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ORTH AMERICAN AIR DEFENSE COMMAND

Weekly Intelligence Review (U)

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NORAD

Weekly Intelligence Review

Issue No. 19/64, 8 May 1964

The WIR in Brief

Portion identified as non-responsive to the appeal

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Space

COSMOS 29 APPARENTLY DE-ORBITED ON REVOLUTION 127

Vehicle re-enters long before expected decay date; may have had photoreccе mission.

NEW TYPE SPACE SUIT REPORTED UNDER DEVELOPMENT IN USSR

Claims made that it will protect wearer outside spaceship.

SPACE SUITS DESCRIBED IN SOVIET 'POPULAR-SCIENCE' TYPE MAGAZINE

Current Soviet and US space suits, as well as space suits of future, described.

Portion identified as non-responsive to the appeal

COVER: New Soviet missile, 1 May 1964. (OFFICIAL USE ONLY)

NOTE: Pages 26, 27, 30, 31, 34, 35, 38, and 39 of this issue are blank.

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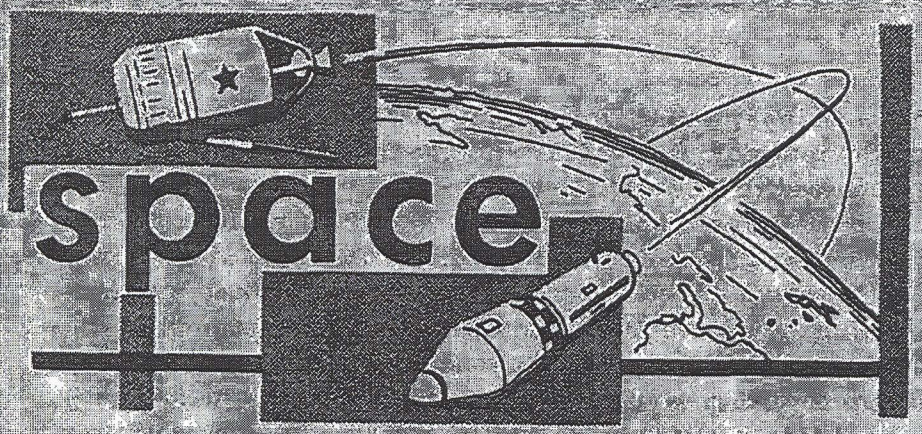

significant intelligence on space developments and trends

Cosmos 29 Apparently De-orbited on Revolution 127

The Soviets apparently de-orbited Cosmos 29 sometime between 0635Z and 0801Z, 3 May 1964, nearly 8 days after launch. This vehicle had been launched from Tyuratam at about 1021Z, 25 April 1964.

Cosmos 29 was detected by Shemya radar on Revolution 126 but not on Revolution 127, when it still would have come within Shemya's radar coverage. Natural decay of this vehicle would not have occurred until late July 1964. Based on previous experience, de-orbit most probably occurred in the initial portion of Revolution 127, with impact occurring within the Soviet Union at about 0750Z.

Cosmos 29 is the second Cosmos launch from Tyuratam this year; it had all the orbital and electronic characteristics of the other Tyuratam-launched Cosmoses, which are suspected of having a mission of photoreconnaissance among other possible missions. For a discussion of evidence of photoreconnaissance by these vehicles, see the article beginning on page 6, WIR 16/64.

(~~SECRET~~ NO FOREIGN DISSEMINATION Except US, UK & Canada)

New Type Space Suit Reported Under Development in USSR

Soviet and East European news media have recently reported on a research and test program aimed at developing a new type of space suit. The information released has been restricted primarily to describing the extremes of temperature and pressure under which tests have been conducted. No details have been provided on either the design of the suit or the materials used in its manufacture. It is claimed, however, that the suit satisfies the requirements of a closed microclimatological system and can protect the wearer outside a space ship.

Present Soviet space suits are believed adequate to support life for only a few minutes outside a space ship. The most critical problem is dissipation of body heat, which may be generated at the rate of 1,000 BTUs per hour.

(The next WIR article is a Soviet discussion of Soviet and US space suits, and space suits of the future.)

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Space Suits Described in Soviet 'Popular-Science' Type Magazine

Following is a NORAD translation of an article on space suits which was published in the December 1963 issue of the Soviet "popular-science" type magazine Nauka i Zhizn (Science and Life). The article, entitled "The Space Suit," was written by Yu. Savitskiy, Kandidat of Technical Sciences. (A "kandidat" is a holder of an academic degree which requires at least 3 years of post-graduate study and defense of a dissertation.)

The space suit....cosmic apparel....Pilot-cosmonauts dressed in space suits look out at us through raised helmet visors from photographs. The pages of science fiction show us cosmonauts of the future in their indispensable requisite -- the space suit. Just what role does the space suit play in space flight? Will it be retained in the future? How will it be changed?

The modern cosmic "costume" has one chief, unique assignment -- it must guard man from danger in flight. The "fashion" of cosmic apparel, its style, is wholly subordinated to this aim; its creators try to foresee all possible dangers in space. The space suit guards man against bursting apart in the cosmic vacuum if accidental damage destroys the hermetic seal of the space ship. It provides air to the pilot if suddenly it becomes impossible to breathe the air of the cabin. It can fulfill the role of cooler and heater. If the cosmonaut leaves his space ship on returning to Earth, only the space suit protects him. It protects against the blow imparted by the atmosphere at the moment of catapulting from the space ship, from the rarefied air during the descent by parachute, and it protects against injury when landing is made in a forest or in the mountains. And if the cosmonaut lands on water, the space suit keeps him afloat and protects him from freezing in icy waters.

In coming space flights the cosmonaut will have more work to do. Correspondingly, the role of the space suit will be more complex.

A visit to other planets will require a special planetary space suit permitting the cosmonaut to leave the space ship, complete more or less

lengthy strolls on red-hot ground on the sunlit side of the Moon as well as along the ice-cold cover of the polar "cap" of Mars and, perhaps, along the boiling oceans of Venus.

The development of cosmonautics apparently will require that man leave the space ship in open interplanetary space -- for example, for assembly of an orbiting station, for inspection and repair of the space ship. A space suit intended for open space will differ both from the modern one and from the future interplanetary one. They will be different even in the manner of travel. In cosmic space, movement will be possible only with the help of a rocket engine. That means that the space suit will have to have a motor installation. It can work, for example, on compressed air.

The vast circle of tasks to be fulfilled by the space suit defines its construction: it consists of several coverings, each with its own purpose. Thus, for example, the clothing of our cosmonauts flying on the Vostoks, as announced in the collection of works "The First Space Flights of Man" (Soviet Academy of Sciences Press, 1962) consists of several unique cover-all garments -- donned one after the other, a hermetic helmet, gloves, and boots. The inner cover-all is a thermoinsulating costume with a ventilating system. Then comes the hermetic covering, the purpose of which is to isolate the man from his environment. The outer covering is strong. It is similar to the covering of a football, which does not burst; it absorbs surplus pressure from within the space suit which tends to distend the hermetic layer.

WHAT DOES THE COSMONAUT BREATHE?

Normal respiration for all situations is one of the chief tasks to be solved in designing a space suit.

Space suits can be divided into two categories, depending on how they supply oxygen -- the ventilators and the regenerators. A space suit of the first type was used on the Vostoks. If the flight proceeds normally, then the air -- both for ventilating the body and for breathing -- enters the suit from the cabin of the space ship. A fan arrangement forces it into the ventilating system of the space suit, blowing on the cosmonaut's body and returning to the cabin. The cosmonaut breathes the cabin air which freely enters the helmet when the front glass cover is raised. But if for some reason the cabin air becomes unsuitable for breathing, the front glass of the helmet (it is lowered either manually or automatically) isolates the cosmonaut from the atmosphere of the cabin, and an oxygen-air mixture begins to enter the space suit. Simultaneously a balloon arrangement with compressed air and a ventilating system are switched on.

A regenerative space suit is completely isolated from the environment. In this case, a gaseous mixture which the man breathes and which ventilates the space suit is driven through a chemical absorber and filter. Here it is freed from the carbon dioxide, moisture, and other substances which the

man exhales. Oxygen enrichment can be accomplished in several ways -- either by a supply from a balloon, from a chemical reaction, or in the future, possibly, by photochemical means.

The space suit of US cosmonauts is an example of a regenerative system of supplying oxygen. A supply of oxygen sufficient for a 28-hour flight is contained in two spherical balloons under a pressure raised initially to 560 atmospheres. Through a reducer, which lowers the pressure to 0.36 atmospheres, oxygen goes into the ventilating system of the space suit and mixes with the air entering from the hermetic helmet. The gaseous mixture formed is passed through an absorber of carbon dioxide and moisture, a filter, and heat exchanger. Pure oxygen cooled to 18-24 degrees is thus provided. It is channeled to the space suit through a valve found at the cosmonaut's waist level and along a distributing tube. This tube is of sewn nylon, in which openings are made; it goes along the space suit, bathes the body, and penetrates the helmet. And then the gaseous mixture is sucked off from the space suit by ventilator, again is supplemented with oxygen from the balloon, and a new cycle or circuit is started.

Aviation flying suits are regenerative and ventilative, as announced in the press. They can be produced in two variants: masked or maskless. In the first instance, as is clear from the name, a mask through which air enters is put over the man's face. In the second case, oxygen is provided straight into the helmet, the man's face remaining uncovered.

What are the advantages and disadvantages of these variants? The mask provides a completely independent breathing system isolated from the ventilating system of the space suit. Also, the valve device provides the gaseous mixture only at the moment of inspiration -- which means that the oxygen is expended more economically. The moist, expelled air is removed along a tubing at once; it does not strike the helmet or degrade the hygienic condition of the space suit's ventilator. However, here is the "but." Perhaps it is not very pleasant to wear the mask continuously for the whole flight, especially on a lengthy one. It interferes with work and it is uncomfortable for eating and drinking.

Therefore, both Soviet and American cosmonauts wore maskless space suits during their flights.

It is best if man in space flight breathes normal "Earth" air. And this is what was done with the Soviet Vostoks. The space suits of the American cosmonauts were maintained at a pressure of only one-third of what is usual for us. It was as thin as the atmosphere at an altitude of 8 kilometers above sea level. Under these circumstances, the cosmonauts had to breathe pure oxygen.

DECOMPRESSION

Soviet cosmonauts breathed cabin air during their flights, with the glass visor of the helmet raised and the face uncovered. Nothing unexpected

happened. But what if, for example, a blow from a meteorite had broken the hermetic seal of the space ship?

A sharp fall in air pressure -- explosive decompression -- is a phenomenon well known in aviation. Explosive decompression is more dreadful than a mere unexpected fall in air pressure. The interval between the moment of damage and a man's loss of consciousness is known as "reserve time." Thus, for example, tests conducted by physicians (in the years when aircraft flight at high altitudes was being mastered) have shown that a sharp lowering of concentration of oxygen from the normal atmosphere to an altitude corresponding to 10 kilometers causes a loss of consciousness in 40 seconds. If the density corresponds to an altitude of 15 kilometers, then the reserve time drops to 15 seconds.

In loss of hermetic seal of a space ship, the drop in pressure does not occur instantaneously, although it occurs in only a few seconds. During that time, the cosmonaut can drop the front glass visor of his helmet, which provides hermetic seal of his space suit. If he is unable to cope with the situation, this is done by automatic means.

But a new complication now arises inside and outside the space suit. The air confined in the space suit, striving to break out, begins to inflate or, as the specialists say, exert pressure against the layers of the space suit. Two objectionable consequences accompany this phenomenon. We shall tell about them in detail.

Every material put under pressure is distended in some degree. This applies also to the protective layers of the space suit. It is easy to see what this could lead to. The helmet is fitted precisely to the head, the feet are shod tightly to the lacing of the boots. If the pressure falls, the helmet will tend to move away from the space suit, the boots are pushed away from the direction of the space suit proper, and the space suit begins to stretch the cosmonaut. With what force?

It is easily computed that during a fall of pressure in the cabin and inside the space suit, let us say, of 0.36 atmospheres, which corresponds to the pressure of the US space suit, this force will reach 200-300 kilograms. It is natural that the space suit has to have some "strong" elements which, when subjected to a loading, prevents stretching. The US space suit has a lacing which attaches the helmet to a strong layer. The membrane (layer) itself, fabricated from a very tough fiber, has seams into which laces are sewn to toughen it.

The second consequence of a fall in pressure is the limited movement of the man in the space suit. Here we have in mind not the discomforts which are provoked by the general unwieldyness of the space suit as a garment. If the space suit does not have special adjustments, then even a simple flexing of the arm will be very difficult when the pressure falls; an excess of pressure within the space suit can make this practically impossible. This is explained by the fact that, when under internal pressure, the soft layers tend to straighten themselves out. You try to inflate an ordinary hot-water bottle and then try to bend it -- it remains rigid.

In order that the cosmonaut can have comparative freedom of movement in his garb, the space suit has to be specially built, for example, such as the hinges of the US space suit which have been named "orange peels." These are ruffled parts of the sleeves and trouser-legs.

The basic difficulty of making hinges for a space suit, according to US scientists, is that it is necessary to provide longitudinal strength so as to prevent stretching of the accordion-pleat joint. This is achieved by a clever combination of lacing which glides along rollers or which is confined (built into) a guiding membrane (layer).

The Earthly Role of the Space Suit. Not so long ago it was believed that a terrible cold ruled space, that the temperature there was close to absolute zero. However, according to the latest findings of science, the speed of gaseous particles in interplanetary space is so great that they correspond to a temperature of thousands of degrees. Does this mean that any living thing in space will inevitably be incinerated?

No, the density of interplanetary gas is so insignificant that the heat transfer to a body placed in space is practically nil. The temperature of the surface of a body in space is determined, in essence, by heat transfer to the body from the sun. And if it weren't for this heat transfer, then thousands of years would have to elapse before the temperature of satellites injected from the Earth reached the temperature of the particles in space.

Just what role does the thermal protective layer of the spacesuit play in the spacesuit as a whole?

Its chief significance is on the Earth. If the spaceship sets down in cold regions of the Earth, the spacesuit protects the cosmonaut from any cold. Even in icy water, a man dressed in a Soviet space suit can float for many hours with no danger to his health.

The space suit, with its thermo-isolating layer and its ventilating system, can provide the cosmonaut comfortable temperature conditions, independent of the temperature and humidity of the air in the cabin of the ship and even in case of its loss of hermeticization.

The Planets Await the Cosmonauts. Visits to the Moon and the closer planets of the solar system are among the most interesting tasks of cosmonautics. Planetary space suits will play no small role in the solution of these tasks. They will enable the cosmonaut to leave the interplanetary ship and conduct expeditions about the surface of the planet. And the success of the expedition will depend in large degree on just how well the creators of the space costume manage to foresee all the demands that a strange planet will present to it. But will the planetary space suit resemble the one now worn by cosmonauts?

The foreign press is widely discussing space suits for lunar and planetary use. Will the costume be a "private house" of the cosmonaut?

Well, the space suit which permits movement far from the spaceship for several hours or days on the surface, for example, of the Moon, must have numerous systems of life support, communications, and navigation. All this heavy load, all this great space it will occupy -- the cosmonaut will have to carry on his shoulders. But will he carry it? Some foreign articles assert that it will be more expedient to make the planetary space suit in the form of an individual "tankette," from which the cosmonaut will be able to thrust out his arms -- protected, of course.

An interesting solution to the problem is a combination of a "suit" and a "house" in the form of a unified space suit in one foreign project described in the French magazine "Science et Vie" (see picture on page 36.) This lunar space suit consists of two parts: a special space suit and transport device, and a sort of "lunar velocipede." The space suit is formed like a truncated egg, atop the horizontal surface of which rests a helmet. This metallic "armored shell" will be placed over the body of the man. Below are protective coverings for the legs. The cosmonaut's arms can be either thrust into sleeves with integrated gloves or can be withdrawn into the shell. This will permit him to control the apparatus installed inside the space suit, to feed himself, etc.

The armor has two pins, which will help the cosmonaut to sit on the transport device on long trips. Last is a cart and motor with a source of current. On this cart can be carried an air supply and a powerful radio station.

What must the "feet" of the transport device be like? Here the opinions of various authors diverge. Some suppose that this has to be of the caterpillar type, others consider it expedient in conditions of "lunar roadlessness" to give up the wheeled locomotion usual to us and go over to a stepping or jumping transport device.

(UNCLASSIFIED)

Space Suits (from Soviet magazine 'Nauk i Zhizn')

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Left: Photo which accompanied text of article in Soviet magazine

Right: Photo of proposed space gear published in French magazine and reprinted in 'Nauka i Zhizn'

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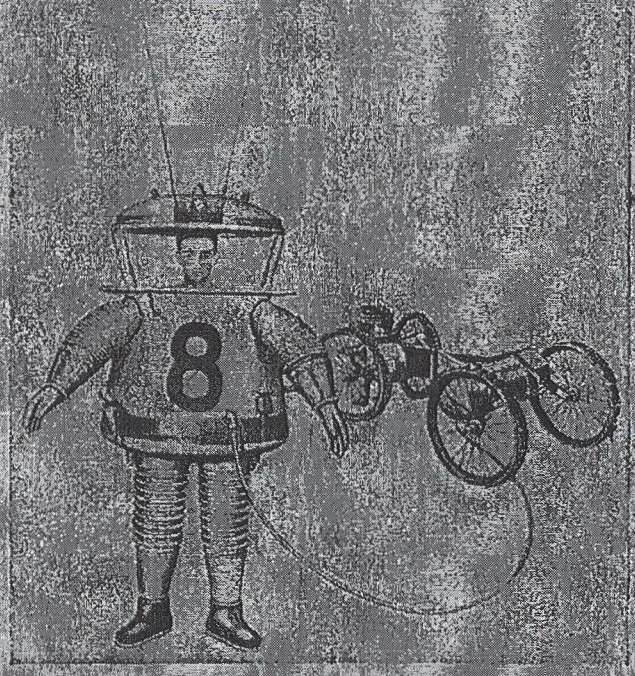

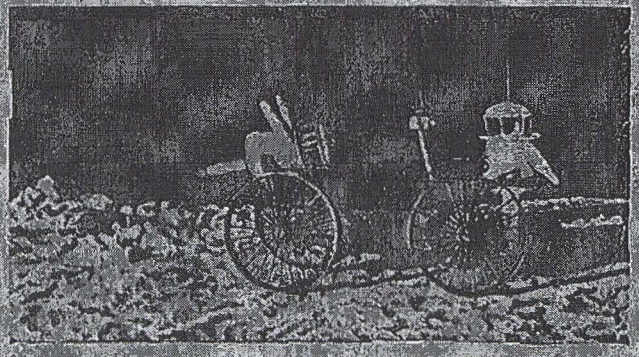

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