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NORTH AMERICAN AIR DEFENSE COMMAND

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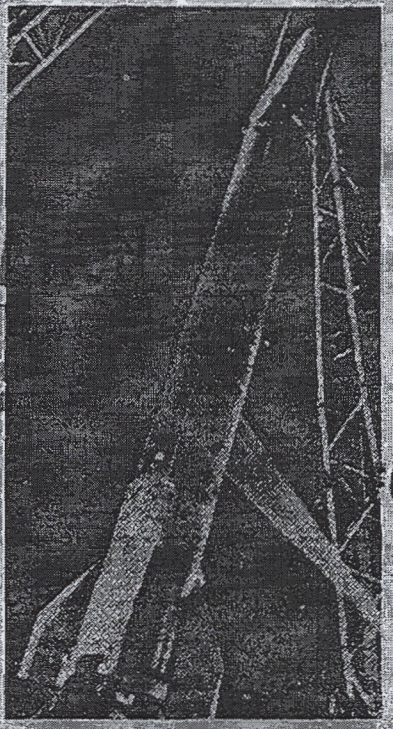
WEEKLY INTELLIGENCE REVIEW (U)



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NORAD Weekly Intelligence Review

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The WIR in Brief

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COVER: Missile being loaded aboard a submarine, according to Red Star. (OFFICIAL USE ONLY)

NOTE: Pages 28, 30, 31, 34, 35, and 38 of this issue are blank.

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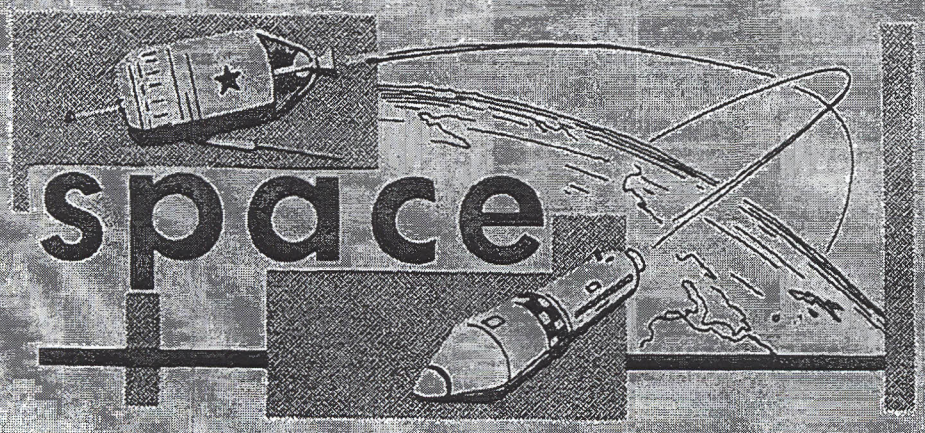

significant intelligence on space developments and trends

The Soviet Lunar Program

Soviet intent to explore the Moon and to exploit any resources or advantages that it may offer has been manifest in Soviet space events and in statements by qualified personnel in the Soviet press. Doubts as to whether the Soviet program would include manned lunar landings were raised in the minds of many Westerners about a year ago when the press misconstrued certain remarks of then-Premier Khrushchev. Later "clarifications" and abundant comment in authoritative Soviet press organs about the Soviet space program should have dissipated these doubts. It is now obvious to all that manned lunar flight is only a primitive step in a much farther-ranging program which envisions eventual flights by man to other planets of the solar system and, if propulsion and other breakthroughs develop, beyond the bounds of the solar system.

Though tremendous expense is involved, Soviet leaders to date have given their space program a high priority, and no reversal of this trend is in sight. Space, they believe, warrants high priority, because:

- It offers the USSR an opportunity to demonstrate to the watching world -- particularly the uncommitted nations -- the alleged superiority of the Communist system over rival social and political systems. The early lead in propulsion which the Soviets enjoyed made the exploration of space an especially inviting arena for competition with the West.
- Space and celestial bodies must be explored because they are there and the knowledge gained from exploration may be useful. Failure to explore them could mean a forfeit of advantage to rivals. Though the search for knowledge about space and celestial bodies does not promise to unveil to Man new, habitable lands or new sources of energy or valuable substances, the potential benefits of new knowledge cannot be ignored. No practical use was found for Boolean algebra,

for instance, until a century after its discovery; now it is the basis of switching circuitry in digital computers.

Progress to Date. Moon flights were a relatively early feature of the Soviet space program. The Soviets' fourth successful space launch was an attempted lunar probe -- Lunik 1, which was launched on 2 January 1959. All known Soviet space events or attempts between late 1958 and early 1960 -- were lunar launch attempts.

To date, the Soviets have made 11 lunar probe attempts. Seven were propulsion failures, 2 were launched successfully but failed to reach the Moon, and 2 were unqualified successes. The successes were Lunik 2, which impacted on the Moon, and Lunik 3, which transmitted photography of the far side of the Moon. (See table on page 29 for a summary of Soviet Moon shots to date.)

These launch attempts fell into two distinct categories:

- Direct ascents to the Moon were tried on at least 6 occasions between late 1958 and the spring of 1960.
- Five attempts were made via the parking-orbit route, in which a third stage injects a payload and fourth stage into parking orbit of the Earth and then, at a suitable moment, the fourth stage ignites and injects the payload into a trajectory toward the Moon.

The SS-6 ICBM booster/sustainer combination was used in all 11 attempts, all of which were launched from the Tyuratam missile test range. All vehicles used an upper (or third) stage, but with this difference: (See table on page 32.)

- The lighter Lunik stage (so-called because it was first used with lunar probe vehicles) was used with the direct ascents.
- The heavier, Venik stage (so-called because it was first used successfully in the Venus probe of 12 February 1961) was used with the lunar probes which used the parking-orbit technique.

But the pacing of the Soviet lunar program cannot be judged solely on lunar launch attempts. Just as the lunar program is only one phase of a much more comprehensive space effort, so it is the beneficiary of technology and research carried on through other space events, many of them less spectacular. Research satellites, such as the Electron-series and some of the Cosmos-series vehicles, are collecting data needed to help determine whether manned flights to the Moon can be made safely. The manned Vostoks and Voskhod have collected information needed to find out what must be done to maximize the human potential in the extraterrestrial environment. The maneuverable Polyot vehicles are helping to pave the way to rendezvous and docking techniques which apparently are to be used in connection with advanced lunar flights. And, in general, all the Soviets' space launches contribute to the development of the technologies necessary for advanced

lunar flights by giving the USSR experience in launch, guidance, tracking, trajectory computation, and space communications.

Also contributing to the lunar program are the researches of astronomy and the lunar counterparts of some of the Earth sciences, such as geology and geophysics. Some of this research is definitely oriented in the USSR to the needs of a manned lunar-landing program (WIR 20/64).

Future Developments. The Soviet lunar program is actually only in its infancy: it is in the early exploratory stage. The Soviets still have little reliable knowledge of the texture and load-bearing characteristics of the lunar surface, nor do they have maps of the Moon detailed enough to select areas in which suitable landing sites are most likely to be found.

The Soviets have the know-how for executing early unmanned exploratory missions, such as photographing the Moon close up and making soft landings of instrumented payloads which would examine the chemical and physical characteristics of the Moon's surface.

Their technology is far from adequate, however, for such advanced missions as the construction of Earth-orbiting space stations (from which payloads would be launched toward the Moon), unmanned circumlunar flights with payload recovery, manned circumlunar flights and safe return to Earth, unmanned landings and return to Earth, manned landings and return, and, eventually the erection and manning of permanent lunar bases.

Completely new propulsion systems must be developed for advanced missions, including boosters and upper staging. The minimum manned lunar mission -- circumlunar flight and return -- will require that 35 tons be placed in parking orbit in a minimum number of launches and assembled in orbit -- to serve as the "launch site" for advanced lunar missions. As lunar missions increase in complexity -- such as a manned lunar landing and safe return to Earth -- the weight of the space station orbiting the Earth will have to be about 150 tons. Again, it will be desirable to keep to a minimum the number of launches necessary to inject this payload into orbit and assemble it there.

The most likely Soviet engine for orbiting components of the larger space station is the one believed to be associated with an apparent engine-test facility which was photographed while under construction at Kurumoch (5330N-5002E) -- 20 n.m. northwest of Kuybyshev -- about 5 years ago. A single-chambered engine compatible with this possible test facility would probably be able to produce 1-2.5 million pounds of thrust. Five such engines, clustered in a fashion similar to that used with the SS-6 ICBM booster/sustainer combination, could probably produce some 5-12.5 million pounds of thrust for a single launch. The "Kurumoch engine" is believed to be in the process of completing single-engine test qualifications and could have its first launch in the near future. The clustered version might complete its qualification testing in the period 1966-1967. If this timetable proves accurate, then it is also possible that the Soviets could develop and test a still-larger follow-on liquid

propellant engine by 1969 and have a clustered version available in 1972.

Still in the propulsion line, the Soviets must also develop an "interplanetary" upper stage larger and much more reliable than the 4th stage now used to inject interplanetary and lunar probes into transfer trajectories toward their targets. The failure rate of this interplanetary stage is 67 percent -- a rate indefensible for manned flight. The new and larger interplanetary stage will first have to be injected into parking orbit of the Earth and coupled there to its payload.

And, before space stations can be built, the Soviets will have to master the techniques of rendezvous, docking, and assembly of components in orbit.

Advanced spacecraft will also have to be developed specially for advanced lunar missions. Even the early ones will include mid-course guidance engines and retrorockets. Those which are to return to Earth will also have to have heat-shielding for re-entry, and those which land on the Moon and later return to Earth, will have to carry, in addition, rockets for launching from the lunar surface. It may be necessary for returning vehicles to incorporate wings, or lift surfaces of some sort, for the final Earth recovery phase.

The Soviets will also have to:

- Erect launch facilities for the new and larger boosters, probably comparable in size with those now being built by the US at Cape Kennedy. (The main assembly building for the US's Moon shot, construction of which has already started, is to be larger than any building in the world now known or planned.)
- Advance their propellant technology, especially with respect to high-energy and storable propellants.
- Expand the present Soviet spacetracking network to global scale.
- Improve forecasting of solar flares so that men circumnavigating the Moon or landing on it will not be killed or incapacitated by primary cosmic rays from the Sun. (Present-day Soviet forecasting techniques are believed to be accurate for no more than about 2 days in advance. (See page 6, WIR 43/64.) Forecasts accurate for a week or more in advance are needed, since manned lunar missions will probably last at least this long.

These developments, as well as the step-by-step nature of the Soviet space program as a whole, will be useful to Western intelligence in its efforts to gauge the progress of the Soviet lunar effort.

The Soviets, it is believed, could accomplish the minimum manned lunar mission -- circumlunar flight and return to Earth -- in the period 1967-1969, if the "Kurumoch engine" becomes operational, as is anticipated, in the period 1966-1967. (See pages 33 and 36.)

There are no known technological constraints to the Soviets' putting a man on the Moon by 1970 if they so desire.

The Immediate Future. The Soviets' most pressing needs with respect to their lunar effort are:

- To develop the techniques necessary to build space stations from which to launch advanced lunar probes.
- To map the Moon and to find out as much as possible about its load-bearing characteristics.

The Soviet space program can thus be expected to feature in coming months:

- Attempts to rendezvous and dock vehicles in orbit. (These ventures could come at any time that the Soviets are confident of their readiness, although manned flights are less likely in winter -- because of the risks involved in recovery in deep snow -- than in spring, summer or autumn.)
- Lunar exploratory flights, such as photography of the Moon (similar to the US's Ranger 7 event), soft landings of instrumentation on the Moon to help determine the nature of the surface, and the recovery of photography from circumlunar or Moon-orbital flights. (Events involving landing on or photography of the near side of the Moon would be most likely during full moons, which occur once each 29.5 days. Circumlunar or lunar-orbit flights would most likely be tried during "old" moons, when the far side of the Moon basks in the full light of the Sun; these periods, too, recur each 29.5 days, but half-way in time between full moons. Theoretically, such flights could occur during any month but, because of Earth-Moon geometry, the next favorable period will come in mid-January.)

(For a review of the Soviet interplanetary program, see WIR 43/64.)
(FTD, SPADATS, NORAD)
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8 Soviet Space Vehicles Still Transmitting as of Recent Date

The following have been reported as the most recent intercepts of transmissions from Soviet space vehicles, as of 27 October:

	Most Recent Intercept

50X1 and 3, E.O.13526

50X1 and 3, E.O.13526

(Various ELINT monitors)

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Soviet Lunar Probes -- Successes and Failures

Date of Launch	Soviet Designation	Achievements, or Reasons for Failure
04 Dec 58	none	Propulsion (sustainer) failure.
02 Jan 59	Lunik 1	Missed Moon, went into orbit around the Sun. The first manmade vehicle to escape the Earth's gravitational field. Probably an attempt to hit the Moon, a mission achieved later by Lunik 2.
18 Jun 59	none	Propulsion (sustainer) failed.
12 Sep 59	Lunik 2	Impacted on Moon. Magnetometer indicated that the Moon has little or no magnetic field.
04 Oct 59	Lunik 3	Flew around the Moon and returned to vicinity of the Earth, believed to have decayed about 30 Mar 60. Photographed far side of Moon and pictures transmitted to Earth by video.
15 Apr 60	none	Propulsion (3d stage) failed.
04 Jan 63	none	Propulsion (4th stage) failed.
03 Feb 63	none	Propulsion (3d stage) failed.
02 Apr 63	Lunik 4	Successfully launched but missed Moon by 8500 kilometers. Probably an attempt to soft-land an instrumented package on the Moon. Now in Earth-Moon orbit.
21 Mar 64	none	Propulsion (3d stage) failed.
20 Apr 64	none	Propulsion (3d stage) failed.

NOTE: First 6 launches (all before 1963) were direct-ascent attempts, using the so-called light Lunik 3d stage. The 1963 and 1964 launches involved the parking-orbit technique, in which the so-called heavy Venik 3d stage injects 4th stage and payload into parking orbit and 4th stage injects payload into lunar trajectory.

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Soviet Lunar Probes -- a Comparison of the Two Trajectory Techniques

	Direct Ascents	Parking Orbit Events
Time period	1958-1960	1963-1964
No. of attempts	At least 6	At least 5
Accomplishments	Hard impact; lunar flyby; photographed far side	1 launch successful but missed Moon by 8500 km.
Advantages	Shorter transit time (1.5-2.5 days vs 3.5 days for parking-orbit technique)	Heavier payload than for direct ascent.
Propulsion used	SS-6 booster/sustainer plus Lunik (light) 3d stage.	SS-6 booster/"improved" sustainer plus Venik (heavy) 3d stage
Launch site	Tyuratam	Tyuratam
Weight of vehicle in parking orbit	(not applicable)	15,000-15,500 pounds
Useful payload weight	800-1,000 pounds	3,135 pounds to lunar vicinity 650-1,000 if a lunar soft-landing 1,550-2,000 if a lunar orbiter