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by Aleksei Leonov



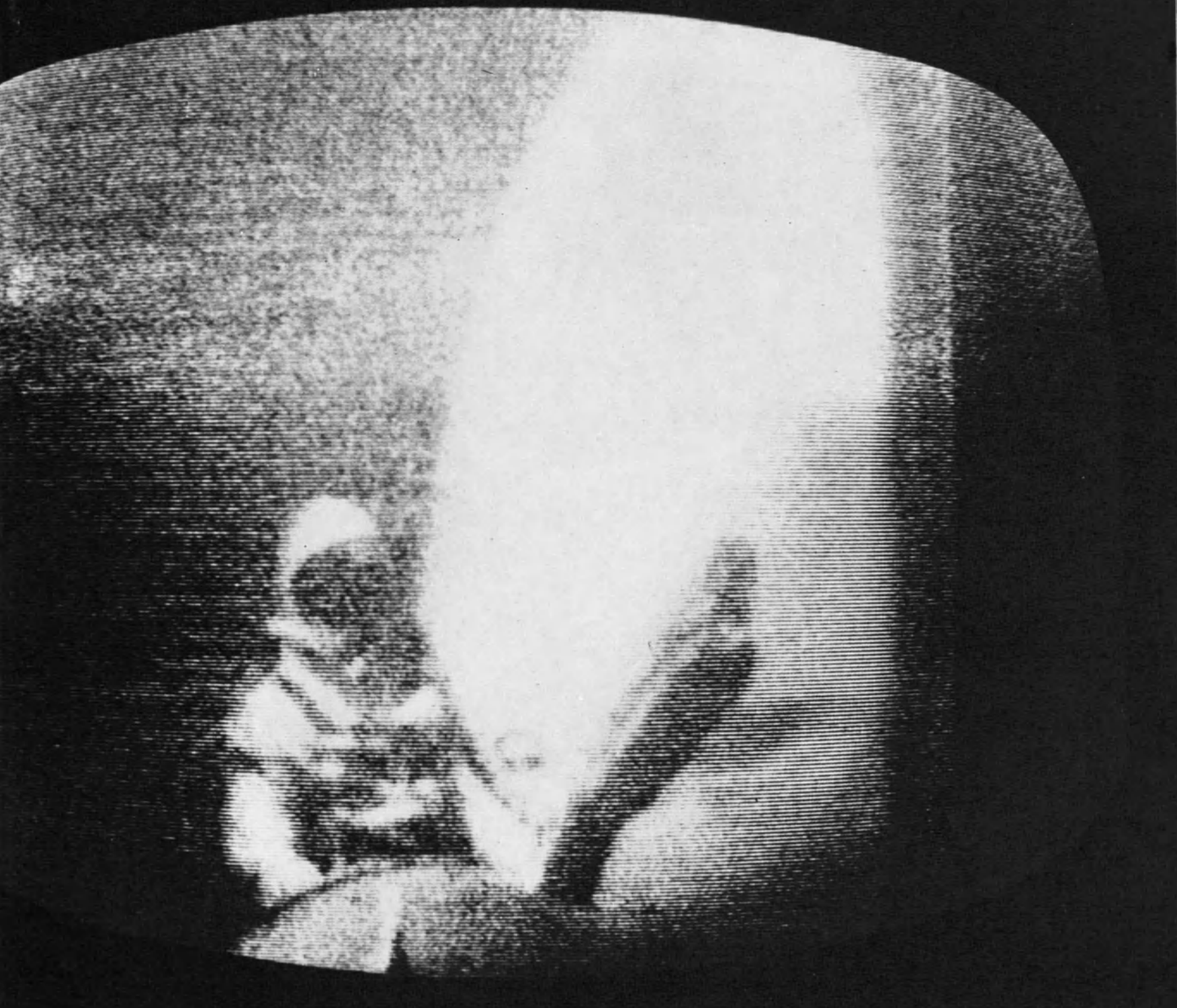
MY FIRST STEPS IN SPACE

by Aleksei Leonov



Photos © APN

March 18, 1965 is a date that will be remembered in the history of astronautics. On that day, Aleksei Leonov became the first man to leave a space vehicle and walk about in outer space. The thrill he experienced as he emerged from the capsule, hurtling around the earth at more than 28,000 kilometres an hour, and what he saw during his extraordinary adventure is recounted to us in this article specially written for the readers of *The Unesco Courier* by Aleksei Leonov himself. Photographs are reproduced from the colour film taken by Leonov and his colleague aboard ⁴ *Voskhod II*, P. Belyayev. This film was given its world première at Unesco House, Paris, on May 6, 1965.



The outer door of Voskhod II's air lock opens into cosmic space. Aleksei Leonov emerges slowly into the blinding sunlight. Far behind the astronaut (right of photo), the curving edge of the sunlit earth.

ONLY the unforgettable moments at the take-off and the recollection of the long months of flight training forced me to believe in the reality of the scene that unfolded before my eyes as I viewed the spaceship while I floated through the vacuum of space. Voskhod II sailed with an awesome majesty, its antennae—like the whiskers of some monster—probing the emptiness of space. Its portholes looked like enormous eyes contemplating fixedly my each and every movement. The lenses of the television and photographic cameras were trained on me.

Before me—blackness: an inky-black sky studded with stars that glowed but did not twinkle; they seemed immobilized. Nor did the sun look the same as when seen from Earth. It had no aureole or corona; it resembled a huge incandescent disc that seemed embedded in the velvet

black of the sky of outer space. Space itself appeared as a bottomless pit. It will never be possible to see the cosmos the same way on Earth.

Below me our sky-blue planet drifted by. It did not look round but completely flat, like a giant physical map. Only the curvature of the horizon showed that it was round. Everything about me looked like a scene from a science fiction film. The only thing missing was the electronic music. This was the fantastic setting I was to work in.

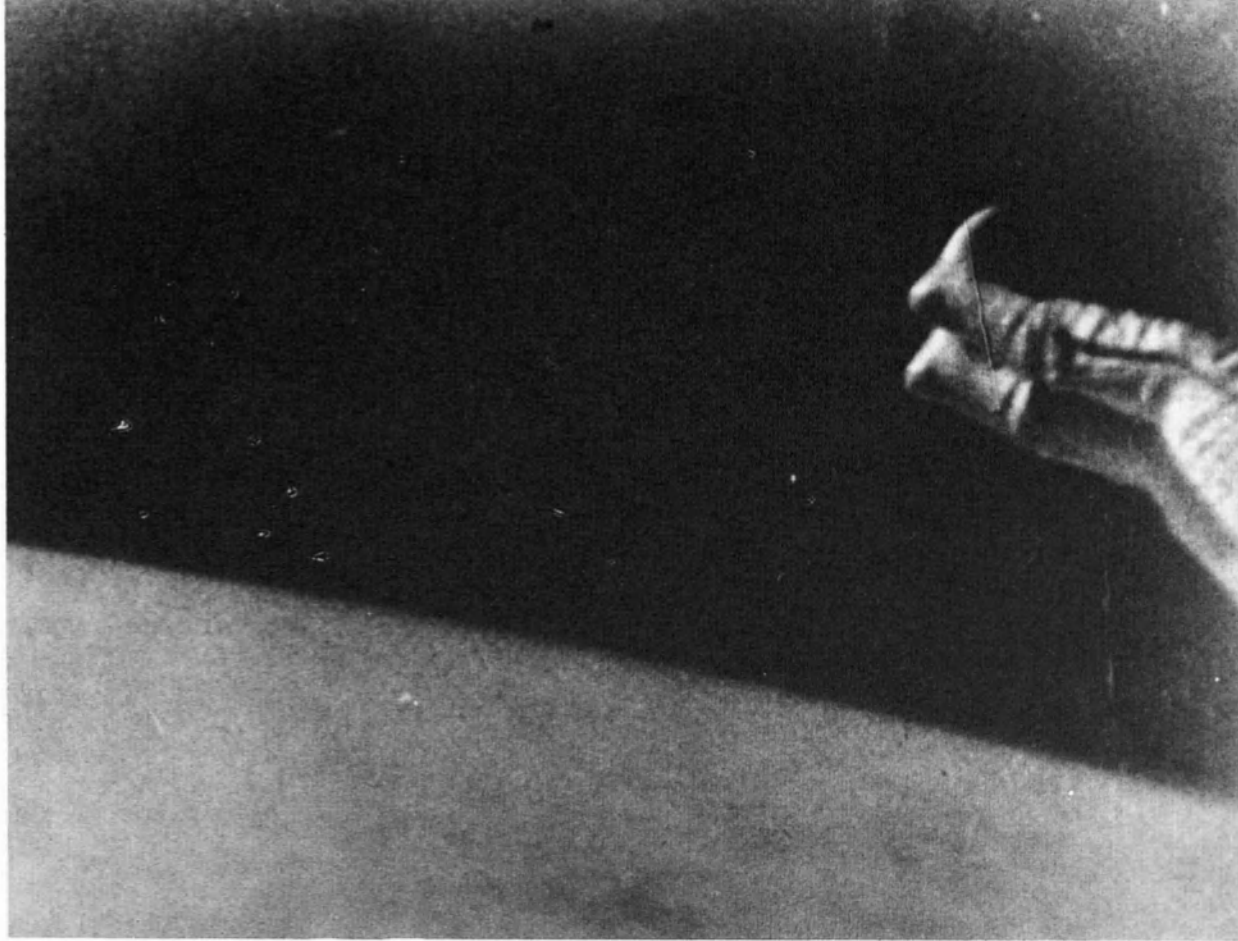
Interplanetary exploration has been developing at an unprecedented tempo. Four years ago my countryman Yuri Gagarin, spent only 108 minutes in space. Today spacecraft make flights lasting several days. Nor is space flight still restricted to the cosmonaut-pilot. Last October, Voskhod I carried aboard not only the cosmonaut Vladimir Komarov but also a scientist, Konstantin Feoktistov, and a doctor, Boris Yegorov.

In the future spacecraft will be spending more and more time in orbit, and there will probably be several in flight



Freed from the effects of gravity, Leonov floats in the silent immensity of outer space, protected from its deadly vacuum by his pressure suit. Here there is no top and no bottom. The earth with its curving silhouette passes before him. It is partly covered with clouds, but during a few minutes Leonov saw the Mediterranean, the Volga River, the Ural mountains and several large Siberian rivers.

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MY FIRST STEPS IN SPACE (Cont'd)

I unstrapped and floated into the airlock

at the same time. The number of crew members will also increase. Scientists are already studying the problem of setting up permanent stations in orbit. Man will naturally want to explore other planets.

But if this is to be possible man must learn to assemble heavy spacecraft directly in orbit. He must be able to pick up the crews of orbiting space laboratories, move from one ship to another in cases of emergency or simply maintain contact with fellow human beings during interplanetary flight. For this to be feasible, man had to learn to leave his spacecraft and find the best way of doing so. But the question arose—was it possible for man to leave a space vessel and survive? If so, could he work in space? Could he, for example, carry out the assembly work that is indispensable to the rendezvous of spacecraft?

This is what the great Russian scientist, Konstantin Tsiolkovsky saw as an answer to these questions in 1926. He wrote:

"It is easier to perform work of every kind in space than on earth. In the first place, there is no limit to the size of the projects that can be undertaken, and the most frail materials can be used since they are not endangered by stress and strain since space is weightless. In the second place, man is able to work here in any position that he desires provided that his feet or another part of his body are firmly held in place. There are neither vertical nor horizontal planes; there is no top or bottom. One cannot fall.

"No object—not even the heaviest—can crush a man at work, for it falls nowhere even when unsupported. No member of the body, regardless of its size, is subject to the pressure of another member. Objects displace themselves at the slightest touch irrespective of their mass and dimensions. All that is needed is a single impulse proportional to the mass and to the square of its velocity: then the bodies are in perpetual movement."

This was no more than a theory, though an ingenious

one, based on his knowledge of the Laws of Mechanics, but it had still not been confirmed in practice.

As a result of the flights of artificial satellites and manned-spacecraft, scientists had theoretically defined all of the problems connected with man's exit into space. They were familiar with the ambient conditions in space: the intensity of radiation, the effect of weightlessness. But no one knew exactly how man would react to weightlessness in the open space of the cosmos.

Pavel Belyayev, commander of Voskhod II, and I had the good fortune of being chosen for the space flight of March 18 that aimed to give the first answers to these questions and to verify in practice the hypotheses and calculations of the scientists. We believe that we have resolved these problems and justified the hopes that had been placed in our flight.

This is what happened.

Two minutes after the ship had been placed in orbit we began making preparations for my sally into space. There was no time to waste admiring the wonders and beauties of space; this would have to wait until our mission had been accomplished.

During flight training on Earth we had tested time and again the air lock controls and the systems regulating man's body condition as he steps forth into space; and we rehearsed the exit and re-entry procedures. We had tested them under conditions simulating those with which we would be actually confronted. In spite of this, as the ship went through its first revolution we rehearsed the operation once again.

When we were over Kamchatka Commander Belyayev started preparing me for my exit from the craft. He helped me to put on the cylinder containing my air supply. I checked the connexions linking my breathing mixture to the spacesuit. Belyayev opened the inner door of the air lock. Together we fastened to my spacesuit the tether-

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I found the spaceship bearing down on me

cable that would keep me attached to the ship. Built into the tether was the telephone cable that would be my link with the ship and Earth. I unstrapped myself from the seat and floated into the chamber of the air lock.

I gave a hand signal to the commander. The inner door closed behind me. Belyayev at once began to empty the chamber of air in order to equalize the pressure with that outside the ship. I could feel this happening from the way my spacesuit became inflated. Suddenly the outer door of the air lock opened out into space. A blinding burst of sunlight poured into the chamber of the air lock. So brilliant was the light it seemed as if someone were welding close by with an acetylene torch.

I MADE my way forward in the lock toward the exit and poked a bit of my head out. We were over the Mediterranean. I was in a hurry to leave the lock, get a look at the Earth from space and see the ship, but Commander Belyayev restrained me: the timetable had to be followed precisely.

Before we were over Simferopol, Belyayev signalled me to cast off. In my impatience to get out, I pushed off too vigorously from the edge of the air lock and left the ship like a cork popping from a bottle. Below—directly underneath me—was Kerch. I saw the Black Sea, the blue swath of the bay near Novorossisk, the cloud-capped mountains of the Caucasus. Visibility was magnificent. I've done a great deal of flying in my time, more than 550 hours, but I find that you see everything better from space, the relief is much sharper than from an aeroplane. I distinctly saw, for example, that the region of Sochi was enjoying fine, sunny weather.

I found myself spinning and was powerless to control it. I had had the same experience when Belyayev and I were practising in the aeroplane-laboratory the technique of exit and re-entry under conditions of weightlessness. So I did nothing about it. I merely waited for the kinking of the tether to slow down the rotations. And, as I expected, I noticed that the angular momentum was decreasing little by little. I was, of course, still turning on a transversal axis. I could have checked this by grabbing hold of the tether, but I preferred to keep on rolling because this enabled me to see better.

BELOW the majestic green mountain ranges of the south of our country floated by. I recognized the Volga; then I saw the Urals, and the mighty Siberian rivers, the Ob and the Yenisei.

I removed the lens guard of the motion picture camera that was to photograph all of my movements in the vacuum of space. It was mounted on a special stand near the edge of the air lock. A moment later, to pull myself forward, I tugged rather vigorously at the tether and found the ship bearing down on me. I warded it off with my hands, otherwise I might have knocked my pressurized helmet against its hull. By stretching out my arms I was able to break the impact. It is clear that once man has adapted himself to the extraordinary conditions in space, he can move about in a sufficiently co-ordinated and precise manner.

While I was drifting in space, I was always in telephonic contact with Pavel Belyayev and with Earth. I spoke to Yuri Gagarin who was on duty in the control room of the spaceport. I heard Radio Moscow announce the launching of our craft.

While over the Yenisei, Commander Belyayev gave me the signal to re-enter the ship. I was feeling wonderful, in excellent spirits, and was in no hurry to leave open space. So I pushed off once again from the edge of the air lock as I wanted to find out what produced the angular movements immediately following the push-off. It turned out that these movements were caused by even the slightest displacement in the angle of the force of thrust in relation to the axis of the space capsule.

I then carried out Commander Belyayev's order and began to approach the ship. On the way I picked up the camera from its support.

I wanted to enter the air lock directly, but this proved anything but easy. The inflated spacesuit constricted my movements. I had to use all of my strength to re-enter the air lock. But before long I was back in the cabin alongside Pavel Belyayev.

SO ended the experiment in which a man climbed out of a capsule into space. I had spent twenty minutes outside the cabin. During this time, Voskhod II had gone far from the Mediterranean over which we have been travelling when I first went into the air lock; we were now approaching the Pacific Ocean.

Was I afraid?

I am often asked whether I was frightened when I left the ship to enter space, whether I thought my life was in danger. Each time my reply is the same: "No, I was not." Now, why wasn't I afraid?

In orbit my spacesuit was the only thing protecting me from the sun's rays, from radiation, sudden variations in temperature, and other phenomena no less dangerous to man. But I had faith in the spacesuit and in all of the equipment on board the capsule. My faith was born in the long months of training that preceded the flight.

An integral feature of the Soviet school for space flight training is that the cosmonauts participate directly in the development and testing of all the new systems and equipment that have been produced for their mission. They have no secrets for us; we know exactly how they will function in space.

Both Belyayev and I, for example were in on the designing of our particular ship, the air lock and its controls, the spacesuit and all the new gadgetry and equipment that our spaceship had and Voskhod I didn't. All these projects were approved in our presence. We tested the equipment ourselves, not wishing to rely exclusively on professional testers. After the tests we suggested modifications which we felt were essential, and the constructors and engineers never failed to take account of our recommendations.

It was also reassuring to know that if anything went wrong during my flight in space Commander Belyayev, who is also one of my best friends, could always come to my assistance. If necessary, he could even have de-pressur-



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COSMONAUT IN A HALO OF DARKNESS AND SUNLIGHT

This image of Leonov spinning in space has a dramatic, unreal quality. Brilliant rays of sunlight piercing the velvet black of the sky in outer space have struck the camera lens and trace strange, ghostly patterns of light. 9



MY FIRST STEPS IN SPACE (Cont'd)

Next goal: a rendezvous in outer space

ized the ship, abandoned it and, with the aid of a spare tether, himself climbed into space.

Under these circumstances why should I have been afraid? Quite honestly, if I had been afraid, I don't think I'd have gone aboard the space capsule.

At the spaceport, after returning from our landing spot, the journalists asked me, "Which was your greatest moment of joy, when you came out of the capsule or when you climbed back into it?" I replied that my greatest thrill had been leaving the spaceship. And I wasn't being boastful.

OUR flight confirmed all the hypotheses of the scientists. It is really possible for man to leave a space vehicle and move about outside. More than that, he can also work in space successfully. Naturally he must learn to co-ordinate his movements and train himself to act under the unusual conditions of weightlessness. But this is not a terribly complex problem.

I think that scientists and engineers can now give serious thought to the problem of linking up spacecraft, of assembling heavy spacecraft in orbit for interplanetary travel, and of setting up permanent space station laboratories.

The air lock system was also given a thorough testing

during the flight. In my view scientists have found the method highly satisfactory for exiting into space. What advantage does this air lock system have over the complete depressurization of the ship?

In the future, exiting into space will be required for transferring from one ship to another or to allow a rendezvous between spacecraft or to carry out repairs while in orbit. In all likelihood, this will be the work of selected cosmonauts and not of all members of the crew. For it would make little sense for all crew members to wear spacesuits as, in fact, they would be compelled to do if the cabin were depressurized.

It would be far more logical for the one or two cosmonauts who are going to perform the work to don spacesuits, then to leave by the air lock and seal the inner door. This would enable the other crew members to carry on their own activities inside a cabin where normal conditions prevail, as was done, for example, by the crew members of Voskhod I—Komarov, Feoktistov and Yegorov.

Let us consider another problem: the rendezvous of spaceships. It is extremely unlikely that spacecraft will succeed in linking up porthole to porthole. What probably will be required is a linking chamber similar to the flexible "concertina" device which joins up the carriages of passenger trains.

Our flight demonstrated that cabin pressure can be main-

tained if an air lock is used for exit and return. Commander Belyayev verified that there was no variation in the pressure of the cabin either when I left or when I returned. Thus at no time was it necessary for him to put on a spacesuit. This is most important; the spacesuit is anything but ideal for working inside the cabin.

As for working conditions in the cabin, they are in no way different from those in an ordinary room. Throughout the flight of Voskhod II, the cabin temperature never exceeded 18 degrees centigrade. At no time did we perspire excessively which would have resulted in dehydration of the body. If we did perspire occasionally, it was simply the result of physical effort or over-exertion.

When we weighed in after the flight, we had both lost 500 grammes (just over one pound); neither of us attributes this loss to our sojourn in space. In all probability it was due to the fact that prior to the flight we were weighed in the morning, and after our return, in the evening. In other words our flight was normal in every respect.

Through *The Unesco Courier*, I should like to thank all who have congratulated Belyayev and myself on the mission that it was our privilege to carry out.

SOVIET ASTRONAUTS VISIT UNESCO

On May 11, two Soviet astronauts, Valentina Tereshkova and her husband, Andrian Nikolayev, were received at Unesco House by the Executive Board of Unesco, meeting in Paris. After the chairman of the Executive Board, Mr Mohammed El Fasi, and the Director-General of Unesco, Mr René Maheu, had welcomed the astronauts, Professor Norair Sissakian, chairman of the 13th session of the Unesco General Conference, spoke briefly on Man in Space. Valentina Tereshkova became the world's first spacewoman on June 16, 1963. She remained in space for 70 hours, her capsule orbiting the earth simultaneously with that of the Soviet astronaut, Valeri Bykovsky. The previous year, on August 11, 1962, Valentina Tereshkova's husband made a space flight of 64 orbits aboard Vostok III.

Leonov had the impression of taking part in a science-fiction film. Left, in this close-up shot, the hand of the astronaut, outlined against the mass of the earth, has just removed the lens guard from the automatic camera mounted on the space capsule. Right, Leonov returns to the spaceship. Here he enters the air lock and in a moment will close its outer door. When the commander of Voskhod II has repressurized the air lock, Leonov will open the inner door to the cabin.

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