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NORTH AMERICAN AIR DEFENSE COMMAND

WIR

WEEKLY INTELLIGENCE REVIEW (U)

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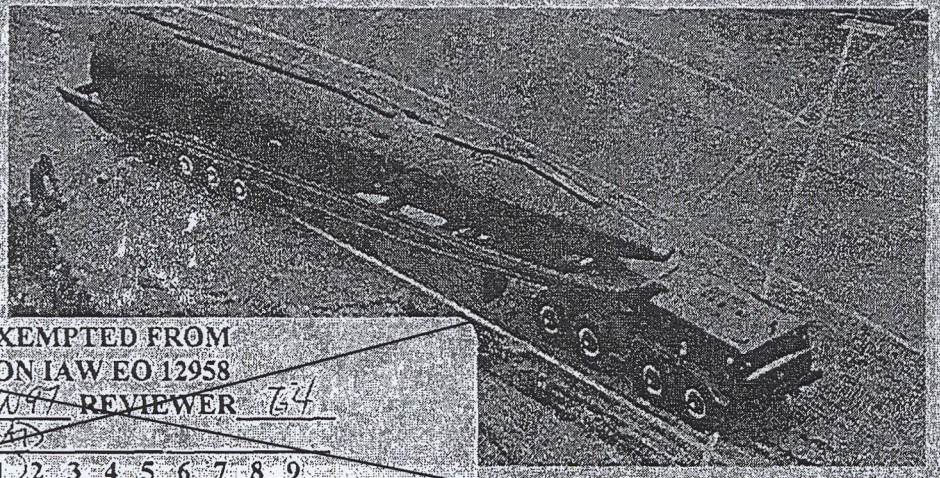

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NORAD Weekly Intelligence Review

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Issue No. 25/65, 18 June 1965

The WIR in Brief

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Space

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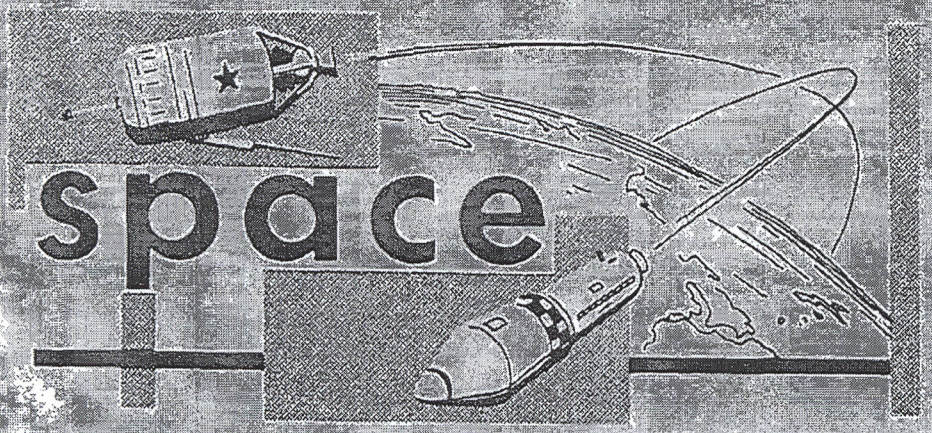

significant intelligence on space developments and trends

Design of Soviet Recoverable Satellites Apparently Based on Old Balloon Gondola

The design of all known Soviet recoverable spaceships appears to have been based on a balloon gondola designed and built by the Soviets in 1933. This estimate was made by a CIA-NASA group, several of whose other conclusions on Vostok design, which were reached several months ago, have since been confirmed by Soviet publicity.

The similarities between the spaceships and the old gondola are too numerous to disregard:

- Both appear to be spherical in shape, about 88 inches in diameter, and of double-walled construction.
- Both provide for maintenance of sea-level barometric pressure.
- Both have two circular hatches diametrically situated on the surface -- one for entry, the other for emergency escape.

Use of the gondola design in a satellite is an outstanding example of the Soviets' well-known design philosophy, "If it works, don't change it." Evidence of this philosophy has been noted repeatedly in the development of Soviet aircraft, missiles, and radars. The design appears to have been used in all 5 series of recoverable Soviet satellites:

5 Korabli (biosatellites) (1960-1961)
6 manned Vostoks (1961-1963)
24 "light" recoverable Cosmoses (1962-1965)
8 "heavy" recoverable Cosmoses (1963-1965)
2 Voskhods (1964-1965)

All were launched from Tyuratam by the SS-6 ICBM, all had orbital inclinations of about 65 degrees (except for 5, which had 51 degree inclinations), and all were in relatively close Earth orbits.

The first three series were probably essentially the same type of vehicle, weighing about 10,430 pounds, modified only to suit differences in missions. All were injected into orbit by the light Lunik upper stage.

The last two series were probably slightly heavier modifications, essentially alike in configuration and weight (about 11,730 pounds). All were injected into orbit by the heavy Venik upper stage.

The Biosatellites (Korabli). Nothing is known directly about the configuration of the Korabli, but all the evidence, including telemetry analysis and Soviet announcements, indicates that they were basically the same as the manned Vostoks. They paved the way for the Vostoks by:

- Proving the feasibility of spaceflight for terrestrial organisms.
- Proving the adequacy of the Vostok vehicle and its systems.

Ordinary prudence, which the Soviets seem to have exercised throughout their space program, would demand these proofs before launching humans into space.

The most telling evidence of their mission is:

- Their timing -- the last Korabl was launched only 16 days before the first Vostok.
- The first Korabl carried a dummy cosmonaut, according to demodulation of the vehicle's video signals.

Perhaps the only Vostok system not tested by the Korabli was the ejection seat for escape during on-pad or post-launch emergencies: this system was tested aboard a modified BEAGLE/IL-28 light jet bomber (photos on page 38).

The Manned Vostoks. The external (pre-launch) configuration of the Vostoks was first publicly shown during the 9 July 1961 Tushino air show, when a HOOK/MI-6 helicopter carried a model of it (photo on page 35). A similar model appeared in the Soviet film, "First Trip to the Stars" (photo on page 35).

These photographs give no clues to internal configuration. Initial analysis suggested that the aft cylindrical section was the Lunik upper propulsion stage, that the conical and fore cylindrical sections were fairings which dropped off after powered flight, and that inside the fairings was the cosmonaut's capsule with an instrument compartment fore and retrorockets aft. The West's initial estimate of the configuration is shown on page 38.

The recent CIA-NASA estimate that the Vostok is spherical appears to be confirmed by the Vostok shown at the Soviets' Economic Achievements Exhibition in Moscow (photo on page 39, and by photos of a recovered Vostok (page 39). The exhibit, however, indicates that both the instrument/service module and retropackage are at the same "end" of the spheroid, that is, back of the cosmonaut. The antennas to the front probably burn up during re-entry, despite their relatively protected position. The heat shield, of course, is back of the cosmonaut. The re-entry rocket, not visible in the photo, is believed to be the booster of the GUIDELINE/SA-2, the Soviets' most widely deployed surface-to-air missile.

The "Light" Recoverable Cosmoses. The configuration of "light" recoverable Cosmoses launched from Tyuratam is not known, but the evidence indicates that they are, in essence, Vostoks which have been modified for unmanned missions. Their primary mission is photoreconnaissance (with recovery of film), but the large volume and payload-weight of the basic vehicle permit the installation of equipment for other missions. Several vehicles reportedly have collected space-environment data, and at least one has been identified as probably collecting electronic intelligence. One of these vehicles usually precedes manned Vostok flights into space, to monitor space-radiation hazards.

The "Heavy" Recoverable Cosmoses. The recoverable Cosmoses injected into orbit by the heavy Venik upper stage weigh about the same as the manned Voskhods, according to analysis of propulsion telemetry. They are evidently essentially the same vehicle. Though many of them apparently executed photoreconnaissance, the first members of this series appear to have concurrently tested and proved out the Voskhod-type vehicle and "man-rated" the Venik, that is, assured that it was reliable enough for manned flight. (Previously, it had been used only for injecting interplanetary probes and certain lunar probes into parking orbits.)

Two of these vehicles -- Cosmoses 47 and 57 -- appear to have been full-scale dress rehearsals for later Voskhod flights. Cosmos 47, for example, which carried a cosmonaut dummy (according to demodulated video signals), was launched 6 days before Voskhod 1; its orbital parameters were almost identical to those of the manned vehicle. A similar relationship was probably intended for Cosmos 57-Voskhod 2; however, Cosmos 57 disintegrated after making two orbits, possibly during an attempt to maneuver or by design. This mishap may have forced a change in Soviet plans, which may explain the 24 days which elapsed between the launches of Cosmos 57 and Voskhod 2.

The Manned Voskhods. Voskhod 1, though it carried three times as many

cosmonauts as any Vostok, weighed only about 1300 pounds more (11,730 vs 10,430 pounds), according to a Soviet announcement. A NASA study indicates that a Vostok modified to carry a crew of 3 and provide it with a landing rocket would weigh only about 800 pounds more than the original Vostok; the other 500 pounds differential could have been taken up by the announced back-up retrorocket system. Much of the needed volume could have been gained by eliminating the cumbersome ejection seat; this alone would have doubled the usable volume.

And there is other evidence which suggests that the Voskhod still features the old balloon-gondola structure of the Vostoks:

- Soviet-released photography of the two vehicles shows some similarities, such as a port hole of identical size atop each vehicle.
- [redacted] indicates that the retrorockets on both types of vehicle had the same thrust and burning duration.
- Attitude-control systems and retrorocket-system pressures were the same.
- Extreme Soviet confidence in the Voskhod capsule, as evidenced by the lack of pressure suits and ejection seat aboard Voskhod 1, is more likely to have been generated by use of the old Vostok pressure shell and its systems than by use of an entirely new design.
- A new vehicle designed to carry 3 men would probably have had a gross weight closer to the 14,500-pound payload capability of the Venik upper stage.

Modification of a proven vehicle is, of course, well in line with Soviet design philosophy.

Less is known about the 2-man Voskhod 2 than about Voskhod 1, but the same basic pressure shell probably was used. An extension or protrusion at the place where the recovery chute was located on the Vostok would provide the space for the airlock through which Lt Col Leonov emerged into space and returned.

Pros and Cons of Use of the Balloon Gondola. The use of a relatively ancient balloon gondola as a pressure shell in a manned space vehicle was, for the Soviets, a crude but effective expediency. The shell's weightiness was of little concern to the Soviets, since it was well within the weight-lifting capabilities of their launch vehicle, the SS-6 ICBM. Its use must have moved ahead substantially the vehicle's availability date and afforded the Soviets significant savings in the money, materiel, and

technical manpower that would have been required to design, develop, test, "man-rate," and series-produce a completely new pressure shell.

The sphere is an ideal shape for a pressure shell. However, it is not as suitable in many respects as the blunt shape of the US's Mercury for a re-entry vehicle:

- The blunt shape can be lighter, since it requires about 30 percent less heat protection.
- The Mercury's shape should produce less astronaut discomfort during re-entry. There should be less oscillation, since the force vectors of re-entry are aligned along the vehicle's center of geometry.
- The blunt shape has more growth potential. The sphere has no lift; neither does the Mercury, but later-generation vehicles of its shape will provide some lift during re-entry.

The Future. The Vostok pressure shell offers little or no growth in volume over that provided by the Voskhods. Weight can be increased by nearly 3,000 pounds, however, owing to the lifting power of the heavy Venik. Thus, the propulsion and equipment to be used for rendezvous and docking can be added when the Soviets are ready for these missions.

The West should be able to detect significant changes in payload weights of future Voskhod-type vehicles, including "heavy" recoverable Cosmoses. There was less than a 300-pound difference between the Soviet-announced weight of Voskhod 1 and the weight estimated on the basis of propulsion-telemetry analysis.

Though not suitable for use as space stations or for making lunar landings, the basic Vostok/Voskhod vehicle will probably still be used for a long time to come for such missions as photographic, infrared, and electronic reconnaissance; for inflight testing and development of new space equipment and systems; for exploration of near-Earth space; for development of the techniques of rendezvous and docking; and for cosmonaut training.

It could also become the Soviets' "space taxi" -- to bring space-station assemblers and satellite repairmen to work and return them to Earth, and to effect changes of crew of space stations, of possible orbital weapon-delivery vehicles, and of other manned satellites.
(CIA, NASA, FTD, SPADATS, Press; NORAD)
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Cosmos 68 a Routine Photorecce Launch

Cosmos 68, which the Soviets launched from Tyuratam at about 0945Z, 15 June, appears to be a routine Soviet photorecce vehicle -- the 7th this year. Equipment for other missions might also be carried. Orbital parameters have been reported as follows:

	By SPADATS	By TASS
Inclination	65.03 degrees	65 degrees
Period	89.93 minutes	89.77 minutes
Apogee	331.6 kilometers	331.7 kilometers
Perigee	211.1 kilometers	204.4 kilometers

The new satellite was launched by an SS-6 ICBM booster-sustainer and injected into orbit by the light Lunik upper stage. Thus, it adheres to the regular alternation, since the first of the year, in the use of Lunik and Venik upper stages: the 1st, 3d, 5th, and 7th Cosmos-series photorecce vehicles were orbited by Lunik stages, the 2d, 4th, and 6th by Venik stages.

If events follow the pattern of photorecce launches of the past year, Cosmos 68 will be de-orbited on 23 June on Revolution 127 or 128, after nearly 8 days in orbit.

TASS made its usual announcement that the vehicle is engaged in scientific research.

(SPADATS; TASS; NORAD)

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Luna 6 is Soviets' 9th Consecutive Lunar-Probe Failure

Malfunction of midcourse guidance on Luna 6 caused that Soviet lunar probe to fail, the 9th such consecutive failure in the Soviet lunar program. TASS announced, just 24 hours before the probe was to approach the Moon, that the maneuvering engine had ignited and was properly oriented at the time, but that Luna 6 would miss the Moon by 160,000 kilometers (86,000 n.m., or 99,000 statute miles) because the engine failed to obey the transmitted cut-off command.

NORAD had estimated that the probe would pass in "front" of the Moon (to the left of it, as viewed from the Earth) and slightly above it, at a distance of 26,000 kilometers (14,000 n.m., 16,200 s.m.) if no course correction was made. This indicated that the probe had an excess of velocity and would have to be slowed down to hit the Moon.

The magnitude of the announced miss distance indicates that the decrease was far too great, that is, the probe was slowed so much that the Moon had passed the scheduled "collision" point long before the probe arrived. The great miss distance also indicates an expenditure of fuel far too great for a mid-course guidance correction engine. It would seem, therefore, that the engine was intended to serve two purposes, that is, it was to shut off after the correction and then, at a suitable altitude above the Moon, restart, slowing the probe down to a soft landing. All of the 9 lunar probe failures of the period 1963-1965 -- with one possible exception -- are believed to have been attempts to soft-land a data-collecting payload on the Moon. (The 21 March 1964 launch occured 1 day earlier than would ordinarily be expected for a soft-landing attempt.)

For a listing of Soviet lunar probes and their achievements, or reasons for failure, see page 42.

The Soviets would appear to be pressing their lunar-exploration program harder than ever at this time:

- Luna 6 is the 4th Soviet lunar probe attempt in less than 4 months. Never before have the Soviets launched so many in so brief a period.
- The amount of time that Luna 6 (and, to a lesser extent, Luna 5) would be visible from the Soviets' tracking facility in the Crimea was less than it would have been for any of the Soviet lunar launches of 1963 and 1964 and the first two of this year. The Soviets obviously did not want to wait until late fall this year, when more tracking time would again be available.

(TASS; NORAD; FTD)

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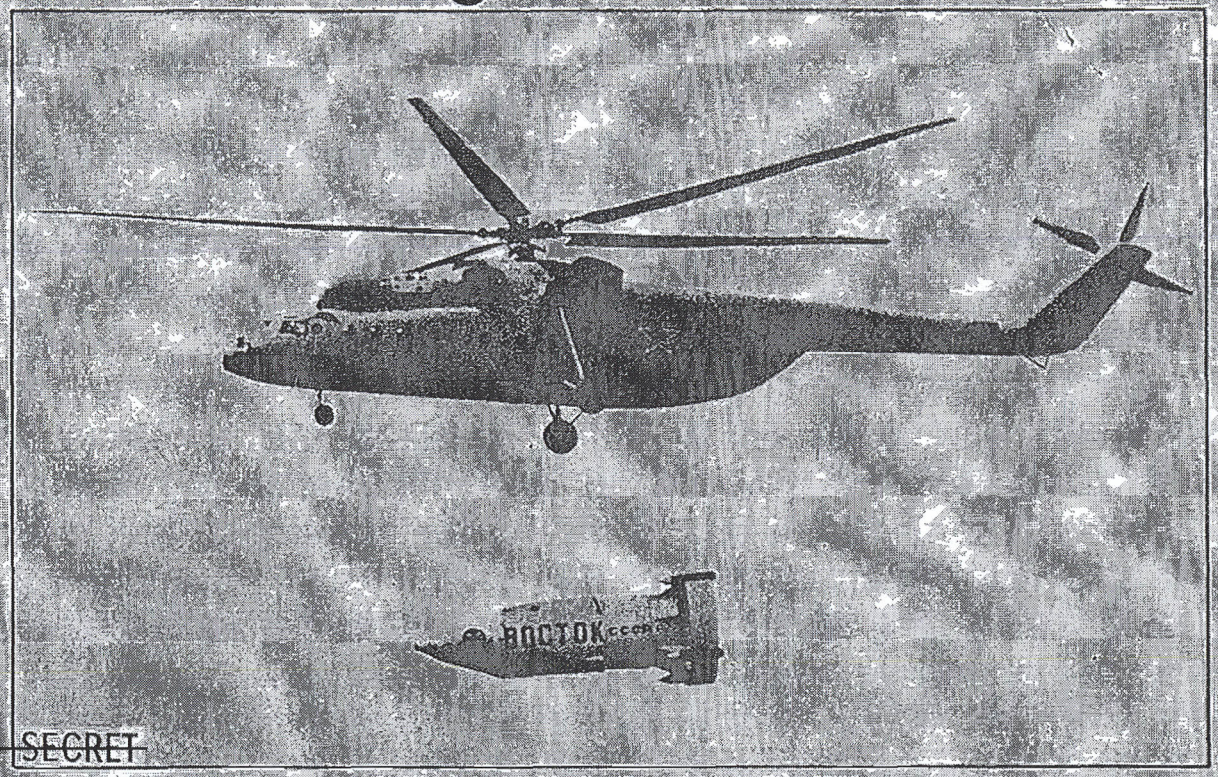
Vostok, Soviet Manned Space Vehicle



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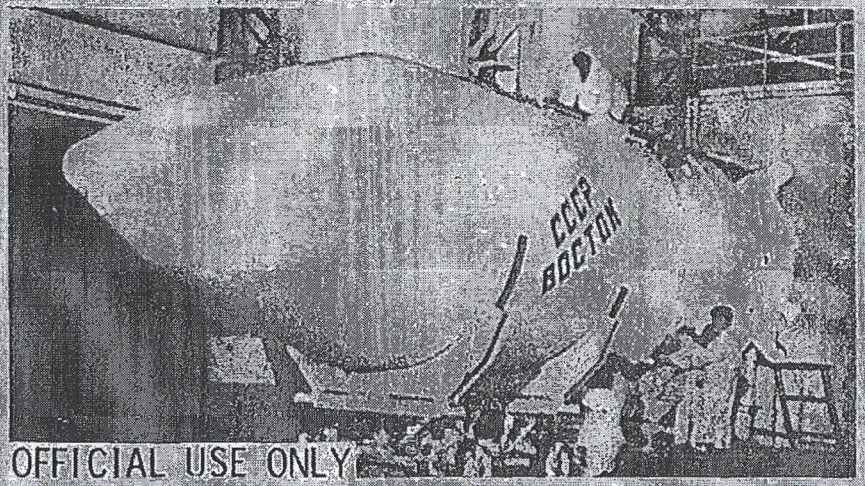
From the Soviet film "First Flight to the Stars"

Model of Vostok Displayed at Tushino, July 1961



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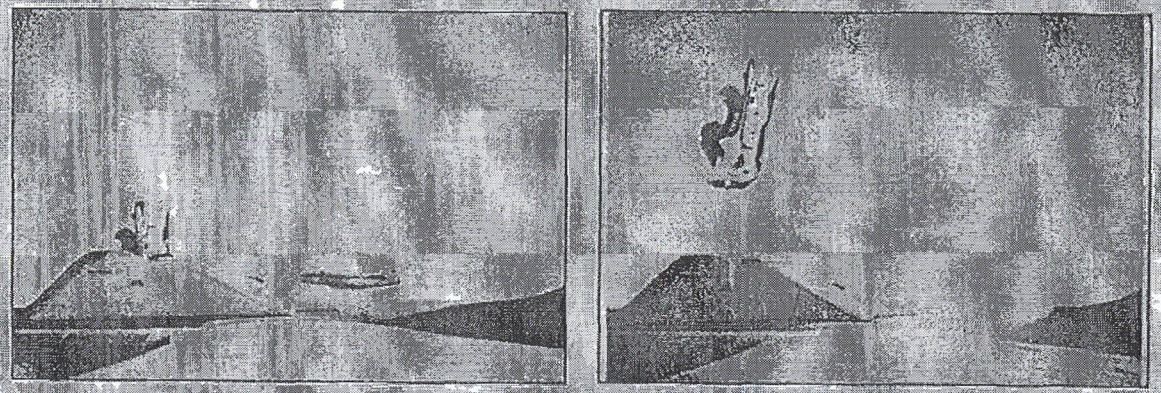
EJECTION OF VOSTOK SEAT FROM MODIFIED IL-28 BOMBER



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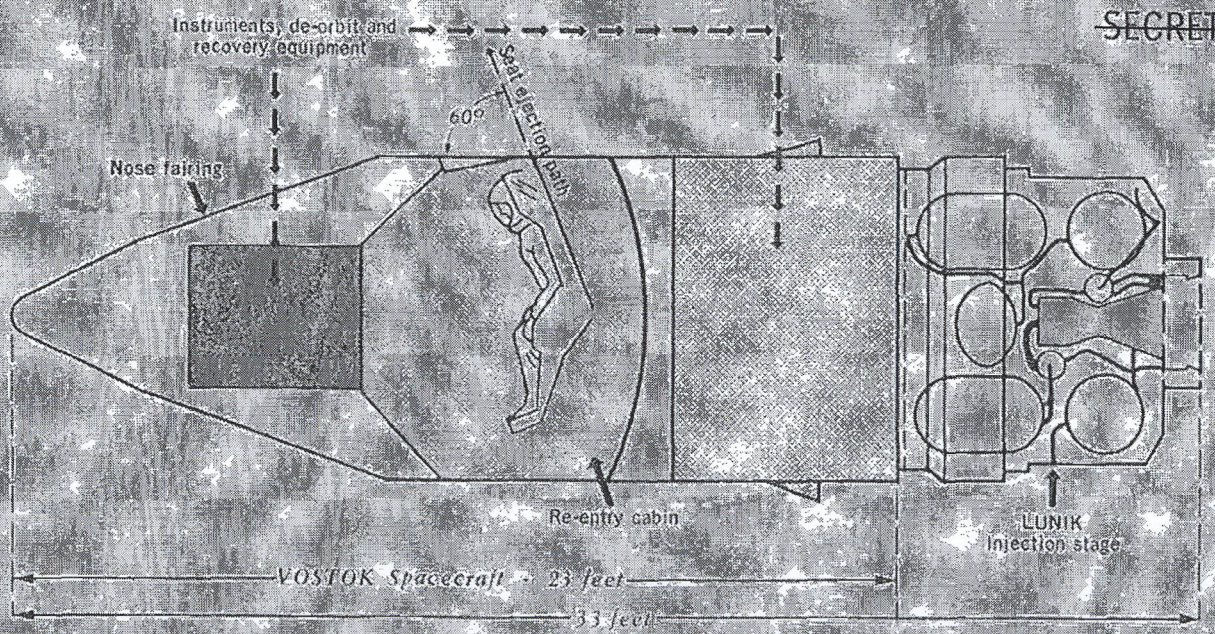
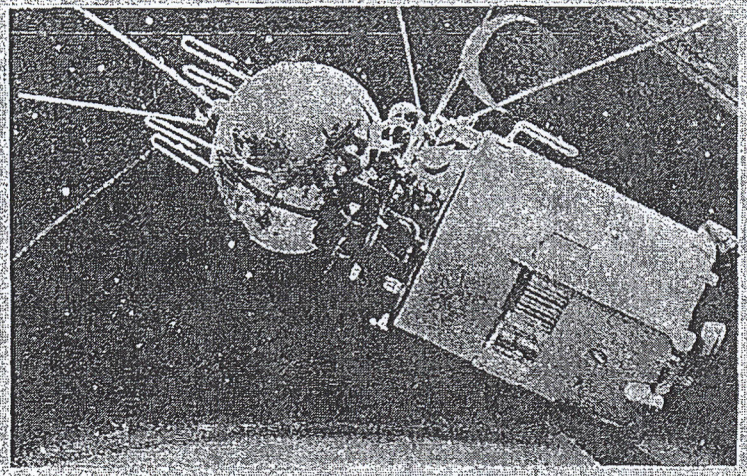
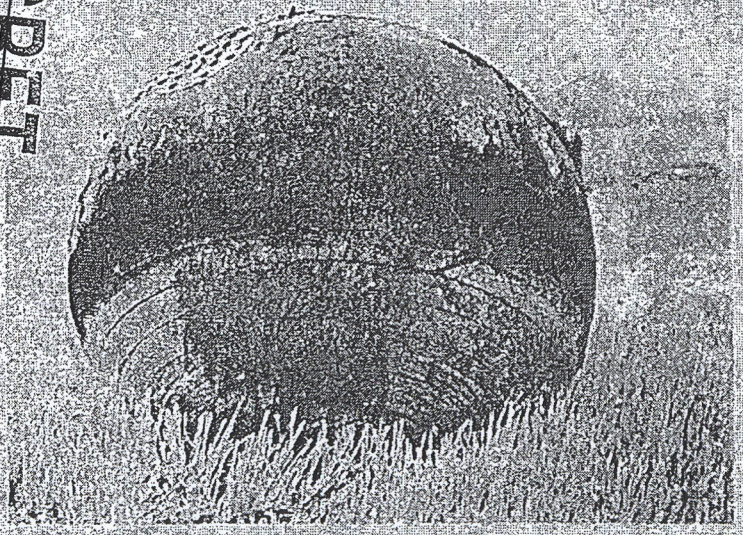
Original Western Assessment of Vostok Layout & Capsule Shape





Vostok Manned Space Vehicle
with Lunik upper stage attached
(on exhibition in Moscow)

recovered Vostok in field



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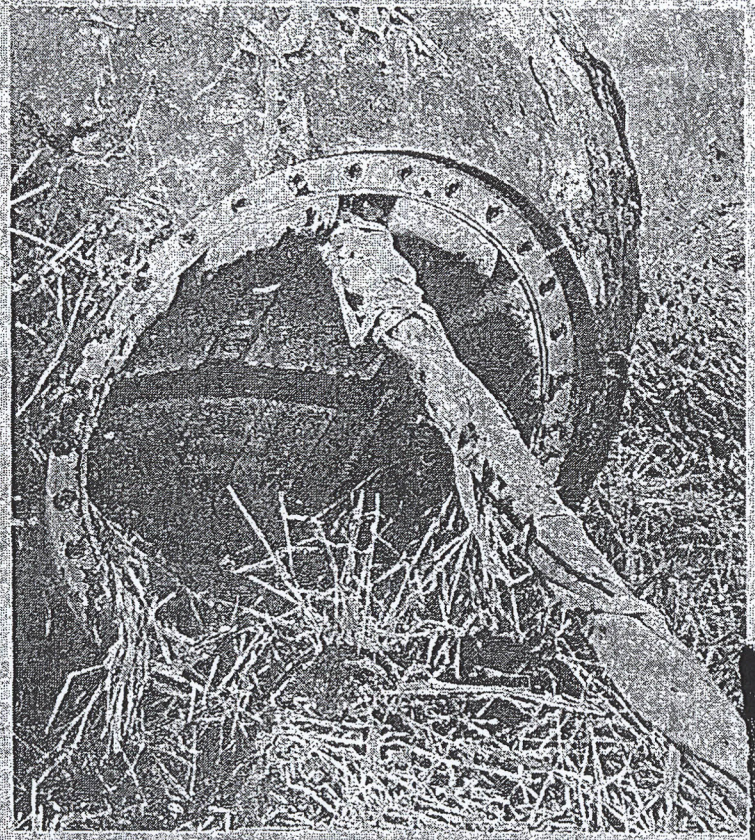

parachute compartment
(with chute line
still attached)

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Soviet Lunar Probe Attempts -- 4 December 1958 to mid-June 1965

Date of Launch	Soviet Designations	Achievements, or Reasons for Failure
[redacted]		
04 Dec 58	•	Direct ascent failed -- sustainer failure.
02 Jan 59	Luna 1	Probably an attempt to hit the Moon. Missed, went into orbit around the Sun. First man-made vehicle to escape Earth's gravitational field.
18 Jun 59	•	Direct ascent failed -- sustainer failure.
12 Sep 59	Luna 2	Impacted on Moon, its apparent mission.
04 Oct 59	Luna 3	Flew around Moon and returned to vicinity of Earth, suffering orbital decay about 6 months later. Photographed far (unseen) side of Moon and sent video pictures to Earth.
15 Apr 60	•	Direct ascent failed -- 3d stage failure.
04 Jan 63	•	Did not achieve transfer trajectory -- 4th stage failure.
03 Feb 63	•	Did not achieve parking orbit -- 3d stage failure.
02 Apr 63	Luna 4	Missed Moon by about 8500 km (4560 n. m.), according to TASS. Midcourse guidance maneuver may have failed. Went into barycentric (Earth-Moon) orbit. Soviets claim it is now in heliocentric (Sun) orbit. Probably an attempt to soft-land an instrumented payload on Moon.
21 Mar 64	•	Did not achieve parking orbit -- 3d stage failure.
20 Apr 64	•	Did not achieve parking orbit -- 3d stage failure.
12 Mar 65	Cosmos 60	Did not achieve transfer trajectory -- 4th stage failure. Launch announced to comply with UN Resolution, but true mission concealed by Cosmos designation.
10 Apr 65	•	Did not achieve parking orbit -- 3d stage failure.
9 May 65	Luna 5	Crashed on Moon when retrorockets failed to slow it for its scheduled soft landing.
8 Jun 65	Luna 6	Missed Moon by 160,000 km (86,000 n. m.) when mid-course guidance engine failed to turn itself off on command.

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