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FUTURE SOVIET EARTH SATELLITE CAPABILITIES

PROBLEM

To define near future Soviet earth satellite Space Vehicle capabilities.

CONCLUSIONS

It is concluded that Sputnik III, by the use of a combination of propulsion stages, could be one of the following types:

1. A 160-300 lb scientific earth satellite.
2. A large satellite up to 5,000 lbs containing an animal passenger with the intention of returning the animal to earth.
3. The orbiting of a preliminary (1000 - 5000 lbs) reconnaissance satellite.
4. Impacting a payload (100 - 400 lbs) on the moon.

In view of the extremely high priority placed on the effects of outer space on mammals and high interest in manned space flight it is considered most probable that Sputnik III will contain an animal suitable for space studies.

DISCUSSION

The Soviet Union announced that Sputnik I, orbited on 4 October 1957, had a weight of about 185 lbs. and Sputnik II, orbited on 3 November 1957 had a weight of about 1120 lbs. Sputnik III could probably be launched at any time and, according to Soviet statements, additional satellites will probably be launched at about one month intervals throughout the remainder of the IGY.

We believe that the Soviet ICBM and the Soviet earth satellite vehicles probably utilized the same first and second stage propulsion system. The Soviet ICBM is estimated to have a gross weight of about 300,000 lbs. with a propulsion system consisting of paired nominal 100 metric ton thrust engines or an equivalent single engine in the first stage and a nominal 35 metric ton engine in the second stage.

Additionally, although no evidence exists, we believe the Soviets are probably capable of adding a third propulsion stage to this system. The capability of such a staged propulsion system to orbit satellites or propel payloads to the moon are approximately:

<u>STAGES</u>	<u>CONFIGURATION</u>	<u>SATELLITE WT. ORBITED</u>	<u>MOON IMPACT WEIGHT</u>
1. 2	paired <u>100</u> mt engines plus a <u>35</u> mt engine	200 lbs	----
2. 2	paired <u>120</u> mt engines plus a <u>35</u> mt engine	1200 lbs	----
3. 3	paired <u>100</u> mt engines plus a <u>35</u> mt engine plus <u>12</u> mt engine	3000 lbs	100
4. 3	paired <u>120</u> mt engines plus a <u>35</u> mt engine plus <u>12</u> mt engine	5000 lbs	400

The use of super fuels in large quantities would allow greatly increased payload weights, but would also introduce hazardous handling problems for personnel, and cause equipment and site contamination problems. Major thrust unit component redesign would also be necessary, requiring additional R & D flight tests. None of these problems are insurmountable but do take time to solve. Small quantities of super fuels (up to about 10%), however, could be added to conventional fuels without particular difficulty thereby increasing the specific impulse and allow payload weights to be increased to some degree. There have been contradictory statements by knowledgeable Soviet officials about whether a super fuel was used in the Sputnik II launchings, and firm knowledge on this point is lacking.

We believe that the present Soviet capability for Sputnik III probably includes the orbiting of up to about 5000 lbs. of satellite. We believe that Sputnik III will be in one of the categories, which are discussed in the following:

1. The orbiting of a 160-300 lb. scientific earth satellite.
2. The orbiting of a large satellite (up to 5000 lbs.) containing an animal passenger with intention of returning the animal to earth.

3. The orbiting of a preliminary (1000-5000 lbs) reconnaissance satellite.

4. Impacting a payload on the moon (100-400 lbs).

If Sputnik III is devoted to purely scientific aspects of upper atmosphere research, it will most probably carry instrumentation for the study of cosmic rays, x-rays, ultraviolet radiation, the earth magnetic field, temperature, pressure, meteors and ionospheric phenomena. A 300 lb. satellite could carry the necessary equipment and power for about two-three weeks of transmissions providing satellite transmissions were not continuous. Satellite to ground command data readout would have to be fairly frequent due to limited data storage facilities in a satellite of this size.

The biological experiment in Sputnik II could have allowed determination of a dog's major physiological reactions during launching and at high altitude with a single major exception of cosmic radiation effects. Recovery and study of the animal is essential to this radiation effects determination. The effort involved in returning a mammal to earth includes the provision of an additional propulsion stage to remove the satellite from orbit and provision of escape or deceleration apparatus to allow safe re-entry conditions. It is possible that the first satellite intended to return an animal to earth will have a low orbit, short life and more predictable recovery location.

While Soviet interest in a reconnaissance satellite is probably not as high as that of the US, the capability to orbit at least 1200 lb. satellite (by two stage rocket system) is high and includes the possibility of the payload being optical or electronic reconnaissance equipment and the transmission of such information to Soviet recording stations. There is no reason to believe that the USSR would not be able to provide this equipment.

The fact that a longer interval of time has been required to launch Sputnik III may be indicative of a more complex launching device, such as a three stage vehicle orbiting a large satellite or a lunar flight.

Implicit in the Soviet orbiting of a mammal in their second satellite attempt is the extremely high priority placed on the effects of outer space on mammals and high interest in manned space flight.