ELEKTRA FOR REVIEW

SUBJECT: Meeting of Upper Atmosphere Rocket Research Panel

1. At the invitation of Air Force Scientific Advisory Board, I attended a meeting of the Upper Atmosphere Rocket Research Panel on 6 September at the J. S. Lawrence Laboratory, Columbus, Ohio. The two agenda items of primary concern were: 1) After Altitude and Satellite Vehicles, 2) International Geophysical Year, and the logistics thereof.

2. This panel was formed in 1952 by representatives of various organizations which were concerned with upper atmosphere research through rockets. It is chaired by Dr. James L. Van Allen who is Chairman of the Department of Physics, State University of Iowa. The panel has representation from: Brown University, University of Chicago, J. W. Brown Laboratory, General Electric Company, J. S. Lawrence Laboratory, Air Force Institute of Technology, Institute of Nuclear Physics, Inc., Harwell, University of California, Institute of Technology, and Harvard Observatory. It has no official connection with any rocket or experiment and is informally supported by the Office of Naval Research. In connection with the forthcoming International Geophysical Year, it has been assigned the function of reviewing the United States program for upper atmosphere research through the use of high altitude rockets.

3. At the 6 September meeting, there were in addition to the panel itself, representatives from the Office of Aeronautics, United States Navy, the Western Research, Inc. Corporation, the Office of Naval Research, Aerophysics Development Corporation, Air Force X-15, National Science Foundation, etc.,

4. The meeting opened the discussion of the first agenda item - After Altitude and Satellite Vehicles - by a discussion of past upper atmosphere research with rockets. It cited the extensive use of -75 which could carry 2,500 pounds payload to a 100-mile altitude, the ability of which has been demonstrated. It received the -50, which was not used as a direct one shot, primarily because it could carry only 25 pounds to an altitude of 60 miles. The -50 was therefore used as a second stage in combination with the T-2 and achieved an altitude of 200 miles. The combination of the T-2 only, its own rocket, has been developed and used as a single stage rocket. These are the rockets which in its present form can carry 400 pounds payload to 135 miles.
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altitude and in its forthcoming modifications will carry 500 pounds to 100 miles altitude. The second rocket in the scheme which can carry 200 pounds payload to 60 miles altitude. In addition to these two, there is also the ISV which is a system of launching a rocket from a "stratos" balloon. The launch is made at a balloon altitude of approximately 125,000 feet and the rocket carries 30 pounds of instrumentation to an altitude of 60 miles. Dr. Van Allen concluded his presentation by stating that, from here on, civilian upper atmosphere rocket research will probably be curtailed, due to lack of civilian funds, even the military rockets being covered now by the Department of Defense. He then introduced Mr. and Mrs. of the Harvard Observatory for a discussion on Earth Satellite Vehicles (ESV).

5. Mr. did as stated that the interests of civilian research and of the Department of Defense in ESV are synonymous. He pointed out the main scientific aims which could be made through the ESV which have application both to civilian sciences and to defense. These include meteorology, astronomy, solar-terrestrial relations, for ultraviolet and X-ray research, etc. He described the ESV sequence as being in three phases as follows:

(1) The placing in orbit of an observable object (uninstrumented) which could be seen either optically or by radio.

(2) The placing in orbit of an instrumented vehicle, "an armed physical laboratory". This place will be a precise research station starting with a very small vehicle similar to the other RV which will carry telemetry equipment. Solar energy will be gathered as energy and more reliable power units are developed. Once latter will probably be nuclear or solar energy plants. Instrumentation such as telescopes will progress through more complicated stages until television and finally a telescope is included. The last stage in this phase will be a remote controlled vehicle.

(3) The final phase of ESV will be the putting in orbit of a named satellite vehicle.

6. Mr. did as mentioned that the placing of a star in orbit was in fact the first step in the process. He stated that such a vehicle even without instrumentation could produce useful scientific results such as the density characteristics and relative positions on the stars. The main problem in connection with a satellite is the effect of observation from the earth, which will require much study. This problem will be simplified if the ESV is on either an equatorial or a polar orbit, in regard to
the unmanned instrumented vehicle (Phase 2), he said that the main problem will be development of small reliable power plants; television, the technical detail of which is already well along; orientation of the vehicle itself and of the instrumentation carrying; and eventual reduction of weight of the equipment to be carried. He stated that the altitude at which the vehicle should orbit will depend upon the purpose envisaged. Theoretically, an altitude of 1,000 miles at a speed of 5 miles per second would be ideal. This would provide a 5-hour orbit.

7. The Air Force, through Dr. C. R. Paul, made the next presentation concerning high-altitude vehicle projects. The project has three main projects in this field, the first of which is the development of a manned conventional aircraft to operate at a maximum altitude of 500,000 feet. Two designs are presently under consideration—the Bell X-1 and the Northrop 553. The latter is designed to have an altitude of 700,000 feet. (Note: this field of study is covered in report No. 7-12/1120), "Altimeter and High-Speed Study" by Douglas Aircraft Corporation. (Continued.) The second AS project is development of a special high-altitude balloon to operate at 100 to 200,000 feet. The system would be based on the "skynyrd" polyethylene balloon carrying a capsule equipped to sustain one or two men. The third AS project is for manned space flight and the study of this is being conducted at the Aero Jet Laboratory. The first phase of this latter project is called Phase I; the purpose of which is to place a TV in orbit at an altitude of 200 miles in order to secure meteorological and astronomical data at that level as the first step toward higher-altitude work. Project IMA has been tentatively approved by the Navy and ONR is going ahead with it in cooperation with the Army. It is now also being conducted with the Air Force at a very high level. The project calls for the use of the Army Atlas rocket (see para. 8 below) as the first stage with the I-10 cluster (see para. 9 below) providing the second and third stages. Under Aero Jet leadership, four subsidiary studies are planned to be undertaken as follows:

1. A stability study to determine the size and weight of the vehicle required at an altitude of 100 miles. It is hoped that Mr. Fred Whipple will be the leader of this.

2. A orbital study to determine the power required, the radiation rating, etc. It is hoped that Mr. Fred Singer of the University of Maryland will head this.

3. A near-trajectory study to determine the final design and the staging requirements.
(b) A Lawrence study to determine where and how the vehicle should be located, the logistics requirements, and the range risks involved.

Following the completion of these four studies, construction of the actual vehicle will be commenced. It is considered that successful completion of project 780 will lead into the launching of a vehicle similar to the T80 project itself, an instrumented vehicle using a polar mount at an altitude of 22000 feet. It is expected that this could remain intact for ten days while the T80 could probably remain intact for about one month. The Lawrence estimated that if complete testing is available for project 780, it might well be used during the International Geophysical Year as lead great states on the necessity for the United States being the first in launching an instrumented test that project 780 was absolutely essential to achieve this end.

Be the release of Lawrence annual then give a briefing on the location studies. The vehicle used normally as a tactical weapon has a range of 200 miles with a trajectory apex of 15 miles. If used as a research tool, it has a vertical range of 100 miles with a ceiling of about 15,000 feet. This required well which is not under construction will have a vertical range of 22000 miles with an available weight allowance of 7000 pounds. Instrumental in this concern is the selection of these missiles as research instruments. They will cost $10,000 to $25,000 per missile if more than five are used. As proceeds, they have a speed of approximately 1500 miles.

C. The Lloyd of Delaware Incorporated Company described the T360 as a tactical missile that they are constructing as an air force project. The vehicle consists of two clusters of eight rockets: the first cluster of seven acting as the first stage booster and second cluster of four exhausting the excess store. It has a speed of Mach 10 and a duration of 30 seconds. Simulated vertical range is 100,000 feet. It is desired to follow a vertical range of 22000 feet. It is planned to use either a Jakian or a folding radar reflector for tracking purposes. In service, it is intended to use an altitude of 20 miles with a speed Mach 1. In fact, the second stage achieves 1500 miles. The missile has yet to be flown vertically as a research instrument. No studies indicated that the second stage cluster could be expected to carry 12 pounds of research payload.

D. The Army report was convened briefly on a design which they are considering. This consists of the third booster as the first after the main rocket as the second stage. It is estimated that this vehicle could attain an altitude of 12,000 feet. This would be very low cost, in the range of $7,000 to $15,000.
II. The utilization of the National Science Foundation gave a brief account of the possibility of a total of $200 million worth of rocket research. The estimate was that approximately $100 million will be available this year and $50 million of this will be transferred immediately to the Air Force for procurement and accounting purposes. The balance of the rocket project funds - $500,000 - will become available next year.

12. Following adjournment of the panel meeting, I spent a couple of hours with Mr. Schellin, the law officer under me for a time back in New York. The Allen was one of the key figures in the development of the VT-24 rocket motor, and was one of the officials assigned to introduce the fire to the Pacific Ocean. In our conversation, I mentioned the difficulty that we might experience in the development of the rockets, particularly with solid propellant. I mentioned specifically the difficulty we encountered in the use of the liquid nitrogen, etc., and Mr. Allen said that he had found that there should be no such difficulty. He pointed out that the VT-24 contained a high percentage of a liquid and a solid, and that this instrument, with a high percentage of solid propellant, would withstand 20,000 times more than liquid propellant. He also pointed out the fact that the instrument had been in use for something like 12 months at different places in the world, and that he had no trouble whatever in introducing instrumentation.

In regard to the question of the priority, he arrived with Mr. Allen, and I would still like to believe that the University plans were of a high enough priority that it would be possible to put a ship in which the time of the test, I think, possibly even put up an instrumented vehicle.

[Signature]
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