Г. П. МАЗОКИНА

ПОСОБИЕ
ПО АНГЛИЙСКОМУ ЯЗЫКУ
ДЛЯ III-IV КУРСОВ АВИАЦИОННЫХ ВУЗОВ

Допущено
Министерством высшего и среднего
специального образования СССР
в качестве учебного пособия
для студентов авиационных вузов

МОСКВА "ВЫСШАЯ ШКОЛА". 1977

4И(Англ)

М 13

Р у к о п и с ь р е ц е н з и р о в а л и :

кафедра иностранных языков Куйбышевского авиационного института имени С. П. Королева и кафедра иностранных языков Харьковского авиационного института

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М13 Пособие по английскому языку для I I I —IV курсов авиационных вузов. М., «Высш. школа», 1977.

128 с. с ил.

Пособие состоит из 23 текстов и упражнений к ним и рассчитано на 100 часов аудиторных занятий.

Тематика текстов разнообразна и интересна: история развития и современное состояние авиации и космонавтики, основные сведения о самолетах и вертолетах, силовых установках, приборах аэронавигации и космической навигации, полетах на Луну и на Марс.

Грамматические упражнения охватывают основные грамматические явления, характерные для языка научно-технической литературы. Лексические упражнения на усвоение терминов, интернациональных и служебных слов, а также упражнения на словообразование расширяют словарный запас студентов.

Цель пособия — подготовить студентов к самостоятельному чтению и переводу оригинальной литературы по специальности при минимальном пользовании словарем.

4И (Англ)

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От автора

Данное учебное пособие предназначено для студентов III — IV курсов авиационных вузов. Основная цель пособия — научить студентов читать литературу по специальности на английском языке с целью получения нужной для работы информации. В задачи пособия также входит развитие навыков перевода научно-технической литературы с английского языка на русский.

Пособие включает 23 урока и рассчитано приблизительно на 100 часов аудиторной работы. Структура всех уроков однотипна. Каждый урок содержит список терминов, текст, лексические и грамматические упражнения, а также вопросы для контроля понимания содержания текста.

В списке терминов к тексту и к упражнениям урока приводятся новые термины и их контекстуальные значения.

Тексты пособия предназначены для развития навыков чтения и адекватного перевода. Тематика текстов: современное состояние советской авиации и космонавтики, основные сведения о самолетах, вертолетах, силовых установках, приборах, аэронавигации и космической навигации.

Лексические упражнения включают:

(1) упражнения на перевод словосочетаний с терминами из текста (уроки 1— 23);

(2) упражнения на перевод слов общего корня в английском и в русском языках (уроки 1 — 11);

(3) упражнения на перевод слов, образованных путем конверсии, чередования ударения, чередования звуков (урок 6), на перевод производных слов (уроки 7— 11), на перевод сложных слов (уроки 12—13), на перевод сокращенных слов (урок 14);

(4) упражнения на перевод многозначных строевых слов (уроки 16—23).

Грамматические упражнения охватывают основные грамматические явления,
характерные для языка научно-технической литературы:

(1) временные формы глагола в действительном и страдательном залогах (уроки 2 — 10);

(2) неличные формы глагола (уроки 11 — 16);

(3) сложноподчиненные предложения (уроки 18 — 23).

При работе с настоящим пособием рекомендуется пользоваться любым англо-русским словарем на 20 000 слов и более, а также Англо-русским авиационно-космическим словарем под общей редакцией А. М. Мурашкевича (М., 1974 г.).

Автор выражает глубокую благодарность доктору технических наук, профессору Московского авиационного института В. М. Шашину за ценные советы, способствовавшие улучшению качества данного пособия.

У Р О К 1

Лексико-грамматические темы урока: 1. Перевод словосочетаний, *образованных по наиболее распространенным моделям.* 2. Перевод терминологических сочетаний. 3. Слова общего корня в английском и в русском языках. 4. **Past Indefinite** и **Participle II** нестандартных глаголов.

Термины к уроку

highway *зд.* дорога
elapse проходить, протекать
the state of the arts современный уровень (состояние) развития науки или техники
complement дополнять
vehicle *(авто)* транспортное средство; летательный аппарат
patrol охранять
assess определять, оценивать
mapping картографирование
competitive соперничающий, конкурирующий
short takeoff and landing aircraft самолет короткого взлета и посадки (с коротким разбегом и пробегом)
short haul air route авиалиния малой протяженности
vertical takeoff and landing aircraft самолет вертикального взлета и посадки
profitable выгодный, доходный
scheduled services полеты по расписанию, регулярные рейсы
aeronautical technology авиационная техника
power plant силовая установка
wind load аэродинамическая или ветровая нагрузка
structural analysis расчет конструкции
aeroelasticity аэроупругость

ТЕКСТ

AVIATION— HIGHWAY TO THE FUTURE

1. During those years which have elapsed since A . Ph. Mozhaisky built his first aeroplane in 1885, aviation has enjoyed phenomenal progress. At present the state of the arts of aviation is such that it influences many aspects of social life.

2. In the dynamic world of today, aviation provides a rapid transportation link between different population centers, comple menting a road and rail transportation network. In many places the airplane is the only known vehicle for the large-scale movement of passengers and freight over large distances. The airplane has made it possible to patrol the forests effectively, to fight their fires, to as sess their timber resources and to plan their harvesting. It has made an enormous contribution to the photographing and mapping of the vast territories, to exploring and prospecting for mineral wealth, and to studying and assessing water resources. As for the helicopter,

this type of aircraft has proved its value in special applications where vertical or near vertical take-off landing and vertical load lifting were required.

3. The USSR airlines have grown to be one of the foremost in the world. The Soviet Union has pioneered in many of the technical advances which have brought aviation to its present state of efficiency. The growth in the popularity of air travel is due to the comfort and services provided by the modern aircraft, to the high speed of reaching the point of destination and to the moderate cost of air travelling.

4. The growth in the number of passengers carried by the world's airlines has been tripling every 10 years. It has been predicted that in the eighties there will be 2 $^1/_2$ to 3 times as many passenger-miles flown and 2 $^1/_2$ to 3 times as many people using air transportation as there are today. As measured by the number of aircraft and pilots employed, civil aviation is expected at least to double. This expansion of civil aviation will reflect an immense growth in the worldwide business travelling, cargo transportation and tourism.

5. Civil airplanes will be continually improving from the point of view of their speed, comfort and operating cost, but their capital costs will not increase proportionally. Airline fares will tend to decrease but better service will be given to passengers.

6. It has also been predicted that in the eighties it should be possible to design a supersonic transport that could be economically competitive with subsonic transports. Short takeoff and landing aircraft will dominate the short-haul air routes up to 500 miles. But it is unlikely that vertical takeoff and landing aircraft will be economically profitable for scheduled flights.

5. In the foreseeable future aeronautical technology will be increasingly employed in non-aeronautical applications. Obvious examples are high-speed trains, marine and industrial power plants. Less well known perhaps is the new field of architectural aerodynamics as exploited in the study of the influence of wind flow, in combination with rain, in the design of windows for tall buildings and the forecasting of wind loads on roofs of large buildings. The techniques of aircraft structural analysis and aeroelasticity are finding increasing industrial applications, a typical case being of a bridge design.

6. There are no doubts about the continuing importance of aviation and the dynamic nature of its development in succeeding years. Civil aviation will continue to flourish in the year ahead contributing to the economic growth, scientific and technical development, and forming a sound basis for international relationships between countries.

УПРАЖНЕНИЯ

I. *Переведите словосочетания «существительное + существи-тельное». Обратите внимание на последовательность расположения слов в английских и в русских словосочетаниях.*

1 2 1 2

О б р а з е ц 1: **test flight** *испытательный полет*

sound barrier, depth bomb, smoke bomb, altitude engine, carburettor engine, piston engine, altitude flight, trial flight, aviation fuel, aviation medicine, sea mine.

1 2 2 1

О б р а з е ц 2: **wing thickness** *толщина крыла*

airplane aerodynamics, helicopter aerodynamics, propeller aerodynamics, aileron area, flap area, rudder area, wing area, airplane body, airship body, bomb body, bank indicator, course indicator, direction indicator, range indicator, speed indicator, yaw indicator, f i n spar, tailplane spar, wing spar.

l 2 2 l

О б р а з е ц 3: **cloud flying** *полет* в *облаках*

ski landing, water landing, crosswind takeoff, instrument takeoff, water takeoff, compression test, creep test, fatigue test, flutter test, reliability test, simulator test, tower test, water test.

II. *Переведите словосочетания «существительное + существительное + существительное». Обратите внимание на последовательность расположения слов в английских и в русских словосочетаниях.*

1 2 3 3 2 1

О б р а з е ц 1: **flight control system** *система управления полетом*

engine speed indicator, missile range measurement, shaft rotation speed, aircraft control system, aircraft escape system, target identification system, antenna rotation switch

1 2 3 3 2

О б р а з е ц 2: **sea-level temperature** *температура* на *уровне*

1

моря

sea-level ejection, sea-level pressure, missile-movement information, target position information, parachute-test missile, sea-level velocity, moon exploration vehicle, motor test vehicle

III. *Переведите словосочетания «прилагательное (причастие) + существительное + существительное». Обратите внимание на последовательность расположения слов в английских и в русских словосочетаниях.*

1 2 3 1 3 2

О б р а з е ц 1: **total wing area** *общая площадь крыла*

critical escape altitude, effective wing area, gross wing area, automatic flight control, automatic temperature control, automatic fighter direction, automatic bomb release, effective aircraft thrust, effective propeller thrust

1 2 3 3 1

О б р а з е ц 2: **boundary layer control** *управление пограничным*

2

слоем

ballistic flight control, guided missile control, spatial attitude control, vertical speed indicator, boundary layer measurement, magnetic f i e l d measurement, variable pitch propeller, aerial defence[1] system, automatic stabilization system, interplanetary communications system, interplanetary navigation theory, supersonic wing theory, free flight trajectory, maximum range trajectory, free fall velocity, free flight velocity

1 2 3 3 1 2

О б р а з е ц 3: **straight wing aircraft** *самолет* с *прямым крылом*

annular wing aircraft, crescent wing aircraft, fixed-wing aircraft, folding-wing aircraft, open cockpit aircraft, reciprocating-engine aircraft, rotary wing aircraft, tilting-wing aircraft, constant-level flight, extreme-altitude flight, high-temperature flight, low-altitude flight, high-acceleration missile, moving-wing missile, free-flight test, high-speed test, low-pressure test, low-speed test

IV. *Переведите словосочетания со следующими терминами из текста:* **aviation, pilot, speed, transport.**

army aviation, commercial aviation, naval aviation, military aviation, civil aviation, fighter aviation, passenger aviation, reconnaissance aviation, ambulance aviation, sport aviation, strategic aviation, tactical aviation, transport aviation, training aviation;

acceptance pilot, airline p i l o t , assistant pilot, automatic pilot, chief pilot, civilian pilot, commercial pilot, first pilot, helicopter pilot, instructor-pilot, jet pilot, second pilot, senior pilot, skilled pilot, test pilot;

actual speed, air speed, climb speed, combat speed, cruising speed, diving speed, flight speed, flying speed, gliding speed, ground speed, high speed, hypersonic speed, landing speed, level-flight speed, low speed, Mach-2 speed, near-sonic speed, slow speed, sonic speed, subsonic speed, supersonic speed, transonic speed, ultra-high speed.

air transport, cargo transport, commercial transport, freight transport, jet transport, military transport, passenger/cargo transport.

Прочтите и запомните:

По значению различают три группы слов, имеющих общие корни в английском и в русском языках:

1. Слова общего корня, значение которых полностью совпадает в английском и в русском языках. Например:

aerodrome ['Fqrqdroum]
aeroplane ['Fqrqplein]
antenna [xn'tenq]
biplane ['baiplein]
diameter [dai'xmitq]

[1] defence = defense *(ам.)*

2. Слова общего корня, значение которых лишь частично совпадает в английском и в русском языках. Например, слово **pilot** ['pallqt в зависимости от контекста переводят не только *пилот, летчик,* но и *лоцман, опытный проводник, механик-водитель, вы сококвалифицированный машинист; вспомогательный механизм, система управления, регулирующее приспособление.* К этой группе относятся, например, следующие наиболее употребительные слова (их значения следует уточнять в отраслевых терминологических словарях):

activity [xk'tlvltl
apparatus ["xpq'relтqs
booster ['bu:stq
capsule ['kxpsju:l
compass ['kAmpqs
conductor [kqn'dAktq
construction [kqn'strAkSqn
control [kqn'troul
course [kO:s
element ['ellmqnt
figure ['flgq
instrument ['Instrumqnt
machine [mq'Si:n
object ['ObdZlkt
operation ["Opq'relSqn
record['rekO:d
section ['sekSqn
service ['sq:vls
structure ['strAktS,
tank [txnk

3. Слова общего корня, значения которых совершенно не совпадают в английском и в русском языках. Это так называемые «ложные друзья переводчика». Запомните наиболее употребительные из них:

Слова, имеющие общий корень в английском и русском языках	Правильный перевод	Ошибочный перевод
accuracy ['xkjurqsl	*точность*	аккуратность
accurate ['xkjurlt	*точный*	аккуратный
brilliant ['brllјqnt	*блестящий, сверкающий*	бриллиант
contribution ["kOntrl'bju:Sqn	*вклад в дело, содействие*	контрибуция
data ['deltq	*данные, величины, сведения*	дата
decade ['dekeld	*десятилетие*	декада
fabric ['fxbrlk	*фабрикат, изделие*	фабрика
graph [grRf	*график, диаграмма*	графа
instance ['Instqns	*пример, требование*	инстанция
list ['llst	*список, перечень*	лист
manufacture['mxnju- 'fxkCq	*изготовление, производство*	мануфактура
principal [' prlnsqpql	*главный, основной*	принципиальный
production [prq'dAkSqn	*производство, выработка*	продукция
procpect ['prOspqkt	*перспектива, изыскание, разведка*	проспект

V. *Образуйте Past Indefinite и Participle II от следующих нестандартных глаголов.*

cost, cut, hit, let, put, set, shut, spread;

bend, bind, bring, build, burn, buy, dream, feed, feel, fight, find, get, have, hear, hold, keep, lead, learn, leave, lose, make, mean, meet, read, say, sell, send, shoot, sit, spend, spoil, stand, strike, swing, teach, tell, think, understand, win;

beat, blow, break, do, draw, drive, eat, fall, fly, forget, freeze, give, go, grow, hide, know, lie, ride, rise, see, speak, take, tear, throw, wear, write;

run, come, become, begin.

VI. *Ответьте на вопросы к тексту.*

1. When did A.Ph.Mozhaisky build his first aeroplane? 2. What is the state of the arts of aviation at present? 3. What does aviation provide in the dynamic world of today? 4. In what way is the airplane used as a vehicle? 5. What can you say about the USSR airlines? 6. How can you explain the growth in the popularity of air travel? 7. What has been predicted with regard to the development of aviation in the eighties? 8. Will it be possible to design a supersonic transport? 9. What are the obvious examples of using aeronautical technology in non-aeronautical applications? 10. What can you say about the development of aviation in the years ahead?

УРОК 2

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Слова общего корня в английском и в русском языках. 3. Функции глагола **to be**. 4. Функции глагола **to have**.

Термины к уроку

air range дальность полета
airborne бортовой
airline авиалиния
airliner рейсовый пассажирский самолет; воздушный лайнер
approach заход на посадку
arrival airfield аэродром посадки
booster ракетный ускоритель
commercial operation эксплуатация на гражданских авиалиниях
coupling сцепление
cruise совершать крейсерский полет
cruising range крейсерская дальность
cruising speed крейсерская скорость
deicer антиобледенитель
departure отправление; вылет
domestic airline внутренняя авиалиния
failure отказ; неисправность, авария
grass air field грунтовой аэродром
gross weight полетный вес
hold отсек; помещение
landing run пробег при посадке
leg стойка (шасси)
load factor коэффициент загрузки
low pressure undercarriage шасси с пневматиками низкого давления
medium haul aircraft самолет со средней дальностью полета
operate эксплуатировать; работать
package отсек
pod nacelle гондола на пилоне
pressurise герметизировать
reliability надежность
seek наводить
short haul местная авиалиния
shut-down выключение *(двигателя)*
slat предкрылок
tail assembly хвостовое оперение

take-off run разбег
thrust reversal system система реверсирования тяги
thrust-weight ratio тяговооруженность
turboprop aircraft самолет с турбовинтовым двигателем
turboprop engine турбовинтовой двигатель
ultimate range максимальная дальность
unpaved field грунтовой аэродром
wind tunnel аэродинамическая труба
working section рабочая часть

ТЕКСТ

SOVIET PASSENGER AIRCRAFT

1. The USSR is one of the leading aviation powers of the world. The Soviet aircraft industry and aviation are developing exceptionally fast. The total length of Aeroflot's civil airlines exceeds 600,000 kilometers, and is longer than the air routes of any other country in the world.

2. Modern passenger liners f l y over seas and the highest mountains, over the torrid tropics and the frozen Arctic. Each year air communications are becoming more reliable, more economical and more comfortable for passengers

3. Below is given the description of some Soviet passenger aircraft designed by famous Soviet designers O. Antonov, G. Beriyev, S. Ilyushin, A. Tupolev and A. Yakovlev.

Antonov Aircraft

4. The group of aircraft constructors headed by Oleg Antonov is known far beyond the Soviet Union for the wide range of machines designed and built by it — from the record-breaking An-15 glider and the baby An-14 plane to the giant An-22 air transport, the world's biggest turbo-prop aircraft, which broke 15 world records during a single flight late in 1967, and lifted more than 100 tons of cargo to a height of 7,800 metres.

5. The An-24V short and medium haul aircraft has excellent take-off and landing qualities, great air worthiness, and high reliab i l i t y . Its basic (economy) version carries 50 passengers with the baggage, plus 5.5 tons of freight. The cabin of the basic model can be readily converted either into a de luxe passenger aircraft or into a pure cargo plane. The An-24V's take-off permits it to be used on grass airfields with a ground hardness of six kilogrammes per square centimetre, or more.

6. The An-24V Mark II combines high cruising speed with good landing and take-off qualities, and can be operated from grass airfields. Take-off can be continued even in case of failure or shut-down of one engine. Completely modern navigational and radio equipment, and an effective deicing system enable it to give round-the-clock service even in adverse meteorological conditions. When fitted with a u x i l i a r y f u e l t a n k s t h e A n - 2 4 V M a r k I I h a s a c r u i s i n g r a n g e o f

2,720 kilometres. On concrete runways its take-off run is under 600 metres.

7. The rear hold of the planes measures 1.4 metres by 2.85 metres, and the front hold 1.1 metres by 1.2 metres.

Beriyev Aircraft

8. The Be-30 has been designed by the design bureau working under G. Beriyev. It is intended for carrying passengers, luggage and mail on the local airlines. Such features as adequate thrust-weight ratio, low pressure undercarriage adapted for soft surface airfields, and high-lift wing with low unit load make the Be-30 suitable for operation from unpaved fields with a runway of 550-600 m.

9. The Be-30 is designed to carry 15 passengers. It can easily be re-equipped into a freight version or ambulance.

10. The plane is powered by two turbo-prop engines developing 950 hp each. They can be started either from the airborne or a ground electric starting system. The fuel system of the plane is simple in design and reliable in operation. The four wing tank compartments hold 1,000 kg of fuel giving the plane a non-stop range of 1,300 km. The aircraft is equipped with a rigid dual-control system. It also has an effective deicer.

11. Such features as low take-off and landing speeds and the ability confidently to proceed with the take-off and horizontal flight even in the event of failure of one engine make for high reliability . and safety. Modern flight and navigational equipment, radar and radio apparatus have made the plane an all-weather round-the-clock machine. The equipment makes possible automatic approach for landing when the cloud height is only 50 m from the ground and the visibility 500 m.

The Be-30 cruises confidently at 480 km/hr.

Ilyushin's Aircraft

12. The constructors of Sergei Ilyushin's bureau have built many first-class planes. The Il-12, Il-14, and Il-18 ranked among the best passenger planes of the period.

13. In 1968 the Il-62 went into commercial operation, carrying 186 passengers, plus mail and freight, non-stop over a distance of 9,200 kilometres at a cruising speed of 900 kilometres per hour.

14. The great economy of this giant, aerodynamically perfect aircraft, ensures a high load factor (payload and fuel make up 57 per cent of its speed gross weight) and relatively low fuel consumption, with high speed and long range. The plane is easy to service and the roomy baggage holds (48 cubic metres) make it possible to take an extra cargo when there are few passengers. The flying l i f e of the Il-62 is between 25,000 and 30,000 hours.

15. The Il-76 jet transport appeared over Moscow on March 25, 1971, for the first time.

It is powered by economical-turbo-fan engines with the latest thrust reversal system and is equipped with high-lift wings. The Il-76 is characterised by low take-off and landing speeds. The undercarriage is a multi-wheel device to ensure higher ground negotiability. When the "legs" are in the down position the compartments in which they are housed in the air are completely closed. The takeoff and landing runs are short. This jet transport can be operated both from concrete runways of limited length and from unpaved airfields.

The take-off weight is 150 tons, flight altitude 13,000 m and cruising speed 850-900 km/hr.

16. The flight and navigational equipment, radar and radio apparatus enable the plane to f l y on different routes at any time of the year and round the clock. The airborne computer makes it possible to perform automatic flight along the route and automatic approach for landing.

17. The cabin is suited for carrying various freight in containers. Special means of mechanisation help cut down the ground time of the plane at the airport. The large freight cabin of the Il-76 is pressurised.

(to be continued)

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **aircraft, airline, airliner, altitude, airfield, landing, range, take-off.**

ambulance aircraft, amphibian aircraft, bomber aircraft, cargo aircraft, civil aircraft, combat aircraft, enemy aircraft, friendly aircraft, general-purpose aircraft, heavier-than-air aircraft, high-altitude aircraft, high-speed aircraft, hypersonic aircraft, lighter-than-air aircraft, long-range aircraft, low-speed aircraft, medium-range aircraft, military aircraft, multi-purpose aircraft, passenger cargo aircraft, research aircraft, short-haul aircraft, short-range aircraft, subsonic aircraft, transoceanic aircraft;

cargo airline, domestic airline, internal airline, international airline;

helicopter airliner, long-haul airliner, long-range airliner, passenger airliner, short-haul airliner, supersonic airliner;

ceiling altitude, cruising altitude, flight altitude, maximum altitude, medium altitude, minimum altitude, operational altitude, safe altitude, sea-level altitude;

arrival airfield, departure airfield, factory airfield, grass airfield, ice airfield, landing airfield, natural ground airfield;

all-weather landing, automatic landing, good landing, night landing, safe landing, ski landing, water landing;

air range, aircraft range, cruising range, flight range, flying range, gliding range, non-stop range, operational range, ultimate range;

blind take-off, instrument take-off, subsonic take-off, vertical take-off, water take-off.

II. *Назовите русские слова, имеющие общий корень со следующими английскими словами.*

comet ['kOmIt], carburettor ['kQ:bjuretq], catapult ['kxtqpAlt], classification ["klxsIfI'kelSqn], combination ["kOmbI'nelSqn], compass ['kAmpqs], component [kqm'pounqnt], compressor [kqm'presq], configuration [kqn"flgju'relSqn], correction [kq'rekSqn], section ['sekSqn];

cylinder ['sIlIndq], centre ['sentq , circulation ["sq:kju'lelSqn], deficit ['deflslt], glycerine ["glIsq'rI:n], incident ['Insldqnt], medicine ['medsIn], officer ['OfIsq], official [q'flSql], process ["prouses], specialist ['speSqIIst ;

generator ['Genqrelq], apogee ['xpouGi:], gas [gxs], gravitation ["grxvI'telSqn], navigation ["nxvI'gelSqn], original [q'rIGqnI], perigee ['perIGi: , regulator ['regjulelq ;

fuselage ['fju:zIIQ:Z , budget ['bAGlt], dirigible ['dIrIGqbI], drainage ['dreInIG], engineer ["en-GI'nIq], longeron ['IOnGqrqn], ogival [ou'GalvqI], regime [re'Zi:m], tonnage ['tAnIG \

mechanism ['mekqnIzqm], character ['kxrIktq], chord [kO:d], chronograph ['krOnqgrQ:f], epoch ['I:pOk], mechanic [mI'kxnIk], scheme [ski:m], technics ['teknIks ;

parachute ['pxrqSu:t], chassis ['Sxsl], chauffeur ['CO:fq], echelon ['eSqIOn], machine [mq'Si:n];

thermometer [Tq'mOmltq], author ['O:Tq], cathode ['kxTOoud], isotherm ['alsouTq:m], mathematics ["mxTI'mxtIks], method ['me-Tqd], theorem ['TIqrqm], theory ['TIqrI], zenith ['zenIT];

phase [felz], diaphragm ['dalqfrxm], graphic ['grxflk], philosophy [fI'IOsqfI], phonograph ['founqgrQ:f], phosphor ['fOsfe], photography [fq'tOgrqfI], physics ['flzIks], sphere [sflq];

equivalent [I'kwIvqIqnt], equator [I'kweltq], quadrant ['kwOd-rqnt], quantitative ['kwOntltqtlv], quartz [kwO:ts];

maximum ['mxksImqm], approximation [q"prOksI'melSqn], axiom ['xkslqm], complex ['kOmpleks], experiment [Iks'perIment], export ['ekspO:t], reflex ['ri:fleks].

III. *Переведите предложения, обращая внимание на перевод глагола* **to be** *в различных функциях.*

а) 1. Engines of modern airplanes are in the wing. In case of thin wing sections engines are in pod nacelles beneath the wing. 2. The geometrically similar model of the aircraft is in the centre of the wind-tunnel working section. 3. The landing gear is under the fuselage.

б) 1. Mach number is the ratio of air speed to the local velocity of sound, 2. Fatigue is not a new problem. In fact it is a very old problem. 3. The main parts of a vehicle structure are tanks, engine, guidance and payload compartments. 4. The external source of heat is solar radiation. 5. The principal characteristics of the atmosphere are its density, temperature composition, and time variations. 6.

The most interesting feature of Saturn is the presence of the rings. 7. The first principal objective of space flights is the scientific exploration o f space, the planets, and, later, the stars. 8. Decelerations are oppositely acting accelerations.

в) 1. Air is compressible. 2. The density of Mercury is high. 3. Conditions for life on Mars are not very favourable. 4. Above 30,000 feet oxygen equipment for men is essential. 5. Jupiter is the largest of all planets. 6. Shielding of spaceships is necessary, but the weight penalty is costly.

г) 1. The first task in the study of a rotor is to find the airflow surrounding it. 2. The aim of this paper is to illustrate the significance of the heating problem. 3. The plan of the chapter is to present first a brief discussion of noise factor. 4. The next problem is to maintain adequate cabin pressure. 5. The next step in the design sequence is to estimate the major characteristics of the vehicles. 6. The purpose of the landing gear is to support the airplane on the ground and provide take-off and landing. 7. The purpose of the tail assembly is to stabilize the airplane.

д) 1. The airplane is to reach the point of destination in two hours. 2. This new helicopter is to carry eight passengers. 3. These scientists were to take part in the conference on vertical take-off and landing problems. 4. More experimental results are to be obtained in order to reach definite conclusions. 5. Hydrogen is to be used in a number of advanced propulsion systems. 6. The flight is to be made from Moscow to Leningrad. 7. The resistance of the atmosphere is certainly not to be neglected.

е) 1. Air currents are constantly moving with respect to the Earth. 2. The large missile-type booster was firing a piloted rocket-plane into space. 3. Final launch preparations are conducted at the launch pad area. 4. The pilot in flight is aided by a computer and the ground radar. 5. The surface of Venus is perpetually shrouded by dense white clouds.

IV. *Переведите предложения, обращая внимание на перевод глагола* **to have** *в различных функциях.*

а) 1. Mars has two very small satellites. 2. The Moon has a completely airless environment. 3. Mercury has no satellite, so far as it is known. 4. The test pilot must have a strong heart, good lungs, eyesight and hearing much above average and quick reflexes. 5. Unlike the Earth, the Moon has no atmosphere.

б) 1. The aircraft mechanic has to make vibration measurements more carefully. 2. On landing the undercarriage wheels have to take very large loads. 3. Two kinds of antennas have to be designed specifically for space communications applications. 4. The unknown velocity functions have to be determined from the following conditions. 5. Designers and scientists have had to solve many of the problems of flight in space. 6. Before flight the airborne equipment has to be thoroughly checked.

в) 1. The reporter has already referred to the substantial variation in the density of the atmosphere. 2. Many experiments have been carried out in an effort to control the temperature distributions. 3. Attempts have been made to explain solar-flare increases. 4. Turbojet engines have been built in many sizes, ranging from a few hundred pounds of thrust to many thousands of pounds.

V. *Найдите в тексте урока (абзацы 11—14) нестандартные глаголы. Назовите три формы этих глаголов и их значение.*

VI. *Найдите в тексте урока (абзацы* 5, *10 и 15) глаголы* **to be** *и* **to have.** *Определите их функцию в предложении и переведите на русский язык.*

VII. *Ответьте на вопросы к тексту.*

1. What turbo-prop aircraft is the biggest in the world? 2. What cruising range has the An-24 Mark II aircraft? 3. How many passengers can the Be-30 aircraft carry? 4. At what speed does the Be-30 cruise? 5. When did the Il-62 go into commercial operation? 6. What is the cruising speed of the Il-62? 7. When d i d the Il-76 appear over Moscow for the first time? 8. From what runways can the Il-76 be operated? 9. What is the take-off weight of the Il-76? 10. What is the flight a l t i t u d e of the Il-76? 11. What is the cruising speed of the Il- 6?

У РО К 3

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Слова общего корня в английском и в русском языках. 3. Функции глаголов **to be** и **to have** (*повторение*).

Термины к уроку

advisory route заданный маршрут
airframe планер
attachment крепление
design конструкция; предназначать
digital computer цифровая вычислительная машина
ferry route перегоночный маршрут
flight deck кабина экипажа
gangway проход *(между рядами кресел)*
guide rail рельсовая направляющая
intake воздухозаборник
long distance flight полет на большую дальность
multi-purpose aircraft многоцелевой самолет
nozzle сопло
performance characteristics летные данные
piston-engined aircraft самолет с поршневым двигателем
power u n i t силовая установка
scheduled route маршрут регулярных полетов
specific fuel consumption удельный расход топлива
start up запускать
structural design расчет на. прочность
tail unit хвостовое оперение
tailplane хвостовое оперение
terminal airdrome конечный аэродром
thrust reverser реверсер тяги
turbo-fan engine турбовентиляторный двигатель

TEKCT

SOVIET PASSENGER AIRCRAFT

(continued)

Tupolev Aircraft

1. The magnificent planes built by the designers working under Andrei Tupolev have long been world-famous. Back in the twenties and thirties his planes performed a number of spectacular long-distance flights, including the first non-stop flight from Moscow to the USA — across the North Pole. In 1956 the world's first jet liner, the Tu-104, was introduced into service in the USSR. From it have been developed the Tu-124, Tu-134, and Tu-154 civil airliners.

2. The Tu-134, designed for hauls between 600 and 3,200 kilometres, is powered by two outboard turbo-fan engines, each with a thrust of 6,800 kilograms. This power, combined with the powerful mechanisation of the "clean" wing, and the advanced aerodynamic design, give the plane excellent take-off and landing characteristics. Its maximum fuel load is 13,500 kilograms, its maximum take-off run 2,100 metres.

3. The positioning of the engines in the tail unit of the fuselage and the well-thought-out attachment have reduced the level of noise and vibration in the passenger cabin (seating 72 passengers) below the accepted international standards.

4. The Tu-154 is a multi-purpose jet aircraft designed for routes from 500 to 5,500 kilometres, and is available in an economy version (seating 158 to 164 passengers), tourist-class version (seating 146 to 152 passengers), and a combined first-class and tourist version (providing 24 first-class seats and 104 tourist-class places).

5. The aircraft is powered by three rear-mounted engines, two located at the base of the tail and one in the fin. Each develops a thrust of 9,500 kilograms. Specific fuel consumption at cruising speed at an altitude of 10,000 metres is 0.79 kilograms per kilogram of thrust per hour. Its normal take-off weight is 80 tons.

6. This airliner can f l y on two engines without losing altitude, and can continue flight at altitudes under 5,000 metres on only one engine. The airframe has great structural strength, all main systems are duplicated, and some are triplicated.

7. The finish of the passenger saloons meets all the demands of modern industrial design. The ventilation, pressurization, and heating systems provide a pleasant microclimate, while the high cruising speed of 1,000 kph and the rear positioning of the engines practically eliminate noise and vibration on the passenger deck.

8. To enable the aircraft to operate from underequipped airdromes, the Tu-154 has been fitted with an auxiliary power unit to start the engines and provide air-conditioning to the cabins while grounded, and for checking systems without starting up the main engines;

also with a fuel tank filling system, and a semi-automatic system for loading and unloading containers of baggage.

9. The transport version of the Tu-154 can carry 30 tons of cargo over 1,700 kilometres. It has a freight door on the port side measuring 2,100 millimetres by 3,400 millimetres. Guide rails for loading containers or separate items of freight up to 4 tons weight, are provided on the reinforced floor of the hold.

10. The flight-control, navigational, radio, and electronic equipment of the Tu-155 ensure automatic control of flight in any weather conditions and automatic approach for landing. The crew of the aircraft consists of three men. Provision is made on the flight deck, however, for a navigator and an additional pilot.

11. The supersonic, intercontinental Tu-144 airliner has ushered in the era of supersonic passenger flight. The airliner has no tailplane since its variable-geometry swept-back wing gives it good stability and control at both subsonic and supersonic speeds. Its cruising range of 6,500 kilometres enables the plane to cover the distance between Moscow and Khabarovsk in three hours.

12. The Tu-144 has two passenger saloons, one accommodating 18 first-class passengers, and the other 80 tourist-class passengers. The first-class cabin, however, can be converted without difficulty to accommodate 40 tourist-class passengers. For summer flights of under two hours' duration it is possible to re-seat the plane for 130 to 135 passengers.

13. The crew for the supersonic Tu-144 includes two pilots and a flight engineer. The nose section of the fuselage can be depressed for better visibility during take-off and landing, and the location of the equipment section immediately behind the flight deck facilitates access to assemblies during flight and for preflight servicing.

14. The plane is powered by four separately controlled turbojets whose air intakes are automatically adjusted to flight conditions and whose nozzles are also adjustable. Each engine is fitted with a thrust reverser. All these features ensure very economical operation and full flight safety. A semi-automatic system for loading baggage is fitted, which greatly reduces turn around time. Operationally tested high-strength aluminium alloys and titanium are used in the aircraft's construction.

Yakovlev Aircraft

15. The Yak- 40 has been designed by the design bureau working under Alexander Yakovlev. It is designed to replace the obsolescent fleet of piston-engined aircraft. It is equipped with reliable engines, collapsible passenger gangways and all-weather round-the-clock navigation equipment.

16. Characteristics: overall length — 20 m, wing span — 25 m, wing area — 70 sq. m, maximum range — 1,650 km, cruising speed — 550—600 km/hr, flying altitude— 4,000-6,000 m, payload — 2,500 kg, seats (main version) — 24, seats (tourist version) —31,

take-off and landing run — 340-360 m, power plant — 3 engines, each developing a thrust of 1,500 kg.

17. It is a fact that operating aircraft from unpaved airfields is characterised by certain specificities. These have been taken into account in the design. The Yak-40 engines are arranged at a sufficient height from the ground. The air intakes are so arranged that the wing protects the engines from pebbles and mud thrown up from the ground by the undercarriage wheels. The pressure in the tyres does not exceed 4 kg per sq. cm. This makes it possible for the aircraft to take off from runways whose hardness is about 5 kg per sq. cm.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **airdrome, characteristics, design, equipment, load, route.**

Civil airdrome, helicopter airdrome, landing airdrome, main airdrome, marine airdrome, reserve airdrome, sea airdrome, terminal airdrome, underground airdrome, water airdrome;

aerodynamic characteristics, air characteristics, aircraft characteristics, flight characteristics, flying characteristics, landing characteristics, manoeuvring characteristics, military characteristics, performance characteristics, take-off characteristics;

aerodynamic design, clean aerodynamic design, poor aerodynamic design, structural design, wing section design;

aeronautical equipment, aircraft equipment, airfield equipment, airport equipment, aviation equipment, emergency equipment, navigation equipment, training equipment;

aerodynamic load, air load, cargo load, commercial load, flight load, fuel load, full load, passenger load, pay load, useful load;

advisory route, air route, domestic route, ferry route, intercontinental route, passenger route, scheduled route.

II. *Назовите русские слова, имеющие общий корень со следующими английскими словами.*

parame**ter** [pq'rxmltq], cent**er** ['sentq , cylind**er** ['slIlndq], filt**er** ['flltq], manomet**er** [mq'nOmltq];

propell**er** [prou'pelq], adapt**er** [q'dxptq], boost**er** ['bu:stq], contain**er** [kqn'telnq], emitt**er** [I'mltq];

accumulat**or** [q'kju:lmjuleltq], collect**or** [kq'lektq], commutat**or** ['kOmjuteltq], compress**or** [kqm'presq], detect**or** [dl'tektq], generat**or** ['Genqreltq], indicat**or** ['ldlkeltq], modulat**or** ['mOdjuleltq], regulat**or** ['regjuleltq ;

classific**ation** ["klxslfl'kelSqn], approxim**ation** ^[q"prOksl'melSqn], communic**ation** [kqmju:nl'kelSqn], gravit**ation** ["grxvl'telSqn], ionis**ation** ["alqnal'zelSqn], navig**ation** ["nxvl'gelSqn], oper**ation** ["Opq-'relSqn], orient**ation** ["O:rlen'telSqn], vibr**ation** [val'brelSqn];

correl**ation** ["kOrl'lelSqn], accumul**ation** [q"kju:mju'lelSqn], calcul**ation** ["kxlkju'lelSqn], circul**ation** ["sq:kju'lelSqn], modul**ation** ["mOdju'lelSqn];

transmi**ssion** [trxnz'mISqn], commi**ssion** [kq'mISqn], discu**ssion** [dIs'kASqn], emi**ssion** [I'mISqn], prece**ssion** [prI'seSqn];

corro**sion** [kq'rouZqn], colli**sion** [kq'IIZqn], diffu**sion** [dI'fju:Zqn , divi**sion** [dI'vIZqn], ero**sion** [I'rouZqn];

aeronaut**ics** ["Fqrq'nO:tIks], acoust**ics** [q'ku:stIks], astronaut**ics** ["xstrq'nO:tIks], dynam**ics** [daI'nxmIks], electron**ics** [IIek'trOnIks], techn**ics** ['teknIks], stat**ics** ['stxtIks];

astronom**y** [qs'trOnqmI], artiller**y** [Q:'tIIqrI], chemistr**y** ['kemIsItrI], geometr**y** [GI'OmItrI], philosoph**y** [fI'IOsqfI], energ**y** ['enqGI], laborator**y** [Iq'bOrqtqrI], theor**y** ['TIqrI], trajector**y** ['trxGIktqrI];

alumin**ium** ["xIju'minjqm], calc**ium** ['kxIsIqm], cadm**ium** ['kxd-mIqm], pluton**ium** [plu:'tounjqm], rad**ium** ['reIdjqm], stront**ium** ['strOnSIqm], vanad**ium** [vq'neIdjqm];

profi**le** ['prOufi:I , automobi**le** ['O:tqmqbi:I], conso**le** ['kOnsouI], dipo**le** ['daIpouI], modu**le** ['mOdjuI].

III. *Переведите предложения, обращая внимание на перевод глаголов* **to be** *и* **to have** *в различных функциях (повторение).*

1. Compared with Jupiter, Saturn is somewhat smaller and less dense. It rotates more slowly and its axis of rotation is much more inclined to its orbit. Its distance from the Sun is twice that of Jupiter. 2. The digital computer is the most powerful ally of our thinking available at present. 3. Titanium has a melting point of 3074°F. 4. Laser using very powerful and narrow beams of light is a promising means of communication. 5. The purpose of the wing is to support the aircraft in the air. 6. At present, one of the two planned launch pads is under construction, and design of the other is nearing completion. 7. The modern airplane has evolved from a primitive structure of wood, wire, fabric and dope to a very complex structure. 8. In the latest three-engined airplanes two engines are mounted on each side of the aft fuselage and one engine is inside the extreme rear of the fuselage. 9. In the past wood has been widely used in aircraft construction. 10. The cause of the boundary layer is the friction between the surface of the wing and the air. 11. The control of a l l international and world records is through the medium of the International Astronautical Federation. 12. Instruments necessary for space experiments have to have high sensitivity. 13. The Earth is wider at the equator than it is at the poles.

IV. *Найдите в тексте урока (абзацы 6—10) нестандартные глаголы. Назовите три формы этих глаголов и их значение.*

V. *Найдите в тексте урока (абзацы 11 и 12) глаголы* **to be** *и* **to have.** *Определите их функцию в предложении и переведите на русский язык.*

VI. *Ответьте на вопросы к тексту.*

1. When was the Tu-104 introduced into the service? 2. What versions is the Tu-154 available in? 3. What engines is the Tu-154 powered by? 4. What is the normal take-off weight of the Tu-154?

5. What airliner has ushered in the era of supersonic passenger flight? 6. What is the cruising range of the Tu-154 airliner? 7. In how many hours can the Tu-144 cover the distance between Moscow and Khabarovsk? 8. For what purpose can the nose section of the Tu-144 fuselage be depressed? 9. What metals are used in the construction of Tu-144? 10. What are the main characteristics of the Yak-40 aircraft?

У РО К 4

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Слова общего корня в английском и в русском языках. 3. Времена группы **Indefinite, Continuous, Perfect** и **Perfect Continuous** действительного залога.

Термины к уроку

accommodate размещать
coaxial rotors соосные несущие винты
cut out выключать *(двигатель)*
free-turbine engine двигатель со свободной турбиной
hinged seat откидное сиденье
life-support system система жизнеобеспечения
payload полезная нагрузка
piston engine поршневой двигатель
strut стойка; подкос
suspension platform подвесная платформа
tail rotor хвостовой винт
touchdown приземление; касание

ТЕКСТ

SOVIET HELICOPTERS

Kamov Helicopters

1. Long experience in the USSR with helicopters with coaxial rotors has proved their main advantages — great manoeuvrability, small size, high payload, and great effectiveness. The coaxial system has also enabled the designers to dispense with a tail rotor (which usually consumes about 10 per cent of the power developed by the engine).

2. These qualities are particularly in evidence in the Ka-26 multipurpose helicopter developed by Nikolai Kamov's group of designers.

3. For passenger and freight carriage a comfortable cabin can be fitted with heat and sound insulation and a heating and ventilation system. In this version the helicopter seats six passengers with their baggage, while a seventh passenger can be accommodated beside the pilot. The deck of the cabin is fitted with a hatch through which passengers can be embarked or landed by the machine's hoist without touchdown.

4. The Ka-26 is adapted for crop spraying by replacing the cabin with a 900-litre plastic-glass tank for liquid insecticides and weed-

killers, with a maximum rate of spray of ten litres per second. For bulky loads up to 900 kilogrammes, the helicopter can be fitted with a suspension platform; and as a "flying crane" for construction jobs, and to carry tubes, containers, and other large-sized loads up to 900 kilogrammes for short distances, it is fitted with a cargo sling and hook.

5. The Ka-26 is powered by two reliable and economical air-cooled, 9-cylinder piston engines, each rated at 325 hp. Average fuel consumption at cruising speed is between 210 and 230 grammes per horsepower per hour. In the event of failure of one engine, the helicopter can continue on horizontal flight; if both engines cut out it descends and lands safely by autorotation. With two auxiliary fuel tanks the machine has a range of 1,200 kilometres.

6. The crew of the helicopter normally consists of the pilot only, but provision can be made for dual controls, if required. The radio and navigational equipment fitted permits the Ka-26 to be used round-the-clock in any kind of weather. The latest reliable and durable materials are extensively used in its construction, the rotor blades, for example are made of glass plastic.

Mil Helicopters

7. The team of constructors led by Mikhail Mil is well known around the world for their helicopters.

8. The V-8 helicopter is built in two versions — all-passenger, and combination passenger/freighter. The first accommodates 28 to 32 passengers in soft, comfortable seats. Large rectangular windows, giving a good view, an efficient system of air conditioning, ventilation and heating, a low level of vibration, and excellent sound insulation provide comfortable, non-fatiguing flight. The passenger/freighter version has a hold of 23 cubic metres for four tons of cargo and is fitted with 24 hinged seats along the sides. A special hatch and on-board steps are provided at the stern end of the cabin. Large-dimension loads can be carried by means of a special sling. Both versions of the V-8 can be quickly converted for medical use carrying 12 stretchers, with a seat for a medical attendant.

9. The navigational equipment installed, auto-pilot, and de-icing system enable a crew of two to operate the helicopter day or night and in any kind of weather. Its designed cruising speed is 250 kph with a take-off weight of 11.1 tons, and 220 kph with a weight of 12 tons. Its cruising range at 11.1 tons (with 2.6 tons of payload) is 455 kilometres, and at 12 tons (with 3.45 tons of payload) 440 kilometres.

10. The Mil team have also developed a family of heavy helicopters — the Mi-6, V-10, and V-10K.

11. The Mi-6 — the biggest and most powerful helicopter in the world — holds fourteen world records, and has been called the "king" of helicopters in the Western press. It can be used for all types of operation. In its transport version it has a cargo hold of 80 cubic metres, big enough to accommodate an omnibus or outsize freight

measuring 11.5x2.3x2.6 m and weighing up to 12 tons. In addition, it is fitted with external suspension equipment and can carry 8-ton spans, bridges, or other bulky loads. Hinged seats along the sides of the hold provide accommodation for 65 passengers where required. It can also be quickly converted for ambulance service, with accommodation for 41 stretchers.

12. The Mi-6 is powered by two 11,000 hp turboshaft free-turbine engines. The turbines allow the revolution speed of the main rotor to be altered independently of the operating speed of the engines. Output at each speed remains unchanged up to an altitude of 3,000 metres even in high atmospheric temperatures. Its navigational equipment, improved radio apparatus, and automatic pilot ensure safe flying in adverse weather conditions, day or night.

13. The Mi-6 is served by a crew of five, develops a maximum speed of 300 kph and has a cruising speed of 250 kph. With a fuel load of 9,805 kilogrammes, it has a cruising range of 1,050 kilometres.

14. A successor to the Mi-6 was developed in the V-10 in 1965. It has set two world records by lifting 25 tons of cargo to an altitude of 2,830 metres, and five tons to an altitude above 7,000 metres.

15. The V-10 helicopter has a four-strut undercarriage with a track of more than six metres and a ground clearance of 3.75 metres. Outsize loads weighing to 15 tons can be lifted on a special platform (8.5 m x 3.5 m) attached beneath it by special hydraulic grips. In addition it is fitted with special suspension gear for transporting loads up to eight tons. The freight hold has a capacity of 60 cubic metres, and is fitted with 28 hinged seats. The V-10 is operated by a crew of three. In field conditions its main engines are started by a turbo-generator.

16. The V-10K is a short-legged variant of the V-10. It is capable of lifting up to 11 tons of cargo attached to a long steel cable. An additional cabin fitted under the fuselage enables the pilot to control the helicopter during erection work and to watch the behaviour of suspended cargo. A special automatic pilot maintains the machine in a definite position to prevent the cargo swinging and thus reduces erection time.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **blade, helicopter, hold, rotor, seat, tank, undercarriage.**

airscrew blade, all-metal blade, fixed blade, helicopter blade, main-rotor blade, propeller blade, rotor blade;

all-purpose helicopter, ambulance helicopter, amphibious helicopter, civil helicopter, commercial helicopter, compound helicopter, high-performance helicopter, hospital helicopter, jet helicopter, marine helicopter, multipurpose helicopter, one-man helicopter, production helicopter, research helicopter, single-seat helicopter, training helicopter, transport helicopter;

baggage hold, cargo hold, forward hold, freight hold, luggage hold, nose hold, rear hold;

coaxial rotors, folding rotor, front rotor, helicopter rotor, highspeed rotor, lifting rotor, main rotor, rear rotor, single-bladed rotor, three-bladed rotor, twin-bladed rotor;

belt seat, cabin seat, cockpit seat, ejection seat, forward-facing seat, rearward-facing seat, tip-up seat, triple seat, twin seat;

fuel tank, gas tank, gasoline tank, liquid tank, oil tank, oxidant tank, oxidizer tank, oxygen tank, petrol tank;

bicycle undercarriage, fixed undercarriage, hydroski undercarriage, main undercarriage, nose undercarriage, retractable undercarriage, seaplane undercarriage, ski undercarriage, ski-wheel undercarriage, tail undercarriage, tricycle undercarriage, wheel undercarriage.

II. *Назовите русские слова, имеющие общий корень со следующими английскими словами.*

stabi**lize** ['stxbIlaIz], activ**ize** ['xktIvaIz , centra**lize** ['sentrqlaIz], local**ize** ['lqukqlaIz], normal**ize** ['nO:mqlaIz], special**ize** ['speSqlaIz , standard**ize** ['stxndqdaIz];

mod**ify** ['mOdIfaI], class**ify** ['klxsIfaI], electr**ify** [I'lektrIfaI], gas**ify** ['gxsIfaI], ident**ify** [aI'dentIfaI], intens**ify** [In'tensIfaI], qual**ify** ['kwOlIfaI ;

vibr**ate** [vaI'breIt , demonstr**ate** ['demqnstreIt], evacu**ate** [I'vxk-jueIt], integr**ate** ['IntIgreIt], regul**ate** ['regjuleIt], simul**ate** ['sImjuleIt], ventil**ate** ['ventIleIt];

act**ive** ['xktIv], effect**ive** [I'fektIv], extens**ive** [Iks'tensIv], negat**ive** ['negqtIv], pass**ive** ['pxsIv], primit**ive** ['prImItIv], posit**ive** ['pOzqtIv];

experiment**al** [eks"perI'mentl], continent**al** ["kOntI'nentl], function**al** ['fAnkSqnl , glob**al** ['gloubql], loc**al** ['loukql], orbit**al** ['O:bItl], radi**al** ['reIdjql], univers**al** ["ju:nI'vq:sql], visu**al** ['vIZjuql];

electr**ical** [I'lektrIkql], cosm**ic** ['kOzmIk], con**ical** ['kOnIkql], mechan**ical** [mI'kxnIkql], techn**ical** ['teknIkql], theoret**ical** [TIq're-tIkql], automat**ic** ["O:tq'mxtIk], hydraul**ic** [haI'drO:lIk], metal**lic** [mI'txlIk], seism**ic** ['saIzmIk].

III. *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в различных временах группы Indefinite действительного залога.*

1. The term "moon" denotes, in general, a natural satellite of any planet. 2. The Moon shows only one face to the Earth. 3. Air flows over and under the wing of an airplane. 4. The rocket engine does not take in any atmospheric air. 5. The decrease in air density results in a corresponding decrease of air pressure. 6. Galileo discovered the telescope in 1609.7. K.E. Tsiolkovsky, the father of Russian astronautics, gave solutions concerning the weightless state before the turn of the century. 8. On October 4, 1957, the Soviet Union put *Sputnik 1* into orbit. It weighed 184 pounds and travelled in an elliptical orbit. 9. Space flights to the Moon open the possibility of flight to near-by planets. 10. The manned orbital laboratory will weigh several hundred tons. It will rotate slowly to provide an artificial

gravity field. It will provide a unique capability for a great number of experiments. 11. Satellite investigations will refine our understanding of the gravitational attraction of the Earth. 12. Interplanetary flights will be essentially the same as trips to the Moon. 13. In this section we will discuss jet propulsion systems. 14. Experts will watch a trial firing of a ballistic missile.

IV. *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в различных временах группы Continuous действительного залога.*

1. At present the design of the aircraft is nearing completion. 2. During rotation, two basic forces are acting upon the main rotor blades of the helicopter. 3. Titanium alloys are finding extensive applications as structural materials in aircraft. 4. Fatigue of materials is assuming more and more importance. 5. Scientists are trying to develop new means of communication. 6. Some stars are moving away from the Earth, and some towards the Earth. 7. Space flight is no dream of the distant future. It is happening already every day. 8. The equipment on board the space station is functioning normally. A special command and measuring complex is controlling the flight of the automatic station. 9. Many volunteers are subjecting their bodies to "g" forces in the cabins of centrifuges. These tests are giving information about man's reaction to "g" force. 10. Some scientists are working to improve pressure suits. Others are working to improve ejection techniques. 11. Witnesses reported that the airplane was flying east and then turned and started to f l y west. At that moment the plane was flying at a constant speed.

V. *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в Present Perfect и Present Perfect Continuous действительного залога.*

a) 1. Wind tunnels have played an important part in the development of airplanes. 2. The main objective of every aircraft designer has always been — "more thrust — less drag" and "more lift — less weight". 3. This new experimental airplane has reached speeds in excess of 4,000 mph and altitudes above 125,000 ft. 4. The thin wall has become the most important structural element of advanced aircraft, missiles, and space vehicles. 5. Aerodynamic forces during the launch flight, are of great concern and have been the cause of many launch failures. 6. Several hundred years of telescopic exploration of the universe have resulted in the catalogueing, naming, and numbering of thousands of the observable millions of stars. 7. The rapid advances in the field of astronautics have made possible the serious planning of space exploration. 8. Cosmic rays have played a tremendous role in nuclear physics since their discovery early in this century. 9. The computer has brought about the most profound revolution in our scientific processes since the appearance of the *homo sapiens* [1]. 10. From the earliest

[1] *homo sapiens – лат.,* человек как разумное существо. Понятие, введённое Линнеем для обозначения человека как биологического вида.

days of science fiction, manned space travel has been the ultimate goal of astronautics.

б) 1. Since the launching of the first man-made satellite, scientists all over the world have been discussing the vital question of re-entry. 2. During recent years the problem of re-usable space vehicles has been attracting much attention. 3. Over the past decade the laboratory has been developing different life-support systems.

VI. *Найдите в тексте урока (абзац 10) нестандартные глаголы. Назовите три формы этих глаголов и их значение.*

VII. *Найдите в тексте урока (абзацы 7—9) глаголы* **to be** *и* **to have.** *Определите их функцию в предложении и переведите на русский язык.*

VIII. *Ответьте на вопросы к тексту.*

1. What are the main advantages of helicopters with coaxial rotors? 2. By what engines is the Ka-26 helicopter powered? 3. What is the range of the Ka-26 with two auxiliary fuel tanks? 4. What materials are used in the Ka-26 construction? 5. In how many versions is the V-8 helicopter built? 6. What provides comfortable, non-fatiguing flight in the V-8 helicopter? 7. What are the main characteristics of the V-10 helicopter? 8. What helicopter is the biggest and most powerful in the world? 9. What ensures safe flying of the Mi-6 helicopter in adverse weather conditions? 10. What undercarriage has the V-10 helicopter?

У РО К 5

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Слова общего корня в английском и в русском языках. 3. Сопоставление глагольного управления предлогами в английском и в русском языках (действительный залог). 4. Перфектный инфинитив в сочетании с модальными глаголами.

Термины к уроку

accessories вспомогательные агрегаты
aft cabin кормовая кабина
airfoil профиль крыла
aspect ratio относительное удлинение
brace расчалка
cantilever консоль
component агрегат
continuous aileron неразрезной элерон
control stick ручка управления
cowling капот
dihedral поперечное
diving rudder руль высоты
drag лобовое сопротивление
electric aileron элерон с электроприводом
elevator руль высоты
empennage хвостовое оперение
flight control система управления самолетом
floatation gear поплавковое шасси
framework рама
inflight trimming балансировка в полете
landing gear шасси
lift подъемная сила
lifting surface несущая поверхность
mount установка

nacelle мотогондола
pitch тангаж; выполнять движение тангажа
pod гондола; контейнер
pontoon поплавок
power plant двигатель; силовая установка
reposition изменять положение
retract убирать
rudder руль направления
sweptforward wing крыло обратной стреловидности
tail section хвостовой отсек
trailing edge задняя кромка
vorticity завихренность
yaw rudder руль направления
up-going aileron отклоняющийся вверх элерон

ТЕКСТ

AIRPLANE COMPONENTS

1. The major components of airplanes can be divided into six main parts: fuselage, wings, empennage, flight controls, landing gear or floatation gear, and nacelles. (See Fig. 1.)

2. The fuselage is the main body of the airplane and contains the pilot's compartment (cockpit) and passenger and baggage compartments. The cockpit contains the flight controls and instruments. The larger part of the fuselage contains passenger seats or cargo space and usually some provision for baggage.

3. The wings are the main lifting surfaces which support the aircraft in flight, and they are attached to a strongly-built or stressed section of the fuselage.

4. The empennage, more commonly known as the tail section, consists of a vertical stabilizer and rudder and the horizontal stabilizer and elevators.

5. The three basic flight control surfaces are the ailerons, the elevators, and the rudder.

6. The ailerons are located at the trailing edge and near the tips of the wings. When one is raised, the other lowers, and the airplane banks or rolls. The lowered aileron increases l i f t causing the wing to rise, while the raised aileron reduces l i f t, causing that wing to drop. These modifications to the airfoil impose additional drag. The lowered aileron presents a relatively greater amount of drag than the raised aileron, resulting in a tendency to skid. To overcome this, a differential control mechanism causes the up-aileron to move a greater distance than the down-aileron for a given control movement.

7. The elevators are hinged to the horizontal stabilizer and control the airplane's movement up and down about the lateral axis. When the control stick is moved forward, the elevators lower, and the airplane dives, and vice versa. Because more force is necessary to climb than to descend, on most airplanes the maximum number of degrees the elevators can be raised is greater than the maximum number of degrees they can be lowered. Thus, the stick can be pulled back farther than it can be pushed forward. Where necessary, the pilot is aided in moving this control by a differential mechanism. Many newer aircraft possess a different method of controlling pitch. This method combines the horizontal stabilizer and the elevators into a single surface known as the controllable horizontal t a i l. This surface

gives easier manoeuvring of the aircraft at transonic speeds. The whole surface can be repositioned from the cockpit when inflight trimming is necessary.

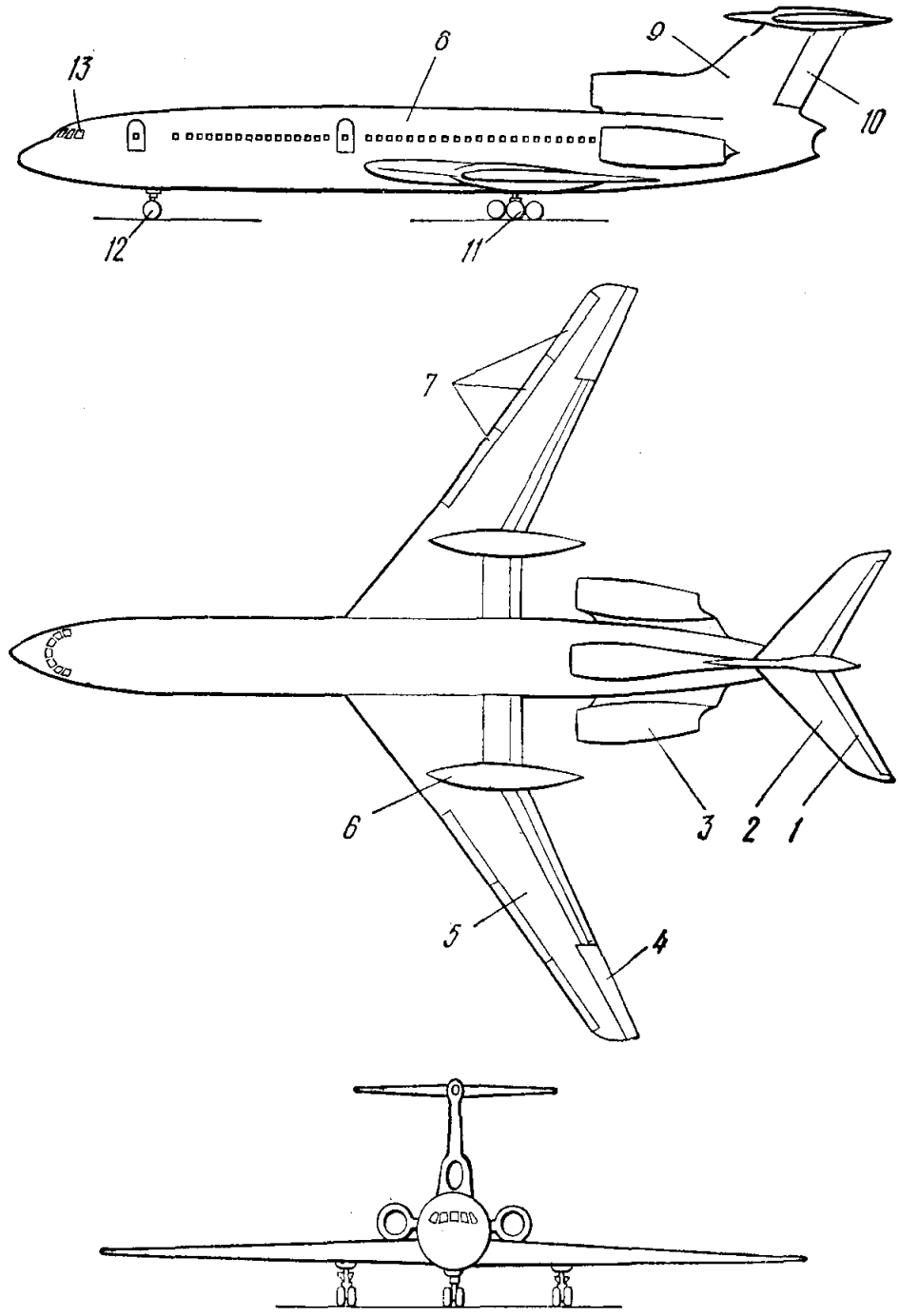

Fig. 1. Turbojet Airplane Components

1 — elevator; 2— stabilizer; 3 — engine nacelle; 4 — aileron; 5 — wing; 6 — undercarriage housing; 7 — leading edge flaps; 8 — fuselage; 9 — fin; 10 — rudder; 11 — main undercarriage wheels; 12 — nose wheels; 13 — crew's canopy

8. The rudder is hinged to the vertical stabilizer (fin), and it controls the movement of the airplane around the vertical axis. The right pedal moves the rudder and the aircraft to the right. The left pedal works similarly.

9. The main landing gear or wheels are attached by struts and braces to the fuselage and often to the wings outboard of the fuselage. Usually a smaller wheel supports either the nose or tail of the airplane.

10. Flotation gear for landing on water consists of pontoons or floats. Some airplanes are equipped with skis for landing on snow.

11. Nacelles are compartments housing the power plant or engine and its accessories. The nacelle is usually covered with a detachable cowling and contains a framework or engine mount which is attached to the fuselage or airframe.

УПРАЖНЕНИЯ

I. *Переведите словосочетании со следующими терминами из текста:* **aileron, cabin, elevator, flap, fuselage, landing gear, nacelle, pod, rudder, stabilizer, wing.**

balanced aileron, continuous aileron, down-going aileron, drooped aileron, electric aileron, external aileron, fixed aileron, lowered aileron, moved-up aileron, outer aileron, powerful aileron, power-operated ailerons, simple aileron, slotted aileron, tapered aileron, unbalanced aileron, up-going aileron, wing-tip aileron;

aft cabin, air-conditioned cabin, airtight cabin, baggage cabin, cargo cabin, clear-view cabin, closed cabin, conditioned cabin, crew cabin, enclosed cabin, hermetic cabin, luggage cabin, open cabin, passenger cabin, pilot's cabin, pressure cabin, pressurized cabin, single-seat cabin, soundproofed cabin, two-seat cabin;

down-elevator, lowered elevator, outer elevator, up-elevator; brake flap, full-span flap, high-lift flap, landing flap, lowered flap, manually operated flap;

aft fuselage, center fuselage, drooping-nose fuselage, front fuselage, lift fuselage, monocoque fuselage, pressurized fuselage, rear fuselage, round fuselage, semi monocoque fuselage, sharp-nosed fuselage, soundproofed fuselage, supersonic fuselage, upper fuselage;

bicycle landing gear, extended landing gear, fixed landing gear, four-wheel landing gear, multiple-wheel landing gear, nonretractable landing gear, nose-wheel landing gear, retractable landing gear, single-wheel landing gear, ski landing gear, tail-wheel landing gear, tricycle landing gear, wheeled landing gear;

cockpit nacelle, engine nacelle, inboard nacelle, inner nacelle, outboard nacelle, outer nacelle, pod nacelle, single-engine nacelle, two-engine nacelle;

cargo pod, drop pod, engine pod, jet pod, nacelle pod, passenger pod, power pod, rocket pod, underfuselage pod, underwing pod, wing-mounted pod, wing-tip pod;

aerodynamic rudder, diving rudder, electric rudder, fixed rudder, neutralized rudder, yaw rudder;

adjustable stabilizer, horizontal stabilizer, mechanical stabilizer, movable stabilizer, vertical stabilizer;

arrow wing, cambered wing, cantilever wing, crescent wing, delta wing, dihedral wing, double-cambered wing, double-delta wing, high

wing, high-aspect-ratio wing, high-lift wing, highly swept wing, high-speed wing, lifting wing, long wing, low wing, low-aspect-ratio wing, low-drag wing, low-lift wing, low-mounted wing, low-speed wing, main wing, minimum-drag wing, multispar wing, nonlifting wing, one-piece wing, port wing, sharp leading-edge wing, single-spar wing, starboard wing, straight wing, subsonic wing, supersonic wing, swept wing, sweptback wing, swept-forward wing, tapered wing, transonic wing, unswept wing, untapered wing, zero-aspect-ratio wing, zero-span wing.

II. *Назовите русские слова, имеющие общий корень со следующими английскими словами.*

aviator ['eIvIeItq], cosmos ['kOzmOs], instrument ['Instrumqnt], material [mq'tIqrIqI], meridian [mq'rIdIqn], meteor ['mi:tjq , moment ['mqumqnt], motor ['mqutq], proton ['prqutOn], radiator ['reIdIeItq], start [stQ:t];

problem ['prOblqm], attack [q'txk], bomb ['bOm], cabin ['kxbIn , chord [kO:d], comet ['kOmIt], mass [mxs], matrix ['meItrIks , orbit ['OrbIt], platform ['plxtfO:m], rocket ['rOkIt];

atmosphere ['xtmqsfIq], amplitude ['xmplItju:d], capsule ['kxpsju:l], figure ['fIgq], machine [mq'Si:n], minute ['mInIt], molecule ['mOlIkju:l], phase [feIz], structure ['strAkCq], turbine ['tq:bIn], zone [zqun ;

aeroplane ['Fqrqpleln , aerodrome ['Fqrqdrqum], anode ['xnqud], biplane ['balpleln], cosmodrome ['kOzmqdrqum], course [kO:s], ellipse [I'IIps], gyroscope ['GalqrqskOup], meteorite ['mi:tjqralt , parachute ['pxrqSu:t], satellite ['sxtqlalt].

III. *Переведите предложения, обращая внимание на перевод следующих глаголов в различных временах действительного залога.*

to affect *воздействовать на;* **to approach** *приближаться к*; t**o encounter** *сталкиваться с, входить в;* **to follow** *следовать за;* **to influence** *влиять на;* **to mention** *упоминать о*; **to orbit** *вращаться вокруг;* **to enter** *входить в; выходить на;* **to rely** *полагаться на.*

1. Science **affects** our life today and tomorrow. 2. The rotation of the Earth **affects** the movement of the air. 3. Changes in air density **affect** the flight of an airplane. 4. Many factors **affect** the heating of a missile. 5. The airplane **approached** the runway and landed safely. 6. Under these conditions the Reynolds number **approaches** very large values. 7. When a spaceship **encounters** the atmosphere, the friction of the gas molecules against the surface of the ship generates heat. 8. The artificial satellite entered the Earth's atmosphere and burned. 9. At a preset time the artificial satellite **entered** the orbit around the Moon. 10. The reentry phase of the space vehicle flight **follows** a ballistic trajectory. 11. The fluid **follows** the contour of the tank very closely. 12. The selection of the propulsion engine **influences** the over-all characteristics of the vehicle. 13. On October 4, 1957, the event occurred that will-greatly **influence** the future of all mankind. This

event will **affect** us not only from a technical, scientific and military point of view, but also socially, p o l i t i c a l l y and economically. 14. The previous reporter did not **mention** the following details of the inertial guidance system. 15. The Moon **orbits** the Earth about once a month. 16. As the spacecraft **orbits** the Earth, the centrifugal force balances the force of gravity. 17. Unmanned spacecraft **rely** completely on automatic instrumentation to gather scientific data.

IV. *Переведите предложения, обращая внимание на перевод перфектного инфинитива в сочетании с модальными глаголами.*

1. The aerodynamisists must have carried out the aerodynamic analysis of the aircraft. 2. Some of the largest meteorites, such as the Sikhote-Alin meteorites of 1947, must have had masses of 70 tons or more when they entered the Earth's atmosphere, and the meteorites that created some of the large craters, such as the one in Arizona, must have been even bigger. 3. The dark side of Mercury may have been one of the coldest places in the solar system. This situation must have produced some very interesting effects on the geology of the planet. 4. The pilot may have lost the control. 5. Viscous forces may have produced vorticity. 6. As you may have learned at school, the speed of sound in air varies with the temperature. 7. Most readers may have heard of the variety of ideas to produce artificial gravity.

V. *Найдите в тексте урока (абзац 6) нестандартные глаголы. Назовите три формы этих глаголов и их значение.*

VI. *Найдите в тексте урока (абзацы 7—11) глагол* **to be.** *Определите его функцию в предложении и переведите на русский язык.*

VII. *Ответьте на вопросы к тексту.*

1. What are the major components of an airplane? 2. What does the fuselage contain? 3. What are the wings attached to? 4. What does the empennage consist of? 5. Where are the ailerons located? 6. What do the elevators control? 7. What does the rudder control? 8. What supports the nose or tail of the airplane? 9. What are some airplanes equipped with for landing on snow? 10. What do nacelles house?

У РО К 6

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Слова общего корня в английском и в русском языках. 3. Слова, образованные путем конверсии, чередования ударения, чередования звуков. 4. Различные времена действительного залога *(повторение)*.

Термины к уроку

board подниматься на борт
bogie тележка шасси
brake тормоз
check pilot летчик-инспектор
fail отказывать; выходить из строя
flap закрылок
flight engineer бортинженер
fore and aft axis продольная ось
ingest засасывать
jet efflux реактивная струя
reaction control jet струйный руль
roll крен; движение крена
safety belt привязной ремень
section секция; отсек; сечение
shield защищать
span размах
spoiler интерцептор
steady установившийся
steer поворачиваться
tip-up seat откидное сиденье
tricycle трехколесный
yaw рыскание; движение рыскания

ТЕКСТ

THE TU-154 AIRCRAFT DESIGN

1. To illustrate the modern aircraft design the Tu-154 aircraft is used.
2. The Tu-154 is a short-haul aircraft equipped with three turbo-fan engines. They are situated at the t a i l , two outside and one inside the fuselage with the air intake above.
3. There are a number of advantages obtained from grouping the engines tightly round the fore and aft axis of the airframe. For example, if an engine fails, the roll and yaw moments are reduced to a minimum. Also the wings are kept aerodynamically "clean" and the designer has simpler l i f t and drag problems, and the whole span of the wings can be used to take such wing-shape altering devices as flaps and slats.
4. There are also a number of advantages in having the engines right at the back of the airframe. The engines have less area of fuselage to damage with the force and temperature of the jet efflux. Because they are high off the ground and shielded by the wings from material thrown up by the wheels, the engines are less likely to have water and stones ingested. Finally passengers in the cabin do not hear so much engine noise.
5. The wings are constructed on a framework of three main spars. The ailerons are normally effective at cruising speeds but are assisted by the outer spoilers at lower speeds. The middle spoilers are used as air brakes in flight, and the inner spoilers are used as air brakes both in flight and on landing.
6. The tail unit has the horizontal part on top of the vertical (the so-called "T" design) to give greater aerodynamic efficiency. The tailplane is movable and is deflected on take-off and landing. A single elevator assisted by a slight adjustment of the tailplane can control the aircraft.
7. The undercarriage is tricycle and the twin nosewheels are able to steer 55° either side. The six-wheeled bogie main undercarriage was designed to give a good take-off run and good braking in wet and snowy conditions.
8. The flight deck can accommodate up to five crew. The normal crew includes two pilots and a flight engineer, but a navigator can

be carried for routes that are poorly equipped with navigation aids. The fifth seat can be used for relief crew or for a check pilot. There are tip-up seats with safety belts for the six members of the cabin crew. The passenger cabin is divided into two sections. The forward one can be used as a first-class cabin. It will take 54 tourist/economy seats and 24 first-class seats arranged in pairs either side of the aisle. The rear section normally takes 104 economy-class seats mainly in threes either side of the aisle, so that an all economy-class configuration gives a total of 158 seats and a mixed-class configuration gives a total of 128 seats.

9. The pitch of the economy-class seats is normally 750 mm (29 1/2 in.). Despite such a small pitch between the rows of seats they are very comfortable. The back can tilt 26°.

10. Passengers board the aircraft through two doors. They are both on the port side of the fuselage, forward of the wings. One door leads into the centre vestibule and the other into the forward vestibule. Each vestibule has coat hanging space.

11. There are three baggage compartments. Two are pressurized and are big enough to take containers so that loading time can be reduced. A third smaller compartment is unpressurized.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **compartment, configuration, drag, lift, pitch, roll, section, span, spar, yaw.**

baggage compartment, cargo compartment, crew compartment, flight compartment, luggage compartment, passenger compartment, pilot compartment;

airplane configuration, canard configuration, high-wing configuration, low-wing configuration, mid-wing configuration, tail-first configuration;

aerodynamic drag, air drag, airfoil drag, body drag, engine drag, fuselage drag, helicopter drag, tail drag, wing drag;

aerodynamic lift, aileron lift, air lift, airfoil lift, blade lift, body lift, horizontal tail lift, profile lift, section lift, tail lift, vertical tail lift, wing lift;

nose-down pitch, nose-up pitch, steady pitch;

aileron roll, steady roll, wing roll;

after section, body section, centre section, cockpit section, engine section, instrument section, nose section, power section, power-plant section, rear section, tail section, tank section;

airfoil span, tailplane span, total wing span, wing span;

aileron spar, auxiliary spar, box spar, centre spar, fin spar, front spar, leading-edge spar, main spar, rear spar, rudder spar, tailplane spar, trailing-edge spar, wing spar, wooden spar;

aerodynamic yaw, aileron yaw, negative yaw, positive yaw, steady yaw,

II. *а) Переведите без словаря следующие английские слова из текста, имеющие общий корень с русскими словами.*

aerodynamic *a*, aerodynamically *ad*⁄, aileron *n*, cabin *n*, center *n*, class *n*, comfortable *a*, configuration *n*, construct ⁄, container *n*, effective *a*, engineer *n*, equivalent *a*, fuselage *n*, grouping *n*, horizontal *a*, illustrate ⁄, material *n*, minimum *n*, moment *n*, navigation *n*, passenger *n*, pilot *n*, problem *n*, temperature *n*, tourist *n*, typical *a*, vertical *n*, vestibule *n*.

б) Уточните значение нижеприведенных слов в словаре. В тексте урока их рекомендуется перевести следующим образом:

А б з а ц 3: l i f t *n* подъемная сила.
А б з а ц 5: normally *adv* обычно.
А б з а ц 6: control ⁄ управлять; elevator *n* руль высоты.
А б з а ц 8: navigator *n* штурман; section *n* отсек; салон.

III. *Переведите следующие слова.*

а) существительными и глаголами:

О б р а з е ц : **model** — модель; моделировать

control, fight, guide, house, land, launch, lift, load, machine, man, manufacture, mark, mount, name, record, result, rivet, screw, seat, ship, sound, space, start, support, taxi, track, travel, turn, twist, view;

б) прилагательными и глаголами:

О б р а з е ц : **slow** — медленный; замедлять

clean, clear, complete, correct, double, dry, empty, narrow.

IV. *Прочтите следующие слова, значение которых зависит от места ударения. Выучите эти слова наизусть.*

'contract *соглашение* — **con'tract** *сжимать, сокращать*
'decrease *уменьшение* — **de'crease** *уменьшать*
'increase *увеличение* — **in'crease** *увеличивать(ся)*
'detail *подробность* — **de'tail** *подробно излагать*
'extract *извлечение, выдержка* — **ex'tract** *извлекать*
'forecast *прогноз* — **fore'cast** *предсказывать*
'import *ввоз* — **im'port** *ввозить*
'object *предмет; цель* — **ob'ject** *возражать*
'perfect *совершенный* — **per'fect** *совершенствовать*
'produce *продукт* — **pro'duce** *производить*
'progress *успех, развитие* — **pro'gress** *продвигаться вперед, развиваться*
'project *проект* — **pro'ject** *проектировать*
'protest *протест* — **pro'test** *протестовать*
'record *запись; отчет; рекорд* — **re'cord** *записывать*
'subject *тема; подверженный, подлежащий* — **sub'ject** *подвергать (воздействию), подчинять*
'transfer *передача, перенос*
'transport *перевозка* — **trans'port** *перевозить*

V. *Переведите следующие слова (прилагательное — существительное — глагол).*

deep — depth — deepen, wide — width — widen, broad — breadth — broaden, long — length — lengthen, strong — strength — — strengthen, high — height — heighten, short — shortness — shorten, weak — weakness — weaken, dark — darkness — darken.

VI. *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в различных временах действительного залога (повторение).*

1. This book deals with the theory of the universe structure. 2. This book opens with a review of the propulsion problem. 3. This chapter has discussed some of the many possible applications of the air cushion principle. 4. Many factors have affected the heating of an airplane. 5. Navigation in space required the determination of position and velocity relative to the desired path. 6. Man has succeeded in soft-landing on the Moon. 7. In future meteorological, communications, and navigational satellites will continue to play an important role. 8. This laboratory has been operational since May 1966. 9. Satellites are already helping map-makers to plot the Earth's shape more precisely. And they are helping to prepare the way for further manned flights by gathering information about outer space. 10. Equipment on board the interplanetary space station is functioning normally. 11. Aircraft engines have become more complicated. 12. Pilots and technicians can perform their duties better if they know the characteristics and limitations of an airplane.

VII. *Ответьте на вопросы к тексту.*

1. How many engines has the Tu-154 aircraft? 2. Where are the engines of the Tu-154 aircraft situated? 3. What are the advantages obtained from grouping the engines tightly round the fore and aft axis of the airframe? 4. What are the advantages in having the engines right at the back of the airframe? 5. In what manner are the wings constructed? 6. When is the tailplane deflected? 7. Whom does the normal crew include? 8. Into how many sections is the passenger cabin divided? 9. In what way do passengers board the aircraft? 10. How many baggage compartments are there in the Tu-154 aircraft?

У РО К 7

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Слова общего корня в английском и в русском языках. 3. Слова с префиксами отрицательного значения. 4. Слова с прочими префиксами. 5. Времена группы **Indefinite** страдательного залога. 6. **Infinitive Indefinite Passive** в сочетании с модальными глаголами.

Термины к уроку

blade stall срыв потока с лопасти
carrier-airplane самолет-носитель
compound helicopter комбинированный вертолет
copter вертолет
craft летательный аппарат
hover зависать
production производство
repeater satellite ретрансляционный спутник связи
retractable убирающийся
running landing посадка с пробегом
stall потеря скорости
tilting propeller воздушный винт с изменяемым наклоном
tilt-prop с поворотным несущим винтом
tilt-wing с поворотным крылом
vehicle летательный аппарат
vertical riser аппарат вертикального взлета
water airplane гидросамолет

ТЕКСТ

VTOL AIRCRAFT

1. Vertical take-off and landing aircraft (VTOL) are all those machines including the helicopter, that have the ability to rise or descend vertically and to hover in midair. They include compound helicopter, tilt-prop and tilt-wing, jet VTOL, and a few other more exotic specimens as well. It is singificant that almost all the VTOLs are also capable of making a running take-off that requires only the shortest of runways. In fact, when space is available the running takeoff is always preferred, since it is less of a strain on the aircraft and the engines and permits a greater payload. The VTOLs have the ability to land by descending vertically or by making a running landing with a very short forward roll. It should be noted that only the oldest of the VTOLs, the well-tried helicopter, has ever been in regular service, at least up to the date of this writing. Despite years of research and testing, the other aircraft are still in the trial stage.

2. Short take-off and landing (STOL) aircraft, on the other hand, are simply specialized fixed-wing airplanes, unrelated to helicopters or other vertical risers, designed with aerodynamic features that provide high lift and good control at very low airspeeds. The STOLs can take off and land at extreme angles and require only the shortest of runways; for some of the smaller machines as little as 200 or 300 feet may be enough. During take-off the STOL airplane requires only a short run in order to reach the low airspeed at which its wing will begin to lift. While landing, a STOL can fly so slowly, without stalling, that when it touches down it can be stopped easily after a short forward roll. The STOLs, as a class, are not to be considered as experimental aircraft; numbers of them are in production in various parts of the world. Nor is the concept especially new.

3. There are many advantages to the STOL airplane. It is less complicated and therefore less expensive than VTOL aircraft. The wings are fixed, and there are no rotors or tilting propellers — no pivoting or rotating system such as those needed for the vertical flight of the VTOLs. But it is seriously lacking in one critical area: it is incapable of vertical flight or hovering and must always keep moving in order to keep flying, however slowly. The larger STOLs, for example,

could be expected to require at least 60 miles per hour of airspeed during an approach. In addition, the STOL has to have a runway on which to land, and, perhaps more important, it must have an adequate amount of clear airspace in which to manoeuvre and line up on the runway.

4. Returning to the VTOLs, the true vertical-risers, we find that, despite their very great differences in outward appearance, we can reduce them to four primary types: standard helicopter, compound helicopter, tilt-prop airplane, and jet VTOL. Each of the four will be discussed in turn, with an eye to method by which each achieves vertical flight and its individual advantages and disadvantages.

5. First in the line-up is the standard helicopter. With this aircraft, the rotor is the heart of the flight mechanism, actually serving two purposes: it provides the direct l i f t needed to make the machine rise vertically and to support the ship in flight, and at the same time, by "leaning forward" slightly, it propels the craft through the air. The helicopter is superior to other VTOLs in its a b i l i t y to pull itself straight up or to hover in the air, it is primarily a direct-rising and hovering aircraft. This is owing to the fact that a helicopter rotor offers the lowest thrust-to-weight ratio for vertical take-off of all the various VTOL types; it can l i f t the most weight for the least amount of engine power. However, the copter has to pay for its superiority as a hovering machine; it is the slowest of a l l the VTOLs.

6. The fastest speed to be expected of a helicopter with a conventional rotor system — even the most powerful of the turbine-powered machines — is rarely over 200 miles per hour. The problem is that when the high speed limit of the helicopter is reached, a phenomenon termed "blade stall" occurs. This creates so much extra drag that a great deal of extra power is required, excessive vibration may be experienced, and there will be a troublesome — if not dangerous — loss in control as well. This is not to say that ultimately new rotor systems may not be developed to the point where this limitation can be overcome; considerable research has been underway in this area. Another point to be considered is that if some form of direct thrust is provided — such as added jet engines mounted on the fuselage — the aircraft may then be forced to higher speeds despite the limitations of blade stall.

(to be continued)

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **airplane, manoeuvre, propeller, ratio, thrust.**

attack airplane, carrier airplane, delta-winged airplane, general-purpose airplane, high-aspect-ratio wing airplane, high-flying airplane, high-wing airplane, jet airplane, low-aspect-ratio wing airplane, prototype airplane, research airplane, rocket airplane, STOL airplane, straight-wing airplane, swept-wing airplane, tailless airplane, tar-

get airplane, tilt-prop airplane, tilt-wing airplane, training airplane, vertical take-off and landing airplane, VTOL airplane, water airplane;

aerial manoeuvre, air manoeuvre, down manoeuvre, flight manoeuvre, pitching manoeuvre, rolling manoeuvre, up manoeuvre, yawing manoeuvre;

aerodynamic propeller, aircraft propeller, all-metal propeller, multiblade propeller, single-blade propeller, variable-pitch propeller;

aspect ratio, cargo-passenger ratio, compression ratio, density ratio, drag-lift ratio, drag-weight ratio, fineness ratio, high-aspect ratio, lift-drag ratio, low-aspect ratio, thrust-to-weight ratio, weight-to-thrust ratio, wing thickness ratio;

air thrust, airscrew thrust, available thrust, backward thrust, cruise thrust, effective thrust, engine thrust, flight thrust, forward thrust, propeller thrust, propulsive thrust, resultant thrust, reverse thrust, rocket thrust, rotor thrust.

II. *а) Переведите без словаря следующие английские слова из текста, имеющие общий корень с русскими словами.*

aerodynamic *a*, class *n*, critical *a*, experimental *a*, fixed *p . p . ,* fuselage *n*, individual *a*, manoeuvre *n*, mechanism *n*, method *n*, mile *n*, regular a, sort *n*, special *a*, standard *n*, system *n*, turbine *n*, vertical *a*, vibration *n*.

б) Уточните значение нижеприведенных слов в словаре. В тексте урока их рекомендуется перевести следующим образом:

А б з а ц 1: machine *n* летательный аппарат; helicopter *n* вертолет; exotic *a* необычный.

А б з а ц 2: airplane *n* самолет; l i f t *n*, */* подъемная сила; создавать подъемную силу; control *n* управление; production *n* производство.

А б з а ц 3: propeller *n* воздушный винт.

А б з а ц 5: support */* поддерживать.

А б з а ц 6: rotor *n* несущий винт; problem *n* задача; limit *n* предел; limitation *n* недостаток; phenomenon *n* явление.

I I I . *Переведите слова с префиксами отрицательного значения.*

anti- ['xnti : antiaircraft, antiatom, antibomb, antibody, antifreeze, antigravitation, antiicer, antimissile, antirocket, antisubmarine

counter- ['kauntq : counter-action, counteraircraft, counter-attack, counter-blow, counterfighter, counter-intelligence, countermeasures, countermine, countermissile, counterradar, counterrocket

de- [di: : deatomize, decentralization, decompose, decompression, deconcentration, deicer, demagnetize, demilitarize, demine, demobilize, depressurize

dis- [dls : disadvantage, disappear, disarmament, disconnection, discontinuity, disintegrate, dislocation, disorder, disorientate, disorganization

in- [ɪn]: inactive, incombustible, incontrollable, incompressible, incorrect, independent, ineffective, insensitive, instabilized, invisible, invulnerable

im- [ɪm]: immovable, impatient, imperfection, impersonal, impossible, impermanent, impure

ir- [ɪr]: irregular, irrelative, irresistible, irrespective, irresponsible, irreversible, irrotational

non- [nɔn : nonaggressive, nonatomic, nonaxial, noncombat, noncontrolled, nonlinear, nonmilitary, nonnuclear, nonregular, nonstandard, nonstationary, nontactical, nonturbulent, nonviscous, nonvortex, nonuniform

un- [ʌn : unaccelerated, unarmed, unbalanced, uncontrolled, uncorrected, undamped, unguided, unidentified, unlimited, unmanned, unpowered, unstabilized;

unacceptable, unaggressive, uncertain, unequal, unexplosive, unstable, unswept, unsymmetrical.

IV. *Переведите слова со следующими префиксами.*

inter- ['ɪntə : interaction, interatomic, interchangeability, interconnection, intercontinental, international, interplanetary, intersection, interspar;

over- ['əuvə : overbalancing, overbank, overboil, overcompensation, overexpansion, overflight, overflow, overheat, overland, over-stability, oversea, overweight;

under- ['ʌndə : underarmed, underbalancing, underbelly, under-cooled, underestimate, underground, underpressure, undersea, under -snow, understable, undersurface, underwater, underwing;

sub- [sʌb : subassembly, subbase, subcooled, subcritical, subdivide, subgroup, submarine, subnormal, subpressure, subsonic, substation, substratosphere, subtropical;

super- ['sju:pə : superaerodynamics, superalloy, superaltitude, superbomb, superbomber, supercooled, superfighter, superfluid, supersonic, supervelocity;

re- ['ri: : reaction, recirculation, recompression, reconstruct, redistribution, reentry, reevaluation, refuel, regeneration, reorganize, replace, reproduce, restart.

V. *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в различных временах группы Indefinite страдательного залога.*

a) 1. Venus is covered by a thick layer of clouds. 2. The climate of Mars is relatively well known. 3. Most present-day aircraft are equipped with three-point retractable landing gears. 4. Thrust is provided by the engine and propeller. 5. Each part of a missile is tested thoroughly before it is used in actual flight. 6. The density of the atmosphere is measured by balloons below 30 km. 7. Any vehicle in space is exposed to the hazards of collision with meteorites. 8. In the conventional rocket engine a fuel and an oxidizer are mixed and ignited in a combustion chamber.

б) 1. The satellite was launched into a 1500-km circular orbit. 2. The cosmic rocket was launched from the satellite at a pre-determined point on the orbit. 3. With the advent of a supersonic flight new problems were introduced. 4. The accuracy of the airplane flight control system was considerably improved. 5. Till recently very little was known about Venus, in spite of its proximity to the Earth. 6. Mid-course velocity corrections of the satellite were made in due time.

в) 1. The aerodynamic heating problem will not be discussed further here. 2. Permanent bases on the Moon and Mars will be established for many reasons. 3. Several types of vehicles will be developed and used for space flights. 4. The term "planet" will be applied here to nine celestial bodies orbiting around the Sun. 5. The space station will be equipped for research in geophysics, meteorology and astronomy. 6. The geometrical properties of the circular orbit are well known and, therefore, will not be discussed in this article.

VI. *Переведите предложения, обращая внимание на перевод Infinitive Indefinite Passive в сочетании с модальными глаголами.*

1. Airplanes can be used as launch platforms for space carrier vehicles. 2. The speed and range of an aeroplane can be predicted with considerable accuracy. 3. The rocket engine can be used in the air, under water, or in the vacuum of spare. 4. The general character of the Moon's surface features can be studied by direct telescopic observation and photography. 5. Mercury cannot easily be observed because of its closeness to the Sun. It can be seen only for a short while. 6. The Moon's history may be arbitrarily divided into several epochs. 7. A rocket propulsion system may be used as a primary or as an auxiliary power plant of an airplane. 8. Orbital launchings may be made from space stations. 9. Satellites may be used in two ways to extend our capabilities for continental and world-wide communications. First, passive satellites may be employed as reflectors of signals between two ground points; and, second, active repeater satellites can be used for the reception and storage of a message over one ground point, and subsequent delivery on command during transit over a second ground point. 10. Food for space crews must be well packaged and protected. 11. Materials for a space vehicle must not be selected on the basis of isolated properties.

VII. *Ответьте на вопросы к тексту.*

1. What specimens do VTOL aircraft include? 2. Why running take-off is preferred? 3. Are all types of VTOL aircraft in regular service now? 4. What aerodynamic features have STOL aircraft? 5, What run does the STOL airplane require during take-off? 6. Are the STOLs in production now? 7. What are the four primary types of the VTOLs? 8. What purpose does the rotor of the helicopter serve? 9. What is the fastest speed of a helicopter? 10. What phenomenon occurs when the high-speed limit of the helicopter is reached?

УРОК 8

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Слова общего корня в английском и в русском языках. 3. Существительные с суффиксами. 4. Существительные латинского и греческого происхождения в единственном и множественном числе. 5. Времена **Present Continuous** и **Present Perfect** страдательного залога.

Термины к уроку

ascent набор высоты; подъем
development разработка
freewheel авторотация несущего винта вертолета
ground-effect machine аппарат на воздушной подушке
pivot шарнирная опора
rate скорость
reconnaissance-fighter airplane истребитель-разведчик
simulator моделирующая установка; имитатор; тренажер
structure конструкция
top speed максимальная скорость

ТЕКСТ

VTOL AIRCRAFT

(continued)

1. A variation of the standard helicopter is the compound helicopter. In the last few years there has been a revival of interest in the compound type, basically a standard helicopter redesigned with a propeller (or a jet engine) to give it added push; usually a small lifting wing is also part of the configuration. The rotor is used for vertical take-off; after reaching altitude, power to the rotor is then reduced or stopped entirely and it is allowed to freewheel as the ship goes into forward flight. With the rotor thus unloaded it is possible to obtain a cruise speed considerably greater than that attainable with the rotor under power. For vertical descent, the rotor is clutched in and, in effect, the machine is converted back to a helicopter.

2. The compound helicopter can be thought of as a kind of helicopter that can partially convert while in flight to an airplane configuration by unloading the rotor. The intention, of course, is to combine the superior vertical flight and hovering characteristics of the helicopter with the high cruise speed available from use of an unloaded rotor. However, in some ways the compound helicopter has to pay for its higher rate of speed. There is a decrease in its vertical take-off and hovering capability, since the wing interferes with the airflow through the rotor; then, too, the added weight of this structure reduces the payload.

3. The third type of VTOLs is the tilt-prop airplane, a complete break from the tradition of the helicopter. If the compound helicopter can be thought of as a kind of helicopter that can partially turn

itself into an airplane, the tilt-prop machines may be considered as airplanes that have the ability to turn into helicopters. The tilt-prop, basically, is an airplane that has oversized propellers, or fanlike rotors, mounted on pivots so they can be shifted to point either straight up or straight ahead. With some aircraft of this type the wings t i l t along with the propeller, and these have been referred to as "tilt-wings". The term tilt-prop is perhaps more suitable, since it covers both configurations. The tilt-prop airplanes have no rotors, there is only a small wing to support the machine in forward flight.

4. The reason for this design approach, again, is to achieve higher speed than with the helicopter. The tilt-prop designs are another step forward on the speed scale; the large ones should be capable of cruising speeds in the 300- to 400-mile-per-hour range, perhaps more. However, at this time they seem to be inferior to both the helicopter and compound helicopter in vertical take-off and in hovering ability; their propellers are not as efficient as rotor systems. Presumably, control in hovering flight may not be as good, and the payload that can be lifted vertically is much less (for the same power) than with a helicopter. Another point to be considered is that the vertical take off of the tilt-prop can be more of a strain on the engines than it would be with a helicopter.

5. The last type we will consider is the jet VTOL, basically a jet airplane with the ability to rise vertically. A number of aircraft of this type are currently in various stages of development. All have one important point in common: in order to rise vertically the flow from the turbojet engines is directed downward so a lifting force is created. [1] Since all are jets, these aircraft are the fastest of any of the VTOLs. In fact, several reconnaissance-type airplanes have been built along these lines. However, most jet VTOL designs — particularly those intended for development into transport-type aircraft — are s t i l l in the experimental stage, are complex, and generally do not have lift-off and hovering characteristics that are equal to the helicopter or other VTOLs.

6. Each of these VTOL types represents a different compromise between the a b i l i t y to rise vertically, lifting the most weight for the least power, and the ability to cruise at a high forward speed. At one end of the spectrum we have the helicopter. Because of the superior lifting capability of its rotor, which provides the most lift for the least power — as compared to the other VTOL systems — the copter is the best hovering and lift-off machine. However, because of the high drag created by the rotor when in forward flight, it has relatively poor speed. At the other end of the spectrum we have the tilt-prop airplanes, where the situation is reversed. And then, more or less in between (though closely related to the helicopter) we have the compound helicopter, which has a lift-off capability nearly equal to the standard helicopter but a top speed that is considerably greater.

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[1] There are exceptions, however.

7. Concerning the lift-off and hovering characteristics of the new VTOL types, there is one fact to be considered. These aircraft are completely dependant upon the perfect functioning of their engines and control systems, unlike the helicopter (or compound helicopter) which has an inherent safety factor in the autorotational capability of the rotor. If a serious power failure or a failure in the control system is experienced while the VTOL is being supported by the thrust from its engines, obviously, a crash is almost inevitable. In the last few years there have been several disastrous crashes of experimental VTOLs (a tilt-prop, a lift-fan, and a jet) due to trouble while the aircraft was in the slow flight or hovering condition.

(to be continued)

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **ascent, control, copter, descent, failure, force, machine, rate.**

ballistic ascent, e l l i p t i c ascent, powered ascent;

aileron control, air control, aircraft control, aircraft engine control, airplane control, air traffic control, autopilot control, bank control, cabin pressure control, cabin temperature control, constant Mach number control, elevator control, elevon control, engine control, flap control, flight control, flying control, landing-gear control, lateral control, longitudinal control, manual control, pitch control, radio control, range control, roll control, rudder control, speed control, tail control, tailplane control, thrust control, undercarriage control, velocity control, yaw control;

cargo copter, transport copter, turbine copter, utility copter;

flat descent, gliding descent, parachute descent, powered descent, steep descent, uniform descent, vertical descent;

autopilot failure, catastrophic failure, engine failure, fatigue failure, power failure, random failure, receiver failure;

aerodynamic force, air force, brake force, centrifugal force, centripetal force, component force, downward force, drag force, external force, friction force, G-force, gravity force, inertial force, lateral force, lift force, longitudinal force, propulsive force, reactive force, side force, total force, upward force, variable force;

fixed-wing machine, flying machine, ground-effect machine, research machine, training machine;

rate of climb, rate of descent, angular rate, initial rate, maximum rate of climb, negative rate of climb, positive rate of climb, rotation rate, sea-level rate of climb.

II. *а) Переведите без словаря следующие английские слова из текста, имеющие общий корень с русскими словами.*

autorotational *a*, characteristics *n*, compromise *n*, configuration *n*, efficient *a*, experimental *a*, fact *n*, factor *n*, functioning *n*, interest

n, machine *n*, mile *n*, spectrum *n*, standard *a*, system *a*, tradition *n*, transport *n*, type *n*, vertical *a*, vertically *adv;*

б) Уточните значение нижеприведенных слов в словаре. В тексте урока их рекомендуется перевести следующим образом.

А б з а ц 1: variation *n* вариант; helicopter *n* вертолет; propeller *n* воздушный винт; rotor *n* несущий винт.

А б з а ц 2: combine *v* объединять; interfere *v* взаимодействовать; structure *n* конструкция.

А б з а ц 3: propeller *v* воздушный винт; rotor *n* несущий винт; support *v* поддерживать.

А б з а ц 4: reason *n* причина; forward *adv* вперед; control *n* управление.

А б з а ц 5: complex *a* сложный.

А б з а ц 6: situation *n* положение.

А б з а ц 7: control *n* управление; support *v* поддерживать; condition *n* режим.

III. *Переведите существительные со следующими суффиксами.*

-er [ɵ : builder, commander, controller, designer, leader, manufacturer, organizer, worker;

adapter, analizer, bomber, booster, carrier, container, cruiser, fighter, glider, oxidizer, receiver, stabilizer, trainer, transformer;

-or [ɵ : constructor, contractor, director, inspector, inventor, navigator, operator, sailor;

accumulator, alternator, collector, compressor, detector, detonator, elevator, generator, indicator, interceptor, protector, regulator, separator, simulator;

-tion [Sɵn : action, combustion, completion, connection, construction, consumption, correction, deflection, destruction, direction ejection, ignition, injection, insertion, inspection, instruction, interception, intersection, perfection, reflection;

-(at)ion [('el)Sɵn : adaptation, application, classification, computation, deformation, determination exploration, formation, identification, inclination, information, installation, magnetization, observation;

accumulation, approximation, calculation, communication, concentration, detonation, deviation, formulation, generation, indication, insulation, modulation, navigation, orientation, oscillation, rotation;

-sion [Zɵn : collision, corrosion, decision, division, explosion, inclusion, provision;

-(ss)ion [Sɵn : compression, discussion, expression, submission, transmission;

-ment [mɵnt : accomplishment, achievement, adjustment, arrangement, attachment, department, development, displacement, employment, equipment, fulfilment, movement;

-ance [ɵns : appearance, assistance, disturbance, endurance, guidance, insurance, performance, resistance;

-ence [ns] : dependence, difference, existence, insistence, occurrence, referrence;

-ness [nis] : blackness, darkness, effectiveness, hardness, roughness, thickness, usefulness, weightlessness;

-ity [iti] : activity, conductivity, density, extremity, equality, humidity, intensity, productivity, rigidity, sensitivity, accessibility, availability, capability, controllability, flexibility, possibility, reliability, visibility, vulnerability.

IV. *Прочтите и запомните слова латинского и греческого происхождения.*

Единственное число	*Множественное число*
-um [əm], **-on** [ən]	**-a** [ə]
continu**um** [kən'tɪnjuəm] *континуум*	continu**a**
criteri**on** [kraɪ'tɪərɪən] *критерий*	criteri**a (-ions)** [1]
dat**um** ['deɪtəm] *данная величина*	dat**a**
equilibri**um** [ˌi:kwɪ'lɪbrɪəm] *равновесие*	equilibri**a**
maxim**um** ['mæksɪməm] *максимум*	maxim**a (-ums)**
medi**um** ['mi:djəm] *среда*	medi**a (-ums)**
minim**um** ['mɪnɪməm] *минимум*	minim**a (-ums)**
moment**um** [mou'mentəm] *количество движения*	moment**a (-ums)**
phenomen**on** [fɪ'nɔmɪnən] *явление*	phenomen**a**
quant**um** ['kwɔntəm] *квант*	quant**a**
spectr**um** ['spektrəm] *спектр*	spectr**a (-ums)**
trat**um** ['strɑ:təm] *слой, пласт*	strat**a**
symposi**um** [sɪm'pouzjəm] *симпозиум*	symposi**a (-ums)**
vacu**um** ['vækjuəm] *вакуум*	vacu**a (-ums)**
-is [ɪs]	**-es** [i:z]
analys**is** [ə'næləsɪs] *анализ*	analys**es**
ax**is** ['æksɪs] *ось*	ax**es**
bas**is** ['beɪsɪs] *базис; основа*	bas**es**
cris**is** ['kraɪsɪs] *кризис*	cris**es**
hypothes**is** [haɪ'pɔθɪsɪs] *гипотеза*	hypothes**es**
parenthes**is** [pə'renθɪsɪs] *скобка*	parenthes**es**
synthes**is** ['sɪnθɪsɪs] *синтез*	synthes**es**
-us [əs]	**-i** [aɪ]
calcul**us** ['kælkjuləs] *исчисление; математический анализ*	calcul**i (-uses)**
foc**us** ['foukəs] *фокус*	foc**i**

[1] Здесь и далее в скобках даны современные формы множественного числа.

Продолжение

Единственное число	*Множественное число*
locus ['loukəs] *геометрическое место точек*	loci
modulus ['mɔdjuləs] *модуль*	moduli (-uses)
nucleus ['nju:klɪəs] *ядро*	nuclei (-uses)
radius ['reɪdjəs] *радиус*	radii (-uses)
rhombus ['rɔmbəs] *ромб*	rhombi (-uses)
-a [ə]	**-ae** [i:]
abscissa [æb'sɪsə] *абсцисса*	abscissae (-as)
corona [kə'rounə] *корона*	coronae (-as)
formula ['fɔ:mjulə] *формула*	formulae (-as)
hyperbola [haɪ'pə:bələ] *гипербола*	hyperbolae (-as)
nebula ['nebjulə] *туманность*	nebulae (-as)
Идентичные формы единственного и множественного числа	
apparatus [ˌæpə'reɪtəs] *аппарат, прибор*	apparatus
headquarters ['hed'kwɔ:təz] *штаб*	headquarters
means [mi:nz] *средство*	means
news [nju:z] *новость*	news
series ['sɪəri:z] *ряд*	series
species ['spi:ʃi:z] *вид*	species

V. *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в Present Continuous страдательного залога.*

1. Passive and active radio waves are now being used to explore the Moon. 2. For weather forecasting vast sums of money are being spent on meteorological satellites. 3. Incompressible flows are now also being studied intensively by aerodynamisists. 4. New titanium alloys are being introduced into production rapidly. 5. This type of battery is being developed along two lines. 6. A large number of different types of guided missiles are being developed. 7. New discoveries are constantly being made in the field of astronautics.

VI. *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в Present Perfect страдательного залога.*

1. Venus has been called the Earth's twin sister. 2. The visible features of the Moon's surface have been discussed by astronomers. 3. A number of ideas have been put forward to account for the appear -

ance of the surface of the Moon. 4. Photometric and other methods have been used in an attempt to determine the nature of the material of the Moon's surface. 5. The atmosphere and surface of Mars have been studied more than those of any other planet. 6. Many types of simulators have been constructed for the study of space rendezvous problems. 7. Several different methods have been proposed to utilize nuclear energy for rocket propulsion. 8. Man's view of the Universe has been enormously expanded during the last decades. 9. Fantastic advancements have been made during the past decades in the performance of gas-turbine power plants. 10. Wheeled vehicles have been more thoroughly analysed than any other type. 11. Since that time many experiments have been made. 12. Since that time a great many papers have been written on the subject of perturbations due to the Earth's oblateness. 13. Since the use of X-rays and radium in medicine, men have been exposed to much larger quantities of radioactivity than before. 14. Since 1820, sunspot activity on the Sun has been recorded by astronomers. It has been determined that every 11 years sunspot activity is maximum.

VII. *Ответьте на вопросы к тексту.*

1. What variation of the standard helicopter do you know? 2. What is used for vertical take-off of a compound helicopter? 3. What is done with the rotor for vertical descent of a compound helicopter? 4. Why is there a decrease in the vertical take-off and hovering capab i l i t y of a compound helicopter? 5. What propellers has the t i l t - prop airplane? 6. Have the tilt-prop airplanes rotors? 7. Have they wings? 8. What is the range of cruising speeds of tilt-prop airplanes? 9. Why is the copter the best hovering and lift-off machine? 10. In what case a crash of VTOL is almost inevitable?

У РО К 9

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Слова общего корня в английском и в русском языках. 3. Прилагательные с суффиксами. 4. Сопоставление глагольного управления предлогами в английском и в русском языках (страдательный залог). 5. Глаголы с послелогами в страдательном залоге. 6. Глагольные фразеологические сочетания в страдательном залоге.

Термины к уроку

freewheeling rotor самовращающийся несущий винт
full throttle полностью открытый дроссель
gross payload полная полезная нагрузка
lifting wing несущее крыло
operating cost стоимость эксплуатации
power setting положение рычага управления двигателем
run разбег; пробег
service обслуживание; эксплуатация; служба
scheduled service полет по расписанию
shut down выключать двигатель
speed скорость; набирать скорость
streamline по потоку
survival спасение; **выживание**
trail укладывать

ТЕКСТ

VTOL AIRCRAFT

(continued)

1. An important characteristic of most VTOLs is their capability for STOL operations from short runways while making airplane-type running take-offs and landings. When operating this way, they can take off and climb out at quite severe angles, using little runway, with high payloads and without placing undue strain on the engines. This is true of the helicopter, compound helicopter, and the tilt-prop. Of these three types of VTOLs, the new tilt-props are the aircraft that might stand to benefit most from the STOL type of operation. They are the fastest in forward flight and therefore offer the most from the viewpoint of speed and range. However, they seem to be the poorest hovering machines of the three types and might be operated as short take-off airplanes — with the propellers in the horizontal position — whenever possible with certain important benefits. The vertical take-off ability could then be saved for special situations where it would be needed. This might be where a take-off would be made in the short take-off airplane configuration with a maximum gross payload. At the end of the flight after enough fuel had been used up, the ship might then be light enough to make a vertical descent landing easily at a heliport.

2. This description of how a tilt-prop VTOL might be operated as a short take-off airplane in order to increase its payload touches on a crucial point: the question of whether these aircraft have any reasonable chance of economic survival, particularly if they are used for carrying passengers in scheduled service. The outstanding fact that has been learned from the experience of most helicopter airlines in the last decade is that operating costs are too high; as a result, fares are too high and passenger volumes too small. Whether faster, larger VTOLs and STOLs are the answer, or even part of the answer, remains to be seen. For the most part, the development of these aircraft has been funded by the military, and they have been designed for military requirements. This consideration, as well as many economic and technical factors, makes it impossible to do justice to the question here. It may be helpful, however, to outline a few of the important technological trends now under way.

3. One trend is toward an increase in the size of transport helicopters, for very much the same reason that transport airplanes have grown steadily in size in the last twenty to thirty years. All things being equal, the larger the helicopter, the lower the cost per seat mile; the cost of operating new, larger aircraft ordinarily does not rise in the same proportion as the increase in passenger capacity. A forty-passenger helicopter can operate with only a pilot and copilot — exactly the same number of flight crew members as a twenty-passenger machine. Here, the capacity has doubled, but the crew cost is the same.

4. Another basic trend, as we have noted, is the consistent effort to reduce drag so that a higher cruise speed is possible, while retaining the high-lift capability, needed for vertical take-off and hovering. The examples include the compound helicopter, with its freewheeling rotor and additional means of thrust; the tilt-prop airplanes that can convert to a low-drag high-speed airplane configuration for forward flight; and the jet VTOL airplanes. Any number of other experimental configurations have been proposed, and several involve the complex stopped-rotor concept. This would consist of an aircraft furnished with a lifting wing in combination with a rotor that could be slowed down, and then stopped entirely while in flight. For high forward speed the rotor would then form a fixed lifting surface. Still another somewhat similar — though more complicated — approach would have the rotor stopped, the blades nearly folded and trailed aft in a streamline position, and then the entire bundle stowed away in the top of the fuselage while the aircraft sped along on the lift of its wing.

5. There has also been a particularly strong engineering effort in another area: the creation of new turbo-shaft engines that are lighter and more powerful — in other words, the most power for the least weight. This, of course, benefits any type of aircraft, but it is particularly vital for VTOL machines that need great levels of thrust for a take-off that is a direct struggle against gravity. Part of the engine designer's problem is that the vast power needed for take-off is not needed for an economic cruise speed. Then, too, there is the fact that turbo-jet engines run best at full throttle; they cannot run with any efficiency at partial power settings. For this reason various VTOL designs have been proposed with ultra-lightweight extra engines to be run at full power at take-off and landing and then shut down completely during cruise flight.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **ability, capability, capacity, climb, run, service.**

climbing ability, load-carrying ability, range ability, speed ability, weight-lifting ability;

airfield capability, altitude capability, blind-landing capability, escape capability, speed capability, water landing capability;

airport capacity, baggage capacity, cargo-passenger capacity, carrying capacity, hold capacity, lift capacity, payload capacity, runway capacity, seating capacity, total capacity, traffic capacity;

flat climb, full-throttle climb, initial climb, maximum climb, normal climb, optimum climb, shallow climb, steady climb, subsonic climb, supersonic climb;

ground run, landing run, level run, record run, take-off run;

aeronautical service, airfield service, flight service, maintenance service, traffic service, weather service.

II. *а) Переведите без словаря следующие английские слова из текста, имеющие общий корень с русскими словами.*

characteristic *n*, combination *n*, configuration *n*, experimental *a*, fact *n*, factor *n*, fuselage *n*, horizontal *a*, machine *n*, maximum *n*, mile *n*, operation *n*, passenger *n*, pilot *n*, problem *n*, proportion *n*, result *n*, technical *a*, transport n, type *n*, vertical a;

б) *Уточните значение нижеприведенных слов в словаре. В тексте урока их рекомендуется перевести следующим образом.*

А б з а ц 1: helicopter *n* вертолет; position *n* положение; heliport *n* вертодром.

А б з а ц 2: economic *a* экономичный; service *n* эксплуатация, полеты; decade *n* десятилетие; economic *a* экономический; technological *a* технический.

А б з а ц 4: rotor *n* несущий винт; complex *a* сложный; position *n* положение; lift *n* подъемная сила.

А б з а ц 5: gravity *n* тяготение; economic *a* экономичный.

III. *Переведите прилагательные со следующими суффиксами.*

-able [əbl : adjustable, allowable, changeable, considerable, favourable, movable, reliable, remarkable, steerable, valuable, variable;

-ible [əbl : admissible, convertible, permissible, responsible, reversible;

-ant [ənt : ascendant, descendant, espectant, important, resistant;

-ent [ənt : dependent, different, existent, insistent;

-ive [ɪv : active, attractive, constructive, corrective, creative, detective, effective, expressive, initiative, intensive;

-al [əl : accidental, agricultural, centrifugal, continental, experimental, formal, frontal, fundamental, global, industrial, normal, operational, orbital, sectional, structural;

-ic(al) [ɪk(əl) : algebraic, atomic, ceramic, climatic, organic, metallic, ohmic;

analogic(al), astronomic(al), biologic(al), economic(al), geographical), graphic(al), harmonic(al), historic(al), meteorologic(al), metric(al), periodic(al), technologic(al);

-ful [ful : careful, doubtful, helpful, meaningful, peaceful, powerful, successful, truthful, useful, watchful, wonderful;

-less [lɪs : aimless, careless, doubtless, endless, helpless, hopeless, meaningless, moonless, motionless, nameless, powerless, shapeless, soundless, useless, weightless;

-ous [əs : advantageous, adventurous, dangerous, famous, spacious;

-ary [ərɪ : disciplinary, elementary, evolutionary, fragmentary, momentary, planetary, primary, reactionary, revolutionary, segmentary, stationary, supplementary.

IV. *Переведите предложения со следующими глаголами в различных временах страдательного залога.*

а) **to affect** *воздействовать на;* **to follow** *следовать за;* **to influence** *влиять на;* **to report** *сообщать о;* **to track** *следить за.*

1. The speed of sound **is not affected** by a change in atmospheric pressure because the density also changes. 2. A rocket engine **was unaffected** by its environment. 3. The first two chapters of the book give elements of kinematics and of dynamics, and **are followed** by a study of the motion of rocket- and jet-powered vehicles. 4. The first rocket **has been followed** by a number of smaller rockets. 5. The dynamic of the flow **may be** profoundly **influenced** by different effects. 6. Choice of the diameter of the vehicle **is influenced** by many factors. 7. Radio waves **are influenced** by the troposphere and the ionosphere in their passage to or from the Earth's surface. 8. The spacecraft design **is** obviously strongly **influenced** by the environment of space. 9. Drop tower experiments at high Bond numbers **were not reported.** 10. The early space vehicles **have been tracked** by ground-based radar and controlled by telemetered guidance commands. 11. The flight of the automatic interplanetary station **is being tracked** by a special centre. 12. The satellite flight **must be tracked** continuously by radar.

б) **to account for** *объяснять;* **to arrive at** *достигать чего-либо;* **to deal with** *иметь дело с;* **to insist (on) upon** *настаивать на;* **to refer to** *ссылаться на;* **to rely on (upon)** *полагаться на;* **to send for** *посылать за;* **to speak about (of)** *говорить о;* **to write about** *писать о.*

1. Flight results **must be accounted for.** 2. In this report gravity **is** satisfactorily **accounted for.** 3. The idealized structure of the fuselage **was** finally **arrived at.** 4. After all these calculations the gravitational attraction of Mars **must be dealt with.** 5. The preflight inspection of the airplane **was insisted upon** by the flight engineer. 6. The high cost of engine development **was referred to** at the beginning of this article. 7. Venus **is** sometimes **referred to** as the "twin planet" of the Earth. 8. The critical acceleration level **is referred to** as the "stability limit". 9. Liquid motions **are** generally **referred to** in the literature as capillary waves. 10. Such a device **cannot be relied upon.** 11. This rapid trajectory calculation **can be relied upon.** 12. The equipment for this experiment **was sent for.** 13. The satellite defence problem **was** much **spoken about.** 14. The lunar exploration programme **has been** much **written about.**

V. *Переведите предложения, обращая внимание на перевод следующих глагольных фразеологических сочетаний в различных временах страдательного залога.*

to take account of *учитывать;* **to take advantage of** *воспользоваться, использовать;* **to make application of** *применять;* **to call attention to** *привлекать внимание к, обращать внимание на;* **to confine attention to** *ограничиваться;* **to draw attention to** *привлекать внимание;* **to give attention to** *уделять внимание;* **to pay attention to** *обращать внимание на;* **to take care** *заботиться, позаботиться;* **to draw a conclusion** *делать вывод;* **to give consideration to** *рассмат-*

ривать, обсуждать; **to place emphasis on** *подчеркивать, выделять; придавать значение;* **to make mention of** *упоминать;* **to make provision** *предусматривать, обеспечивать; принимать меры.*

1. **Account should be taken of** the boundary layer oscillations. 2. In planning the development of bases on the Moon **account must be taken of** environmental conditions. 3. In dropping the parachutists **account should be taken of** the local surface conditions. 4. **Advantage is** often **taken of** the effect of the solar radiation. 5. **Advantage was taken of** this newly-discovered phenomenon. 6. **Application should be made of** this new design of a swept wing. 7. **Attention has been called to** these specific features of the turbofan engines. 8. Our **attention was confined to** a brief description of the experiment. 9. **Attention is confined** here **to** considering the simplest shapes of airplane wings. 10. **Attention has been drawn to** some of the more specific problems of the parachute recovery. 11. **Attention will** now **be given to** the incompressible fluids. 12. In this book **attention is** also **given to** a riview of the propulsion systems. 13. Particular **attention must be given** by the author **to** the sound problem. 14. Special **attention has been paid to** the laboratory investigations. 15. **Care is taken** not to overheat this fluid. 16. **Care was taken** to minimize the air drag effect. 17. **Care should be taken** to minimize the friction effect. 18. Certain general **conclusions can be drawn** from a study of fig. 2. 19. Careful **consideration was given to** the selection of suitable vibration frequencies. 20. **Consideration is given to** the following onboard systems. 21. **Consideration was** also **given to** a rectangular wing. 22. Careful **consideration must** also **be given to** exact positional relationship of the space stations. 23. **Emphasis is placed** chiefly **on** low frequencies. 24. **Mention has** already **been made of** the aircraft high performances. 25. So far, no **mention has been made of** the Moon's topographical details. 26. **Mention has been made of** the possibility of using approximation method. 27. **Provisions must be made** to minimize the jamming of emergency exits in an airplane.

V I . *Ответьте на вопросы к тексту.*

1. What is an important characteristic of most VTOLs? 2. What VTOLs can take off and climb out at severe angles? 3. What VTOL aircraft are the fastest in forward flight? 4. What VTOL aircraft are the poorest hovering machines? 5. What has been learned from the experience of most helicopter airlines in the last decade? 6. How can you explain the technological trend toward an increase in the size of transport helicopters? 7. Does the cost of operating new larger aircraft rise in the same proportion as the increase in passenger capacity? 8. What is another basic technological trend? 9. What is the purpose of a strong engineering effort in creating new turboshaft engines? 10. Can turbo-jet engines run with any efficiency at partial power settings?

У Р О К 1 0

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Слова общего корня в английском и в русском языках. 3. Наречия с суффиксами. 4. Различные времена страдательного залога *(повторение)*.

Термины к уроку

air-breathing engine воздушно-реактивный двигатель
burner форсунка
canopy фонарь
centrifugal compressor центробежный компрессор
compression ratio степень сжатия
drive shaft приводной вал
exhaust gas выхлопной газ
forward flight прямолинейный горизонтальный полет
ground speed путевая скорость
hub втулка
impeller рабочее колесо
input подводимая мощность
propulsive efficiency тяговый к. п. д. двигателя
ram-air pressure скоростной напор
reduction gearing редуктор
rotating blade рабочая лопатка
turbojet турбореактивный двигатель
twin-spool engine двигатель с двухкаскадным компрессором
vane лопатка

ТЕКСТ

TYPES OF AIRCRAFT GAS-TURBINE ENGINES

Turbojets

1. Gas-turbine engines for aircraft come in many types and sizes, each of which has its advantages and also its limitations. The most common type is the uncomplicated turbojet. Because they have no added features such as a fan, propeller, or free turbine, turbojets are sometimes referred to as straight jets.

2. Most turbojets operate best at relatively high altitude, in the 25,000 to 40,000-foot range, although they are able to go very much higher, if need be. There is no simple explanation for the fact that turbojets are so well suited to high-altitude operation. The high-altitude capability of a turbojet is due to a number of reasons, some of which are rather complex. For one thing, this capability is designed into an engine at the time the plans are first laid down on a drawing board. For another, the cold temperature of the air at high altitude gives an engine extra thrust. More importantly, the rarified atmosphere at high altitude reduces airplane drag (which may be thought of as the air resistance of flight). Low drag means that the Mach number selected for cruising can be attained at a low engine thrust setting. This, in turn, results in a relatively low fuel consumption for the airspeed attained — a feature that makes for economical operation.

3. But, good as they are at their optimum altitude, high thrust at low airspeed, is not a turbo-jet characteristic. To be at their best, turbojets need the ram-air pressure at their inlet which comes only with speed. Therefore, they require very long runways for take-off.

4. Turbojets are classified according to the kind of compressor they use. For years, they had only centrifugal compressors because this was the type that designers knew best how to build. Centrifugal compressors operate by taking in air near a hub at the centre and rotating it with an impeller.

5. As the impeller whirls the air at high speed, centrifugal force carries the air to the perimeter of the impeller at a considerable velocity. Here the air is collected in a diffuser to increase the pressure, then led to a manifold which, in turn, feeds it to the engine's burners.

6. The early centrifugal compressor turbojets were (and still are) both reliable and simple. But the amount of thrust they can produce is relatively low because their compression ratio is not very high. Nevertheless, there are several turbo-prop and turbo-shaft engines now in current production that employ a compressor arrangement using one or more centrifugal-type compressors. The improved design of these engines makes them far superior to the centrifugal-compressor power-plants of several years ago.

7. The majority of today's turbojets use an axial compressor. Axial compressors are used, especially in the larger engines, because they are capable of producing high compression ratios, sometimes as high as 13 : 1, or more. An axial compressor, as the name implies, compresses air as it flows in an axial direction through an engine. A series of rotating blades and stationary vanes work on the air as it passes through a series of stages inside the compressor. Each stage adds to the compression process.

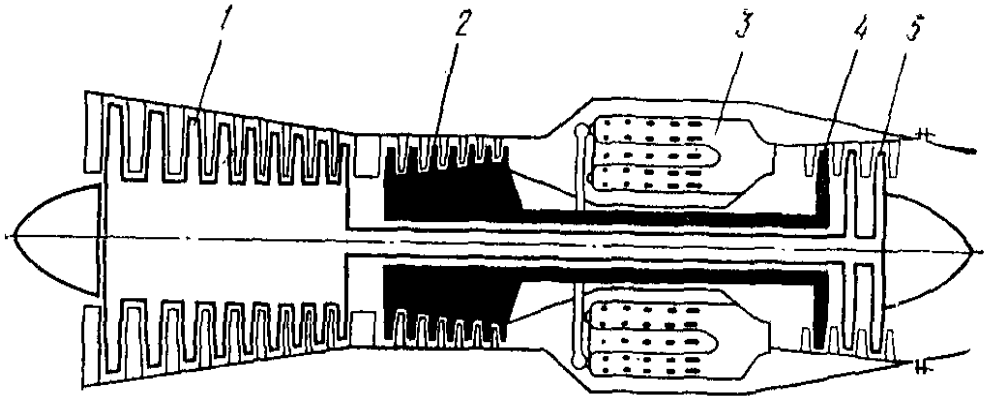

Fig. 2. Dual-axial Compressor Turbojet
1 — low-pressure compressor; 2 — high-pressure compressor; 3 — combustion chamber; 4 — turbine for the high-pressure compressor; 5 — turbine for the low-pressure compressor

8. There are two types of axial-compressor engines, those with so-called single compressors and those with dual compressors. In dual-compressor engines (sometimes called twin-spool engines), there are two compressors that are mechanically independent of one another, although they are related as to airflow (see Fig. 2). Each compressor has its own turbine. The turbine for the forward, or low-pressure compressor, is the rear turbine. It is connected to the low-pressure compressor by a drive shaft that passes through the hollow drive shaft for the high-pressure compressor and turbine unit.

9. If a gas generator (turbojet) turns an aircraft propeller through a system of gears, it becomes a turboprop (see Fig. 3). The propeller-drive reduction gearing may be driven by the shaft from the same turbine that rotates the compressor, or the gearing may be driven by a shaft from a so-called free turbine that rotates independently in the exhaust gas stream of the basic gas generator. In either case, the gas generator for a turboprop might be either a single- or dual-compressor type, although, as this is written, there are no dual-axial compressor turboprops in production.

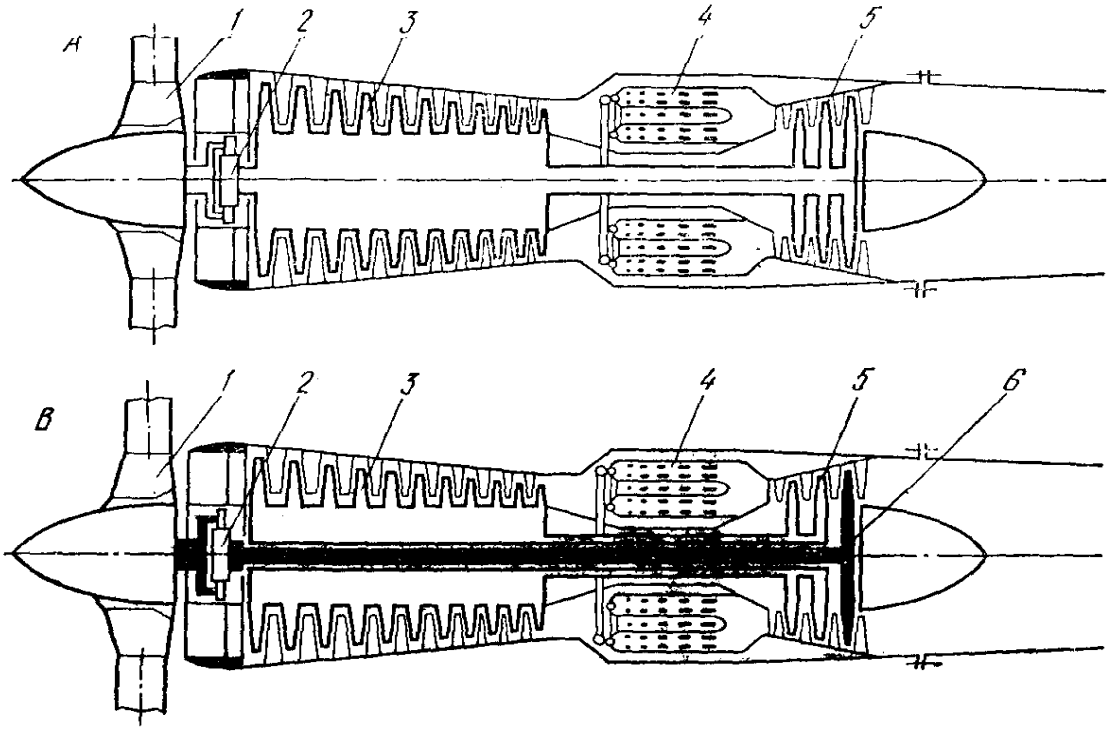

Fig. 3. Single-axial Compressor Turboprop
A — direct-drive turboprop; B — free turbine-drive turboprop; 1 — propeller; 2 — reduction gear; 3 — compressor; 4 — combustion chamber; 5 —compressor turbine; 6 —propeller turbine

10. Although a turboprop is more complicated and heavier than a turbo-jet engine of equivalent size and power, it will deliver more thrust up to medium-high subsonic airspeeds. However, the advantage decreases as flight speed increases. In normal cruising-speed ranges, the propulsive efficiency (output divided by input) of a turboprop remains more or less constant, whereas the propulsive efficiency of a turbojet increases rapidly as airspeed increases. The spectacular performance of a turboprop during take-off and climb is the result of the ability of the propeller to accelerate a large mass of air while the aircraft is moving at relatively low ground and flight speed.

(to be continued)

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **engine, power plant, turbine, turbojet, turboprop.**

air-breathing engine, aircraft engine, aircraft rocket engine, airplane engine, copter engine, diesel engine, gasoline engine, gas-turbine engine, helicopter engine, internal-combustion engine, jet engine, jet-prop engine, liquid-cooled engine, liquid-fuel rocket engine, petrol engine, piston engine, plasma engine, prop-jet engine, pulse-jet engine, ram-jet engine, reciprocating engine, rocket engine, turbine engine, turbo-fan engine, turbo-jet engine, turbo-prop engine, turbo-shaft engine;

air-breathing power plant, a u x i l i a r y power plant, helicopter power plant, nuclear power plant, power plant, rocket power plant, turbine power plant, turbo-fan power plant, VTOL power plant;

air-cooled turbine, axial-flow turbine, cooled turbine, gas turbine, high-pressure turbine, propeller turbine, single-stage turbine;

axial flow turbojet, by-pass turbojet, centrifugal-flow turbojet, nuclear turbojet;

free-turbine turboprop, two-spool turboprop.

II. *а) Переведите без словаря следующие английские слова из текста, имеющие общий корень с русскими словами.*

airplane *n*, atmosphere *n*, centre *n*, classify *v*, compressor *n*, diffuse *n*, equivalent a, fact *n*, gas *n*, generator *n*, mass *n*, mechanically *adv*, normal *a*, optimum *a*, plan *n*, result *n*, system *n*, temperature *n*, turbine *n*, type *n*;

б) Уточните значение нижеприведенных слов в словаре, В тексте урока их рекомендуется перевести следующим образом.

А б з а ц 1: limitation *n* недостаток; propeller *n* воздушный винт.

А б з а ц 2: results in... приводит к...; economical *a* экономичный.

А б з а ц 3: characteristic *n* характерная черта.

А б з а ц 6: production *n* производство.

А б з а ц 7: series *n* ряд; stationary *a* неподвижный.

А б з а ц 10: constant *a* постоянный.

III. *Переведите наречия со следующими суффиксами..*

-ly [lɪ] : continuously, completely, experimentally, manually, permanently, simply, slowly, smoothly, substantially, permanently;

alternatively, badly, directly, fairly, hardly, incidentally, necessarily, nearly, occasionally, previously, properly, readily, really, unfortunately;

aerodynamically, aeronautically, astronautically, astronomically, geographically, mathematically, mechanically, physically, physiologically, scientifically, symmetrically, technologically, theoretically;

-ward [wəd] : backward, forward, downward, upward, northward, southward, west-

ward, eastward;

-wise [waiz : clockwise, counter-clockwise, crosswise, likewise, otherwise.

IV. *Переведите предложения, обращая внимание на перевод наречий.*

a) 1. The great majority of space vehicles are aerodynamically unstable. 2. This function represents geometrically an optimal surface. 3. The lift of an airfoil can be determined mathematically. 4. For each test, velocity data were obtained photographically. 5. Physically, this type of problem arises when a material changes its state. 6. The two-spar construction of the wing is not technically suitable for this kind of airplane.

b) 1. Characteristically, all spacecraft are as small and light as it is practical to construct them. 2. Tests are currently in preparation at the laboratory. 3. Distance travelled is directly proportional to speed. 4. At a height of 36,000 ft or more, the air temperature remains fairly constant at about —56°C. 5. This is a fairly simple theorem. 6. Meteorites differ greatly amongst themselves in size, weight and velocity. 7. A successful investigation of an aircraft accident largely depends on good organization. 8. The rocket engineer is mostly interested in getting as much thrust as he can. 9. There are many flows in which these coefficients are nearly constant. 10. Obviously, the optimum design is not necessarily the cheapest one. 11. Theories proposed for the origin of the Moon necessarily involve the origin of the entire solar system. 12. The missile returns to its original position readily. 13. The chosen propellants must be readily available. 14. The company tested a 38-passenger, 10-ton air cushion vehicle for river operation. 15. In a suitably arranged high-speed wind tunnel shock waves can be photographed. 16. This, unfortunately, is not the case. 17. The dark markings on the face of the Moon were variously considered to be seas, forests, etc.

V. *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в различных временах страдательного залога (повторение):*

1. Nuclear rockets will not be used for some time for transporting people because of the obvious radiation hazards. 2. Rocket engines can be classified as follows. 3. The electric conductivity of a plasma is influenced by the intensity of the gravitational field. 4. The combination of a spacecraft and its launch vehicle is called a space vehicle. 5. This chapter is concerned with the exploration of the planets, satellites and asteroids. 6. The aircraft with a total seating capacity of more than 5 persons must be provided with at least one emergency exit. 7. Different types of unguided missiles have been developed. 8. Our Sun and its planets are called the solar system. 9. In this chapter emphasis is placed upon fuselages, wings, and control surfaces, and considerable attention is given to cockpits, cabins, compartments,

canopies, windows, landing gears and power-plant structural parts. It is not intended to

describe the details of all aircraft or all the details of any particular aircraft. 10. Launch vehicles are usually made up of several stages. 11. A full scale model of the astronaut's space suit has been constructed and tested. 12. The behaviour of the system is strongly influenced by gravity.

VI. *Ответьте на вопросы к тексту.*

1. What is the most common type of the gas-turbine engine? 2. In what altitude range do most turbojets operate? 3. According to what are turbojets classified? 4. In what way do centrifugal compressors operate? 5. Do the majority of today's turbojets use an axial or a centrifugal compressor? 6. What are compression ratios of axial compressors? 7. How many types of axial-compressor engines do you know? 8. In what case does a turbojet become a turboprop? 9. What engine is more complicated and heavier, a turboprop or a turbojet? 10. What can you say of the propulsive efficiency of a turboprop and a turbojet in normal cruising-speed ranges?

У Р О К 11

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Слова общего корня в английском и в русском языках. 3. Глаголы с суффиксами. 4. Составные глаголы. 5. Существительные, соответствующие составным глаголам. 6. Функции инфинитива.

Термины к уроку

axial-flow fan осевой вентилятор
carry aloft поднимать в воздух
case кожух
chamber камера
circumnavigation навигация по замкнутому маршруту
combustion chamber камера сгорания
commercial гражданский
discharge истекать; выпускать
drop off падать
duct канал; труба; трубопровод; подавать, нагнетать по трубопроводу
duct-enclosed fan вентилятор в кольцевом обтекателе
exhaust выпускать *(газ)*
fanjet турбовентиляторный двигатель
gear-driven propeller воздушный винт с редукторным приводом
guided управляемый
inlet вход; впуск; входное отверстие
internal engine двигатель внутреннего сгорания
launch запускать
propellant топливо
pulsejet пульсирующий воздушно-реактивный двигатель
ram air воздух, сжатый за счет скоростного напора
ramjet прямоточный воздушно-реактивный двигатель
shutter пластинчатый клапан
stage ступень
steering управление

ТЕКСТ

TYPES OF AIRCRAFT GAS-TURBINE ENGINES

(continued)

Turbofans

1. Fanjets and turbofans are one and the same thing. In principle, the turbofan (or fanjet) is the same as the turboprop except that the ratio of the secondary airflow (i . e . , the airflow through the fan or propeller) to the primary airflow through the basic engine is less. Also, in the turbofan, the gear-driven propeller is replaced by a duct-enclosed, axial-flow fan whose rotating blades and stationary vanes are considerably larger but otherwise similar to the blades and vanes of an axial compressor (see Fig. 4).

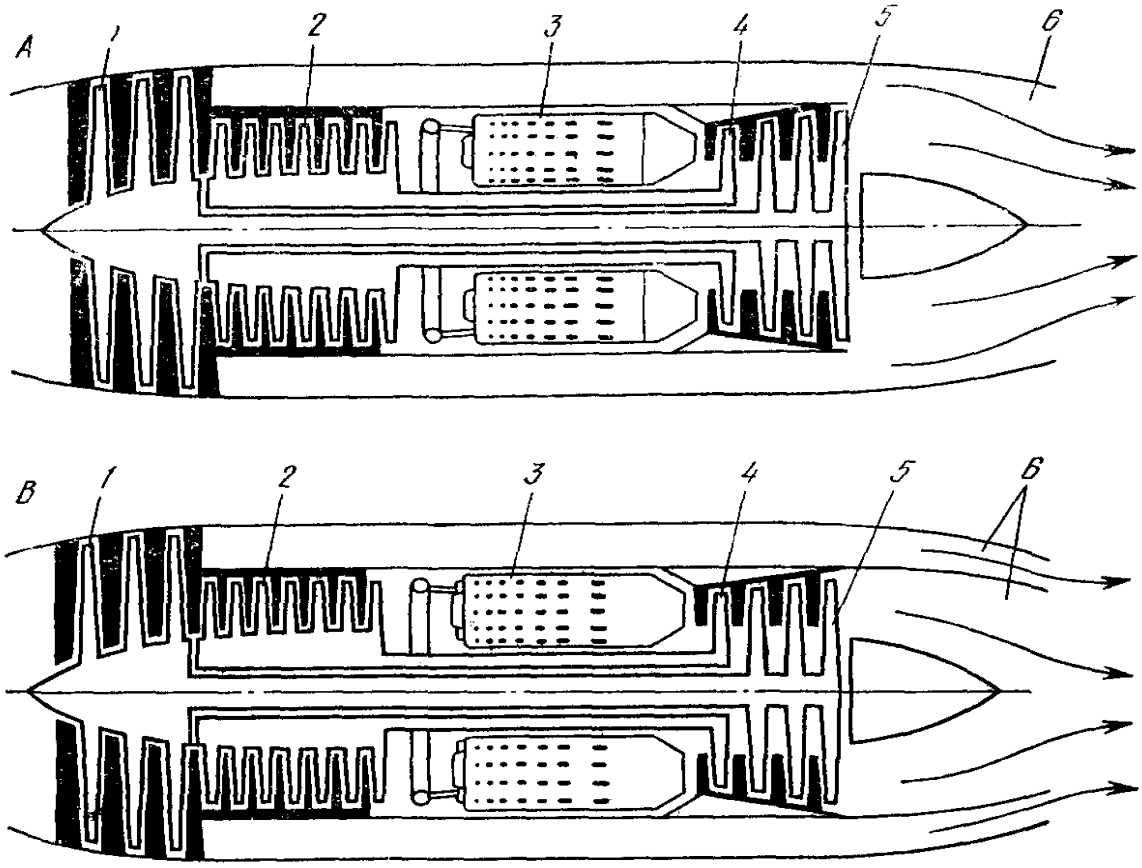

Fig. 4. Turbofans
A — forward turbofan with mixed exhaust; B — forward turbofan with non-mixed exhaust; 1 — fan; 2 — compressor; 3 — combustion chamber; 4 — compressor turbine; 5 — fan turbine; 6 — nozzle

2. There are two principal configurations for a turbofan, each of which has several variations. In one configuration, the fan is placed at the front of the engine where it is an integral part of the compressor. When the engine is a dual-compressor type, it is a part of the for-

ward, low-pressure compressor. In the other configuration, the fan is mounted at the rear

of the engine where it forms the rim, or outer perimeter, of a free turbine that rotates by itself in the exhaust gases discharged from the engine. These two turbo-fan designs are called forward-fan and aft-fan engines, respectively.

3. In both turbo-fan configurations, the fan makes a substantial contribution to the total thrust. Over and above the thrust produced by the basic engine, the fan accelerates the air passing through it to generate thrust of its own in the manner of the propeller of a turboprop. The fan air is exhausted without passing through the engine; it is not burned, with fuel or used for internal engine cooling.

4. Two different duct designs are used with forward-fan engines. Either the air exhausted by the fan may be ducted overboard directly after it leaves the fan, or it may be ducted along the outer case of the basic engine to mix, or not mix (depending upon the design), with the turbine exhaust gases before the gases pass through the jet nozzle.

5. The fundamental difference between a turbofan and a turboprop is that the airflow through the fan is controlled by the design of the engine in such a manner that the air velocity through the fan blades is not affected very much by the speed of the aircraft. (How this is accomplished will be explained later.) This means that the loss of operational efficiency at high air speeds that limits the airspeed capability of turbo-prop aircraft is eliminated in turbo-fan aircraft. Indeed, supersonic aircraft not only can, but are being powered by turbofans.

6. Turbofans are rapidly becoming the most widely used of all the types of jet engines, particularly in large multi-engine aircraft. The turbofan is, in effect, a compromise between the good operating efficiency and high-thrust capability of a turboprop and the highspeed, high-altitude capability of a turbojet. At cruising altitude, the engine-propeller combination of a turboprop loses efficiency rapidly at airspeeds above 400 knots.[1] Not only does the turbofan have no such limitation but it is much simpler than a turboprop.

7. The complexity and weight of the propeller reduction gearing and the intricate propeller-governing feature of a turboprop are completely eliminated in a turbofan. The turbofan is therefore not only lighter than a turboprop but can never be plagued by any of the malfunctions to which a propeller and its associated systems are susceptible.

8. The fact that the fan air does not pass through the basic engine enables a, turbofan to achieve a relatively low specific fuel consumption. In addition, because it accelerates a large mass of air to restively low velocity, even at very low aircraft speeds, a turbofan, like a turboprop, produces much more thrust than a turbojet during takeoff and the initial climb.

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[1] knot — морской узел (мера длины = 1,853 м.)

9. Another advantage of the turbofan is a lower noise level, which

is an important feature at all commercial airports. The lower level of noise occurs because a turbo-fan engine has at least one additional turbine stage to drive the fan. Extraction of more power from the engine exhaust gases as they pass through the additional turbine (or turbines) serves to reduce the velocity of the engine exhaust. Less velocity through the jet nozzle results in less noise.

Ramjets and Pulsejets

10. The simplest jet engine of all is the ramjet (Fig. 5), which has no moving parts. Such an engine is but l i t t l e more than a pipe equipped with a fuel metering and injection system. Because a ramjet must be accelerated by some means other than the engine's own power to a very high speed before it will operate, the engines have l i m i t e d use. They have principally been employed in guided missiles that must be carried aloft and launched by a conventional aircraft.

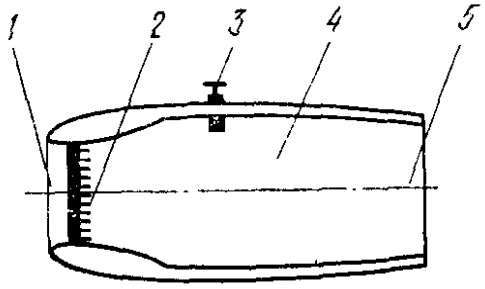

Fig. 5. Ramjet Engine
1 — a i r inlet; 2 — fuel nozzles; 3 — igniter; 4—combustion chamber; 5 — j e t nozzle

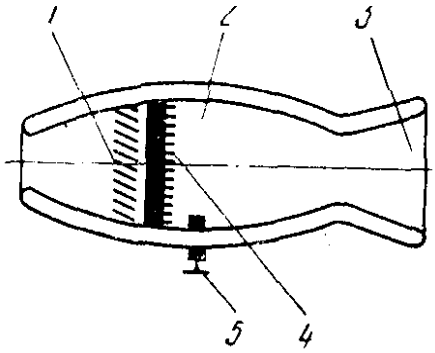

Fig. 6. Pulse-jet Engine
1 — shutters; 2 — combustion chamber; 3 — jet nozzle; 4 — fuel nozzle; 5 — igniter

11. A pulsejet (Fig. 6) is a ramjet with a set of shutters, spring-loaded to remain in the closed position normally, placed across the engine's air inlet. When the engine is launched at a speed sufficient to maintain operation, ram air pressure forces the shutters open. Fuel is injected and burned continuously in the combustion chamber. As soon as the combustion chamber pressure equals the ram air pressure, the shutters close. The combustion gases are ejected through the jet nozzle at the rear, generating thrust. When the pressure in the combustion chamber drops off, the shutters open again, admitting more air. The cycle repeats itself with great rapidity.

Rocket Motors

11. The solid fuel rocket motor is the oldest and most widely known jet-propulsion device. The body consists of a cylinder in which a solid fuel thoroughly mixed with a solid oxidizer is carried. When the fuel, called a propellant, is burned with the oxidizer, the rocket

develops thrust by accelerating the gases of combustion through a jet nozzle. There are also l i q u i d propellant rockets (Fig. 7) which operate much in the same manner.

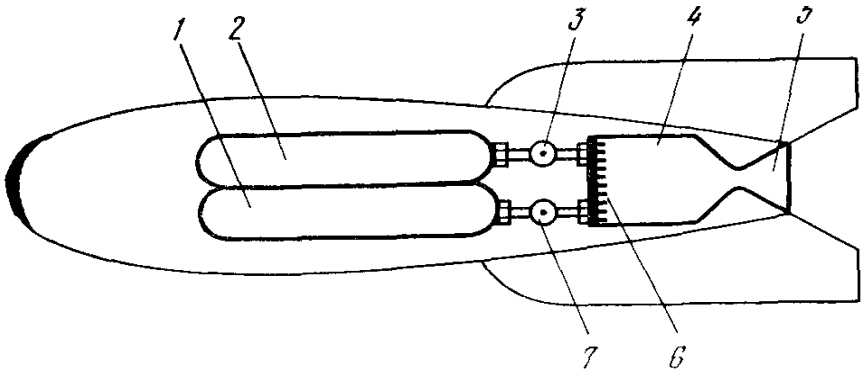

Fig. 7. Liquid Propellant (Fuel) Rocket Motor
1 — l i q u i d oxygen (o x i d i z e r); 2 — l i q u i d hydrogen (f u e l); 3 — fuel valve; 4 — combustion chamber; 5 — j e t nozzle; 6 — fuel and oxidizer injection and m i x i n g nozzles; 7 — oxidizer valve

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **chamber, compressor, fan, fuel, inlet, motor, nozzle, propellant.**

a l t i t u d e chamber, combustion chamber, cooling chamber, engine chamber, gas chamber, pressure chamber;

air compressor, axial compressor, centrifugal compressor, high-pressure compressor, low-pressure compressor;

axial-flow fan, centrifugal fan;

alcohol fuel, aviation fuel, gas fuel, hydrogen fuel, kerosene fuel, l i q u i d fuel, nuclear fuel, petroleum fuel, rocket fuel, solid fuel;

air inlet, nozzle inlet, variable inlet;

electric motor, hydraulic motor, jet motor, l i q u i d motor, pulsejet motor, rocket motor, turbine motor;

adjustable nozzle, aerodynamic variable nozzle, exhaust nozzle, exit nozzle, fixed-area nozzle, rotating nozzle, vectorable nozzle;

gaseous propellant, l i q u i d propellant, solid propellant.

II. *а) Переведите без словаря следующие английские слова из текста, имеющие общий корень с русскими словами.*

compressor *n*, configuration *n*, cycle *n*, cylinder *n*, efficiency *n*, fact *n*, fundamental *a*, gas *n*, perimeter *n*, position *n*, principle *n*, rocket *a*, standard *a*, system *n*, turbine *n*, type *n*.

б) Уточните значение нижеприведенных слов в словаре. В тексте урока их рекомендуется перевести следующим образом:

А б з а ц 1: propeller *n* воздушный винт.

А б з а ц 2: principal *a* основной; variation *n* вариант; front *n* передняя часть; integral *a* неотъемлемый; form *v* образовывать.

А б з а ц 3: contribution *n* влияние; total *a* полный; generate *v* создавать; propeller *n* воздушный винт.

А б з а ц 5: control *v* регулировать; operational *a* эксплуатационный; limit *v* ограничивать.

А б з а ц 6: limitation *n* недостаток.

А б з а ц 7: complexity *n* сложность.

А б з а ц 8: specific *a* удельный; accelerate *v* ускорять.

А б з а ц 9: commercial *a* гражданский.

А б з а ц 30: injection *n* впрыск; accelerate *v* разгонять(ся); operate *v* работать; limited *p.p.* ограниченный; principally *adv* главным образом.

А б з а ц 11: operation *n* полет; inject *v* впрыскивать; eject *v* выбрасывать; generate *v* создавать.

А б з а ц 12: motor *n* двигатель; operate *v* работать.

III. *а) Переведите глаголы со следующими суффиксами.*

-ize [aIz : characterize, crystallize, magnetize, organize, revolutionize, standardize, summarize, vapourize;

activize, centralize, generalize, localize, neutralize, normalize, realize, specialize;

- i f y [IfaI : gasify, classify, qualify;

amplify, electrify, intensify, justify, purify, rarify, simplify, solidify;

-en [qn : frighten, hasten, heighten, lengthen, lighten, strengthen;

blacken, brighten, broaden, fasten, harden, soften, stiffen, straighten, tighten, weaken, widen, worsen;

б) Переведите глаголы с суффиксом **-ate.**

-ate [eIt : accelerate, actuate, complicate, create, decelerate, deviate, duplicate, eliminate, estimate, incorporate, integrate, investigate, regulate, rotate.

IV. *Прочтите и запомните наиболее употребительные составные глаголы.*

bring *приносить*	**bring about** *приводить к (результату)*
	bring down *сбивать*
	bring up *поднимать (вопрос)*
build *строить*	**build up** *создавать, образовывать*
carry *нести*	**carry away** *уносить, отводить*
	carry on *проводить (опыт)*
	carry out *выполнять*
do *делать*	**do away** *избавляться*
f i n d *находить*	**find out** *выяснять, выявлять*
get *получать*	**get out** *выходить*
give *давать*	**give off** *отдавать, излучать*
	give up *отказываться*
go *идти*	**go on** *продолжать*
	go over *рассматривать*

look *смотреть*	**look ahead** *предвидеть*
	look for *искать*
	look through *просматривать*
	look upon *рассматривать*
make *делать*	**make out** *доказывать, выявлять*
	make up *устанавливать*
put *класть, ставить*	**put away** *убирать, устранять*
	put down *записывать*
	put forward *выдвигать*
take *брать*	**take away** *убирать, снимать*
	take off *снимать; взлетать*
	take for *принимать за*
	take up *браться за*
turn *поворачивать*	**turn off** *выключать*
	turn on *включать*
	turn to *обращаться к*
	turn out *оказываться*
work *работать*	**work out** *разрабатывать*

V. *Переведите существительные, соответствующие составным глаголам.*

cut in *включать*	cut-in
cut off *выключать*	cut-off
cut out *выключать*	cut-out
fall away *отделяться*	fall-away
flame out *прекращать горение*	flame-out
fly off *взлетать*	fly-off
lift off *отрываться от земли*	lift-off
lock on *захватывать цель*	lock-on
nose over *капотировать*	nose-over
nose up *поднимать, задирать носовую часть*	nose-up
roll off *крениться*	roll-oft
run in *обкатывать двигатель*	run-in
run up *гонять двигатель на больших оборотах*	run-up
slow down *снижать (скорость)*	slow-down
slow up *снижать (скорость)*	slow-up
splash down *приводняться*	splash-down
take off *взлетать*	take-off
turn about *делать разворот на 180°*	turn-about
turn around *делать разворот на обратный курс*	turn-around
warm up *прогревать*	warm-up

VI. *Переведите предложения, обращая внимание на перевод инфинитива в функции подлежащего и дополнения.*

a) 1. To land the airplane at night is rather difficult. 2. To investigate the danger of radiation is quite necessary. 3. To release the undercarriage was impossible and the airplane crashed on landing. 4. To determine the accurate position of the plane is the task of

navigator. 5. To provide an explanation for this phenomenon is the task of the present article.

б) 1. It was essential to solve the problem of aerodynamic stability. 2. It is important to determine the velocity of a rocket. 3. It is necessary to protect the occupants of a space station from the intense solar-particle radiation. 4. At this period of the year it is possible to launch a probe into a circumnavigation trajectory of Mars. 5. It was possible to make only general conclusions from the results of test flying.

в) 1. The pilot decided to use the automatic landing system. 2. Here we should like to discuss some methods of training for manned space flight. 3. The astronaut wanted to ensure the successful coupling of space vehicles in orbit.

VII. *Переведите предложения, обращая внимание на перевод инфинитива в составном именном сказуемом.*

1. The a i m of this paper is to find basic properties of fluid oscillations. 2. One answer to this problem is to use electronic-beam steering rather than mechanical steering. 3. One of the most important functions of unmanned lunar programme will be to find suitable lunar sites. 4. The basic idea is to determine the pressure under zero-gravity conditions. 5. The object of this discussion is to describe some probable future propulsion systems. 6. The objective will be to determine the most promising device for a particular fuel tank. 7. Our problem is to determine the unknown shape of the fuel tank. 8. The basic problem was to determine the atmospheric conditions. 9. The purpose of the surface-to-underwater missile is to enable the ship to destroy targets. 10. The purpose of this paper is to present a brief description of the spacecraft and its systems and to provide a limited description of the performance of the spacecraft during the manned orbital flight. 11. The purpose of this chapter is to apply the basic principles of rocket motion to the various phases of space mission. 12. The main task of each space flight is to overcome the gravitational field and pass through the atmosphere of the Earth or some other planet.

VIII. *Переведите предложения, обращая внимание на перевод инфинитива в функции обстоятельства цели и следствия.*

а) 1. The crystal maser must be held at a very low temperature in order to operate efficiently. 2. Refrigeration units are used in airplanes to cool air. 3. This research airplane is designed to fly at more than 3,600 mph and to reach heights of up to 100 miles. 4. To fly day after day in high-speed airplanes the pilot must be physically and mentally f i t . 5. To find the answers to these questions and many others a number of research rockets were sent into space. 6. To investigate this effect we changed the previously described calculations. 7. To insure a uniform internal temperature inside the generator the engineers designed a special thermal control device.

б) 1. Mercury is too small to retain a considerable atmosphere. 2. These laboratory experiments are too difficult or costly to per-

form. 3. The mass of an electron is so small as to be neglected. 4. This method was so complicated as to give only little results. 5. The space environment between 200 and 1,000 km from the surface of the Earth can be considered safe enough to establish stable orbits for the various types of space vehicles. 6. The velocities are not high enough to be of major concern. 7. Engines of the carrier rocket must have sufficient power to launch the satellite into the Earth's orbit.

IX. *Переведите предложения, обращая внимание на перевод инфинитива в функции определения.*

1. There are a number of hypothesis to account for the Moon's origin. 2. The first living being to experience weightlessness for a long period of time was the dog Laika. 3. Tests to determine properties of propellants are currently in preparation at the laboratory. 4. There are no winds or rain to erode the surface of the Moon. 5. The space vehicles to be discussed in this section can be divided into two broad categories. 6. There are a number of problems still to be considered. 7. Now we shall discuss the system of units to be used in the next section of the article. 8. Propellant properties are the main two factors to be considered here. 9. The Moon was the first celestial body to be reached by men. 10. In the experiments to be described in this section, the electric field has a frequency of 400 Hz. 11. For many years to come the solar system will be the arena for astronautical investigations. 12. The reciprocating engine probably will be retained for many years to come for use in low-speed airplanes. 13. Leonardo, da Vinci was the first man to treat aeronautics scientifically. 14. Valentina Tereshkova is the first woman to orbit the Earth. 15. Galileo Galilei was the first to examine the Moon in detail through a telescope and to draw a certain conclusion from what he saw. 16. The Russian scientist Konstantin Eduardovitch Tsiolkovsky was the first to understand the use of rockets in space travel.

X. *Найдите в тексте урока (абзацы 3, 4, 8 и 9) по одному инфинитиву и переведите их в тексте.*

XI. *Ответьте на вопросы к тексту.*

1. Where is the fan mounted in the turbo-fan engines? 2. How are turbo-fan designs called? 3. What is the fundamental difference between a turbofan and a turboprop? 4. In what aircraft are turbo-fans most widely used? 5. What engine is simpler, a turbofan or a turboprop? 6. What engine is lighter, a turbofan or a turboprop? 7. What enables a turbo-fan to achieve a relatively low specific fuel consumpion? 8. Why does a turbo-fan produce much more thrust than a turbojet during take-off and the initial climb? 9. What is the simplest jet engine? 10. What jet propulsion device is the oldest and most widely known?

У Р О К 12

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Сложные существительные. 3. Инфинитивные обороты.

Термины к уроку

altimeter высотомер
bar стержень; полоса
behaviour характеристики
boost pressure давление наддува
branched pipe ответвленный трубопровод; патрубок
device устройство; механизм; приспособление
direction indicator указатель курса
directional gyro курсовой гироскоп; гирополукомпас
encount встречать
environment окружающая среда
gauge манометр
gyro horizon авиагоризонт
head головка
horizon горизонт; авиагоризонт
induction впуск; всасывание
machmeter указатель числа М
master engine основной двигатель
meter измерять
propulsion тяга; силовая установка
sharp turn крутой разворот
skid скользить (при развороте)
slip скользить
straight and level flight прямолинейный горизонтальный полет
Pitot tube трубка Пито
turn-bank indicator указатель крена и поворота
wide turn пологий разворот

ТЕКСТ

AIRCRAFT INSTRUMENTS

1 Aircraft instruments are basically devices for obtaining information about the aircraft and its environment, and for presenting that information to the pilot in a concise form. Their purpose is to detect, measure, record, process and analise the variables encountered in flying an aircraft. They are mainly electrical, electronic or gyroscopic. They are concerned with the behaviour of the engines, the speed, height and attitude of the aircraft and its whereabouts. Instruments concerned with the whereabouts of an aircraft are navigation instruments and these are dealt with separately in Lesson 13. Lesson 12 is concerned with instruments that obtain and present information on flight (excluding whereabouts and direction), propulsion, fuel, air frame, electrical and pressure systems.

2. The history of the development of aircraft instruments shows a movement away from instruments that merely obtain and present information to those that automatically do something about the in formation they receive. For example, at one time an instrument would have told a pilot that his aircraft was nose-down and it would have been left to the pilot to take corrective action manually if necessary. Nowadays it is often the case that a pilot will "instruct" an automatic system, for example, to f l y level, and the appropriate instrument will usually show the "instruction" is being "obeyed" and only exception ally that something is wrong because the automatic system has failed.

3. A modern aircraft cockpit looks on first sight to consist of a be wildering array of instruments that no human being could ever master or understand. It looks as though so much information presented simultaneously could never be absorbed by a small team of two to four people with any certainty. However, instrument panels are designed in such a way that instruments are grouped logically so that to a pilot it is an "open book".

Instruments Concerned with Flight Information

4. **Height.** An instrument for measuring and showing height above a level of reference is called an altimeter. It is basically an extremely sensitive aneroid barometer which measures static pressure at the height the aircraft is flying and, according to the difference between this and the pressure at a predetermined reference level, indicates height above reference level. There are three possible reference levels. The first is a theoretical mean sea-level reference which is of no use on landing. The second is true pressure at airfield height so that the altimeter reads zero on landing. The third is true pressure at sea-level so that the altimeter indicates true altitude on landing.

5. A radio altimeter measures height above terrain and so would not help in maintaining a constant flight-level over land. Its purpose can be stated quite simply as that of measuring the depth of air immediately below the aircraft, rather as sounding devices in a ship are used to measure the depth of water beneath its keel.

6. **Vertical Speed.** The rate of change in altitude is measured and shown by a vertical speed indicator. This indicates the speed of climb (ascent) or descent (dive or glide).

7. **Horizontal Airspeed.** Horizontal airspeed is measured and shown by an airspeed indicator (ASI). The ASI is an aneroid capsule which measures the difference between static pressure and the pressure inside an open-ended tube, called Pitot tube, usually situated on or underneath the nose of the aircraft. The airspeed indicator tells the pilot what his airspeed would be if he were flying at sea-level under standard atmospheric conditions, temperature 59°F (15°C) and barometric pressure 29.92 inches (760 mm). True airspeed (TAS) may be calculated approximately from indicated airspeed (IAS) by adding 2 per cent to the IAS for every one thousand feet above sea-level.

8. The machmeter indicates the Mach number which expresses airspeed as a fraction of the speed of sound. It is essential equipment on jet aircraft.

9. **Turning Characteristics.** Aircraft turning characteristics can be measured and shown by a simple device known as a turn-bank indicator. The turn-bank indicator tells the pilot two things. Firstly, it tells him whether he is doing a tight turn or a wide turn, and whether it is to port or starboard. Secondly, the turn-bank indicator tells the pilot whether, on the turn to right or left, his aircraft is slipping

inwards or skidding outwards. In big aircraft information on turning and banking is incorporated in a flight system direction indicator.

10 **Attitude.** The attitude of an aircraft relative to the surface of the earth is shown by an "artificial" or "gyro" horizon. There is a horizon bar on the instrument that always remains parallel to the surface of the earth. Another small piece of metal shaped to indicate the aircraft appears above or below the horizon bar if the airplane is in a climbing or gliding attitude. When the aircraft is banked to the left or right the imitation airplane in the instrument appears banked to the left or right.

11 **Direction.** An elementary direction-measuring instrument is a simple magnetic compass which may, however, be inaccurate by a degree or two in straight and level flight and much more inaccurate in turns. The magnetic compass is used in conjunction with a directional gyro which is not affected by the angles of bank normally employed in airlines.

Instruments Concerned with Propulsion Information

12 **Speed.** Engine speeds are measured and shown on rpm indicators which measure the revolutions per minute of the main rotor in each engine. Any differences in rpm from a master engine used as a basis for synchronizing are shown on a synchroscope.

13 **Temperature.** The temperature of each engine on an aircraft is measured and shown on a temperature indicator. Piston-engined aircraft have indicators for cylinder head temperature (CHT). Turbine engines have indicators for jet-pipe temperature (JPT) or turbine-gas temperature (TGT). All types of engines have oil temperature indicators showing the temperature of their lubricants.

14 **Pressure.** Various sorts of pressure occurring in a piston engine in operation are shown by instruments. A manifold pressure gauge is an instrument for measuring the absolute pressure in the induction system (a branched pipe for distributing air or a mixture to a number of cylinders) at a point standardized for each engine. Alternatively boost pressure, which is pressure in the induction system at a point standardized for each type of engine may be shown on a boost pressure gauge.

Oil pressure is indicated by an oil pressure gauge.

Instruments Concerned with Information about Fuel

15 **Fuel Content.** Fuel tank contents indicators show how much fuel the aircraft has left at any moment of time. Usually each tank is metered individually and the amount of fuel is measured in litres or by weight.

16 **Fuel Flow.** The fuel consumption of each engine is measured by fuel flowmeters calibrated in kilos per minute. These are integrated in a device to indicate kilos gone since engines were started.

(to be continued)

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **altimeter, device, horizon, instrument.**

airborne altimeter, aircraft altimeter, cabin altimeter, landing altimeter, radar altimeter, radio altimeter;

automatic navigation device, calibration device, sensing device;

approach horizon, artificial horizon, director horizon, gyro horizon;

airborne instrument, aircraft instrument, blind-flying instruments, board instrument, electronic instrument, flight instrument, flying instrument, measuring instrument, navigation instrument, performance instruments.

II. *Прочтите и переведите сложные существительные. Назовите существительные, от которых они образованы.*

О б р а з е ц: **airspeed** (air+speed) *воздушная скорость*

a) airbus, airflow, airframe, airline, airliner, airscrew;
lifeboat, liferaft, lifetime;
radioactivity, radiolocation, radioman, radiosonde, radiotelemetry, radiotelephone;
sideline, sidegust, sideslip, sidewash;
tailcone, tailhook, tailpiece, tailpipe, tailplane;
windscreen, windshield, windstream;

b) airplane, floatplane, seaplane, tailplane;
aircraft, spacecraft;
airship, spaceship;
airman, crewman, spaceman, weatherman;
airport, spaceport;
nosewheel, tailwheel;
ampermeter, flowmeter, voltmeter.

III. *Переведите предложения, обращая внимание на перевод сложного дополнения, выраженного оборотом «объектный падеж с инфинитивом».*

1. For the illustrative purposes we assume a plasma to consist of three fluids. 2. The designer assumed the form of the tank to be spherical. 3. For simplicity hydrodynamisists believe the two fluids to be inviscid and incompressible. 4. On some occasions scientists may consider the acceleration of gravity to be constant. 5. Physicists consider nuclear energy to be the prime source of heat energy. 6. We may expect this new problem to be qualitatively similar to that discussed above. 7. We know an incompressible fluid to occupy this cylindrical tank of radius *a*. 8. The astronaut reported spacecraft mean temperature to exceed the designed temperature by 5°C. 9. The early artificial satellites showed the Earth to be surrounded by intense radiation. 10. The autnor of the paper states these motions to be initially irrotational. 11. Suppose the Earth's orbit to be a circle. 12. Suppose the

Earth and Venus to move in coplanar circles. 13. The ancients thought electricity to be invisible fluid. 14. Until quite recently scientists thought the space between the Sun and the Earth and the planets to be empty.

IV. *Переведите предложения, обращая внимание на перевод сложного подлежащего, выраженного оборотом «именительный падеж с инфинитивом»:*

a) 1. The velocity at all points is assumed to depend only on *t*. 2. No other forces are assumed to act on the fuel tank bottom. 3. In this analysis the liquid is assumed to be inviscid and incompressible. 4. This condition is assumed to be valid. 5. The angle between these surfaces is assumed to be 75°. 6. To early man the Earth was believed to be the centre of the Universe. 7. The polar caps of Mars are believed to be ice crystals. 8. Astronautics is considered to be the science and technology of the design and operation of space vehicles. 9. The speed of the aircraft at the time of the explosion is estimated to have been about 300 knots. 10. The first Earth's satellites were expected to stay on their orbits for a month or two. 11. The Sun is known to have a 11-year cycle of activity. 12. The rocket may be said to work on the
reaction principle.

b) 1. At present the rocket engine appears to provide the best means for producing the tremendous thrust forces. 2. The artificial s a t e l l i t e appears to an observer on the Earth to remain fixed in space. 3. Two schemes appear to be particularly attractive for emergency landing. 4. The spacecraft appears to have encountered very few micrometeoroids in its travel. 5. The shape of Venus seems to resemble that of the Earth. 6. This wing structure seems to present serious problems. 7. Venus has a shape and surface conditions which seem to resemble those of the Earth. 8. The inner satellites of Saturn seem to be composed primarily of ice.

V. *Переведите предложения, обращая внимание на перевод оборота* **«for**+*существительное (или местоимение)+инфинитив».*

1. It has been necessary for scientists and engineers to develop new methods of tests. 2. It is important for the pilot to know the airplane construction. 3. The Sun is a power source which makes it possible for man to live on Earth. 4. The noise from the engine was so deafening that it was impossible for the passengers to talk with each other. 5. The Earth is not a perfect sphere. This fact makes it necessary for astronomers to make corrections for the Earth's slight oblateness. 6. The necessity may exist for the pilot to reduce the speed of the airplane. 7. For problems to be solved on large computing machines it is better to use symmetric matrices. 8. For such a system to operate efficiently, the propellant must be kept quiescent. 9. The returning spaceship must intersect the beam patterns from two ground stations in order for its position in space to be determined. 10. This value must be negative in order for Eq. (5) to hold. 11. The flow field shows the tendency for surface distortion to occur.

VI. *Найдите в тексте урока (абзацы 1, 4, 6, 9, 11, 13 и 15) по одному словосочетанию и переведите их на русский язык. Обратите внимание на последовательность расположения слов в английских и в русских словосочетаниях.*

VII. *Ответьте на вопросы к тексту.*

1. What is the purpose of aircraft instruments? 2. What does the history of the development of aircraft instruments show? 3. In what way are instrument panels designed? 4. What instrument is called an altimeter? 5. What is the purpose of a radio altimeter? 6. By what instrument is the rate of change in altitude measured? 7. What does the airspeed indicator measure? 8. What does the machmeter indicate? 9. What instrument shows direction? 10. What does the fuel tank contents indicator show?

У РО К 13

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Сложные прилагательные. 3. Инфинитив в различных функциях и оборотах (*повторение*).

Термины к уроку

alert привести в состояние готовности
buried утопленный
control column ручка управления
control panel панель управления
detector чувствительный элемент; датчик
duplicate дублирующий механизм
flight recorder бортовой самописец
leading edge передняя кромка
manhandling управление вручную
margin of safety запас прочности
pen recorder самописец пером
pitot head приемник полного давления
prestall преждевременный срыв потока
recorder самописец
stick shaker вибросигнализатор ручки управления
store запоминающее устройство; хранить
tape recorder ленточный самописец

ТЕКСТ

AIRCRAFT INSTRUMENTS

(continued)

Instruments Concerned with Information about Conditions on the Outside of the Airframe

1. **Temperature.** The outside air temperature (OAT) gauge gives the pilot general information about the temperature of the air immediately surrounding the airframe. This will enable him to assess the influence of temperature on certain performance aspects of the aircraft. He needs to know particularly whether the temperature is within certain limits in humid conditions so that there is danger of

ice forming. This enables action to be taken to heat the affected areas. Critical parts include the leading edges of the wings, control surfaces of the tail unit, engine air intakes and the pitot head.

2. On the other hand there are certain parts of the airframe that might possibly become overheated because they are close to something like an engine or a generator producing a lot of heat. The temperature of important zones of the airframe in the vicinity of a heat-producing component, for example the rear spar of a mainplane containing a "buried" jet engine, are monitored by electrical temperature bulbs.

3. Cabin temperature indicators are normally fitted to modern aircraft to enable the pilot to confirm that the automatic system controlling temperature is in working order. Cabin humidity indicators may be fitted but humidity control systems are rare.

4. **Pressure.** It is important to know the pressure inside the passenger cabin because it must be neither too high nor too low for human comfort. It is also important to know the difference between the air pressure outside the cabin and the air pressure inside it because it represents a force exerted in normal circumstances in an outwards direction. The difference in pressures must be kept within limits imposed by the strength of the fuselage. The cabin altitude indicator is the instrument monitoring passengers' comfort and the cabin differential pressure indicator monitors the margin of safety.

5. Other pressures concerned with the airframe that have to be watched are the hydraulic and pneumatic systems used in powering controls of such moving parts as brakes, undercarriage and so on.

Instruments Concerned with Information about the Aircraft's Electrical System

6. **Voltage.** Direct current and alternating current voltages are measured and shown by AC and DC voltmeters. Where information is required only periodically from a number of points it is usual to have only one voltmeter with a device for selecting each point of measurement as required.

7. **Current.** The instrument that measures an electric current in amperes is called an ammeter.

We may summarize the nature of information presented by aicraft instruments as follows:

8. (a) it may be continuous presentation, as in the case of a gyro-horizon.

(b) it may be on-tap presentation, as in the case of moving a switch for a particular reading on a voltmeter.

(c) it is always concerned with situations that are expected to change within certain limits, for example temperature.

(d) most is presented visually.

9. Attempts are made to minimize the heavy demands made on the aircrew's use of their eyes by employing their senses of hearing and touch. Unfortunately at the same time there are ever increasing demands on hearing coming from the various radio aids now installed in aircraft.

10. However, some of the instruments for alerting aircrew to the fact that something abnormal is happening do employ the senses of hearing and touch. Throughout the aircraft there are various heat, flame and smoke detectors which relay their warnings to the pilots by bell as well as by light. If for some reason or other the undercarriage has not been lowered for an intended landing, in addition to a warning light sometimes a horn is operated by the throttle setting. If the speed of the aircraft inadvertently drops below what is regarded as safe, a mechanical instrument called a stick-shaker, operating from a device on the underside of a wing, gives warning of a pre-stall condition by shaking the control column. On the other hand warning of excessive speed is given by means of a horn.

11. The history of aircraft development is, among other things, the change from manhandling aircraft to the automatic handling of an aircraft. The history of the development of aircraft instruments shows a movement away from instruments that merely obtain and present information to those that automatically do something about the information they receive. A notable exception to this general trend is a flight recorder which does not present information at the time of obtaining it, but stores it away for future reference. The need for flight recording has been recognized in aviation for a very long time. Early methods of meeting this need were by the pilot or observer recording data normally on a notepad, or by relatively crude pen recorders or even a camera photographing the pilots' instruments or duplicates of them.

12. Today, nearly all commercial aircraft are required to carry a recorder whose performance far exceeds the maximum capability of these simpler devices. All the pilot sees of it is a small control panel on which he can set some dials which correspond to the date and flight number. This information is inserted on the recording medium before every flight and the recorder can detect whether the aircraft is flying and switch itself on or off accordingly. Data collected at any point on the aircraft are transmitted electrically to a central electronic unit where they are converted to a binary code similar to that used in computers. This ensures that accuracy can be of the order of 1 part in 1,000. It is stored in this form in an almost indestructible store normally consisting of an armoured cassette containing about 50 miles of hair-thin magnetic steel wire operating on the same principle as a tape recorder. This cassette can be removed from the aircraft at any time for decoding and analysis. Any lengthy or repetitive analysis work involved is carried out by computer.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **detector, gauge, indicator, recorder.**

angle-of-attack detector, course detector, fire detector, heat detector, ice detector, infra-red detector, smoke detector, vibration detector;

air gauge, altitude gauge, angle gauge, barometer gauge, cabin-pressure gauge, fuel gauge, fuel-pressure gauge, gas-density gauge, gasoline gauge, gas-pressure gauge, Mach-number gauge, oil gauge, oil-pressure gauge, oil-temperature gauge, temperature gauge;

airspeed indicator, air-temperature indicator, altitude indicator, angle-of-attack indicator, attitude indicator, bank indicator, bank-and-turn indicator, climb indicator, course indicator, direction indicator, dive-angle indicator, engine speed indicator, flight indicator, height indicator, landing-speed indicator, Mach indicator, rate-of-climb indicator, rate-of-descent indicator, revolution indicator, speed indicator, temperature indicator;

airborne recorder, airspeed recorder, altitude recorder, course recorder, flight recorder, flight path recorder, pressure recorder.

II. *Переведите сложные прилагательные, образованные по модели «существительное+прилагательное».*

Образец: **oxygen-rich (oxygen+rich)** *с избытком кислорода, богатый кислородом*

temperature-dependent; time-dependent; pressure-dependent; accident-free; air-free; fault-free; friction-free; trouble-free; vortex-free;
combat-ready; flight-ready;
heat-resistant; fire-resistant;
oxygen-sensitive; pressure-sensitive; temperature-sensitive.

III. *Переведите сложные прилагательные, образованные по модели «существительное+причастие II».*

Образец: **sun-warmed (sun+warmed)** *согреваемый солнцем*

air-based; earth-based; ground-based; land-based; sea-based; water-based;

air-controlled; ground-controlled; pilot-controlled; radio-controlled; trajectory-controlled; wire-controlled;

air-cooled; gas-cooled; liquid-cooled; water-cooled;

fabric-covered; ice-covered; linoleum-covered; metal-covered, paper-covered, rubber-covered; snow-covered;

air-driven; battery-driven; belt-driven; engine-driven; hand-driven; spring-driven; steam-driven; turbine-driven; water-driven; wind-driven;

ground-guided; radio-guided; wire-guided;

air-launched; ground-launched; fighter-launched; satellite-launched; space-launched;

factory-made; hand-made; machine-made; man-made;

fuselage-mounted; wing-mounted; pod-mounted; truck-mounted;

air-operated; foot-operated; motor-operated, power-operated; pressure-operated;

battery-powered; engine-powered, jet-powered; man-powered; rocket-powered; sun-powered; water-powered;

jet-propelled; rocket-propelled; steam-propelled;

earth-stabilized; fin-stabilized; position-stabilized; roll-stabilized; space-stabilized.

IV. *Переведите предложения, обращая внимание на перевод инфинитива в различных функциях и оборотах (повторение).*

1. Since the Moon was first observed by telescope, a number of ideas have been put forward to account for the appearance of its surface. 2. The major objective of our programme is to improve performance without reducing reliability. 3. The light areas of Mars seem to be sand deserts; the dark areas of Mars were formerly believed to be oceans. Now they are proved to be dry. 4. The purpose of tests is to determine the wing loading. 5. We expect the new aircraft to fly this year. 6. To maintain the forward movement of the wing through the air, a force equal to the drag must be constantly exerted. 7. Comets are known to have highly eccentric orbits. 8. A spaceship is designed to sustain a man in a space environment for a given period of time, to protect him from external heating and acceleration during exit and re-entry, to provide him with means for controlling the attitude of the spaceship, to permit him to perform observations and a number of experiments in space, and to bring him safely back to Earth. 9. The temperature in the stratosphere is estimated to be as low as 130°K. 10. The problems connected with the construction of large satellites by men in space are chiefly to keep the man alive while outside his spaceship, and to enable him to move in the direction desired. 11. The stabilizer of an airplane is considered to consist of two sections.

V. *Найдите в тексте урока (абзацы 3, 4 и 6) по два словосочетания и переведите их на русский язык. Обратите внимание на последовательность расположения слов в английских и в русских словосочетаниях.*

VI. *Найдите в тексте урока в абзаце 1 девять, в абзаце 11 шестнадцать и в абзаце 12 двадцать слов, имеющих общие корни в английском и в русском языках. Переведите их на русский язык.*

VII. *Найдите в тексте урока (абзацы 1, 2 и 4) по два инфинитива. Найдите инфинитивный оборот в абзаце 12. Переведите их па русский язык.*

VIII. *Ответьте на вопросы к тексту.*

1. What information does the outside air temperature gauge give the pilot? 2. Why are cabin temperature indicators fitted to modern aircraft? 3. Why is it important to know the pressure inside the passenger cabin? 4. Why is it also important to know the difference between the air pressure outside the cabin and the air pressure inside it? 5. By what instruments are direct current and alternating current voltages measured? 6. In what units does the ammeter measure an electric current? 7. By what means do various heat, flame and smoke detectors relay their warnings to the pilots? 8. What is operated if

the undercarriage has not been lowered for an intended landing? 9. Does a flight recorder present information at the time of obtaining it? 10. Must all commercial aircraft carry a recorder?

У Р О К 14

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Сокращенные слова. 3. Функции герундия. 4. Отглагольное существительное.

Термины к уроку

aid оборудование; средство; устройство
astro fix астрономическая ориентировка
band полоса частот; диапазон
crosswind боковой ветер
dead-reckoning navigation навигация счислением и прокладкой пути
drift снос
homing наведение
lane воздушная трасса
NDB (nondirectional beacon) ненаправленный маяк
path траектория
radar device радиолокационное устройство
reboun d отскок
referen ce начало отсчета; начальные условия
self-contained автономный
travel совершать полет
VOR (very high frequency omnidlrectional radio range) всенаправленный ультракоротковолновый радиомаяк

ТЕКСТ

AIRCRAFT NAVIGATION

1. The most elementary form of aircraft navigation is where the pilot looks down from his cockpit on to a familiar terrain and guides his aircraft from one landmark to another. Because the territory is well known to the pilot he requires no device or instrument to assist him. If the territory over which he is flying is not familiar he will require at least a map. In both cases the pilot is using what might be called the "inductive" method in that he observes features on the surface and obtains an instant "fix" on his position, without having to do any calculations involving past movement of the aircraft.

2. Astronomical navigation is also inductive. The pilot observes the position of celestial bodies and with the help of an accurate clock, and instruments for measuring angles and sensing the vertical, he can compute his position. Calculation is involved but not basically of past movement of the aircraft, although account must be taken of the fact that astro fixes are normally "running" fixes.

3. Another well-known method of navigation, sometimes referred to as the "historical", is based on a record of the movement of the air craft from a known point. From this record of what has happened before, present position and future movement may be deduced. This might be called the "deductive" method to distinguish it from the "observational" or "inductive" method referred to above. In practice

this method is known as dead reckoning navigation. The only aids required in an elementary form of DR navigation are a compass, a clock, an airspeed indicator, a forecast wind and a map. If a pilot knows the direction in which he has been travelling from a known point, and the length of time and speed at which he has been travelling from that known point he can work out his present position and future course.

4. As navigational aids have become more sophisticated, methods are now usually classified by reference to the nature of the aids rather than the inductive or deductive, historical or observational process. So now there is an important distinction, for example, between independent and dependent systems. The independent systems are self-contained on board the aircraft so that they do not require any assistance from the ground, except of course for maintenance. The dependent systems (sometimes called external reference systems) need the co-operation of ground-based components.

5. Yet behind this new classification we can see the old one. Self-contained systems operate by not getting lost. For example, the Doppler system starting from a known point deduces present position from a record of velocity over the ground. External reference systems on the other hand often provide an immediate fix.

6. **Independent (Self-contained) Systems of Navigation.** Under this category we must include those systems where information is obtained either by human eyes or by radar on geographical features (on the ground or in the air) to determine present position. Thus the simplest form of navigation described above is both independent and observational. A radar device that tells a pilot he is a mile from a mountain would also come in this category.

7. Doppler is at present the most widely used self-contained aid working on dead reckoning-principles. It sends radio signals of a known frequency to the ground below and measures their frequency on the rebound. By using the principles of the "Doppler" effect it then measures the aircraft's ground speed. The principle referred to is that to a moving observer the frequency of a radiation appears to shift by an amount proportional to the velocity of the observer. So starting from a known point and a difference in radio frequencies the system deduces present position through ground speed, and aircraft heading (in other words: aircraft velocity).

8. The next most widely used self-contained aid working on dead reckoning principles is the inertial system. This is based on the fact that if a vehicle starts from a known point and is equipped with extremely sensitive means of measuring accelerations along precisely defined paths this can be related to time and distance travelled to present position. Basically the instrument consists of gyros and accelerometers.

9. **Dependent (External Reference) Navigation Systems.** There are invisible roads built into the skies over Europe, America and many other parts of the world where the air traffic is dense enough to justify the expense of maintaining them. These airways, sometimes called

air traffic lanes, are commonly constructed of beams of radio waves. A beam of radio waves is just as real to the pilot as a road of concrete is to the motorist. But a radio beam is not a two-dimensional path like a road; it is three-dimensional like a tunnel. The idea of an airplane flying through a tunnel is helpful except that the walls offer no construction in a radio beam. The airplane can stray through the walls. It does not have to wait until it reaches the end to get out.

10. At the end of each tunnel is some sort of radio transmitter. This sends out the radio signals that form the tunnel. In order to be able to make use of the airway the pilot has to tune a radio receiver in the cockpit to the frequency of the radio transmitter. Nowadays, most airways are defined by VOR station, though many are still using non-directional beacons (NDBs). NDBs are comparatively cheap and simple but have several major disadvantages, viz: (1) they operate in the overcrowded "medium frequency" band, which is subject to static interference; (2) as the name indicates, the radiation from a NDB does not give the pilot a really positive "tramline" but only an indication that it is now on a certain bearing from the aircraft. Whilst the aircraft is heading towards the NDB, its path may actually describe a parabola, due to drift caused by the local wind effect on the aircraft.

11. The VOR (Very High Frequency Omnidirectional Radio Range) does not suffer from these disadvantages. It does provide a static-free "tramline" down the centre of the airway, which it is easy for an aircraft to follow regardless of crosswind effect.

12. Whichever system of defining airways is used, it is nowadays common practice to present the information visually in the cockpit on dials.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **aid, navigation, navigator, reference.**

air-navigation aids, long-distance aids, radar aid, radar-navigation aid, radio aids, radio-navigation aids, short-range aids;

aerial navigation, air navigation, celestial navigation, dead-reckoning navigation, enroute navigation, flight navigation, ground navigation, independent navigation, long-range navigation, medium-range navigation, radar navigation, radio navigation, self-contained navigation, short-range navigation, star navigation, terrestrial navigation;

air navigator, automatic navigator, bombardier-navigator, Doppler navigator, robot navigator, second navigator;

attitude reference, azimuth reference, directional reference, heading reference.

II. *Переведите сокращенные слова, построенные по модели: «начальный элемент первого слова+целое второе слово». (Такие слова читаются слитно.)*

О б р а з е ц : **radnote (radio+note)** *радиограмма*

A-bomb (atom + bomb); H-bomb (hydrogen+bomb); ammeter (amper+meter); helipad (helicopter+pad); heliplane (helicopter+ plane); heliport (helicopter+port); helitaxi (helicopter+taxi); midair (middle+air); mid-chord (middle+chord); midspan (middle+ span); midwing (middle+wing); navaid (navigation+aid); paraboy (parachute+boy); paradiver (parachute+diver); paradoctor (para-chute+doctor); paradrop (parachute+drop); paranurse (parachutes-nurse); parawing (parachute+wing); radome (radio+dome); ramark (radio+mark); velocimeter (velocity+meter).

III. *Переведите сокращенные слова, образованные по модели «начальный элемент первого слова+конечный элемент второго слова». (Такие слова читаются слитно.)*

О б р а з е ц : **avionics (aviation+electronics)** *авиационное электронное оборудование*

elevon (elevator+aileron); flaperon (flap+aileron); motivator (motion+elevator); naviation (naval+aviation); naviator (naval+ aviator); neutron (neutral+electron); pibal (pilot+ball); positron (positive+electron); radiotronics (radio+electronics); transceiver (transmitter+receiver); transponder (trransmitter+responder).

IV. *Переведите сокращения, состоящие из начального элемента слова, (Такие сокращения читаются как несокращенные слова.)*

approx approximate
Fig; f i g figure
GAL; gal gallon
I N ; in inch
LAB; lab laboratory
MAX; max maximum
OX; OXY; oxy oxygen
PROP; prop propeller
sec section, secondary
tac tactical

V. *Переведите сокращения, состоящие из согласных букв. (Такие сокращения читаются как несокращенные слова.)*

APRX; aprx approximately
FT; ft foot
H; h hour
KG; kg kilogram
KM; km kilometer
KN; kn knot
Mk mark
mm millimeter
YD; yd yard

VI. *Переведите сокращения, состоящие из начальных букв сокращенных слов. (Каждая буква читается как в алфавите.)*

A attack, a i r p l a n e
B bomber
C cargo airplane
F fighter
H helicopter
M missile carrier
R reconnaissance airplane
T trainer
U u t i l i t y airplane
W weather airplane

NASA National Aeronautics and Space Administration
USAF United States Air Force
USN United States Navy
RAF Royal Air Force
RN Royal Navy
NA North American
GE General Electric
RR Rolls-Royce
HS Hawker Siddeley

VII. *Переведите предложения, обращая внимание на перевод подлежащего, выраженного герундием.*

1. Solving these complex equations can require a digital computer. 2. Landing on the Moon is considerably different from landing on the Earth because of the lack of atmosphere on the Moon. 3. Flying over the ice in polar regions is extremely difficult. 4. Landing on the planets will vary according to atmospheric conditions. 5. Launching a man or a crew into space can be accomplished in several ways.

VIII. *Переведите предложения, обращая внимание на перевод составного именного сказуемого, выраженного герундием.*

1. The main point of a transformer is raising or lowering voltage. 2. The advantage of the new equipment is functioning under wide changes of temperature and pressure. 3. The purpose of the satellite was lifting the airborne instrumentation to a vertical distance of 250 miles from the surface of the Earth. 4. The main advantage of the rocket engine is operating independent of its environment medium. 5. The designation of the wind shield made of highly tempered glass is withstanding almost 1,000 degrees Fahrenheit. 6. The first task is predicting accurately the remaining time of powered flight until thrust termination. 7. The main purpose of an active communication satellite is receiving a signal, amplifying it and returning it to the surface of the Earth. 8. The principal interest of the author of the paper was verifying the shift of resonance frequency with amplitude.

IX. *Переведите предложения, обращая внимание на перевод дополнения, выраженного герундием.*

1. The automatic landing system must ensure landing the passenger airplanes at night. 2. The aircraft designer suggested testing this equipment under altitude conditions. 3. The test engineer avoided using this new instrument under high temperatures. 4. Capillary forces prevent air from entering the tube. 5. The f i l m serves to demonstrate a new approach in using the computer. 6. The rocket engine differs from the air-breathing engine in carrying its own oxidant as well as its fuel. 7. Our scientists succeeded in solving the problem of landing the airplanes at night. 8. Many pilots dream of going to the Moon and distant planets. 9. For years men have dreamed of placing large platforms in orbit around the Earth. 10. Our proof will depend on showing that $X=0$. 11. The radar homing types are all based upon receiving some detection and tracking signal from the target. 12. These complex problems are associated with maintaining the health of the astronaut.

X. *Переведите предложения, обращая внимание на перевод определения, выраженного герундием.*

1. The idea of flying has existed in men's minds from time immemorial. 2. There is no doubt that aviation is a safe means of travelling. The risk of flying by an airplane is not very much greater than the

risk of going by train or bus. 3. Scientists are trying to develop better ways of lifting space vehicles from the Earth. The problem of escaping from the Earth is essentially a matter of overcoming the gravitational field of the Earth. 4. The task of flying to the Moon is not an easy one. 5. There is little hope of discovering, from the Earth, another member of our solar system. 6. Space orbital rendezvous is the technique of bringing together in orbit two or more spacecraft. There are several methods of accomplishing the rendezvous manoeuvre. 7. This article gives a simple method for estimating pressure distribution. 8. There are two principal methods for determining the distances and velocities to the stars. 9. The rocket offers a means for escaping the Earth and for creating a research station in space. 10. Systems for detecting, inspecting, and, if necessary, attacking enemy satellites and space vehicles can be either ground- or space-based. 11. Another interesting device for testing materials at high temperatures and speed is hypersonic shock tube.

XI. *Переведите предложения, обращая внимание на перевод обстоятельства, выраженного герундием.*

1. Peak temperatures occur after heating the test specimen. 2. The astronaut orbited the Earth 22 times before guiding his spacecraft safely back to a landing in the Pacific Ocean. 3. In preparing man for space flight care should be taken of his health. 4. In returning from the Moon, the spacecraft must be accelerated to a velocity greater than "escape velocity". 5. Upon eliminating *w* from *Eq.* (2) we obtain the following results. 6. Man can live on liquid foods for weeks without losing his weight. 7. It is not possible to understand the reasons for all these shapes of the wing without first understanding the reason for sweepback itself. 8. The velocities of stars can be determined by examining the spectrogram of the light which comes from them. 9. The principle of a satellite is very simple. A good analogy may be obtained by tying a stone to a piece of string and whirling it round in a circle. 10. Reliability of the construction can be improved by using additional elements. 11. This task is accomplished by launching a spacecraft and the fuel separately into orbit. 12. Midcourse corrections are made by sending pitch and roll commands from the ground to the satellite. 13. Big rockets have been used for launching satellites into the Earth orbit. 14. As on the surface of the Earth, the magnetic field in space can also be used for determining directions of flight.

XII. *Переведите предложения, обращая внимание на перевод отглагольного существительного.*

1. The falling of the aircraft began soon after the explosion. 2. Sometimes the buffeting of an airplane occurs only in a particular Mach number range. 3. The automatic opening of a parachute increases the chance of the pilot survival. 4. The testing of missile equipment is long and complicated. 5. The heating of an aircraft skin increases rapidly at the higher speeds. 6. The year 1957 saw the launching of the first artificial Earth satellite and the beginning of a new era of

scientific exploration in space. 7. The launching of spaceships from the Earth orbit presents a number of previously unfamiliar technical problems. 8. A galaxy is a grouping of stars, dust clouds, and gases.

XIII. *Найдите в тексте урока в абзаце 2 двенадцать и в абзаце 3 девятнадцать слов, имеющих общие корни в английском и в русском языках. Переведите их на русский язык.*

XIV. *Найдите в тексте урока (абзацы 1, 2, 5 и 7) по одному герундию. Переведите их на русский язык.*

XV. *Ответьте на вопросы к тексту.*

1. What is the most elementary form of aircraft navigation? 2. How can the pilot compute his position? 3. On what is another well-known method of navigation based? 4. What method is known as dead reckoning navigation? 5. Under what conditions can a pilot work out his present position and future course? 6. What are the independent systems of navigation? 7. What are the dependent systems of navigation? 8. On what principles does Doppler navigation system work? 9. On what fact is the inertial navigation system based? 10. Is a radio beam two-dimensional or three-dimensional?

У Р О К 15

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Паронимы. 3. Функции причастия I и II.

Термины к уроку

bow wave головная волна
break *зд.* преодолевать
build-up увеличение
challenge сложная задача; проблема
circumvent обходить
coast лететь по инерции с неработающим двигателем
escape velocity вторая космическая скорость
manufacturer изготовитель
market рынок сбыта
set up создавать
shock (-wave) drag волновое сопротивление
sonic boom звуковой удар

ТЕКСТ

SUPERSONIC FLIGHT

1 For many years the figure of 1,223 km per hour has had a special meaning for the people who work in the aviation industry. Within a mile or two it is the speed of sound through the air at sea level. It symbolizes the so-called "sound barrier".

2. To most aviation engineers this figure represented a formidable obstacle in the path of technical progress. Many of them thought that the obstacle was so great that it could never be overcome or circum-

vented. Others saw it as something different only in degree from the problems they had been facing for decades.

3. Wave drag, or shock drag as it is sometimes called, was the biggest sound barrier problem. These are the names aerodynamisists used to describe the increased resistance of the air caused by abrupt build-up of density at supersonic speeds.

4. When an aircraft is being flown at subsonic speeds, pressure waves moving ahead of it activate the air in its path and the molecules of air move aside to allow the aircraft to pass. These pressure waves move at the speed of sound. When the aircraft itself moves faster than sound the waves get left behind and the air ahead is not made to move out of the way.

5. Consequently the aircraft strikes the air and sets up shock waves rather like the bow waves made in water by a ship moving at speed. It is formation of these shock waves that causes the sonic boom that is heard on the ground.

6. It appeared obvious to aviation engineers that if ever aircraft were to overcome the problem of shock wave drag much more engine power would be required. Largely because of problems of propeller design piston engines were no good for breaking the sound barrier. Their efficiency began to fall off as aircraft speed increased above 560 kph.

7. Military aircraft led the way in developing the jet engine. The early jets were much too uneconomical for commercial operation and it was left to the military, who must have higher speeds and better performance with less regard for cost, to support their development.

8. Without doubt the biggest operational problem associated with supersonic flight, yet to be overcome, is the sonic boom. As an aircraft flies at speeds greater than sound it sets up two main shock waves, one at the nose and one at the tail. When these shock waves reach the ground the resulting sudden jump and fall in air pressure (the "overpressure") is heard as the sonic boom.

9. Normally this sound consists of two distinct booms, heard in rapid succession, but in certain atmospheric conditions the sound merges into one boom. Two main factors influence the intensity of the boom. These are the weight of the aircraft and the height at which it is flying. The heavier the aircraft the louder will be the boom. The higher the aircraft is flying the more the boom will be reduced.

10. A focussing of several shock waves can occur during acceleration to and deceleration from supersonic speed. A supersonic airliner will normally produce the loudest boom during the acceleration phase.

11. During deceleration the boom will be much less intense because, by that time, most of the fuel will have been used up and the weight of the aircraft greatly reduced.

12. As supersonic aircraft are not likely to attain supersonic speed until 160-240 kilometres after take-off, by careful flight planning it should be possible to time the acceleration to supersonic speed so that it occurs over the sea or over sparsely populated land.

13. In the event that the sonic boom will cause supersonic flight to be pro-

hibited over well-populated land there will still be a market for supersonic aircraft. More than three quarters of the earth's surface is ocean, and more than 40 per cent of the world's long-haul traffic is concentrated on the North Atlantic.

14 Whatever problems face the manufactures of supersonic airliners there is a hope that they will one day be overcome. The supersonic airliner is no longer a dream, no longer a mere challenge to the aviation engineer; it is possibly the airliner of tomorrow. In the 1970s air passengers may be able to travel at a speed of 2,335 kilometres per hour.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **acceleration, flight, flying, resistance.**

acceleration due to gravity, acceleration of gravity, acceleration of the earth, back-to-chest acceleration, backward acceleration, centrifugal acceleration, centripetal acceleration, chest-to-back acceleration, downward acceleration, drag acceleration, earth acceleration, footward acceleration, forward acceleration, gravitational acceleration, head-to-seat acceleration, headward acceleration, leftward acceleration, rightward acceleration;

accelerated flight, altitude flight, automatically controlled flight, blind flight, climbing flight, constant-level flight, cruising flight, curvilinear flight, day flight, day-light flight, demonstration flight, diving downward flight, enroute flight, gliding flight, high-angle-of-attack flight, high-speed flight, high-temperature flight, hovering flight, hypersonic flight, instrument flight, intercontinental flight, jet flight, level flight, long-distance flight, long-range flight, low-altitude flight, low-speed flight, night flight, refuelling flight, routine flight, scheduled flight, sea-level flight, sonic flight, spy flight, steady flight, straight flight, subsonic flight, supersonic flight, trisonic flight, unsteady flight, VTOL flight;

bad-weather flying, blind flying, cloud flying, development flying, low flying, zero-altitude flying;

aeyrodynamic resistance, air resistance, frictional resistance, skin resistance, turbulence resistance, wave resistance.

II. *Прочтите и запомните наиболее употребительные паронимы (слова, близкие по написанию или звучанию, но имеющие разное значение).*

accept [ɑk'sept *принимать*

except [lk'sept *исключать; исключая, за исключением*

adapt [ɑ'dxpt *приспособить*

adopt [ɑ'dOpt *принимать, усваивать*

addition [ɑ'dlSɑn *прибавление, добавление*

edition [l'dlSɑn *издание*

affect [ɑ'fekt *воздействовать на,*

effect [l'fekt *совершать, выпол-*

влиять на

also ['ɔ:lsou] *тоже, также*

area ['ɛəriə] *площадь, зона*

case [keis] *дело, случай*

expand [iks'pænd] *расширять(ся)*

feature ['fi:tʃə] *черта, особенность*

later ['leitə] *позже*

principal ['prinsipəl] *главный*

quiet ['kwaiət] *спокойный; тихий*

same [seim] *тот же самый*

science ['saiəns] *наука*

than [ðæn, ðən] *чем*

vary ['vɛəri] *меняться, отличаться*

нять

although [ɔ:l'ðou] *хотя; несмотря на то, что*

era ['iərə] *эра*

cause [kɔ:z] *причина, основание*

expend [iks'pend] *расходовать, тратить*

future ['fju:tʃə] *будущее*

latter ['lætə] *последний из*

principle ['prinsəpl] *принцип, правило*

quite [kwait] *вполне, совсем, совершенно*

some [sʌm] *какой-то, некий, несколько*

since [sins] *с, после; с тех пор; с тех пор как, так как, поскольку*

then [ðen] *тогда, потом, затем*

very ['veri] *очень*

III. *Переведите предложения, обращая внимание на определение, выраженное причастием I.*

1. The forces acting on an airplane in flight are l i f t , weight, drag and thrust. 2. Air flowing around the cockpit makes a tremendous noise. 3. Food, water, air and electric supplies in the *Vostok* spacecraft were sufficient for a flight lasting up to 10 days. 4. The term "planets" will be applied here to nine celestial bodies orbiting around the Sun. 5. Tests simulating overland flights at various speeds are of great importance. 6. Decelerations are oppositely acting accelerations. 7. In spite of the probable prospects of failure, let us observe existing information. 8. In preceding chapters of this book we have discussed the development and construction of turbo-jet engines.

IV. *Переведите предложения, обращая внимание на обстоятельства, выраженные причастием I.*

a) 1. Applying the new methods of investigation mathematicians obtained quite extraordinary results. 2. Referring to figure 3 one can see that the airplane is flying straight and level in calm air. 3. Combining these two equations we get the following one. 4. Orbiting at an altitude of 22,300 miles above the Earth, in a synchronous or 24-hr orbit, a satellite has the same period of rotation as the Earth. 5. Neglecting the drag of the air we may write the working equation. 6. Using autoland approach the performance of the airplane may be improved sufficiently. 7. The airplane cools itself giving off heat to the surrounding air. 8. On large platforms orbiting about the Earth

men will live for long periods of time conducting scientific work, observing the heavens or assembling rockets for journeys into space. 9. The water flow rate was monitored visually using a stopwatch. 10. Numerical results have been obtained using equations (3) and (4).

б) 1. When discussing high-speed aerodynamics, we constantly refer to the speed of sound. 2. When describing a turbo-prop, turbo-shaft, or piston engine, the accepted unit for measuring the rate of doing work is horsepower. 3. When dealing with astronomical distances we find the change in gravity to be very significant. 4. When applying these two methods, consideration should be given to the physical phenomenon. 5. When reviewing a year's progress it is natural to seek out the most significant event. 6. While coasting in Kepler orbits, liquid propellant floats in the tank.

V. *Переведите предложения, обращая внимание на перевод причастия II в функции определения:*

а) 1. Escape velocity is the velocity required to depart the gravitational field of an astronomical body. 2. The results of flights made by Soviet *Luna* automatic stations enriched science with new important data on the Moon. 3. High temperatures associated with space-vehicle re-entry, and low temperatures associated with cryogenic propellants, present needs for special materials. 4. In a V/STOL aircraft the thrust required for vertical take-off is much greater than the thrust required for level cruise flight. 5. Planes designed to f l y above the speed of sound have strong and thin wings.

б) 1. The structures considered are large and complex. 2. According to the data obtained the development flight of the prototype was successful. 3. Satisfactory results were obtained in every case investigated. 4. The masses of meteors are rather uncertain because of the difficulties involved. 5. Because of the cost involved and the high requirements for reliability, it is unlikely that new intermediate types of space launch vehicles will be developed in the next decade. 6. The amount of dry food required will depend upon the duration of a space flight. 7. The case shown characterises a low-conductivity fluid. 8. The design shown has tapered wings. 9. Table 1 lists the numerical values of the parameters used. 10. Figure 6 is a drawing of the test apparatus used. 11. The results obtained permitted to formulate some general statements. 12. The amount of heat generated depended on the quality of the fuel used. 13. The methods introduced received general recognition. 14. The temperature of the liquid obtained remained constant.

VI. *Найдите в тексте урока (абзацы 2 и 9) по пять слов, имеющих общие корни в английском и в русском языках. Переведите их на русский язык.*

VII. *Найдите в тексте урока (абзацы 4 и 5) по одному причастию II. Переведите их на русский язык.*

VIII. *Ответьте на вопросы к тексту.*

1. What figure symbolizes the so-called "sound barrier"? 2. Why did this figure represent a formidable obstacle to most aviation engineers? 3. By what is the increased resistance of the air at supersonic speeds caused? 4. What causes the sonic boom that is heard on the ground? 5. Why were piston engines no good for breaking the sound barrier? 6. At what speed did the efficiency of piston engines begin to f a l l off? 7. What factors influence the intensity of the boom? 8. When will a supersonic airliner produce the loudest boom? 9. Why will the boom be much less intense during deceleration? 10. At what speed may air passengers be able to travel in the 1970s?

У Р О К 16

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Многозначные слова **this, these.** 3. Независимый причастный оборот.

Термины к уроку

ablation абляция; унос массы
astronaut космонавт; астронавт
docking стыковка
habitable обитаемый
journey полет
mooring причаливание
rock горная порода
rocketry ракетостроение
spaceman космонавт
train подготавливать

ТЕКСТ

SOVIET COSMONAUTICS

1. The development of Soviet cosmonautics is closely connected with the achievements of Soviet pilots and spacemen, aircraft and spacecraft designers and builders.

2. Aviation has become the cradle of cosmonautics. Soviet scientific and engineering thought was the first to blaze the trail to the stars. And this was not accidental. At the turn of t h i s century the Russian scientist Konstantin Tsiolkovsky solved several problems bearing on the theory of reactive movement and substantiated the possibility of manned space flight. Konstantin Tsiolkovsky's theoretical calculations have been widely used by scientists in many countries.

3. In the 1920s several groups of scientists and engineers worked on problems of rocketry in the Soviet Union. In 1934 the Soviet Government organised a Research Institute of Reactive Propulsion. All the fundamental works and investigations in rocketry were concentrated in i t. It was this institute that trained many outstanding experts in rocketry, including S. Korolyov who subsequently became chief designer of powerful multi-stage rockets.

4. The main stages of the Soviet space exploration programme are as follows.

5. October 4, 1957, witnessed the launching of the world's first artificial Earth satellite — *Sputnik 1*. The USSR has also launched heavy research *Electron* and *Proton*-type satellites, *Motniya*-type communication and *Polyot*-type manoeuvring satellites. In addition to these, several special scientific space stations have been launched in the direction of Venus and Mars.

6. Since 1959 the Moon and the space in the proximity of the Moon have been successfully explored. On February 3, 1966, the *Luna 9* automatic station made a soft touch-down on the Moon's surface. For the first time in human history a spacecraft developed by Soviet scientists landed on the Moon to transmit to the Earth information about its natural satellite. Finally in September, 1968, the *Zond 5* automatic station first flew round the Moon and returned to the Earth at the second cosmic velocity of about 11 kmps with a large amount of scientific information.

7. The launching of five satellite spaceships between May 1960, and March 1961, played an important role in paving the way for manned space flight in the poximity of the Earth. The experience thus accumulated enabled the Soviet Union to usher in the era of man's penetration into outer space. On April 12, 1961, the *Vostok* spaceship piloted by Yury Gagarin, pilot-cosmonaut of the USSR, was put into orbit round the Earth. On October 12, 1964, the *Voskhod* spaceship with a crew of three aboard was launched. The crew consisted of the pilot-cosmonaut V. Komarov, scientist K. Feoktistov and physician B. Yegorov.

8. On March 18, 1965, man first ventured to "walk out " into space from the spaceship *Voskhod 2*. Pilot-cosmonaut A. Leonov spent 20 minutes outside the ship. This experiment has proved that man can work in outer space without necessarily being confined to the spaceship.

9. The Soviet Union is carrying out a vast programme of space exploration and research. In October 1968 Georgy Beregovoi, pilot-cosmonaut of the USSR, performed a successful flight in a fundamentally new type of spaceship — the *Soyuz 3*. And in January 1969 pilot-cosmonauts V. Shatalov, B. Volynov, E. Khrunov and A. Eliseyev performed an outstanding scientific and technological experiment — in the process of an orbital flight they carried out mutual search, manifold manoeuvring, mooring and hand-controlled docking of the *Soyuz* spaceships. Cosmonauts A. Eliseyev and E. Khrunov passed through the open space from the *Soyuz 5* into the *Soyuz 4*. This experiment carried out for the first time in history is of vital importance for the development of manned flights and the creation of orbital stations which will subsequently make it possible to solve a wide range of scientific and economic tasks.

10. During the subsequent flights of the *Soyuz* 6, *Soyuz 7*, *Soyuz 8* and, in particular, *Soyuz 9* many problems linked with the creation of permanently functioning habitable space laboratories were resolved.

The flight by cosmonauts Andrian Nikolayev and Vitaly Sevastyanov in *Soyuz 9* (June 1970) lasted 425 hours. It was the first experiment of such duration with man's active participation under conditions of a space flight.

11. A fundamentally new problem — the flight of an automatic vehicle to another celestial body and its return to the Earth after carrying out its programme there — was resolved in 1970. The *Luna 16* automatic station made an unprecedented journey to the Moon and returned to the Earth with samples of lunar rock. It was followed by the *Luna 17* and *Luna 21* automatic stations, which took the first-ever automatic self-propelled vehicles to the Moon. These vehicles, *Lunokhod 1* and *Lunokhod 2,* have successfully carried out a wide programme of scientific and technical experiments.

12. The time will come when people will build and inhabit orbiting stations and reach other planets in order to harness outer space to the service of humanity.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **astronaut, docking, exploration, research, rocketry, space.**

astronaut, female-astronaut, pilot-astronaut, astronautics, military astronautics;

man-controlled docking, rendezvous docking, tandem docking;

interplanetary exploration, manned lunar exploration, planet surface exploration, space exploration;

interplanetary research, near-space research, pilotless research, planetary research, space research;

military rocketry, nuclear rocketry, strategic rocketry;

adjacent space, circumplanetary space, circumterrestrial space, deep space, empty space, free space, inner space, interplanetary space, interplanetary space, lunar space, moon space, near space, near-lunar space, near-solar space, outer space, planetary space, solar space, terrestrial space.

II. *Переведите следующие производные слова из текста, опираясь на значение корня и суффикса.*

accidental, communication, creation, designer, development, exploration, investigation, movement, necessarily, orbital, participation, penetration, permanently, possibility, powerful, scientific, scientist, subsequently, successfully.

III. *Переведите предложения, обращая внимание на перевод слов* **this (these):**

Указательные местоимения **this (these)** переводят словами *этот, эта, это, эти.*

Слово **this (these),** заменяющее предшествующее существительное, переводят этим же существительным или словами *он, она, оно, они.*

Слово **this,** заменяющее предшествующую группу слов или целое предложение, переводят словом *это.*

а) 1. **This** aircraft is designed for a life of 30,000 flying hours. 2. **These** devices replenish the oxygen that the astronaut consumes.

б) 1. Three basic schemes for protection against re-entry heating were developed. **These** use thermal capacity, thermal radiation and material ablation. 2. The efficiency of the engine depends largely on its air intake system and its exhaust system. **These** can be altered to suit the different conditions of subsonic and supersonic flight. 3. Manned satellites are usually placed into orbit for a few major purposes, and when **these** are accomplished, the pilots return back to the Earth.

в) 1. During most of the night satellites are eclipsed by the Earth's shadow. **This** limits their optical observations. 2. Small meteorites can damage the body of a spaceship. **This** can be prevented by using a bumper screen.

IV. *Переведите предложения, обращая внимание на перевод независимого причастного оборота.*

а) 1. The indicated airspeed of the airplane being controlled constantly, the pilot may determine the plane's true airspeed. 2. The Earth's orbit being an ellipse (not a circle), the distance between the Earth and the Sun constantly changes as the Earth revolves around the Sun. 3. The Sun being near the zenith, its rays are nearly vertical. 4. The temperature of an object being raised, the velocity of electrons increases. 5. A fatigue crack having been initiated, the endurance of the welded member is sharply decreased. 6. Soon the aircraft exploded in the air and broke into several pieces, two of them falling in flames. 7. D.-C. generators are used to supply either 28-volt or 112-volt systems, the higher voltages being used for the larger machines. 8. About 24 million visible meteors reach the Earth's atmosphere every 24 hours, their total weight amounting to about 5 tons per day. 9. The Earth is not a perfect sphere, but a little flattened at the poles, the polar diameter being 26 miles less than equatorial. 10. Stars differ tremendously in size, the largest ones being several times the size of the Sun and the smallest star being about the size of the Moon. 11. An infrared radiation is directed through two parallel chambers, one containing hydrogen and the other oxygen. 12. The name electronics is known to be derived from the word "electron", the electron itself being the basic unit of negative electricity. 13. Computers and calculating machines can be conveniently subdivided into two classes, analogue and digital, the basic distinction being the way in which numbers are represented inside the machine for purpose of calculations. 14. The tracking of a space vehicle may be accomplished in three different ways, the most obvious being the complete measurement of position and velocity.

б) 1. With the rocket travelling at around 4,500 mph, at an angle of 45 deg. to the Earth's surface, the first-stage motor stopped and fell away. 2. With the additional coefficient known, the derivation of the equation of time simplifies. 3. With the first phase of the test flight completed, attention now turns to modifications of the aircraft. 4. With

this manoeuvre of the spacecraft completed, two of the three crewmen will transfer from one module to the other. 5. With submarines being nuclear-powered, anti-submarine defence has become an even more difficult science. 6. The first indication of icing the airplane is a loss of power, with the loss increasing at a rapid rate.

V. *Найдите в тексте урока в абзацах 2, 6 и 11 по десять слов, имеющих общие корни в английском и в русском языках. Переведите их на русский язык*

VI. *Ответьте на вопросы к тексту.*

1. What problems did the Russian scientist Konstantin Tsiolkovsky solve? 2. When was *Sputnik 1* launched? 3. When did the *Luna 9* automatic station make a soft touchdown on the Moon's surface? 4. When was the *Vostok* spaceship put into orbit? 5. When was the *Voskhod* spaceship with a crew of three aboard launched? 6. How many minutes did Leonov spend outside the ship? 7. In what spaceship did Georgy Beregovoi perform a successful flight? 8. How long did the flight by cosmonauts Nikolayev and Sevastyanov last? 9. What journey did the *Luna 16* make? 10. What programme has *Lunokhod 1* successfully carried out?

У Р О К 17

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Многозначные слова **only, very.** 3. Слова с омонимичными формами **-ed, -ing** *(повторение).*

Термины к уроку

airship дирижабль
ambient окружающий
bearing подшипник
carrier rocket ракета-носитель
contribution вклад
descent stage спускаемый аппарат
effect осуществлять
eject сбрасывать
expose подвергать
generation поколение
inject выводить на орбиту
manned пилотируемый
pad стартовая площадка
parking orbit орбита ожидания; промежуточная орбита
power input выходная мощность
probe космическая ракета
satellite спутник
unmanned непилотируемый

ТЕКСТ

SOVIET UNMANNED SPACE VEHICLES

Cosmos

1. The *Cosmos* satellites are often called "toilers of space". The "professions" of this type of satellite are varied indeed. For instance, the altitude control system of the piloted *Voskhod* spaceship was pre-

viously tested aboard the *Cosmos 2*. The *Cosmos 8* explored the degree of meteor danger for manned flights at an altitude of 250-600 km.

2. A considerable contribution to space biology was made by the *Cosmos 110*. This satellite with dogs named Veterok and Ugolyok aboard made a long-term flight (22 days) round the Earth. The flight of the *Cosmos 186* and *188* satellites was of very great importance for further developing astronautics. Precisely this flight made it possible to utilise automatic systems for the first time and to carry out automatic orbital docking. The effect of solar activity on the terrestrial atmosphere was studied aboard the *Cosmos 348*. A biological programme was fulfilled by the *Cosmos 368*. Besides a large number of scientific problems the *Cosmos* satellites helped to solve a number of important technical problems.

Meteor

3. *Meteor* is the name given to the series of first-generation operational meteorological satellites, developed from a number of *Cosmos* prototypes.

The satellites provide information about the state of the atmosphere both on the "day-light" and "night" sides of the Earth. Information received from *Meteors* is supplied to the Soviet hydro-meteorological service and to the World Meteorological Service.

Molniya

4. The first *Molniya 1* satellite was launched on April 23, 1965. It was put into a high elliptical orbit with an apogee of 39,957 km and a perigee of 548 km. Since then, Vladivostok has been brought very close to Moscow, for a radio signal covers the nearly 80,000 km distance (Moscow — *Molniya-1*—Vladivostok) in as little as three-tenths of a second.

Proton

5. The first *Proton*-type space laboratory was launched on July 16, 1965. The weight of the station is 12.2 tons without the last stage of the carrier rocket. The laboratory was put into orbit by a rocket developing more than 60 million hp. Its power output is three times greater than that of the spaceship *Vostok* series. The highly sophisticated apparatus of *Proton 1* helped to conduct a detailed analysis of the cosmic rays emitted by the Sun.

6. The exploration programme started by *Proton 1* was continued by *Proton 2* and *Proton 3*. The year of 1968 witnessed new achievements scored by the USSR. On November 16 *Proton 4* was launched. Its weight without the last stage of the carrier rocket was approximately 17 tons. The scientific apparatus alone weighed 12.5 tons.

Venus

7. *Venus 1* probe was launched in February 1961. On March 1, 1966, the *Venus 3* probe reached Venus and became a man's first spacecraft to impact on a planet. On October 18, 1967, *Venus 4* probe reached Venus and ejected a capsule which landed by parachute at a speed of 3 m/sec near the surface.

8. Launched on August 17, 1970, *Venus 7* probe reached Venus on December 15 and soft-landed successfully on the surface. It transmitted data on the ambient temperature for some 23 minutes. It was the first occasion on which a spacecraft had soft-landed and operated on another planet.

Luna

9. *Luna 16* was an unmanned spacecraft which successfully brought samples of Moon rock back to the Earth. Launched on September 12, 1970, the spacecraft was first placed in an Earth parking orbit and was then injected into a translunar trajectory, during which one midcourse correction manoeuvre was effected. On September 21 the lunar module's main restartable liquid-propellant engine was fired to initiate the descent manoeuvre. Weight of the craft at touchdown was 1,880 kg.

On the surface *Luna 16* was commanded to activate a drill for collecting Moon rock. The soil sample obtained measured 2 cm in diameter by 34 cm long and weighed 120 g. On September 24, when the craft was near the Earth, a landing capsule was detached from the instrument compartment of the carrier rocket. The capsule landed safely at 08.26 Moscow time.

10. *Luna 17 (Lunokhod 1)* was launched on November 10, 1970. The *Luna 17* spacecraft is a development of the *Luna 16* descent stage. The *Lunokhod* vehicle is capable of continuous forward or backward movement at various speeds, but also can be commanded to move short distances, stopping automatically after each stage. *Luna 17* and *Lunokhod 1* represent a technical achievement of the first magnitude.

11. Latest in this series of automatic unmanned spacecraft was *Luna 21*. It was launched at 07.00 GMT on January 8, 1973. After a midcourse correction manoeuvre on January 9 the spacecraft spent four days in a lunar orbit. Carrying the lunar roving vehicle *Lunokhod* 2, the spacecraft touched down on the Moon at 22.35 GMT on January 16, 1973.

12. Less than three hours after landing *Lunokhod 2* rolled down ramps to the surface. The vehicle began its task of lunar exploration on January 17 and travelled a total distance of 23 miles during five lunar days of operation. It took 80,000 pictures, including 86 panoramic views and successfully performed its mission.

Zond

13. *Zond 8* was launched on October 20, 1970 on a free-return trajectory towards the Moon, which it rounded on October 24 at a distance of 604 nm (1.120 km). Its task was to take pictures of the lunar surface and check on-board systems, units and spacecraft construction.

Salyut

14. The *Salyut* was the first orbital space research station which promoted the solution of rather important scientific problems. Soviet science regards orbital stations with replaceable crews as the main road for man to outer space. Such stations may be used as "cosmodromes in outer space" or launching pads from which to make interplanetary flights.

The weight of the *Salyut* space station was 25 tons with some 2,000 on-board instruments, units, plants and 20 control panels.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **probe, satellite, ship, station, vehicle.**

earth-space probe, lunar probe, lunar landing probe, outer solar system probe, solar probe, space probe, Venus probe;

artificial satellite, earth satellite, lunar satellite, man-made satellite, manned satellite, military satellite, natural satellite, reconnaissance satellite, recoverable satellite, scientific satellite, spy satellite, terrestrial satellite, unmanned satellite;

interplanetary space ship, lunar space ship, recovery space ship;

automatic interplanetary station, lunar station, manned space station, scientific satellite station;

aerospace vehicle, carrier vehicle, earth satellite vehicle, entry vehicle, interplanetary vehicle, launch vehicle, launcher vehicle, launching vehicle, lunar exploration vehicle, lunar-landing vehicle, lunar re-entry vehicle, manned vehicle, moon vehicle, return vehicle, reusable vehicle, unmanned vehicle.

II. *Переведите следующие производные слова из текста, опираясь на значение корня и суффикса.*

achievement, activate, activity, approximately, carrier, continuous, development, exploration, importance, movement, previously, scientific, successfully, terrestrial.

III. *Переведите предложения, обращая внимание на перевод слова* only.

Наречие only переводят словом *только*. Прилагательное only переводят словом *единственный*.

a) 1. In this text we will learn **only** the basic information concerning the most common systems. 2. Research beyond atmosphere

opens vast possibilities not **only** for astronomers but also for meteorologists. 3. A space flight not **only** exposes the crew to the environment of weightlessness but also to the stress of extended periods of high acceleration.

б) 1. The United States and the USSR are not the **only** nations to have put satellites in orbit. 2. Normal breathing in space is not the **only** problem solved with the aid of space s u i t . 3. Mars is the **only** planet in the Solar system where some sort of l i f e can be found.

IV. *Переведите предложения, обращая внимание на перевод слова* **very.**

Наречие very переводят словом *очень.*
Прилагательное very переводят словами *самый, этот (тот) самый.*

а) 1. A **very** thick layer of heat-resistant metal on the nose of the space vehicle prevents it from burning. 2. **Very** l i t t l e is known about the surface of Mars.

б) 1. The **very** first satellite ever put into orbit was *Sputnik 1.* 2. This **very** method will be applied later to proving a new theorem. 3. By i t s **very** nature the conditions on the Moon differ from those on the Earth.

V. *Переведите следующие предложения. Определите, какой частью речи являются слова с омонимичными формами* **-ed.**

1. Airships are **provided** with propulsive systems and are **controlled** about all axis. 2. *Sputnik 2,* **launched** less than a month later than *Sputnik 1,* **carried** a passenger — a dog **named** Laika. 3. The weapons may be **subdivided** into several classes. 4. The various orbital operations **discussed** above are **considered** in detail below. 5. Flight tests **indicated** a **marked** improvement **established** by the more **refined** technique. 6. Under weightless conditions, liquids cannot be consumed from open containers. 7. We **used** a procedure very similar to that **described** above. 8. A large number of different types of **guided** missiles have been and are being **developed.** 9. A **streamlined** flow may be **defined** as a smooth, nonturbulent flow. 10. Our knowledge of the ambient conditions on the surface of the planets is derived from astronomical observations. 11. Because of the large flows **involved** the pumps **used** are of the centrifugal type. 12. The shape of the Earth could be **determined** from direct trigonometric survey. 13. **Closed** cabins on all passenger aircraft must be **provided** with at least one easily accessible external door. 14. With both *X* and *Y* **determined** it is now possible to calculate the speed.

VI. *Переведите следующие предложения. Определите, какой частью речи являются слова с омонимичными формами* **-ing.**

1. The **shooting** stars are caused by meteorites **burning** up as they enter the Earth's atmosphere. 2. After **putting** a piloted rocket-plane into space, the pilot will switch off the engines and glide around the Earth once or twice before **slowing** and **landing** l i k e in an ordinary aeroplane. 3. **Travelling** to Mars will be done by **travelling** along the

proper orbit about the Sun. 4. **Bearings** are used for **supporting rotating** shafts. Screws are used for **holding** two or more machine parts together. Rivets are used for **fastening** two or more plates. Bolts are used for **holding** two or more machine parts together. 5. After many hours of preparation, **checking,** and **fuelling** the huge missile is ready for **firing.** 6. Molecules are continuously **leaving** and **returning** to the surface of liquid or solid. 7. The fluid behaves like a soft spring, its free vibration frequency **decreasing** with **increasing** amplitude. 8. The nine major planets are the largest bodies **revolving** around our Sun. 9. The **launching** of the rocket **carrying** the spaceship requires great precision. 10. **Landing** an airplane at night is difficult. 11. Science has provided a new way of **getting** planes into the air. 12. The **tracking** of a space vehicle may be accomplished in three different ways. 13. The reporter is **planning** to discuss in detail all the other lines of investigation. 14. For the purpose of **investigating** an aircraft incident, the term "witness" is a general term **referring** to those persons who may be connected, even remotely, with the accident. The witness may be the **surviving** pilot, or member of the crew, and those personnel who were responsible for **maintaining servicing, scheduling,** and **controlling** the aircraft on the ground or in flight. 15. **Landing** the airplane the pilot communicated with the Earth. 16. The world of aviation has been **changing** very rapidly in all aspects over the last few years.

VII. *Найдите в тексте урока в абзаце 3 и 12 по двенадцать слов, имеющих общие корни в английском и в русском языках. Переведите их на русский язык.*

VIII. *Найдите в тексте урока в абзаце 7 пять, в абзаце 8 четыре и в абзаце 9 семь слов с омонимичными формами* **-ed.** *Переведите их на русский язык.*

IX. *Ответьте на вопросы к тексту.*

1. Why was the flight of the *Cosmos 186* and *188* satellites of very great importance for further developing astronautics? 2. What information do the *Meteor* satellites provide? 3. When was the first *Molniya 1* satellite launched? 4. What is the weight of the *Proton 4* space station? 5. When did the *Venus 3* probe reach Venus? 6. When did *Venus 7* probe softland success-fully on the surface of Venus? 7. What spacecraft successfully brought samples of Moon rock back to the Earth? 8. When was *Luna 17* launched? 9. What was the task of *Zond 8?* 10. What was the weight of the *Salyut* space station?

У Р О К 18

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Многозначные слова **both, due.** 3. Обороты **there + to be, it is (was) . . . who (that).** 4. Сложноподчиненные предложения с придаточными предложениями-подлежащими и с придаточными предложениями-сказуемыми.

Термины к уроку

carbon dioxide углекислый газ
circle совершать полет по орбите
duplicate дублировать
facility оборудование; средства
get down спускаться
guidance наведение; управление
outfit оборудовать; снабжать
recover входить в плотные слои атмосферы
retardation торможение
retroengine тормозной двигатель
spacecraft космический летательный аппарат
standby резервный; аварийный
sustenance поддержание
technique метод; способ

ТЕКСТ

SOVIET MANNED SPACE VEHICLES

The *Vostok* Spacecraft

1. On April 12, 1961, for the first time in the history of mankind, a manned spacecraft was launched into the Earth's orbit. On board the *Vostok* spacecraft Yury Gagarin made one orbit of the Earth and returned safely.

2. The characteristics of the *Vostok* spacecraft are surprising. The weight of the ship with the last stage of the carrier rocket is 6.17 tons and without the last stage 4,725 kg. The shipborne equipment weigh 2 tons. The launcher vehicle has six engines with a total capacity of 20,000,000 hp.

3. The spacecraft consists of the two main parts — a descending apparatus in the shape of a sphere 2.3 m in diameter, and an instrument compartment. The first accommodates the cosmonaut, facilities to ensure his l i f e and work and the landing system. The second houses the equipment functioning during orbital flight and the retroengine.

4. The *Vostok* instruments constantly reported the parameters of the microclimate in the capsule: pressure, humidity, temperature, content of carbon dioxide, oxygen, radiation level, etc. Altogether the ship equipment comprises 300 instruments carrying 240 electronic tubes, 6,300 semi-conductors (diodes and triodes), 760 electromagnetic relays and switches.

5. The shipborne supplies of food, water and electric power make it possible to travel in space for ten days. The orbital spacecraft is designed in such a way as to be able in case of a failure of the retroengine to get down to the Earth in 7 or 8 days because of the natural retardation of flight in the atmosphere.

6. The *Vostok* spacecraft enabled the preparation of new, more complicated flights. Taking over the traditions of the single-seater *Vostok* multi-seater *Voskhod* and *Soyuz* spacecraft have begun circling around the Earth's orbits.

The *Voskhod 2* Spacecraft

7. *Voskhod* 2 is a two-seater piloted spacecraft developed on the basis of the *Voskhod* with the object of providing facilities for the cosmonaut to leave the ship during flight.

The spaceship consists of:

— a pressurized cabin housing the crew, food and water, apparatus for the sustenance of life, control and operating systems, radio equipment, TV cameras, video-control devices, filming and photographic equipment, medical and scientific observation apparatus and reentry and landing direction finding equipment;

— an instruments compartment housing the radio-instruments, retrorockets, control apparatus, temperature control system and electric power supply sources.

8. The ship is outfitted with a standby solid fuel retrorocket engine which duplicates the main retrorockets and an airlock to permit exit and entry while in orbit. The airlock chamber is installed on the cabin. Access to it can be obtained through a hatchway with an air-tight door. The upper part of the airclock chamber is fitted with a hatch which in turn has an air-tight door. The door can be opened with either the help of an electric or hand-operated drive. It is through this hatch that the cosmonaut is able to leave the ship in flight. After the cosmonaut has completed his programme in open space, the airlock chamber is jettisoned.

9. At 12.02 hours (Moscow time) on March 19, 1965, the Soviet spaceship *Voskhod 2* after circuiting the Earth 17 times in 26 hours and covering an overall distance of 720,000 kilometres landed safely in the Soviet Union near Perm, the crew having carried out its entire programme.

The *Soyuz* Spacecraft

10. Developed for the Earth-orbital space station programme *Soyuz* spacecraft are equipped for missions of up to 30 days duration.

11. Each spacecraft comprises three basic sections or modules: a laboratory-cum-rest compartment (orbital module), a descent compartment (landing module) and a propulsion and instrument section (service module). The orbital module is mounted on the extreme nose of the craft, and communicates with the landing module via a hermetically-sealed hatch. The orbital and landing modules have a combined internal volume ot 9 m^3 and can accommodate up to four cosmonauts. The *Soyuz* craft are equipped with an automatic control system for approach and docking manoeuvres.

12. The *Soyuz 9* spacecraft was launched on June 1, 1970, carrying Col Andrian Nikolayev and engineer Vitaly Sevastyanov. A primary objective was to study the physical condition of the crew under prolonged periods in space, and *Soyuz* was not recovered until June 20, thereby establishing a record for duration in Earth orbit up to that date (since exceeded by *Soyuz 11).*

13. Launched on April 23, 1971, *Soyuz 10* was crewed by Vladimir Shatalov (commander), Alexei Yeliseyev (flight engineer) and Nikolai Rukavishnikov (test engineer). The spacecraft rendezvoused and docked successfully with *Salyut,* contact being made during the 12th orbit of *Soyuz 10* and the 86th orbit of *Salyut.* The docked craft

flew together for 5 $^{1}/_{2}$ hours. The docking manoeuvre was performed in two stages. First *Soyuz 10* was brought to within 180 m of *Salyut* by automatic guidance, after which the final approach and docking were performed manually.

14. Launched on June 6, 1971, *Soyuz 11* was crewed by Lt Georgy Dobrovolsky (commander), Vladislav Volkov (flight engineer) and Viktor Patsayev (test engineer). It docked with the *Salyut 1* space station at 07.45 GMT on June 7. After checking the security of the locking mechanism, the crew climbed through a tunnel into *Salyut.* The *Soyuz 11* cosmonauts spent a record of 23 days, 17 hours, 40 minutes in space. Their programme of experiments was completed successfully.

15. In July 1975 a Soviet *Soyuz* manned spacecraft and an American *Apollo* manned spacecraft performed a joint flight in the Earth's orbit, the joint US-Soviet *Apollo-Soyuz* space mission achieved all of its major objectives including the successful rendezvous, docking and 44 hours of joint flight.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **crew, launch, orbit, spacecraft.**

combat crew, firing crew, ground crew, guidance crew, handling crew, launch crew, maintenance crew, missile crew, multiman space crew, one-man crew, rescue crew, space crew, two-man crew;

lunar launch, sea launch, staged launch, tandem launch;

circular orbit, circumlunar orbit, circumsolar orbit, circumter-restrial orbit, earth orbit, elliptic orbit, equatorial orbit, lunar orbit, parking orbit, polar orbit, rendezvous orbit, satellite orbit, waiting orbit;

artificial spacecraft, interplanetary spacecraft, manned spacecraft, multilaunched spacecraft, planetary exploration spacecraft, recoverable spacecraft, soft-landing spacecraft, winged spacecraft, wingless spacecraft.

II. *Переведите следующие производные слова из текста, опираясь на значение корня и суффикса.*

direction, equipment, failure, guidance, launcher, manually, observation, preparation, retardation, scientific, security, successfully.

III. *Переведите предложения, обращая внимание на перевод слова* **both.**

Местоимение **both** переводят словами *оба, обе.*
Составной союз **both ... and** переводят словами *как …, так и; и ... и.*

а) 1. **Both** astronauts of the *Gemini 9* spacecraft suffered considerable fatigue. 2. In January 1969 **both** *Soyuz 4* and *Soyuz 5* were successful. 3. **Both** of these methods are effective.

б) 1. **Both** the *Apollo* **and** *Gemini* spacecraft used the oceans as their landing area. 2. The spacecraft crew experiences **both** accelera-

tion **and** deceleration during a flight. 3. **Both** piston **and** turbine engines are internal combustion engines. 4. **Both** passive **and** active radio waves are now being used to explore the Moon, Sun and near planets. 5. The Moon is the major objective of **both** unmanned **and** manned astronautical explorations.

IV. *Переведите предложения, обращая внимание на перевод слова* **due** (to):

Предлог **due to,** стоящий перед группой существительного, переводят словами *из-за, вследствие, ввиду, благодаря.*

Прилагательное **due** (to), стоящее после глагола-связки **is** переводят словами *вызываться, обусловливаться, происходить вследствие (из-за).*

а) 1. The potential energy of the body **due to** the Earth gravitational field is annihilated by the centrifugal force. 2. In our formula *g* is the acceleration **due to** gravity. 3. The magnetic compass is quite susceptible to oscillation error **due to** turbulence or rough pilot technique. 4. The Earth gravitational field is anything but constant **due to** oblateness and mass concentration.

б) 1. The cause of this airplane accident was **due to** metal fatigue. 2. The apparent lag in the instrument readings is **due to** the following fact. 3. This is **due to** two primary factors. 4. Many of the time variations of cosmic rays are **due to** effects of the Earth's atmosphere. 4. This error in calculations is **due to** numerical integration of the differential equation.

V. *Переведите предложения, обращая внимание на перевод оборота* **there+to be**[1].

а) 1. To every action there is an equal and opposite reaction. 2. There is still much to be learnt about the Moon. 3. For each angle of attack there is a corresponding airspeed. 4. There is no useful ionosphere on the Moon. 5. There are already a number of planes in our skies which exceed Mach 2 in level flight. 6. There are 2.54 cm in one inch; there are 12 inches in a foot. 7. There are many ways to guide missiles. 8. There are many factors which affect the heating of a air plane. 9. There are many advantages to this communications systems, but there is one serious drawback. 10. There are a number of hypotheses to account for the Moon's origin. 11. On board the satellite there was no special equipment for the scientific study of outer space. 12. In recent years there have been many techniques developed for the numerical solution of these complicated problems. 13. In a given system, there will be some instability.

б) 1. Up to October 4, 1962, just 5 years after the first space launch, there had been launched 49 Earth satellites. 2. There does not exist in nature any completely uniform motion. 3. Under such test conditions there does not exist the problem of the influence of high temperature. 4. In our calculations there remains only the determination of the derivative in order to compute *f*. 5. There appears to be no requirement for a computer onboard the vehicle. 6. There seem

[1] Вместо глагола **to be** могут употребляться и другие глаголы.

to be several objectives of space-flight operations. The first principal objective is the scientific exploration of space, the planets, and, later, the stars.

VI. *Переведите предложения, обращая внимание на перевод оборота* **it is (was) . . . who (that, which).**

1. It is the space vehicle that must successfully carry out the launch manoeuvre. 2. Even though the rocket principle has been understood for many years, it is only recently that rockets have been adapted as power plants for aircraft. 3. It is within this group of planets that life could exist. 4. It is only after this period that a missile deviation develops. 5. It is the combination of these two effects that causes the slowing of the air current. 6. It is at this point that the shock wave begins to curve. 7. It was in the 1520s that the Polish astronomer Nicolaus Copernicus. (1473-1543) showed that the Earth was a planet and that it moved around the Sun. 8. It was not until 1946 that man actually made radio contact with another body in the solar system. 9. It is the chief test pilot who is mainly responsible for an optimum compromise in the layout of the cockpit. 10. It was the high speed flights which brought about the introduction of the "ejector seat". 11. It was the introduction of the great optical telescopes which led to the major revolution in our ideas about the size and organization of the cosmos. 12. The space environment between 200 and 1,000 km from the surface of the Earth can be considered safe enough to establish stable orbits for the various types of space vehicles. It is this very region in which manned space flight will develop in the near future.

VII. *Переведите сложноподчиненные предложения, обращая внимание на перевод придаточных предложений-подлежащих.*

О б р а з е ц : **That such an experiment is possible in principle** has been proved by the take-off from the Moon of the Soviet *Luna 16* automatic station. *То, что подобный эксперимент в принципе возможен,* было доказано взлетом с Луны советской автоматической станции «Луна-16».

1. That man would some day visit the Moon was quite clear for mankind. 2. When to start the experiment and how frequently it should be carried out will depend on the type of the specimen. 3. That designers have to provide the oxygen and the pressure in the spacecraft cabin was quite necessary. 4. That the coating material under discussion is heat-protective will be seen in the following section of the article.

VIII. *Переведите сложноподчиненные предложения, обращая внимание на перевод придаточных предложений-сказуемых:*

О б р а з е ц : The main result of the Moon research with the help of artificial satellites **is that astronomers now have photographs of practically the entire lunar surface.** Основной результат исследо-

вания Луны с помощью искусственных спутников *состоит в том, что в настоящее время астрономы располагают изображением практически всей лунной поверхности.*

1. One of the outstanding achievements of the Soviet science is that radar observations of Venus provided the first reliable determination of the main characteristics of Venus's rotation. 2. A problem is whether the spacecraft will be protected from meteoroids in a proper way. 3. The question is whether or not the angle of attack can be predicted. 4. The difficulty is that the initial velocity of the object is unknown. 5. The question is what the density of this gas is. 6. The advantage of this technique is that the crew can make their ascent to orbit by means of a proven vehicle.

IX. *Найдите в тексте урока (абзац 7) двадцать пять слов, имеющих общие корни в английском и в русском языках. Переведите их на русский язык.*

X. *Найдите в тексте урока в абзаце 1 три и в абзаце 8 семь слов с омонимичными формами* **-ed.** *Найдите в абзацах 3 и 14 по два слова с омонимичными формами* **-ing.** *Переведите их на русский язык.*

XI. *Ответьте на вопросы к тексту.*

1. When was a manned spacecraft launched into the Earth's orbit? 2. What are the characteristics of the *Vostok* spacecraft? 3. Of how many parts does the *Vostok* spacecraft consist? 4. What is the object of the *Voskhod 2* spacecraft? 5. What does a pressurized cabin of the *Voskhod 2* spacecraft house? 6. What does the *Voskhod 2* spacecraft instrument compartment house? 7. How many sections does each *Soyuz* spacecraft comprise? 8. What was a primary objective of the *Soyuz 9* spacecraft? 9. When was *Soyuz 10* launched? 10. By whom was *Soyuz 11* crewed?

У Р О К 1 9

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Многозначное слово **one.** 3. Сложноподчиненные предложения с придаточными дополнительными и определительными предложениями.

Термины к уроку

bladder надувной мешок
cripple приводить в негодность
feed снабжать топливом
hypergolic propellant самовоспламеняющееся ракетное топливо
ignite зажигать(ся); воспламенять(ся)
manufacture изготавливать
noncryogenic propellant некриогенное ракетное топливо
performance характеристики
pressure-feed propulsion system вытеснительная система подачи *(топлива)*
pressurize создавать давление
propulsion system силовая установка
proven апробированный
redundant резервный

ТЕКСТ

SPACECRAFT PROPULSION

1. One of the most critical systems on a spacecraft is its propulsion system. If the propulsion fails, the spacecraft will be unable to return from a mission and the lives of the crew will be lost. In a manned spacecraft, the propulsion system should not only be immune from catastrophic failures, but it must start and operate reliably many times during the mission.

2. The propulsion systems on spacecraft are selected primarily on the basis of reliability as opposed to performance. Solid rocket motors are used whenever they are suitable, since a solid motor is simple and can be made extremely reliable. In the many applications for which solid rockets are unsuitable, liquid rockets using hypergolic, noncryogenic propellants are used. Hypergolic propellants will ignite upon contact and therefore the rocket engine need not be equipped with an ignition system. The avoidance of the use of cryogenic propellants, which must be kept in insulated containers, greatly simplifies the spacecraft's propellant storage and feed systems.

3. Only pressure-feed propulsion systems are currently being employed on manned spacecraft. In such systems, the force required to cause the propellants to flow into the rocket combustion chamber is created by pressurizing the propellant tanks with helium gas. Helium from high-pressure storage bottles is fed into the propellant tanks at the desired pressure through pressure regulation valves. Compared to conventional pump-feed propulsion systems, a pressure-feed system is considerably heavier since the propellant tanks must be made stronger and a great deal of helium pressurant must be carried in high-pressure containers. On the other hand, many simplifications are achieved. For instance, the number of valves and controls for start and shut-down are greatly reduced and the rocket motor's turbopump is eliminated.

4. Spacecraft are all equipped with small auxiliary rockets, used for attitude control and minor manoeuvres. They may also carry large main propulsion systems for major manoeuvres.

5. It is common practice to carry an excess of auxiliary rockets arranged in a manner so that one or more of these rockets may fail without crippling the spacecraft. On the other hand, it is not practical to carry more than one main propulsion system. The designer must therefore design this system to be extremely reliable. One approach is to use redundant components wherever it appears to be practical. For instance, four valves arranged in a series-parallel arrangement may be used to replace a single valve. Such an arrangement protects the system against either a failure to open or a failure to close.

6. Spacecraft propulsion systems must be capable of starting in the weightless environment. It is therefore important that the propellant storage tank be arranged so that propellants rather than helium will always be transferred to the engine. The propellant tanks

of the auxiliary propulsion system are manufactured with an internal bladder. The propellant is stored within the bladder and the helium pressurant is introduced outside the bladder. Thus the bladder collapses as the propellant is expended and the bladder wall separates the helium from the propellant. The large tanks used in the main propulsion systems are not equipped with bladders. The auxiliary propulsion system must therefore be used for a short period to settle the propellant before the main propulsion may be started.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **propulsion, reliability, rocket, weight, weightlessness.**

cruise propulsion, ion propulsion, jet propulsion, nuclear propulsion, photon propulsion, reaction propulsion, rocket propulsion, satellite propulsion, thermal jet propulsion;

combat reliability, computed reliability, crew reliability, engineering reliability, ground equipment reliability, maintenance reliability, missile reliability, operational reliability, overall reliability, performance reliability, structural reliability, use reliability, vehicle reliability;

airborne rocket, aircraft rocket, antiaircraft rocket, antisubmarine rocket, antitank rocket, armament rocket, boost rocket, brake rocket, carrier rocket, exploration rocket, ground-to-air rocket, ground-to-ground rocket, ground-to-sea rocket, ground-to-ship rocket, ground-to-underwater rocket, guided rocket, liquid-propellant rocket, solid-liquid rocket, solid-propellant rocket, space rocket, step rocket, two-stage rocket, unguided rocket;

weight at launch, all-up weight, artificial weight, burnout weight, construction weight, design gross weight, electronics weight, empty, weight, final weight, fuel weight, in-orbit weight, launching weight, missile weight, over-all weight, payload weight, structural weight, take-off gross weight, warhead weight;

dynamic weightlessness, extended weightlessness, prolonged weightlessness.

II. *Переведите следующие производные слова из текста, опираясь на значение корня и суффикса.*

application, arrangement, considerably, currently, designer, extremely, failure, greatly, ignition, performance, primarily, reliable, reliability, simplification, storage, suitable, weightless.

III. *Переведите предложения со словом* **one.**

Числительное **one** переводят словами *один, одна, одно.*

One, заменяющее предшествующее существительное, переводят этим же существительным или совсем не переводят.

Слово **one** не переводят в конструкциях типа **One considers that ...** *Считают (считается, мы считаем), что ... .*

a) 1. On January 30, 1964, the Soviet Union used **one** carrier rocket to launch a system of two research stations: *Electron 1* and

Electron 2. **One** of the most hazards of a space flight is the meteorite damage.

б) The liquid rocket unit comprises two rocket engines — the main and a reserve **one**. 2. The landing process of a spacecraft comprises two stages. The first stage involves departure from the orbit. The second **one** consists of re-entry into dense atmosphere and soft landing. 3. There exists a severe problem of returning from space for all manned vehicles and for some unmanned **ones.**

в) 1. **One** assumes that . . . . 2. **One** believes that . . . . 3. **One** may conclude that . . . . 4. **One** should expect that . . . . 5. **One** should not forget that . . . . 6. **One** must note that . . . . 7. **One** will obtain that . . . . 8. **One** observed that . . . . 9. **One** should point out that . . . . 10. **One** should recognize that . . . . 11. **One** will see that . . . . 12. **One** may suppose that . . . .

IV. *Переведите сложноподчиненные предложения, обращая внимание на перевод придаточных дополнительных предложений.*

1. This work shows how a step rocket works. 2. The investigator must locate the origin of the fire in the aircraft and determine how it caused the accident. 3. We want to know if cosmic rays and other radiation are so intense that they would kill any living creature exposed to them. 4. The investigator must determine whether fire in the aircraft preceded the crash. 5. To characterize the rocket one has to state whether the rocket is equipped with a solid or a liquid propellant engine, whether the rocket is guided or non-guided, whether the frame is winged or wingless. 6. The astronaut reported that some difficulty was encountered in separating the lunar module. 7. It is a well-known fact that the Earth and eight other planets rotate about the Sun. 8. The engineers said they would like to design a new type of a spaceship for transportation to Mars. 9. We find this value is directly proportional to the volume of the fuel tank. 10. Some investigations indicate the above described statistical method is correct.

V. *Переведите сложноподчиненные предложения, обращая внимание на перевод придаточных определительных предложений.*

1. An artificial satellite is a man-made object that revolves about the Earth, the Moon, or the Sun. 2. The Sun is just one of perhaps 100 billion stars that belong to a system of stars called a galaxy. 3. Drag is the force which opposes the forward motion of the airplane. 4. There are large bluish-green putches on the surface of Mars which change in size and colour with the seasons. The poles of Mars are covered with ice caps which grow and shrink with the seasons. 5. In 1929 Tsiolkovsky suggested the multi-stage rocket which made the orbital and escape velocities feasible. 6. The energy of the Sun provides the necessary environment, weather conditions, and power source which make it possible for man to live on the Earth. 7. There are already a number of planes in our skies which exceed Mach 2 in level flight. 8. In fact, no bodies exist which are not acted upon by other bodies. 9. There are a number of means by which exploration vehicles can move across

lunar and planetary surfaces. 10. The speed at which sound travels in air under standard sea-level conditions is 1,116 ft per sec. 11. There are schemes by which the crew may be carried away from the launch vehicles when a failure occurs. 12. Photon propulsion offers a theoretical means by which the exploration of interstellar space can be accomplished. 13. A spacecraft is by far the fastest travelling vehicle in which a man has ridden. 14. Lack of weight is one of the many problems with which spaceman must cope. 15. Pluto is the outermost planet of the Solar system, beyond whose orbit lies interstellar space. 16. The centre of pressure is the point where the combined effect of all aerodynamic side forces is concentrated. 17. There is a certain amount of radioactivity present in the air we breathe, in the water we drink, and in all the food we eat. 18. The equation we used combines the radiation and conduction modes of heat transfer.

VI. *Найдите в тексте урока (абзац 3) шесть словосочетаний и переведите их на русский язык. Обратите внимание на последовательность расположения слов в английских и в русских словосочетаниях.*

VII. *Найдите в тексте урока в абзацах 1 и 5 по семь слов, имеющих общие корни в английском и в русском языках. Переведите их на русский язык.*

VIII. *Найдите в тексте урока в абзаце 2 шесть и в абзаце 6 девять слов с омонимичными формами* **-ed.** *Переведите их на русский язык.*

IX. *Ответьте на вопросы к тексту.*

1. What system is the most critical on a spacecraft? 2. What happens if the propulsion fails? 3. On what basis are the propulsion systems on spacecraft selected? 4. Why are solid rocket motors used whenever they are suitable? 5. In what applications are liquid rockets used? 6. What propulsion systems are currently being employed on manned spacecraft? 7. Is a pressure-feed system considerably heavier compared to conventional pump-feed propulsion systems? 8. For what purpose are small auxiliary rockets used? 9. Have the propel-lant tanks of the auxiliary propulsion system an internal bladder? 10. Are the large tanks used in the main propulsion systems equipped with bladders?

У Р О К 20

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Многозначные слова **after, before, for, because, as.** 3. Сложноподчиненные предложения с придаточными обстоятельственными предложениями времени, причины и цели.

Термины к уроку

cut off выключение двигателя
dead reckoned position счислимое место летательного аппарата
dead reckoning счисление пути
deboost замедление движения; торможение
event операция
leg отрезок траектории
man-made искусственный
midcourse маршевый (средний) участок траектории
pelorus пелорус
pericynthian перицинтан(*ближайшая к Луне точка траектории космического летательного аппарата)*
sight визирование
sighting device визирное приспособление

ТЕКСТ

SPACE NAVIGATION AND GUIDANCE

1. A fundamental problem in navigation is the determination of one's position. Many of the principles of marine navigation are applicable to space navigation. In marine navigation the determination of one's position is a straightforward problem in geometry, provided landmarks are visible. A bearing is taken on the landmarks by measuring their direction relative to north. This may be done with a sighting device, such as a pelorus, mounted on deck. The observed bearings are converted to an angle measured clockwise from true north. These "true bearings" are then plotted as lines on the navigator's chart. Where the bearing lines cross on the chart is the location that was occupied by the ship at the time the sightings were made.

2. The determination of position from measured bearings of known landmarks is the simplest form of marine navigation. When out of sight of landmarks, the navigator can determine his position from the location of the Moon, the Sun, and some of the planets and stars. This is done by sextant measurements of the elevation angles of these bodies above the horizon. Based upon the use of pre-computed tables, the navigator can then determine the line of positions on the Earth's surface from which the measured elevation angle could be obtained. The crossing of two such lines obtained from sighting on two bodies is then its position. A navigator can also estimate its position by computing its direction and distance travelled since his last fix. This is called dead reckoning.

3. The important difference between marine navigation and space navigation is that the spacecraft is free to travel in three dimensions, whereas the ship which travels on the surface of the water is limited to movement on a surface. The general procedures of navigation are basically the same. However, the great speed of spacecraft requires that positions be determined quickly and accurately. The position of a spacecraft is determined from measured l i n e of sights and possibly ranges to known reference points, the only difference being that angular measurements must be made in two reference planes instead of one. The speed and direction of travel can then be determined from the progress made from one measured position to the next.

4. The determination of position in space is only a part of the navigation task. The computer must also determine the velocity and

direction of travel of the spacecraft. This can be done by the comparison of a series of fixes. The gravitational attraction of the Earth and Moon must be accounted for in this process since gravitational fields will bend the path along which the spacecraft is travelling, and will cause the velocity to change. The next step is to predict the space-

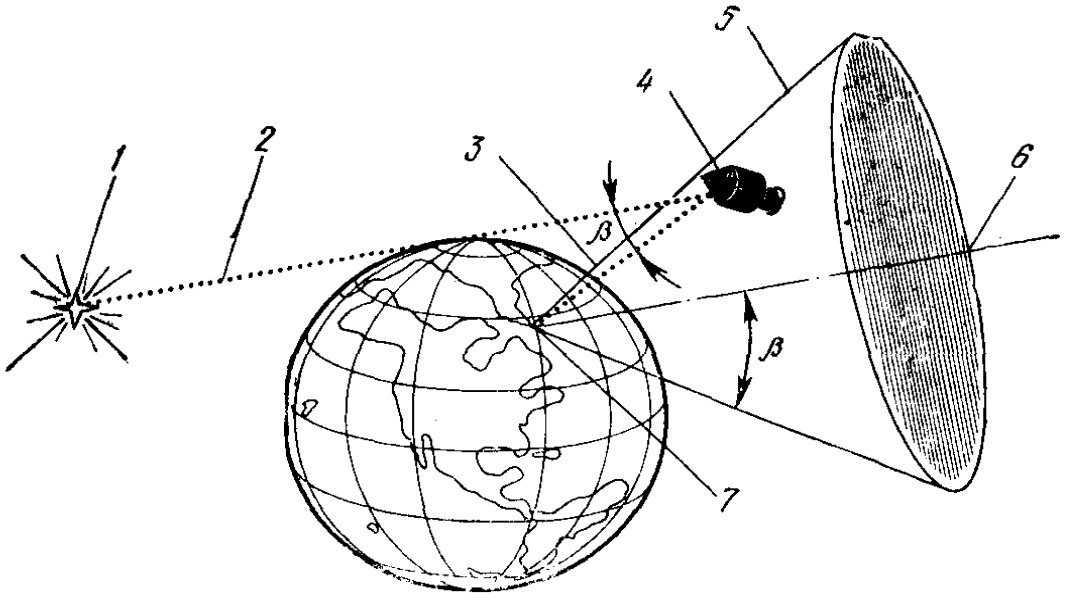

Fig. 8. The surface of position of the spacecraft is established from the measured sextant angle, the location of the landmark, and the position of the star on the celestial sphere
1 — Canopus; 2 — starline of position; 3 — landmark line of position; 4 — spacecraft; 5—surface of position; 6 — Cone axis is parallel to the star's line of position and is established from its coordinates in the celestial sphere; 7 — landmark

craft's position at future times. The predicted position is then compared with a "target" position for the particular leg of the journey. For instance, when the spacecraft is outbound for the Moon, the target position is the planned location of pericynthian. If the calculated position of pericynthian is different than the desired one, then the path must be corrected. The computer not only determines such errors, but also computes the requisite corrective manoeuvre. Such manoeuvres are called mid-course guidance manoeuvres.

5. A mid-course guidance manoeuvre consists of the following events. First, the spacecraft's attitude is rotated to the desired one. The reaction control jets are used to turn the spacecraft. The inertial measuring unit is used to indicate the desired attitude. When the spacecraft propulsion axis is pointed in the direction desired, the main propulsion engine is started and accelerates the spacecraft in the direction necessary to eliminate the computed error. The inertial measuring unit in conjunction with the computer integrates the change taking place in the spacecraft's velocity. At the instant the computed error is nullified, the computer sends a cut-off signal to the propulsion system.

6. The mid-course manoeuvres are of small velocity magnitude and take place at fairly great distances from either the Earth or the

Moon. These manoeuvres are therefore carried out with the spacecraft on a constant heading. For other propulsive manoeuvres, requiring a large change in velocity such as the deboost manoeuvre into lunar orbit, the direction along which the thrust should be applied changes during the period of the manoeuvre. This is so, because, as the spacecraft moves in the vicinity of the Moon, its flight path curves and the direction of pull from lunar gravity also changes. The computer is programmed to guide the spacecraft through this manoeuvre.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **attitude, bearing, chart, direction, guidance, position.**

flight attitude, landing attitude, launching attitude, level attitude;

azimuth bearing, compass bearing, reverse bearing, true bearing;

aeronautical chart, air-navigation chart, landing chart, navigation chart, radar chart, route chart, weather chart;

compass direction, flight direction, magnetic direction, radar direction, travel direction;

astronautical guidance, astronomical guidance, celestial guidance, celestial-inertial guidance, docking guidance, earth-moon guidance, global ranging guidance, interplanetary guidance, launch guidance, manned lunar mission guidance, re-entry guidance, re-entry corridor trajectory guidance, rendezvous guidance, satellite guidance, satellite re-entry guidance, stellar-inertial guidance, terminal guidance;

dead-reckoned position, flying position, ground position, pre-calculated position.

II. *Переведите следующие производные слова из текста, опираясь на значение корня и суффикса.*

accurately, angular, applicable, attraction, basically, comparison, computer, determination; difference, direction, elevation, fairly, guidance, location, measurement, movement, navigation, possibly, quickly, reaction, reference.

I I I . *Переведите предложения, обращая внимание на перевод слова* **after:**

Предлог времени **after** переводят словом *после.* Союз **after** переводят словами *после того как.*

а) 1. **After** take-off, we should attempt to follow the extended centreline of the runway. 2. **After** several hours of manoeuvring in orbit, the two spacecraft rendezvoused and then docked. 3. Each stage of a rocket is jettisoned **after** burn-out.

б) 1. **After** the spacecraft is placed into orbit the astronauts start carrying out the flight programme. 2. **After** the spacecraft reentered the atmosphere, braking parachutes were deployed. 3. *Kosmos 186* linked up with *Kosmos 188* shortly **after** the latter was launched.

IV. *Переведите предложения, обращая внимание на перевод слова* **before:**

Предлог времени **before** переводят словами *до, перед, прежде чем.*
Союз **before** переводят словами *прежде чем, до того как.*

а) 1. **Before** Gagarin's flight we had no definite opinion about human behaviour in zero-gravity condition. 2. **Before** putting the spacecraft on the re-entry trajectry it is oriented in space at the appropriate time. 3. Just **before** the landing of a spacecraft the landing retrorockets are switched on.

б) 1. Five or six years may elapse **before** the idea in scientist's mind becomes the reality of a flight experiment. 2. **Before** we activate the magneto switch or the starter, we must be absolutely positive that no person is within range of the propeller.

V. *Переведите предложения, обращая внимание на перевод слова* **for.**

Предлог **for** переводят словами *для, ради, за, по; в течение, в продолжение.*
Союз **for** переводят словами *так как, потому что, ибо.*

а) 1. All of the necessities of l i f e **for** the crew must be considered in the design of a spacecraft. 2. Astronauts wear space suits **for** two purposes. 3. Newton's third law states that **for** every action there is an equal and opposite reaction.

б) 1. **For** many years scientists observed stars and planets through telescopes. 3. The problem of building space stations has engaged the attention of scientists **for** a long time. 3. Space engines of definite types should operate **for** periods of up to three years.

в) 1. Earth satellites' l i f e is limited **for** they disintegrate upon re-entering the denser portion of the atmosphere. 2. The pitot-static system is very important **for** it drives primary flight instruments. 3. The problem of building space stations is drawing the attention of many scientists **for** to launch a heavy satellite assembled on the Earth presents great difficulties.

VI. *Переведите предложения, обращая внимание на перевод слова* **because:**

Предлог **because** переводят словами *из-за, вследствие.*
Союз **because** переводят словами *потому что, так как.*

а) 1. Optical observations of satellites are limited **because** of their small size. 2. The scheduled flight was postponed **because** of deteriorating weather. 3. Public laws prohibit commercial supersonic flights over the United States **because** of the sonic boom.

б) 1. Space stations must be well stocked with food, water and other supplies **because** they are designed to sustain multiman crews for long periods. 2. The re-entry compartment re-entered the atmosphere in a predetermined position **because** the astronaut carefully con trolled the flight. 3. Weather satellites have paid back all the money that went into their development **because** they gave advance warnings of the approach of hurricanes.

VII. *Переведите предложения, обращая внимание на перевод слова* **as.**

Союз **as** в зависимости от контекста переводят: 1) *когда; в то время как;* 2) *так как; поскольку;* 3) *так, как; как.*

Предлог **as** переводят словами *как, в качестве.*

а) 1. **As** the satellite moves forward, its path is curved by the pull of gravity. 2. **As** the velocity of the air increases, the pressure decreases. 3. **As** propellant is expended, the weight of the space vehicle becomes less. 4. **As** more rockets became available, the scope of the experiments grew. 5. **As** manned spacecraft become more complex, the demands for power increase sharply. 6. The thrust of the engine will increase **as** atmospheric pressure decreases or as altitude I creases. 7. Lift increases **as** the angle of attack increases. 8. **As** the air moves to ward the trailing edge of the wing, the boundary layer becomes thicker. 9. The centre of pressure moves backward **as** the angle of attack in creases and forward as it decreases. 10. **As** thrust and drag are equal, the airplane flies at a constant speed.

б) 1. Space suits serve **as** a protective measure against inadvertant loss of cabin pressure. 2. Communication satellites initially had to overcome the same skepticism **as** the automobile. 3. Mars rotates at about the same rate **as** the Earth.

VIII. *Переведите сложноподчиненные предложения, обращая внимание на перевод придаточных обстоятельственных предложений времени, причины и цели.*

а) 1. After the space probe is placed into its interplanetary trajectory the solar panels are unfolded and the probe is oriented to wards the Sun. 2. The general nature of the Venusian surface must first be determined before detailed investigatory programmes can be initiated. 3. Each part of a missile is tested thoroughly before it is used in actual flight. 4. When the crew of the spacecraft is ejected from the capsule at high dynamic pressure, they are exposed to large drag forces. 5. The aircraft remains in a stable position until other forces influence it. 6. The rocket accelerates gradually until the maximum velocity is reached. 7. This process continues until the last stage of a rocket has burned. 8. The missile flies along the beam until it collides with its target.

б) 1. Because Mars has a very thin atmosphere surface features can be easily seen and photographed from the Earth. 2. A rocket does not need air from the atmosphere to support combustion because it carries its own oxygen in the propellants. 3. The Earth's ionosphere is of great everyday importance because of the role it plays in radio communications. 4. Since there is no atmosphere, there can be no storms on the Moon. 5. Because of the high cost of development of new types, a strong effort has been and will continue to be made to standardize the launching vehicles for space flights.

в) 1. The propellants must be injected into the combustion chamber so that they may thoroughly mix and completely burn. 2. The abscissa and the ordinate must be known in order to determine the

direction of the centrifugal force. 3. Lunar and interplanetary missions require sufficient cut-off velocity so that the vehicle will completely escape the Earth's gravitational field.

IX. *Найдите в тексте урока в абзацах 5 и 6 по два словосочетания и переведите их. Обратите внимание на последовательность расположения слов в английских и в русских словосочетаниях.*

X. *Найдите в тексте урока в абзацах 1 и 4 по пятнадцать слов, имеющих общие корни в английском и в русском языках. Переведите их на русский язык.*

XI. *Найдите в тексте урока (абзац 3) шесть слов с омонимичными формами* **-ed.** *Найдите в абзаце 1 пять и в абзаце 5 четыре слова с омонимичными формами* **-ed.** *Переведите их на русский язык.*

XII. *Ответьте на вопросы к тексту.*

1. What is a fundamental problem in navigation? 2. What is the simplest form of marine navigation? 3. How can the navigator determine his position? 4. By what measurements does the navigator determine his position? 5. What is the difference between marine navigation and space navigation? 6. How is the position of a spacecraft determined? 7. Is the determination of position in space only a part of the navigation task? 8. What must the computer determine? 9. Of what events does a mid-course guidance manoeuvre consist? 10. Do the mid-course manoeuvres take place at fairly great distances from the Earth or the Moon?

У Р О К 21

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Многозначное слово **provided**. 3. Сложноподчиненные предложения с придаточными обстоятельственными предложениями условия.

Термины к уроку

acquisition определение местоположения
boresight визировать
directional antenna направленная антенна
display показывать на индикаторе
display console пульт индикации
Doppler tracking сопровождение с помощью доплеровской радиолокационной станции
emergency аварийный
generate получать
increment приращение
man укомплектовывать
operation support team группа по обеспечению операций
pitch высота *(тона)*
radar set радиолокационная станция
radar tracking радиолокационное сопровождение
round trip полет по замкнутому маршруту
scanning сканирование; обзор
tracking слежение; сопровождение цели
track траектория
transponder приемоответчик

ТЕКСТ

SPACE TRACKING AND COMMUNICATIONS

1. Although a manned spacecraft is designed to carry out its mission independent of the support of the facilities on the Earth, it is intended that this be done only as an emergency flight mode. Actually, extensive facilities have been constructed on the Earth to provide every reasonable and practical aid to the flight. These ground facilities are manned by operations support teams which help the flight crew monitor the performances of all the vital systems aboard the spacecraft as well as assist them in flight navigation. In fact the facilities on the ground are able to provide more precise and more reliable navigation data than that which can be generated aboard the spacecraft. Thus, the communication and tracking links between spacecraft and ground are vital elements of a manned space mission.

2. Radar tracking of the spacecraft is used to determine the position and velocity of the spacecraft. The position of an object is obtained from a radar set by measuring the elevation and azimuth angles of the radar beam illuminating a target and by measuring the time increment that it takes for a signal to make the round trip from the radar antenna to the target and back. This last measurement gives the radial distance to the target. Velocity is measured by the Doppler effect [1]. The returned signal is changed in frequency by an amount that is directly proportional to the radial component of the target's velocity. While the radial component of velocity is in itself of little value this measurement combined with other measurements can be used to make accurate computations of velocity and direction of motion.

3. The location of the radar set on the Earth must be determined to at least the same degree of accuracy that is desired for tracking the spacecraft. In addition, the radar must be boresighted to an accurate reference so that the measured elevation and azimuth angles will be of sufficient accuracy. The scanning accuracy of the radar beam is also limited by the sharpness of focus of the beam. Thus, a highly directional antenna must be used for high accuracy tracking. A radar with such a very narrow beam cannot be depended upon to acquire (initially find) the spacecraft. For this reason it is sometimes necessary to employ a broader beam antenna system as an acquisition aid. Another scheme is to use computed information to direct the steering of the radar antenna along the predicted track of the spacecraft while the radar acquires the target.

4. Because it is desired to track spacecraft at great distances, they are usually equipped with radar transponders. A transponder is

[1] An example of the Doppler effect is the change in pitch of a train's whistle and a car's horn on passing an observer. Because of this effect, the frequency of the radio waves received on the Earth is changed by the velocity of the spacecraft in exactly the same way that the pitch of a train's whistle is changed by the velocity of the train. A system for measuring the trajectory of spacecraft from the Earth using continuous radio waves and the Doppler effect is called Doppler tracking.

a device which receives a radar signal, amplifies it and re-transmits it on a slightly different frequency. The amplification of the radar signal in the transponder greatly increases the effective range of the radar.

5. In addition to radar tracking, radio frequency transmissions between the ground and spacecraft are used to transmit a great deal of information during the mission. The most important communications are by voice. The spacecraft crew keeps personnel on the ground informed of the status and performance of the spacecraft by this means. At the same time, those on the ground are able to advise and consult with the flight crew on problems which may arise. They are able to give the crew important navigation instructions based upon the precise and reliable information generated by the ground facilities.

6. Radio transmissions are also used to transmit data directly to remote display consoles, recorders, or to computers for further processing. This is also a two-way transmission; however, the majority of operational data is transmitted from spacecraft instrumentation to the ground activity. Some of these measurements are displayed to the ground monitoring crews while others are fed into computers which generate computed performance of the spacecraft or predicted capabilities for future manoeuvres. Similarly, valuable data generated by the ground facilities can be transmitted to the spacecraft for display to the crew or to be stored in the spacecraft computer for future use.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **angle, communication, computer, data, facility, increment, performance, radar, tracking.**

antenna angle, attitude angle, azimuth angle, bearing angle, glide angle;

air-ground communication, cosmic radio communication, ground-air communication, interplanetary communication, intersatellite communication, lunar probe communication, re-entry communication, satellite-to-satellite communication, ship-to-satellite communication, space communication, space-to-space communication;

airborne computer, air navigation computer, angle computer, autopilot computer, course-and-distance computer, flight computer, guidance computer, height computer;

averaged data, design data, launch research data, lunar data, orbital data, planetary data;

approach facilities, autopilot facility, navigational facilities;

drag increment, escape increment, impulse velocity increment, lift increment;

entry performance, launcher performance, launch-vehicle performance, manoeuvring performance, re-entry performance;

airborne radar, aircraft radar, approach radar, Doppler radar, early-warning radar, flight path radar, general-purpose radar, ground radar, landing radar, navigational radar, position radar;

all-the-way tracking, celestial radio tracking, deep space probe tracking, mid-course tracking, orbital tracking, radar tracking, re-entry tracking, space tracking.

II. *Переведите следующие производные слова из текста, опираясь на значение корня и суффикса.*

accuracy, acquisition, actually, addition, amplification, capability, computer, dependent, directional, directly, effective, elevation, greatly, highly, initially, location, measurement, performance, proportional, reasonable, recorder, reference, reliable, sharpness, similarly, slightly.

III. *Переведите предложения, обращая внимание на перевод слова* **provided.**

Provided — форму прошедшего времени от глагола to provide и причастие II, образованное от того же глагола, переводят исходя из значений глаголов: **to provide** *давать, обеспечивать, снабжать;* **to provide for** *предусматривать, обусловливать.*

Союз **provided** переводят словами *если, если только, при условии.*

а) 1. The exploration of the Moon **provided** a great deal of scientific knowledge. 2. The instruments **provided** a precise record of the astronaut's state of health. 3. On-board radio systems **provided** reliable communication with ground tracking facilities. 4. Manned satellites have **provided** initial data on weightlessness. 5. Power for this aircraft is **provided** by two turboprops. 6. A system of small jets is **provided** for attitude control of the spacecraft during manoeuvre. 7. The environmental control system should be **provided** for in spaceships. 8. Data **provided** by these tests were processed by electronic computers.

б) 1. A vehicle is considered a sounding rocket **provided** it rises above the atmosphere out to 4,000 miles. 2. The magnetic compass can be used with precision **provided** its peculiarities are understood. 3. The project of building a thrusted model will become a reality **provided** all the necessary materials are found in time.

IV. *Переведите сложноподчиненные предложения, обращая внимание на перевод придаточных обстоятельственных предложений условия.*

О б р а з е ц 1: If an object **changes** its position, **it is said** to be in motion.=> Если тело *изменяет* свое положение, то *говорят,* что оно находится в движении.

а) 1. If the air is rising from the earth, it is called a vertical current or thermal. 2. If the climate is cold and the altitude is low, the air will be dense and an airplane will take off at a much lower speed than it will if the air is warm or at high altitudes. 3. If outside forces disturb a stable aircraft from its normal flight, the aircraft tends to return eventually to its original position. Sometimes an aircraft, if disturbed from its original position, assumes a new position. 4. If the centre of mass is behind the centre of pressure, this will tend to

rotate the space vehicle to a greater angle-of-attack. 5. The actual pressure, temperature and composition of the atmosphere are of fundamental concern if men wish to land on Venus. 6. This conclusion is true provided the average electrode spacing is less than the tank radius. 7. Scientists know that all living things can be killed by radiation provided they receive a high enough dose. 8. Effective actions to prevent future aircraft accidents cannot be taken unless the true causes of past accidents are known. 9. Flight of passengers above 10,000 ft requires supplementary oxygen unless it is accomplished in a pressurized cabin that provides equivalent.

О б р а з е ц 2: If lift **were** less than gravity, the aircraft **would descend.** => Если бы подъемная сила *была* меньше силы тяжести, то самолет *пошел бы* на снижение.

б) 1. If a spaceship were lighter in weight the cost of its launching rockets would be tremendously reduced. 2. If an infinite number of sensors were used the control system would be correct at all times. 3. The accuracy of the system would be considerably improved if signals were transmitted on two or more frequencies simultaneously. 4. If a step-rocket of this kind had ever been fired it would have dropped into the Pacific Ocean. 5. If thrust were increased and became greater than drag, the aircraft would accelerate. 6. If thrust were decreased, drag would cause the aircraft to decelerate.

О б р а з е ц 3: **Should** the retrorockets of the vehicle **fail,** reentry **would occur.** => *Если бы отказали* тормозные двигатели, то летательный аппарат *вошел бы* в плотные слои атмосферы.

в) 1. Had the wall thickness been 0.025 in instead of 0.25 in, the first natural frequency would have been 14 Hz instead of 140 Hz. 2. Aeronautical engineering would have taken a very different course had aluminium alloys with suitable properties not been developed. 3. Should the attitude control system of the vehicle f a i l , then a safe re-entry might be impossible. 4. Should this system detect an equipment malfunction, then telemetering signals regarding the defect would be transmitted to a ground station. 5. The crew of the spaceship will be able to determine their impact point, should they initiate re-entry procedures. 6. The astronaut occupied an ejector seat which enabled him to leave the cabin, should the need arise.

V. *Найдите в тексте урока в абзацах 1, 3 и 5 по одному слово сочетанию и переведите их на русский язык. Обратите внимание на последовательность расположения слов в английском и в русском языках.*

VI. *Найдите в тексте урока в абзацах 2 и 3 по двенадцать слов, имеющих общие корни в английском и в русском языках. Переведите их на русский язык.*

VII. *Найдите в тексте урока (абзац 1) шесть слов с омонимичными формами* **-ed.** *Найдите в абзаце 1 два слова с омонимичными формами* **-ing.** *Переведите их на русский язык.*

V I I I . *Ответьте на вопросы к тексту.*

1. For what purpose have extensive facilities been constructed on the Earth? 2. What do operations support teams do? What is radar tracking of the spacecraft used for? 4. How is the position of an object obtained? 5. How is velocity measured? 6. To what degree of accuracy must the location of the radar set on the Earth be determined? 7. By what is the scanning accuracy of the radar beam limited? 8. What is a transponder? 9. What are the most important communications? 10. Are radio transmissions also used to transmit data?

У Р О К 22

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Многозначные слова **it, that (those), should** и **would.** 3. Сложноподчиненные предложения с глаголами типа **to demand,** с конструкциями типа **It is desirable that,** с союзами **as if, as though,** содержащие в придаточных предложениях глагол-сказуемое в сослагательном наклонении.

Термины к уроку

advanced усовершенствованный
cell топливный элемент
desplay panel приборная доска
dispose of избавиться; ликвидировать
ignition зажигание; воспламенение
input вход
lifetime срок службы
mission полет; задание; задача; цель
reject отводить; отражать
shielding экран; экранирование
thermionic термоэлектронный
waste heat тепло отработанных газов

ТЕКСТ

EIECTRICAL POWER GENERATION IN SPACE

1. There are a great many uses for electrical power on board a manned spacecraft. Power is used by the communications equipment, by the radar, navigation and guidance equipment, and by the automatic control system. The environment control system uses electricity to drive the blowers that circulate oxygen in the cabin and through the space suits of the crew, and then through purification and cooling equipment. Cooling fluids must be circulated past heat-producing equipment and then through external radiators. The cabin and the display panel are illuminated by electricity. In other words, virtually every piece of equipment aboard the spacecraft consumes some electrical power.

2. Electrical energy can be produced aboard a spacecraft from either chemical, nuclear, or solar energy. Invariably, the conversion of energy from the raw source into usable electrical power involves processes that are not 100 per cent efficient. This means that the amount of energy obtained in electricity is less than the amount of energy taken from the source. The difference between the useful energy out put and the raw energy input is excess heat that cannot be used (in other words, waste heat). Since waste heat must be rejected from the

spacecraft, the amount of waste heat produced in the power generation system may be a significant consideration in the selection and design of the system.

3. The simplest form of electric power supply is primary cells, more commonly called storage batteries. The energy source in primary cells is in the chemical properties of the cell materials. When the electricity is withdrawn from a battery which is a series of cells, a chemical reaction takes place within the individual cells. The chemical energy is converted into electricity as ions flow from the cathode to the anode in each cell. The energy that produces this current is obtained from chemical reactions taking place between the electrodes and the electrolyte in the cell.

4. Batteries are quite efficient in converting chemical energy to electrical energy. Very little waste heat is produced, and that which is produced can be easily disposed of by the regular spacecraft cooling system. Unfortunately, the best storage batteries do not store a great deal of available energy per pound of weight.

5. For durations in excess of a few weeks, chemical power systems are not competitive with systems based on nuclear or solar energy. This is because solar energy systems require no fuel at all, and nuclear systems require only a very small amount of fuel. Solar energy systems suffer from the basic requirement that the energy collection system must be positioned so that it can receive energy from the sun. This not only imposes an extra duty upon the attitude control system, but also restricts the freedom to manoeuvre. On the other hand, nuclear energy systems may require heavy shielding to protect the crew from harmful radiation. Nevertheless, technology has advanced to the point where it is practical to build systems that could supply electrical power to manned spacecraft for periods in excess of one year using either solar or nuclear energy. Manned space laboratories and interplanetary spacecraft will undoubtedly be equipped with power systems using one or the other of these energy sources.

6. The most straightforward way to use solar energy is by photovoltaic conversion using solid state devices (solar cells). Such solar cells need only be exposed to sunlight to produce electrical energy. While only a small portion (perhaps six per cent) of the solar energy falling on a cell may be converted into electrical energy, the simplicity and lightness of the solar cell, as well as the abundance of solar energy in space, make this an attractive way to provide power aboard a spacecraft. Waste heat is not a problem since each cell is able to act as its own radiator.

7. To supply adequate power for a large spacecraft will require thousands upon thousands of individual cells. This great number of cells will allow the use of circuit arrangements that should continue to provide adequate power in spite of the failure of individual cells or groups of cells during the lifetime of the spacecraft.

8. Solar energy can also be concentrated by a parabolic mirror and focussed as a heat source. The thermal energy thus obtained may then be converted to electricity by one of numerous methods.

9. The most practical way to use nuclear energy to produce electricity is to first convert the nuclear energy into thermal energy. Heat can be generated by a nuclear reactor or by the use of the energy created by the decay of short half-life radioisotopes. Nuclear reactors suffer from the handicap of requiring very heavy shielding. If there is a need for a large quantity of power, as might be the case if electric propulsion is employed, then nuclear reactors may be the most practical means for power production.

10. In comparison to a nuclear reactor, there are several attractive features found in the use of radioisotope fuel. Radioisotopes release energy at a steady but slowly decreasing rate without any need for control, and without the danger of a runaway reaction. Power generation systems using isotopes that decay with alpha emissions require little or no special shielding, since alpha particles have very little penetration capability. Another advantage is that there is no special restriction on the size of the power-generating unit that can be constructed. The heat output and therefore the power level is dependent upon the activity level of the particular radioisotope employed, and the mass of the radioisotope constituent in the fuel charges. Thus, small, lightweight, compact power generation systems are feasible using radioisotope fuel. The main problems associated with the use of radioisotope fuel are associated with the fact that the fuel charge cannot be "turned off". It starts producing heat from the moment it is manufactured. This means that it should be manufactured only a short time before it is to be used, otherwise it will deplete itself as the quantity of radioisotope mass remaining becomes reduced through radioactive decay. And of equal importance is the fact that from the time the fuel charge is manufactured, it relentlessly releases heat that must be removed. This not only complicates storage, but also is very bothersome once it becomes installed in the spacecraft, which may be a significant time before launch.

11. Both the nuclear reactor and the radioisotope fuel charge are heat producers. To convert the thermal energy produced, these heat sources must be used in conjunction with a heat sink. A heat sink is a cold region providing a means for dumping waste heat from the energy conversion process. In space, the only practical heat sink is a thermal rediator.

12. It can be seen that, with a variety of methods to choose from, suitable electrical power systems can be developed for future spacecraft regardless of size or mission.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **energy, power, radiation, source.**

chemical energy, heat energy, infra-red energy, mechanical energy, molecular energy, nuclear energy, radioactive energy, solar energy, sound energy, thermal energy;

available power, external power, onboard electrical power, propulsive power, required power, scientific power, space power, used power, useful power;

acoustic radiation, heat radiation, thermal radiation;

heat source, noise source, power source, sound source.

II. *Переведите предложения со словом* **it.**

Личное местоимение **it** переводят словами *он, она, оно, его, ее* и т. д.

Слово **it** не переводят в конструкциях типа **It is considered that**... *Считают (считается), что ... .*

(Примеры на употребление слова it в других функциях приведены в упр. VI урока 18 и в упр. VI урока 22.)

а) 1. From 100 miles up, the universe looks much different than **it** does from the Earth's surface. 2. Scientists are considering how to collect the Sun's energy in space and convert **it** to electrical power for transmission to the Earth. 3. May 15, 1958, saw the launching of the third Soviet satellite. In its technical characteristics and the number of parameters to be measured, **it** was much superior to the first two satellites.

б) 1. **It** is assumed that . . . . 2. **It** is believed that . . . . 3. **It** should be borne in mind that . . . . 4. **It** is concluded that . . . . 5. **It** was determined that . . . . 6. **It** should be emphasized that . . . . 7. **It** is to be expected that . . . . 8. **It** has already been explained that . . . . 9. **It** was estimated that . . . . 10. **It** should not be forgotten that . . . . 11. **It** should be noted that . . . . 12. **It** was observed that . . . . 13. **It** should be pointed out that . . . . 14. **It** is proposed that . . . . 15. **It** must be realized that . . . . 16. **It** should be recalled that 17. **It** has long been recognized that . . . . 18. **It** will be recalled that . . . . 19. **It** is said that . . . . 20. **It** will be seen that . . . . 21. **It** must be shown that . . . . 22. **It** should be stressed that . . . . 23. **It** had long been supposed that . . . . 24. **It** may be thought that . . . . 25. **It** could be understood that. . . .

III. *Переведите предложения, обращая внимание на перевод слова* **that (those).**

That (those), заменяющее предшествующее существительное, переводят этим же существительным.

(Примеры на употребление **that** в конструкции **it is (was) ... who (that)** приведены в упр. VI урока 18. Примеры на употребление **that** в других функциях приведены в упр. VII урока *18,* в упр. IV, V урока 19 и в упр. V, VI урока 22.)

1. The atmosphere density of the Moon is lower than **that** which can be produced in the finest vacuum equipment. 2. One of the most misunderstood considerations is **that** associated with recovery of manned spacecraft. 3. Crews of space vehicles will have to function in an environment which is drastically different from **that** encountered in ordinary life. 4. The cosmonauts carry out experiments in a mock-up spacecraft, where conditions similar to **those** of actual space flight are simulated. 5. Experiments already performed by means of artificial satellites, and **those** in the planning stage cover a wide range

of application. 6. The *Luna 11* trajectory was similar to **that** of the *Luna 10,* but the orbit

was inclined 72° to the lunar equatorial plane.

IV. *Переведите предложения, обращая внимание на перевод слов* **should** *и* **would.**

Should в качестве модального глагола переводят словами *должен, необходимо, следует, надо.*

В текстах, описывающих проекты, смысловой глагол с **would** переводят в настоящем и в будущем времени.

а) 1. An airplane **should** be stable laterally as well as in a fore-and-aft direction. 2. According to the communication scheme 40 satellites **should** be placed in polar orbits and 15 satellites in equatorial orbits. 3. The development of the vehicle **should** begin with a definition of the basic mission objectives to be accomplished. 4. The escape capsule **should** re-enter the atmosphere at the precalculated flight angle. 5. The results presented herein **should** help the designer to obtain a minimum weight structure.

б) 1. Depending on the form in which water is found on the Moon, different technique **would** be employed to extract it. 2. Exploration of the planets **would** include a search for life in any form. 3. A helicopter **would** be a useful vehicle on Mars since it could take off and land vertically. Furthermore, its velocity **would** permit a greater geographical area to be covered in a given period of time. 4. Suppose we travel at the rate of 50 miles per second. To reach the Moon at this speed we **would** have to travel for 1 hr, 19 min, and 20 sec. To travel to the Sun **would** require about 21 days, and a trip to Pluto **would** take about 20 months. 5. Interstellar spaceships must be entirely self-supporting. Periodic maintenance **would** be conducted aboard the craft. Consequently, sufficient spare parts, to effect repairs during the entire trip **would** be necessary. A small hospital with operating room **would** be essential; entertainment facilities **would** be required.

V. *Переведите сложноподчиненные предложения, содержащие следующие глаголы.*

to demand *требовать*	**to propose** *предлагать*
to require *требовать*	**to suggest** *предлагать*
to insist *настаивать*	**to recommend** *рекомендовать*
to order *приказывать*	**to specify** *определять*

Образец: The aircraft designer **demanded** that this experiment should be carried out in zero-gravity conditions. => Авиаконструктор *требовал,* чтобы этот эксперимент был проведен в условиях невесомости. (Авиаконструктор требовал провести этот эксперимент в условиях невесомости.)

1. The producers recommended that the goods should be sent by airplane. 2. An air transport service demand that the aircraft should fly reliably, on schedule and, above all, safely in almost any weather by night as well as by day. 3. The aircraft commander ordered that the parachutists be ready to jump. 4. The chief pilot ordered that

the cargo aircraft should be unloaded at once. 5. The test pilot proposes that the measures eliminating the stability malfunction be taken immediately. 6. A complete solution requires that these equations be solved by the method of elimination. 7. This requires that the form of the equation (4) be somewhat more complicated than Eq. (1). 8. This requires that there be no change in the steady-state flow. 9. The programme instructions specify that the space vehicle be sufficiently compact to be housed in the forepart of a multi-stage rocket, 10. The aerodynamisists suggested that the structural elements should be tested under severe conditions. 11. The development of long-range ballistic missiles has required that concentrated attention be focussed on many technical problems associated with atmospheric entry.

VI. *Переведите сложноподчиненные предложения, содержащие следующие конструкции.*

It	**is**	**desirable that** . . .	*Желательно, чтобы . . .*
It	**is**	**essential that** . . .	*Важно,чтобы . . .*
It	**is**	**important that** . . .	*Важно,чтобы . . .*
It	**is**	**necessary that** . . .	*Необходимо, чтобы . . .*
It	**is**	**unlikely that …**	*Невероятно, чтобы …*

О б р а з е ц : **It is desirable that** this method of air refuelling be introduce at *once. => Желательно, чтобы* этот метод дозаправки топливом в воздухе был введен немедленно. (Желательно немедленно ввести этот метод дозаправки топливом в воздухе.)

1. It is desirable that the problem should be solved before the airplane test flights begin. 2. It is desirable that a number of trained and qualified examiners have the opportunity to test a future astronaut. 3. It is essential that the wing construction be aerodynamically stable. 4. In order to understand the movements of bodies in orbit, it is essential that certain laws and principles be considered. 5. In case of emergency it is important that the pilot take measures immediately. 6. It is important that the spaceship should start at a preset time. 7. It is necessary that stability of space vehicles be artificially provided. 8. It is necessary that a spacecraft be correctly positioned. 9. It is necessary that the type of the airflow be determined. 10. It is necessary that this method of retracting the landing gear should be tested in practice. 11. It is unlikely that this liner should f l y so low.

VII. *Переведите сложноподчиненные предложения с союзами* **as if, as though** (как) будто (бы).

1. The distance is not measured on the curved surface of the Earth but is computed **as if** the line were passing through the Earth. 2. The fluid motion in the transition region may be treated **as if** the region were plane. 3. At speeds less than 300 mph the airflow around an aircraft behaves **as though** the air were compressible. 4. Such specialized curves must usually be analyzed **as though** they were two or more separate curves.

VIII. *Найдите в тексте урока в абзацах 1, 6, 11 и 15 по одному словосочетанию и в абзаце 7 шесть словосочетаний и переведите их на русский язык. Обратите внимание на последовательность расположения слов в английских и в русских словосочетаниях.*

IX. *Найдите в тексте урока в абзацах 1 и 4 по шестнадцать слов, имеющих общие корни в английском и в русском языках. Переведите их на русский язык.*

X. *Найдите в тексте урока (абзац 12) пятнадцать производных слов. Определите по суффиксам, к какой части речи они относятся и переведите их на русский язык.*

XI. *Найдите в тексте урока один оборот* **there+to be** *в конце абзаца 1, по два оборота в абзацах 2 и 12 и один оборот в абзаце 14. Переведите их на русский язык.*

XII. *Ответьте на вопросы к тексту.*

1. By what systems is power used on board a manned spacecraft? 2. Is the total consumption of electricity significant? 3. On what considerations does the type of system providing power in a spacecraft depend? 4. What is the primary consideration when the mission is short? 5. What is the most important consideration for long missions? 6. From what kind of energy can electrical energy be produced aboard a spacecraft? 7. What is the simplest form of electric power supply? 8. What is the most straightforward way to use solar energy? 9. What is the most practical way to use nuclear energy to produce electricity? 10. Are the nuclear reactor and the radioisotope fuel charge heat producers?

У Р О К 23

Лексико-грамматические темы урока: 1. Перевод терминологических сочетаний. 2. Многозначные слова *(повторение)*. 3. Сложноподчиненные предложения с придаточными предложениями разных видов *(повторение)*.

Термины к уроку

airlock воздушный шлюз
carrier ракета-носитель
fire запускать
rover unit транспортное средство
shelter укрытие
shuttle челночный воздушно-космический аппарат
transfer переход

ТЕКСТ

MANNED MARS LANDING MISSION

American scientists' point of view

1. Landing on the Moon represents a vital step towards the understanding of the Solar System and Universe. The exploration of the Moon will take generations.

2. The lunar landing is just the beginning — not the end — of a new era of discovery of new worlds. Manned flight to Mars seems to be the next logical step after the lunar landings.

3. From the scientific and engineering standpoint, it appears to be feasible to begin the first manned Mars travel in mid-November 1981. If a mission departed at that time, it would arrive at Mars about 9 August 1982 and return to the Earth in mid-August 1983.

4. A typical Mars landing mission, as conceived on the basis of upgraded *Saturn 5* technology, would begin with the orbiting of the elements for either one or two identical spaceships by two-stage *Saturn 5's* and newly developed "space shuttles". These would be reusable carriers for transporting men and equipment between the ground and the Earth's orbit. While the mission could be carried out with a single ship, the use of two would provide an additional safety factor, since each would be large enough to accommodate the astronauts of its sister ship in the event of a major failure. Furthermore, with two ships, additional equipment could be carried, enhancing the probability of achieving mission objectives. The nominal crew of each ship would be six men.

5. The interplanetary vehicle assembled in the Earth's orbit would weigh 1.6 million pounds and consist of three nuclear shuttles, or propulsion modules, placed side by side, with the ship (or ships) carrying the astronauts docked to the centre module. The two outer modules would be fired to put the vehicle onto trans-Marsian trajectory, after which they would be separated and returned to the Earth's orbit. There, they would be checked out and re-fueled by the Earth-to-orbit shuttles for further use. Meanwhile, the spaceship with the remaining module would continue on its 270-day voyage to Mars.

6. The spaceship itself would be divided into three major sections. The forward compartment would be an unpressurized area housing the Mars surface exploration module, an airlock to provide for pressurized transfer to this module, and unmanned exploration probes (six for use on Mars, two for Venus on the return leg of the trip). The main mission module, aft of the airlock, would contain living quarters, the control area, experimental laboratories, and a radiation "storm" shelter in which the crew could live during periods of intense solar activity. To the rear of the mission module, and adjacent to the nuclear propulsion system, would be the biological laboratory for receiving and analyzing surface samples from Mars. This unit would be sterilized and remain sealed until initial analyses of the samples had been performed by remote control.

7. The entire spaceship would be continuously rotated. If two ships made the trip simultaneously, they could be docked end to end and rotated in the plane of the longitudinal axis.

8. On reaching Mars, the spaceship — its weight now down to 675,000 pounds — would be placed in an elliptical orbit. The crew's first task would be to launch the unmanned probes, whose prime purpose would be to return samples from the ground to the biological laboratory. If analysis revealed no significant biological hazards, three of the crew members would then descend to the planet in the surface exploration craft, or Mars excursion module. This 95,000-pound, 22-foot-base-diameter craft would contain living quarters, a labora-

tory, and a one-man rover unit. The Mars excursion module, would have ascent and descent stages. After spending thirty to sixty days on the surface collecting scientific information, the astronauts would return in the ascent stage to the orbiting mother ship, abandoning he descent stage on the planet.

9. The trip home would begin after the transfer of the three-man exploration party and their scientific payload from the ascent stage of the Mars excursion module to the mission module. Just prior to departure from Mars orbit, the interplanetary vehicle would weigh about 380,000 pounds — the loss in weight being accounted for by consumption of propellant, food, and oxygen and by abandonment of the surface probes and the excursion module.

10. The manned Mars landing mission would conclude with the return to the Earth's orbit, using the remaining propellant in the nuclear stage for the braking manoeuvre. This would further reducs the weight of the vehicle to 160,000 pounds. After docking with a space station, the crew would be given medical examinations and, if there were no need for an extended quarantine, promptly returned to the Earth via shuttle.

УПРАЖНЕНИЯ

I. *Переведите словосочетания со следующими терминами из текста:* **carrier, journey, mission, shuttle, trajectory, travel, trip.**

missile carrier, rocket carrier, satellite carrier, space-cargo carrier, space-weapon carrier, terrestrial carrier;

round trip interstellar journey, space journey;

interplanetary mission, interstellar mission, lunar orbit mission, lunar surface mission, manned lunar-landing-and-return mission, one-way space mission, orbital mission, return mission, soft lunar landing mission, unmanned lunar orbital mission;

lunar shuttle, planetary surface to lunar shuttle;

circumlunar trajectory, coast trajectory, computed trajectory, desired trajectory, escape trajectory, estimated trajectory, given trajectory, lunar impact trajectory, lunar launch trajectory, re-entry trajectory, round-trip trajectory, satellite trajectory;

interplanetary travel, interstellar travel, manned travel, satellite travel, space travel;

manned trip, orbital trip, round trip to the moon.

II . *Переведите предложения, обращая внимание на перевод многозначных строевых слов (повторение).*

1. The first three Soviet satellites and many of **those that** followed were designed to investigate the upper atmosphere and outer space. 2. All bases on the planets **should** have visual observation facilities. Windows on surface bases **would** be necessary, while special observation towers **would** have to be constructed in association with underground bases on airless worlds. 3. *Polyot 2,* launched in November 1963, a few weeks **after** the orbiting of *Kosmos 20,* was to prove **that** a satellite could be manoeuvred to change the size and shape of its orbit. 4.

Metals **that** are resistant to very high temperatures are ideal **for this** purpose. 5. The Moon itself is unique among satellites in **that it** has the largest size in comparison with the planet around which **it** revolves. 6. The advantages of VTOL, STOL or the combined V/STOL aircraft are obvious. They **would** make it possible to increase traffic at existing airports. They **would** also make possible a network of smaller airports. 7. A space shuttle is a revolutionary new vehicle **that** will combine the advantages of airplanes and spacecraft, and will fly repeatedly to space and back to the Earth. **It** will not be expended **as** present space vehicles are **after** a single flight. 8. Each *Apollo* flight **provided for only** a very short stay of two men on the surface of the Moon. 9. **This** helicopter operating cost is close to **that** of a modern propeller aircraft. 10. Artificial satellites can be observed telescopically during the brief periods **after** sunset and **before** sunrize. 11. The world's first artificial satellite weighed 184 pounds. **It** circled the Earth about every $1\ ^1/_2$ hours in an elliptical orbit **that** ranged in altitude from about 140 to 560 miles.

III. *Переведите сложноподчиненные предложения с придаточными предложениями разных видов (повторение).*

а) 1. As the number of satellites grows, tracking stations become busier than ever. 2. The frequency of space flights has steadily increased since the first satellite rose into the sky late in 1957.3. It does not matter whether a stream of air is blowing against a flat plate or the flat plate moves through still air. 4. The rocket accelerates gradually until the maximum velocity is reached. 5. The complexity of this task will depend upon whether the target is active or passive. 6. After the orbital phase of the flight is completed, the spacecraft will be prepared for re-entry. 7. All that can be said with certainty is that the density of the gas is very low. 8. Since the Moon was first observed by telescope, a number of ideas have been put forward to account for the appearance of its surface. 9. Passive communications satellites are nothing more than orbiting reflectors that return a signal from a transmitter on the primary body. 10. Before the missile is launched, it is set to fly to a certain target. 11. The objects of the study were to determine if liquid motion would have an effect on vent operation. 12. After it had arrived in orbit, the spacecraft separated from the final stage of the carrier rocket.

б) 1. It is essential that a careful examination of the powerplant and its associated components be made before each flight. 2. The pilot would be safe at Mach 2 if he were wearing an air-cooled pressure suit with an airtight helmet, but any exposed parts of his body would be burned by the heated air. At higher speeds he would not be able to survive in his cockpit if special cooling devices were not used. 3. It is important that the pilot of a high-speed aircraft should know how near his aircraft is to the sound barrier. 4. If satellites were launched into an orbit 22,000 miles above the Earth they would take 24 hours to make a circuit. If the orbit were parallel with the equator, the satellites could be made to stay permanently over a particular point on the surface.

If such s a t e l l i t e s were used as relay stations television programmes could be beamed to every place on Earth from a single transmitter. Satellites could a l s o be used as manned or unmanned observatories. 5. It is recommended that the utmost caution be exercised in the installation of a l l fuel tanks and lines in order to preclude the possibility of any leakage which could lead to a subsequent explosion.

IV. *Найдите в тексте урока в абзаце 6 три словосочетания и в абзаце 8 пять словосочетаний и переведите их на русский язык. Обратите внимание на последовательность расположения слов в английских и в русских словосочетаниях.*

V. *Найдите в тексте урока в абзацах 4 и 5 по четырнадцать слов, имеющих общие корни в английском и в русском языках. Переведите их на русский язык.*

VI. *Найдите в тексте урока в абзаце 1 четыре, в абзаце 9 пять и в абзаце 10 три существительных с суффиксом* **-ion.** *Переведите их на русский язык.*

V I I . *Найдите в тексте урока в абзацах 3 и 10 строевые слова* **after, for, it, that, this, would.** *Определите их функцию в предложении и переведите на русский язык.*

VII I . *Найдите в тексте урока в абзаце 1 два, в абзаце 2 три и в абзаце 6 четыре слова с омонимичными формами* **-ing.** *Переведите их на русский язык.*

IX. *Ответьте на вопросы к тексту.*

1. Will the exploration of the Moon take generations? 2. What is the next logical step in space exploration after the lunar landing? 3. When is it feasible to begin the first manned travel to Mars? 4. When would a mission arrive at Mars and return to the Earth if it departed in mid-November 1981? 5. How much would the interplanetary vehicle assembled in the Earth's orbit weigh? 6. How long would the voyage to Mars last? 7. In how many sections would the spaceship be divided? 8. In what orbit would the spaceship be placed on reaching Mars? 9. What would the crew's first task be? 10. When would the trip home begin?

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СОДЕРЖАНИЕ

Мазокина Галина Павловна

ПОСОБИЕ ПО АНГЛИЙСКОМУ ЯЗЫКУ

для I I I —IV курсов авиационных вузов

И. Б. № 747

Редактор *А. И. Миронова*

Издательский редактор *И. А . Краснова*

Художественный редактор *В. Ю. Поляков*

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Технический редактор *И. А. Битюкова*

Корректор *З. Ф. Юрескул*

Сдано в набор 16/VII-7 6 г. Подп . к печати 28/X-76 г. Формат 60x90$^{1}/_{16}$. Бум. тип. № 3. Объем 8 печ. л. Усл. п. л. 8. Уч.-изд. л. 8,79. Изд. № А-479.

Тираж 15 000 экз. Заказ № 575. Цена 25 коп.

План выпуска литературы издательства «Высшая школа» (вузы и техникумы) на 1977 год. Позиция № 164

Москва, К-51, Неглинная ул., д. 29/14, Издательство "Высшая школа"

Ордена Трудового Красного Знамени Первая Образцовая типография имени А. А. Жданова Союзполиграфпрома при Государственном комитете Совета Министров СССР по делам издательств, полиграфии и книжной торговли. Москва, М-54, Валовая, 28