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NORAD Weekly Intelligence Review

Issue No. 8/67, 24 February 1967

The WIR in Brief

Portion identified as non-responsive to the appeal

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Space

SATELLITES TO BECOME PART OF U.S.S.R.'S COMM SYSTEM IN TIME FOR NOVEMBER CELEBRATIONS
At least 8 new ground terminals in Siberia under construction.

CORRECTION: WRONG THEORY OF RELATIVITY CITED IN WIR
Special theory should have been cited in WIR 4/67.

COSMOS 133 A TEST OF NEW SPACECRAFT FOR LONG MANNED FLIGHTS,

FUEL-CELL RESEARCH IN U.S.S.R. BELIEVED RE-ORGANIZED, FOLLOWING GEMINI SUCCESSES
Soviets once believed fuel cells impracticable for space use.

COMMUNIST NATIONS AID U.S.S.R. SLIGHTLY IN MAN-IN-SPACE RESEARCH, GET EVEN LESS IN RETURN

Portion identified as non-responsive to the appeal

COVER: TU-134 production (from Soviet press (OFFICIAL USE ONLY)

NOTE: Pages 32, 33, 36, 37, and 40 of this issue are blank.

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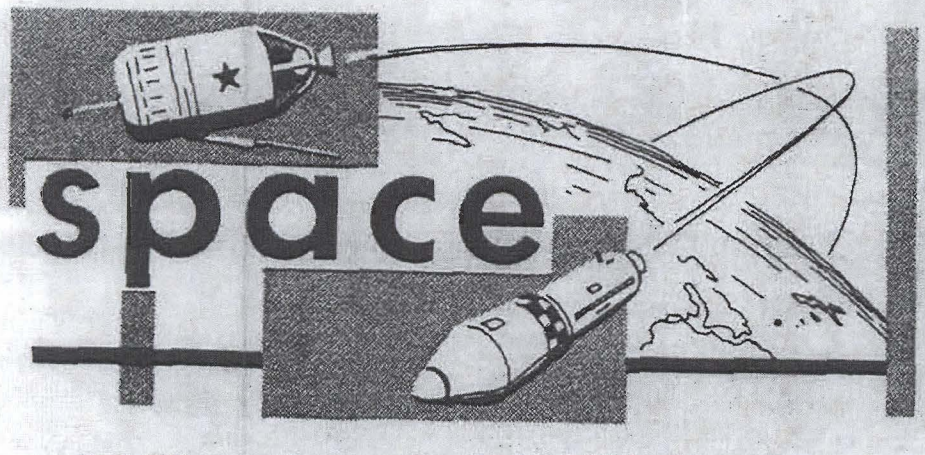

significant intelligence on space developments and trends

Satellites to Become Part of USSR's Comm System in Time for November Celebrations

The USSR is making preparations to expand the use of its Molniya communications-relay satellites for domestic communications, particularly TV, possibly in time for transmission of the Moscow celebrations on 7 November 1967 of the 50th anniversary of the Bolshevik Revolution.

Construction has started on at least 8 new ground terminals for the communications relay via satellite in the northern and eastern USSR -- areas not now adequately served by conventional communications facilities. The 8 stations will be near switching centers of the advanced ground-based telecommunications network now being extended to these areas.

The locations of the 8 new terminals is shown on page 31. Their remoteness from the developed portions of the USSR supports earlier indications that the Molniya system was intended primarily to meet internal communications needs. But the Soviets are also well aware of the propaganda and communications role that the Molniya system could play abroad. It has invited France and Japan to experiment with the Molniya satellites in color TV exchanges with the USSR. (Only the French have accepted the invitation.) A ground stations is to be installed in Cuba and, according to a Cairo service paper, another will be located in Egypt.

The Molniya could also be used to communicate with Soviet military forces -- at home or abroad.

(CIA; NORAD)

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CORRECTION

Wrong Theory of Relativity Cited in WIR

The NORAD comment on p. 6, WIR 4/67, which cited Einstein's general theory of relativity in regard to time compression for a body in motion, should have cited his special theory of relativity.

(NORAD)

(UNCLASSIFIED)

Recce Cosmos 141 De-orbited Routinely

Military reconnaissance satellite Cosmos 141, which the Soviets launched from the Plesetsk missile and space complex on 8 February, was de-orbited on 16 February on Revolution 125, after nearly 8 days in orbit. This spacecraft was the second Soviet recce satellite launched this year. (NORAD)

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Cosmos 133 a Test of New Spacecraft for Long Manned Flights, [redacted]

Preliminary analysis of [redacted] of Cosmos 133, which was launched from Tyuratam 28 November 1966 and which was very similar to the recently launched Cosmos 140 (p. 10, WIR 7/67), supports earlier estimates that this event involved test of a new type of spacecraft which will probably be used in manned flights, possibly of long duration.

- [redacted]

- The ground control code of Cosmos vehicles and the manned Voskhods was not present. Coordinated activity on certain channels suggests use of a new ground command system.
- An unusually great amount of monitoring was done, a condition which would be expected of prototype rather than of operational spacecraft.
- Two counters which were monitoring continuously throughout the flight may have been involved in a test of radiation shielding. One counter ran at a much higher rate than the other, suggesting that one was registering radiation in a shielded area, the other in an unshielded area. Shielding would most likely be used on a biological or manned satellite, or on a prototype thereof. Similar counters were noted on Korabl Nos. 1, 2, and 3 -- the forerunners of the Vostok.
- Pulse duration modulation (PDM) which was observed on Cosmos 133 appeared previously only on the Korabl-seies precursors of the manned Vostoks.
- More timers than usual were monitored, including 10,000-minute, 1,000-minute, and 10,000-second clocks. Recycling would enable the Soviets to devise an "infinite" calendar suitable for flights of weeks, months, or even longer.
- Abnormalities noted in the power supply may have been malfunctions, or they may have resulted from use of a new type of system. There were disturbances in subcommutation synchronization and radiation counters when the ground-command system functioned; cross-talklike disturbances [redacted] probably due to on-off keying of the PDM signal; and momentary "frame roll" on telemetry associated with ground

control operations. Possible causes include battery malfunctioning, poor electrical connections, or inadequate inverter voltage regulation. However, abnormalities of this type have not been observed on Soviet manned vehicles, which depended on battery power, and they are not likely to appear in a normally functioning battery-power supply system. If they were not malfunctions, these abnormalities may have resulted from the use of a new power system with high internal impedance which could not supply peak power demands. A solar-powered system would not appear to be involved, since the disturbances were noted during both day and night intercepts. The apparent testing of shielding against radiation suggests use of an isotope power source, such as the one which had been used previously on 2 unmanned satellites.

Cosmos 140. Cosmos 140, which was launched 7 February, is believed to have been a second test of the same type of spacecraft. [redacted]

[redacted]

[redacted]

(CIA)
~~(SECRET)~~

Fuel-Cell Research in USSR Believed Re-organized, Following Gemini Successes

The fuel-cell program to which the USSR has been committed since mid-1960 apparently experienced a crisis in 1965, when the US's Gemini spacecraft became the first to use fuel cells as their source of electrical power. The Soviets were completely out of the running for this important "first" because their fuel-cell authorities had contended that these devices would not be suitable for spacecraft power supplies. A major rearrangement of personnel and distribution of effort is believed to have resulted. An attempt also has been made to resolve an apparent conflict among key personnel by taking the program out of the hands of A. N. Frumkin, aging figurehead of Soviet fuel-cell research, around whom the conflict probably centered.

The Soviet fuel-cell effort, as of mid-1966, was estimated to be about 2 years behind the US's. Work in some fundamental research areas was comparable to that of the US, but the Soviets had made no significant breakthroughs in hardware.

The Soviets had developed a Justi-type hydrogen cell of 200-watt output which weighed 48.4 pounds. To supply 2 kw of spacecraft power over an extended period would require 48 of these cells, imposing a weight requirement of 2500 pounds, almost as much as the 3,000 pounds of silver-zinc cells carried by the 10,000-pound manned Vostoks.

The Soviets are known to have been interested for some 2 years now in the Bacon-type cell, a hydrogen-oxygen unit using concentrated alkaline electrolyte and operating at a temperature of 200-250 degrees C. -- the type developed for the US's Apollo.

For nonspace uses, work is directed toward cheap fuel cells which will run silently at better than 90% static efficiency on low-cost fuel for extended periods. The ultimate goal is a low-temperature fuel cell operating at atmospheric pressure on abundantly available natural gas and air. Present units which operate on cheap hydrocarbons are inefficient and must operate at 700-900 degrees C., using fused salts as electrolytes.

Efforts are also being made to couple fuel cells with a radiation source to increase efficiency and to build low-cost cells for vehicular use and general electrification. Various researchers are studying the use of ion-exchange membranes in fuel cells, alcohol oxidation for low-cost systems, and the development of highly efficient, long-lived sintered-metal electrodes.

The Soviets have now revitalized their program -- expanding it, broadening its scope, and lending it new emphasis. The number of doctoral candidates engaged in fuel-cell electrochemistry is estimated to be 10 times that of the US. The Institute of Electrochemistry now has over 300 people engaged in fuel-cell research, including some prominent experts in this field. Both fundamental and applied research are being carried on at Odessa State University. At the Institute of Energy Conversion, a high-security installation, some 40-50 people are believed to be conducting fuel-cell research directly related to military and space uses.

Details of noteworthy Soviet accomplishments with fuel cells have become more difficult to obtain since the program was reorganized. The realization that fuel cells have a high potential for military and space applications has probably caused imposition of high security restrictions on publicizing progress in this area.

(US Army STIC; CIA)

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Communist Nations Aid USSR Slightly in Man-in-Space Research, Get Even Less in Return

The Soviet Union is not dependent upon other Communist nations for any essential scientific resources to carry out its manned space program. However, the USSR has used a few East European research and technological developments to complement its bioastronautic effort. Some of the cooperating nations have complained that there is little feedback from the Soviets and that they are allowed to do only theoretical research related to space.

Although benefits from the exchange have been mostly one-sided, the Soviets have shown some interest in including the other Communist nations in its bioastronautic program. At a meeting in Moscow in November 1965, representatives of the East European nations and the USSR discussed future

areas of cooperation in space, including space medicine and biology, joint development of instrumentation, and the possibility of the USSR launching scientific payloads with experiments proposed by the Satellites. Communist China was invited to the meeting but did not attend.

Poland, using an indigenously developed sounding rocket, in 1961 carried out a small biological experiment. It was also the first European member of the Bloc known to be involved in the Soviet bioastronautic program. For this program the Poles designed a relatively sophisticated centrifuge to carry out experiments on the effects of weightlessness and the loss of calcium from the bones. In the future, experiments will possibly be performed to determine optimum spacesuit design and body support for cosmonauts. The key bioastronautics researcher in the Soviet/Polish cooperative program is J. Walawski of the Polish Military Institute of Military Medicine.

Czechoslovakia has provided basic-research support and has worked for the Soviets in some applied areas, such as development of the zipper for the Soviet spacesuit and possibly the electrode design for cosmonaut monitoring. It has only basic laboratory equipment but could contribute research support to the Soviets in such areas as closed environments and day-night cycles. Reports that Czechs were being trained as cosmonauts cannot be substantiated, although it is possible, though unlikely, that scientifically trained candidates from East European nations have been allowed recently to enter the cosmonaut training program.

The East Germans provided the Soviets with some 18 pressure chambers for possible tests on humans from 1956 to 1959 and fabricated the Velcro tape seen on Leonov's spacesuit during his extravehicular activity. The possibilities of future Soviet-East German participation in space medicine and medical electronics were discussed by Soviet scientist V. V. Parin with East Germans in November 1965.

Bulgarian investigators have done some basic research on the effects of radiation on living organisms, but they would not be expected to contribute significantly to the field of bioastronautics with their present facilities and personnel.

Rumanian scientists have complained about the difficulty of getting equipment from the Soviets. They appear to have taken a characteristically independent approach in their research effort in preference to cooperation with the Soviets. Work has been done in Rumania on the effects of chronic centrifugation on plants and animals that is more advanced than similar research in the USSR.

Bioastronautic research in Hungary also has been limited by inadequate personnel and lack of facilities. There is little indication that Hungarian aerospace medical personnel are being trained in Hungary or the USSR. Hungary contributes to the Soviet manned space effort (as do the other East European nations) with optical tracking and solar observation stations. Historically, the Hungarians have had an interest in vestibular problems, which are involved in orientation during weightlessness; the basic research

on the inner ear was accomplished by the Hungarian R. Barany.

There is little evidence of past cooperation of Communist China in the USSR's manned space program except for optical tracking of Soviet satellites by the ChiComs. Almost no bioastronautical research has been carried out by the Chinese; most of their research relates to aviation medical requirements and medical support of ground troops in high altitudes. (CIA)

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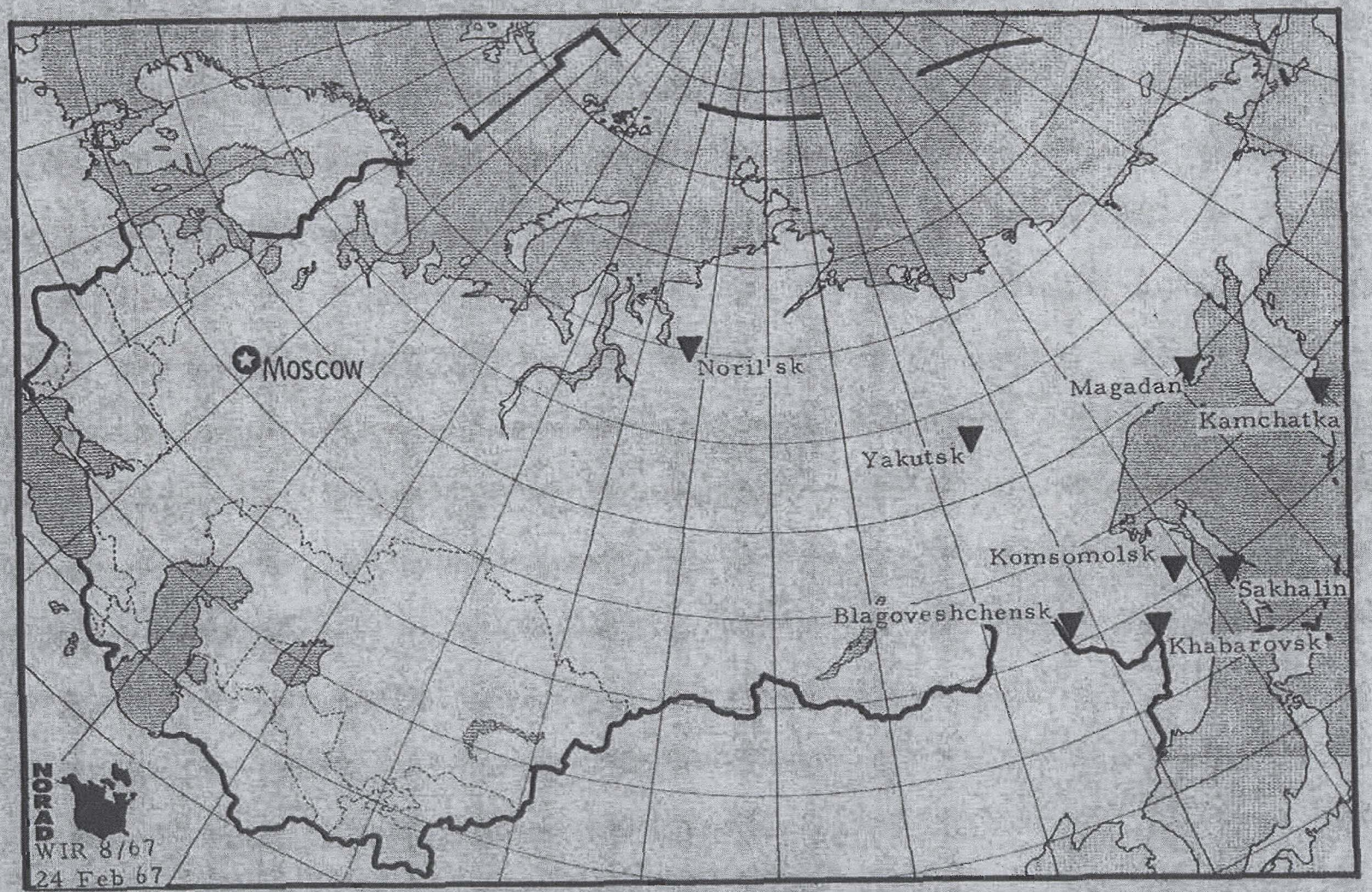
Ground Terminals for Communications via the Soviets' Molniya-type Satellites



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