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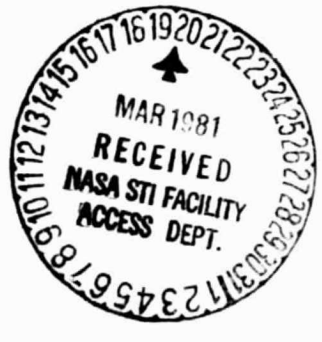
FIFTEENTH ANNIVERSARY OF FIRST SPACE WALK

Ye. V. Khrunov

Translation of "Odin na odin s kosmosom (k 15-letiyu vykhoda cheloveka v otkrytoye kosmicheskoye prostranstvo)," Zemlya i Vselennaya, No. 2, Mar-Apr 1980, pp. 8-11.



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16. Abstract

The history of space walks is recounted, and their importance for the development of the space program is stressed.

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FIFTEENTH ANNIVERSARY OF FIRST SPACE WALK

Ye. V. Khrunov
Hero of the Soviet Union, USSR pilot-cosmonaut,
candidate of technical sciences

On March 18, 1965, Twice Hero of the Soviet Union, USSR pilot-cosmonaut A. A. Leonov spent 12 minutes in outer space oustide the ship, the first in the world to do this. Many cosmonauts have followed the path laid down by him. /8*

The idea of a space walk and its necessity were first related by K. E. Tsiolkovskiy in his story "Vne Zemli" [Outside the Earth], in which he described even the technique of the walk and the man's emotions: "When the outer door was opened and I saw myself at the threshold of the rocket, my heart stood still and I did a convulsive movement which pushed me from the rocket. It seemed that I was used to hanging without support between the walls of this cabin, but when I saw that below me was an abyss and that there was no support around me, I felt faint and I came to myself only when the entire chain had already unwound and I was a kilometer from the rocket." "Flying in space, one cannot not go into it, just as in the ocean it is impossible not to know how to swim," academician S. P. Korolev said more than fifteen years ago. In March, 1964, three years after Yu. A. Gagarin's flight, man's space walk was unexpected and very brave.

Why a Space Walk?

Why must a cosmonaut exit the ship to open space? We shall list several goals: routine inspection and maintenance, replacement of equipment on the exterior surface of the station, and technical and operational servicing of nonpiloted satellites. Thousands of satellites are presently flying in near outer space. In the future there will be beacon satellites, information satellites and tanker satellites. It

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* Numbers in the margin indicate pagination in the foreign text.

will be necessary to repair them, replace equipment on them, and collect the accumulated information. All this can be done by a cosmonaut who leaves the space ship for space. The heavy-duty orbital stations of the future, laboratory stations and interplanetary ship testing stations will be sent into orbit in individual blocks and put together in outer space. This is yet another task, the completion of which requires the work of a person in outer space. Scientific-technical experiments and tests of individual centers and systems in outer space must not be forgotten.

And if the ship has an accident? Then the cosmonaut's exit into open space or transfer from ship to ship is necessary for aid to be given to the crew of the ship that suffers the disaster.

It would be possible to tell about other crucial and complex tasks that necessitate the cosmonaut's exit from the ship during flight. However, even the above list provided the groundwork to affirm that the work of the cosmonaut in open space is an important and necessary operation; without it it is impossible to imagine further development of space research and the mastery of outer space and the planets. Therefore, after the first manned space flights the efforts of scientists, designers and cosmonauts have been directed at the solution of problems connected to man's exit into open outer space and movement and work outside the ship.

First Space Walk

In 1964 a group of cosmonauts was formed that included P. I. Belyayev, V. V. Gorbatko, A. A. Leonov and Ye. V. Khrunov. Complicated preparation lay ahead of us. On a Tu-104 airplane we set up a model of a ship with a lock chamber, on which the entire process of the space walk was developed in stages--exit from the ship and entry to the ship. This work demanded a great deal of labor and time. The condition of weightlessness in the airplane lasts 24-25 seconds for one "steep climb," and the whole experiment took more than two hours. It would seem, what could one do in 25 seconds? And yet we succeeded

in doing a lot. Of course, the entire uninterrupted process was not developed on the airplane, but only the most difficult and vitally important operations. For example: exit from the ship to the lock chamber, exit from the lock chamber to open outer space, and the most crucial step--exit from the ship and free swimming in outer space. This was a very difficult moment, since the cosmonaut, freely soaring in space, had no means of orientation and stabilization of his body and was connected to the ship only by a safety halyard. It was possible that after leaving the lock chamber the cosmonaut would begin to rotate and the halyard would become entangled. Care was required. A very tangled halyard could create a great speed of approach to the ship /2 and the cosmonaut would hit against the ship. Therefore during the training on the airplane we carefully developed this operation and strove to push ourselves away in such a way that the body would not begin to rotate. The commander learned to help a cosmonaut who was freely swimming in outer space and lost ability to work. This also is a very difficult operation. The commander, in the lock chamber, has to drag the second pilot, who has lost consciousness, into the lock chamber, close the hatch of the lock chamber, take his place in the ship, put the second pilot alongside himself and, finally, close and seal the ship's exit hatch. During the training perspiration flowed over the eyes and the body became wet because before and after weightlessness there was an overload of about two units, and even in weightlessness work is not easy. And we were dressed in space suits with packs on our backs. Several times we fell from a height of 2-2.5 m (in the airplane) after the end of the weightlessness. Of course, our trainers did everything possible to ease our work as much as possible.

Also developed was a way to enter the ship from a nonsealed lock chamber, that is, entrance into the ship from a lock chamber in an inflated space suit. Many other emergency situations were worked out in the training. In a pressure chamber, in which there was a ship cabin with a lock chamber, sluicing in a vacuum was developed. We trained in conditions as close as possible to the conditions of space flight. Unfortunately, on earth it is not possible to create simultaneously all the factors of space flight. Weightlessness was imitated

Space walk of Twice Hero of the Soviet Union, USSR pilot-cosmonaut A. A. Leonov.

on an airplane, vacuum--in a pressure chamber, overload--on a centrifuge, and vibration--on a vibration table, but during the flight the factors listed above occur in a complex. Great attention was paid to physical preparation and, of course, to study of the construction of the ship, its systems, and the instructions for control and use.

It was morning, March 18, 1965. A gloomy, rainy day. Outside it was somewhat bleak. But the workers at the space-vehicle launching site did not seem to notice all that. Each was busy with his job. The primary and backup crews put on their space suits and rode to the launching pad to the rocket. Having wished the primary crew success, they rode to the communications center. Finally, the command "Blast off" followed. Literally in 10-15 seconds the rocket was hidden behind clouds. The ship went into orbit, and the crew began preparation for the space walk. It was necessary to put on a pack, open the ship's hatch to the lock chamber, go into it and close the hatch. To reduce the air pressure from the lock chamber, to open the hatch for the first time, and to step out into outer space. We wait impatiently.

P. I. Belyayev, commander of the "Voskhod-2" ship, announces in a

trembling voice, "Man has stepped into open outer space." Everyone was glued to the television screen, on which a ship with a lock chamber slowly appears, and in the recess of its hatch, already in open space, is A. A. Leonov in space armour. He has stopped beside the hatch. Now it is time to step away. Smoothly, very smoothly A. A. Leonov pushes himself from the hatch and freely swims in outer space.

Many people are in the hall, but it is very quiet. Everyone looks at the screen intently. There are no external manifestations of emotions. That is understandable. Everyone is happy that man has stepped into outer space, but he still needs to return to the ship! There is still a great deal of difficult and complicated work, which will require maximal strain of physical and spiritual powers, before the crew. The ship left the zone of radio visibility. It must be stated that now there is practically uninterrupted radio communication with the crew of a ship, but then everyone waited tensely for the next radio communication on the next circuit of the ship. In almost 1½ hours P. I. Belyayev, not hiding his happiness, announces that A. A. Leonov is next to him and that the ship's hatch is closed.

The task of man's walk in space has been solved. But it is clearly not sufficient. It is important to clarify what he will do there. How long can man work in open outer space? Work continued in the designers' offices. The "Soyuz" ship was created, with two living compartments that could be hermetically separated. And we again began training.

Work in Outer Space Continues /10

Whereas on the "Voskhod-2" ship the cosmonauts took off already dressed in space suits, the crew of the "Soyuz" ship wore a sports costume and took with them space suits for the space walk tightly wrapped up in packages. The space suits had to be donned after the take-off, in a condition of weightlessness. Another first.

Together with A. S. Yeliseyev and our backup crew V. V. Gorbatko and V. N. Kubasov, I repeatedly and with great care learned to put on

Semi-rigid space suit of new construction. Photograph by A. Pushkarev.

the space suits in the model ship. Whereas A. A. Leonov returned to the ship from which he had exited after his space walk, in the upcoming flight it would be necessary to leave the ship; cross, by means of /11
handrails on the outer surface, to the other ship, which is rigidly joined to the first ship; and make a landing on this ship with another commander.

In January, 1969, on the "Soyuz-4" and "Soyuz-5" ships a flight was completed in which for the first time two piloted ships were docked, and then there was a space walk and a transfer from one ship to another by two cosmonauts--A. S. Yeliseyev and Ye. V. Khrunov.

The commander of the "Soyuz-4" ship was V. A. Shatalov; of "Soyuz-5," B. V. Volynov. In practice the first experimental orbital station was created then.

The following basic problems for future orbital stations were solved in this flight: docking of a transport ship with the station for the delivery and replacement of crew, scientific equipment, fuel, offering of assistance to the crew of the station in case of emergency or its evacuation through open space, and development of means of man's activity in open outer space.

Time passed. A long-term orbital station began to work in the orbit of an artificial earth satellite. Crews are exchanged, and various

V. V. Kovalenok descends under water for training in water weightlessness.
Photograph by A. Pushkarev

scientific equipment, water, food products, oxygen and fuel are delivered. In the process of work on the "Salyut-6" station cosmonauts walked in space three times. On December 20, 1977, Yu. V. Romanenko and G. M. Grechko worked in open outer space almost one and one-half hours in semi-rigid space suits of a new construction. They had to determine

the viability of the docking connection. Without a space walk it would not have been possible to make such an evaluation, and, consequently, it would have been necessary to send the transport ship by guesswork or to shorten the period of the use of the station.

The space walk made it possible to solve the problem unambiguously: the docking connection was corrected. As a result hundreds of scientific-technical and medical-biologic experiments were completed, tens of thousands of photographs of the earth's surface were taken, and more than a hundred technical experiments on the obtainment of new materials were carried out.

V. V. Kovalenok and A. S. Ivanchenkov took a space walk on July 29, 1978, to dismantle some equipment mounted on the exterior of the "Salyut-6" station. They worked in open outer space for about two hours.

On August 15, 1979, the space walk of the participants of the next expedition to the "Salyut-6" station, V. A. Lyakhov and V. V. Ryumin, lasted about one and one-half hours.

In its program of piloted flights, in open space the U.S.A. tested systems and aggregates that assure the astronaut's activity, life-support systems and a space suit for work on the surface of the moon, serviced scientific equipment on the exterior surface of the ship, and also conducted repair work.

During the flight of the "Gemini-4" ship with astronauts J. MacDivitt and E. White in June 1965 (2.5 months after A. A. Leonov's space walk), E. White made the first space walk by an American astronaut, although according to the initial plan he was supposed to only open the hatch and stand on the seat. However, A. A. Leonov's successful space walk allowed the American specialists to renounce the preliminary experiments. E. White left the ship on a 7.6-meter halyard and for three minutes with the help of a reactive device was maneuvered in outer space. In June 1966 G. Sernan ("Gemini-9") tested equipment for the transfer of an astronaut during a space walk.

There were also space walks in the process of flights of the "Gemini-10, -11, and -12" ships (M. Collins, R. Gordon, E. Aldrin).

When the "Skylab" program was under threat of a breakdown in 1973, C. Conrad, J. Lusm and O. Herriot made a space walk to rectify the malfunction. Much can be said about the difficulties that man must deal with during a space walk, the problems that he must solve, and the means of controlling his activity. If this problem interests the reader, I would like to recommend the book "Na orbite vne korablya" [In Orbit Outside the Ship], published by "Znaniye" in 1977 and written by USSR pilot-cosmonaut Yu. N. Glazkov, doctor of medicine L. S. Khachatur'yants and the author of this article.

The accumulated experience in the USSR and U.S.A. of work by a man in open outer space makes it possible to affirm that in future space flights a significant part of the work will be done outside the ship.

Today, on the eve of the 15th anniversary of the first space walk, we clearly remember that this first space walk, like the first space flight of Yu. A. Gagarin, laid the groundwork of great and very useful work in space.

Space walk of American astronaut E. White.