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NORTH AMERICAN AIR DEFENSE COMMAND

W I R

WEEKLY INTELLIGENCE REVIEW (U)

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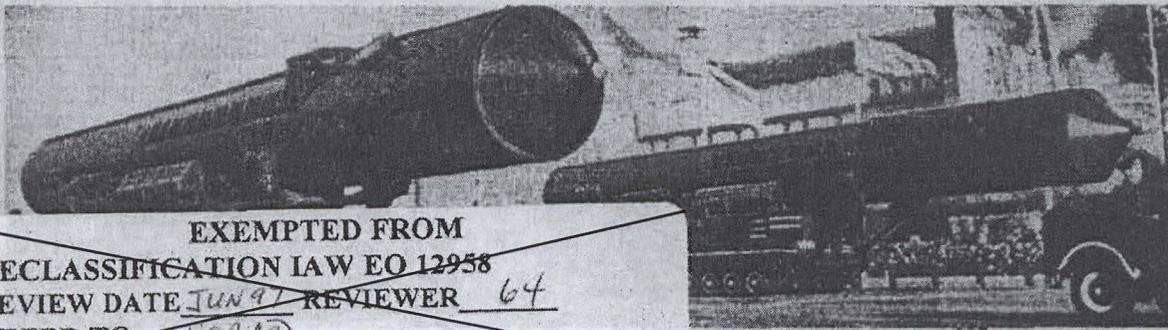
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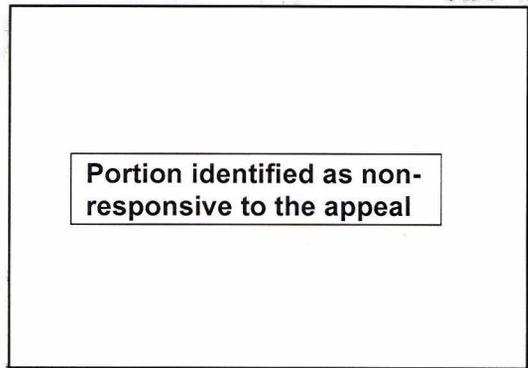
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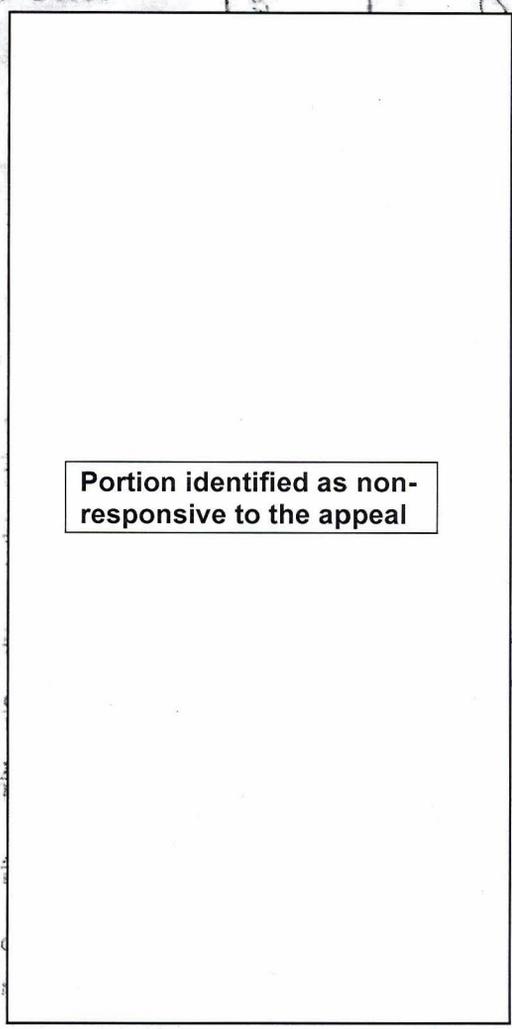
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Issue No. 4/67, 27 January 1967

The WIR in Brief



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Space

AMMONIA MASER, LIKE ONE ABOARD COSMOS 97, HAS SEVERAL SPACE USES

Device simple in design, has highly stable frequency.

FIRST SOVIET LAUNCH OF 1967 IS COSMOS 138, A RECCE SATELLITE

Launched from Plesetsk.

NONSTANDARD ATMOSPHERES, AS IN U.S. SPACECRAFT, SLOWS LEARNING, ADAPTABILITY, SOVIETS SAY

Experimental support claimed for statement, LARGE-SCALE LIQUEFACTION OF HYDROGEN MAY BE PENDING, POSSIBLY FOR UPPER STAGE OF SPACE ROCKET

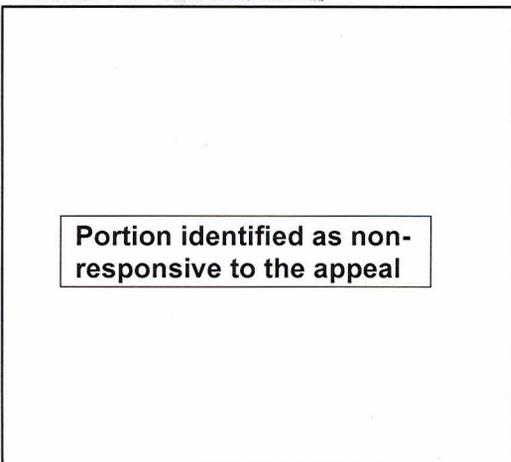
US uses liquid hydrogen in Saturn 4B.

SOLAR STUDIES WITH NEW RADIOTELESCOPE COULD IMPROVE FLARE PREDICTIONS FOR MANNED FLIGHTS

Studies made at 8 mm wavelengths.

COSMOS 139 APPARENTLY ANOTHER ORBITAL BOMBARDMENT SATELLITE TEST

Success or failure not known.



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significant
intelligence
on space
developments
and trends

Ammonia Maser, Like One Aboard Cosmos 97, has Several Space Uses

Cosmos 97, which the Soviets launched from Kapustin Yar in November 1965, carried an ammonia gas-beam maser, according to the Soviet press (p. 9, WIR 45/66), to test its operation in a space environment. Such a device could improve the mission potential of many types of spacecraft which require extremely precise timing instrumentation or transmissions on an extremely stable radio frequency.

An ammonia maser is essentially a low-power narrow-bandwidth microwave amplifier operating at the ammonia transition frequency of 23,870 mhz. Its most outstanding attribute is a frequency stability several orders of magnitude better than that of conventional oscillators. A short-term stability of a few parts in 10^{12} (1 trillion) and a long-term stability of a few parts 10^{11} (100 billion) are common for these masers. This extreme stability at this superhigh frequency enables highly accurate timing and very precise determination of range and range rate. Greater accuracy in these areas would improve satellite capabilities in several areas, the most important of which are:

- Satellite tracking.
- Navigation and communication by Earth satellite.
- Communication with and tracking of deep-space probes.
- Rendezvous and docking of space vehicles.
- Geodetic investigations conducted by satellites.
- Programs which require precise timing.

Satellite-mounted masers will also permit performance of unique experiments concerning gravitation and relativity.

Although more stable maser generators are available, the ammonia maser is simpler in design and would present a less severe reliability problem in space applications. The Soviets, therefore, are likely to keep on using the ammonia maser in near-term space uses.

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NORAD Comment: The relativity experiment, which has been the subject of much discussion, would test the validity of that proposition of Einstein's general theory of relativity which says that time passes slower for a body in motion than for one at rest in the ratio

$$\frac{T_m}{T_r} = \frac{\sqrt{C^2 - v^2}}{C}$$

where C is the speed of light, v is the speed of the body in motion, T_m is the rate of time passage for a body in motion, and T_r is the rate of time passage for a body at rest. In other words, a moving clock would keep slower time than one at rest, a moving oscillator would oscillate more slowly than one at rest. The difference is significant at speeds close to that of light (186,000 miles per second), but difficult to detect at lower speeds, even those associated with ordinary space flight. For example, a clock which orbits the Earth at a speed of 5 miles per second would lose only 0.000016 second in 24 hours.

The idea of the proposed experiment is to synchronize the timing pulses of two highly precise oscillators, inject one of them into orbit, and then determine by comparing their emissions whether the one in orbit operates at a lower frequency than the one on the ground. (This paragraph is UNCLASSIFIED)

(FTD; NORAD)

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First Soviet Launch of 1967 Is Cosmos 138, a Recce Satellite

Cosmos 138, a military reconnaissance satellite, is the Soviets' first satellite of 1967. Launched from the Plesetsk complex at about 1240Z, 19 January, it carries a medium-resolution camera system and probably has an electronic intelligence collection capability. It will probably be de-orbited on 27 January.

Cosmos 138's orbital inclination is about 65 degrees, the same as that of Cosmoses 129 and 136, also launched from Plesetsk. All other Plesetsk launched recce satellites have had orbital inclinations of about 72 degrees.

(NORAD)

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Nonstandard Atmospheres, as in US Spacecraft, Slows Learning, Adaptability, Soviets Say

Soviet space-medicine literature has criticized the US for supplying nonstandard atmospheres in the cabins of manned spacecraft, claiming that such atmospheres cause metabolic stresses which adversely affect physical functioning. US data also suggests that undesirable physiological changes can be caused by breathing nonstandard atmospheres, since each component of the standard atmosphere appears to exercise its own influence on the body. In space flight, these changes are additive to those posed by the unusual space environment, thus increasing the probability of stress.

The Soviets also claim that the depressed physiological state which results from breathing nonstandard atmospheres decreases speed of learning in the face of new and unusual situations, such as those which could present themselves during space flight. They now claim to have experimental support for this belief. They report that mice which breathed an atmosphere in which helium was substituted for the nitrogen content but the oxygen percentage was undisturbed:

- Consumed more oxygen.
- Experienced a decrease of body temperature.
- Required more time to form conditioned reflexes (learning).

After exposure to the modified atmosphere for 40 days, the mice required two weeks of exposure to normal air before biological conditions returned to their standard values.

(CIA)

(UNCLASSIFIED)

Large-scale Liquefaction of Hydrogen May Be Pending, Possibly for Upper Stage of Space Rocket

The Soviets appear to be preparing to produce liquid hydrogen on a large scale, judging by several pieces of evidence. The latest piece is a report that cryogenics expert V. I. Yepifanova had been transferred from Moscow University to the Bauman Institute to conduct a course in hydrogen liquefaction and other low-temperature technology. Yepifanova earlier had been reported as stating that the USSR would soon have a plant for large-scale production of liquid hydrogen.

The most likely use for large quantities of liquid hydrogen in the USSR would be as fuel in the upper stage of a space rocket. Hydrogen has greater thrust per unit weight than other standard chemical propellants. The US intends to use liquid hydrogen in the Saturn 4B which was developed for the Appollo manned lunar-landing program.

(CIA; NORAD)

~~(CONFIDENTIAL)~~





Solar Studies with New Radiotelescope Could Improve Flare Predictions for Manned Flights

A new 22-meter radiotelescope recently put into operation at the Crimean Astrophysical Observatory in the USSR reportedly is being used to study solar emissions at 8-millimeter wavelengths. US observations at millimeter wavelengths indicate that these studies could be useful in early detection of solar flares.

Flare forecasting is important in the scheduling of manned space flights and of HF radio communications, since the huge amounts of corpuscular radiation incident to these flares disrupt HF radiowave propagation and could be harmful to men in space.

The new 22-meter dish in the Crimea is an improved version of an instrument of similar size at Serpukhov which has been used mainly in the lunar and planetary programs. Improved pointing and surface accuracies of the dish should enable the Soviets to conduct highly accurate solar radio mapping at millimeter wavelengths.

(CIA)

~~(CONFIDENTIAL)~~

Cosmos 139 Apparently Another Orbital Bombardment Satellite Test

Cosmos 139, which the Soviets launched from Tyuratam at about 1356Z, 25 January, is believed to have been another test of an orbital bombardment system, contrary to TASS reports that it is an instrumented scientific-research satellite.

It is not known whether the test was a success. A large number of objects appeared in orbit, suggesting that the vehicle exploded after an expected attempt to de-orbit it. However, there is also a possibility that the explosion or apparent disintegration was deliberate -- in a test of penetration aids.

This is believed to be the Soviets' 6th in a series of tests of an orbital bombardment system which began in December 1965. The first 3 tests were suborbital: the first failed, the second may have been successful, and the third is believed to have been a success. The next 2 tests, which seemingly were intended to be carried out to full orbital range, failed when the payload apparently exploded or disintegrated.

An orbital bombardment system would carry less destructive might than an ICBM of equal thrust but would be less vulnerable to detection and tracking by a defensive system.

The data from the 25 January event are still being analyzed. A final assessment of the operation will be covered in a later issue of the WIR.

(NORAD)

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