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# HUNGARIAN COSMONAUT IN SPACE

Translation of

"Magyar Urhajos a Vilagrurben, MTIjelenti," Special Edition, May 26, 1980, pp. 1-31



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16. Abstract

This lengthy article describes the joint Soviet-Hungarian space flight. Commander of "Soyuz-36" was V. Kubasof, the space researcher, B. Farkas. "Soyuz-36" linked up with "Salyut-6", at that time being flown by Lt. Col. L. Popov, Commander, and V. Ryumin, the on-board Engineer.

The flight was launched from the Baykonyr Spaceport, May 26, 1980.

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FRONT COVER





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International Mission

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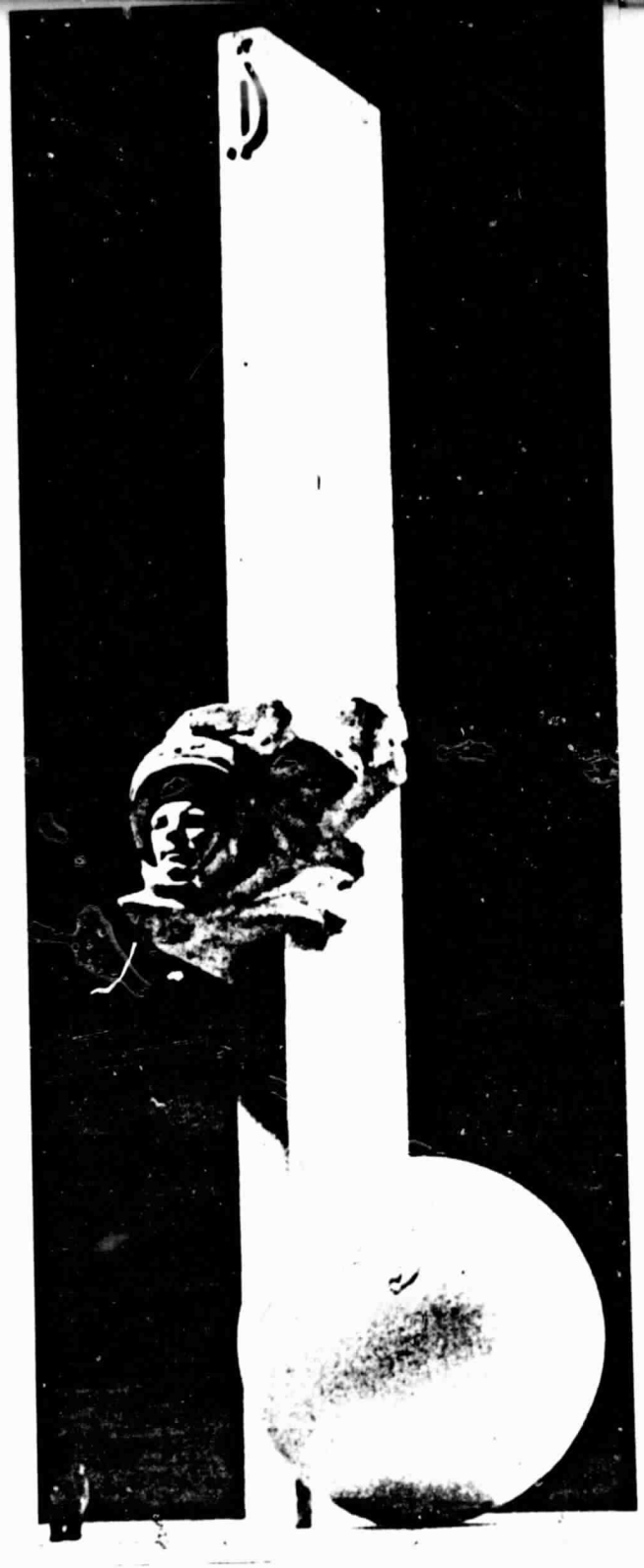
The wanderings of the imagination have entered the realm of reality. A Hungarian space traveler has entered space. He is participating in unique and unrepeatable adventures with the blessings and with a farewell from our entire nation. For the first time many of our fellow countrymen, realizing their dreams and desires, can look back from the height of the stars at our planet, at their native country, at the Hungarian People's Republic.

Icarus, risking an approach to the sun, was the hero of fable. The drawings of Leonardo da Vinci of apparatus for putting man into flight are considered fantastic, but everything was inspired by nature. Since then science and technology have erected a base for taking over the air. The Wright brothers' airplane, driven by an automobile engine, left the surface of the earth for almost a whole minute. Bleriot flew across the English Channel, Lindbergh flew across the ocean, Valeriy Chkalof and his two comrades flew across the North Pole, taking a journey more than 60 hours long from Moscow to Vancouver, Canada. In the meantime Chiolkofskiy developed rocket propulsion, the theory of space flight and the principles of the multi-stage rocket. Far ahead of his times, he foresaw that humanity would feel the restrictions of its cradle and would aim at conquering space.

Farther, faster, higher! To reach the unreachable, to grasp and touch the untouchable, to conquer the unknown.... Sometime before history began the cells of our ancestors formulated the ancient thirst for knowledge which, accompanied by a creative intellect, has exposed newer and newer prospects in every area of life. It drove and guided Columbus to America and Sandor Korosi Csoma to Tibet. Even at the cost of sacrifices it drove all of the explorers of past centuries on. It also raised and directed the first sputnik into its path beyond the atmosphere of our planet, and later Gagarin, the



*Szeretettel üdvözlik lapunk olvasóit a szovjet és a magyar űrhajósok.*

The Soviet Hungarian space voyagers sincerely greet the readers of our publication.

[Signed by cosmonauts]

first space traveler, to where the infinity of space becomes directly perceptible, where new colors flash, where the old customary ones fade, and from which the eye could embrace continents at a single glance.

It is already natural today that a space station is revolving somewhere up there. We have become accustomed to its inhabitants to work and experiment for months, and to receive visitors from time to time. We have also become familiar with the idea of freight spaceships. Even the services of the telecommunication and other artificial satellites have become important in our daily life. Many of the results of space research are already drawing practical interest, from television transmission through the performance of intercontinental telephone conversations to weather predictions. Even more is promised in this sequence. Every newly developed program and undertaking is partially associated with the previous ones, and at the same time the current enrichment serves future plans by means of experience and lessons.

This is also the basic purpose of the Soyuz-36 mission, but with the significant addition that scientific cooperation is assuming a new socialist form on a higher level. The Interkosmos program also partially expresses the fact that every nation shares a common interest in a better knowledge of space and responsible use of the new discoveries. This is true even if a national economy cannot bear the astronomical costs of setting up the necessary conditions.

The Hungarian traveler on the spaceship approaching Salyut-6, similar to the previously launched Polish, Czechoslovak, NDK [East German] and Bulgarian cosmonauts, has been able to travel into space through the favor of unselfish aid from the Soviet Union. With his commander he has been launched on high as a joint deputy of Hungarian and Soviet science, in order to gain personal experience with weightlessness, to conduct the experiments, measurements and examinations and to test the new instruments which Hungarian experts have planned in the infinite regions of space.

The collaboration of the fraternal socialist countries in this area has multiplied our power and possibilities, and in our country as well provides new impetus to develop the science of sciences.

Soviet-Hungarian crew launched to the Salyut-6 space station. Another new pair of space travelers in space within the framework of the Interkosmos Space Research Program: commander of Soyuz-36, Valeriy Kubasof; space researcher: Bertalan Farkas.

Preparation, Examinations, Farewell, Launch

The space foursome said goodbye to the unaccustomed cold of Moscow, and found every tulip at the height of its flowering back in Baykonyr. The former plain was covered with an enormous complex, and the spaceport was waiting for the members of the new international expedition with feelings of warmth.

The last days in Csillagvaros were unusually busy. In the last examination, scarcely two weeks before launch, Berci Farkas and Bela Magyari received equally outstanding reports, this time as earlier. In the course of two years of difficult work there was no other type of examination report, and in the well prepared space unit this is considered an outstanding achievement. The final medical examination also had a unanimous result: both candidates were fit to carry out the planned program of the expedition, to fly in space. Then they said farewell to their family and friends, and took off for Baykonyr.

Arrival in Baykonyr

The Hungarian space candidates had already walked over the spaceport and were familiar with this enormous space complex, but this trip was different. It was now necessary to put an end to the two years of difficult work, and their journey was now to be into space. In accord with the newer preparatory program the two now had to undergo their final preparation at the spaceport, and had to reach the launch site earlier than their predecessors. Ten difficult, work-filled days awaited the young men, with their red, white and green badges, and their Soviet commanders. Here with the aid of experts they were molded into final form, determining almost by the second the complete detailed program of the space trip, and here they had to prepare the complete on-board documentation.

The "Scenario" of the Space Trip

The "scenario" is an unusually important document, since every Salyut program is carefully planned and, although there is a great role for individual initiatives, the cosmonaut is the slave of the plan: he spends his nights and his activity from hour to hour, from minute to minute, according to the established plan, and this is the way he prepares for the flight.

In the assembly shops the space travelers themselves, naturally under the supervision of experts, must try out the test bench and their already frequently practiced scripts, and here supervise the faultless operation of the spaceship. Although there is no written rule they must be there when the powerful space vehicle, the launch rocket with the spaceship attached to it, begins its journey from the gigantic shop to the launch site, and is raised to the starting position. This is a beautiful and festive moment. But there is still a great deal of work to be done before the fuel tanks are filled and the instruments, equipment and functioning of the drive mechanisms are inspected. The two Hungarian space cadets and their Soviet commanders were no exception: along with the planners, technicians and mechanics they made a final examination of the path of the launch vehicle, and waited to be raised high up on the nose of the powerful rocket.

Naturally in the meantime their physical conditioning, their physical preparation, could not be abandoned. But sport was also urgently necessary, running, cycling and lively athletic games, after hard theoretical work every day on the simulators and exercises performed in the spaceship; recreation and entertainment, promoted by regular physical conditioning, were also needed. And before, after--and sometimes in between--the athletic occupations the doctors would come with their relentless instruments; they would check the health of the cosmonauts, especially the operations of their various systems.

Every individual examination brought more and more excitement: now no-one could interfere....

The Most Severe Medical Examination

Quite understandably the physicians conducted the most severe and most thorough examination immediately before the meeting of the State Commission. At this time the candidates were already living completely under trip conditions: their timetable had been arranged in such a way that the departure time required them to stay up the first night, and so during their preparation time their days began to get later.

The moment before the doctors again expressed their opinion seemed to be infinitely long: but the candidates were healthy and the trip could be started. Even longer perhaps were the few minutes until the chairman of the Commission announced the decision of which pair was receiving the flattering task.

Choice of the Pair

The decision was not easy since a choice had to be made between candidates of identical preparation and identical suitability. "I would have been very happy to launch both pairs on the voyage," said one of the Commission members. "Unfortunately there is no chance of doing this now, and so only one pair can go."

During these moments the attention of the spacemen was concentrated on the forthcoming launch and on the journey. After this came the rest before the launch. There was one more glance at the starting point: the imposing launch rocket rose high in the air, and the men who fill the fuel tanks and give a last inspection to the equipment were working there on the scaffolding. Someplace at this very time, many thousands of kilometers from Baykonyr and more than 300 kilometers higher, the target was racing along: the Salyut-6 space station, with the comrades they would soon meet and with whom for days

they would carry out their responsible work in a foursome, one Hungarian in a fraternal unit with three Soviet spacemen.

Dressing Starts

This procedure had been practiced many times, but was now particularly important. It was not a matter of a few minutes, but of a long time before the cosmonauts got into their special clothing, until they disappeared at the starting point and got into their unearthly spacesuits: their functioning had to be checked with as much care as their spaceship. Only when every examination had been completed was it possible to clamp on the helmet visors, and grasp the "suitcase" of the small fan which would provide air for the spacesuit until the latter was plugged in to the ventilation system of the spaceship. The backups and reserves are also checked: the pair must be ready for launch at the last minute. Then comes the well-known bus, a few seconds and the two members of the new expedition are standing there, the Soviet commander and his partner, the first Hungarian space researcher, with his red, white and green emblem. The members of the State Commission line up opposite them. Also present are the members of the Hungarian party and government delegation, who will be witnesses of the expedition launch; the leaders, the friends of the spacemen and the experts leave.

Still Two Hours to Launch

It is true that there are still about two hours remaining until launch, but here there is no more time for long farewells. A few stairs, then after the short elevator journey, they will have to take their places with the aid of technicians in the control capsule of the spaceship. They wave from the entrance and begin a final inspection before launch. A series of numbers, unintelligible to the spectators, contains valuable data: the condition of the various instruments and indicators, and a significant report on launch preparation.

Only after comparing the data from the external sensors and the internal instruments is the final order given to start the drive mechanism.

The black and white television, which transmits a picture of the spacemen to those remaining on earth, shows the conclusion of the inspection. And then comes the particularly festive moment. The Soviet and Hungarian members of the team indicate from inside the spaceship that they are ready for launch, ready to fulfill their great task....

The Last Minute Has Arrived

The backward count occupies the final minute. The two spacemen can be seen well on the television screen: they are calm and expectant. Then the picture trembles slightly, the first sheet of flame appears at the foot of the launch rocket. The gantries release the rocket: it begins slowly, almost imperceptibly, to rise. "Bon voyage," is heard from the liaison radio. The ground rumbles and shakes beneath our feet. The Soviet spaceship, with the first Soviet-Hungarian space team in its capsule, has begun its journey on the nose of the launch rocket.



Valerij Kubasof

Valerij Kubasof was born in 1935 in a town named Vyaznyiki in the district of Vladhimir.

In 1952 he was accepted in the Moscow flying academy named for Ordzhonikidz. Even at the academy he showed his outstanding capabilities.

his great industriousness and his wide learning. His outstanding capabilities early attracted the attention of the scientific leader of Soviet space flight, Sergei Korolyof, who suggested that he be prepared for thorough work in space, along with other planning engineers. Thus in 1966 Kubasof became a member of the space team, and began preparations for space flight. He was the on-board engineer of the Soyuz-6 spaceship. Kubasof became responsible for special work: he conducted the first welding in space.

In recognition of his outstanding capabilities, he was one of the participants in the first international, Soviet-American, joint space experiment, and was the on-board engineer on Soyuz-19.

After the success of July 1975 he undertook an important task in the preparation of the Salyut program, and participated in directing other programs.

Valeriy Kubasof is married. They have two children, 13-year old Katya and 9-year old Dimitri.

Kubasof is a member of the Communist Part of the Soviet Union and a candidate in technical sciences. He has twice been a Hero of the Soviet Union.

On Monday, 26 May 1980, the Newest International Space Pair Began Their Journey On Board the Soyuz-36 Spaceship, Launched From the Baykonyr Spaceport. The Commander of the Spaceship was Valeriy Kubasof and the Researcher was Bertalan Farkas

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Bertalan Farkas was born in Gyulahaza, in the Szabolcs-Szatmar megye in 1949. Before retiring his father was a skilled worker in the Kisvarda Shoe Industry Cooperative, while his mother took care of the family.

After finishing grammar school he enrolled in the Bessenyei Gyorgy Vocational High School in Kisvarda.

After graduating he began to study at the Kilian Gyorgy Flight Technology Academy in 1967. After two years of successful study he continued his education in the Soviet Union. He was appointed lieutenant in 1972 and became part of a fighter pilot unit in national anti-aircraft defense. In 1977 he qualified as a first-class interceptor pilot.

Through his unselfish readiness to help and through his industry he gained the love and respect of his commanders, fellow officers and subordinates. His direct and lively basic nature united him with the community. He is married and has two children: a son Gabor born in 1974 and a 3-year daughter Aida. This upright, disciplined officer was admitted into the ranks of party members in 1976. In 1978 he was promoted to captain. With many of his comrades he volunteered as a space candidate. Since he met the rigid requirements in every respect he began preparation for space flight on 20 March 1978 at the Csillagvaros Space Training Center.

Bertalan Farkas

How Did Berci Become a Spaceman?

When his benchmate in the Bessenyei Gyorgy Technical School, Gyuszi Kopasz, made the suggestion that they apply for the flying course, Berci Farkas was not overly thrilled with the idea. Up to then he had seen airplanes for the most part in films, photographs and even in the sky,

but his chosen trade was engine mechanics; however, in the final analysis they had time in the school, so why not try it? They applied and underwent the severe medical examination, and such is life! Berci passed the medical examination but the idea-originating Gyuszi failed: because of high blood pressure he was not admitted to the course.

In spring 1965 he entered the high school and quickly became a good friend of a stout boy: Bela Magyari, who was also beginning motor-driven flight. At the Nyireghaza airport "uncle" Gyula Rozman instructed the young pilot students, and they camped out at Bekescsaba for two years; since Berci proved to be a good student, he received permission to go up several times during the 6-week course. He felt the air, the charm of flying, and therefore applied to flight officers school. At the Kilian flight officers school he found difficult work, but the son of the Gyulahaza shoemaker overcame the ever increasing difficulties and every part of his studies, so that after two years he was "promoted to the upper class"; he went to study in the Soviet Union. Here he was able to acquire a knowledge of piloting modern combat aircraft, and had to fly under difficult circumstances, with his instructors being the most outstanding pilots in the Soviet air force. Berci also studied here with his good friend Bela. From their first class on their lives were almost completely intertwined: they went to Szolnok together, and then to the Soviet Union. It is also strange that there were many similarities between the two boys: they both came from the country to pilot courses, they were promoted to higher levels at the same time, and there is not even a week's difference in their birthdays, since both were born in August 1949, Berci on the second and Bela on the eighth. (Berci has modestly added that Bela's exam results at officers school were somewhat better, but the difference between them was not really great.)

The young pilot quickly became accustomed to the new circumstances after his several years of study. At the flight unit where he came as a lieutenant he was accepted with love and a readiness to help, and they were not afraid to assign individual tasks to him; they helped him to acquire experience and necessary skill. Not much time was needed before he acquired qualifications as a second-class airplane pilot, and afterward he spent more and more hours in the air: from his staff he required constant readiness and a high degree of concentration in protecting the airspace of the Hungarian Republic. In addition the rural town, where Berci Farkas was serving, had a happy surprise for him, many pretty young girls. Actually only one caught Berci's interest, and marriage rapidly followed their acquaintance.

The unit still did not know that the training of socialist country cosmonauts would soon begin in Csillagvaros, but they read with interest and listened to the news of the newer and newer successes of the large-scale space research program of the Soviet Union, of the space station circling the earth and of spaceships. Many of the young officers thought of possibly joining their Soviet comrades and finishing their studies with them; there would certainly soon be someone who would sometime soon don a spacesuit, but certainly few dared to think that one of them would become a space candidate. But even at this time the leaders of the program were dealing with this reality. Conditions were stated: mature age, first-class piloting qualifications, proper physical qualities.... They also looked through the personnel records of the unit where first lieutenant Farkas had completed his service and set his records aside with those of several of his comrades.

The young flight officer was very surprised and very happy when he was chosen as one of the candidates. Examination followed examination, one more severe than the others, and there were fewer and fewer left in the candidate

group. Medical examinations, tests and technical examinations became the everyday life of the candidates until only four of them were left. They were taken to Czillagvaros for the final examination; the top leaders of the space program, members of the Soviet State Commission, and medical experts would decide, along with Hungarian representatives of the program, which two would be lucky and begin their training. When the decision was made known, the two old friends joyfully embraced each other: Farkas and Magyari were the names announced.

The Farkas'es From Pacin (by Attila Melykuti) 76

When the Farkas parents loomed over the little stranger 30 years before, they could not have thought....

A picture message from Csillagvaros to the family

Final advice before the practice flight

With his kid brother when he was in high school

The road led from this school bench to cosmonaut candidacy. The aircraft technician at the Kilian Gyorgy Flying Technical Institute acquired the most modern theoretical and practical information.


Film frames of the days before the departure.

The two space candidates with their wives.

Now, while Bertalan Farkas is rushing through space, I am again filtering the pictures through my memory, but the details are fading. The childhood features are blurring, and his father, Lajos Farkas, remembers only his inevitable smile. Lajos lives in Gyulahaza, where his son Berci was born. He is 64 years old already and waits at the garden gate for the mailman bringing his pension. His mother is from Pacin, and the family lived here for three years, not far from Satoraljaujhely. In the small community, scarcely a stone's throw from the Czechoslovak border, the Farkas property included 600 square fathoms. His mother says, "Nowadays many people ask how Berci was as a child, but it is very difficult to say anything about your own son. Was he good? Of course he was, but he was also mischievous.... He was very fond of stories, and could not be put to bed without one. He was perhaps 3-years old when he himself lisped the little story about the baby goat.

He might have been ten years old when he helped his grandfather during the summer vacation. He plowed from a horse and worked so hard that the old man's share of labor for the farmers' cooperative was done. He smiled a lot, and was carefree and unselfish, so that his pals loved him very much...."

With this statement the 49-year old woman suddenly paused. She began again slowly, almost apologetically, "I'm praising him, only praising him, but what else can a mother say? If Berci heard this, he would shake his head, because he didn't like to be praised very much."

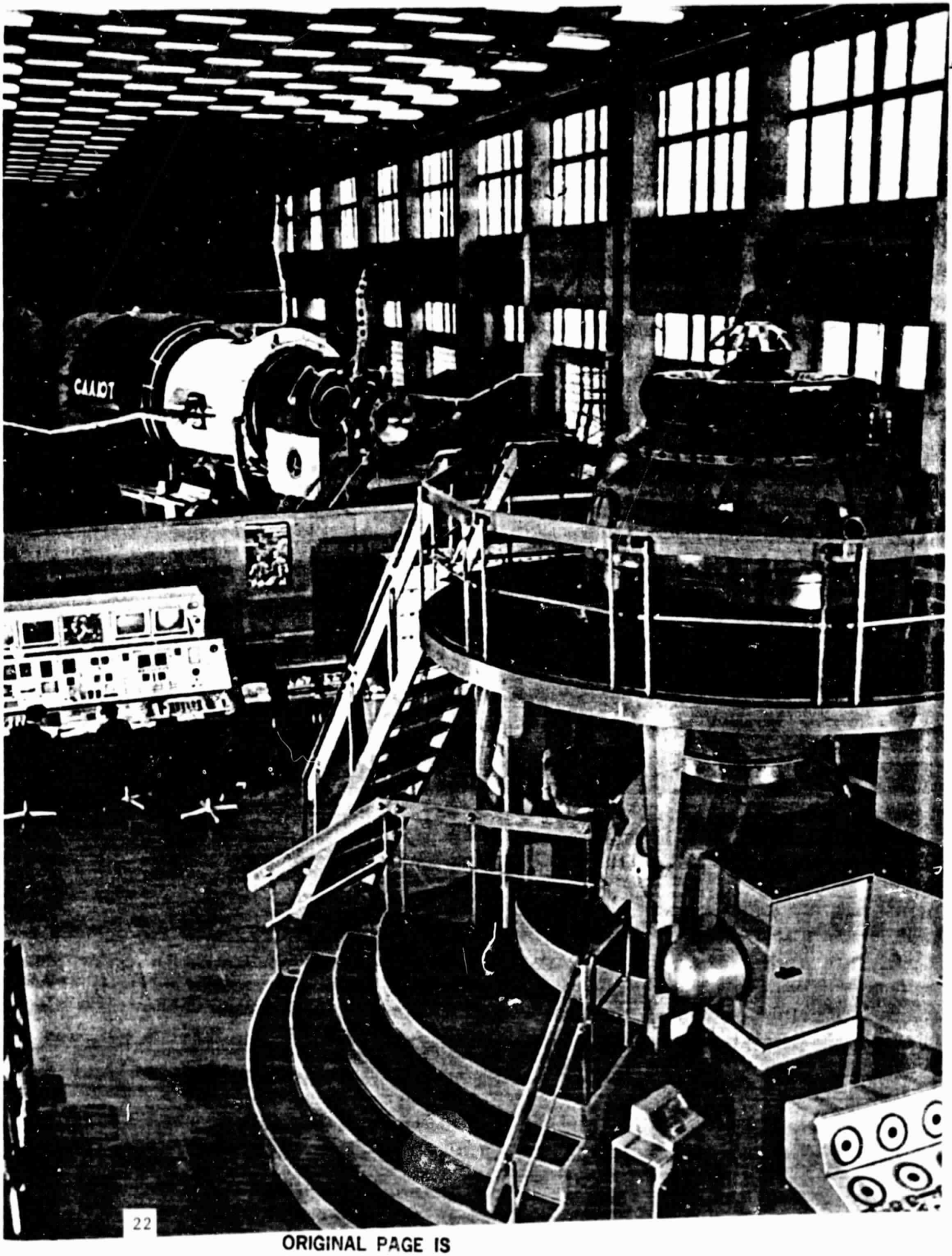
His father guided us to a small secluded room at the back of the house. On the table in front of the window were lying a last, awl, and a shoemaker's knife, while footwear were lined up on a shelf. Lajos Farkas, who had deserted the land a little bit and learned the tricks of being a master shoemaker, did not throw his tools into the corner because he had a pension from

producer cooperative. He still repaired the shabby shoes of the villagers. When it needed doing he also patched up broken bicycles with the younger son, Bertalan's 14-year old kid brother. The boy is not preparing by accident for Miskolc, a technical center.

"We still have to take what we can get, because although work has ceased, money has never possessed us," said the father. "Whatever came in my wife distributed well, and thus Berci was able to study and Lala was able to finish school without difficulty. Boske, a buddy of mine, always said that you can't send your kids on the way with money. He was right, and they got and are still getting just what they see."

Then the subject turned to the 1978 memories, and the parents recall the invitation of their cosmonaut son to Csillagvaros. Then, after a long time, the family was again able to be together, along with their 2-year old grandchild Aida, the apple of everyone's eye.

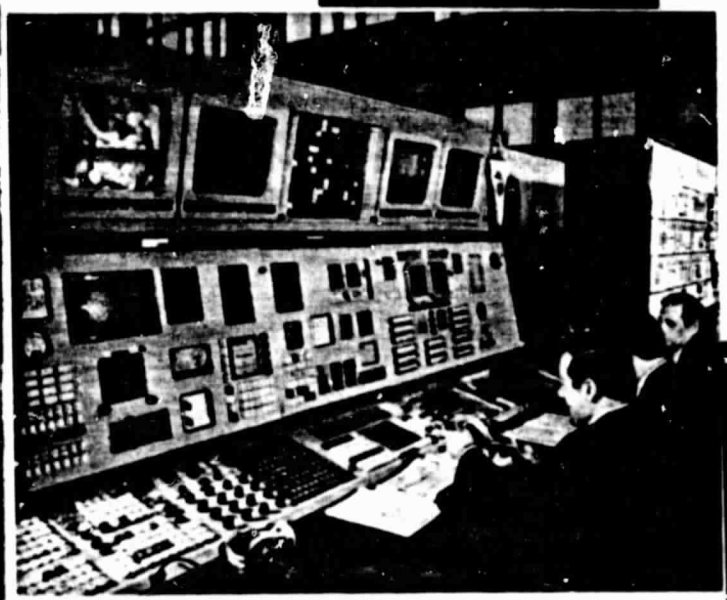
"Everyone in the village kept repeating," Mrs. Farkas interrupted, "Hey, Boske, how proud you can be of that boy. Of course I understood and realized that something great was happening to Berci, but deep in my heart I also recall fear. As early as high school I had warned Berci not to begin flying, and he always comforted me; he might soon fail some medical examination. Even now, when I walked up to him outside before the blast-off, I searched his face for signs of being overtired or of studying too much. He smiled and I felt that nothing was wrong, but I will really only be at peace when he is again down here and I can hug him...."



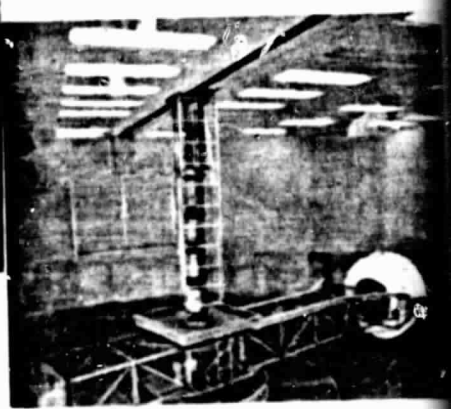
Csillagvaros: Preparation for the Space Trip

(Csaba Kis)

Medical check-up before practice.



Practice space object control panel.



One of the most difficult exercises: in the centrifuge.

The Jurij Gagarin Cosmonaut Training Center in Csillagvaros. The applicants are exercising with the complex operations of space flight on the floor.

The packing and the final preparation have begun. What can be waiting for the candidates and their families in Csillagvaros? Both of them are preparing for the journey with little children. However the charming prospects have suppressed worries and problems: how will they place in this test which so far only a few have managed to share. What is waiting for them in Csillagvaros, about which they have heard so much and still know so little?

In Csillagvaros friends are waiting for them with a great deal of affection. Not far from the buildings of the center a brand new apartment build ing is waiting for them, where the cosmonaut candidates studying in the interkosmos program get a 3-room furnished apartment. Brigadier General Leonov humorously put his hand behind his back with the keys for the two Hungarian apartments in them. It was up to the women to choose which hand they were in. When they walked into the apartment they were accompanied by future friends, commanders, and the outstanding personalities of space conquest: Beregovoj, Nyikolajev, Klimuk, Volinof, the cosmonauts whose names have already appeared many times on the first pages of the world press, and who received the rookies from far away with as much affection as if they were very old friends.

"I thought it would be easier," recalled Berci of the fatiguing months of preparation. The cosmonaut course is a program for several years and, although the socialist countries have somewhat shortened it for space researchers, they still have to learn a great deal. The daily schedule is rigid: at 9:00 a.m. they already have to be in the classroom and there will certainly be no rest before 7:00 p.m., there is a lot of complex material, and constant practice. And if the slightest problem turns up, training continues, often until 11:00 p.m. Although the "methodist", the expert conducting the preparations, is always ready to answer a question and to help find a necessary book, is also ready to probe the knowledge acquired and to check on preparations.

The most prominent experts, scientists and cosmonauts guide their pursuits.

The first section of the course primarily aided in theoretical preparations. Ballistics, astronomy, the basic operating elements of spaceships and the space station were subjects whose rudiments they had acquired in flight training, but which the future cosmonauts now had to study with a great deal more concentration, range and determination. How can you control a spaceship if you cannot orient yourself on the basis of constellations, or if you do not know the ballistic laws which determine the movement of the spaceship? How can you intervene if you do not have the necessary technical knowledge about everything which makes the spaceship and the space station function. In space you cannot call for the help of the "yellow angel", and everything must be solved by the cosmonaut.

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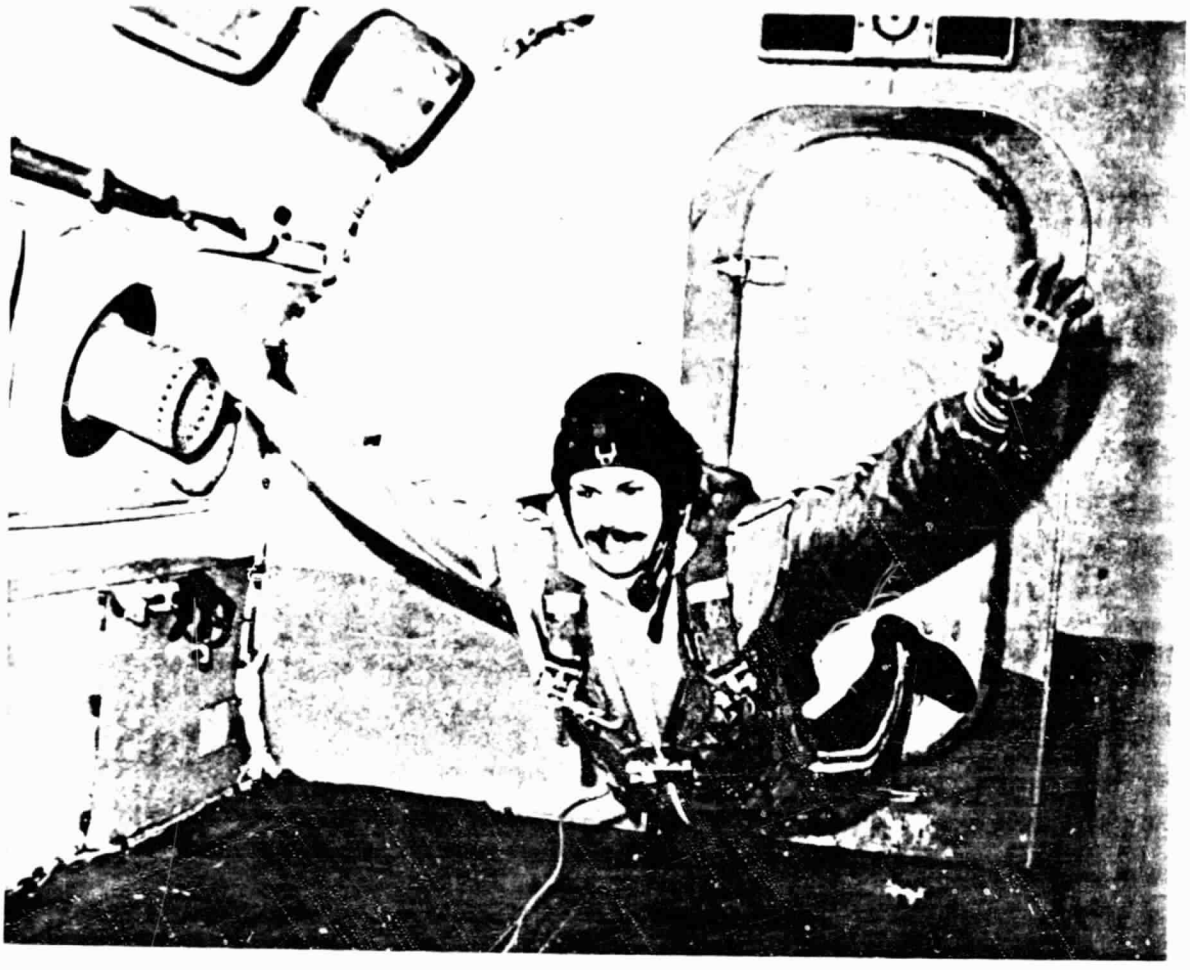
The two cosmonauts with their training commander, A. Leonov.

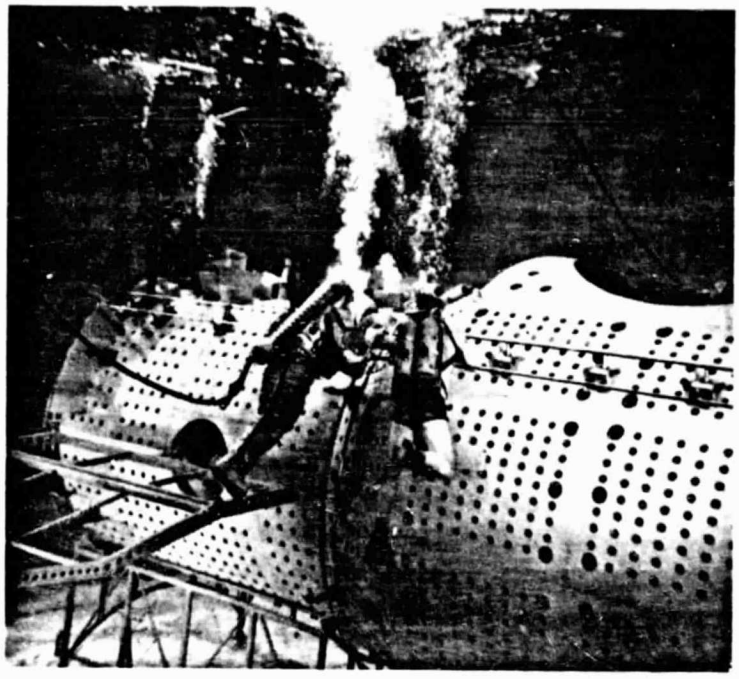
V. Kubasof and Bertalan Farkas discuss the next training phases.

Here they are in spacesuits in the control cabin of the practice Soyuz spaceship.

The cosmonauts must know their way around hundreds of instruments and knobs.



Practice with weightlessness during preparations.



Practice with weightlessness in underwater experiments.

The first successful tests came along and afterwards the candidates were "promoted to the upper class". Then came the practice flights, the parachute jumps, the first and unforgettable encounter with weightlessness in the aircraft flying a parabola, initial familiarity with the spaceship and the space station, long hours spent on the centrifuge where the system gets used to overloads, the exercises performed in the water where the candidates become accustomed to work which must be done under weightless conditions. Undoubtedly the greatest adventure of this period was when the candidates for the first time sat down in the simulators, in the exact models of the spaceships and space stations, first only for familiarization, then to become familiar with handling the equipment and practicing with it, and finally for the purpose of solving concrete flight tasks. The computers and the mathematic and logic equipment imitate every phase of flight precisely, and the space candidates must solve more and more complex tasks.... This is a difficult and responsible

subject, but good friends, comrades and experienced spacemen stood there with Berci and the others. For example, Gubarof and Volinof gave a great deal of assistance to the candidates who had come from the socialist countries, and the program experts never left them alone. Recreation in the busy days consisted of physical education, and preferably filling the few free hours with a little soccer, but with moderation, because the doctors would not have been enthusiastic if one of the candidates broke a hand or a foot.... The families could spend only a little time together, and it was rare good fortune when they could take little Aida for a walk in the Csillagvaros park or in the neighboring forest. On the other hand the future cosmonaut was well rewarded by the host of adventures. Who could forget the first visit to Baykonyr, the moment that the future cosmonaut stepped into Gagarin's former apartment, and when he saw a spaceship rising into the air for the first time? No, it was not possible to forget these adventures, the moments which amply compensated for the long, difficult days, the heavy studying and the fatigue.

At this time Berci and Bela were already being prepared differently from the others; they had the honorable task of working soon with the next Salyut-6 crew. They became acquainted with Leonyid Popof and Valeriy Ryumin, and then came the long awaited day: they received their precise classification and orders. Berci scarcely believed his ears when he learned that his commander would be one of the most experienced Soviet cosmonauts, one of the participants in the Soyuz-Apollo program, an expert in technical missions, and a colleague in Korolyof's planning office, Valeriy Kubasof himself.

"I already knew him and he often visited our courses, but I hardly dared think that he would sometime be my commander," said Berci, recalling that December day. He is not only very knowledgeable and a very experienced expert, but he is also unusually friendly. At first I was very afraid of

him.... How could I approach him? He had twice been in space and his head was full of knowledge; what could this flight teach him that he did not already know, and more important, how could I give him any assistance in his work?

Later it became clear that Valeriy did not feel this difference at all. We had later become accustomed to him giving us a great deal of aid in our preparation whenever any kind of problem arose. Kubasof's approach was different: he decided what had to be learned and what we had to be aware of, he assigned a task, and there it was: do it yourself. He did not expound ahead of time, although questions could be asked, but only after we had prepared the material. He himself was convinced that I had thoroughly succeeded in mastering the material, and that I knew a great deal about solutions, and then he would explain what I still had to do and what it would be best for me to study and practice.

Berci already "flew in space" with Valeriy Kubasof every day, actually only for a while in a simulator, but in this practice he had to solve more and more difficult tasks. For those conducting the exercise it was the accepted custom that the commander would "lose consciousness" during the liftoff of the spaceship, and that the candidate would have to carry out complex and unusual tasks by himself. Berci had no complaints: he made mistakes, but gradually less often. And at the same time there were always new adventures: trying on the spacesuit, and "live" preparation of the spacesuit to be used during flight. This was not because it is an elegant suit which is tailored with care and fittings, but because the spacesuit may save the cosmonaut's life. There were exercises for landing on the water, actually only "survival" drills in the pool, practice for the period following a forced landing at an unknown place which might be a real

forest (although a desert or steppe landing and survival practice play a part in the Soviet cosmonaut program), improving the body and physical conditioning, becoming accustomed to more and more drills, and how to control the equipment of the spaceship and the space station weightlessly. And examinations, examinations and examinations; on theory and practice, on astronomy and on linking up the spaceship and the space station.

/12

Becoming acquainted with Moscow. The Hungarian space candidates and the Soviet cosmonauts with their wives at the Spaceship Monument.

"Here everyone helps everyone else", said Berci. "Everywhere I turned I found someone who was ready to sit down with me, to discuss my problems and to help solve them. There were Zholobof and Glazkof, comrades who had come from the socialist countries, and we worked together as if we had done it all our lives and as if we had always flown together. And although we became weary, although it was sometimes very difficult, we did not really feel the difficulties. If the willpower and the enterprising desire are there, if there is the desire to solve the most difficult tasks, then they can be solved. I always felt this in Valeriy Kubasof when I spoke with him, and this also affected me. He helped me like an elder brother and a real friend: I really have a great deal to thank him for.

During this period there were also odd things which could not be thought of at that time. Although it was not the most comfortable moment, a memory has still remained of the time spent in the "plaster tub": an exact plaster model was taken of the back of our bodies. In this way the spaceship seat was fitted to our measurements with unusual precision, helping to bear the extra pressure when ascending and descending, the pressure exerted on our chest and back, because the back must conform exactly to the seat. (When the Bulgarian cosmonauts, Rukavisnyikof and Ivanof, were coming down, there was an almost tenfold increase in pressure. "It was as if they were piling a plank with a Zaporozsec automobile on it. This can be taken without collapse or injury only if the back has been most precisely calibrated", Rukavisnyikof said of it.) Berci also stretched out in the plaster tub for the appointed time, with about a dozen people crowding around him; but he could soon see the seat which was made expressly for him and prepared for the spaceship. For this purpose who would not undergo a little lack of mobility in the "plaster tub"?

The time for the final examinations and tests came: Farkas passed the examinations and tests with 100% success. And although he hoped that he would be picked, although he was sure of success, he did not neglect his old friend Bela. "You know that the two of us cannot fly, that one of us must remain here. Naturally, I want to be the one who is successful, but if Bela is chosen I will be almost as happy," he said during a conversation not long before the State Commission announced its decision.

Our cosmonaut candidates become acquainted with the history of Soviet space research in the Jurij Gagarin Museum.

Bertalan Farkas with his wife and little daughter, Aida, in Csillagvaros.

The two Hungarian cosmonaut candidates place flowers at the Gagarin Monument.

Then came the day when Captain Farkas received the first number. It is true that the drill routine and the constant study did not come to an end; there could be no rest until the final inspection and examination, until the final period of training, and until the order for departure with the crew expected at the spaceport.

"This was not an easy time, but the affectionate help of our friends and comrades made it possible for us to successfully maintain our positions. And we finally felt that the people at home regarded us with affection, worried about us and had cold feet for us. They fulfilled our demands and took care to see that we did not lack the little customary things from home, favorite foods and contact with our families. Our parents visited us, we went home on leave, and our commanders kept us in close touch with home; in a word they did everything to help make our work successful," said Berci. "The rest was really up to us...."

Space Records

The peak performances in space research change almost from one month to the next, so let us see who hold the world records in space research and when they were set.

Length of time record: The Soviet Vladimir Lyahof and Valeriy Ryumin, who spent 175 successive days in space.

Time spent outside spaceship record: The same two Soviet men worked continuously for 2 hours and 5 minutes on a manned satellite outside of the Salyut-6 space station.

The oldest space pilot: The American Donald K. Slayton, who flew on Apollo-18 at the age of 51, and the Soviet Georgiy Beregovoy, who was lofted into space for the first time at the age of 47.

The youngest spaceman: The Soviet German Tyitof took part in the Vostok-2 space voyage at the age of 26. The youngest American astronaut, Eugene A. Cernan, flew on Gemini-9 at the age of 32.

Four times in space: Charles Conrad, James Lovell, Thomas Stafford and John Young, and another 9 space pilots have experienced the space travel adventure 3 times, 6 Soviet and 3 American men.

The world's first artificial satellite: Sputnik-1 (4 October 1957); the first artificial planet of the Solar System: Luna-1 (3 November 1957).

The first living creature in space: The dog Layka (2 January 1959).

The first man in space: Jurij Gagarin (12 April 1961).

The first manned space flight: Vostok-3, Vostok-4 (11-16 August 1962).

The first feminine cosmonaut: Valentyina Tyereskova on Vostok-6 (16-19 June 1963).

The first space walk: Aleksey Leonof from Voshod-2 (18-19 March 1965).

The first orbiting space station: The first transfer in space (Soyuz-4, Soyuz-5) (14-17 January 1969).

The first man on the moon: Neil Armstrong with Apollo 11 (20 July 1969).

The first joint flight of 3 spaceships: Soyuz-6, Soyuz-7, Soyuz-8 (11-18 October 1969).

The first international linking: Soyuz-Apollo (15-24 July 1975).

The first international crew: Aleksey Gubarof and Vladimir Remek on Soyuz-28 (2-10 March 1978).

Space Pairs



Start: 9 October 1977 (Soyuz-25)

V. Kovolyonok, V. Ryumin

Start: 10 December 1977

(Soyuz-26)

J. Romanyenko, G. Grechko

Start: 10 January 1978 (Soyuz-27)

V. Djanibekof, O. Makarof

Start: 2 March 1978

(Soyuz-28)

A. Gubarjev, V. Remek

Start: 15 June 1978 (Soyuz-29)

V. Kovolyonok, A. Ivanchenkof

Start: 27 June 1978

(Soyuz-30)

P. Klimuk, M. Hermaszewski

Start: 26 August 1978 (Soyuz-31)

V. Bikofski, S. Yahn

Start: 11 April 1979

(Soyuz-33)

Ny. Rukavisnyikov, G. Ivanov

(Soyuz-25 and Soyuz-33 did not link up with the Salyut-6 space station)

Start: 25 February 1979 (Soyuz-32) V. Lyahof, V. Ryumin

Start: 9 April 1980 (Soyuz-35) V. Popof, V. Ryumin

Joint Ten-Nation Program [Eva Molnar]

Interkozmos is the largest and only international space research cooperative program and organization in the world, and scientists and experts from 10 socialist countries participate in it: Bulgaria, Czechoslovakia, Cuba, Poland, Hungary, Mongolia, the German Democratic Republic, Romania, Vietnam and the Soviet Union. This multilateral research collaboration of the socialist countries is already more than 10 years old. The Soviet government invited its socialist partners to join in the space research collaboration and, with no compensation from them, provide the space technology, the launch rockets and the ground tracking network. Moreover, instead of each country bearing a proportion of the entire expenses for the material weight of the experiments, each bears only the expenses connected with its own experiments.

On 17 April 1967 representatives of the 9 countries (Vietnam only joined Interkozmos later) approved the joint experimental and research program in Moscow. However, it was only in 1976 that the international cooperative agreement, placing the peaceful research and use of space on the agenda, was signed in Moscow. According to the agreement the joint work extends to research on space physics, cosmic meteorology, biology and medicine, and a survey of natural resources on earth, the so-called resource research. This program was expanded by the space flights of international crews, which we have been able to witness in recent years.

The Interkozmos participants have taken a more and more active part in research work for various purposes, depending on their own technical and scientific background. Czechoslovakia has primarily been involved with the active processes taking place on the sun and with the long-wave electromagnetic irradiation in space. Researchers from the German Democratic Republic have been examining the turbulent physical processes occurring in the upper layers of the atmosphere and have been examining the surface of the earth with special procedures from high altitudes. Polish scientists have undertaken radio astronomy measurements of the upper layers of the ionosphere and studies of ionospheric irregularities. Bulgaria assigned a prominent role to plasma measurements and to investigation of ionospheric irregularities. In our country [Hungary] we particularly deal with research on cosmic particle radiation, problems of maintaining earth contact with artificial satellites and observation of the ionosphere. Romanian specialists have mainly emphasized the measurement of high-energy particles and mass spectroscopy examination of the ionosphere. Cuba and Mongolia have been studying the operation of telecommunication satellites.

The joint experiments already span a decade. On 14 October 1969 the first joint artificial satellite was launched, Interkozmos-1, which

carried out geophysical and solar physical measurements. Since then a total of 20 Interkozmos satellites have been launched.

Hungary in Interkozmos /15

In our country space research activity was directed by the State Research Government Committee until November 1978. Since then the Interkozmos Council of the Hungarian Academy of Sciences has conducted this mission with the help of committees of experts corresponding to the 5 main research fields, cosmic physics, cosmic meteorology, biomedicine, space communication and resource research.

Since the beginning we have participated in the Interkozmos program by processing experiments, observations and data, and by interpreting them. In the 1970's our participation became more intensive, after it became clear how we could contribute to the realization of the program in accord with our capabilities and knowledge. From that time on we also became associated with the technological preparation of the joint satellites and research rockets.

Already 9 Interkozmos satellites and 4 geophysical rockets have operated or are operating with equipment for which Hungarian experts have made components. The first Hungarian made electronic instrument operated on Interkozmos-12, and a refined version of it was part of the Interkozmos-14 equipment. A unique telemetering system designed for the Interkozmos satellite was tried out on Interkozmos-15, and Hungarian engineers also collaborated in its development. The main power unit of the satellite, supplying electricity for some of the equipment, was developed by researchers at the Budapest Technical University, including the so-called digital converter which transforms signals coming from measurement equipment into more reliable digital signals. The system operates reliably on Interkozmos satellites 17, 18, 19 and 20.

In our cosmic meteorological research, on the basis of photographs taken from the artificial satellites, we have been able to computerize pictures of the atmosphere and clouds, provided for service since 1968 and which the pilots from the Ferihegyi Airport can view immediately.

In connection with biomedical research Hungary has basically examined the harm which can occur to a spaceman's organism during space flight as a consequence of cosmic radiation. Biological reactions have been studied on animals exposed to small doses of irradiation and to the individual organs of animals sent into space. One of the tasks of Hungarian spacemen, among others, is to examine the intensity of radiation and the amount of radiation exposure by means of the dosimeter carried with them. In 1972-1973 Hungarian researchers developed an image composed of elements similar to the tissue components of the human body, on which the radiation exposure absorbed by the human organism can be precisely measured. Outside of space flights, the image can be used well for ordinary radiation therapy. Investigation of the organs of the nervous system and of equilibrium provide important data for cosmonaut training. They deal with the problem of how the physical and psychic condition of the cosmonauts can be precisely checked.

In 1975 our country joined in the resource research which is becoming more and more important from the viewpoint of national economic development. Evaluation of the basic tasks of resource research has already been finished, and the launching of the first resource research satellite, on which Hungarian equipment will also be operating, is expected very soon.

The First "Cosmic Apartment" of Man

The first "cosmic apartment" of man, the Soviet space station of the Salyut type, was put into earth orbit in 1971, while Salyut-6 has been circling the earth since 1977 and offering a comfortable home in space for any 6 people. Already a number of spaceships have brought visitors to the Salyut-6 deck for a shorter or longer period of time, and the Progress-type freight ship has "linked" with cargo for the "celestial base" 9 times.

The living space is approximately 100 cubic meters. The furnishings of the space apartment are unusually practical, and include a workroom, dining room, bedroom, bathroom and gym track. A total of 7 working positions, for different purposes, have been developed for the space station. A separate eating and recreation place is provided, where the meals are prepared on a small table equipped with a special heating device. Perhaps the shower stall is the most ingenious facility. Under conditions of weightlessness the water does not flow downward, but filters freely in the air in tiny drops, and therefore they are pulled together with a vacuum-cleaner-like apparatus. The space bicycle and running pad on the spaceship see that the pilots maintain good conditioning.

The spacemen can choose among packages of food prepared in advance. Their menu is quite varied: roast beef, chicken, weiners, ham, bacon hash, ground sausage, various sauces sealed in tubes, cream cheese, vegetable puree and cheese appear, with other foods, in the "space menu".

The scientific work performed on Salyut requires unusually great preparation, and 90 experimental research devices and more than 400 instruments are found onboard.

The cosmonauts already arrive at the space station almost by time-table. The first permanent crew of Juri Romanyenko and Georgiy Grechko lived on Salyut-6 for 96 days.

The third permanent crew of the spaceship, Vladimir Lyahof and Valeriy Ryumin, set a record in the "space marathon". So far three permanent crew members and four visitors (including three international ones) have worked on board Salyut 6. The fourth permanent crew began their work in April this year.

Observation, Horticulture, Fusion

Everyday On Board Salyut-6

The two Soviet-Hungarian space crew members, Lt. Col. Leonid Ivanovich Popov as commander and Valeriy Viktorovich Ryumin as on-board engineer, began their journey in the Soyuz-35 spaceship on 9 April 1980 and reached the Salyut-6 spaceship on 10 April.

Popov was born on 31 August 1945 in the town of Alexandria in the Kirovograd region. His original profession was fighter pilot, and he finished his training in 1968 at the Chernyigof Flight Officer School. A decade later, in 1970, he joined the cosmonaut unit. Although this is his first space-flight, he took part at the ground center in directing a number of spaceships, including Salyut-6.

Ryumin, the absolute world record holder in spaceflight, was born in Komsomolsk in 1939. In 1961 he began his studies at the Moscow Forestry Institute, and after finishing them he worked as a structural engineer. He began training to become a cosmonaut in 1973, and on 9 October 1977 set out on his first spaceflight with Kovolyonok as his partner. Then he missed docking with the Salyut-6 spaceship because of a technical error, but one and one-half years later he completely redeemed himself. On 25 February 1975, at the side of Lt. Col. Vladimir Lyahof, he started a spaceflight from which he would return one-half year later, on 19 August. Ryumin's current flight was unexpected, and the decision to launch him again was only made when

Popov's partner Lebegyef, was injured during training. Ryumin, whose state of health was completely satisfactory, voluntarily took Lebegyef's place.

At the space station the space team was already awaited by the Progressive-8 space freightship, the first freightship of the program which had reached the space station while it was uninhabited. Thus the first great task for Popov and Ryumin was to unload Progressive-8 and to revive Salyut-6 which had been "dormant" for a half-year.

After checking the docking and making sure of the good operating order of the space station, Ryumin himself was able to open the letter which he had left behind in August of the previous year for the following crew when he and Lyahof left the vessel.

From the first moment Ryumin moved around the station as if at home, but Popov did not have much trouble becoming familiar with it either, since he had been the reserve for the previous commander, Lyahof. Thus "moving into" Salyut-6 did not take much time, and after some cleaning they were able to begin replacing outdated devices and starting up equipment which had been disconnected.

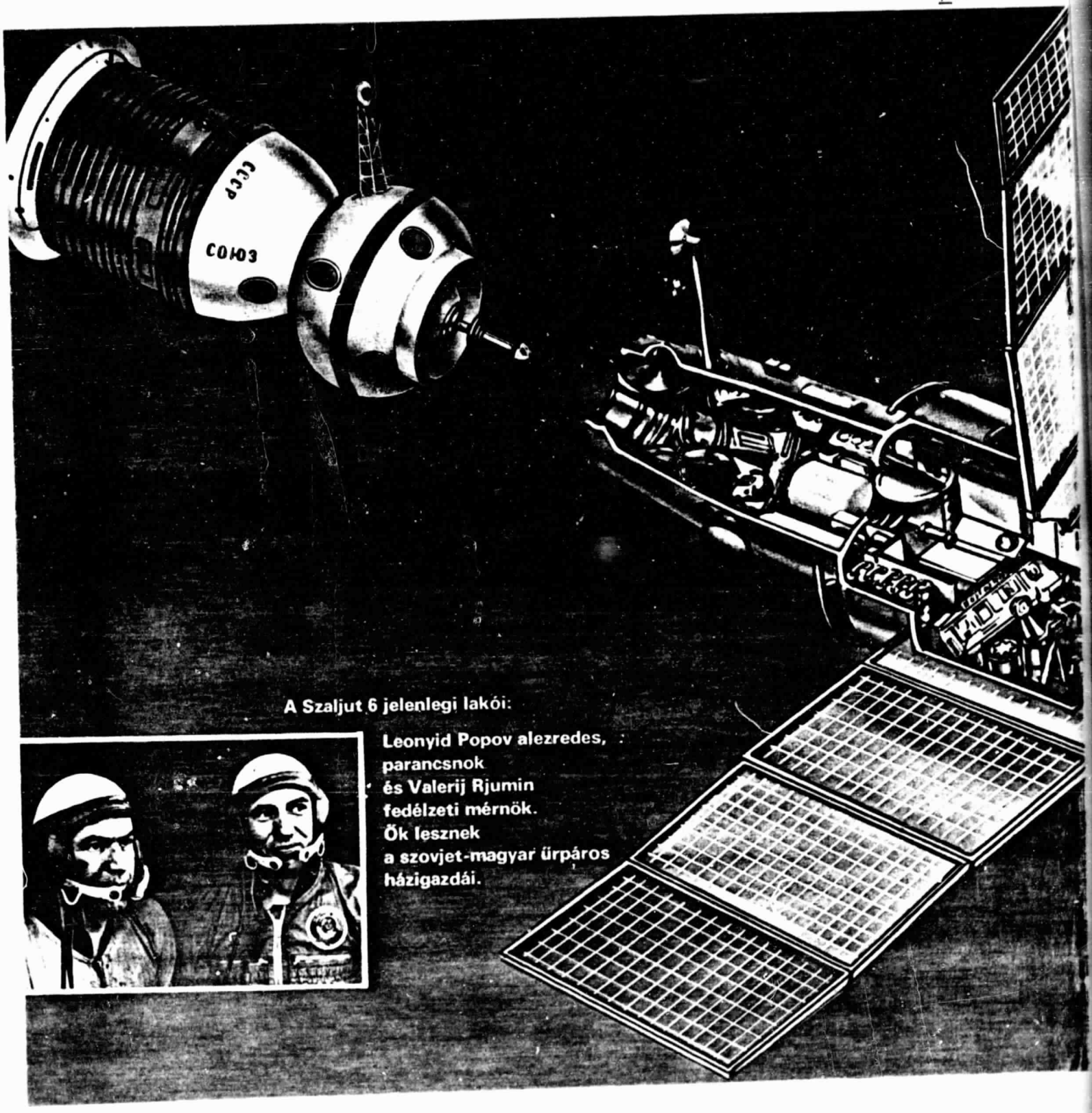
The Splav miniblast furnace, the Jelena gamma telescope and the apparatus for purifying and regenerating water are all operating again. Likewise they put the MKF [expansion unknown] multichannel photographic equipment back into operation.

They also started biological experiments: they planted the space station kitchen garden with peas, onions and grain. To make their surroundings more beautiful and comfortable the space crew had also brought along orchids in the miniature greenhouse named Malachit.

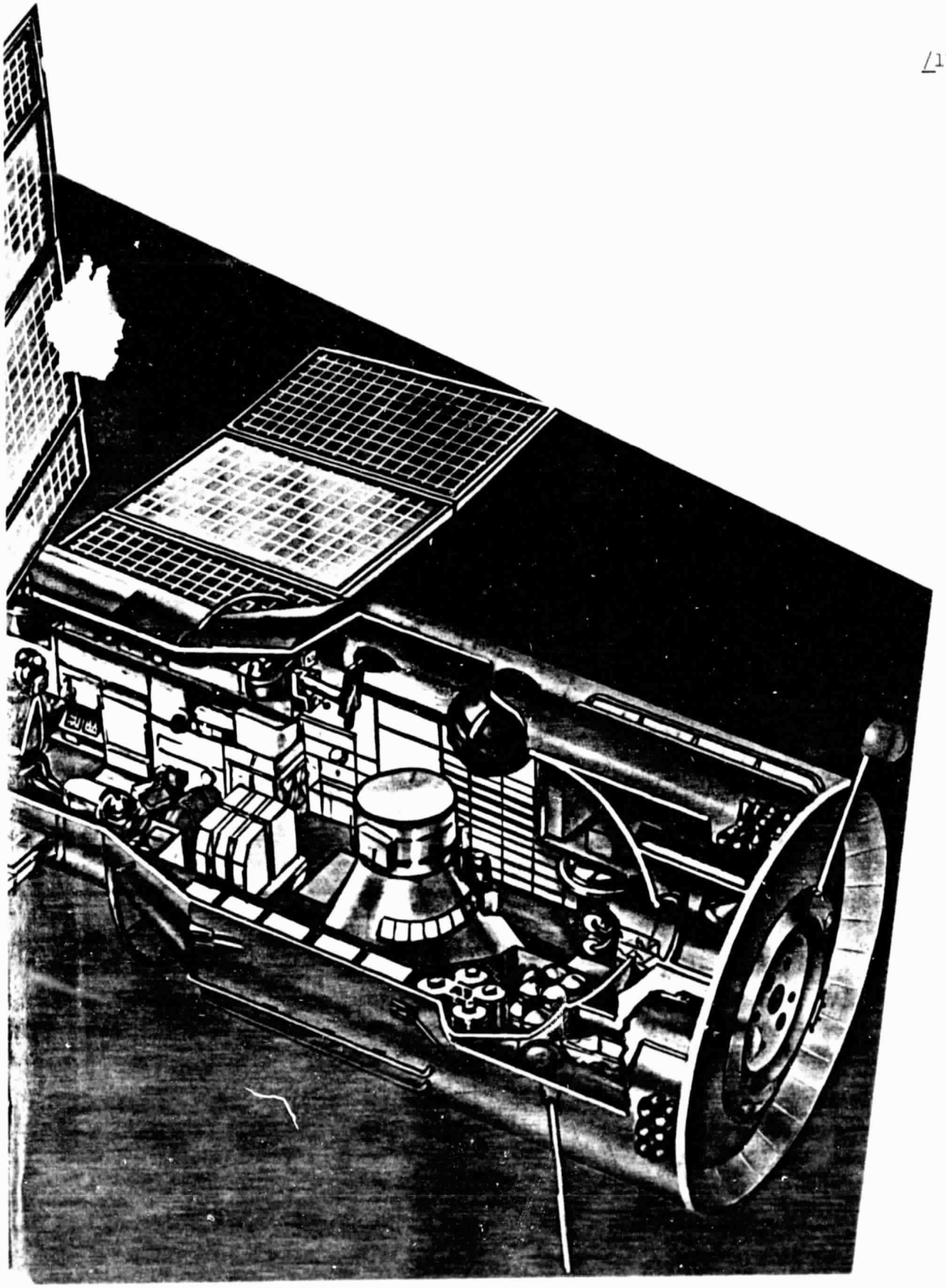
They became occupied with the already familiar visual observations which had observation of the earth and of the oceans on the earth as their object.

The crew from the previous year had already been able to enjoy the washing possibilities provided by the shower which overcame the impediments of weightlessness, as well as the black and white television set which made two-directional contact with people on earth possible.

Popov and Ryumin had barely finished emptying Progressive-8, transferring their consumable baggage and separating from the freightship, when Progressive-9 arrived. Emptying and separating from it were only part of the tasks for the two crew members, since they continued their scientific observations at the same time with heightened intensity. And they prepared for the arrival of the next international space couple.




The current inhabitants of Salyut-6: Lt. Col. Leonid Popov, the commander, and Valeriy Ryumin, the on-board engineer. They will be the hosts for the Soviet-Hungarian space crew.



Linking Up the Soyuz Spaceship and the Salyut Space Station

An important part of the space station is the linking system which serves, on the one hand, to attach the two revolving space objects and, on the other hand, as a door which, when opened, the spacemen use to go from one vessel to the other without stepping into space. The Soyuz spaceships have been equipped with such a linking apparatus since 1970. The passive part contains the conical passage, with a short cylindrical section at its end, while the active part contains a cylindrical pen with a hemisphere at its tip.

The linking task consists of getting the pen into the passage at the last moment of approach, and then by precise maneuvering guiding the pen into the cylindrical part of the passage, until the engaging flanges are in complete contact.

For internal transfer the two flanges must be hermetically sealed, so that the air cannot escape. After this has been checked it is possible to just move to the side the doors between the linking elements and to begin transfer.

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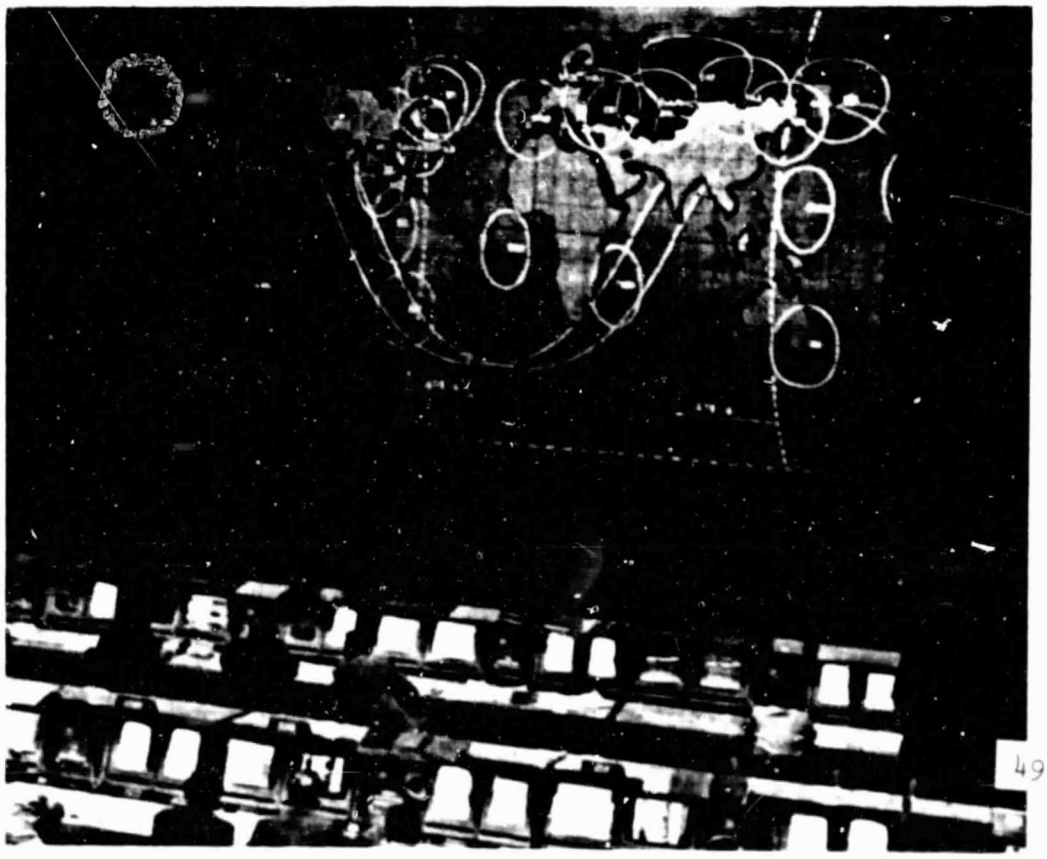

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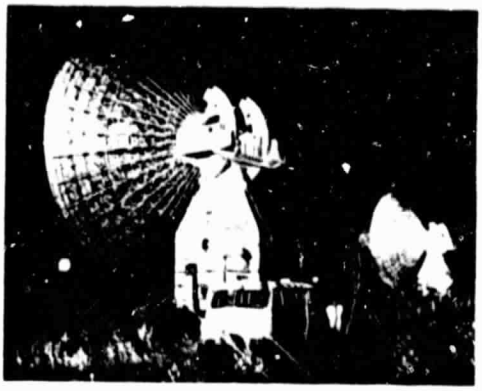
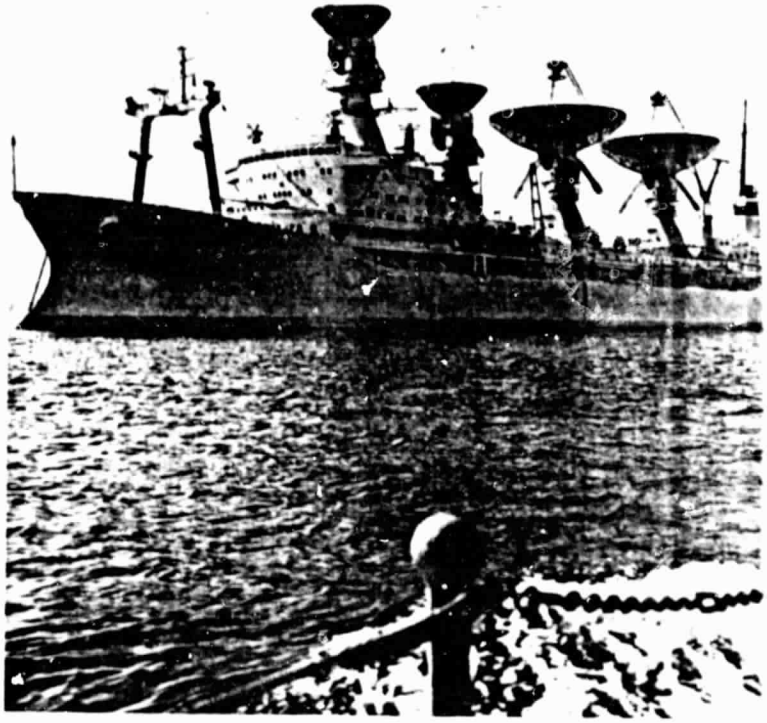




Picture and Sound from Space [Ferenc Jaszonyi]

Space Communication Ground Station

"This is Troyka."

"This is Balaton, go ahead...."

The discourse takes place in Russian, by telephone and without a wire. The sound is not "transmitted" in the traditional way, but with the intervention of an artificial satellite. The conversation is sharp and clear. And it comes from space! It travels twice 40,000 kilometers and, if I figure as the bird flies, some 2,500 kilometers. It travels easily, as if from the neighbor's, or from nearby Tapolca, but not from the Soviet Union, from the only space communication station on earth, with the "cooperation" of an artificial satellite.

The Hungarian participant in the conversation is at the Taliandorogdo telecommunications station.

The Tasks of the Kalinino Flight Control Center:

-- Operating control of space instruments and coordination of their work;

-- Collection, processing and display of the telemetrics, orbital and television information received from the space station, the spaceships and the space freightships;

-- Coordination among the launching and research-rescue complex, the practice model instruments, and the other systems taking part in spaceflight.

The flight leader and the flight-control staff work in the center.

The Tracking and Control Station

These measure the orbital parameters of the spaceship during spaceflight and receive telemetric and television information coming from the vessels. The tracking stations transmit decisions related to spaceflight control, partially in the form of conversations conducted with the staff and partially in the form of radio instructions transmitted to the vessel.

Control stations fixed on the vessels make it possible to receive the complete telemetric information and to transmit it to the center. Molniya type satellites are used in the satellite telecommunication system.

Ground space telecommunications station at Taliandor do in the Veszprem megye.

The "Balaton" center was built up in the Tapolca basin in an area of artistic beauty. Sandor Szabo, the dispatcher, "specifies" the technical data from the station with his Soviet colleagues. The conversation has a good, friendly feeling. One can feel that two well trained and knowledgeable experts are checking the input-output program. In particular everything is fine with the broadcasting line, the satellite fulfills its tasks splendidly, and the same is true of the technical equipment of the two ground stations. 19

"In 1971 the Intersputnik telecommunications system was established with the participation of the socialist states," explained Gabor Szekeres, the station manager. The Soviet satellites render an exchange of news between countries possible by means of telephone, telegraph and television.

"What are the advantages of this system?"

"In the conventional "ground channel" on the Budapest-Moscow span, shortwave stations had to transmit signals every 40-50 kilometers for

2,400-2,500 kilometers. Thus maintaining the large number of stations required a great deal of care because the least error could cause "constantly increasing" concern, not to mention the maintenance costs. Since this space transmission line has been operating only with "upper" stations, satellites, the probability of error has been less.

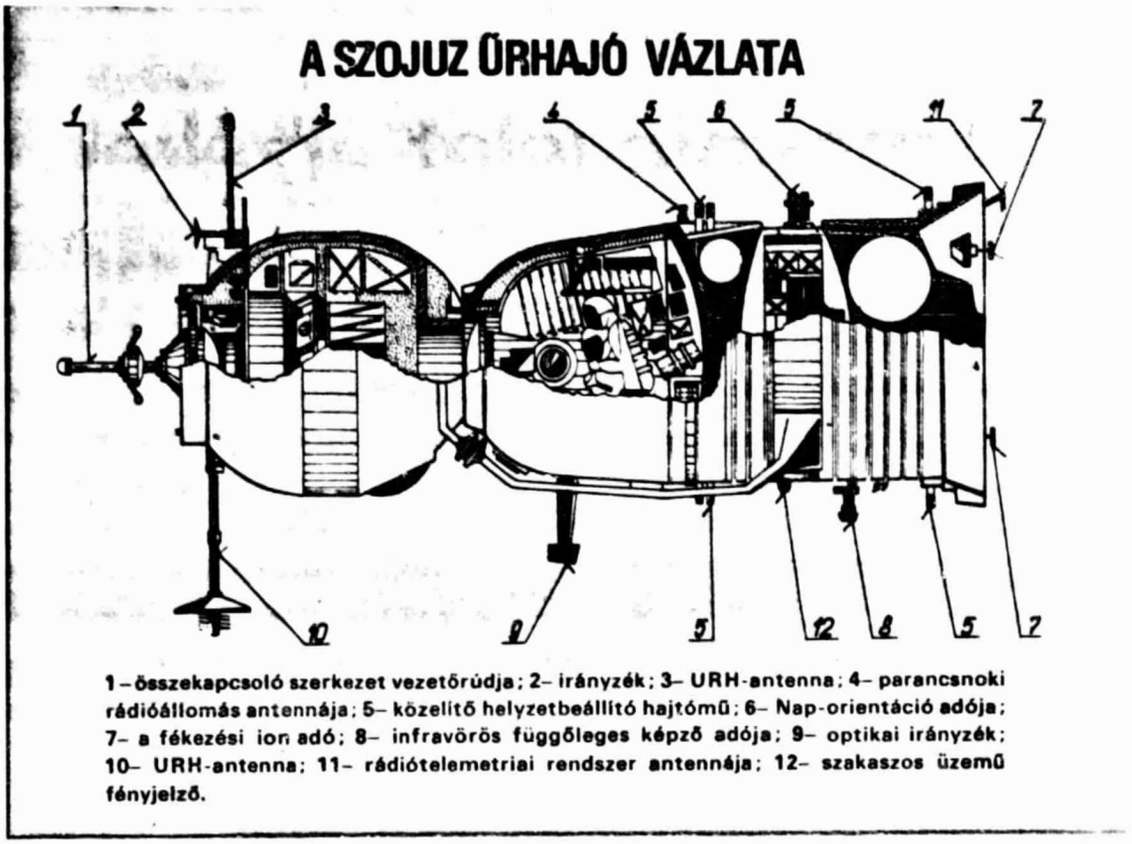
A flight of stairs leads up to the antenna of the 16-meter diameter parabola. There is no one at the top of the station right now. The movement of the parabolic mirror cannot be seen, but it follows the course of the satellite in the "sky" by a constant displacement. The movements of the parabola are controlled by computer, and therefore only routine supervision of the control panel is necessary. A competent engineer recently inspected the system and judged its operation to be faultless. The equipment, the electrical devices and the motors, are double. In case of need the spare one takes over the main function.

The center engineers explain that the signals of the "message" arriving from space are conducted to a vacuum-type amplifier filled with liquid nitrogen, at minus 200°, so that the self-movement within the material can be lessened. The cooling decelerates the collisions of the micro-particles in the material, so that there is no "noise", and so that this "frozen" signal can finally release better quality sound and figure.

The manager informs us, "Two hours ago the artificial satellite, which is now working, transmitting and beaming down this picture, arose. Four of the satellites "work" in the orbit. Every 6 hours they rise or set, replacing one another. The permanent telephone connections require this 24-hour service. In addition the satellite "on duty" transmits pictures coming from the space-ship.

The signals received and amplified by the station depart from the building through another smaller parabolic antenna located alongside the building. The signals are "aimed" at the Kabhegy TV tower, are picked up from there by television and, through this chain, finally reach the receivers.

The ensuing picture is the result of perfect international collaboration.




**1 – összekapcsoló szerkezet vezetőrúdja; 2– irányzék; 3– URH-antenna; 4– parancsnoki rádióállomás antennája; 5– közelítő helyzetbeállító hajtómű; 6– Nap-orientáció adója; 7– a fékezési ion adó; 8– infravörös függőleges képző adója; 9– optikai irányzék; 10– URH-antenna; 11– rádiótelemetriai rendszer antennája; 12– szakaszos üzemű fényjelző.**

Sketch of the Soyuz Spaceship

Key: 1-Linking mechanism guide bar; 2-Sights; 3-UHF antenna; 4-Commander radio station antenna; 5-Approach stationing drive mechanism; 6-Sun orientation transmitter; 7-Brake ion transmitter; 8-Infrared vertical image transmitter; 9-Optical sights; 10-UHF antenna; 11-Radiotelemetry system antenna; 12-Periodically operated signal light.

The Penc Observatory "Brings Space Closer" [Laszlo Baumann]

Before 1976 very few people were acquainted with the settlement of 1,400 inhabitants, the Penc community, in the Vac district in the Pest megye. For 4 years the Cosmic Geodetic Observatory of the Surveying Institute has been working here under the leadership of Dr. Ivan Almar, an astronomer and doctor in physical sciences. We discussed with him and his colleagues how the Institute participates in carrying out the tasks assigned to the spaceship crew. I first asked Dr. Ivan Almar, "What is the duty of the Observatory on weekdays?", and it became clear from his answer that in this work the essential matter is not so much the periodic results, but the process itself.

"The main activity of our Institute in general is conducting the cosmic geodetic missions devolving on our country, and participating in international programs by observing the artificial satellites. The result is the collection of data aiding in cartography by means of optical and radial measurement of the direction, the distance and the velocity of the satellites," he said, and immediately added, "This is work of a space research nature which we are conducting within the framework of Interkozmos and with its support.

Since 1978 a team has been working in the Observatory in developing the processing of remotely perceived data, in more common language space photographs. Their work is already closely associated with the Hungarian cosmonaut program. This is also the opinion of Dr. Zsuzsa Mike, a senior scientific colleague, of Eva Csato, a scientific colleague, and Andras Szentesi, the department head of the National Bureau of Geodesy and Cartography of MEM [Ministry of Agriculture and Food Industry]. These days they are coordinating continuous work in many assigned areas of the country, which includes many ground and air collaborators in addition to the space "senior colleague". They are taking photographs of 4-5 selected plains of our country on, as they

say, "four levels", on the ground, from low and high flying aircraft, and from the spaceship at the same time, and are observing and measuring special conditions and phenomena.

"The team working in our Observatory has been called the research section of resources," said Dr. Zsuzsa Mike. "We are responsible for carrying out this program of space research in Hungary. Actually this involves a number of programs which we are conducting with Soviet collaboration during flight time. The photographs taken of the above-mentioned, so-called test areas, including the Penc plain, and the observational data can later be used in very different branches of the national economy, in agriculture, water management, environmental protection, meteorology and many others."

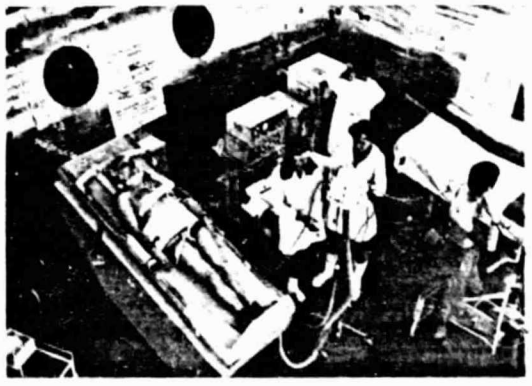
The Hungarian cosmonaut "up there" works with innumerable modern devices, spectrographs and photographic instruments. The reader can get acquainted with these on other pages of our publication. Here in the Observatory are a number of excellent devices of great efficiency, such as the SBG laser radar, mounted on a telescope, which can determine within a meter the distance of a passing satellite, even 2,800-3,000 kilometers away. The various assemblies work with similar precision in the four-step measurements mentioned above. The small-circle water-collecting area, the Balaton, will soon be measured, measurements are being made of various agricultural areas, and many thousands of significant data are being collected in a joint file which expert collaborators are compiling from ground, from space and from aircraft alike.

The workers at the Penc Observatory are in constant and systematic contact with many institutes, beginning with universities and research institutes through meteorological stations and continuing with various agricultural organizations, and are garnering experience in carrying out the programs fixed precisely for today.

The processing frequently consumes as much time as the travel of the Hungarian cosmonaut, but as the colleagues in the Observatory state: "Its usefulness for science and economy is almost immeasurable."

Perceiving Eighteen Signs in One Second [Peter M. Feher] /20

Conversation with Col. Dr. Jozsef Szabo, a member of the Interkozmos Council of MTA [Hungarian Academy of Sciences]





Examination with the ergometer and the teetering table

Choice of the Hungarian space candidates in the Flight Medicine Examination and Research Institute. Examination with the Hilof rocker.

An educated pilot with an iron physique and a navigator of outstanding capability in one person form a cosmonaut. These completely unexaggerated qualities were taken into consideration in selecting the first Hungarian cosmonaut candidates.

When the doctors and experts began to choose the space candidates, it was relatively simple to answer the first question, who can be considered? The expert, Col. Jozsef Szabo, told us that these were first of all those whose constitution was already honed for great physical and mental stresses, and primarily pilots who with no health restrictions are capable of flying

supersonic aircraft. From these, all volunteers, a rather large group of men were first chosen and then the circle was narrowed by stricter and stricter medical examinations. Those who successfully passed the final examination could really be referred to as men of iron. However, physical condition was only the basis and those who finally traveled to Csillagvaros had human qualities meriting the proud title of space candidate.

The great responsible job of choosing was carried out with due attention to the series of requirements which had been established by the theoretical research and practical experience of Soviet doctors and cosmonauts.

Sometimes we Hungarians also had a little to do with this, including the basic direction of Hungarian-Soviet collaboration developed in the field of cosmic biology and medical science, investigation of the physiological and psychological effects of spaceflight, and elaboration of procedures assuring the cosmonauts of stability in equilibrium. This series of requirements was formed as a result of such memorable flights as the first flight of Gagarin into space, Leonof's walk in space, the joint Soviet-American space experiment and the "long term" residence on the Salyut spaceship. The same requirements were levied on the Hungarian space candidates: they must be capable of withstanding the unpleasant effects of spaceflight, they must be able to control the spaceship by hand in case of failure of automatic instruments, they must carry out scientific observations and must be able to control their own ability to work throughout the period of spaceflight.

The stress factors affecting a cosmonaut physically and mentally had been determined on the basis of more than two decades of experience in Soviet "space medicine science". First of these is acceleration, and therefore the future Hungarian cosmonauts must withstand pressures of 5-8 g on the so-called

centrifuge examination. The second is that weightlessness should not cause any lasting change, because this has an exceptionally bad effect on the performance and state of health of a cosmonaut during flight. The list could be continued, but these two examples show that a future cosmonaut must dispose of qualities and abilities significantly above average. For example the health records of the candidates included data from 35 EKG's, and 49 different blood characteristics had to be examined. Again fighter pilots can leave a special "rocking chair" after 5 minutes, while the space candidates must bear it for 15 minutes. The severity of the medical examination is also "tattled" by the following fact: it has been determined with various instruments that in one second the average man can correctly perceive seven of a flood of signals and information, a fighter pilot must be able to perceive 15, but no one can become a space candidate unless he can discern at least 18.

Here is the personal experience of the writer: In March 1978 I participated in several examinations at the Kecskemet Flight Medicine Examination and Research Institute, where the future Hungarian spacemen were selected. Well, the writer was fortunate when the young soldier "handling" the special rocker began to brake it after 2 minutes, and I learned with some disappointment that I did not even reach the "average man" level, since I correctly identified only 6 of the flood of information in one second. I also sadly realized that although my self-control, my "self-governing ability" might cope with the stresses of civil life, I could not even be considered to be a cosmonaut.

The examination was comparatibely simple: a counter was attached to the pulse of the "subject", who was then left in a comfortable and relaxed position. The digital indicator of the instrument gleamed with monotonous

sameness: the pulse per minute was 70, 71, 70, 71, 70, 71.... Suddenly a sharp clang rang through the perfect silence and calm, and with the sudden noise the pulse jumped: 107, 108, 111.... And now came the role of self-governing readiness: the time required for the pulse to calm down is the time a candidate would need to again become master of himself in the case of a sudden crisis. Well, it was not a space candidate lying on the medical bed, but "only" a fighter pilot. And still something wonderful happened: during the time in which someone loudly and comfortably counted the series of numbers backwards, the pulse quieted down. The instrument showed: 71, 72, 71, 72.... The pilot could again think "with a cool head", while the heart of the writer was still pounding: 123, 125, 123, 124....

Life Processes During Weightlessness [Gabor Deregan] /21

Medicine Chest on the Space Station: Do Not Shake the Tablecloth; If the Cosmonaut Cuts His Finger.

Weightlessness causes such specific strains on an organism that only a few of even the healthiest can bear it continuously. Overworking the nervous system, the heart, the lungs and the muscles requires a "little walk". The cosmonauts are not some kind of wonderful beings," I said to Col. Dr. Janos Hideg; after all they eat and drink. Sometimes they even have to push the lever in the bathroom.... "Naturally," he answers laughing. "But if we wish to be very precise the expression for their eating is snacking. Daily they consume food corresponding to 2,500-2,900 calories, literally in the form of snacks. Primarily to make their work easier, but also for the sake of order and cleanliness, the foods are prepared in sizes corresponding to bites. They hardly have time to struggle with fish bones or the bones of fried chicken, or with bread crust; nor can they shake the tablecloth out the window. On

the other hand they electrically heat their goulash and keep "perishable" food, such as mushrooms, in the refrigerator...."

"Excuse me, all of this is very interesting, but we're overlooking something essential: how does the snack go down the esophagus? The law of free fall does not operate in the condition of weightlessness, and the gravity of the earth has no effect...."

"With his famous dog Pavlov demonstrated that the weight of food plays no role in swallowing; actually the contraction of the esophagus and the muscles force the food into the stomach, and in the same way the movement of muscles "carries" it to the end of the digestive system."

"Then this explains how, for example, we can drink a glass of water standing on our head?"

"Yes. Of course a glass with water is a somewhat more complex situation on the space station. If we poured a liquid into a glass, within minutes a great deal of it in the form of drops would be flying around in the air, and this would represent ineffable danger. For example, the astronauts could inhale it into their lungs. Therefore they drink liquids through nipples from closed containers."

"You mentioned goulash. Doesn't the gravy fly around?"

"The space cooks have made sure that it contains no more than 10% liquid, and this is in a jellied form."

"How much do the spacemen eat and drink?"

"After the first days of seasickness their appetite returns, but they never want liquids in the weightless state. We do not know the explanation for this, but we have one remedy: the spacemen drink on order at definite times. This is particularly important because urinary output, the elimination of fluids, is increased as a result of blood circulation different from normal."

"But what if they have to go? Where do they go?"

"In the lavatory. The experts have devised an assembly which stores body wastes in a completely sterile way, while urine is converted into clean water and can be used again for industrial purposes."

"What happens if a cosmonaut cuts his finger while eating?"

"Nothing. He bandages it. He must also be careful that the drop of blood does not escape."

"And if someone has a headache? Or can that situation occur?"

"Why wouldn't it occur? If it does not go away by itself, if there is an excruciating headache, the ground control center is consulted and the proper tablet is taken from the medicine chest and swallowed with a mouthful of water. A small, well-stocked on-board medicine chest is at the disposal of the cosmonauts, among other things vitamins, heart drugs, medicines for respiratory irregularities, tranquilizers and sleeping pills. If I may say so, there is recognition of the Hungarian drug industry: there is a Hungarian medicine on the space station, Trioxazin, used to reduce internal stress. According to my knowledge experiments are being conducted domestically with a drug to neutralize seasickness better than any previous tablet."

"According to this a headache isn't the only trouble a cosmonaut can have. For example, can he catch cold? Can the influenza virus begin its "blessed" activity? Can there be sneezing from space?"

"These diseases are shut out, and the steady, draft-free air at 20-22° and the completely sterile environment does not support catching cold or the development of contageous diseases. However, a healthy human organism can carry within itself so-called endogenous viruses, endogenous disease agents, which cannot be demonstrated nor removed from the organism. Under certain circumstances, not known beforehand, they can multiply and reduce the

resistance of the organism to them, and the organism can become ill. Signs indicating such a phenomenon were present in the first 15 days of spaceflight. The doctors have tried to wage war against them, but today there are still a number of questions for science to solve."

"You mentioned sleeping pills. Are they necessary, can they be necessary on the station?"

"The cosmonauts carry out unusually intensive mental work everyday for 6-8 hours; imagine yourself in their place. At such times even here on earth it sometimes happens that we cannot fall asleep. Up there the mental stress caused by the artificial environment excluding the outside world and the disturbance of the customary biorhythm contribute to this. If this happens the cosmonauts can fall asleep by using a certain sleeping pill. Although this is not a law, we know an astronaut who always slept poorly on earth, but up there a cannon fired next to him would not awaken him."

Space Meteorology

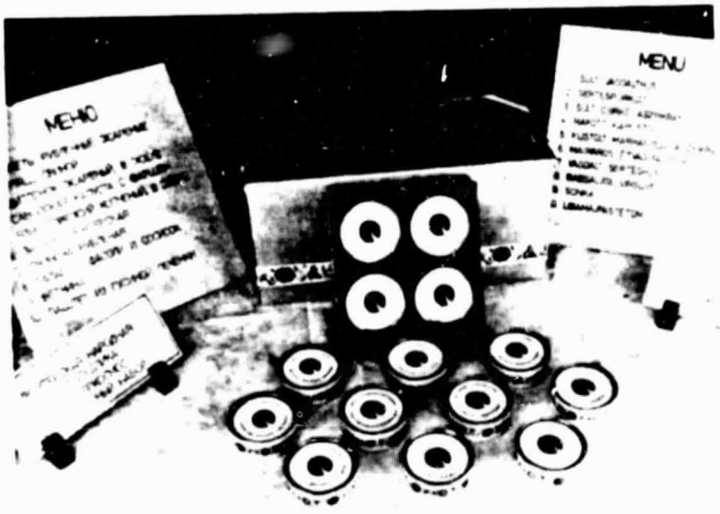
Daily Application

The attention of many people is still called to changes in the weather by a splitting backache, recurrent rheumatism or a frog climbing a ladder, but the "soaring science" space research, certainly provides aid for reliable prediction by compiling a daily weather forecast from data received from artificial satellites. In Budapest the Lorinci Atmospheric Physics Research Institute maintains contact with satellites revolving at a height of 900 kilometers. From the cosmic bird's-eye view the information transmitted about the position of cyclones and cloud formation provide a basis for compiling a local weather report and for scientific analysis.

The first weather satellite was launched in 1960, and our meteorological satellite receiving station was built in Pestlorinc in 1967. At the present

time data is received here from three meteorological satellites. On the basis of the information coming from space the meteorologists draw up the weather map and compile the prognosis. Data transmitted on weather conditions developing above the Mediterranean Sea are particularly useful for Hungarian meteorologists; in the past little data was received from here because of the lack of a sufficient number of observation posts, but the sudden rains and changes in weather in the Carpathian basin often have their origin here.

Hungarian Menu in Space; Stuffed Cabbage and Goulash in Cans /22






There is nothing special in this kitchen, except that the heating equipment in a new apartment could be smaller. On the other hand the temperature must be strictly regulated in the preparation area next to the kitchen, where it must be held within 5° and where the preparation of incoming meat cannot take more than one-half hour. It is also unusual that

from time to time experts in white jackets spray the snacks with an air purifier and thus sterilize the air.

In the factory unit of the Hungarian People's Army Food Supply Service they prepare the "guest packages" taken up by the Hungarian cosmonaut on the basis of instructions from experts in the Preserve Industry Research Institute.

According to the health experts in space food the appetite decreases in space, and therefore desirable foods and snacks must be provided for the crew. Since the Hungarian kitchen makes wide use of appetizing spices, flavor enhancers and flavors, they were given the task of trying to complement the space diet so that the cosmonauts would finally enjoy consuming their lunch and their supper.

Fulfilling these special requirements was not easy. The juice content in the preserves could not exceed 10%, and this in the form of gelatin, simply so that during a meal it would not take flight in the space capsule and foul the air. In addition they cut the pieces of meat in an exact size so that the snacks could easily be taken from the cans.

"What about the menu?"

"The Hungarian professionals prepare ten kinds of preserved foods," we were informed by Bela Nuszbaum, a lieutenant colonel in the engineers. "This includes stuffed cabbage, goulash, chicken, goose liver spread and one specialty, the Hungarian appetizer, pork cheese."

The lieutenant colonel pointed to some metal boxes. They were made of a special aluminum alloy in the Aluminum Industry Research Institute. They were decorated on the side with a Hungarian national motif. The emblem of the Soviet-Hungarian space flight was printed on them. The cover had the Hungarian national colors. The Hungarian cosmonaut can offer his Soviet colleague some food from them.

Then it can be written in the on-board log that the Hungarian menu was tasty.

## Heavy Industry in Space, Promise of the Future

Incoming information from the artificial satellite is already indispensable today in preserving water sources, raw materials and sources of energy, as well as in estimating agricultural harvests, in directing ships, and in transmitting television programs. Space research has become an organic part of civilization and has entered the everyday life of people. It is not even possible to really evaluate the future possibilities of its development.

However, experts consider it certain that space will occupy a significant level in industrial development. Industry on earth will shortly begin to employ the special materials which can only be prepared in space in the state of weightlessness, and will soon apply new technology learned in space. It is also considered certain that in the not distant future manufacturing plants will be established in space from frameworks, and that the necessary structural materials for them will be produced up there, and it will be necessary only to send up from earth raw materials which can be packed well.

Solar energy will be collected in space to operate the factories. This promises to be a better solution than the earlier idea of somehow sending to earth the solar energy collected in space. Some investigations and calculations have suggested that solar energy collected in space and radiated to the earth could cause difficulties in passing through the ionosphere, and could contain hidden dangers.

Thus the promise of the near future is the space factory, which can be set up in any size and serve human society well by means of automated operation.

What Does Space Law Prohibit? [Margit Gyori]

"What kind of measures has the main "legislature", the Space Committee of the U.N. General Assembly worked out differently from regulations valid on earth?" Dr. Gyula Gal, the Chairman of the Space Law Working Committee of the Central Astronautic Division of MPESZ [Federation of Technical and Scientific Associations], answered this question as follows.

"Space law is an inseparable part of international law.

"We began with the idea that space law, like the law of the sea or the law of the air, would be valid in a definite area, that is that there would be some kind of cosmic law distinguished in this case from airspace. It quickly became evident that human activity continued in space could not be regulated as the material of some kind of traffic law. Space law is very much a man-centered and the effect of pertinent international agreements is not valid "from the limits" of space. The agreements bind the states from the moment of launching."

"What does space law permit and what kind of prohibitions does it set up?"

"The declaration of basic principles referring to space research and application, published in our country with legislative decree number 41 in 1967, is among the most important legal measures. The pact concerning the rescue of cosmonauts and the return of space objects has become part of the Hungarian legal system, just like the international convention on compensation for damages caused by space activity. The international law cannot stop a single state from researching the moon and other heavenly bodies and from using scientific results. Its only prohibition is that space research be continued only for the good and in the interests of humanity, while continuing to observe the laws of other countries. Among other things interference with the natural balance, and altering the environment of the earth or causing

artificial, perceptible and permanent damage to the moon and other heavenly bodies is forbidden."

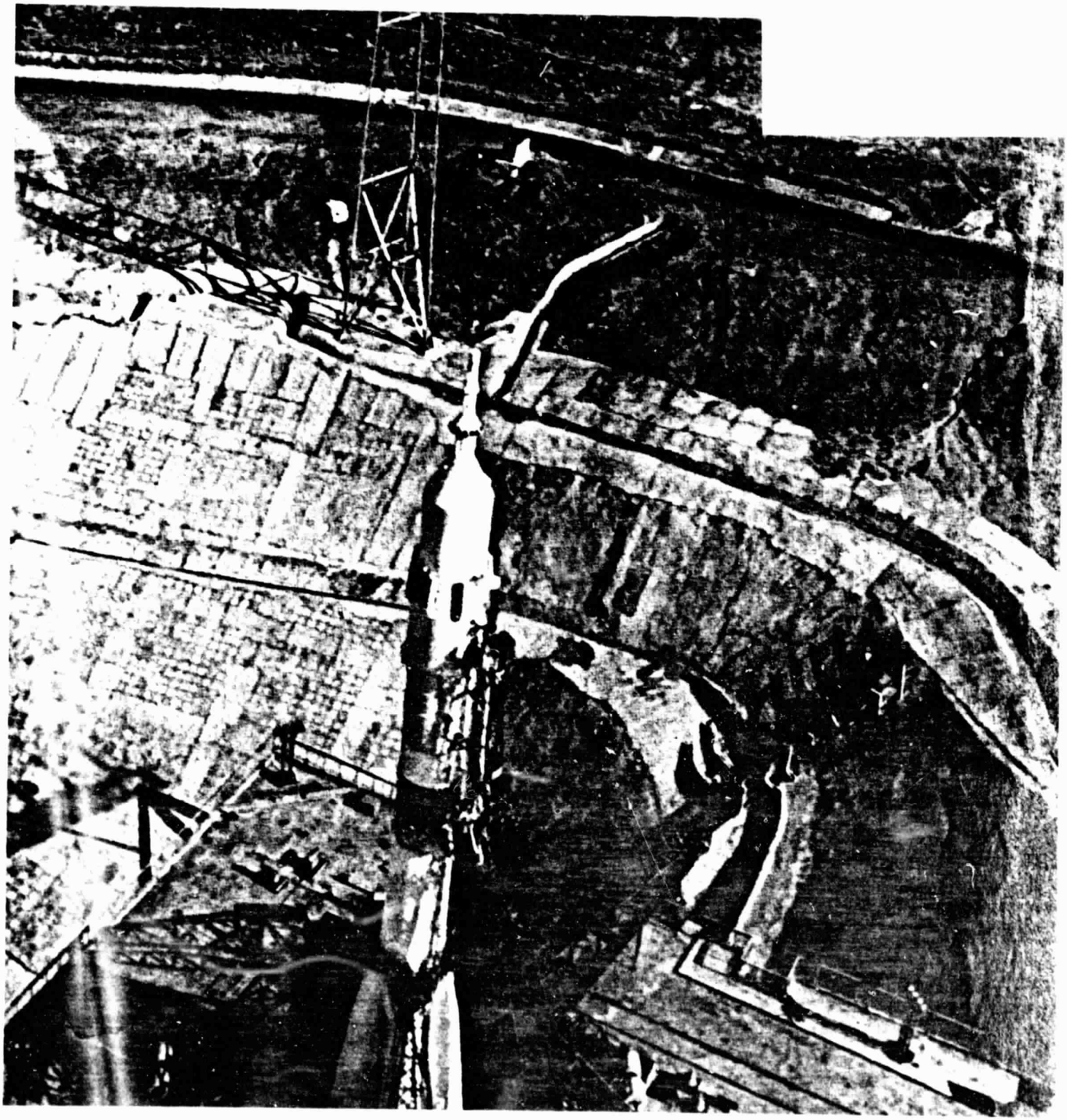
"If we only think of the fact that already more than 4,500 objects are revolving around our earth, more than 1,700 operating satellites, along with "used up" equipment, rocket stages and the remains of spare parts, the cosmic garbage, if we continue to fill the zone between 500 and 1,200 kilometers at the current rate, in scarcely a half century some 10,000 space objects will crowd around us like the zone of natural asteroids between Mars and Jupiter. As the rate of space exploitation accelerates, so does the danger of technical accidents. The "celestial KRESZ [Traffic Regulations for Public Thoroughfares]" detailed regulations to prevent spaceship collisions, will develop new territory to prevent damages caused by returning and falling space objects."

"The international agreement, which obliges every country in case of emergency to help rescue spaceships in the air, on solid ground or in the water, is already 10 years old. International law experts are now occupied by the idea of how this obligatory provision of aid could be made more fruitful."

The spaceport was established in 1955. The first artificial satellite of the earth was launched from here. The first spaceman Jurij Gagarin and the first spacewoman Valentyina Tyereskova were launched here. The Soyuz-type spaceships and the Salyut space stations are launched from here. The carrier rockets are finished here and the assembly and checking of the spaceships takes place here. The final preparation of the cosmonauts before launch is completed here. /23

The most important elements of the spaceport are: the hall for outfitting the carrier rockets, the shop for outfitting the space object, the starting sites and the observation and control points.

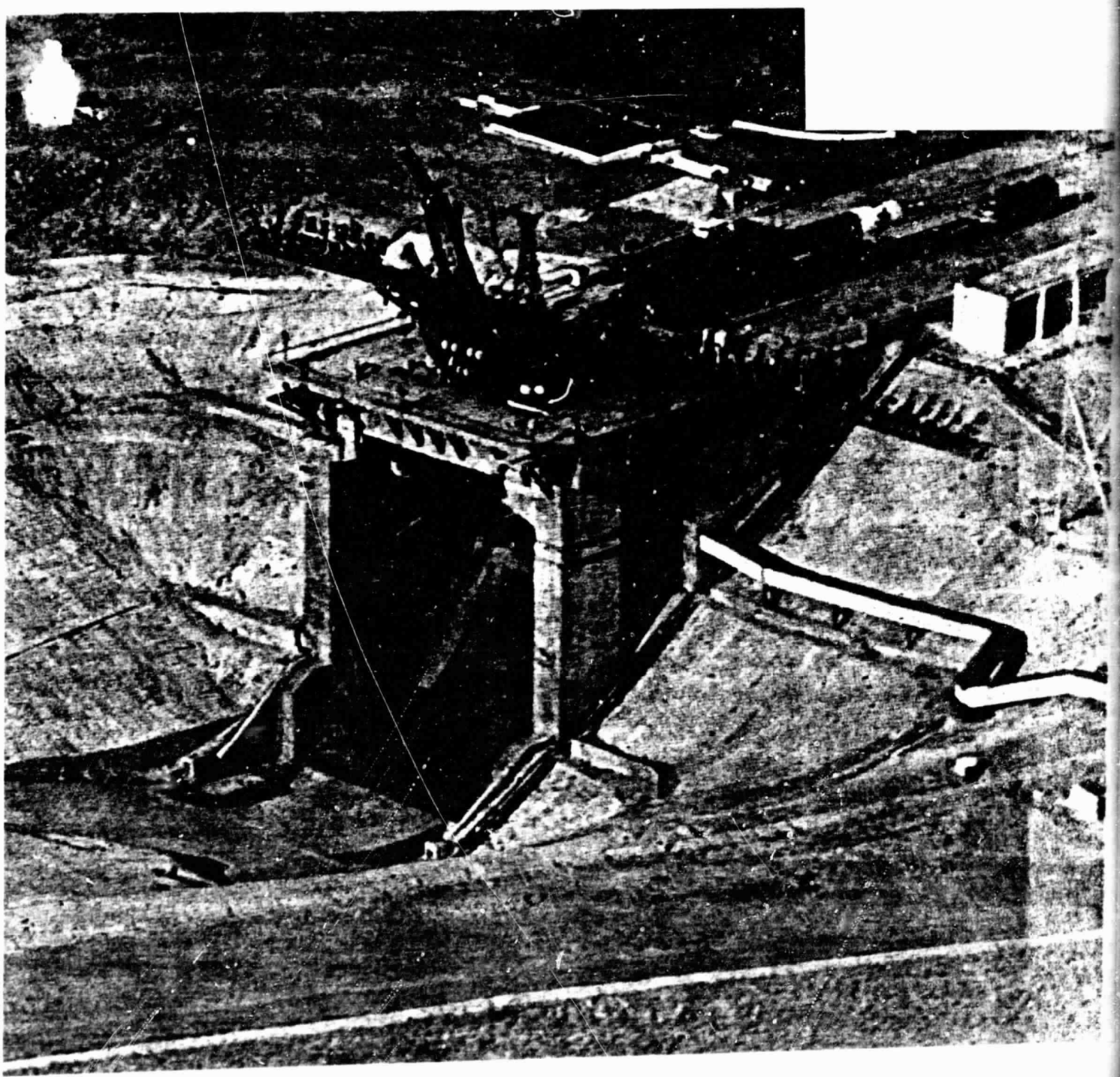
(Caption for following figures.)



The individual stages of the carrier rocket and the units of the spaceship /25
are moved by rail into the assembly shops. After the spaceship tanks have been filled with fuel and condensed gases, the space assembly is taken to the launch site by means of moving and lifting apparatus. The assembly is raised into the proper position. Following this the rocket and the spaceship are given a number of inspections before the complex is prepared for launch.

A three-stage rocket, 35 m long and weighing 330 tons, is used to place the Soyuz into orbit.

(Caption for next page)



For Millenia Humanity Has Been Seeking the Space History of the Universe [Compiled by Eva Hatar]




For long centuries mankind has been obsessed by the desire to know the Universe. As early as the second century space legends existed, and we still have the comedy by Lucian entitled True History (Vera Historia), in which the Greek comedian elaborated the ideas developed by that time about space travel.

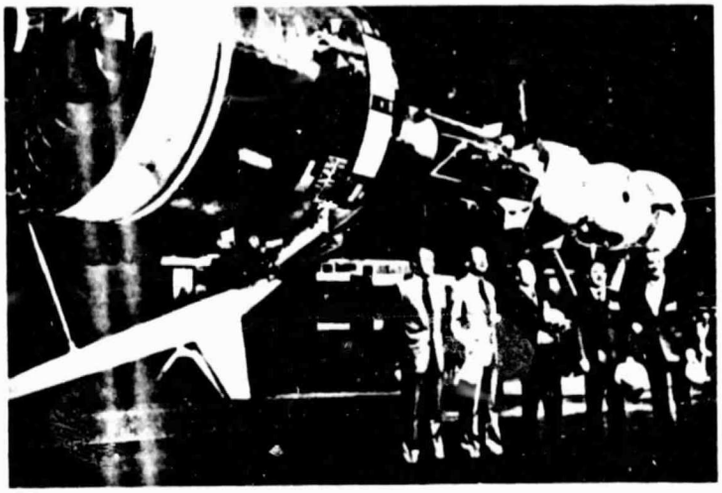
In one of his most popular works, "Journey to the Moon", Jules Verne has his heroes shot into space by a powerful cannon. The travelers on the Columbiad "traveled to the moon" in a spaceship equipped with air conditioning and an oxygen supplier.

A gigantic role in making the dream become reality was played by Konstantyin Ciolkovskiy, who realized toward the end of the last century that man could only go into space in a spaceship powered with a rocket mechanism. We can properly consider him as the "father of space travel", because in addition to the above he established the mathematically exact principles for overcoming gravitation and for rocket movement.

On 4 October 1951 the Soviet Sputnik-1 went into orbit. This sensational event was quickly followed by the launching of newer artificial satellites, and the Soviet and American space probes alternated in making the Universe the subject of study. After it had been established that space technology was able to assure living conditions for man in space under conditions

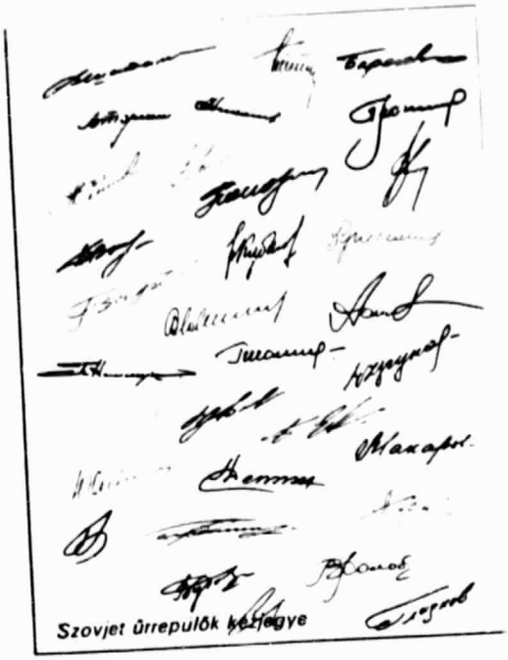
The first man in space: Yuriy Gagarin on Vostok 1 on 12 April 1961.

differing from those on earth, the spaceship Vostok-1 was launched on 12 April 1961 with Yuriy Gagarin on board; his flight changed the thousand-year old dreams of man to reality. Scarcely a year later John Glenn began the American spaceflight series on board the spaceship Mercury.

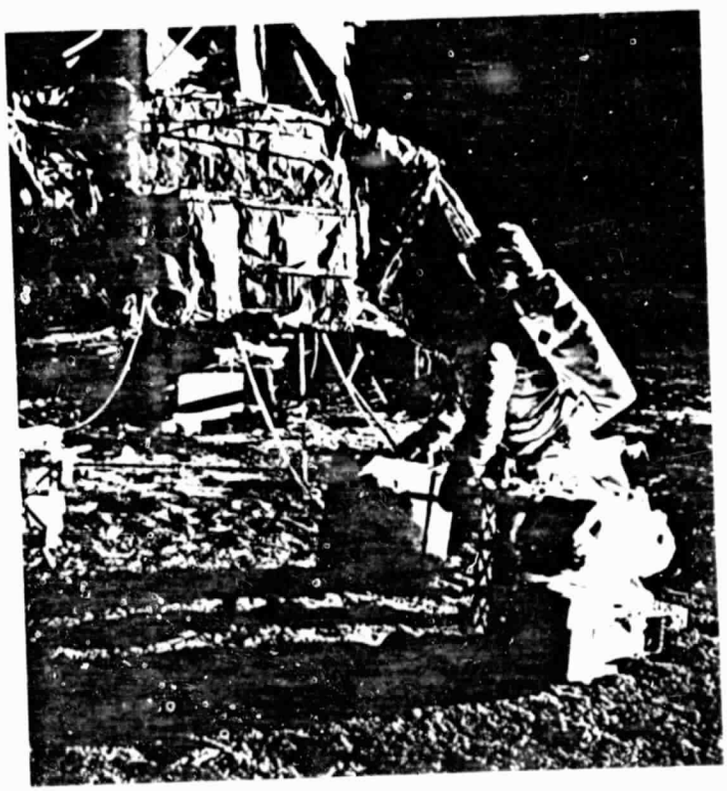


The crews of the Soyuz and Apollo spaceships met in space in July 1975.

Belka and Strelka, the first living beings to return from space in August 1960.




Signatures of Soviet spacemen.



Neil Armstrong, the first man to step on the moon on 20 July 1969.

At the end of the 1960's the Soviet and American space research kept placing more and more goals before themselves. While Soviet scientists kept working at improving the space stations circling the earth, the Americans turned all their energy toward achieving the goals of the Apollo program, travel to the moon. As a result of this in July 1969 the first man stepped on the moon in the person of Neil Armstrong. Following this there were five more American moon expeditions. Since their conclusion the "investigation" of the companion of our planet has continued with automated equipment.

In April 1971 the launching of the Soviet Salyut-1 space station opened a new chapter in space history, since the cosmonauts, in a group replacing one another, were able to work on several occasions on the space station remaining in space for a rather long period of time. The American space research also exploited a favorable opportunity, and, making use of instruments left over from the Apollo program, Skylab was launched in May 1973. Following this beginning it had received astronauts three times by February 1974.

Our Cosmonaut Guests

Of the Soviet cosmonauts who have gone into space, 16 have so far been guests in our country. On 19-22 August 1961 Yuriy Gagarin was a guest in Hungary. The Gagarin family had already conquered Hungarian hearts before they even arrived. Almost 200,000 men heard the account of the adventures of the space hero at the large assembly organized in his honor in Budapest.

The first woman cosmonaut, Valentyina Tyereskova, came to Hungary for the first time in 1964 with her husband, space pilot Andriyan Nyikolayef. She again visited Hungary in 1965, 1969, 1970 and 1974.

Our country was visited in 1966 by Aleksey Leonof, the first man to walk in space, in 1969 by Pavel Belyayef and in 1970 by the cosmonaut Georgiy Beregovoy. Cosmonaut and colonel Anatoliy Filipchenko participated in the

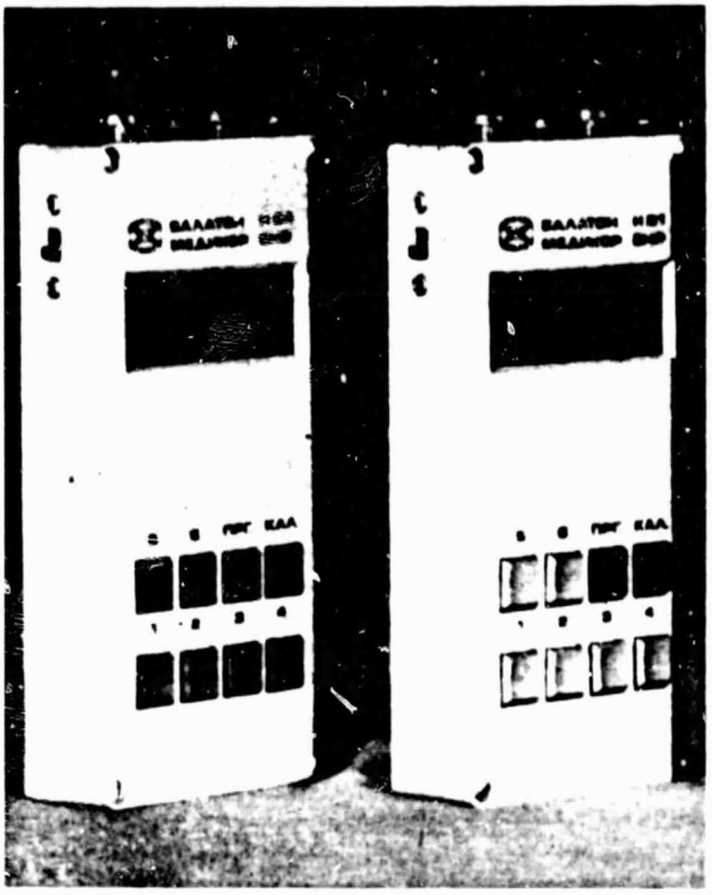
Eighth Congress of the DIVSZ [World Federation of Democratic Youth] in Budapest.

On a number of occasions cosmonauts have been "guests" on the popular TV foreign policy program, the Forum: Boris Yegorof in 1971, later Georgiy Grechko and on a number of occasions Vitaliy Sevestyanov also came to our country.

Boris Volinof was in our country in May 1973. Aleksey Yeliseyev came to our country on 8-16 August 1975 for the First Hungarian-Soviet Friendship Festival. We had two more cosmonaut guests in the following year: Lef Gyomin and Pyotr Klimuk. The youngest cosmonaut (who entered space for the first time at the age of 26), German Tyitof, arrived in our country in May 1977 on the ship of the socialist countries, the Friendship. In April 1978 V. Aksyonof took part in the Interkozmos council held in Budapest, and Lebegyef came to our country in the autumn. The cosmonaut Lt. Col. Andryan Nyikolayef (today a Brigadier General) in Budapest in 1974.

"Balaton" in Space: Only 420 grams





Where is the limit of mental ability of men, in this case the cosmonauts? How long does the ability to perform work last in the cosmonauts, when do they become mentally tired, and when can they be relied on again to perform complex tasks? At the Medicor Muvek Works they have designed and constructed a device to measure this, the only one in the world and able to be held in the palm of the hand, by using the most modern electronic units.

The spaceman holds the "Balaton", with all of its 420 grams, in his left hand, his two fingers touch two tiny metal discs which sense and measure the changes in the electrical conductivity of the skin, while at the same time it measures the pulse in the index finger. In this way these two data show whether a given task has been performed easily or with great effort.

The apparatus gives eight kinds of tasks to the cosmonaut, but since each one individually can be used in four ways, under different stress circumstances, a choice can be made among 32 kinds of tasks. The simplest is for a zero to flash on a dial, while at almost the same time the cosmonaut has to press the button with the same number. This becomes a more difficult task when there are 16 flashes in succession with numbers from one to four, and the buttons with the proper values must be depressed. If the answer is good, the set of 16 numbers flashes more rapidly, and the rate keeps accelerating. The subject must respond to this, comparatively, as if he had to hit the bullets fired in a series from a machine gun with a ping pong racket. Naturally all of these are considered the simple tasks. The tasks can be combined with long and short sound signals reaching earphones, and these can be produced in a confused, varied rhythm. On the basis of all this the limits of the maximal ability of a cosmonaut can be demonstrated.

During the test the "Balaton" instrument records the fatigue state of the cosmonaut. It indicates the so-called voltaic skin resistance, i.e., the clamminess and perspiration of the skin, and counts the rapidity of heart rhythm, i.e., pulse frequency.

Six models of the "Balaton" instrument, developed through joint work by Medicor and the Hungarian People's Army Flight Medicine Examination and Research Institute, have been built.

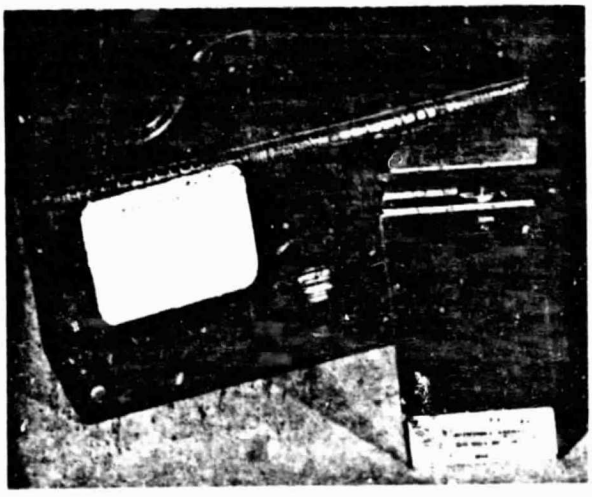
Interferon, Resistance to Virus

It has scarcely been two decades since the discovery of the so-called interferon substance, which is formed in the cells of every vertebrate, and therefore in man. Interferon is a minute protein, one of the most active biological substances in nature, with a molecular weight of 20,000-40,000 daltons. Its production in the human organism is a basic, primeval

mechanism. It is resistant to viral infection in the amount of only a billionth of a gram. It has also been discovered that interferon affects the multiplication of both normal and tumorous cells. In a word it is one of the greatest enemies of viruses.

Thus it is not by accident that doctors and researchers are becoming more and more intensively involved with interferon research. Within the framework of the Interkozmos program Hungarian experts have already put more than a decade into this work.

So far there is one unanswered question: how do the special circumstances of cosmonauts affect the manufacture of interferon in human white blood cell culture. One of the major parts of the current space program is a medical and biological experiment with interferon, developed in the virus laboratory of the microbiological research group of the Hungarian Academy of Sciences. The equipment necessary for the experiment was designed and manufactured by the Medicor Muvek Works.



Clinic In a Briefcase, Five Measuring Models

This is a genuine clinic, although no larger than a crammed briefcase. The portable diagnostic equipment was developed only a few years ago by the research staff of Medicor Muvek Works, and since then has been patented in many countries, becoming one of the most sought after export items of the factory.

The experts have further modernized it and developed the so-called Diagnosz, a special portable diagnostic assembly useful in examining cosmonauts. The cosmonauts did not take this Hungarian instrument with them, but it is closely associated with the program, since it is used to measure several important characteristics of their health and physical condition immediately before lift-off and after landing.

The assembly consists of eight measurement modules. Among other things it measures the threshold of hearing, the pulse, and the state of the heart and the circulatory system.

What Can the Pille Do? Radiation Dosage Measurement

The causes of sleeplessness, nervousness and lack of concentration are often not to be sought in our immediate environment, but in protuberances of the sun at a distance from us which can only be expressed in millions of kilometers. The cosmic radiation of this natural phenomenon rushes toward the earth at the speed of light and releases energy into the air cushion of our planet, but at the same time disturbs the upper air layers, which cause a rapid change in weather fronts, and this can lead to our health problems.

The greatest danger of cosmic radiation lies in wait for the cosmonauts who are likewise within the circle of air of the earth, rotating in its outer "zone", and thus more exposed to radiation. A Hungarian instrument, Pille, looks after their safety; it was developed by the Central Physical Research Institute research staff within the framework of the Interkozmos program.

Clinic In a Briefcase, Five Measuring Models

This is a genuine clinic, although no larger than a crammed briefcase. The portable diagnostic equipment was developed only a few years ago by the research staff of Medicor Muvek Works, and since then has been patented in many countries, becoming one of the most sought after export items of the factory.

The experts have further modernized it and developed the so-called Diagnosz, a special portable diagnostic assembly useful in examining cosmonauts. The cosmonauts did not take this Hungarian instrument with them, but it is closely associated with the program, since it is used to measure several important characteristics of their health and physical condition immediately before lift-off and after landing.

The assembly consists of eight measurement modules. Among other things it measures the threshold of hearing, the pulse, and the state of the heart and the circulatory system.

What Can the Pille Do? Radiation Dosage Measurement /29

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The Pille is nothing but an instrument weighing about one kilogram, indicating the amount of radiation a space pilot has received. In this instrument is located the special crystal particle which the space traveler always carries on himself, in order to make sure that the radiation dosage in his immediate vicinity does not reach the value endangering health. In the past the crystal could only be "interrogated" at the very end, after the return to earth.

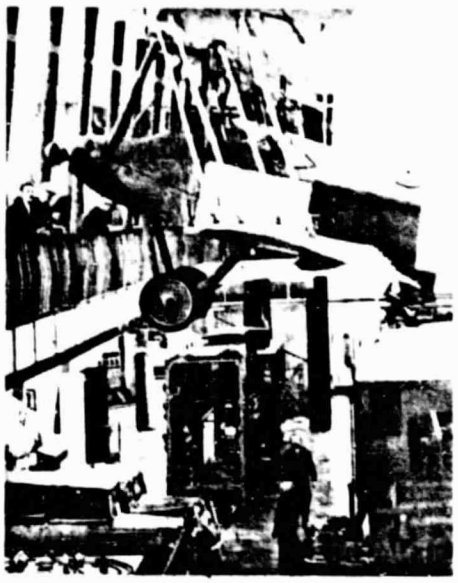
The Pille instrument primarily makes it possible to evaluate the dosage received on the space station. It is very easy to handle the instrument, and a measurement takes about one-half minute.

From the Heroic Epoch of Flight [Lajos Nagy]

The Kvasz craft after its first successful flight.

Aladar Zselyi's aircraft.

The most daring Hungarian pilot of the time, Karoly Kaszala.



The Hungarian Lloyd airplane, which held the record at the altitude of 6,000 meters.

Flying is an ancient desire of mankind. For centuries attempts and experiments were accompanied by disaster, and men paid with their lives for envying the wings of birds. Then, following an understanding of the principles of aerodynamics, airplane technology began to develop with whirlwind speed. At the turn of the century trials were still being held, and already in our day space launchings are being made almost by timetable.

In the heroic epoch of flight many names were written into the history of air conquest, and we can take pleasure in the fact that a number of Hungarian experimenters, discoverers and creators are found among the best

known. The great Frenchman Bleriot flew in Hungary before he flew abroad, in 1909. This was a tremendous event and tens and hundreds of thousands celebrated it, while experts and lay people alike began to build aircraft in all areas of the country under its influence.

We can be proud of the fact that as early as 1909 Aladar Zselyi designed the dimensions of an aircraft with due regard for the principles of flight fundamentals. During the same year his book appeared, entitled "The Basic Principles of Aircraft Technology", and we essentially still consider this the first Hungarian professional book on flight. To mention just a few of the better ones from hundreds, Sandor Svachulay, Karoly Horvath, Mihaly Szekely, Andras Kvasz and Andras Dobos achieved significant success in the formulation and technical development of airplanes.

David Schwarz gained unforgettable respect in the development of the light metal airships equipped with controllable and rigid coverings. The German Zeppelin used his plans and patents in creating his navigable airships.

In later years a whole series of outstanding airplane designers worked in Hungary.

Among the latest Hungarian aircraft designers we must by all means mention the name of Erno Rubik, on the basis of whose plans a whole series of domestic gliders were developed.

The role of Hungarian engineers in the theory of modern aircraft propulsion is significant, as it is in practice. First of all must be mentioned the name of the engineer, Albert Fono, who during World War I designed the still simplest plan for an atmospheric jet propulsion system, the ram jet. Fono was at least decades ahead of his time, since even at present there is no high-thrust ram jet system, but on the contrary only this can be used for economic thrust on atmospheric aircraft flying at speeds five times greater than the speed of sound.

In a similar way Gyorgy Jendrassik, the well-known diesel motor designer, was involved with the gas turbine. Among the very first in the world he partook in the development of the propeller-driven gas turbines. The Technical Museum has an experimental propeller-driven gas turbine of his designed to produce 735 kW (1000 HP), built in the beginning of the 1940's.

Many engineers and scientists of Hungarian origin collaborated, abroad to be sure, in the production of practical space research instruments. Todor Karman, a former assistant at the Budapest Technical University, stands out among them; in the middle of the 1910's he experimented with a pilotless helicopter in Budapest with the engineers Petroczy and Zurovecz. This unusually well-rounded scientist, whose aerodynamic and mathematical activity is known worldwide, later emigrated from the Soviet Union and his path took him through the German city of Gottingen to the United States.

Now, when the first Hungarian has already reached space, we must not forget our domestic successes in the history of flight and spaceflight.

Twinkling Stars

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Telescopic and visual observations also play a role in the Salyut-6 astronomical program. Among the tasks of those living on the space station is observation of the solar corona and of the zodiac from the space station as it passes over the northern part of the earth. The purpose of the experiment is to examine the components of the solar corona at a great distance from the sun but without the interference of the earthly atmosphere.

A visual astronomical observation program, called "Extinction", also plays a role in the research tasks assigned to the international crew. Observations by Soviet and American astronauts and from the automated astronomical satellites have already shown that as setting stars approach the horizon they begin to twinkle, their color changes and they suddenly seem to

flash brighter before they disappear in the thicker layers of the atmosphere. This phenomenon has not yet been investigated with sufficient thoroughness, and no exact explanation has been found for it.

The Soundproof Chamber

As an important feature of space training, the applicants must spend a certain period of time in an insulated "soundproof chamber". Their endurance in the silence and solitude is checked with television equipment inside the chamber, hermetically sealed from the outer world. The atmospheric pressure prevailing in the chamber is unexpectedly changed several times, and the tasks assigned to the applicant are interrupted, now with a suddenly flashing strong light and again with sharp sounds.

The "Space Dogs"

At one time the scientists reflected a great deal about which animal was most suited to be the pioneer in space. At first the decision favored the dog, as the oldest domestic animal, which is easy to train and, thanks to Pavlov's experiments, a great deal is already known. Still it was not easy to make a choice of the "space dogs", since the representatives of various scientific branches participating in the experiments set very different requirements on them.

For example, the zoologists suggested mongrels, because experiments have shown that mixed breeds are the toughest. Rocket technologists insisted on a "light" dog which did not weigh more than 6-7 kilograms, because the useful load of the first experimental rockets was still quite limited.

The biologists wanted a female because it would be easier to attach the "space clothing" and the sanitary equipment to a female dog.

The media people wanted a brightly colored dog, or at least a multi-colored one, because it could be seen better in film and television shots.

A number of dogs were examined and "tested", before the first candidates were selected at the end of 1960.


Traveling Companion, the Frog

The cosmonauts also carried out experiments with higher-order animals. Within the framework of amphibian investigation, they hatched fertilized frog eggs which had been placed in the spaceship, and observed the development of the tadpole with special attention to the development of the organ of equilibrium. Other programs proceeded with fruitflies and midges, already accustomed inhabitants of space objects, since experiments had been performed with them in a number of Soviet spaceships, the space station and biological satellites. Interest in these tiny insects comes from the fact that the total time for their development is 13-15 days, so that the cosmonauts can raise several generations during an expedition. From the specimens brought back to earth experts can determine whether space conditions can cause permanent changes.

## Four Hundred Orders

From some viewpoints the research program prepared for the Salyut-6 cosmonauts differs from the tasks of earlier expeditions. For example, in the scientific tasks the quality of information is receiving emphasis, the amount of research is somewhat reduced and preference is being given to special equipment of a larger size. From the national economic standpoint much more room than in the past is being given to tasks leading to practical usefulness or to producing such results in the near future.

The various Soviet scientific research institutes have given approximately 400 "orders" to the cosmonauts for examination and observation of individual phenomena. The list of desires spreads from biological experiments through technical tests to observation of the earth.

## 6 Out Of 508

According to Air Force records in America 508 pilots applied with the hopes of being suitable as astronaut candidates. After the opinions of their commanders had been studied, this number was reduced to 110. Then observers were assigned to the pilots and flight exercises were performed with them. The observers checked the nervous condition and reaction capabilities of the pilots. After this the number was reduced to 69.

The rest were ordered to Washington, where they were informed of their planned share in the program. The majority of those invited, 37 pilots, then resigned; they did not choose the further, extremely exhausting training. Thus 32 candidates remained. After some training, and medical and psychological tests, another 14 pilots bid farewell to the group, and the remaining 18 "were narrowed down" to 7 space pilots, of whom 6 finally participated in the Mercury program.

## What Are "Space Fashions" Like?

### Space Clothing Models

The spacesuit, which makes it possible for spacemen to survive and work in space under conditions differing from those on earth, has undergone significant changes in recent years in both form and material.

With respect to its structure the latest model, in a semi-rigid variation, resembles the armor of a former knight. In contradistinction to earlier spacesuits, the part covering the body and the neck is completely firm, almost in the shape of a breastplate. Only the fingers and the trousers legs are flexible. The spacesuit, similar to the zippers found on women's clothing, opens from the back by turning a grip, and the weightless cosmonaut can practically swim into it. First he inserts his legs, then his head and arms, and then by turning the grip he seals the suit. In minutes he can pick up his special gloves and seal them perfectly with the suit. The tinted visor of the helmet filters out the rays of the sun.

There are no external wires on the surface of the suit which could harm the astronaut while working in space. All such equipment, which is necessary to support life, is located "at the entrance, on the back of the suit." The central heating and cooling systems are built into the clothing, and water running in plastic tubes takes care of removing internally developed heat and balancing the enormous external temperature differences (+140°C to -140°C). The spacesuit, made from several layers of special plastics and textiles, with a metallic lustre, provides protection through its heat-retaining and light-reflecting ability.

The advantages of the new model are that its manufacture has become simpler and that, except for the gloves, it need not be made according to size. It has been designed in such a way that, with a few internal

modifications, the cosmonauts with their similar physique can wear it with complete safety, and can dress themselves alone in 2-3 minutes.

Space ABC's

LIFTOFF is an important phase of the launch rockets leaving their perpendicular position. Liftoff occurs at the moment that the thrust force exceeds the initial weight of the rocket.

The STARTING SWITCH is an important systematic element on the launch control panel. Only after the start order has been given is it inserted into the opening on the control panel, and only after this operation can the lift-off rocket be started.

The HEAT SHIELD is a part of the return assembly on spaceships and satellites which is immediately exposed to the effect of aerodynamic heating on entering the dense layer of air and protects the returning unit from the effect of heat. The basic elements of the heat shield are layers of covering of great heat resistant, great heat insulation capability and great rigidity.

SPACE SICKNESS is motion sickness or a form of it caused by weightlessness. As a result of deviant information (only the vision of sight provides information corresponding to reality), the organs of perception are affected by disturbed spatial orientation and compensating vegetative phenomena (perspiration, nausea and vomiting).

METEOR RISK is the danger found in space of colliding with solid particles of a planetary, interstellar or other material. The amount of danger from a meteor depends on the collision speed and the size of the colliding particle.

MOLNIYA is a type of Soviet telecommunication artificial satellite which has the mission of making long-distance, two-way telephone, telegraph and wire-photo connections, and of relaying central television and radio programs to the ground stations of the Orbita system.

The SPACE AIRPLANE is a space aircraft in development, planned according to completely new principles, reusable and man-piloted, which can be used as a maneuverable airplane within the atmosphere, in an earth orbit or at altitudes of 30-150 kilometers.

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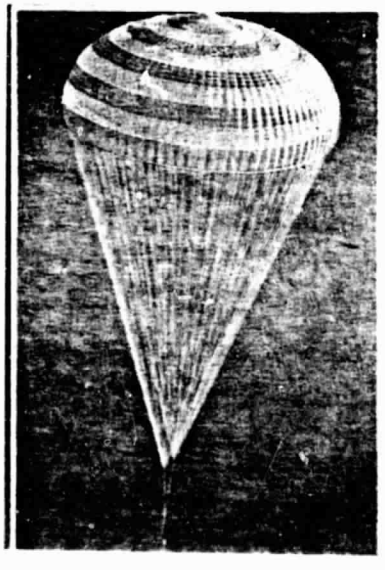
Our Earth From Above

On the basis of a special scientific program designed by the experts of the "Priroda" (Nature) scientific research center, the Salyut-6 cosmonauts are continuing observations and making many photograpns and films of various phenomena and formations. This can be done easily since more than two dozen "space windows" on the space station provide a look at the earth and into space. From the viewpoint of visual observations the long duration of the space journey is of great significance. The vision of the cosmonauts can

thus better accommodate from day to day to their environment, and thus discover more and more details.

The majority of the visual observations are important for the national economy. An important area is observation of geological formations for the purpose of opening up deposits of minerals. Among others these include observation of the so-called "ringed formations" (according to one assumption four billion years ago the earth was similar to the moon today, and there still remain "ringed formations" like "business cards", promising various kinds of rare minerals). Also important for various reasons are observations of natural phenomena (e.g., the Central Asia glacier regions, the movement of icebergs and observations of weather phenomena).



The returning capsule comes to earth in the plain previously assigned by the Soviet Union. The returning capsule was structurally designed to land on solid ground, but it has also been equipped with special assemblies which provide necessary safety in case the crew has to land on water.



C-2

The Penguin and the Lapwing

Two special outfits have been prepared for the cosmonauts in order to prevent the unpleasant effects of weightlessness. For 10-12 hours everyday they wear the so-called "Penguin" suit, which is intended to prevent dangerous consequences from the lack of pressure on the organs of movement, the muscles and the spine: by creating artificial stress it partially compensates for the lack of weight. Structurally the "Penguin" is a common training space-suit, which has had elements prepared from a flexible material similar to rubber shock absorbers sewn into the front and back of the chest portion. The tension of the elements can be regulated.

The so-called "Lapwing" suit has made it possible to moderate blood circulation difficulties. The cosmonauts wear this on the first and last days of a spaceflight. Although it recovers in a few days, there is the danger that after a prolonged space voyage the supply of blood to the upper part of the body of a cosmonaut will not be as good as normal on his return and as he readjusts himself.

BACK COVER