric power. Reduction of hydraulic sytems could happen soon, as the first step toward the "all-electric" aircraft. Reliability will be a major concern, of course. One of the approaches could take advantage of modular avionics and software to reconfigure the system to cope with problems. Aerospatiale Matra expects to see more "global" integrated solutions, meaning it is not sufficient to just look at the end item. For example, electrical actuators themselves will be heavier than hydraulic actuators, but the entire system of power generation and distribution must be considered and, it is the total system that offers to yield weight savings and increased flexibility.

IX. Say in what connection the following notions and phrases are used. Give their Russian equivalents.
A double-decker; a 50% reduction in fuel consumption; a sonic boom; specific design features; synthetic vision; the carrying capacity; to meet the challenges; folding outer wings; hyper-laminar flow; blown air techniques; aerodynamic optimization; very high-bypass engine; modular avionics and software.

X. State the purpose of the article and give the facts supporting it.

XI. Answer the following questions.
1. What is European airlines' prediction as for future aircraft?
2. What improvements would be necessary in a supersonic transport compared to Concorde?
3. What restrictions will European manufacturers have to cope with to operate a high-speed civil transport?
4. What are specific design features for a next-generation supersonic transport offered by Aerospatiale Matra?
5. What changes in conventional structures, controls, integration of the engines and airframe will be needed to meet the challenges in designing a flying wing?

XII. Complete the following sentences in Russian and then translate them into English.
1. Для того, чтобы быть жизнеспособным с экономической точки зрения, сверхзвуковому транспортному самолету потребовалось бы …
2. Конструкторы ожидают требование снизить шум самолета …

3. Вместо этого, сверхзвуковой транспортный самолет следующего поколения может основываться на искусственном обзоре …
4. Тогда как грузоподъемность делает концепцию привлекательной, …
5. Вероятно, что будет необходимо гиперламинарное течение, и оно, вероятно, …
6. Большой размер «летающего крыла» означает, что его конструкция …
7. Определенное расположение волокон может использоваться для регулирования свойств композитов …
8. И поскольку производители двигателей рассматривают двигатели с очень высокой степенью двухконтурности …
9. Один из подходов, возможно, примет во внимание преимущество модульного радиоэлектронного оборудования …

XIII. Comment on general trends for future aircraft according to European designers. Explain what new technologies, materials will be applied in developing future supersonic aircraft.

XIV. Divide the text into logical parts, define the main idea and suggest a title for each part. Write an outline of the first part of the article.

Text B

I. Study the second part of the article: "21st Century Aircraft"

Airbus first new aircraft for the 21st century will really be a family – the A3XX – with a number of models. Interestingly, it is very clear that the 747-400 is the benchmark[1]. The basic aircraft, the A3XX –100, is intended to carry 555 passengers 7,650 naut.mi[2]. – which is more passengers than the 747-400 –with a maximum gross takeoff weight of 540 tons.

The next version would be the extended-range – 100R, using the same fuselage, but with an increased takeoff weight to 590 tons and a maximum range of 8,750 naut.mi. The – 200 is envisioned[3] as having a stretched fuselage to carry 656 passengers but the same range as the –100.

Finally a –50R would have the same range as the 100 but would only carry 380 passengers. Aaerospatiale Matra is also working with cargo carries on plans for a freighter version and on a 570- passenger short-haul version.

Aerospatiale Matra, like Boeing, had considered an aircraft larger than the 80x80 meter footprint that is now the standard size constraint for existing taxiways and gates. But after considering the question with an international industry working group and regulatory agencies, the company decided to remain within the standard footprint.

When the airlines were asked what they want, the answer was "comfort equal to the A340 on the top deck, and more comfort than the 747 (in the coach[4] seats) on the lower deck". Current plans are for eight-abreast seating[5] in the upper deck and 10 abreast on the main deck, with double aisles on both. The fuselage tube will

have a larger cross-section than either of the two sizes Aerospatiale Matra manufactures today. That will give it a larger interior than a 747.

The aircraft will have five doors on each side of the main deck and four on each side of the upper deck, but the intent is to board passengers through just two doors on the main deck. Passengers will use big double stairways, fore and aft, to the top deck. Some airports are considering the possibility of two-level boarding.

One factor mitigating[6] against using an extra boarding ramp is the traffic congestion around the aircraft at the gate. Every possible parking space around the aircraft is already filled with servicing vehicles. Adding an extra boarding ramp would diminish the ability to service the aircraft.

The A3XX cockpit will be at an intermediate level, between the main and upper deck level. The crew will have a separate ladder up to the cockpit. The intermediate level flight deck was selected to give pilots better visibility, reduce drag and air flow noise in the cockpit and for the first row of passengers, and to optimize cargo capacity.

The wing design will be aerodynamically comparable to an earlier A 340-600 design. But this aircraft is to have a higher indicated Mach number[7] - 0,85 compared with 0,82. Airlines want that higher IMN, according to Aerospatiale Matra, and would actually like to get 0,86 or 0,87. The initial cruising altitude[8] goal is 35, 000 ft. for the 100 and 33, 000 ft. for the 200. A good wing design will also be important to hold wake vortices to the level of those on the 747- 400.

Designers would like to have turnaround time[9] no longer than that of the 747 – 400, which is 90 min., but to do so with 145 more passengers. Even though weighing 140 tons more than the –400, the landing gear will spread the load so it won't impose greater strains on runways and taxiways, using 20 wheels for the A3XX, four more than the 747.

Another goal is to lower operational costs by 15 – 20% per seat, compared with the – 400. It will come from improved engine performance, aerodynamics, weight savings from improved designs and use of composites, and reducing maintenance costs.

The A3XX will use more composites than previous aircraft. The A310 had some in the tail plane. Aaerospatiale Matra is also working on a composite fiber reinforced plastic, and new alloys for possible use on the fuselage. The wing trailing edge is one area being considered for composites.

In addition to new aircraft, Aerospatiale Matra is examining how best to refurbish[10] existing aircraft fleets. Along with new engines, the company may propose "three – surface aircraft" – modifying the classic design with the addition of canards[11]. Benefits should be more flexibility and balance on all surfaces. A stretch version of an aircraft might increase its lift with a canard. Canards could either be controllable, or in some applications, fixed. As early as 2005, canards might show up as modifications to existing aircraft.

Notes to the text

1. benchmark – отметка уровня; исходный пункт.
2. naut.mi (nm) – nautical mile – морская миля (1853 м)

3. envision – представлять, воображать
4. coach –туристический класс
5. eight – abreast seating – расположение кресел по восемь в ряд
6. mitigate – уменьшать
7. indicated Mach number – приборное число М
8. cruising altitude –высота крейсерского полета
9. turnaround time – продолжительность двустороннего рейса
10. refurbish – обновлять, переоборудовать
11. canard – аэродинамическая схема «утка»

II. Say in what connection the following notions and phrases are used. Give their Russian equivalents.
A stretched fuselage; a short-haul version; a larger cross-section; an extra boarding ramp; to optimize cargo capacity; a higher indicated Mach number; wake vortices; a composite fiber reinforced plastic; with the addition of canards.

III. Find the statements corresponding to the content of the text.
1. Aerospatiale Matra intends to develop future aircraft as a family – the A3XX – with a number of versions.
2. The future aircraft will radically differ from existing models.
3. A wing design will be paid special attention to as this aircraft is to have a higher indicated Mach number.
4. Composites and new alloys are not considered for using in new aircraft.
5. The company also proposes programmes for modifying the classic design.

IV. State the key idea of each paragraph of the text and give some facts proving it.

V. Answer the following questions.
1. What versions of future aircraft are developed by Aerospatiale Matra?
2. What changes will be made in the design of new aircraft compared with existing models?
3. What design improvements will help to lower operational costs?
4. What are the company's proposals for modifying existing aircraft?

VI. Compare the information presented in the article with the facts you have known before. Have you discovered any new and valuable information unknown to you before? Reproduce this information.

VII. Discuss the problem of future aircraft designs. What trends in the design of future aircraft are the most perspective from your point of view? Give some arguments to support your opinion.

VIII. Unite the both parts and write an abstract of the article "21st Century Aircraft" in Russian. Render it in English.

Text C

Hazardous Weather Warnings

I. Skim through the text and answer

1. What systems are described?
2. What is the purpose of the systems?

II. Translate the text in a written form.

The first two Weather Systems Processors, out of 38 in total, manufactured by Northrop Grumman Electronic Systems were commissioned by the FAA[1] in November 2002. Following the installations at Austin and Norfolk, the remaining systems are due to enter service in a year. The equipment is designed to provide timely information to pilots and controllers on weather conditions such as wind shear[2] and gust[3] front activity. The systems work in conjunction with the ASR – 9 airport surveillance radar[4] supplied by Northrop Grumman at 135 USA locations in a programme starting in 1985.

Meanwhile, another Northrop Grumman company Denro Systems has won a 10-year FAA contract to equip automated flight service stations with voice communications switching systems[5]. The stations provide flight planning, advisory and communications services for general aviation pilots. Up to 65 systems are planned.

Notes to the text

1. FAA – Federal Aviation Administration – Федеральное авиационное управление (США)
2. wind shear – градиент ветра (по высоте)
3. gust – (воздушный) порыв
4. surveillance radar – обзорная РЛС
5. voice communications switching system – речевая система коммутации для связи.

Unit 2
Text A

I. Study the following words.

1. long – haul plane – самолет с большой дальностью (протяжностью) полета
2. short take –off plane – самолет с коротким взлетом
3. paratroops – парашютные части
4. hardware – оборудование
5. penetration – глубина разрушения
6. pull – тянущая сила, натяжение
7. to alter – переделывать, изменять
8. telpher – тельфер

II. Read the text. Try to understand all details.

An-70 - New Step in the Development of Transport Aviation

An-70 is a long-haul short take-off military transport plane intended for airlifting military cargo of total mass of up to 47t.

The plane can airlift 20-351 of cargo on 3800-7400km distance at 750kmph cruising speed, airdrop the paratroops and hardware, including single pieces weighing up to 20t, from either high or low altitude, bring in 300 troops with their small arms, evacuate 206 sick and wounded.

Depending on the operational mode and cargo mass An-70 can take off from the average-strength concrete runways 1800m long or the loosely-bound ground airstrips 600-900 m long. In the latter case it carries 20-35t of cargo on 1450-3000km distance.

Four D-27 engines with SV-27 coaxial fans ensure high cruising speed at 20-30% lower fuel consumption comparing with other modern turbojets.

The integrated digital avionics provides for steady operation of the plane by day or night, at every latitude[1] in any weather, flights over the blank terrain, air-defence penetration, formation flights, take-offs from and landings on the unprepared ground airstrips.

The use of multiplexed data exchange channels makes for an easy adaptation of the avionics to any mission profile.

In-built load-carrying contraptions enable the plane to load and unload the cargo, as well as airdrop it. They include four electric telphers of total carrying capacity of 12t, two electric winches[2] having the pull of 1.5t each. On Customer's demand the plane can be equipped with the second easily demountable deck or roll-ways for container-handling.

On-board control & diagnostic systems allow An-70 to operate autonomously without any special ground infrastructure. All maintenance is done when the conditions so require. An-70's high technical and operational potential makes it

possible to build upon its base a whole range of models, both military and civilian: early warning aircraft[3], flying command post, patrol aircraft, refuel aircraft and many various An-70T commercial transports.

In 1998 has been set up the International Consortium Medium Transport Aircraft which founders, beside Antonov Aeronautical Scientific Technical Complex, include the Russian and Ukrainian aviation factories, scientific research institutes, commercial enterprises and governmental bodies.

Consortium conducts joint R & D, production, export. Its prime objective is the long-term pooling of the financial, industrial and human resources for the successful certification, production, sale, leasing and after-sale support of An-70.

Consortium is the sole legal entity[4] having the right to build An-70 and alter its design.

At present An-70 is undergoing flight and certification tests for its compliance[5] with the Airforce's requirements and AP-25 (FAR-25, JAR-25) airworthiness criteria.

Notes to the text:

1. latitude – широта
2. winches – лебедки
3. early warning aircraft – самолет дальнего радиолокационного обнаружения
4. sole legal entity – единственное юридическое лицо
5. compliance – податливость

III. Say in what connection the following notions and phrases are used. Give their Russian equivalents; concrete runways; coaxial fans; blank terrain; unprepared ground airstrips; electric telpher; electric winches; fuel consumption; ground infrastructure; legal entity; air-defence penetration.

IV. Answer the following questions:

1. What type of plane is An-70?
2. What is An-70 intended for?
3. What enables the plane to load and unload the cargo?
4. What can the plane be equipped with on Customer's demand?
5. What allows An-70 to operate autonomously?

V. What does R&D mean?

VI. Put the questions to the underlined words.

VII. Speak on basic characteristics of An-70.

Text B

USN plans three-tier UAV strategy

I. Look through the list of the English words and word-combinations and their Russian equivalents before reading the text.

1. unmanned air vehicles (UAVs) – беспилотные летательные аппараты

2. medium (high) altitude endurance – продолжительность полета на средней (большой) высоте
3. real-time targeting – наведение на цель во время полета
4. battle –damage assessment – оценка повреждения в бою
5. reconnaissance - разведка
6. signals intelligence - быстрое понимание сигналов
7. sampling – образец, проба
8. austere land bases – простые наземные базы
9. suppression – подавление
10. stealth – скрытость, тайна
11. surveillance – наблюдение
12. asset – (зд) проект
13. targeting accuracy – точность попадания в цель
14. laser –guided missile – ракета с лазерным наведением
15. spate of crashes – поток аварий

II. Read the text and find the information about the cost of UAVs.

USN plans three-tier UAV strategy

The US Navy is focusing its plans for unmanned air vehicles (UAVs)[1] on developing a family of systems comprising three tiers: tactical, medium-altitude endurance[2] and high-altitude endurance. But the US Air Force and army face challenges in their UAV plans.

Under the tactical tier, the USN wants an expeditionary capability for real-time targeting[3], battle-damage assessment[4], reconnaissance[5], signals intelligence[6], nuclear, biological and chemical sampling[7], short-haul communications relay and mine countermeasures.

The vehicle will be operated from austere land bases[8] and possibly ships. It will have limited stealth and sensitive technology, and will be attritable (inexpensive and numerous enough to be expendable), according to a senior USN official.

Under the medium-altitude endurance tier, the USN wants to field a UAV capable of performing strike support missions in a medium-threat environment, with growth to a limited weapons capability for strike and suppression[9] of enemy air defences.

This system, which could result from a melding of the navy's multirole endurance and UCAV-N naval unmanned combat air vehicle programme, would require more stealth[10] and manoeuvrability, and would be based on aircraft carriers, the official says.

Under the high-altitude endurance tier, the USN is looking for a long-range, long-endurance UAV capable of performing widearea surveillance[11], reconnaissance, maritime patrol, stand-off strike support, signals intelligence, and long-distance communications relay duties.

This UAV will be "a very expensive asset[12] and hence not attritable at all", the official says. The USAF's Northrop Grumman RQ-4 Global Hawk is an option and "a very attractive one", he says.

While the USN refines its UAV vision, the USAF has made moves to defend its General Atomics RQ-1 Predator medium-altitude endurance UAV against a report criticising its targeting accuracy[13].

A senior USAF official says the vehicle's sensor suite has been improved since initial operational test and evaluation was conducted in April last year. He confirms that the air force is interested in General Atomics' turboprop-powered Predator-B.

Funds for testing an armed Predator ran out before moving-target tests of laser-guided[14] Lockheed Martin Hellfire missiles[14] could be conducted, but the US Army plans to drop Northrop Grumman Brilliant Anti-Tank self-guided submunitions from an AAI Israel Aircraft Industries Hunter interim tactical UAV next year.

Development of the US Army's objective tactical UAV, the AAI Shadow 200, had been threatened by a spate of crashes[15].

An independent review has concluded that the failures were not systemic, a senior official says, and the army is continuing with its plans for initial operational test and evaluation scheduled for April.

III. Say:

a) What three tiers are mentioned in the text;
b) What technology UAVs will have;
c) What the US army plans are.

IV. Explain why the army is continuing with its plans (inspite of some failures).

V. Which paragraphs contain the information about
a) various UAV capabilities
b)funds for testing missiles.
Translate them

VI. Find answers to the following questions:

1. What is the US Navy focusing its plans on?
2. What does the USN want?
3. Where will the vehicle be operated from?
4. What would require more stealth and manoeuvrability?
5. What is the USN looking for?

VII. State the key idea of this text and give some facts proving it.

Text C

Boeing to start EA-18 jammer flight tests in bid to sell
electronic warfare variant of Super Hornet.

I. Look through the list of English words and their Russian equivalents before reading the text.

1. jammer – станция умышленных помех
2. pod- отделяемый грузовой отсек, гондола двигателя, обтекаемый подвесной контейнер
3. jamming pod – контейнер с помехосоздающей аппаратурой
4. fiscal year – финансовый год
5. to estimate – оценивать
6. to reduce – снизить, уменьшить
7. procurement contract – контракт о закупке

Boeing plans to start company-funded flight tests of jamming pods on an F/A-18F this week in support of its bid to sell an electronic attack variant of the Super Hornet to the US Navy. The two-seat aircraft will be fitted with three ALQ-99 jamming pods for two flights to collect noise and vibration data. More flights are planned for next early year, says Paul Summers, director, F/A-18 derivative programmes.

For the later flights, the aircraft will also feature wingtip pods which will house the receiver antennas on the EA-18. The initial flights will be conducted at up to 35,000ft (10,700m), Mach 0.8 and 3g, typical of a stand-off jamming orbit, he says.

Boeing's proposal is based on re-using the ALQ-99 jamming pods carried by the USN's Northrop Grumman EA-6B Prowler jamming aircraft, which the EA-18 is intended to replace.

For the initial flight tests, the F/A-18F will carry three pods, one on the centreline and two on the mid-wing pylons, plus two fuel tanks on the inboard wing pylons, and air-to-air missiles on the wingtip and nacelle stations.

The flights are intended to reduce risks attached to the proposal, which has yet to be accepted by the USN, although it plans to request funds in fiscal year 2003 to begin work on a follow-up to the EA-6B.

According to the latest estimates, Summers says, the EA-6Bs need to be replaced from 2008. "We have to start (EA-18 development) in 2003 if we want to deliver by 2008," he says.

Boeing's proposal involves a five-year development effort costing "a little over $1 billion in then-year dollars", says Summers. The EA-18 will cost "$7-9 million" more than an F/A-18E/F built at the same time, he adds, depending on the number and mix of E/Fs and EA-18s produced each year.

Boeing's goal is to reduce the unit flyaway cost of the F/A-18E/F below $50 million by the end of the current multi-year procurement contract.

II. Skim through the text and say what it is about. (You are given 15 minutes)
III. Give the main points of this text.

Unit 3

Text A. Fresh Start

I. Read and memorize the following words and word combinations.

1. designation – название, обозначение
2. genuine – подлинный, истинный, настоящий
3. to tackle – энергично бороться за что-либо; решать; заниматься чем-либо; работать над чем-либо; перехватывать, отнимать
4. to unveil – открывать, раскрывать (планы и т.п.); обнародовать
5. incumbent – возложенный (об обязанности и т.п.); зд. пригодный, совместимый
6. commonality – общность (конструкции, в т.ч. двигателей)
7. shareholder – акционер, пайщик
8. foothold – точка опоры; прочное устойчивое положение
9. to ensure – обеспечивать; гарантировать
10. (tail) moment arm – плечо (момента) хвостового оперения
11. to enhance – повышать (качество); увеличивать, усиливать
12. field length capability – зд. взлетно- посадочные характеристики
13. single – slotted flap – однощелевой закрылок
14. leading edge slat – отклоняемый предкрылок
15. to retain – удерживать, поддерживать; сохранять
16. to reap – снимать урожай; пожинать (плоды чего-либо); заслужить (что-либо)
17. ground handling – управляемость (самолета) на рулежке; управление (самолетом) при движении на земле
18. to reshuffle – переставлять, перегруппировать
19. flight envelope – граница (область, диапазон) режимов полета

II. Read the international words and give their Russian equivalents.

Service, regional, alternative, technical, version, standard, stability, production, structural, identical, perspective, integration

III. Give the verbs from which the following nouns are formed.

Decision, designation, seater, application, maintenance, incorporation, extension, operator, installation, certification, management, designer

IV. Find pairs of synonyms and antonyms.

To develop- to devise; fruitless – fruitful; to link – to connect; to offer – to suggest; forward – aft; to include – to comprise; to reinforce – to weaken; similar – different; to enhance – to improve; to gain – to lose; major – chief; definite – indefinite; to reduce – to increase; overall – entire

V. Read and translate the following phrases facilitating understanding the text.

To enter service; a genuine A320-based 100 –seater; the only engine option; “power-by-the-hour” fleet management programme; direct operating cost; a high-

density configuration; through the incorporation of a 0.7 m extension of the fin tip; to reap benefits; the nacelle and wing –trailing edge clearances; the engine/aircraft and nacelle integration.

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

1. To maintain a constant temperature in a container is an important technical problem.
2. Altimeter is one of the instruments to be used by pilots.
3. The more the aircraft is able to fly by itself, the more the pilot is free to perform other vital duties.
4. To harden the metal it was subjected to intense heat.
5. The main advantage of this principle lies in its ability to allow one of the major obstacles to be avoided.
6. Several requirements are to be met to make such a device operate efficiently.
7. For a battery to be charged it is only necessary to maintain an electric current in it in a direction opposite to that in which the current flows when the cell is in use.
8. These regions were too far away to be affected by the explosion.
9. It is too early to properly weigh the significance of this method.
10. In order to express the magnitude of a force some standard force must be selected as a unit in terms of which other forces must be expressed.
11. The excessive heat during the operation of the device was one of the problems to be solved.
12. Both instruments and human explorers are sure to find many surprises in the solar system.

VII. Read and translate the text.

Fresh Start

The A318, the latest and smallest member of the Airbus A320 family, is determined to enter service with CFM International CFM 56 power.

The company's decision to develop an A320-based 100-seater followed fruitless plans in the mid-1990s to create an all-new family of 80-100 seaters with China under the Airbus Industrie Asia (AIA) AE 317/AE 318 designation. In parallel with these studies, Airbus had devised a plan to remove four-and-a – half fuselage frames from the 124 –seat A319, providing a genuine A 320 –based 100-seater to tackle the Boeing 717 and 737-600 and new-generation large regional jets.

Airbus linked up with P&W which was looking for an application for its PW 6000 engine and the two were able to offer a highly competitive 100-seat aircraft to the market. It was unveiled in September 1998 adopting the A318 designation with the PW 6000 as the only engine option.

Although the PW 6000 was "the engine of reference" for the programme from the beginning, Airbus left the door open for the incumbent A320 family powerplants (the CFM International CFM 56-5 or International Aero Engines

[IAE] V 2500) to be offered to provide commonality for existing operators. While IAE (in which P&W is a shareholder) decided against offering an engine, CFMI joined the programme in July 1999, when major CFM 56 operator Air France specified its engine for the 25 A 318s it had on order and option.

This decision to offer an alternative engine on the A318 would later be of great benefit when the PW 6000 ran into major technical problems. Although the first A318 is equipped with the PW 6000, the CFM 56 version now leads the programme.

In its effort to gain a foothold in the market, P&W designed the PW 6000 as a simple engine to keep maintenance costs to a minimum and developed its "power-by-the-hour" fleet management programme.

According to Airbus chief engineer, the PW 6000 – powered A318 equipped with the definite version of the engine will have the around 2% higher fuel consumption than the CFM 56 –version-but its 6% lower, maintenance costs ensures direct operating cost is below that of any of its competitors including the CFM 56 version.

The 4.5 fuselage frame reduction over the A319 –1.5 frames forward of the wing and three aft-reduced the A318's overall length to 31.45 m (103ft 2 in). This enables to 107 passengers to be accommodated in a standard two-class layout or 129 in a high-density configuration –similar to the rival Boeing 717 and 737-500/600.

To compensate for the shorter moment- arm, the surface area of the vertical stabilizer is increased through the incorporation of a 0.7 m (28 in) extension of the fin tip. This provides greater stability and control at low speeds and enhances the A318's field length capability. The nose gear has also been reinforced to compensate for the higher loads.

The A319's 34.1 m –span wing is unchanged, with the single-slotted flaps and leading –edge slats retained. With A318 production not expected to exceed four per month, designers made no structural changes to the wing or fuselage to reduce weight as it would have been too costly from an industrial perspective.

Airbus has introduced new production techniques with the A318 at its plants in Einswaden and St. Nazaire. These will reap benefits in the longer term. They have replaced riveting with laser-welding on parts of the lower fuselage shell- this will reduce production costs and help maintenance as the structure is much cleaner.

The engine pylon and interfaces are identical to the current aircraft, with an adopter plate bolted to the existing pylon for the PW 6000 installation.

The belly cargo doors are each one frame narrower to ensure that the nacelle and wing-trailing edge clearances are maintained during ground handling. Six maximum take-off weight options are offered from the baseline 59t up to 68t – the latter providing a maximum range with 107 passengers of 6, 013km (3, 250nm) with CFM 56 engines.

When it was clear that the PW 6000 was not going to meet its performance guarantees, Airbus decided to delay the programme for that version of the A318.

This has resulted in the PW 6000 –powered A318's in-service target being delayed to mid-2005 as the engine undergoes a major redesign. Although the delay

was a major blow, as most A318 customers had specified the P&W engine, Airbus has coped by reshuffling the programme and PW 6000 customers Frontier Airlines and International Lease Finance have switched to the CFM 56. Of the 108 A318s on order, around two-thirds are now CFMI powered.

The first phase of the certification programme has been completed. It involved exploring and exceeding the normal flight envelope. The aircraft has been operated beyond its normal Mach 0.78 cruise speed to M 0.87 Auto-land and auto-braking systems have also undergone initial tests.

The first A318 is concentrating on tests of the engine/aircraft and nacelle integration for the PW 6000, as well as the powerplant's new Papillion thrust reverser developed by Hurel-Hispano. The next aircraft will be used for testing the fly-by-wire control system, aeroelasticity and reliability. The entire flight-test programme will total 1, 050h, of which around 450h will be flown by the CFM 56 version and the remainder by the PW 6000 model.

VIII. Say in what connection the following terms and phrases are used. Give their Russian equivalents.

Four-and-a-half fuselage frames; the incumbent A320 family powerplants; fuel consumption; maintenance costs; a standard two-class layout; the single-slotted flaps; the belly cargo doors; the normal flight envelope; the fly-by-wire control system.

IX. Select the paragraphs containing the information directly connected with the title of the text. Render this information.

X. Discuss the title of the text. Do you agree with this title? Suggest some other possible titles for the text.

XI. Answer the questions.

1. What was the background of the company's decision to develop an A320-based 100-seater?
2. What was the company's attitude as for an engine for a new aircraft? What powerplants were offered?
3. What advantage did the 4.5 fuselage frame reduction give to the designers of the A318?
4. What improvements have been made in the design of the A318? Has the wing undergone any changes?
5. What new production techniques has Airbus introduced?
6. Why did Airbus decide to delay the programme for the version of the A318 with the PW 6000 engine?
7. What are the purposes of the flight-test programme of the A318?

XII. Find in the text the following grammatical forms:

a) adjectives in different degrees of comparison;
b) infinitive.

Define the function of the infinitive in the selected sentences.

XIII. Discuss the peculiarities of the A318 design. Try to convince potential customers that the A318 performance and merits are superior compared to its competitors.

XIV. Summarize the main ideas of the text and give your own viewpoint concerning the A318 design and performance.

XV. Write a summary of the text.

Text B

I. Skim through the text and indicate the problems touched upon in it.

Pratt & Whitney strains every nerve to rescue PW 6000.

Pratt& Whitney will virtually restart the Airbus A318 PW 6000 programme, after setbacks have allowed CFM International (CFMI) to come from nowhere, overtake the incumbent and assume poleposition. The result is a 30-month effort by P&W, based on the MTU –designed six-stage HDV 12 high –pressure compressor (HPC), to resolve the performance snags that dogged the engine from its initial tests.

Although P&W appears to have had good warning that the once-rejected MTU design was the ready-made answer to boosting compressor flow and reducing fuel-burn, why has it fought so doggedly to use its home-grown five-stage design? Aside from value-per-engine factorsP&W's focus on its simpler core reflected a determination to cut parts count and costs to a minimum.

Arguments that the PW 6000 would involve costs around one-third that of the CFM 56 were convincing, and until Air France opted for the commonality of the existing engine, P&W enjoyed virtual exclusivity on the A318 from the moment of its launch.

The subsequent problems and its decision in early 2002 to delay entry-into-service by 30 months to mid-2005, have seen a gradual erosion of its market as Frontier Airlines followed International Lease Finance in switching to the CFM 56. Added to the loss of TWA's A318 order following its take-over by American Airlines the previous year, P&W's stranglehold has disappeared.

The extensive changes to the PW 6000 are expected to come with the likely selection of the MTU HPC over an indigenous seven-stage HPC option. Should the MTU decision be positive, the German company will negotiate for a risk-revenue shareholding of between 15 and 20%. MTU is a life-time preferred vendor to the PW 6000 with its low pressure turbine, but not yet a full partner.

CFMI is busy applying for joint European and US certification of two new CFM 56-5B variants for the A318.

The baseline – 5B 8/P is rated at 21, 600 lb (96kN) and the – 5B 9/P provisionally at 23, 300lb. These engines will be derated versions of the A319/A320/A321's –5B family, which is capable of higher thrust and is rated at

32, 000 lb on the A321. So CFMI's savings are bundled up in the dramatic derating of the A318 operation and commonality benefits of inter-operability shared spares and maintenance.

Although not enjoying the installed weight benefit of the PW 6000, the commonality advantage outweighs anything else. Early CFM 56 –powered A318 operators flying other A320 family members are expected to "mix and match" – 5B engines to manage life cycle and maintenance costs. The idea will be to remove higher-thrust rated engines from A321s, de-rate them and put them on A318s for another two years of service before removal. Conversely, new engines intended ultimately for A318s will provide initial power on A321s before being swapped.

The de-rated exhaust gas temperature margin of the – 5B 8/9 is so large that a life of 20, 000 cycles on wing before major overhaul is expected. The dual annular combustor option is offered on the B9 but not on the B8, as emission certification tests were not conducted at this lower power level.

II. How many unknown words and terms does the text contain? Can you guess their meaning from the context?

III. Find the terms referring to the engine design. Give their explanation in Russian.

IV. Divide the text into logical parts. Formulate the main idea of each part.

V. Discuss the measures taken by Pratt& Whitney to recover its position on the market.

VI. Compare the engines PW 6000 and CFM 56 from the point of view of their design and performance. Are there great differences between these engines?

VII. Compress and transform the text into a five –sentences –long abstract.

Text C
Detector may speed up passenger scanning.

I. Read the text and answer:

1. What device is described in the text?
2. What is the purpose of the device? How does it operate?

II. Express your point of view whether the device under development will help to raise security of flights.

III. Translate the text in a written form.

A trial[1] at London Gatwick airport has shown security procedures could be faster and less intrusive[2] for passengers.

A prototype millimeter- wave (MMW) detector[3] developed by UK research company Qinetiq is able to scan people or baggage and "see" weapons or explosives[4], eliminating the need for hand-held scanners[5] or pat-down searches[6] of passengers.

Qinetiq's "MMW imager" is contained in a "portal", a short corridor through which passengers walk. MMW energy naturally occurring in the atmosphere is reflected 100% by metal, and in different percentages according to the type of material. The human body reflects around 30% of the radar energy but it penetrates[7] clothes so a security officer can see the body shape and the outline of any objects being carried against the body or in clothing.

Qinetiq says the portal could be positioned as part of a gate or corridor so that people would not be aware that they were being scanned.

In the Gatwick trial 400 passengers who activated the standard metal detector arch were asked if they would volunteer[8] to go through the scanner. The results have just been released.

Qinetiq says more than 95% were happy to participate and "almost all" of them preferred the scanner to the "pat-down" or hand-held scanner.

Now the company is continuing psycho-physical tests at its Farnborough site to establish the effectiveness of security officers in detecting a variety of "threats"[9]. Qinetiq says there is more research and analysis to do and is as yet unable to give a completion date.

Notes to the text.

1. trial – испытание, проба
2. intrusive – назойливый, навязчивый
3. millimeter – wave detector – детектор на миллиметровых волнах
4. explosive – взрывчатое вещество
5. hand –held scanner – портативный сканер
6. pat-down search – зд. поиск, осмотр посредством прикосновений
7. penetrate – проникать, проходить
8. volunteer – вызваться (сделать что-либо); выразить желание принять участие в чем-либо
9. threat – угроза, опасность

Unit 4

Text A. The F/A – 18 E/F upgrade

I. Read and memorize the following words and word combinations.

1. upgrade – модернизация, повышение качества
2. revamp – (частичное) переоборудование, переоснащение
3. multifaceted – многогранный, многосторонний
4. survivability – переносимость (неблагоприятных условий); живучесть (объекта)
5. capacity – производительность; мощность
6. adversary – противник, враг; соперник
7. active electronically scanned array radar – активная бортовая самолетная РЛС с фазированной антенной решеткой с электронным сканированием
8. retrofit – модернизация; доработка с целью модернизации
9. obsolescence – устаревание; моральный износ
10. legacy – зд. преемственность, достоверность
11. countermeasures – меры противодействия; радиопротиводействие
12. fibre-optic data network – волокно-оптическая сеть передачи данных
13. lethality – поражающая способность; эффективность действия оружия
14. high resolution synthetic – aperture radar – РЛС с синтезированной апертурой с высокой разрешающей способностью
15. imaging – (наглядная) индикация; воспроизведение изображения
16. to interleave – прослаивать, лежать между чем-лтбо; зд. следовать друг за другом
17. weapon aiming – наведение оружия
18. radar cross-section – эффективная площадь отражения цели
19. stand-off range – дальность пуска ракет «воздух-земля» без преодоления рубежа ПВО
20. uprated – с повышенной тягой или мощностью; с повышенными характеристиками
21. wideband radome – широкополосный обтекатель антенны РЛС
22. radar warning receiver – приемник обнаружения РЛС
23. jamming suite – комплект для создания активных преднамеренных радиопомех
24. backbone – основа; суть, сущность
25. throughput – производительность; пропускная способность (системы)
26. assembly – language software –программное обеспечение на машинном языке ассемблере
27. high-order language – высокоорганизованный алгоритмический язык
28. cathode –ray tube – электронно-лучевая трубка
29. projection CRT – проекционная ЭЛТ
30. to flank – быть расположенным сбоку, располагаться по бокам; примыкать

31. data entry – ввод данных
32. footswitch – ножная педаль
33. intercom – (сокр. От intercommunication) –самолетное переговорное устройство; внутренняя телефонная или селекторная связь
34. rangefinder/designator – дальнометр/целеуказатель
35. munition – снаряжение (в т.ч. боеприпасы, вооружение)
36. electronic warfare – радиоэлектронная война; применение радиоэлектроники в воздушной войне

II. Read the international words and give their Russian equivalents.
Service, mechanically, mission, strategy, result, station, configuration, system, version, commersial, architecture.

III. Analyse the following derivatives. Translate them and find their roots.
Consideration, identification, replacement, survivability, flexibility, supportability, affordability, situational, essentially, significantly, additionally

IV. Find pairs of synonyms and antonyms.
To complete – to finish; limitation –constraint; to rule out – to include; to evolve – to develop; different –similar; upgrade – retrofit; to increase – to reduce; to accommodate – to locate; costly – cheap; substantially – slightly; to select – to choose; to allow – to enable; liquid – solid; multifaceted – versatile; obsolete – modern.

V. Translate the words formed by conversion. Use some of them in your own sentences.
Task – to task; risk – to risk; range – to range; cost – to cost; launch – to launch; lack – to lack; change – to change; approach – to approach; issue – to issue; promise – to promise; beam – to beam; display – to display; strike – to strike; track – to track; manoeuvre – to manoeuvre

VI. Translate the sentences. Define the functions of the Participles and the Gerund.
1. Some substances are capable of existing in each of the four possible states under suitable conditions of temperature and pressure.
2. The galvanometer is the most important measuring instrument used for detecting and measuring small electric currents.
3. While building complex machines of this type, we gain a better understanding of human mental process.
4. It is extremely important now to find ways for supplying mankind with permanent power sources.
5. You should carry out this experiment using the technique developed in our laboratory.
6. The system must control the aircraft in a uniform manner, regardless of the strength of the radio signals being received.
7. The instrument has the additional advantages of being very simple and inexpensive in construction.

8. In the experiments conducted the effect of all the variables introduced has been examined on a laboratory set up and results obtained checked on a full – scale engine working in an altitude chamber.
9. Varying the airspeed will vary the attitude in that while maintaining a low airspeed the pilot must place his aircraft in a nose-high position.
10. The pilot regulates the mixture control of the carburetor as carefully as possible, because flying on an over-rich mixture means a waste of petrol, whereas flying on a too lean mixture can be responsible for serious harm to the engines.

VII. Translate the following phrases for better understanding of the text.
A multifaceted upgrade of the mission system; the same avionics suite; the upgrade effort now under way; the substantially increased capability; the USN's previous approach to updating; more capable versions of the new mission computer; the most eagerly awaited element; air-to-air and air-to-ground modes to interleave sequentially; to run the additional software; the backbone of the upgrade; the existing operational flight programme; air superiority and precision strike roles; the rear-seat weapon system operator.

VIII. Read and translate the text carefully. Try to understand all details.

The F/A – 18 E/F upgrade

When Boeing and the US Navy completed development of the Super Hornet in 1999 the task of taking the F/A – 18 into the 21st century was not finished. The F/A – 18 E/F upgrade tackled the limitations of the original airframe and engine, but budget constraints and risk considerations ruled out a similar revamp of the avionics. Now Boeing has begun a multifaceted upgrade of the mission system.

In addition to extending range and increasing the weight of unused weapons and fuel which can be returned to the carrier deck, the E/F upgrade improved survivability, expanded growth capacity and, ultimately, increased mission flexibility.

To reduce cost and risk it was decided when E/F development was launched in 1992 that the Super Hornet would enter service with essentially the same avionics suite as the last production lot of F/a –18 C/Ds. Although the F/A –18's avionics have evolved significantly since the aircraft entered service in 1983 the Super Hornet today lacks some of the capabilities to be found in its likely competitors and potential adversaries, particularly in the area of advanced sensors.

The F/A – 18 E/F will incorporate those capabilities including active electronically scanned array (AESA) radar, as a result of the upgrade effort now under way.

Raytheon's APG – 79 AESA radar is the biggest change planned for the Block 2 Super Hornet, replacing the same company's APG – 73 mechanically scanned radar. Exploiting the AESA's substantially increased capability requires other changes in the aircraft including new mission computers and displays, high – speed data and video network and, for the two-seat F/A – 18 F, and advanced crew station.

The Block 2 strategy differs from the USN's previous approach to updating the F/A – 18, which saw configuration changes introduced with each new production lot of aircraft. The result is a mix of fighters with different combat capabilities which drives up the cost of retrofitting the fleet. The Block 2 vision is to limit the number of aircraft configurations and to maintain configuration across multiple lots.

Super Hornet is planned in two basic standards. The Block 1 upgrade tackles obsolescence issues with the legacy F/A – 18 displays, engine controls and other systems. It also introduces the advanced mission computer (AMC) and Integrated Defensive Electronic Countermeasures (IDECM) and includes the Advanced Targeting Forward – Looking Infrared (ATFLIR), Joint Helmet – Mounted Cueing System (JHMCS), Multifunction Information Distribution System (MIDS) and Positive Identification System (PIDS).

Block 2 will add the AESA, fibre – optic data network, digital video map computer (DVMC) and the advanced crew station (ACS) with large, 200x250 mm (8x10 in) situational awareness display. It will also introduce more capable versions of the new mission computer and IDECM self-protection suite. The Block 2 upgrades and particularly the AESA will be accommodated in the F/A – 18 E/F by a redesign of the forward fuselage.

The most eagerly awaited element of the Block 2 upgrade is the APG –79 AESA, which promises major improvements in situational awareness, lethality, survivability, supportability and affordability. Compared with the current APG – 73, the active-array radar provides significantly increased range against air targets and higher resolution synthetic – aperture radar (SAR) ground imaging.

The "inertialess" electronically scanned beam allows air – to- air and air-to – ground modes to interleave sequentially, providing near – simultaneous operation. The radar can track four air targets with weapon – aiming quality while doing a SAR map.

The AESA's lower radar cross-section and the long stand – off ranges possible increase survivability.

The environmental control system is uprated to provide liquid cooling to the array, which receives power from an upgraded electrical system. The fibre – optic network is needed to carry the radar data and more powerful mission computers are needed to run the additional software.

This is a highly integrated system. In addition to the array and its liquid cooling system, there is a new wideband radome, and modifications to the radar warning receiver (RWR) and jamming suite are required to ensure compatability.

The backbone of the Block 2 upgrade is the advanced mission computer and displays. F/A – 18 C/Ds and initial E/Fs have dual AYK – 14 mission computers with limited throughput and assembly – language software which is costly to maintain. Under its Bold Stroke initiative Boeing has been developing and testing mission computers based on commersial technology and the dual AMCs for the Super Hornet will use Power PC processers with increased throughput, the Fibre Channel high-speed data network and software written in C + +, a high – order language (HOL) easier to use, test and maintain.

The advanced mission computer, supplied by General Dynamics Information System, will be developed in two stages. The AMC Type 1, in Block 1 aircraft, will begin the transition to HOL software, running the existing operational flight programme (OFP) translated from assembly language to C++ Later OFPs will expand combat capability and integrate Block 2 components.

The AMC Type 2, in Block 2 aircraft, will use a much faster Power PC G4 processor, but the new mission computer architecture isolates the software from hardware changes. This allows development of software modules, such as the navigation function, which can be reused between platforms.

Additionally, the upgrade involves replacing the obsolete cathode –ray tube (CRT) multipurpose displays with 130x130 mm liquid crystal displays (LCD) and, in Block 1 aircraft, replacing the moving –map display with a 150x150 mm projection CRT, also because of obsolescence.

The two –seat F/A – 18F is the US Navy's intended replacement for the Grumman F –14 in both air superiority and precision strike poles. This requirement, and the potential for high crew workload in poor weather and dense threats, generated the need for decoupled cockpits enabling near –simultaneous air – to – air and air – to –ground capability.

A complete redesign of the aft cockpit is made possible by the new forward fuselage. This allows the 200x250 mm situational awareness display to be located in the center of the instrument panel, flanked by two multi-purpose displays and with the upfront control panel for data entry relocated above the glareshield. There are new hand controllers, handles to grab during electronic – countermeasures manoeuvres and push – to – talk footswitches for the intercom. Using the hand controllers the rear- seat weapon system operator can select radar modes, arm the laser rangefinder/designator, launch air – to – air weapons, release air – to – ground munitions and control the self – protection suite.

Initially the operator will be able to scroll through five formats on the display: horizontal situation, situational awareness, electronic warfare, ATFLIR video and AESA SAR. In addition the two multi – purpose LCDs will provide simultaneous air – to –air and air – to – ground radar displays.

The Super Hornet structural upgrade has provided a platform for further development of the F/A – 18 which is determined to be fully functional by 2020.

IX. Say in what conection the following terms are used. Give their Russian equivalents.

A revamp of the avionics; active electronically scanned array radar; high – speed data and video network; the advanced mission computer; fibre – optic data network; higher resolution synthetic – aperture radar ground imaging; radar cross – section; a wideband radome; a high – order language; the cathode – ray tube multi – purpose display; the laser rangefinder/designator; electronic warfare.

X. Find the statements corresponding to the content of the text.

1. A revamp of the avionics of the F/A – 18 E/F upgrade was not possible because of budget constraints and risk considerations.

2. The F/a – 18E/F is not expected to incorporate any advanced capabilities of the avionics systems.
3. The Block 2 strategy does not differ from the USN's previous approach to updating the F/A – 18.
4. Tackling obsolescence issues with some systems of the F/A – 18, the Block 1 upgrade includes the advanced mission systems.
5. Block 2 will introduce more sophisticated avionics systems.
6. The advanced mission computer and displays of the Block 2 upgrade overcome serious limitations of the older mission computers.
7. The installation of the advanced systems does not require any changes in the design of the two – seat F/A – 18 F.

XI. Answer the questions.

1. Why was it impossible to complete upgrading of the F/A – 18 E/F at the end of the last century?
2. What performance did the E/F upgrade improve?
3. What changes are planned in the avionics systems of the F/A – 18 E/F upgrade?
4. What aircraft is the two – seat F/A – 18 F intended to replace? What is the purpose of such replacement?
5. What changes are required in the aircraft design to locate new advanced systems?

XII. Divide the text into logical parts. State the subject of each part and entitle it. Write an outline of text.

XIII. Discuss two basic standards of the aircraft. What issues are tackled by the Block 1 upgrade? Compare the Block 1 and Block 2 upgrades and discuss the additional improvements in the avionics of the Block2.

XIV. Speak about the advanced mission computer and displays of the Block 2 upgrade. What advantages do they offer compared to the previous models?

XV. Discuss the necessity of decoupled cockpits for the two – seat F/A – 18 F/ Find in the text the arguments justifying such design.

XVI. Find in the text the Participles and the Gerund and define their functions.

XVII. Write a summary of the text.

Text B

I. Read and translate the text.

The Multirole SU –30 Fighter.

The development of the Su – 30, the best series production fighter in the world today, started in the second half of 1980s. By that time the fourth generation Su – 27 interceptor fighter had been already put in service. Some time before that the USA, our main potential adversary had equipped its B – 52 strategic bombers with cruise missiles with the launch range of 2500 km.

However, it was not possible to use some of possibilities of the Su – 27 at full extent. The operational experience of long range single-seat fighters showed that work overload of the pilot during modern highly manoeuvrable air combat did not allow him to use fully the capabilities of onboard electronic systems and weapons. It was obvious that for improving the Su – 27's capabilities as an air defence interceptor, the introduction of the second crewmember was required. It was decided to use the twin – seat Su – 27 UB combat trainer as a basis for developing a long – range air defence fighter.

The program resulted in the new aircraft designated the Su – 30 to underline its differences from the single – seat Su – 27.

DESIGN FEATURES.

The Su-30 is of the so-called "longitudinal tri-plane" aerodynamic scheme. The aircraft has been developed using integrated aerodynamic layout, in which the fuselage and the wings form a single lifting body, each of its longitudinal cross-sections having an airfoil shape. This layout ensures high lift-to-drag ratio and lift coefficient during manoeuvre, and also low wave drag at the trance- and supersonic speeds. Such arrangement with smooth transition of fuselage into wing along its span, allows using internal volumes of the aircraft more rationally (for example, for providing more volume for fuel tanks).

The airframe is made mostly from of aluminium alloys with wide use of titanium. The wing with the leading edge sweep of 41 degrees has automatically deflected slats. The K-36DM ejection seat is installed in the cockpit.

THE POWER PLANT.

The first batch is powered by series production AL-31F turbofan rated at 2*7600/12500 kg of thrust without/with afterburner. Subsequent batches will have a number of engine design improvements directed to maximum unification of parts and components with the thrust-vectoring AL-31FP turbofan to provide easy powerplant upgrade to the final configuration. The last batch of fighters will be delivered with AL-31FP engines. The AL-31FP has performance similar to that of the AL-31 F. Though the engine nozzles are deflected only in pitch, the planes of the engine nozzle movement are inclined 30 degrees outwards from the vertical, making an X-shaped intersection. This arrangement provides means of both pitch and roll control momentums for the aircraft on the whole. It is especially important

at low airspeed when aerodynamic controls are not very efficient. The fighter *is* equipped with an integral aircraft and engines control system, ensuring an optimum deflection of aerodynamic control surfaces and thrust vectoring nozzles.

SPECIAL PURPOSE EQUIPMENT

The Su-30 fighter-interceptor can be equipped with a group mission co-ordination and control system. On the multirole Su -30MK fighter modified radar with phased array antenna will be installed. In the air-to-ground mode, the radar can provide ground mapping information for attacking targets even from above the clouds without direct vision of the target. The weapons control system also includes optical-electronic sighting system with an infrared search and track sensor and a laser range finder. A jam-resistant datalink can provide transmission of ground control commands and information for the ground-controlled interception mission.

Automatic/automated low-altitude terrain following and obstacle avoidance mode is provided through integration of radar, navigation and flight control systems. Each of the cockpits has two multirole liquid crystals fill-colour displays with button framing. Each of the four displays has 6x8 inches format of the working field. It is planned to install a third display in each of the cockpits later. The two and three-dimensional area image, extracted from the digital database, can be displayed. The information required for attack of ground targets is displayed on the upgraded HDD. In future it is planned to implement objects recognition and superposition of radar and optical-electronic images onto the district digital map images.

The data selection for the pilot is carried out automatically, according to flight mission data. Special scenario of data providing is being developed.

High throughput digital processors in a combination with the new software developed by GosNIIAS research institute using the C++ core programming language has allowed to introduce elements of artificial intelligence as "helps" to the crew prompting optimum actions in particular combat situations.

WEAPONS. The airplane is equipped with the built-in 30-mm GSh-301 cannon with 150 rounds mounted on the starboard side near the forplane. The maximum warload is 8,000kg mounted on eight underwing and four fuselage weapon stations. The aircraft can carry up to eight R-27R1 or R-27ER1 medium range air - to-air missiles with semi-active radar guidance, two R-27T1 or R-27ET1 with infra-red homing heads, or up to six RW-AE missiles with active radar guidance. For close dogfight, the fighter's weapons can include six R-73 infrared guided missiles.

The air-to-ground guided weapons include up to six anti-radar high-speed Kh-31P missiles, up to six KP-29T, Kh-29L or Kh-25ML missiles with the TV correlation or laser semi-active guidance, two tactical Kh-59M cruise missiles with TV datalink guidance control provided by a pod-mounted ARK-9 datalink and

guidance system, six 500kg calibre guided bombs KAB-500KR with the TV correlation homing guidance.

The guided air-to-ground weapons can include up to ten 500kg or up to 31 250kg free-falling bombs, up to seven KMG-U sub-munition containers, or up to six launch containers of air –to- ground rockets S-13 (30x122mm) or S-8 (120x80mrni missiles accordingly). Various combinations of guided and unguided weapons of different types are possible. Open architecture of the weapons control and stores management systems allows integration with foreign-built weapons. In the maritime attack configuration the aircraft can be equipped with Moskit or Yatagan anti-ship missiles.

II. Select the terms characterizing the aircraft design, the power plant, the avionics, the system of weapon.

III. Discuss the peculiarities of

a) aerodynamic layout of the aircraft;
b) the power plant and design improvements planned in it;
c) the avionics system; compare the avionics of the Russian and American fighters and discuss the merits of both systems;
d) the system of weapon.

IV. Compress and transform the text into a ten –sentence –long abstract.

V. Comment on the present day situation in the field of the military aviation in the world. Try to find additional information and discuss Russia's achievements in this field, compare them with advances of the USA and western countries.

Text C

Translate the text into English.

Что такое пятое поколение истребителей?

К четвертому поколению истребителей относятся такие широко известные машины, как Су – 27 и МиГ – 29. На их базе в середине 80-х гг начали разрабатываться самолеты, относящиеся к поколению 4+. Это истребители Су – 30 и Су – 35 с управляемым вектором тяги (они способны изменять направление реактивной струи) и передним горизонтальным оперением (когда рули глубины находятся перед крылом, что улучшает маневренность). Сейчас их продают в Индию и Китай.

Следующим шагом к самолету 5-го поколения стал С – 37 «Беркут» с обратной стреловидностью крыла, созданный в конце 80-х годов. Этот самолет, существующий в единственном экземпляре, выполнил уже 150 полетов. На нем испытываются базовые технологии для истребителя XXI века. В России прошел тендер на создание реактивного самолета 5-го поколения. Победил проект ОКБ Сухого, выполненный совместно с ОКБ

Яковлева. В США также прошел аналогичный тендер. Победила фирма «Локхид – Мартин» с самолетом F – 35.

Набор характеристик самолета 5-го поколения примерно одинаков для всех. Эта малозаметность с использованием технологий «стелс», широкое применение компьютерной техники для облегчения труда пилота, способность взлетать и садиться на короткие и необорудованные взлетно – посадочные полосы. Кроме того, новый самолет должен «работать» по многим целям одновременно и быть многофункциональным. Последнее означает, что одна и та жа базовая модель в зависимости от «начинки» может быть использована и в качестве перехватчика ПВО, и как фронтовой истребитель, и для нанесения ударов по наземным целям.

В ближайшее время военные выдадут точные требования, и начнется работа по созданию эскизного проекта самолета. Более масштабного проекта в отечественном военном самолетостроении не было уже более 20 лет. При условии нормального финансирования первый полет может состояться уже в 2006-2007 годах. К серийному производству самолет будет готов к 2010 году.

Unit 5

Text A "Airship"

I. Read the following words with their translation. Memorize them.

1. blimp – полужесткий дирижабль
2. a bag – оболочка, отсек в дирижабле
3. a car – клеть
4. to sling (slang, slung) – приспосабливать для подвески
5. to escape – утекать, улетучиваться
6. to collapse – оседать, выходить из строя
7. keel – киль
8. girder – балка, перекладина, распорка
9. fabric – ткань
10. airtight – воздухонепроницаемый, герметичный
11. flammable – огнеопасный, воспламеняющийся
12. disaster – авария, катастрофа
13. envelope – оболочка, обшивка
14. impregnated – пропитанная, насыщенная
15. to supersede – заменять, вытеснять
16. neoprene – неопрен, синтетический хлоропреновый каучук
17. ascending – выходящий
18. Hippodrome - ипподром

II. Read the following international words and try to guess their meaning.
Balloon, type, gas, gondola, propeller, horizontal, vertical, cable, aluminum, helium, kilogram, distance, mile.

III. Read and translate the following word combinations: principle part, vertical/horizontal rudder, sigar – shapped bag, lighter-than-air gas, internal gas, metal keel, aluminum – alloy girder, gas-filled balloon, lifting capacity, gas-containing envelope, cotton/synthetic fabric, steam engine.

IV. Read the text "Airship". Try to understand all details. Use a dictionary if necessary.

Three main types of airships have been built: nonrigids (blimps), semirigids, and rigids. All three types have four principal parts: a cigar-shaped bag, or balloon, that is filledwith a lighter-than-air gas; a car or gondola that is slung beneath the balloon and holds the crew and passengers; engines that drive propellers; and horizontal and vertical rudders to steer the craft. Nonrigids are simply balloons with cars attached by cables; if the gas escapes, the balloon collapses. Semirigids likewise depend on the internal gas to maintain the balloon's shape, but they also have a structural metal keel that extends longitudinally along the balloon's base and supports the car. Rigids consist of a light framework of aluminum-alloy girders that is covered with fabric but is not airtight. Inside this framework are a number of gas-filled balloons, each of which can be filled or emptied separately;

rigids keep their shape whether they are filled with gas or not. The usual gases used for lifting airships are hydrogen and helium. Hydrogen is the lightest known gas and thus has great lifting capacity, but it is also highly flammable and has caused many fatal airship disasters. Helium is not as buoyant but is far safer than hydrogen because it does not burn. The gas-containing envelopes of early airships used cotton fabric impregnated with rubber, a combination that was eventually superseded by synthetic fabrics such as neoprene and Dacron. The first successful airship was constructed by Henri Giffard of France in 1852. Giffard built a 160-kilogram(350 –pound) steam engine capable of developing 3 horsepower, sufficient to turn a large propelle at 110 revolutions per minute. To carry the engine weight he filled a bag 44 m (144 feet) long with hydrogen and, ascending from the Paris Hippodrome, flew at a speed of 10 km (6 miles) per hour to cover a distance of about 30km (20 miles).

V. Choose the proper English equivalents of the Russian verbs with prepositions:

1. покрывать что-либо	a. to fill with
2. состоять из чего-либо	b. to use for
3. заполнять что-либо	c. to steer smth.
4. управлять чем-либо	d. to cover with
5. использовать, применять для чего-либо	e. to consist of

VI. Answer the following questions:

1. What types of airships have been built?
2. How many principle parts do all three types have? Name them.
3. What are nonrigids?
4. What is the internal gas necessary for?
5. What gases are used for lifting airships?
6. Where was the first successful airship constructed? Give its characteristics.

Text B

I. Look through the list of English words and their Russian equivalents:

1. a hull aluminum sheeting – алюминиевая обшивка корпуса
2. sophisticated craft – усовершенствованный летательный аппарат
3. transverse rings – поперечные кольца
4. patrol – патрулирование
5. successor – последователь
6. to inaugurate – представить что-то новое.

II. Skim through the text and say what it is about. (You are given 10 minutes).

In 1872 a German engineer, Paul Haenlein, first used an internal-combustion engine for flight in an airship that used lifting gas from the bag as fuel. In 1883 Albet and Gaston Tissandier of France became the first to successfully power an airship using an electric motor. The first rigid airship, with a hull of aluminum

sheeting, was built in Germany in 1897. Alberto Santos-Dumont, a Brazilian living in Paris, set a number of records in a series of 14 nonrigid, gasoline-powered airships that he built from 1898 to 1905.

The most successful operator of rigid airships was Ferdinand, Count von Zeppelin, of Germany, who completed his first airship, the LZ-1, in 1900. This technically sophisticated craft, 128 m (420 feet) long and 11.6 m (38 feet) in diameter, had an aluminum frame of 24 longitudinal girders set within 16 transverse rings and was powered by two 16-horsepower engines; it attained speeds approaching 32 km (20miles) per hour. Zeppelin continued improving his designs through World War I, when many of his airships (called zeppelins) were used to bomb Paris and London. Airships were also used by the Allies during the war, chiefly for antisubmarine patrol.

In the 1920s and '30s airship construction continued in Europe and the United States. A British dirigible, the R-34, made a round-trip transatlantic crossing in July 1919. In 1926 an Italian semirigid airship was successfully used by Roald Amundsen, Lincoln Ellsworth, and .General Umberto Nobile to explore the North Pole.In 1928 the *Graf Zeppelin* was completed by Zeppelin's successor, Hugo Eckener, in Germany. Before it was decommissioned nine years later it had made 590 flights, including 144 ocean crossings. In 1936 Germany inaugurated a regular transatlantic passenger service with the dirigible *Hindenburg.* Despite these achievements, airships were virtually abandoned in the late 1930s because of their cost, their slow speed, and their intrinsic vulnerability to stormy weather. In addition, a succession of disasters—the best known probably being the explosion of the hydrogen-filled *Hindenburg* in 1937— coupled with advances in heavier-than-air craft in the 1930s and '40s made dirigibles commercially obsolete for most applications.

III. Look through § 1 and say what events happened in 1872, in 1883, in 1897, in 1898, from 1898 – 1905?

IV. Give characteristics of the LZ – 1.

V. Give the main points of § 3.

Text C

a) "Ballooning"

Translate part A of this text. In written form with a dictionary (45 minutes).

Unpowered balloon flight is a sport that became popular in the 1960s. The balloons used are of plastic, nylon, or polyethylene, and are filled with hydrogen, helium, methane, or hot air.

Ballooning began in 1783 with the flight of the Montgolfier brothers' balloons in France, but the earliest uses were scientific and military. Sport ballooning began in earnest in 1906, when the American publisher James Gordon Bennett offered an

international trophy for annual long-distance flights, won permanently by Belgians with victories in 1922-24. Belgium then offered the trophy until it was discontinued in 1939. Initially the sport, like international yachting, was a rich man's pastime.
The sport was revived after World War II following the introduction of new materials and the propane burner to provide hot air. Events include those for duration of flight, altitude, and distance. Hare-and-hound races entail a lead "hare" balloon that takes off and flies a certain distance, pursued by the "hound" balloons. The winner is the balloon landing closest to the "hare." The Fédération Aéronautique Internationale (FAI; International Aeronautical Federation) maintains international records for 10 classes of balloons, both gas and hot-air, ranging in volume from 250 to 16,000 cubic metres (8,829 to 565,035 cubic feet).
Ballooning clubs are mainly local, and world championships have not been highly successful, but out of the sport came the record transatlantic (1978), transcontinental (1980), and transpacific (1981) flights of Maxie Anderson, Ben Abruzzo, and Larry Newman; of Anderson and his son Kristian; and of Abruzzo, Newman, Rocky Aoki, and Ron Clark, respectively. On March 20, 1999, Bertrand Piccard, whose grandfather Auguste Piccard invented the pressurized cabin, and Brian Jones completed the first nonstop trip around the world in a balloon. The flight originated in Switzerland and reached Mauritania in 20 days. The two men eventually landed in Egypt, having traveled more than 29,000 miles (46,000 km).

b) “Balloon”

Skim through part B of this text and speak about the major events described in it.

Balloon is a large airtight bag filled with hot air or a lighter-than-air gas, such as helium or hydrogen, to provide buoyancy so that it will rise and float in the atmosphere. Transport balloons have a basket or container hung below for passengers or cargo. A self-propelled, steerable balloon is called an airship *(q.v.)*, or dirigible.
Balloons were used in the first successful human attempts at flying. Experimentation with balloonlike craft may have begun as early as 1709 with the work of Bartolomeu Lourenco de Gusmao, a Brazilian priest and inventor. In 1783 Joseph and Etienne Montgolfier at Annonay, Fr., confirmed that a fabric bag filled with hot air would rise. On June 4 of that year they launched an unmanned balloon that traveled more than 1.5 miles (2.4 km). At Versailles, they repeated the experiment with a larger balloon on Sept. 19, 1783, sending a sheep, rooster, and duck aloft.
On Nov. 21, 1783, the first manned flight took place when Jean-Francois Pilatre de Rozier and Francois Laurent, Marquis d'Arlandes, sailed over Paris in a Montgolfier balloon. They burned wool and straw to keep the air in the balloon

hot; their flight covered 5.5 miles (almost 9 km) in about 23 minutes. In December of that year the physicist J.-A.-C. Charles, accompanied by Nicolas-Louis Robert, flew a balloon filled with hydrogen on a two-hour flight.

c) Read part C of this text, give a short summary and suggest a suitable title for it.

Military uses for balloons were soon developed. Anchored observation balloons were used by Napoleon in some of his battles and by both sides in the American Civil War and in World War I. The powered airship developed from balloons, but, while the airship was eventually supplanted by the airplane, balloons have continued to find useful applications. During World War II, balloons were anchored over many parts of Britain to defend against low-level bombing or dive-bombing.
Balloons have also proved enormously valuable to science. As early as 1911-12, V.F. Hess, an Austrian physicist, made a daring series of balloon ascensions as high as 5,000 m (about 3 miles) to prove the existence of cosmic rays. Advances in weather science since 1900 have resulted in great part from intensive exploration of the upper air by instrumented free balloons, which have risen to an altitude of 30 km (19 miles). Auguste Piccard, Swiss physicist and educator, set a world's altitude record in May 1931 in a balloon of his own design, which featured the first pressurized cabin used in flight. Jean-Felix Piccard, twin brother of Auguste, experimented with plastic balloons and helped to design the polyethylene Skyhook series of high-altitude balloons with which the U.S. Air Force sent manned flights to more than 100,000 feet (30,000 m) to collect data on the upper atmosphere. Sport ballooning has gained in popularity over the years.

Unit 6
Text A
The Next Generation of 737

I. Look through the list of English words and their Russian equivalents.
Successor – преемник
To ensure – обеспечивать, гарантировать
To demand – требовать
Debris – мусор, наносы
Duct – канал, трубопровод
Casing – обшивка, корпус
Containment – герметичность, противоаварийная оболочка
Collar – хомут, манжета, ограничительное кольцо
To bond – соединять, связывать, скреплять
Fairing – обтекатель
Stiffening – усиление, подкрепление
Crack – трещина
To tackle – заниматься чем-либо, браться за что-либо
Spin tests – штопорные испытания
Pit – углубление, впадина
Stall – срыв потока
Detection – обнаружение
To alter – изменять, переделывать

II. Read the following text carefully. While you are reading try to answer the questions.

1. What type of aircraft is mentioned in this text?
2. What characteristics will the new 737 have?
3. What is planned concerning the new engine?
4. What problems did the first tests show?
5. By April 1999, orders for the Next Generation 737 stood at 1,130, didn't they?

The Next Generation of 737.

The prospect of a successor to the 737 drove the engine maker to new limits to ensure success on the Next Generation family which was launched in 1993.

Boeing performance targets for the aircraft demanded a radical approach. The new 737 not only had to fly faster, higher and further, but it had to achieve these targets with up to 15% lower maintenance costs, improved reliability, better fuel consumption and lower emissions.

The biggest challenge in designing the new engine was how to increase airflow and substantially reduce SFC[1] without increasing fan diameter. The answer was a 1.55 m (61 in[2]) - diameter wide chord fan. The thrust range was from 18,500 lb.[3] to 26,300 lb. The engine ran at 5,540 rpm.[4] on its first test.

By December 1995, four development engines were on test and early indications showed a 4% thrust margin at hot day conditions up to a maximum thrust rating of 26,300 lb.

But already the first problems were starting to show. Fan blade-out and medium birdstrike tests showed changes were needed to the Boeing – designed nacelle and duct. The solid titanium blades weighed 35% more, and debris penetrated the casing in some areas. An additional containment collar, extending forward by 330 mm, was bonded on to the existing nacelle fairing to provide extra protection and increased stiffening. Some areas of the containment ring were also thickened and the inlet gearbox casing was strengthened. Cracks in the exhaust nozzle necessitated a material change from titanium to Inconel.

Inlet manufacturer worked hard to tackle the problems, most of which began to appear after blade – out, spin pit tests. Stall detection was also altered after the birdstrike tests, which caused thrust to reduce to 70% before the post-strike stall could be cleared.

These changes put an additional strain on the flight test phase, which began on 16 January, 1996. The tests went well, indicating cruise SFC to be around 0,6% better than expected.

By this stage, orders had grown to more than 800. Later in 1998, the first – 700s, -800s and 600s entered service in Europe. By April 1999, orders for the Next Generation 737 stood at 1,130 (a record 1,137), guaranteering that this plane is well on its way to becoming the best selling commercial jet airplane in history.

Notes:

1. STC (specific fuel consumption) – удельный расход топлива
2. in (inch) – дюйм
3. lb (libra) – фунт, 0,454 кг
4. rpm (revolutions per minute) – вращений в минуту

III. Put the questions to the underlined words.

IV. Give a short summary of the text.

Text B

Boeing 777 Celebrates Five Years of World-Class Service

I. Look through the list of English words and their Russian equivalents:

1. advanced – усовершенствованный, передовой
2. entertainment – развлечение
3. assessment – оценивание
4. to vote – голосовать, выбирать
5. attendant – бортпроводник
6. to log – записывать в журнале, регистрировать
7. average – средняя величина
8. fuel consumption – расход топлива

9. fatigue – утомление, усталость
10. anxiety – беспокойство, тревога

II. Read the following international words and try to guess their meaning.
Era, passenger, comfortable, class, system, fleet, pilot, industry, standard, design, total, market, model, typical, configuration, mile, product, vice president, program, manager, economical, minimize.

III. Translate the following word combinations: commercial flight, entertainment system, intermediate –and – long range jet liner, flight attendants, industry standard, three – class configuration, nautical mile, worldwide fleet, remarkable airplane, preferred product, program manager, world – class service.

V. Read the text "Boeing 777 Celebrates Five Years of World – Class Service". Try to understand all details. Use a dictionary if necessary.

Boeing 777 Celebrates Five Years of World-Class Service June 7, 2000.

Five years ago, a United Airlines (UAL) Boeing 777 departed London on a flight to Washington, D.C., marking a new era in airtravel. The passengers who boarded UAL Flight 921 that morning for the first commercial flight of the Boeing 777 entered the newest, most technologically advanced[1] and most comfortable jetliner ever built. Flying at 84% of the speed of sound, the Boeing 777 got them to their destination more quickly than any jetliner in its class. During the flight they enjoyed their choice of entertainment[2] on the seat – back in – flight entertainment system. Since that flight the Boeing 777 has established itself as the world's leading intermediate – and – long – range jetliner. In a recent assessment[3] of the 777s in its fleet, United Airlines said that Boeing had built a truly great airplane. "During the past five years, the 777 has been consistently voted[4] best in show by our passengers, our pilots, flight attendants[5], mechanics and – not to be forgotten – our accountants. It has become the industry standard for all future designs", said Gordon Mc Kinzie, United's manager of new Aircraft Development. Since the 777 Program was launched in 1990, the airplane has logged[6] more than 460 orders, about 62% of the total market. The Boeing 777 comes in three models, capable of flying a variety of ranges. In a typical three – class configuration the 777 – 200 carries 305 passengers up to 5, 150 nautical miles (9, 525 kilometers). The 777 – 200 ER (extended range) carries the same number of passengers up to 7, 700 nautical miles (14, 260 kilometers) – the greatest range of any commercial jetliner. A similarly configurated 777 – 300 carries 368 passengers up to 5, 960 nautrical miles 11, 030 kilometers).

New, even longer range versions of the Boeing 777 will be delivered beginning in late 2003, linking cities as far as 8, 860 nautical miles (16, 408 kilometers) apart. For passengers, that range will make it possible to fly nonstop to almost any destination in the world.

The Boeing 777 worldwide fleet, consisting of more than 280 airplanes, has flown a total of more than 2 million hours, with each airplane flying an average[7] of 10 hours a day. "After five years in service, this remarkable airplane speaks for itself as a preferred product to our customers, the airlines, as well as to their customers", said Ron Ostrowski, vice president and program manager of the Boeing 777 Program."With the airlines' participation early on in the program, we were able to desigh an airplane that beats the competition hands down on reliability, performance, economical operation and comfort", Ostrowski said. With its twin – engine efficiencies, the 777 offers airlines superior economic performance. The 777 has seven to 13 % lower seat – mile costs and four to 12 % lower fuel consumption[8] per seat when compared to its competitors. The 777's speed advantage over the competition saves passengers 30 minutes or more on long flights such as between London and Singapore, which minimizes traveler fatigue[9] and reduces anxiety[10] for passengers making a connecting flight to their final destinations.The777 has set a new standard for comfort in airline travel with the widest seats, more headroom, more efficient stowage and a more spacious environment.

V. Answer the following questions:

1. What does Boeing 777 celebrate?
2. What kind of aircraft did the passengers of Flight 921 enter?
3. How quickly did the Boeing 777 get passengers to their destination?
4. Why did passengers enjoy the flight?
5. What did Gordon McKinzie say about the 777?
6. How many models does the Boeing 777 come in? Give their features.

VI. Say what versions of the Boeing 777 will be delivered in late 2003.

VII. Make up a short outline of the text.

VIII. Speak about the events described in this text.

Text C

Read this text and give a short summary of it.

Supersonic Passenger Jets.

In November 2001, the Concord supersonic passenger aircraft resumed its commercial flights.

It has been recently reported that France still hopes to develop a new supersonic passenger airliner to replace Concord and believes that this program can be implemented by joint efforts of the European countries. The Japanese are also actively involved in R\D in this field and plan to begin flight tests of a pilotless demonstration version shortly.

The development of a supersonic passenger aircraft faces two challenging problems, which determine its future. Firstly, these are noise and sonic boom's excessive pressure. It is widely accepted that the new aircraft must not produce a sonic boom with an excessive pressure of more than 50 Pa compared to almost 100 Pa produced by Concords. Experts believe that advanced technologies and recent achievements in aerodynamics can reduce the sonic boom pressure to 20 –30 Pa. In this case, this aircraft virtually fly to any destination.

Secondly, an economically feasible supersonic jet must have a new, highly effective engine capable of operating in a wide range of ratings and feature a relatively low noise level. Neither of these two problems has been solved so far since the exiting solutions are associated with high costs.

However, experts are convinced that there is a market niche for these machines. A market analysis recently made forecasts a demand for 230 to 780 such aircraft by the year 2015. These estimates are based on two assumptions. First, passenger traffic on long – haul routes will annually grow by 5, 5 % and amount to 275 million passengers by 2025. Second, trans – ocean flights will account for almost 70 % of the traffic. Many leading airlines agree with these conclusions.

At the same time, many analysts doubt that the development of new generation supersonic aircraft is feasible, especially from the economic point of view. Today, governments are unable to finance projects like the Concord program that had significant political ground.

Consequently, it is not accidental that the idea of building a supersonic business jet has been discussed continuously. The development of smaller and lighter supersonic aircraft can practically solve the noise and sonic boom problems. This corporate jet must help work out a number of technologies that are vital for further development of second – generation supersonic passenger transport.

Unit 7
Text A.
Business and Pleasure

I. Read and memorize the following words and word combinations.

1. scratch – зд. метка, старт
from scratch – на пустом (голом) месте
2. to encompass – заключать (в себе), касаться
3. entry level – первый этаж (уровень); ав. совершающий полеты на уровне вхождения в атмосферу
4. corporate – корпоративный, принадлежащий или свойственный корпорации
5. dispatch – зд. быстрота, скорость
6. airfield performance – взлетно – посадочные характеристики
7. spoiler – интерцептор
8. standpoint – точка зрения
9. to forecast – предсказывать, делать прогноз
10. crisply – решительно, твердо; четко
11. neatly – четко, ясно; хорошо, искусно сделано
12. standby –запасной, резервный
13. attitude indicator – авиагоризонт
14. to evolve – развивать(ся)
15. complacency – самодовольство, удовлетворенность
16. air – data probe – датчик воздушных данных
17. static – source cone – конус источника статического давления
18. to tuck up – убирать
19. to deploy – развертывать
20. attitude recovery parachute – противоштопорный парашют
21. tailcone – хвостовой обтекатель (конус)
22. G meter – измеритель перегрузки
23. coaming – мягкая обивка (краев кабины)
24. sideslip indicator – указатель (бокового) скольжения
25. glareshield – противобликовый козырек (щиток)
26. to latch down – запирать
27. to obscure – загораживать (вид); мешать (обзору)
28. control yoke – штурвал управления
29. calibration equipment – тарировочная (калибровочная) аппаратура
30. armrest – подлокотник (кресла)
31. harness – пивязная система; ремни
32. crank handle – коленчатая рукоятка
33. headset – шлемофон; головной телефон с микрофоном
34. chart book – сборник карт, диаграмм
35. tiller (“spade handle” – shaped) – рукоятка, рычаг (зд. рукоятка в форме лопатки)
36. two – spool turbofan – двухкаскадный турбовентиляторный двигатель

37. bypass ratio – коэффициент (степень) двухконтурности двигателя
38. abort – аварийное прекращение (прерывание) действия; прерванный полет
39. engine indicating and crew alerting system –система индикации работы двигателя и предупреждения экипажа
40. to cater for – обслуживать; помогать, содержать
41. pressure ratio – степень сжатия
42. tailplane incidence – угол установки хвостового стабилизатора
43. parking brake – стояночный тормоз
44. amber – янтарный, желтый
45. synoptic – синоптический; обзорный, сводный
46. horizontal situation indicator – указатель обстановки в горизонтальной плоскости
47. vertical speed indicator – указатель вертикальной скорости
48. waypoint – пункт маршрута
49. collision avoidance system – система предупреждения столкновения ЛА
50. to superimpose – накладывать (одно на другое)
51. flight director mode – режим пилотирования по командному (директорному) прибору
52. to jam – защемлять, заклинивать, заедать
53. to counter – противостоять; противодействовать
54. artificial feel – искусственное воспроизведение усилий (о системе управления ЛА)
55. accolade – акколада (обряд посвящения)

II. Read the international words and give their Russian equivalents.

Combination, variant, mission, standard, conservative, instrument, automatic, prototype, analogue, configuration, vertical, mechanically.

III. Analyse the following derivatives. Translate them and find their roots.

Impression, requirement, abnormality, awareness, presentation, avoidance; unequalled, superimposed; considerable, adjustable, variable; centrally, logically, correctly, horizontally.

IV. Match up the synonyms.

a) to offer, goal, to forecast, to mount, to evolve, to occur, remote, to contain, failure, to adjust, rear, to assist, efficient, to sustain, vital, dedicated
b) to install, to support, to develop, distant, to propose, to help, malfunction, essential, to trim, special, target, to comprise, to predict, effective, to happen, back

V. Translate the sentence. Define the tense – form and voice of the predicate.

1. The results of their experiments were published and commented on in the last issue of this journal.
2. Data will be collected simultaneously, evaluated, and at the conclusion of the experiment presented in the form of a report.
3. Such metal can quickly and easily be traced, because of its radioactivity, and measured as the motor operates.
4. During the discussion the manufacturers were offered the latest designs of devices.
5. A small error which is ordinarily followed by a mistake is often a cause of a serious damage.
6. These computers were badly needed at that time.
7. It may well be that before fully instrumented space observatories make their journeys, many of the questions they are designed to answer will be answered by the use of radar astronomy.
8. In recognition of the seriousness of this problem, much study has already been given the situation.
9. The emitted radiation can be detected by various means, such as photographic films.
10. An unfavourable feature of such installations is the fact that fuel pumps are generally engine driven and consequently are exposed to a good deal of conducted heat, some of which will be transmitted to the fuel.
11. Although several approaches were attemped no useful solution was obtained .
12. Hybrid machines which use analog computers is one part of the system and digital computers in the other parts of the system are also being developed and applied.
13. When in rough air the aircraft may be affected by strong up or down currents and may be lifted or dropped several thousand feet.
14. This result will be approximately arrived at whatever method is employed in estimating the quantities involved.

VI. Translate the phrases which facilitate understanding the text.

Claimed to be unequalled by any other business jet; performance targets; from a systems standpoint; airline- standard extended twin- engined operations; considerable pilot input; a culture change for pilots; to sustain a high level of systems knowledge; adjustment fore and aft and for height and recline; a dedicated engine- mounted generator; to cater for failures; both analogue and digital presentations; crew alert messages; wheel brake temperatures and fuselage door status; to rectify an abnormality; strong situational awareness cues; to seek particular information within the presentation; the primary flying controls.

VII. Read and translate the article.

Business and Pleasure.

Bombardier's Global Express offers a combination of range, speed and cabin size claimed to be unequalled by any other business jet, a result of designing an aircraft from scratch for the ultra long- range mission.

The Global Express sits at the top of a range of Bombardier business jets which encompasses the entry- level Learjet 31A, mid- size Learjet 60 and large challenger 604, plus corporate variants of the Canadair Regional Jet.

Bombardier had three design goals for the Global Express : to offer the longest range and highest speed of any corporate aircraft; to provide the largest and most flexible cabin of any purpose- designed business jet and to guarantee high dispatch and mission reliability.

The aircraft has been designed to carry eight passengers and four crew 12,040 km (6,500 nm) –nominally. New York to Tokyo-cruising at Mach 0.8 and 51,000 ft (15,500 m). Maximum cruise speed is M 0,89. Good airfield performance was equally important, and take- off field length is 1,750m (5,750ft).

These ambitious performance targets required an advanced wing and new engines. The 20.6m-span, 35^0- swept wing has a supercritical aerofoil, winglets, multi-section leading – edge slats and trailing – edge flaps, and multifunction spoilers. The twin engines are 66 k N (14,750lb) –thrust BMW Rolls – Royce BR 710 turbofans. From a systems standpoint, the Global Express has been designed to meet the requirements of airline - standard extended twin-engined operations.

The programme was launched in December 1993 and Canadian certification was received on 31 July. Development has cost Bombardier and its risk – sharing partners $ 800 million. The company forecasts a potential market of 550-800 long – range business jets by 2010, but has based the programme on a «conservative» estimate of 250 sales.

It is probably the integration and management of the systems that makes the biggest first impression with the Global Express. The cockpit is crisply and neatly designed around the six 200×180mm (8×7 in) screens of the Honeywell Primus 2000 XP avionics system. These are mounted horizontally across the instrument panel, with the standby attitude indicator and altimeter placed centrally.

It looks as if much thought has been given to laying out the cockpit and making it user friendly for the crew which could be occupying it for 12-13 h on a 12,000 km flight. Pilots say there was considerable pilot input when the cockpit layout was evolved.

Adapting to the Global Express' automatic control of systems could clearly be a culture change for pilots with thousands of hours in a dials – and – switches cockpit. It will also be important for pilots to avoid complacency and to sustain a high level of systems knowledge to react logically and correctly should a serious systems failure ever occur.

The first prototype Global Express, aircraft 9001, was used for the flight. It is still very much a development aircraft, with a long air – data probe on the nose and a remote static-source cone, tucked up under the fin and deployed from a drum at the rear of the cabin. The cabin contains the usual flight – test crew positions and water ballast tanks used for development flying. An attitude recovery parachute is

mounted in the tailcone and an emergency exit is built into the cabin floor just behind the cockpit.

The cockpit of aircraft 9001 (registered C-FBCX, reflecting its Canadian origins) is also non-standard. Some of the automatic systems require manual operation, there is a G meter on the coaming above the captain's left hand and angle-of-attack and sideslip indicators, both connected to the nose probe , are mounted above the central coaming. A flat screen folded beneath the glareshield can be latched down to display flight test parameters, but obscures the two middle flight instrument screens when in use. The control yokes have been modified to take calibration equipment.

The seats, however, are to production standard, having adjustment fore and aft and for height and recline, as well as fold away armrests adjustable for height and five-point harnesses.

The rudder pedals can be adjusted for reach via a small crank handle between the pilot's ankles. There is storage space in the captain's side console for a headset or a Jeppesen-style chart book, but not for a flight bag.

An emergency oxygen mask is installed in the side console and the " spade handle – shaped tiller located at the forward end of the console came easily to hand.

The BMW Rolls-Royce BR 710-A2-20/01 engines are two- spool turbofans with a bypass ratio of about four.

Each is controlled by a dual channel full authority digital engine control (FADEC) system, which is powered by a dedicated engine-mounted generator. Engine starting is fully automatic with an automatic abort should a malfunction occur. The start is initiated using a simple switch to the rear of each engine power lever on the center console.

All starting procedures are illustrated step-by-step by the engine indicatign and crew alerting system (EICAS). Of the six displays in front of the pilots, the outboard two on each side are flight instruments while the two inboard screens are used for EICAS and system displays. The displays can easily be switched from screen to screen to cater for failures. The EICAS display (normally the inboard screen on the captain's side) shows engine parameters. Engine pressure ratio, fan and gas-generator speeds and inter-turbine temperature (ITT) have both analogue and digital presentations, while oil temperature, pressure and fuel quantity are digital.

VIII. Say in what connection the following terms are used. Give their Russian equivalents.

High dispatch and mission reliability; airfield performance; multifunction spoilers; the attitude indicator and altimeter; the cockpit layout; an air-data probe; a static-source cone; an attitude recovery parachute; angle – of - attack and sideslip indicators; calibration equipment; a headset, a chart book; two-spool turbofans; an automatic abort; the engine indicating and crew alerting system; pressure ratio.

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

1. Bombardier's Global Express offers a conventional combination of performance
2. The design goals for the Global Express were: to offer the longest range and highest speed; to provide the largest and most flexible cabin; to ensure high dispatch and mission reliability.
3. The performance targets for a new business jet didn't require new engines and any changes in the design of wings.
4. The cockpit layout of the Global Express combines comfort for the crew with advanced avionics systems.
5. The Global Express' automatic control of systems will force pilots to sustain a high level of systems knowledge to react logically and correctly in the case of a failure.
6. The cockpit and the seats of the first prototype Global Express, aircraft 9001, are non-standard.
7. Engine starting is fully manual without any automatic abort.
8. Engine parameters on the display can be presented in both forms: analogue and digital.

X. Answer the following questions

1. What is the purpose of Bombardier's Global Express?
2. What goals did the company try to achieve in designing the Global Express?
3. What factor makes the biggest first impression with the Global Express?
4. Why does adapting to the Global Express' automatic control of systems require a culture change for pilots?

XI. Discuss the peculiarities of the following parts of the aircraft consentrating, on the radically new features in their design.

1. the wing of the aircraft;
2. the engines and their control;
3. the cockpit layout and avionics systems installed in it.

XII. Divide the text into logical parts. Define the subject of each part and entitle it. Write an outline of the first part of the article.

Text B

I. Read and translate the second part of the article «Business and Pleasure».

Configuration diagrams – for undercarriage, flaps, tailplane incidence and control – surface trim positions – appear in the lower right of the EICAS display.

Above these is a vertical box in which crew alert messages (CAMs) are shown. CAMs are used primarily to advise of any changes to, or incorrect, systems status (for example, take-off configuration if the parking brake is on, or the failure of a generator). Routine messages appear in blue or white letters, those requiring crew attention in amber and vital messages in red.

The inboard screen in front of the co-pilot, meanwhile, is used for systems synoptics. There is a menu of eight to choose from. The one most often used is the EICAS secondary display, which shows cabin temperatures and altitude, crew oxygen, oil quantities (for the engines and APU), wheel brake temperatures and fuselage door status. The other options are the AC electrical, DC electrical, fuel, bleed air and anti-ice, flying controls, air conditioning and hydraulic synoptic pages. Each of these shows systems coming alive as valves automatically open and pressures rise – or the automatic corrective action the management system is taking to rectify an abnormality.

Each pilot has the primary flying display (PFD) on the outboard screen and the multifunction display (MFD) on the inboard screen. The PFD has the attitude and direction indicator in the top half of the screen, with an airspeed ribbon to its left and a vertical altitude scale to its right. The lower half of the screen has the horizontal situation indicator and vertical speed indicator.

The MFD has a horizontal navigation display including projected track and waypoints. Traffic alert and collision avoidance system information is superimposed upon this navigation display. The lower third of the screen is used for a vertical navigation display.

These displays provide strong situational awareness cues. They also present much other information (for example, true airspeed, ground speed and flight director modes), so that it takes considerable time to become familiar with the layout and to know instantly where to seek particular information within the presentation.

The primary flying controls are mechanically controlled and hydraulically operated. Control in pitch is via separate elevators (to allow one control surface to operate if one elevator becomes jammed), and longitudinal trim is via the variable incidence tailplane.

Roll control uses ailerons, assisted by multifunction spoilers. An aileron jam would be countered by use of the spoilers.

The controls are well harmonized in all three axes, and the artificial feel is good. The Global Express makes you want to fly it more and know it better. The landing qualities qualify it for the accolade of a «pilot's aeroplane». The automated systems make it efficient and safe to operate. The levels of comfort boasted by Bombardier for its cabin are matched by the efficiency of its cockpit – a working environment equipped to facilitate good crew management and situational awareness.

II. Say in what connection the following terms are used. Give their Russian equivalents.

Tailplane incidence; systems synoptics; the attitude and direction indicator; the horizontal situation indicator and vertical speed indicator; collision avoidance system; flight director modes; the artificial feel.

III. Discuss, the features of the displays installed in the cockpit and information presented by them. Do you agree that the displays provide strong situational awareness cues for pilots? Express your own viewpoint concerning the merits of these systems

IV. Speak about the primary flying controls and principles of their operation. Can you confirm the statement that the controls are well harmonized in all three axes.

V. Do you agree with the author's conviction that the Global Express can be qualified as «a pilot's aeroplane» since it combines efficiency, safety and comfort facilitating management of the aircraft. Find in the text the confirmation of this statement. Express your views on the advantages offered by the aircraft and try to prove your point.

VI. Find in the article the following grammatical forms:

a) the predicates in the Passive voice;

b) the infinitive, define its functions.

VII. Unite the both parts and write an abstract of the article.

Text C

I. Skim through the text and indicate the problems touched upon in it

Anyone who has entered aviation within the past two decades is likely to know Cessna more for its Citation business jets than its propeller aircraft.

Already the largest among business jets, the Citation fleet grew by a record 313 aircraft in 2001. To coincide[1] with its 75th anniversary, Cessna is expected to introduce a series of new models in its Citation business jet line.

The continued vitality of the Citation line is due largely to Cessna's strategy of incremental[2] product development. Since the first Citation was launched the company has introduced new iterations[3] at regular intervals, providing customers with an incentive to trade in or trade up for a new or larger aircraft. Of the 17 Citation models introduced over the last three decades, only five have been all or largely new designs. They made the latest member of the family the mid-size Citation Sovereign, now in flight test.

Unveiled in 1968 as the Fanjet 500 the original Citation was Cessna's first business jet. It offered ease of handling[4] and short-field performance [5] similar to the piston and turboprop twins it was designed to replace. The straight wing Citation was relatively slow and simple by business jet standards, but it was backed by sophisticated marketing and support systems that proved successful with the target customer-smaller businesses which had never owned a jet. The aircraft was designed for single-pilot operation and the owner –flown market has remained an important part of the Citation customer base.

The original Citation light jet was followed by the upgraded Citation I and stretched[6] longer range Citation II. Later, a modified supercritical wing laid the foundations for the further stretched Citation V. The Citation II and V remain in production today as the Bravo and Encore, two of seven models in a line-up[7] reflecting Cessna's incremental approach in its mix of generations.

The CJ1 and CJ2 are upgrades of the entry-level Citation Jet, first introduced in 1989 as a direct successor to the original Citation. The «super light» Excel, introduced in 1994, is a widebody derivative of the Citation V, and currently Cessna's best-selling jet. And the mid-size Sovereign reuses some features from the top-of-the-range, super mid-size Citation X, introduced in 1990. At Mach 0.92, it remains the fastest business jet available.

Cessna has already refreshed[8] the top and bottom of its range and if there is room for improvement in this business jet family, it is in the middle of the line-up.

The CJ1 and CJ2 were built on the success of the Citation Jet, which was introduced to recapture[9] the entry-level market tapped by the original Citation and close the widening gap between piston and turboprop aircraft and business jets. The Citation Jet took advantage of a new laminar-flow wing and Williams-Rolls FJ 44 engine to provide more range on less fuel.

The CJ1 has increased gross weight and upgraded avionics. The new Rockwell Collins Pro Line 21 cockpit is also used in the CJ2, which is a stretch of the Citation Jet with more powerful FJ44 engines.

The standard system of the Pro Line 21 installation includes two large liquid – crystal displays with a second primary flight display available as an option and required for reduced vertical separation minima operations.

The Citation Jet introduced a fresh look to the line-up, with its still-straight, but exceptionally clean wing and new T-tail. The wing carry – through structure passes under the fuselage, so there is no spar intrusion[10] into the cabin as there was in the original Citation. The stretched CJ2 has a longer version of the same wing, housing more fuel and a larger, swept version of the T-tail. The Citation Jet also introduced trailing – link main gear[11] for a smoother ride, a feature now used across the range to replace the notoriously[12] stiff[13] straight – leg gear[14] of the early Citations.

While the CJ1 is an entry – Level jet, the CJ2 is a step-up aircraft[15], based on a "wish list" from Citation Jet operators. Higher cruise speed, longer range and larger cabin topped the list.

Introduced in 1994, the Bravo light jet is an upgrade of the Citation II featuring new Pratt & Whitney Canada PW 530A turbofans. The Encore followed four years later, replacing the upgraded Citation V Ultra and introducing PW535A turbofans. Other changes included the move to heated wing leading – edges, eliminating the de-icing boots[16] still used on the Bravo.

Another Citation looking at a facelift[17] is the Excel. The aircraft was conceived[18] as a logical step-up from the Citation V, and the concept has proved sound[19].

Notes to the text.

1. to coincide – совпадать, соответствовать
2. incremental – возрастающий, увеличивающийся
3. iteration – повторение, повтор
4. handling – управление, управляемость ЛА
5. short-field performance – характеристики, обеспечивающие взлет и посадку на небольших аэродромах
6. stretch – вытягивание, удлинение, увеличение длины (фюзеляжа, самолета)

stretched – с удлиненным фюзеляжем

7. line-up – расположение, расстановка, компоновка
8. to refresh – обновлять, освежать
9. to recapture – взять обратно, снова захватить
10. intrusion – вторжение, внедрение, проникновение
11. trailing-link main gear – зд. главное шасси с задним рычагом управления
12. notoriously – общеизвестно, печально известно
13. stiff – жесткий
14. straight-leg gear – шасси с прямой стойкой
15. step-up aircraft – самолет с превышением
16. de-icing boot – протектор противообледенителя периодического действия
17. facelift – внешнее обновление, освежение
18. to conceive – задумывать, замышлять
19. sound – зд. здравый, разумный, правильный.

II. Read the text again and entitle it.

III. Discuss Cessna's strategy to product development. Supply your discussion with reasoning and examples proving success of such strategy.

IV. Speak about the most popular versions of business jets offered by Cessna. Discuss improvements in the design of the latest models.

V. Translate the text in written form.

Unit 8

Text A **Helicopter**

I. Study the following words.

1. inaccessible – недоступный
2. clearing – площадка, участок
3. to hover – зависать
4. to deliver personnel – доставлять личный состав
5. versatility – многосторонность
6. troops – войска
7. rescue – спасение, спасательные операции
8. surveillance – наблюдение
9. wounded – раненые
10. crop dusting – опыливание с–х культур (посевов)
11. surveying – осмотр, исследование, съемка
12. publicity – внимание, гласность
13. floods and earthquakes – наводнения и землетресения
14. perplex – ставить в тупик, приводить в недоумение, смущать, ошеломлять, сбивать с толку, запутывать, усложнять.
15. autogiro – автожир

II. Read the following international words and try to guess their meaning.
Evacuation, medical, transportation, communication, military, front, centre, experiment, vertical, control, problem, forward, final, practical, rotor, record, technical, innovations, prototype, basic, principle, design.

III. Read and translate the following word combinations:
Wounded men, armed forces, inaccessible areas, medical evacuation, vertical flight, front lines, commercial use, short – haul transportation, technical innovations, manned helicopter.

IV. Read the text "Helicopter". Try to understand all details. Use a dictionary if necessary.

Helicopter

Helicopter is an aircraft with one or more power-driven horizontal propellers or rotors that enable it to take off and land vertically, to move in any direction, or to remain stationary in the air.

The helicopter is often described as a rotary-wing aircraft, in contrast to a conventional fixed-wing airplane. It does not require a runway but can land on and take off from small areas that are inaccessible[1] to most fixed-wing aircraft. It can land in a small clearing[2] in the jungle, on the deck of a ship, or on suitable flat roofs. Its ability to hover[3] motionless over a given area enables it to deliver[4] or take on personnel or cargo without actually landing.

Because of its versatility[5], the helicopter is used extensively by the armed forces for transportation of troops[6] into otherwise inaccessible areas; for rescue[7] and medical evacuation; and for communication, surveillance[8], and search at sea and on land. It proved its military value during the Korean War (1950-53), when it was used to evacuate thousands of wounded[9] men from the front lines. Its commercial uses include short-haul transportation between city centres and outlying airports, transportation into undeveloped or inaccessible areas, crop dusting[10], surveying[11], and exploration. The helicopter also gained widespread publicity[12] as a result of its lifesaving activities in civil emergencies, particularly those resulting from floods and earthquakes[13].

The helicopter was one of the earliest ideas for flying. For many years Leonardo da Vinci was credited with the original idea, but it is now known that the Chinese and the Renaissance Europeans made helicopter toys before Leonardo's time. Various experimenters before 1900 failed with helicopters because they lacked an engine powerful enough to produce the vertical thrust required to raise its own weight and some useful load from the ground. Thus, these early designers never became aware of the difficult in-flight control problems that would perplex[14] later experimenters.

In 1907 the first manned helicopter, built by the Frenchman Paul Cornu, made a brief vertical flight. Controlled vertical and forward flight by a helicopter was finally attained in 1930, and in 1939 Igor Sikorsky in the United States established the practical single-rotor helicopter with record-breaking flights of his VS-300. In 1923 the Spaniard Juan de la Cierva had successfully flown an autogiro[15] *[q.v.)* for the first time. It was the technical innovations introduced by Cierva that paved the way for Sikorsky's first successful prototype of 1939. Once the basic principles of helicopter design had been established, development was rapid on both sides of the Atlantic.

V. Answer the following questions:

1. What do power-driven horizontal propellers enable to do?
2. What are the advantages of a rotary wing aircraft in contrast to a conventional fixed-wing airplane?
3. What do the armed forces use the helicopter for?
4. What do commercial uses include?
5. What were the problems with helicopters before 1900?
6. What happened in 1907? In 1923? In 1930? In 1939?

VI. Say: a. Where and when the helicopter proved its military value?

b. What idea Leonardo da Vinci was credited with?

c. Who made helicopter toys before Leonardo's time?

d. What proper names are mentioned in this text?

VII. Speak on the topic "Helicopter"

Text B **"Principles of flight and operation"**

I. Look through the list of the English words and word combinations and their Russian equivalents before reading the text.

1. elongated –удлиненный
2. pitch control – управление, ручка управления шагом воздушного винта
3. pitch angle – угол тангажа; угол установки лопасти (воздушного винта)
4. torque – вращающий момент
5. gyroscopic precession – прцессия гироскопа
6. retreating blade – идущая назад (отступающая) лопасть
7. advancing blade – идущая вперед (наступающая) лопасть
8. flapping – маховое движение (лопасти несущего винта вертолета)
9. cyclic feathering – циклическое изменение шага
10. rotor hub – втулка несущего винта вертолета
11. to equalize - корректировать, уравнивать
12. to dampen out – глушить, подавлять
13. equalization – коррекция, уравнение
14. coning – конусность; сужение
15. bending effect – изгибающее действие
16. Coriolis effect – эффект Кориолиса
17. drift – дрейф

II. Read the text and find the information about forces acting upon a helicopter not found in a conventional aircraft.

Principles of flight and operation.

Unlike fixed-wing aircraft, the helicopter's main airfoil is the rotating blade assembly (rotor) mounted atop its fuselage on a hinged shaft (mast) connected with the vehicle's engine and flight controls. In comparison to airplanes, the tail of a helicopter is somewhat elongated[1] and the rudder smaller; the tail is fitted with a small antitorque rotor (tail rotor). The landing gear sometimes consists of a pair of skids rather than wheel assemblies.

The fact that the helicopter obtains its lifting power by means of a rotating airfoil (the rotor) greatly complicates the factors affecting its flight, for not only does the rotor turn but it also moves up and down in a flapping motion and is affected by the horizontal or vertical movement of the helicopter itself. Unlike the usual aircraft airfoils, helicopter rotor airfoils are usually symmetrical. The chord line of a rotor, like the chord line of a wing, is an imaginary line drawn from the leading edge to the trailing edge of the airfoil.

The relative wind is the direction of the wind in relation to the airfoil. In an airplane, the flight path of the wing is fixed in relation to its forward flight; in a

helicopter, the flight path of the rotor advances forward (to the helicopter's nose) and then rearward (to the helicopter's tail) in the process of its circular movement. Relative wind is always considered to be in parallel and opposite direction to the flight path. In considering helicopter flight, the relative wind can be affected by the rotation of the blades, the horizontal movement of the helicopter, the flapping of the rotor blades, and wind speed and direction. In flight, the relative wind is a combination of the rotation of the rotor blade and the movement of the helicopter.

Like a propeller, the rotor has a pitch angle, which is the angle between the horizontal plane of rotation of the rotor disc and the chord line of the airfoil. The pilot uses the collective and cyclic pitch control[2] (see below) to vary this pitch angle[3]. In a fixed-wing aircraft, the angle of attack (the angle of the wing in relation to the relative wind) is important in determining lift. The same is true in a helicopter, where the angle of attack is the angle at which the relative wind meets the chord line of the rotor blade.

Angle of attack and pitch angle are two distinct conditions. Varying the pitch angle of a rotor blade changes its angle of attack and hence its lift. A higher pitch angle (up to the point of stall) will increase lift; a lower pitch angle will decrease it. Individual blades of a rotor have their pitch angles adjusted individually.

Rotor speed also controls lift—the higher the revolutions per minute (rpm), the higher the lift. However, the pilot will generally attempt to maintain a constant rotor rpm and will change the lift force by varying the angle of attack.

As with fixed-wing aircraft, air density (the result of air temperature, humidity, and pressure) affects helicopter performance. The higher the density, the more lift will be generated; the lower the density, the less lift will be generated. Just as in fixed-wing aircraft, a change in lift also results in a change in drag. When lift is increased by enlarging the angle of pitch and thus the angle of attack, drag will increase and slow down the rotor rpm. Additional power will then be required to sustain a desired rpm. Thus, while a helicopter is affected like a conventional aircraft by the forces of lift, thrust, weight, and drag, its mode of flight induces additional effects.

In a helicopter, the total lift and thrust forces generated by the rotor are exerted perpendicular to its plane of rotation. When a helicopter hovers in a windless condition, the plane of rotation of the rotor (the tip-path plane) is parallel to the ground, and the sum of the weight and drag forces are exactly balanced by the sum of the thrust and lift forces. In vertical flight, the components of weight and drag are combined in a single vector that is directed straight down; the components of lift and thrust are combined in a single vector that is directed straight up. To achieve forward flight in a helicopter, the plane of rotation of the rotor is tipped forward. (It should be understood that the helicopter's rotor mast does not tip but rather the individual rotor blades within the plane of rotation have their pitch angle varied.) For sideward flight, the plane of the rotation of the rotor is tilted in the direction desired. For rearward flight, the plane of the rotation of the rotor is tilted rearward.

Because the rotor is powered, there is an equal and opposite torque[4] reaction, which tends to rotate the fuselage in a direction opposite to the rotor. This torque is

offset by the tail rotor (antitorque rotor) located at the end of the fuselage. The pilot controls the thrust of the tail rotor by means of foot pedals, neutralizing torque as required.

There are other forces acting upon a helicopter not found in a conventional aircraft. These include the gyroscopic precession effect[5] of the rotor—that is, the dissymmetry of lift created by the forward movement of the helicopter, resulting in the advancing blade having more lift and the retreating blade[6] less. This occurs because the advancing blade has a combined speed of the blade velocity and the speed of the helicopter in forward flight, while the retreating blade has the difference between the blade velocity and the speed of the helicopter. This difference in speed causes a difference in lift - the advancing blade[7] is moving faster and hence is generating more lift. If uncontrolled, this would result in the helicopter rolling. However, the difference in lift is compensated for by the blade-flapping[8] and by cyclic feathering[9] (changing the angle of pitch). Because the blades are attached to a rotor hub[10] by horizontal flapping hinges, which permit their movement in a vertical plane, the advancing blade flaps up, decreasing its angle of attack, while the retreating blade flaps down, increasing its angle of attack. This combination of effects equalizes[11] the lift. (Blades also are attached to the hub by a vertical hinge, which permits each blade to move back and forth in the plane of rotation. The vertical hinge dampens[12] out vibration and absorbs the effect of acceleration or deceleration.) In addition, in forward flight, the position of the cyclic pitch control causes a similar effect, contributing to the equalization[13] of lift.

Other forces acting upon helicopters include coning[14], the upward bending effect[15]on blades caused by centrifugal force; Coriolis effect[16], the acceleration or deceleration of the blades caused by the flapping movement bringing them closer to (acceleration) or farther away from (deceleration) the axis of rotation; and drift[17], the tendency of the tail rotor thrust to move the helicopter in hover.

III. Read and translate the following predicates in Passive Voice.

Is elongated; is fitted; is affected; is considered; is increased; will be generated; are exerted; are balanced; are combined; is directed; should be understood; is titled; is powered; is offset; is compensated; are attached.

IV. Read, translate and explain the use of “ed” and “ing” forms in the following words and word-combinations.

Rotating blades; rotor mounted atop; elongated tail; factors affecting the flight; the flapping of the rotor blades; in determining lift; desired ram; generated thrust forces; the tail rotor located …; the dissymmetry of lift created …; the dissymmetry resulting in ..; advancing blade; blade having more lift; retreating blade; blade is moving; forces acting on ..; if controlled …; cyclic feathering; changing the angle; cyclic feathering; movement bringing them closer ….

V. Find opposite words to the given.

a) like; controlled; torque; symmetry; increase; acceleration

b) decrease; antitorque; deceleration; unlike; dissymmetry; uncontrolled

VI. Answer the following questions.
1. What features differ the helicopter from fixed-wing aircraft?
2. What is “relative wind”? What can it be affected by?
3. What is “pitch angle” Why does the pilot use the collective and cyclic pitch control?
4. What is “angle of attack” in a helicopter?
5. What effects helicopter performance?
6. How is the plane of rotation of the rotor changed? What is the position of the plane of rotation in hovering flight? In vertical flight? In forward flight? In sideward flight?
7. How does the pilot control the thrust of the tail rotor?
8. What causes the helicopter rolling ?
9. What equalizes the lift?
10. What forces acting upon helicopters are mentioned in this text?

VII. Speak about principles of flight and operation of helicopters.
Translate this text in writing using a dictionary. (20 minutes)

Text C “Fixed jet”

A number of attempts have been made to use the power of jet engines to lift an aircraft vertically from the ground and then shift to forward flight, but in every case the difficulties involved in recovery have inhibited the program. An early example, the Ryan X-13 Vertijet, was launched from a trailer bed that was erected vertically prior to takeoff. The aircraft flew successfully in vertical and horizontal modes, including takeoff and "tail-sitter" landings, but the operational limitations in terms of speed, range, and payload were too great for further development. The Ryan XV-5A Vertifan used a jet engine to drive horizontally mounted fans in the nose and wing; it was nominally successful. Another type of fixed jet used separate batteries of jet engines, some dedicated to vertical flight and some to horizontal flight, but this expensive technology was ultimately rejected.
Over time there have been a host of miscellaneous attempts at vertical flight. These include propeller-driven tail-sitters, dusted disc platforms, ground-effect aircraft (Hovercraft [trademark]), and deflected jet thrust. In most cases, the advantages sought were offset by the difficulties encountered, and the tilt rotor, the vectored jet, and especially the helicopter have remained the most successful means to vertical flight.