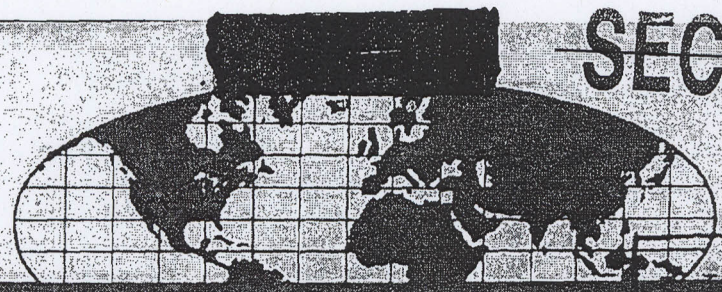


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ISCAP APPEAL NO. 2009-068, document no. 36
DECLASSIFICATION DATE: December 5, 2014



NORTH AMERICAN AIR DEFENSE COMMAND

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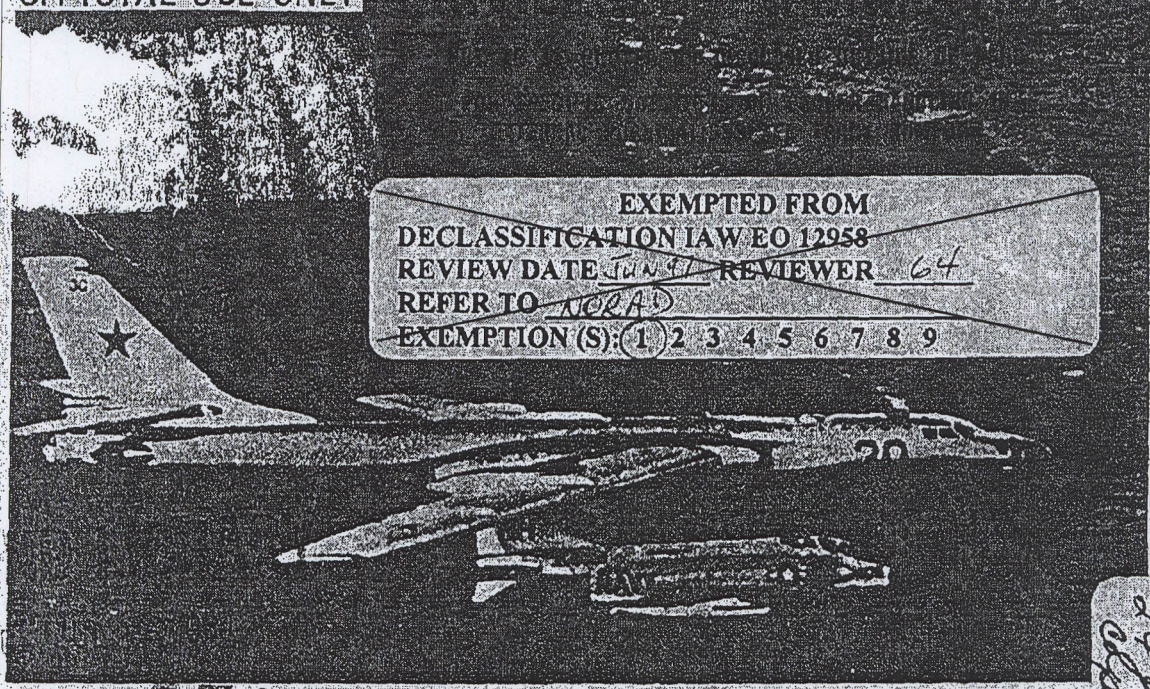
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The WIR in Brief

Portion identified
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to the appeal

MISSILE RANGE FIRING LOG PRESENTED
For week ending 2400Z, 17 July 1964.

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as non-responsive
to the appeal

Space

WHAT ROLE IS PLANNED FOR 'THE THIN MAN'
IN THE SOVIET MAN-IN-SPACE EFFORT?

Wiry master sergeant commended for unspecified
participation in cosmonaut program.

TRANSMITTING FREQUENCIES OF SOVIET
SPACE VEHICLES LISTED

Dates of latest known transmissions shown.

OVER-ALL SPACE SITUATION REPORT AND
LISTING OF SOVIET SPACE VEHICLES PRESENTED 10

As of 21 July.

RADIO TELESCOPES AVAILABLE FOR MONITOR-
ING SOVIET INTERPLANETARY AND LUNAR
PROBES

Several available to Soviets, some known to
have been used already.

2 MORE MISSILE-RANGE SHIPS ENTER PACIFIC;
SPACE EVENT OF UNKNOWN TYPE PROBABLE

Third ship entered Pacific earlier in July.

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as non-responsive
to the appeal

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to the appeal

COVER: Soviet BADGER bomber, US Navy fighter
and USS Kitty Hawk (OFFICIAL USE ONLY)
NOTE: Page 28, 30, 31, 34, 35, 38, 39, 42, and
43 of this issue are blank.

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Missile Range Firing Log Presented

US radar detected the following Soviet missile and space launches during the week ending 2400Z, 17 July 1964:

14 July, 0903Z	SS-4 MRBM	KYMTR#	1050 n.m.
15 July, 1128Z	Cosmos 35*	TTMTR#	Earth orbit
17 July, 1104Z	SS-4 MRBM	KYMTR	1050 n.m.
17 July, 0703Z	SS-4 MRBM	Sovetskaya Gavan	925 n.m.

* Injected into orbit by an SS-6 ICBM and Lunik-type upper stage. (See last week's WIR for details.)

TTMTR -- Tyuratam missile test range; KYMTR -- Kapustin Yar missile test range.

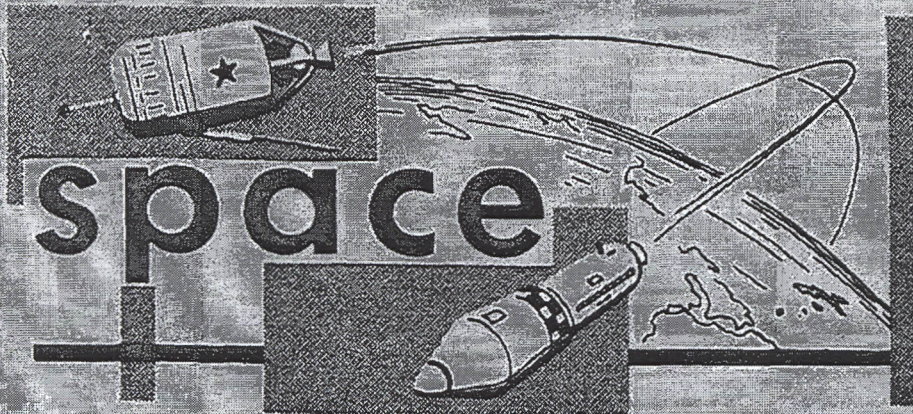
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significant
intelligence
on space
developments
and trends

What Role is Planned for 'The Thin Man' in the Soviet Man-in-Space Effort?

The Soviet armed forces magazine for NCOs, "Starshina-Serzhant," recently commended 5 career master sergeants who participated in the parachute training of cosmonauts and who tested much of the survival equipment they used. One was cited for testing the Soviet space suit for buoyancy and watertightness in the open sea (to insure survivability of the cosmonaut in case he landed in water), another for testing parachute-opening devices, a third for the parachute training he gave Soviet cosmonauts and for testing space suits and helmets, and a fourth for testing ejection devices. The contributions of the fifth man -- Master Sergeant Vladimir Ye. Bukhanov -- were not described; he was referred to only as a thin, lightweight individual.

Sergeant Bukhanov's task, whatever it was, apparently was important enough to deserve mention, but "Starshina-Serzhant" deliberately refrained from describing it. The implication seems to be that the Soviets plan some singular space event in which a very thin man will have a distinctive role and that the USSR, not unexpectedly, does not wish to bare its plan until a success can be announced. The sergeant probably helped test the practicability of the plan or the suitability of the equipment to be used. He is not necessarily the individual who is being groomed for the flight, although he might help train the candidate "thin man" cosmonauts. If the sergeant is chosen for the flight, then he will be the first NCO cosmonaut.

A thin cosmonaut might be particularly suited for certain special space events:

- Those in which the cosmonaut will have to transit a narrow passageway or fit into a very small space. For example, inflight transfer of a cosmonaut between two docked spaceships may be possible initially only for a thin individual since the size of the docking mechanism conceivably could restrict the size of the passageway.

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- Those in which weight is critical. A thin cosmonaut would not only be lighter, but his spacesuit and helmet would be lighter; he would require less food, water, and oxygen; and a less weighty heat-regulating system for the cabin could be used. Weight could be critical in multimanned flights -- including space stations -- and flights of long duration.

The item in "Starshina-Serzhant" might be a hint of a coming space flight by a thin man, similar to hints last year that a woman would be launched into space (WIR 23/63).

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Transmitting Frequencies of Soviet Space Vehicles Listed

Following is a listing of the most recent intercepts of radio signals of Soviet space vehicles in orbit which are believed to be still active:

<u>Type of Signal</u>	<u>Most Recent Intercept</u>
Electron 2	<div>50X1 and 3, E.O.13526</div>
Cosmos 25	
Cosmos 31	
Electron 3	
Electron 4	
Cosmos 35	

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Over-all Space Situation Report and Listing of Soviet Space Vehicles Presented

The over-all space-vehicle situation as of 21 July 1964 was as follows, according to NORAD SPADATS:

	<u>US</u>	<u>UK</u>	<u>Can</u>	<u>USSR</u>	<u>Total</u>
Payloads in Earth orbit	91	2	1	10	104
Payloads in Sun orbit	5			5	10
Payloads in Earth-Moon orbit				1	1
Payloads resting on the Moon	2			1	3
Pieces of debris in Earth orbit	313		2	12	327
Pieces of debris in Sun orbit	4				4
TOTALS	415	2	3	29	449
Objects decayed or de-orbited	196			193	389

A listing of Soviet space vehicles, together with some of their orbital parameters, is shown on page 36.
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Radio Telescopes Available for Monitoring Soviet Interplanetary and Lunar Probes

Based on an FTD analysis.

Deep space probes pose special problems with respect to tracking, communications, and guidance, because these operations involve the transmission and reception of signals over hundreds of thousands of miles (in the case of lunar probes) and tens of millions of miles (in the case of interplanetary probes.)

Radar tracking of space probes can be accomplished only for a short period after launch: within hours after launch, these vehicles are beyond tracking or detection range of even the best of modern radars. Tracking must be accomplished solely by highly directional DF-ing of signals transmitted by a beacon carried by the probe. Such signals, of course, continually get weaker and weaker as the probe recedes from the Earth.

Midcourse guidance of and communications with probes (including the commanding of transmissions from the probe) at interplanetary distances also calls for the use of high-gain highly directional antennas and extreme precision in aiming them at the antenna at the other end of the line of communications. These operations -- particularly when the probe is tens of millions of miles from the Earth -- are feats in themselves, yet their success is also enormously dependent on the accuracy of beacon tracking.





If the location of the probe is not known with adequate precision, the mid-course guidance correction is likely to be incorrect. Accurate tracking is even needed in locating the probe prior to conducting any guidance or communications operations. Failure to locate a probe prior to, say, a communications session, would mean a loss of data -- including tracking data. Successive failures to track the vehicle could mean mission failure, even if the probe itself continued to function properly.

These operations obviously call for the use of very large, high-gain antennas, large amounts of transmitting power, and extremely sensitive receiving equipment. Radio telescopes of certain types can be used for this work. The Soviets, who are active in radio astronomy, have a number of powerful radio telescopes which have been used or could be used for tracking and command and control of deep space probes. These include three 8-dish arrays in the Crimea, three 22-meter dishes at widely dispersed sites, and a Mills Cross interferometer array not yet operational. (See map on page 37.)

The 8-Dish Arrays. The principal Soviet deep-space tracking and communications center, near Yevpatoriya in the Crimea, employs 3 huge 8-dish radio-telescope arrays which are considered representative of the best of the Soviet state-of-the-art in large radio telescopes. The first of the 3 arrays was probably built in 1960, but most Western observers did not become aware of this Soviet development until late in 1962. Not before mid-1963 was the existence of 3 such arrays reported. An artist's concept of an 8-dish array is shown on page 41.

Each antenna consists of 8 parabolic dishes -- each 50 feet in diameter -- arranged in 2 horizontal rows of 4 dishes each. Each array is as tall as a 12-story building and weighs about 1,000 tons. The automatic rotation in elevation and azimuth of such a large structure and preservation of the mechanical tolerances necessary for efficient operation are remarkable achievements of Soviet engineering. Each telescope is mounted in a heavy, solid base, but no other details of the foundation or supporting structure have been reported. Artists' concepts of the array have shown the antenna supported both by a central support and by track-mounted supports at each end of the array. A combination of both types of support embedded in a single platform (page 41) is most likely, since the antenna weight must be evenly distributed to satisfy restrictive mechanical tolerances. Rotation in azimuth could be accomplished by smoothly revolving the platform upon which the entire array rests; rotation in elevation could be accomplished by turning the array about a horizontal axis through the end mounts.

One of the arrays is a transmitting antenna, the other two are receiving antennas. The transmitter is separated from the 2 receivers by a distance of more than a mile. The 2 receiver antennas are located more than 2,000





feet apart on an east-west baseline -- a configuration which suggests that they operate in an interferometer mode. A hill between the transmitter and the receivers aids in electrically isolating the receivers from possible interference generated by the transmitter.

Gain and resolution of each 8-dish array are roughly equivalent, respectively, to those of dishes 150 and 200 feet in diameter. The transmitter nominally operates at an RF of 700 mc/s and an output power of at least 100 kilowatts. The two receivers have effective frequency ranges of at least 700-6,000 megacycles. (The optimum frequency range for space transmission and reception, from the point of view of minimizing atmospheric absorption and galactic noise, is 1,000-10,000 megacycles.)

The noise temperature of the 8-dish-array receivers has been estimated at about 100 degrees Kelvin, assuming that the Soviets use cooled parametric amplifiers or masers. This temperature compares favorably (is lower than) that of the MIT/Lincoln Lab Venus radar (140 degrees Kelvin) but is twice that of the single-dish 85-foot-diameter Goldstone radio telescope in California.

The Soviets reportedly have achieved a mechanical tolerance of a fraction of an inch in shaping the parabolic surface of the 50-foot dishes. Such a fine tolerance is necessary for efficient operation at high frequencies. By positioning the 8 dishes close together in an orderly pattern, the Soviets have partially solved the difficult phasing problem inherent in multi-element arrays. The mechanical synchronization problem has been avoided by moving all 8 dishes as a unit under the control of a single servomechanism.

The 8-dish arrays could track and command cooperating space vehicles operating in a beacon mode out to lunar and possibly even planetary distances. They were used to track the Soviet Venus and Mars probes of February 1961 and November 1962, respectively. However, there is very little data available on the extent of the activity of these radio telescopes during other Soviet space events. They were probably involved in the Soviet lunar probe (Lunik 4) of April 1963. Mid-course guidance may have been commanded by the Crimean complex.

The 22-Meter (72-foot) Dishes. Most Soviet steerable single-dish radio telescopes are not comparable in size to those that are either operational or are being built in the West, but they represent very careful research, development, and construction techniques. The most notable Soviet dish is the 22-meter-diameter parabolic reflector developed by the Lebedev Physics Institute of the Soviet Academy of Sciences. Three of these are known: 1 at Serpukhov, near Moscow, which has been in operation since the summer of 1959; a second at the Ob Astrophysical Observatory, which is associated with Novosibirsk, the "science city"; and a third which is now being built at Simeiz in the Crimea and which is slated for operation in the 2- to 3-millimeter wavelength range.

(A photo of the dish at Serpukhov is shown on page 44.)



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There is no evidence yet that the 22-meter antennas have been used in connection with Soviet space operations, but these radio telescopes may very well play an important space role in the future as the Soviets use an increasing number of radio frequencies in their space program. The heavy investment in 22-meter dishes seems out of proportion to Soviet needs in radioastronomy at short wavelengths. The extensive design effort, the use of standardized subassemblies, and the adaptability of the telescopes for active (transmitting) feeds suggest that more antennas of this type are planned. The development of a network of such antennas would give the Soviets an excellent capability in deep-space command and control.

The Soviet Mills-Cross Radio Telescope. The Mills-Cross interferometer antenna array located at Serpukhov will, when completed, be another significant Soviet achievement in radio astronomy. Most reports indicate that both the interferometer arms have been built but that technical difficulties preventing full operation still exist. (See WIR 34/63.) However, the array is expected to be completed this year. (Photo on page 40.)

This radio telescope consists of an east-west arm 1 kilometer in length and composed of 37 tower-mounted parabolic elements which can be manually rotated about the baseline axis and a north-south arm composed of similar but stationary ground-mounted elements. Beam steering in declination (in a longitudinal direction) is accomplished by mechanical rotation of the elements in the east-west arm along with electrical phasing of the elements in the north-south arm. As the Earth rotates, the antenna beam automatically sweeps out an angle in right ascension (in a ^{longitudinal} latitudinal direction). The antenna was designed to operate at wavelengths between 2.3 and 10 meters and to have a receiving area of 800,000 square feet. Although the resolving power of the interferometer is unknown, a beam width of about 3 minutes of arc at a wavelength of 1 meter is possible.

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2 More Missile-Range Ships Enter Pacific; Space Event of Unknown Type Probable

Two Soviet missile range instrumentation ships (SMRISs), the Chazhma and Chumikan, have left port and on 22 July were sighted at 4014N-1701E, proceeding on a course of 150 degrees at a speed of 10 knots. The ships were abreast 6 n.m. apart.

A third SMRIS, the Chukotka, has been in the Pacific since leaving port early this month.

These reports suggest that a space event or missile test firing or both are forthcoming. The type of event scheduled will become clearer as the deployment pattern emerges. A space event, possibly manned flight, would



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be indicated if the ships are strung out along the Earth trace of a 65-degree orbit. If the ships are bunched closely together in a small triangular pattern, an ICBM test -- or series of tests -- will be indicated. A formal announcement of forthcoming tests usually is publicized before ICBM firings into Pacific Ocean impact areas.

The Soviets have orbited two cosmonauts each year since 1961, but there have been no manned flights yet this year.

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Soviet Space Vehicle Listing

(as of 21 July 1964)

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Soviet Vehicles In Earth Orbit

International Designation	Common Name	Launch Date	Inclination to Equator	Period (Minutes)	Apogee (kilometers)	Perigee	Life Expectancy or Decay Date
1963-17A	Cosmos 17	22 May 63	48.98°	92.8	565.6	248.6	3d Qtr., 65
1963-43A	Polyot 1	1 Nov 63	58.92°	102.4	1,406.2	336.1	Over 50 yrs
1964-6A	Electron 1	30 Jan 64	60.65°	169.3	7,120.1	400.3	Over 50 yrs
1964-6B	Electron 2	30 Jan 64	60.03°	1,356.3	67,838.8	582.6	Over 50 yrs
1964-10A	Cosmos 25	27 Feb 64	49.04°	91.3	421.1	253.1	Jul 65
1964-13A	Cosmos 26	18 Mar 64	48.97°	90.2	311.8	249.2	Jan 65
1964-19B	Polyot 2	12 Apr 64	58.04°	92.2	462.3	306.5	3d Qtr., 65
1964-28A	Cosmos 31	6 Jun 64	48.97°	91.3	448.9	220.3	Feb 65
1964-38A	Electron 3	10 Jul 64	60.86°	168.0	7,027.0	402.7	Over 50 yrs
1964-38B	Electron 4	10 Jul 64	60.77°	1,313.9	66,283.1	458.4	Over 50 yrs
1964-39A	Cosmos 35	15 Jul 64	51.33°	89.2	253.1	216.3	27 Sep 65

Soviet Vehicles In Heliocentric (Sun) Orbit

			Inclination to Ecliptic	Period (Days)	Aphelion (in AUs)*	Perihelion	
1961 Mu 1	Lunik 1	2 Jan 59	0.01°	449.4	1.315	0.9766	Indefinite
1961 Gamma	Venus probe	12 Feb 61	0.58°	300	1.019	0.7183	Indefinite
1962 B. Nu 3	Mars 1	1 Nov 62	2.683°	519	1.604	0.9237	Indefinite
1964-16	Zond 1	2 Apr 64	(Not Available)				Indefinite

Soviet Vehicles In Barycentric (Earth-Moon) Orbit

1963-8B Lunik 4 2 Apr 63 (Not Computed)

Soviet Vehicles Resting on Surface of the Moon

1961 Xi 1 Lunik 2 12 Sep 59 (Not Applicable)

* AU -- astronomical units, roughly 1 AU = 93 million miles (mean distance from Earth to Sun).

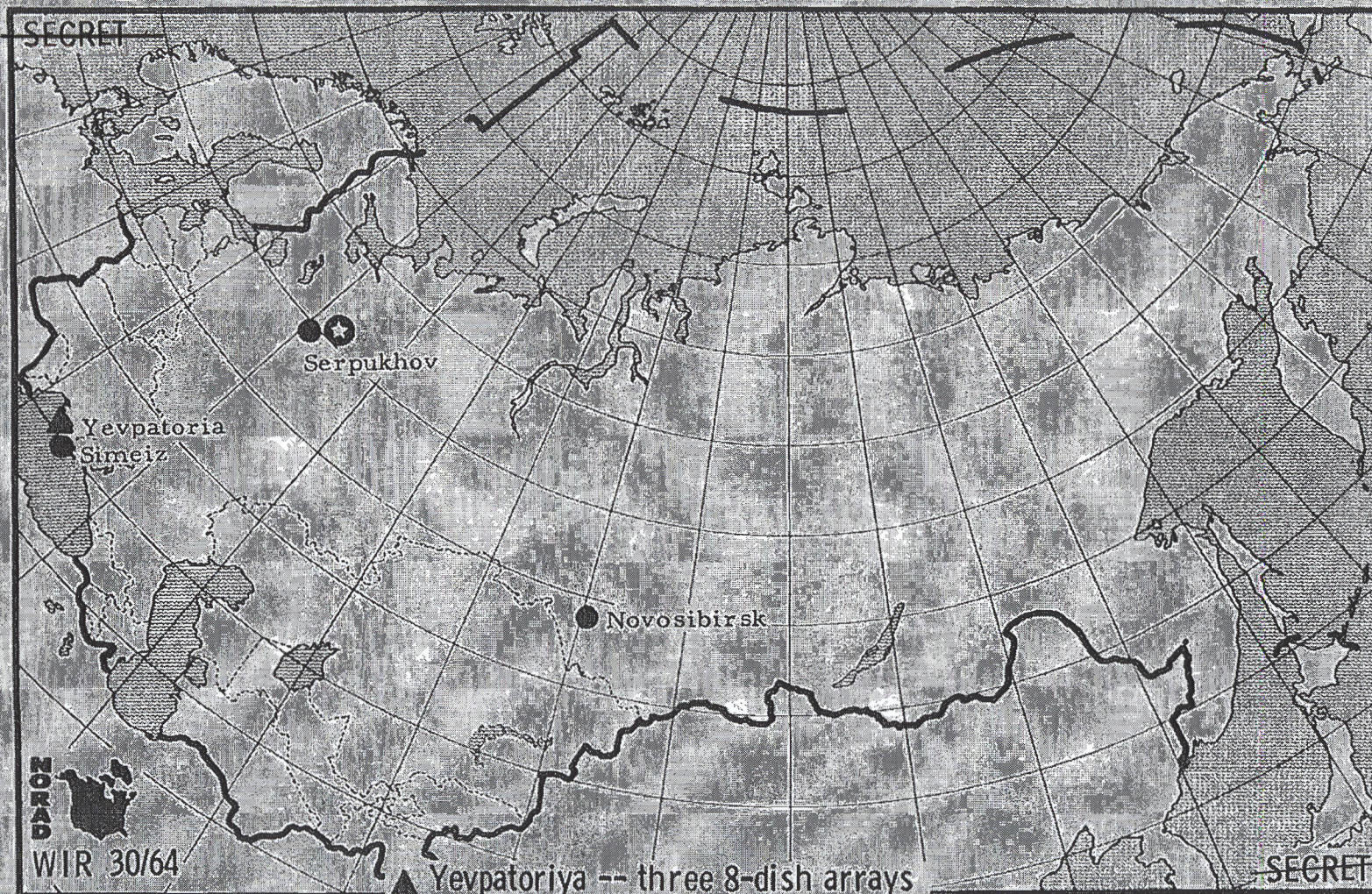
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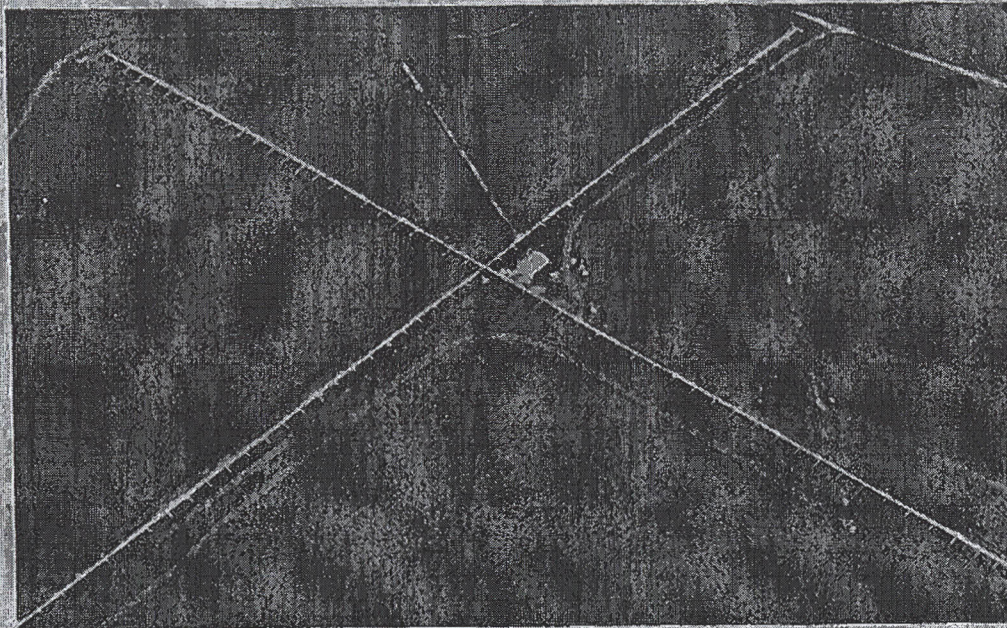
Locations of Principal Soviet Radio Telescopes Which Have Been Used or Could be Used for Commanding, Controlling, and Monitoring Deep-Space Operations



- ▲ Yevpatoriya -- three 8-dish arrays
● 22-meter dishes -- at 1) Serpukhov, 2) Novosibirsk, and 3) Simeiz
★ Mills Cross interferometer at Serpukhov



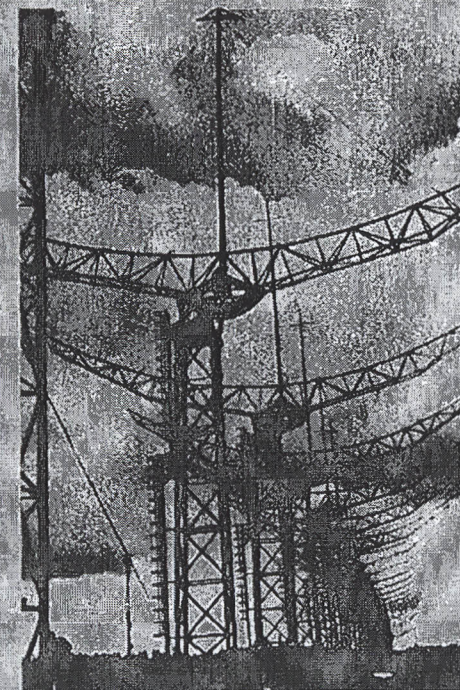
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Typical configuration of Mills cross radiotelescope 

Movable antenna elements of Soviet Mills cross radiotelescope at  Serpukhov.

MILLS CROSS RADIOTELESCOPE



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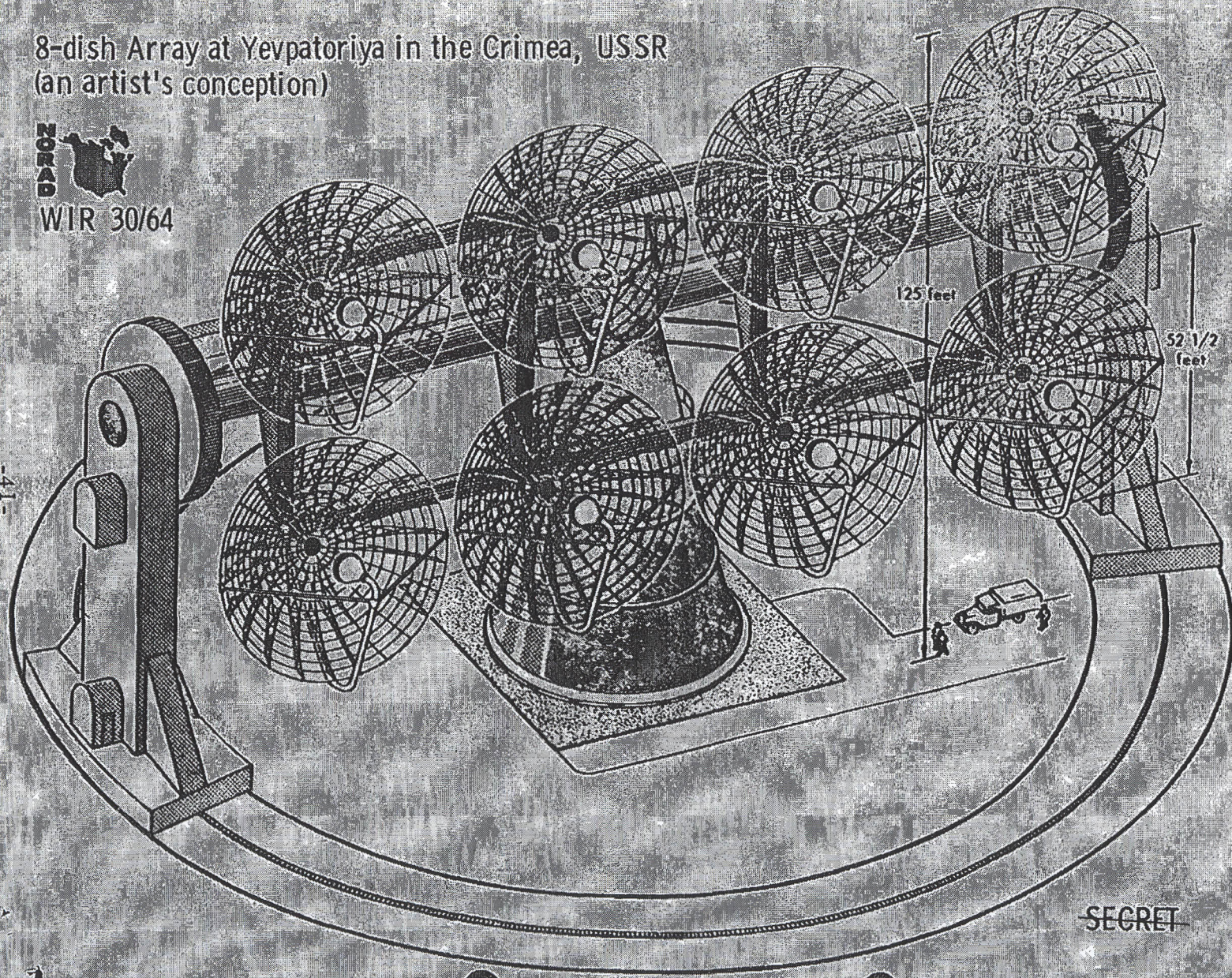
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8-dish Array at Yevpatoriya in the Crimea, USSR
(an artist's conception)



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22-meter (72-foot) Dish of Radio Telescope at Serpukhov, USSR

NOVA
WIR 30/64



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-44-