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NORTH AMERICAN AIR DEFENSE COMMAND

WIR

WEEKLY INTELLIGENCE REVIEW (U)

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WIR 21/66
27 May 66

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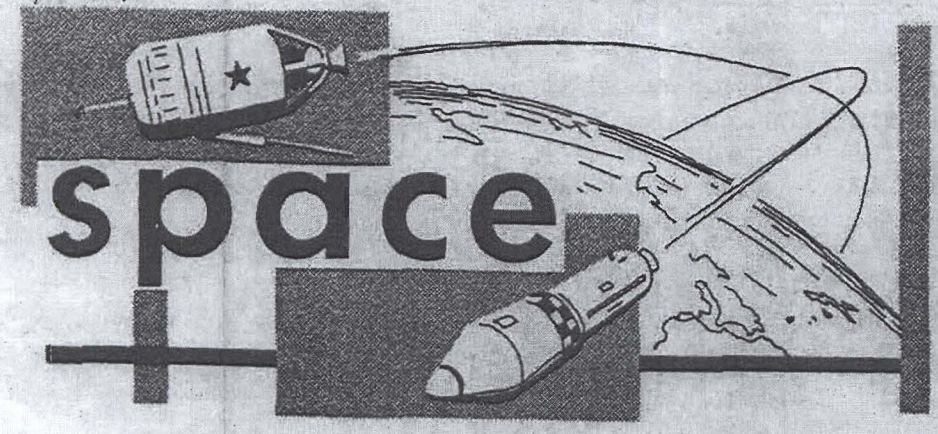
NORAD Weekly Intelligence Review

Issue No. 21/66, 27 May 1966

WIR in Brief

COVER: BADGER D (from ICEDEFOR) (OFFICIAL USE ONLY)

NOTE: Pages 28, 29, 32, 33, 36, and 37 of this issue are blank.



significant intelligence on space developments and trends

Simulators for Rendezvous, Docking, Lunar Walking Indicate Space Program Trends

Two Soviet representatives at the Aerospace Medical Association Meeting in Las Vegas, 17-22 April, said that the USSR has a rendezvous and docking simulator and a device for simulating man's performance under the reduced gravity of the lunar surface. This is the first direct evidence that the USSR has built these devices. Their existence supports long-established estimates that the Soviets intend eventually to land a man on the Moon and that rendezvous and docking experiments will be conducted. The latter will probably pave the way for the assembly in space of the large vehicle needed for a lunar landing -- a vehicle too large to be launched from the Earth in one piece.
(CIA)
~~(CONFIDENTIAL)~~

Computerized Inflight Medical Diagnosis For Cosmonauts Still in Talking Stage

A recent recommendation by Professor V. V. Parin, prominent figure in Soviet space medicine, that work should proceed on designing the equipment needed for diagnosing the physical condition of cosmonauts while in flight, indicates that little or nothing has been done to implement previous proposals along this line.

The Soviets showed an interest in computerized medical diagnosis in 1962 when they claimed that some 100 individual diseases could be differentiated by this means. In 1963, Professor Parin and another individual wrote than onboard systems for automatic processing of medical information might be of great value in providing medical control during flight and insuring the safety of cosmonauts. Such a cybernetics program, they said, depends on creating specially designed diagnostic machines. Now, some 3 years later, Parin points out that small, economical computers should be developed for space ships and effective algorithms worked out to

facilitate onboard automated diagnosis. The Soviets evidently are still in the talking or planning stage with respect to the specialized designs required. (CIA)

~~(CONFIDENTIAL)~~

Optical Tracking Station to Be Established in Mali

The West African nation of Mali has agreed to let the USSR establish an optical satellite-tracking station within its borders, according to TASS. This will be the second Soviet installation of this type in Africa, the first being the one set up in January this year at Helwan Observatory in Egypt (WIR 14/66).

Expansion of the Soviet optical tracking net outside the USSR will help compensate for the previous lack of tracking data from low-altitude locations and may supply needed data on the ejection phase of Soviet deep-space probes. Observations from the new stations may also be helpful in recovery of Soviet space vehicles, at least one of which (Voskhod 2) has been temporarily lost during recovery.

These two stations are in addition to the announced construction of a satellite station for space research at Mirnyy in Antarctica. All three will augment present Soviet mobile shipborne instrumentation stations. (CIA)

~~(SECRET)~~

Video from High-Altitude Satellites Useful for Meteorology, Says Izvestia

The 20 May issue of Izvestia printed the picture shown on page 34 and said that it was a photograph of part of the Northern Hemisphere transmitted to the Earth on 18 May by the 3d Molniya 1, which was launched 25 April. Izvestia said that the area depicted stretches from the North Atlantic across northern Europe and Asia to the shores of the Pacific. Little or nothing is recognizable in the picture except the contrast between the horizon and the Cosmos, since about 80% of the area shown was covered by clouds.

Izvestia said that cloud cover photography such as this, taken at distances of 30,000-40,000 kilometers, would be a valuable supplement to similar photography taken by satellites orbiting at much lower altitudes.

Izvestia did not make clear whether the picture was a direct video image or a photo-TV (facsimile) image. In the past the Soviets have used a photo-TV process for transmitting photography of the Earth and the Moon; this involves taking a picture of the target area, developing the picture

aboard the spacecraft, and then making a video image of the photograph for transmission to Earth.
(Izvestia; NORAD)
~~(SECRET)~~

50X1 and 3, E.O.13526

Probable Recce Satellite Fails 17 May

A Soviet attempt to orbit a probable military reconnaissance satellite failed shortly after it was launched from Plesetsk at about 1100Z, 17 May. [redacted] after lift-off indicated that the standard SS-6 ICBM booster-sustainer combination was used for launch. The type of upper stage has not been determined. The Plesetsk ICBM complex has previously launched two Cosmos-series recce satellites; one was injected into orbit by the light Lunik upper stage, the other by the heavy Venik.

Failures have been relatively infrequent during the Soviets' military recce satellite program. Of 54 launch attempts, there have been only 4 failures (11 Dec 61, 28 Nov 63, 13 Jul 65, 17 May 66), and of 50 de-orbit attempts, there has been only 1 failure.

Another launch may be attempted soon to maintain the apparently programed launch rate of 2 recce satellites per month. No standby vehicle apparently was ready, however, after the launch failure of 13 July 1965.
(NORAD)
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Cosmos 119 a KY-Launched Scientific Satellite

Cosmos 119, which the Soviets launched from Kapustin Yar (KY) at about 0530Z, 24 May, is believed to be a scientific research satellite as claimed by the Soviets. It is the fourth KY launch this year. Parameters have been announced as follows by the NORAD Space Defense Center:

Inclination	48.39 degrees
Period	99.76 minutes
Apogee	1294.8 kilometers (691 n.m.)
Perigee	699 kilometers (375 n.m.)

(NORAD)
~~(SECRET~~ NO FOREIGN DISSEMINATION -- Releasable to US, UK & Canada)

Portion identified as non-responsive to the appeal

Copper Vulnerable to Heat, But Soviets Use It to Advantage in Hot Rocket Engines

Copper and copper alloys usually are not considered for use in high-temperature environments because of their comparatively low melting point (1083° C -- 1952° F) and their low strength at high temperatures in comparison with refractories and steel and iron-chromium-nickel alloys. The highest working temperature for copper and its alloys is usually considered to be 540° C (1004° F).

The Soviets, nevertheless, appear to have used copper successfully as a liner of the hot parts of their rocket engines (combustion chamber, throat, and nozzle), where temperatures reach about 3200-3400°C (5760-6120°F) when LOX/kerosene is burned at 60 atmospheres combustion pressure. Since late 1949 or early 1950 they have been lining the inner surfaces of their engines with a copper alloy, the exact composition of which is unknown but probably consists of copper and 0.5% beryllium. For instance, two large single-chambered engines with thrusts of 100 and 150 metric tons (220,500 and 330,750 pounds) which were developed recently at Khimki Plant No. 456 reportedly were lined with copper alloy.

The Soviets have been able to derive a number of advantages from this use of copper or its alloys.

Overcoming Copper's Vulnerability to Heat. A major factor in the Soviets' success in using heat-vulnerable copper in the hot parts of rocket engines is a layer of cuprous oxide which forms on the inner (exposed) surface of the liner as a result of the fabrication process. The 100-ton and 150-ton engines, for example, were fabricated in 3 sections: combustion chamber, throat, and nozzle. The various parts of these components were tack-welded or brazed, the 3 sections assembled, and the entire unit was then furnace brazed at 900° C (1652° F). The heat of the brazing causes the formation of the cuprous-oxide layer, which adheres to the surface of the copper alloy. Though cuprous oxide may not be thought of as a reflecting surface because

it reflects visible light poorly, it is an effective reflector of infrared radiation, even in the presence of the hydrocarbon combustion products of a rocket engine. Over parts of the IR its reflectivity is as much as 95 percent. And, since about half of the heat transfer from a hydrocarbon flame to the walls of the combustion chamber occurs through radiation (the other half is by convection), the cuprous oxide layer reduces heat transfer by 40-50 percent.

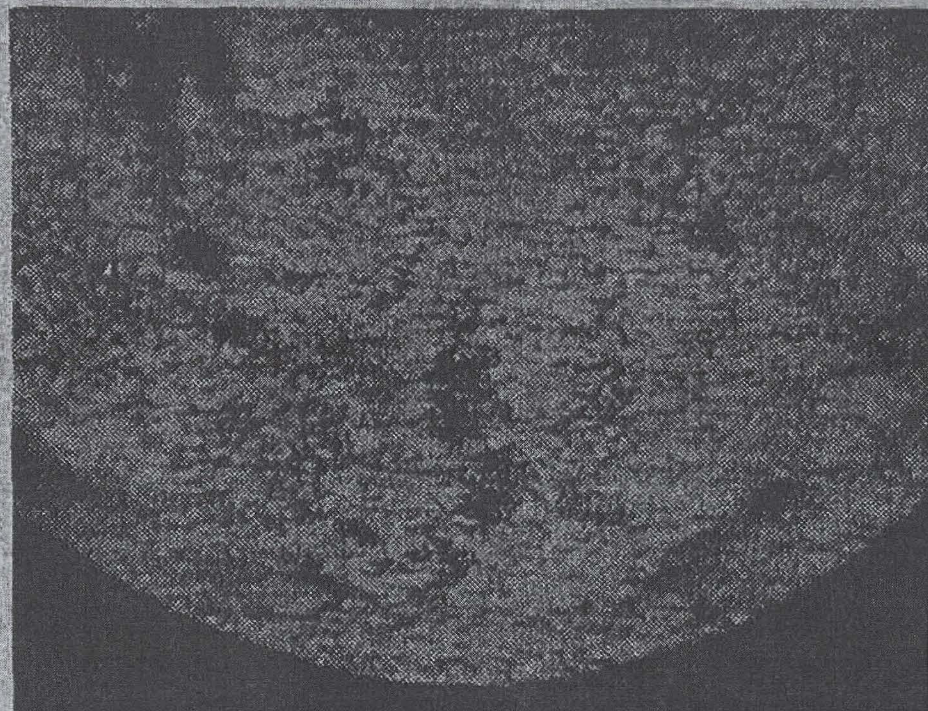
Cuprous oxide, moreover, has low thermal conductivity; thus, the rate at which heat is transferred from the flame to the coolant (via heat-vulnerable copper alloy liner) is further reduced. But the copper-alloy liner itself is a good heat conductor (20 times as conductive as stainless steel, for example) so it rapidly passes heat to the coolant.

Advantages of Using Copper. Copper has several advantages over other materials also used as engine liners. It is easily fabricated and requires no surface protection against corrosion and erosion by hot combustion gases. (It has been found that erosion, even in the throat area, where maximum effects are expected, does not essentially change the dimensions of the throat.)

The major advantage, however, is the fact that the reflection of infrared radiation back into the combustion area aids in maintaining efficient and stable combustion. Hydrocarbon combustion is composed of a particularly complex series of chain reactions involving a variety of intermediate molecules, atoms, and radicals which apparently are needed to intitiate and sustain flame propagation. Thus, smooth and efficient combustion reactions are continued by maintaining a concentration of activated material. Smoothing of the reaction rates helps to prevent an alternate slowing and build-up of reactions, thus effectively reducing instability and detonation, which can be catastrophic.

The high reflectivity of the cuprous oxide and its poor thermal conductivity also enable the Soviets to operate their engines at higher combustion pressures. These high pressures, plus the improvement in engine efficiency derived from reflected IR radiation, should permit the Soviets to obtain equivalent performance from cheaper fuels, such as kerosene. Kerosene burned with LOX at the 882 pounds per square inch (psi) used by the Soviets would have performance equivalent to that derived from LOX/hydrazine burning at 580 psi. Many operational US rocket motors which burn LOX/hydrazine have chamber pressures of 450-600 psi.
(US Navy)
~~(SECRET)~~

Video Image of the Earth
Received from 3d Molniya 1



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