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ИССЛЕДОВАНИЕ КОСМОСА

Учебные задания по английскому языку

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Учебные задания дают возможность познакомиться с ряд[illegible] достижений космической науки и техники, лексико-[illegible] развитию, способствуют обучению различным видам чте[illegible], элементам аннотирования и реферирования. Использованные в работе статьи из журнала "Aerospace Flight" за 1980-90 гг. не адаптировались в учебных целях, а только частично сокращены. Предназначены для студентов 1-[illegible] курсов факультетов и СПО, изучающих на кафедре "Иностранные языки".

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U N I T I.

Genious of Space Flight Technique

Text 1. Read the text and find out the personal contribution of each scientist.

At the dawn of the history of space flight three names dominate: Tsiolkovsky - Goddard - Oberth.

As early as 1903 the Russian Konstantin Eduardovich Tsiolkovsky (17th September, 1857 - 19th September, 1935) depicted in basic treatics the scientific relationships between flight and exhaust velocities and take-off, fuel and burnt-out masses. His basic rocket equation and numerous other findings grant him a place of honour in the history of space flight as one of the founders of Astronautics.

The American Robert Hutchings Goddard (5th October, 1882 - 10th August, 1945) was the first American scientist to deal with rocket development. From 1915 he carried out experiments which were based on rocket principles applied to liquid propellant propulsion. Robert Goddard is considered one of the founders of space flight.

Hermann Julius Oberth, a German born in Hermannstadt on 25th June, 1894, became the father of modern space flight by his early and fundamental essays on rocket and space flight techniques. His predictions, made as early as 1923, have come true and constitute the basis for continuing developments.

These theses, so courageously calculated in those days, are today accepted as valid:

1. With rockets one can leave the Earth's atmosphere and stay outside for a length of time.
2. With rockets the force of gravitation can be overcome and the Earth can be left behind.
3. Man himself can also leave the Earth without risk and travel through space.
4. Manufacture and use of rockets can be economically useful.

Exercises.

1. Find in (t) the Russian equivalents to the English words

and word combinations in (a):

a) at the dawn; as early as; exhaust velocity; manufacture; burnt-out; to depict; relationship; numerous findings; to deal with; a place of honour; to carry out; liquid propellant propulsion; to come true; assays; valid; to leave behind; for a length of time; courageously; predictions; to overcome; treaty

b) многочисленные находки; на заре; длительное время; почётное место; преодолеть; уже; предсказания; выполнять; производство; зависимость; осуществляться; смело; испытания; заниматься; оставлять позади; описывать; трактат (научный труд); скорость истечения (продуктов сгорания); отработанный; двигатель на жидком топливе; действительный, имеющий силу.

2. Memorize the english equivalents.

3. Give the contents of the text in English and in Russian.

Text 2. Look through the text and answer the questions:

1. What problem was K.Tsiolkovsky interested in ? 2. Did K.Tsiolkovsky propose rockets for interplanetary communication? 3. In what work did K.Tsiolkovsky propose the theory of cosmic flights?

4. What questions were paid attention to by K.Tsiolkovsky?

Konstantin Tsiolkovsky - Space Travel Pioneer

At the end of the last century K.Tsiolkovsky turned to a problem of flight into cosmic space. At the time when man first rose into the air, he proposed rockets for interplanetary communication. In his work "The study of cosmic space by rocket engines" which is often referred to by many scientists everywhere he world, K.Tsiolkovsky proposed a scientifically well formed theory of cosmic flights. The ideas presented in this work served as basis for development of the science astronautics.

In the 1911 - 1926 a number of publications were published by K.Tsiolkovsky, which continued his early work. The scientist studied the conditions for the take-off of a spaceship from the surface of a planet and the influence of air resistance on the motion of the rocket, examined questions connected with the life of the human organism in cosmic space and formu-

late a number of principles the theory of rockets is based upon. Many other questions connected with the aims and methods of developing astronautics were paid attention to in some of his latest work. For example, such problems as the design of a spaceship consisting of several rockets and the advantage of using liquid fuel were dealt with by the scientist.

As early as 1895 K.Tsiolkovsky proposed the idea of creating artificial satellites of the earth. The necessity of using satellites for interplanetary flights is now recognized by many specialists in astronautics. The importance of such satellites as observatories is also quite clear.

Exercises.

I. Form adjectives from nouns by adding suffixes -ic, -al, -ar and translate them into Russian.
a)science, cosmos, basis, history, hero, economy; b) technique, practice, industry, origin; c)courage, fame, variation, globe, number.

II. Find in the text synonyms for the following words and translate them:
outer space, foundation, purpose, man-made, to supply, energy, entirely, use.

III. Translate into Russian the following group of words:

space flight, rocket motion, air resistance, spaceship design, flight theory, plant surface, fuel supply, energy transformation, rocket propulsion theory, earth artificial satellite, liquid propellant propulsion.

IV. Translate the following sentences paying attention to the words in bold type:

a)1.What kind of propellant was it? - It was liquid propellant. 2.The spaceship can perform different kinds of operations. 3. This kind of logical problem is very simple. 4.Will you kindly explain to us the operation of this kind of machine? 5.Be so kind, show us the new equipment.
b)1. It was very difficult to work on the development of rockets,for there was no real technical information. The engine

2. Progressive people everywhere must fight for ecological purification. 3.He asked me for the book on rocket research. 4. An interesting lecture on New Space Policy was arranged for the students. 5.The space flight is too expensive to fly for everybody.

V. Translate into Russian paying attention to the predicates [illegible].V.

[illegible] theory which K.Tsiolkovsky arrived at was based on experimental work. 2. Heat is radiated by the sun to the earth, but the land, the sea and the air are affected differently by [illegible] radiation. 3. A gas may be looked upon as the vapour of a [illegible] with a very low boiling point and very great vapour pressure. [illegible] The early works by Tsiolkovsky were followed by a [illegible] very important works in the field of astronautics. [illegible] astronomy has been given new devices for space exploration. 6. The study of the distribution of galaxies in space has been shown on the picture. 7. Energy is never destroyed: one form of energy may be converted into another. 8. People have been given an efficient means for deep penetration into space, one of this is a spaceship.

U N I T II.

Space Science: Retrospect and Prospect

[illegible]. Read the text and list the results of space inves-[illegible].

The modern era of space research had its beginnings in the years following World War II. V-2 rockets launched from White Sands, New Mexico, carried a variety of scientific instruments to altitudes far above the Earth's surface. These investigations studied ultraviolet radiation and X-rays from the Sun, as well as the constituents of the Earth's ionosphere [illegible] belts and magnetosphere - discoveries that led to a [illegible] understanding of the interactions of the Sun and Earth. From these studies space research expanded to investi-

gations of the solar system and the universe beyond. X - ray investigations of the Sun soon led to X- ray and gamma ray observations of distant stars and galaxies. Satellites and spacecraft leaving the confines of the Earth's gravitational field in the early 1960's, led to studies of the Earth and exploration of the Moon interplanetary space, and nearby planets Mars and Venus.

By the early 1980's, astronomical studies in virtually all wavelength regimes had become possible, spacecraft had flown past all the planets known to the ancients, primary cosmic radiation from space was being studied, Earth resources were being monitored, the oceans and the atmosphere were being surveyed, and the manned Space Shuttle was coming into use.

The next major step forward in space studing is the creating of Space labs and Space stations.

The long-range objective of a Space Station programme is to establish the means for the permanent presence of humans in space. "It is the presence of man that enables the routine and continuous utilisation of space for numerous purposes."

Exercises.

1. Find in (b) the Russian equivalents to the English words and word-combinations in (a):
a) following; launch; altitude; far above; investigation; expand; distant; confine; nearby; virtually; monitor; survey; long-range objective; enable; ancients,
b) делать возможным ; взаимодействие; древние народы; дальний, удалённый; долгосрочная цель; расширять; исследование; запускать; после,вслед ; высота; осматривать; значительно выше, контролировать, проверять; граница,предел; близко; непосредственно.

2. Memorize the English equivalents.

3. Discuss the main stages in the development of Space Science.

4. Answer the question: What is the long - range objective of

...station pro...e?

...translate the fol...owing sentence "It is the presence of man ... the routine and continuous utilization of space ... purposes" in writing.

... look through the text and find the sentence w... ...'s construction, translate it into Russi...

... text and answer the questions.
... difficult to make predictions' 2. What are the ... for progress in space science programme?

Future Prospects

... humorist Mark Twain once commented that "Pre- ... very difficult to make , especially when they deal ... Despite such well known difficulties it does ... to make a number of general remarks concerning ... progress in space science programme, such as a ... a piloted mission to Mars. A Mars expedition will ... programme of intensive Mars studies to select landing ... major efforts in the life sciences (many of ... conducted on the Space Stations) to ensure that ... to Mars and return safely.
... the preoccupation with immediate problems is under- ... one looks beyond the current situation at the ... now being developed or planned, the late 1980's and ... would see the rebirth of a vigorous, imaginative, ... space distance programme".

Exercises.

... the following sentences and translate them into

... fly to Mars.
... ...ions deal with the future?
... ... to deal with the future.
... ... many words as I do.
... ...ince the ...vist.

11. Write out the sentence numbers in which "do"("does", "did") are emphatic.

1. He does his work in the evening.
2. He does not know my brother.
3. This reaction does change the volume of the gas.
4. He analysed the text the way he did that.
5. Let us consider what happens when forces do act on the gas.
6. Did he remember to phone you?
7. A good writer does make things real to us when he describes them.

U N I T III.

Space Shuttle

Text 1. Read the text and give a suitable title to it.

There appeared a new type of launcher, called Spacebus, intended to meet the requirements of regular passenger transportation to and from space hotels. Spacebus is of advanced design since it requires standards of safety, comfort, reliability and costs approaching those of today's airliners. Its development would clearly benefit other space enterprises. Mention was made of a step-by-step development strategy for Spacebus involving, firstly, a rocket-powered research [illegible] and secondly, a partially-reusable small and the orbital Spaceplane.

Spacecub is a two-stage vehicle of roughly the same size as Concorde.

The booster stage is a medium sized supersonic aircraft. Four Olympus turbojets are used take-off, acceleration to Mach 2, flyback and landing. Two complete Ariane second stages are carried in the rear fuselage to accelerate from Mach 2 to the orbital speed of Mach 4.

The orbiter stage has a blunt swept configuration dominated by the liquid hydrogen tanks, which make up [illegible] of the stage volume. The payload bay is behind the two [illegible] cockpit and has a useful volume of 6 m³ which is similar

[illegible] with Ariane third stage engines [illegible]. The Orbiter is partially buried in the Booster to protect it from air loads during the boost phase and to [illegible] the supersonic wave drag penalty. As a result, the Booster/Orbiter combination is as clean as Concorde.

"A [illegible] small launcher spacecraft would be a very useful complement to planned space transportation vehicles. Its [illegible] would be logistic support of a large space station [illegible]. It would be ideally suited for rescue, satellite [illegible], carrying the construction crew for large structures, small experiments, in-orbit assembly and military purposes. It would also be suitable for passengers and could therefore be the next step towards a space tourism industry (six [illegible] passengers using a derivative of Columbus (a small [illegible] station) as a space hotel."

[illegible] English words with the Russian ones:

[illegible] intend; meet, benefit; enterprises, make mention, [illegible] booster; bury; blunt; make up; payload bay; van; [illegible], penalty, complement; rescue; dominate;

[illegible] установка; занимать; дополнение; участок [illegible] ускорителем, стартовый участок; намереваться; по- [illegible]; [illegible]; [illegible] отсек; выигрывать; [illegible]; промышленные предприятия; [illegible]; стартовый двигатель; упоминать; [illegible].

[illegible]

[illegible] the text and retell it to your plan.

[illegible] the following words and word com-

[illegible]

[illegible]

[illegible] углеродом

[illegible]

emergency egress - аварийный выход
disconnect valve - разъединительный клапан
spilling - вытекание
interlock - (внутренняя) блокировка
preclude - предотвращать
implement - снабжать
path - путь, траектория

II. Read the text and answer the questions using speaking phrases: to my mind, as far as I know, according to:

1. What does a new Orbiter consist of?
2. What has TPSystem been replaced by?
3. What do RCS engines provide?
4. How many changes to Space Shuttle main engines have been made since the Challenger disaster?
5. What would blockage of the paths result in?

Text 2.

A New Orbiter consists of the following principal units:

Thermal Protection System (TPS) .

A new carbon panel has replaced the TPS tiles on the forward end of the orbiter between the nose cap and the nose wheel door. Because of its position it is known as the carbon-carbon chin panel.

Forward RCS Thrusters. The orbiter's Reaction Control System (RCS) engines which provide on-orbit attitude control have been modified to automatically shutdown if they experience thrust instability and/or chamber wall burn-through. Previously a shuttle commander could continue firing a [illegible] after that had unknowingly burnt through its casing and the result would have been catastrophic.

3. Crew Escape System (CES). It includes explosive bolts to jettison side hatch, telescopic pole and emergency egress slide.

4. [illegible]

5. Main Engines. Since the Challenger disaster [illegible] changes have been made to the Space Shuttle [illegible] increase their operating life, safety, reliability [illegible]

[illegible] Valve. The main propulsion system [illegible] valve is located between the external [illegible] orbiter. It closes after main engine cutoff to prevent propellant spilling during ET separation.

[illegible] Power Units (APU). An electric interlock is added to the APU's tank shut-off valves to preclude [illegible] failures that could overheat the valves and cause [illegible] of hydrazine fuel.

[illegible]

[illegible] An improved design of the fuel cell power [illegible] system has been implemented to provide alternative [illegible] for removing water generated by the cells. This new path [illegible] provides greater physical separation from the other two paths [illegible] reduces the possibility of the pipes becoming frozen and [illegible] blockage of these paths would result in loss of the [illegible] fuel cells and all orbiter power within a very short [illegible].

[illegible] the text the full names for the following abbreviations: FTO, MCC, SMS, ET, APU, OMS.

[illegible] the English words with the Russian ones:
[illegible] b) disconnect valve, c)nose cap, d)chin panel, [illegible] f) firing; g)jettison hatch; h) carbon/carbon; [illegible] j)explosive bolt;
[illegible] 2)углерод; 3)кормовой [illegible]; 5)передняя часть [illegible]; 6)угерон; 7)[illegible] 8)"носовой" обтекатель; 9)разделительный [illegible];

[illegible]
[illegible] is that all measurements should be made [illegible]. 2. The scientific objectives require that a [illegible] should maintain a fixed aspect with the respect [illegible]. 3. If there were no frictional losses in a [illegible] machine would be 100% efficient. 4. It would be much [illegible] to compute satellite orbits if the Earth were perfectly [illegible]. If [illegible] full, the airframe would have to [illegible] forces [illegible] the light of mechanics predicted that

...ld fall to the earth at the same rate as an ir... The early airplane designers would test their planes ... In empty space the thrust would be 15 per cent greater than the thrust at sea level.

... I P ...

... Shuttle ...

... Look through the text and name the ... with

Shuttle Main Engine story.

The Space Shuttle Main Engine (SSME) is one of the ... interesting systems of the Space Transportation System (STS). It is the world's most advanced liquid-fuelled rocket engine and is able to fly several different missions. Three of these engines are installed in the aft compartment of each orbiter and power the Space Shuttle into Earth orbit.

During the first two minutes and 10 seconds of flight it fires along with two Solid Rocket Boosters (SRBs) which are attached to the sides of the huge External Tank ... SRB-separation it burns alone for about 6 1/2 minutes.

Twelve out of the 13 assembled SSME flight units have ... to launch the four orbiters Columbia, Challenger, ... Discovery and Atlantis into orbit on 25 STS missions ... Challenger accident on January 28, 1986 ... to temporarily halt the programme.

II. Give the full names of the following abbreviations.

SSME, STS, SRB, ET

III. Give the Russian equivalents to the following.

liquid-fuelled rocket engine; aft compartment; world's most advanced engine; several different missions; solid-fuel ... ; ... flight units; tragic accident.

IV. ... the Space Shuttle main engine.

V. Read the text and render it in English.

Полёт "Челленджера" был двадцать пятым в серии челночных космических полётов, которые всегда заканчивались благополучно. 28 января 1986 года, через 73 секунды после старта "Челленджера" на глазах миллионов людей, наблюдавших эту сцену непосредственно и по телевидению, взорвался и превратился в огненный

Расследование показало, что причиной взрыва был выброс сжатых газов через щель твердотопливного ракетного ускорителя. Космический шатл выводится на орбиту тремя бортовыми жидкотопливными двигателями, питаемыми от огромного наружного бака, который после опорожнения отбрасывается, и двумя твердотопливными ускорителями; они тоже отбрасываются, когда топливо сгорает. Как и ускорители затем выливают из воды для повторного использования. Гибкие резиновые прокладки герметизируют щель между секциями твёрдотопливных ракет, но запуск "Челленджера" состоялся после необычно холодной ночи на юге Флориды, и одна из прокладок, утратившая эластичность из-за холода, оказалась дефектной.

Дик Бейкер America №3, 1989.

Task 6. I.Read the text attentively and answer the questions: 1. What kind of rocket system is Energia? 2. What are its payload capacities? 3. What does the Energia launcher comprise?

Energia is a multi-purpose rocket system capable of lifting a 100 tonne payload or a shuttle. It has the following payload capacities:

Low Earth Orbit:	100 tonnes
Geostationary Orbit:	30 tonnes
Lunar Trajectory:	32 tonnes
Mars or Venus Trajectory:	28 tonnes

The Energia launcher comprises a central stage and four strap-on boosters, with payload attached to one side. The strap-on boosters (they are the first stage) are fitted with a four-chamber liquid propellant rocket motor burning liquid oxygen and hydrocarbon fuel. These motors produce 740t of

thrust at sea-level and 806t in a vacuum.

The second stage central core burns liquid oxygen and liquid hydrogen and has four single-chamber liquid propellant rocket motors, each having a thrust of 148t at sea level and 200t in a vacuum.

The strap-on and core stage motors are ignited almost simultaneously just before lift-off. The total lift-off thrust is 3,600t.

The strap-on boosters are not yet reusable. Once the boosters fuel is depleted the boosters separate in pairs, then split up and land in the designated area.

The second-stage central core has reusable engines and they are a considerable achievements for Soviet rocket construction. Our designers managed to ensure high performance characteristics with minimal gas-dynamic losses, regenerative cooling and durability of the materials used in a liquid hydrogen environment.

Energia core stage components are eight metres in diameter and weigh up to 40 tonnes. A heavy aircraft has been specially modified to transport them from their consruction sites to the launch complex.

*Whilst our country have mentioned reusable spacecraft and space station modules as payloads for the new giant laucher there are other jobs for it to do in the future which relate to its name - Energy. These included the launching of large reflective mirrors to illuminate the northern regions of the USSR and provide light during hours of darkness (1992-2001 period); power transmission from Earth-space-Earth via satellites in geostationary orbit to the Siberian hinterland (1996-2005); energy generation for space operations using a solar powered satellites in geostationary orbit to power space vehicles (1999-2009) and satellites generating power in geostationary orbit and beaming this to ground stations for distribution via landlines (2003-2015).

II. Match the English words with the Russian ones:

a) strap-on booster; deplete; core stage motor; [illegible]

[illegible] marabili[illegible].

[illegible] ИЗВЕСНОЙ [illegible], [illegible] ОСНОВНО[illegible] ЧАСТИ; УМЕНЬШЕНИЕ, [illegible]

[illegible] make a written translation of the text beginning [illegible] our country... .

[illegible] all the possible applications of "[illegible]

Text [illegible] Look though the text and give a title to it.

A nuclear-propelled journey would require the [illegible] earth orbit of a single craft, weighing [illegible] tonnes, [illegible] missions. Five nuclear motors [illegible] tonnes would be used, one of which would [illegible] the return journey. A rocket-propelled journey [illegible] mission to Mars, [illegible] tonnes, assembled by five [illegible]

UNIT V.

SOVIET SHUTTLE

[illegible] Read the text, make up a plan for it.

[illegible] system. VKK stands for Vo[illegible] Air-Space Aircraft. This system began [illegible] in 1976 and has cost equivalent of [illegible] 10 billion. [illegible] is slightly larger than its U[illegible] counterpart, it [illegible] diameter of 5,6 metres. The main difference between the two shuttles is the absence of main engines from [illegible] booster carries the propulsion system and [illegible] operate independently from the Shuttle by using a cargo [illegible] Americans are only just beginning to investigate the [illegible] of using a cargo [illegible] instead of orbiter.

[illegible] manoeuvring engines of the Soviet Shuttle [illegible] on the rear bulkhead where you would expect to

[illegible] main engines. Smaller manoeuvering thrusters are located in pods that emerge from the rear of the orbiter and are also located in the nose area.

The surface of the VKK orbiter is covered in lightweight heat shielding ceramic tiles. Exactly the same system as the US shuttle uses for reentry. The US shuttle has about 30,000 of these tiles compared with 38,000 on the VKK orbiter.

The VKK can have a crew of two to four cosmonauts and [illegible] passengers, the standard crew will be of seven.

The Soviet Shuttle does not have a crew escape system for [illegible].

If a malfunction occurs in early flight the orbiter can separate from Energia and make a Return to a Launch Site touchdown [illegible] runway at the Baikonur Cosmodrome. In addition to the launch site the Soviet shuttle may be able to land on the [illegible] down range from the launch site. The US shuttle does [illegible] this option because it is launched across the Atlantic.

The Soviet shuttle is thought to use fuel cells. They [illegible] electricity by combining hydrogen and oxygen with water as a byproduct. The US has used fuel cells on its spacecraft [illegible] programme.

The entire Energia/Shuttle combination weighs 2,400 tonnes, [illegible] for over 2,000 tonnes.

[illegible] English equivalents to the following:
[illegible]
[illegible] malfunction, option, [illegible].

[illegible] Discuss the main differences and similarities between the two shuttles using your plan.

[illegible] 2. I. Read the text and summarize it in Russian.

The Soviet space shuttle Buran was successfully launch

on November 15, 1988. Three hours and 25 minutes later it made a perfect landing on a concrete runway at the Soviet spaceport of Baikonur, just 12 km from the launch pad it had started from. The unmanned flight of Buran was a very impressive display by the Soviet Union. Energia takes Buran to Sub-orbital speed where it separates from the orbiter. The Buran's propulsion system serves as an upper stage and is ignited at an altitude of 160km to put the spacecraft into Earth orbit. It is activated once more to enter a circular 250km orbit. When gliding in the atmosphere the orbiter is controlled by ailerons, the control vane and air brakes, just as an ordinary aircraft. The aerodynamic flight begins at 40km and the orbiter can conduct a lateral manoeuvre of up to 2000 km. Touchdown speed at landing from an orbital mission is about 340km per hour and the landing run 1,100 to 2000 metres. A three-canopy "X" Shaped parachute system deploys and is jettisoned when the speed of the orbiter is 50km per hour. The landing strip at Baikonur is 4,5km long by 84 metres wide. TASS correspondent V.Ovcharov reported that he had visited the huge assembly building at Baikonur where the orbiters are prepared and saw a second orbiter, called Ptichka (Birdie). The orbiter was covered with 38000 lightweight heat absorbing ceramic tiles which could resist temperatures of 2000 degrees centigrade. The next flight would be manned and that a docking with the Mir station was anticipated. The manned flight's date is not known because the first flight's results would need to be analysed thuroughly.*

[illegible] (a) the Russian equivalents to the English words and word combinations in (b):

а) [illegible] скорость; отходить; принудительный сброс; аэродинамический полет; стартовая площадка; поверхность управления; суборбитальная скорость;

b) [illegible]; launch pad; jettison; suborbital speed; touch[illegible]; control [illegible]; air brake.

[illegible] the text attentively and divide it into logical parts. [illegible]

[illegible] the text in English.

U N I T VI.

Clothing for Space Activity

Text 1. I. Read and memorize the following words and word combinations:

exhaustion - изнурение, истощение.
deceptive - обманчивый
pulp - сенсационный рассказ
nudge - лёгкий толчок
backpack - ранец, рюкзак
slip ring - скользящее кольцо
status panel - визитная карточка
translation - перемещение
loiter - барражировать, патрулировать
disengage - освобождать
airlock - воздушный шлюз
supplies - запасы, линия питания

II. Read the text and confirm the following statements: 1. The development of MMU is important. 2. EVA is really simple in the conditions of weightless. 3. Support MMU can be successfully used in EVA.

Use the following expressions: that's right; I don't think it is right; I can't agree; on the contrary; quite so; that's wrong.

Manned Manoeuvring Unit (MMU).

Space works had taken place when astronauts began to use MMU that allowed them to rocket (slowly) to and from other spacecraft.

The MMU is the result of two-decade effort to develop a simple way for astronauts to fly during extra vehicular activity (EVA). It has a simple, highly reliable design that should satisfy most EVA requirements.

The simple design is a direct result of exhaustion. In 1965, the first EVA's by A.Leonov of the USSR and Ed White of

the USA were deceptive simple.* They floated about, and a press time and pronounced walking weightless to be effortless, just as pulp science fiction predicated.*

But later EVA during Gemini saw the astronauts tire rapidly when they tried to do real work.

Weightlessness, in addition to being fun, also eliminates the friction that we need to keep everything in place while working. One nudge and astronauts starts to drift. Even putting on astronaut manoeuvring unit proved to be nearly impossible.

So, a new MMU had been designed. It weighs 340 lbs, [illegible] more closely resembles a living backpack: its frame is mounted by a pair of large nitrogen gas bottles. Mounted between the bottles are the control electronics assembly.

The torso section is a rigid aluminium shell with arms. The low section runs from waist to feet and is attached by a [illegible] slip ring to the torso section.

A life supporting unit-with oxygen, batteries and scrubbing - is permanently attached to the back. A status panel and emergency oxygen are mounted on the chest.

The right hand controls rotation (10° per sec^2) and the left hand controls translation (0,3 fps^2). The MMU control [illegible] three rate gyros and [illegible] and to maintain [illegible] so the astronaut can [illegible] can be controlled through [illegible]

[illegible] propellant [illegible] thrusters, [illegible] to 'hibernate' mission. The thrust is [illegible] and astronaut [illegible] and return. The cold gas also permits the astronaut to [illegible] with [illegible] astronaut [illegible]

IV. State the most important characteristics for manned manoeuvring unit.

Text 2. I. Read the text and give it a suitable title. Give your reasons for the choice.

The telescope pole has been chosen as the escape system for future shuttle flights after extensive tests Edwards Air Force Base in California. Over 60 parachute jumps using pole were made from a C-141 aircrift.

The sysytem offers extraction for the full complement of eight crew members in about two minutes.

The pole weighs only 241 pounds, and it occupies little space in the orbiter's middeck.

The escape sequence begins with the opening of a valve to equalize internal cabin pressure with that outside. At an altitude of approximately 22000 feet the side hatch is jettisoned by pyrotechnic devices and the 2,94m telescopic pole angled 45° down and 15° aft is deployed through the open hatch. At about 20000 feet and a velocity of 200 miles per hour the escape can begin. One by One the crew attach a lanyard on their suits to the pole, and leap from the hatch in a tucked position. The rod releases them at a point where there is no danger of colliding with the orbiter. The astronaut's parachute opens about five seconds later.

Each crew member wears a partial pressure suit with a self-contained air supply and is equipped with a survival kit, including a radio beacon and a small raft.

Notes

1. complement - КОМПЛЕКТ
2. escape sequence- последовательность покидания
3. aft - по направлению к корме
4. lanyard - вытяжной шнур
5. tucked position - поджатое положение
6. survival kit - комплект жизнеобеспечения

U N I T VII.

Space Station

Text 1. I. Read the text and a)put down the figures given in the text; b) pick out the key-words associated with these figures; c) make a short summary of the text using the key-words and figures.

Design Features of the Mir Space Station

With the launch of the Mir space station in February of 1986 we began to build the first modular space station in near Earth orbit. The station complex consists of several elements:

- The Mir basic station.
- Large scientific modules such as Cosmos 1443 and 1686.
- Small scientific modules such as Cosmos.
- Soyuz TM crew transporters.

The Mir Basic Station

In general Mir has the same appearance as the former Salyut 6 and 7 stations. The mass is about 20t while Mir, at 13,5m, is about one metre shorter than Salyut. Whereas Salyut had three solar cell arrays, each with an area of $20m^2$, Mir was equipped at launch with only two arrays but an area of $38m^2$ on each array, $76\ m^2$, in total.

Docking Systems Mir provides six possibilities for docking other vehicles. All vehicles will perform rendezvous and docking with one of the axial ports initially and may then be moved to one of the four lateral ports. This would be performed using a manupulator arm, attacked to a module, by bringing it into contact with one of two mechanical fixpoints situated between the axial and two adjacent lateral ports.

Internally Mir is equipped to provide living quarters for a crew of six cosmonauts, male and female, to stay permanently on the station.

Future Scientific Modules. They are instrumented with [illegible] scientific apparatus, such as a radio telescope, a

large descent compartment .

The module will have a system of engines to perform the approach to Mir and, perhaps, be able to hold the complex in proper orbit by some engine kicks to compensate for altitude loss due to drag in the thin atmosphere.

N o t e s

1. modualr space station - МОДУЛЬНАЯ КОСМИЧЕСКАЯ СТАНЦИЯ
2. solar cell array - антенна на солнечной батареи
3. port - отверстие; левый борт
4. descent compartment - отсек снижения
5. kick - толчок

Text 2. I. Read the text and write a short annotation to it using some key-patterns:

1. This text deals with ... .
2. It is specially noted ... .
3. It is spoken in detail ... .
4. Much attention is given to ... .
5. The text is of interest to ... .
6. It should be stressed that ... .

Mir Mission Report

The Joint Soviet/French Mission.

It includes the space walk to erect ERA structure and the return to Earth of cosmonauts Vladimir Titov and Musa Manarov, who spent a record breaking year in orbit.

Medical and biological experiments were prominent amongst the first day's work on the complex namely, cardiac activity, biochemical experiments, the experiments to determine the body's sensory-motor physiology in weightlessness. The equipment used registered numerous physiological activity of the heart muscles, eyeballs and limbs movements simultaneously. The subject was videotaped in stereo.

After having checked out their EVA suits cosmonauts Volkov and Cretien entered the Mir front docking unit and sealed themselves inside. The compartment was depressurized and

opened one of the docking unit hatches. They had to perform five different technological experiments:

- Studying the behaviour of materials in space amongst them: paints, reflectors, adhesives, filament reinforced composites and optical materials.
- Studying the behaviour of polimeric materials.
- Studying the nature and distribution of dust in space.
- Studying the evolution of solar absorptivity and emissivity.
- Erection of ERA structure.

ERA structure consisted of 24 identical prismatic cells made from carbon fibre. Each of the cells had three parallel bars and 12 folding articulated bars. When deployed the structure was 1 metre high with a diameter of 4 metres.

When the experiment accomplished the structure was cast off. The men brought equipment back into Mir and closed the hatch after 5 hour 57 minute long EVA, a new Soviet record.

On December 21, 1988 Soyuz TM - 6 with Titov, Manarov and Cretien aboard undocked from Mir's front docking unit.

The cosmonauts fired the retro engine of the craft to begin the descent as the ship passed over the South Atlantic. The firing lasted 4 minutes 30 seconds.

Eight minutes after engine shutdown the Orbital Module was cast off. The descent cabin continued its controlled descent [illegible] the use of aerodynamic lift. At an altitude of 10[illegible] the parachute container cover was cast off and the parachute system deployed the 1000 square metre main chute. Contact was [illegible] established between the cabin and the helicopters of the search and rescue service. Soyuz - TM-6 touched down some 150km south east of Dzhezkazgan. Titov and Manarov had been in space for 365 days 22 hours 39 minutes. Cretien - for 24 days 21 hours 3 minutes.

[illegible] the Turkish equivalents to the following:

[illegible] sweet, caramel, pomegranate [illegible] Shashlyk [illegible], kebab, Turkish Delight.

III. Give the full names for the following: ERA, EVA, MMU.

IV. Translate the text paying attention to verbals.

U N I T VIII.

Spotlight on Orbital Pollution

Text 1. I. Read the text and express its main idea.

In the early days of space exploration, one of the great fears was that spacecraft would be destroyed by collision with meteoroids. *This fear proved to be largely unfounded, the natural meteoroid flux being less than thought. However, the possibility is growing than spacecraft around the Earth may be damaged by increasing amount of artificial space debris.*

Space debris can be effectively put into three classes: particles, fragments and artifacts.

Many tiny particles of aluminium oxide are produced by solid rocket motor used in space.

Larger particles include paints flakes; spacecrafts are normally coated with thermal paint to help control their temperature, but with the intense thermal cycling in the space environment this paint can easily flake off.

Many particles are produced by explosions, both accidental and deliberate and natural meteoroids could be included in the particle category.

A principle source of fragments and particles is the destruction of space vehicles. The debris from collision and explosions tend to spread out [illegible] cloud.

Another potential source of debris is the break-up of the nuclear power supplies of some satellites. When such crafts crafts reach the end of their useful life, the nuclear power pack is boosted into a higher orbit to prevent its falling back to Earth while it is still dangerously radioactive.

At the 38th IAF Congress held in Brighton in October 1987 there was a lot of talking about international responsibility for national activity in outer space.

II. Make up a plan for the text and discuss the problem of space debris.

The words below will help you

1. destroy- разрушать
2. fear - страх
3. collision - столкновение
4. damage - повреждать
5. debris - осколки, обломки
6. responsibility - ответственность

U N I T IX.

New Achievements in Space

Text 1. I. Read the text and answer the questions:

1. What kind of booster is Pegasus? 2. When did the work on Pegasus begin? 3. What are the advantages of air-launched booster?

The Pegasus Launch Vehicle

The idea of launching a satellite from a conventional aircraft is not new. It began to be realized since the early 1960's. At present an intensive effort is underway to build up the United States' expendable booster capability for both Air Force and and civil users. This is the Pegasus air-launched booster.

Work on the Pegasus began in early 1987. The Pegasus booster is 15 metres long, has a wingspan of 6,7 metres and weighs 16 144 kilograms.

The Pegasus has three solid fuel stages each 1,27 metres in diameter. The wings and fin are of graphite composite. The design of Pegasus was done using NASA's supercomputers rather than in a wind tunnel.

The advantages of an air-launched booster are several. The airplane's velocity adds 1-2% to the rocket's performance. More important the air pressure at launch altitude is 25% [illegible] allows a better rocket nozzle design.

as it does not have to be compromized for operation from sea level up to a near vacuum. The high altitude launch means lower dynamic pressure as well as lower structural and thermal stresses. Taken together this means a 10-15% reduction in the total velocity it would have to achieve for a given payload.*

The result is the Pegasus can put a 272 kilogram payload into a 463 kilometre polar orbit or 408 kilograms into 463 kilometre equatorial orbit. The satellite is fitted into a payload shroud 1,83 metres long with a 1,17 metre diameter. This large volume and payload weight will allow various satellite designs including ones with large optical systems.

The complete Pegasus will be brought out to the launch aircraft about two hours before takeoff. Joining the two vehicles will take about one hour.

It was planned the first Pegasus - launch would be made in July 1989 but in late 1988 this plan had been changed.

Notes

1. expendable – одноразового применения
2. rather than – а не
3. comprize – заключать в себе

Text 2. I. Translate at sight.

Phobos arrives

The Soviet Phobos 2 probe has entered Mars orbit after 200 day, 470 million flight. The spacecraft will at first study Mars, then it will turn its attention on to the Martian moon Phobos.

Operations to bring Phobos 2 into Mars orbit began on January 23,1989, when the probe's trajectory was corrected for its final approach to the Red Planet. Its braking trusters fired at 3.55 pm Moscow time, on January 29, placing the spacecraft in a 79750 x 850m orbit, inclined 1 degree to the Martian equator, with a period of 76,5 hours.

The probe is to carry out a comprehensive survey of the surface, atmosphere, plasma and magnetic envelopes of the planet.

N o t e s

1. comprehensive survey - исчерпывающий осмотр

Text 3. I. Give a short summary showing the trends of Soviet Lunar Program development.

Soviet Lunar Mission

The Soviet Union intends to launch a probe to the Moon in 1992. The project is titled Luna' 92.

The previous missions to the moon had yielded an enormous amount of scientific information."Now it is time to get down to the practical utilization of the moon. This involves first and foremost telephotography of the lunar surface with resolving power of only a few metres.

Soviet Lunar spacecraft will carry a television camera, gamma and X-ray spectrometers (to analyse the chemical composition of lunar sail), an infrared spectrometer (for studying mineral composition), and a magnetometer (for ganging the exact parameteres of the magnetic field).

Apart from the purely explorative purposes, the Lunar'92 project will allow us to test once more the equipment for Soviet Mars expeditions.

N o t e s

1. get down - приступить к чему-то
2. resolving power - разрешающая способность

U N I T X

Space Flight Centres and Museums

Text 1. I. Look through the text and render it in Russian.

Cape Canaveral (Florida)

The early years (1947-53) of the Cape were taken up primarily with the testing of winged missiles.*Soon the skyline of the Cape began to change. Springing up from the flat, brush covered landscape were the gantries for the Thor, Jupiter,

Atlas and Titan ballistic missiles.* The pads were in two areas - the IRBMs (Intermediate Range Ballistic Missiles) in the South end of Cape and the IBMs (International Ballistic Missiles) at the northen end. This formed the layout of IBM row that is now so familiar. Two pad complexes were built, one for the Air Force's Titan III and the other for the Saturn 5. After President Kennedy was assassinated in 1963 the facility was renamed the J.F.Kennedy Space Centre. The whole area was renamed Cape Kennedy (this move was not popular with local residents; the name was changed back in 1974.)

Today there are much more active pad complexes from South to North. For example, he first is Complex 17, that played host to the original Thor IRBM as well as the various versons of of Delta. Farther north are the two Atlas Centaur pads at Complex 36 mainly used now for communications satellites. They have also seen Surveyor, Mariner and Orbiting Astronomical Observatories. Farther up the coast is the Titan III complex, pads 40 and 41.

*The final active complex contains Pads 39A and B. In 1976, after the Apollo-Soyuz flight, work began on modifying the pads and the Apollo support equipment to handle the Shuttle.

The Cape is not just a network of pads, however. Supporting them is the industrial area 8km South.

Walking a few hundred metres from a pad area one finds wild Florida - the way it was before coming of Man.

N o t e s

1. cape - мыс
2. take up - занимаяться
3. winged missile - крылатая ракета
4. gantry - портальный кран
5. layout - расположение

Text 2. I. Read the text and answer the questions:
1. Where is CCAPS centered? 2.What can you see there? 3. What is Apollo 12 CM famous for?

The Us Air Force museum on the Cape Canaveral Air Force

Station (CCAFS) is centred around pads 5/6 and 26, one of the most historic areas of the Cape* because it was from here that Shepard and Grissom flew into Space during suborbital jobs by the Redstone.*

The AF first opened complex 26 as a museum in 1963 and since then it has grown to cover 40 acres.

Of course, the Museum has many displays, for example there is a large collection of missiles (Snark, Minuteman, Jupiter, Polaris, etc.)

Before the visitor actually reaches the gates of the Museum, the gantry and service tower of pad 26 is visible with a Jupo I launch vehicle in residence. The old, red-painted framework looks antique by today's standards but it gives the tourist an idea of spirit of those early days of spacecraft. The blockhouse still stands and houses the electronic equipment used for those launches,

An Atlas B (number 1410) stands at the gate. It was the first Atlas type to carry onto booster and nose cone separation

One of the most impressive exhibits is the Apollo 12 CM. It was launched on November 1969 carrying astronauts Conrad, Gordon and Bean to attempt the second lunar landing. Conrad and Bean spent 7 1/2 hours each on the lunar surface in two EVAs returning part from the Surveyor 3 soft lauder that had been sitting on the surface since 1967.

N o t e s

1. in residence – пребывание по месту работы
2. blockhouse – бетонное укрытие, бункер
3. lander – посадочная ступень, посадочный аппарат

Task 3. Read the text and list all the launch vehicles this center was responsible for

George C. Marshall Space Flight Center (MSFS)

On the 1800-acre site in the midst of the U.S.Army's Redstone Arsenal at Huntsville Alabama is the Marshall Space Flight Center. Under the directorship of Dr.Wernher von Braun the Center was established on 1 July 1960. Named in honour of the soldier and statesman General of the Army G.C.Mar-

shall, the Center was officially dedicated on 8 September 1960 by President Eisenhower.

From its inception through to 1969 Marshall's major mission was the development of several well known launch vehicle families. Its scientists and engineers have been responsible for the design of the Red stone, Jupiter, Saturn I, Saturn IB and Saturn V Boosters.

During the Apollo lunar landing programme 10 V's performed almost flawlessly to allow 12 astronauts to walk on the Moon and return with more than enough lunar rocks and samples to keep scientists occupied for years to come.

Following on from the Apollo series came the Skylab orbital laboratory.

Apart from the main complex Marshall also controls the site for the construction of the Space Shuttle's External Tanks.

One of the scientific payloads for Space Shuttle will be the Large Space Telescope (LST). This multipurpose telescope from its orbit above the Earth's will have an optical range estimated at two thousand million light years. MSFC has management responsibility for it.

Notes

1. inception - начало
2. responsible for - быть ответственным за что-либо; быть инициатором чего-либо
3. following - после, вслед за
4. apart from - кроме того, помимо

II. Write an abstract to the text.

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