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HOLMES CALLS FOR LUNAR EXPLORATION AS NATIONAL GOAL. D. Brainerd Holmes, former director of the U.S. manned space flight program, said yesterday that manned exploration of the Moon should be established as America's next national space goal after the manned lunar landing.

Holmes, a senior vice president of Raytheon, told a National Space Club luncheon in Washington that development of equipment and formulation of plans for exploration of the Moon should be undertaken now. He said this would "maximize the investment" the U.S. has placed in the lunar landing program. The former NASA deputy associate administrator said the U.S. manned space flight program has "progressed tremendously" but he said that a successful lunar landing would "just scratch the surface." The benefits from lunar exploration are unlimited, he said.

It is imperative that the public be sold on the NASA program, Holmes said. "We must sell the program from top to bottom... There is no turning back. The program must be sold with fire." The Raytheon executive said that NASA's **AA (APOLLO Applications)** program was confusing to the public. He said the program must be explained to the public much more clearly. It is mandatory that we have public support in stepping up **AA** "to prevent a serious gap after (the manned lunar) landing."

On other points Holmes said: 1) The first seven years of the NASA space program have gone "remarkably close to plans." He said the next five years would involve a commitment of approximately \$25 billion. 2) The U.S. needs both **GEMINI** and **MOL**. He said he was glad to see the Air Force getting into space, and he said he hoped **MOL** would be accelerated. 3) If the Soviets land on the Moon first it will probably accelerate the U.S. program. 4) He is not in favor of transferring funds from the **APOLLO** lunar landing program to the post-**APOLLO** program.

MOL/AA OVERLAP NOT ENVISIONED--MILLER. Representative George P. Miller (D-Calif.), Chairman of the House Space Committee, in an interview with **SPACE Daily** declared that he was "satisfied" that there was no major duplication of effort in the Air Force **MOL** program and NASA's **AA** space station program. He says his conviction is based on the result of the executive hearings on the **MOL** program by his committee last week.

The Chairman supports the Air Force's decision to launch the manned flights of the **MOL** from Vandenberg (yesterday's (**SPACE Daily**) AFB in California. He says Cape Kennedy is the best site for near equatorial launchings but that WTR was best for polar orbit launches. Miller explains that polar launches from Kennedy have to arc near Miami, Havana and

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South America, whereas launches from WTR arc over the Pacific and do not pass over land until they go over Alaska on a southward leg. The chairman also pointed to the extensive launch experience and facilities at Vandenberg, the experienced recovery teams which the Air Force has based in Hawaii, and the excellent weather. The absence of the necessity of a dog leg launch trajectory also will increase the payload capability of the **TITAN III-C** launch vehicle if it is launched from WTR.

Reviewing the closed hearings of last week which probed the extent of duplication of **MOL** (the Manned Orbiting Laboratory) and the **AA** (**APOLLO** Applications) programs, the chairman admitted that the Air Force frequently has been accused of parochial service jealousy, but said "I don't see it here". He praised the new type of Air Force officers who are primarily investigators, engineers, scientists and managers. He also commented that he was satisfied that the military mission could not be performed adequately on the NASA space stations and that the **MOL** program was achieving the maximum use from NASA manned space flight research.

OAQ/AOSO/SURVEYOR/COMPUTERS TO STAR IN KARTH HEARINGS. **OAQ, AOSO** and NASA computer policies will receive major attention in addition to the **SURVEYOR** during Representative Joseph E. Karth's (D-Minn.) Space Science and Applications Subcommittee hearings beginning this Thursday (SPACE Daily, Feb. 4).

The troubles of the **SURVEYOR** program, its management problems, why the need for the Block II "operational" **SURVEYORs**, the continual slippages in schedules, and the success of **LUNA IX**, its competitor, will take up a large section of the hearings (SPACE Daily, Feb. 11).

The **OAQ** (Orbiting Astronomical Observatory) has remained on schedule with the first launch set for March 10 (SPACE Daily, Feb. 3), but the cost overruns have apparently risen significantly. NASA's cancellation of **AOSO** (Advanced Orbiting Solar Observatory) (SPACE Daily, Dec. 16) and the ability of the **AA ATOM** (**APOLLO** Applications - **APOLLO** Telescope Orientation Mount) system to replace the **AOSO** (SPACE Daily, Jan. 24) will also be thoroughly discussed.

In addition, a special study will be made during the hearings of the overall NASA automatic data processing procurement policies. During FY 1967 NASA proposes to spend \$140.6 million on the purchase, leasing and maintenance of ADP equipment. The reorganization of NASA to make the Office of Tracking and Data Acquisition coequal in rank with OSA, MSF and OART also placed responsibility for working out management policies for ADP equipment with that office. The Karth committee will try to determine if OTDA has worked out satisfactory management controls and purchase criteria for computer use by NASA. It also seems likely that the **MARINER/VOYAGER** (SPACE Daily, Dec. 23) planning will be studied by the subcommittee.

Karth's hearings will start on the 17th, resume on the 22nd and continue through the 25th. Dr. Robert C. Seamans, Jr., deputy administrator of NASA, and Edgar M. Cortright, deputy associate administrator of OSA, will appear. Associate Administrator Homer E. Newell may not be able to appear since he will be traveling in Europe in the advanced party for NASA Administrator Webb's later tour. (SPACE Daily, Jan. 13 & Feb. 9).

TRW STUDIES ORAO SPACECRAFT. The \$97,760 ORAO (Orbiting Radio Astronomy Observatory) contract awarded by NASA to Thompson Ramo Wooldridge last week (SPACE Daily, Feb. 11) calls for a six-month design study of a spacecraft capable of carrying an extendible, one-mile-wide, web-like antenna. The spacecraft will weigh approximately 300 pounds. Negotiations on the contract were announced last fall (SPACE Daily, Oct. 18).

Study of the extendible antenna is being carried out by the University of Michigan's Radio Astronomy Observatory (RAO) under a \$100,000 NASA grant (SPACE Daily, Dec. 14). RAO's study is based on a six-mile-wide, web-like antenna system. The Observatory said the antenna's satellite system would probably consist of a central satellite and four subsatellites, connected by nylon filaments.

ORAO is designed to provide new parameters of measurement of very low frequency natural radio emissions from celestial objects--data to be used in determining fundamental questions about the universe. The program is under the direction of NASA's Physics & Astronomy Programs, Office of Space Science and Applications. Ernest Ott is program director.

GREECE ORDERS NORD DRONES. The Greek Government has awarded a \$20 million contract to Nord Aviation to supply a target and drone system for the NATO Missile Firing Installation in Crete (NAMFI). The contract was signed Dec. 30.

Under contract terms, Nord will provide recoverable CT-20 drones to cover 450 missions over a three-year period. German-built Dornier targets will be used. The CT-20, in use with the U. S. Navy, is 17.8 feet long with a wing span of 11.10 feet. The 1440-pound system has a speed of Mach .85 and can maneuver at 33,000 feet for one hour. The jet-powered system has a ceiling of 40,000 feet. Nord announced that it is establishing a new plant in Crete to meet commitments at NAMFI.

Bids on the program were opened in July 1964, with bidders from eight countries responding (North American from U. S.). The program has been drastically curtailed since its inception. Nord's original quotation amounted to \$38.3 million.

SHILLELAGH MATING BEGINS AT IOWA FACILITY. Aeronutronic Division has delivered first production-line SHILLELAGH subassemblies to the Iowa Army Ammunition Plant where they will be put together with warheads and propellant grains. The Burlington, Iowa, facility, operated by Mason Hanger-Silas Mason, was opened last September. The anti-tank missile is the main armament of the Army's new Sheridan tank, and is being adapted to the MBT-70, the Army tank of the 1970's. First SHILLELAGH guidance and control equipment, which is tank mounted, was delivered to the Army recently at Aeronutronic's Lawndale, Calif., plant, where missile subassemblies and G&C equipment for SHILLELAGH are produced.

PHILCO TO HELP STUDY NCS LONG-RANGE PLAN. Philco is expected to be awarded soon a contract from the Defense Communications Agency to help evaluate the second National Communications System long-range plan. The evaluation will involve data processing with a computer program developed by Philco. The contract will be worth about \$25,000.

NAS ROCKET/SATELLITE RESEARCH PROGRAM RECOMMENDATIONS--1. In response to a request from the Director of the Office of Science and Technology, Executive Office of the President, the National Academy of Sciences undertook an examination of the present state of research by rocket and satellite experiments. The recommendations of an ad hoc committee formed by the NAS Space Science Board make up the major portion of Part III of the Woods Hole report. The report, Space Research: Directions for the Future, evolved from talks between the Space Science Board and NASA.

Funding: Funding of the U. S. rocket research program, currently \$50 million a year, should be doubled or tripled over the coming five-year period. The U. S. near-space satellite program for scientific research, approximately \$500 million at present, should be maintained at the level currently planned (including modest expansion). However, if both programs cannot be maintained, and some trade-off is obligatory, the expansion of the rocket program should be undertaken, even if this can be done only at the cost of a stretch-out of the satellite program. Some specific recommendations:

- 1) NASA should program funds for rocket research, such as development of boosters (improving **AEROBEE 150**), which is now mainly funded by military agencies.
- 2) Universities should have a greater role in the rocket research program.
- 3) The United States should continue efforts towards space cooperation with other countries working toward the next period of solar maximum 1967-70. Special effort should be made to support national rocket and satellite program during the SM. Work can be coordinated through COSPAR.
- 4) Sounding rocket facilities should be improved: a) Suitable shipboard launch facility should be developed; b) Rudimentary rocket facilities at Fairbanks, Alaska, should be enlarged; c) Facilities and support at Ft. Churchill and at White Sands should be improved.
- 5) That a national committee be established, consisting of all the disciplines that use sounding rockets, to establish policy, and recommend and coordinate the U. S. rocket research program.
- 6) The **AEROBEE 150** should be improved by providing a modern booster of increased specific thrust, strengthening the tail section and making other engineering changes to raise reliability. Estimated cost: \$300,000 to \$500,000. Also, if recovery of payloads from new **AEROBEE 350** is required, a launcher should be built at White Sands. Cost: \$2 million.
- 7) Full support should be given to the perfection of various families of pointing or attitude-control systems as a high-priority item. NASA is spending about \$1 million (FY '66 & '67) for a solar-pointing control.
- 8) A detailed study, including a cost analysis, should be made of all factors involved in air recovery. It is also recommended that a special effort be made to improve the reliability of parachute recovery techniques and to decrease the weight penalty of the existing system.
- 9) The number of sounding rockets to be launched for probing the neutral atmosphere in the 1966-70 period should be about 950--about double that launched in 1960-65.

Cost will be three times higher (due to increased sophistication of payloads). A total of about seven scientific satellites devoted to the same types of studies should be launched in the 1966-70 time period. Coordination and comparison of experiments should be arranged among the investigators.

10) The number of rockets provided in support of research concerned with the ionized components of the atmosphere, including airglow observation, should be increased from the present level of about 36 per year to over 100 per year in the next 5 years, reaching about 130 per year during the solar maximum (about 1970).

(This report to be continued.)

ATDA MAY REPLACE AGENA TARGET VEHICLE. Air Force and NASA officials, investigating the test failure of an **AGENA** target vehicle during ground firings at Arnold Engineering Center, Tenn., may make the decision to use the **AGENA** back-up--McDonnell's Augmented Target Docking Adapter (**ATDA**)--as a rendezvous target for **GEMINI VIII**, in order to hold to a March 15 launch date for **GEMINI VIII**. The **AGENA** target vehicle, which successfully underwent five high-altitude firings, failed during its first low-altitude test. The **AGENA** test facility is reported to have suffered no significant damage from the explosion. The **ATDA**, which utilizes flight-rated **GEMINI** hardware mounted in a new cylindrical structure, would be launched directly into a 185-mile circular orbit by a standard **ATLAS** launch vehicle. The **ATDA**, recently delivered to Arnold, was completed less than two months after NASA awarded the contract to McDonnell late last year (SPACE Daily, Dec. 14).

FOURTH TITAN III-C EYED FOR MID MAY LAUNCH. The Air Force has confirmed that **TITAN III-C-4** will likely be launched in May (SPACE Daily, Jan. 19), with mid-month now envisioned.

D-1A LAUNCH SLIPS TO WEDNESDAY. **D-1A**, France's second satellite, set to be orbited last Saturday (yesterday's SPACE Daily), is now planned for launch Wednesday morning. Its **DIAMANT** vehicle failed to ignite Saturday, so the batteries on the satellite must now be recharged and the rocket must be refueled. If the new countdown runs aground, Thursday or Friday are possible liftoff dates, but if major problems develop, the launch may be put off for several weeks, because the first stage is designed for use within a limited time period.

FUNK LAUDS AF SPACE PROGRAM. Major General Ben I. Funk, commander of the Air Force's Space Systems Division, has predicted that 1966 will be the year that the Air Force space program starts producing "big dividends". Addressing the National Association of Manufacturers, Funk referred to the **TITAN III-C** which will place 22 satellites of the **IDCSP** (Initial Defense Communications Satellite Project) system into orbit this year (SPACE Daily, Jan. 19) and said this would provide a global military communications system of "high reliability and reasonably long life, secure against interference". Funk told the NAM that the aerospace and related industries did about a \$21 billion business last year and employed about 100,000 persons.

NASA ADVANCED RESEARCH AND TECHNOLOGY FY '67 (A Special Report)--II

(This is a continuation of the special report beginning in yesterday's SPACE Daily, detailing the NASA advanced research budget which totals \$278.3 million for FY '67 and provides the area of new opportunity for space business development.)

Nuclear Rocket Program--\$53,000,000

Supporting Research and Technology: \$16,900,000

(Rocket Reactor Research: \$11,700,000.) To provide for work on various types of cavity reactors, the development of a liquid hydrogen turbopump feed system to be used in the **PHOEBUS 2** reactor, and liquid-hydrogen regeneratively cooled exhaust nozzles.

(Nuclear Rocket Engine Systems: \$3,950,000.) To fund turbomachinery research, on nozzle technology, on propellants and pressurants, and, at a reduced level, research and engineering related to the use of liquid hydrogen.

(Safety: \$250,000.) Largely includes work on hydrogen safety as well as counter-measure systems to assure safe disposal of nuclear engines and operational safety analysis of them.

(Vehicle Technology: \$1,000,000.) For investigation of modular vehicle concepts, the design of a "reasonably close ground test version" of a modular tank for cold-flow testing, the study of long-term storage of liquid hydrogen in space for periods exceeding half a year and structural design of tanks for applications requiring assembly into clusters.

NERVA:

(Engine Systems Development: \$6,000,000.) The Cold Flow Development Test System will be modified to the ground experimental engine cold flow configuration and the design and systems analysis of the 200,000-to-250,000-pound thrust engine will be continued. Also study of concepts for remote removal and installation of the engine from and into the test stand.

(Component and Subsystem Development: \$9,600,000.) The development of liquid-hydrogen turbopumps, thrust chamber assembly and engine controls. The final assembly and shipment of **XE-1** components and the fabrication and acceptance testing of the second experimental engine will be completed.

(Ground Test and Operations Support: \$15,000,000.) To provide for remote handling equipment, checkout and test equipment, and maintenance equipment. The design criteria and the design and fabrication of the transport, handling, hot disassembly and post-operative equipment for experimental engines will be funded.

(Propellants: \$2,500,000.) For liquid hydrogen to be used in **NERVA** tests.

Nuclear Rocket Development Station Operations: \$3,000,000.) Will be increased by \$2 million to provide additional maintenance support for the E-MAD and ETS-1 facilities which are becoming operational. The **XE** cold flow test will be scheduled for November 1966 followed by the first **XE-1** power test in the summer of 1967.

NASA ADVANCED RESEARCH AND TECHNOLOGY FY '67--Contd

Chemical Propulsion Program

Supporting Research and Technology: \$33,500,000

(Liquid Rocket Experimental Engineering: \$12,250,000.) To investigate combustion at high pressure in a conventional nozzle, and the plug-nozzle concepts by testing of scale-model hardware which may yield information that can be used to uprate **SATURN** vehicles. This activity supersedes the cancelled **M-1** project.

Space Propulsion Systems will be investigated to help design solar probes, delivery of satellite spacecraft to Earth orbit, and planetary orbiting and landing missions. Work with the RL-10 engine study of high-energy deep-cryogenic fluorine-hydrogen propellants is continuing.

A recently initiated program will provide criteria for the design, fabrication, inspection and servicing of fluorine feed systems. Propellants to be studied include oxygen-difluoride or mixtures of oxygen and fluorine as oxidizers, liquified petroleum gases and diborane.

A program to demonstrate the capabilities of pump-fed engines utilizing space storable propellants will be continued. A project has been initiated to demonstrate techniques for using boil-off and direct propellant supply from tankage to provide auxiliary propulsion requirements; this project will move to the breadboard hardware stage in FY '67.

(Liquid Rocket Research and Advanced Technology: \$12,700,000.) Will provide studies of valves, seals, connectors, refractory materials, fibers, and resins, new oxidizers and fuels in gelled and in slush form and catalysts to use in liquid-hydrogen/liquid oxygen engines for ignition. A program to develop theoretical parameters to the design of hardware, the potential of thrust-vector control using a fluid amplifier, the problem of leakage detection are some of the major projects to be continued.

(Solid-Rocket Experimental Engineering: \$5,050,000.) Large launch vehicle motors will be pursued in three projects: to devise instruments and systems for warning of potential failure and burn-through detection method; demonstration of feasibility of vector-control steering systems; methods for recovery and re-use of nozzles and motor cases of large rockets.

FY '67 work will include operation of cold-flow and hot-flow laboratory models, water-impact testing of model motors, and assessment of water effects on nozzle, case and insulation. Medium-size spacecraft motors will be investigated with projects in new high-energy propellants and novel structural concepts. Motor manufacture and test will begin in FY '67 and the manufacture of relatively large amounts of new propellants.

The test program will determine the effects of ignition at simulated altitude, the effects of space environment, and burning characteristics under spinning condition. A program on hybrid propulsion engineering for controllable motors will be a major effort.

The engineering, fabrication and test program will continue with demonstrations of injector designs and materials, nozzle and motor-case design; solid propellant processing methods and quality control and combustion dynamics and efficiency.

Auxiliary motor programs will concentrate on manufacture and test of motors containing a few hundred pounds of propellant for retro and ullage motors, to a few thousand pounds of propellant for escape motors. A new program will study novel concepts of reinforcement to obtain high strength in thin-wall grains.

Future Space Business**SATELLITE PCM ENCODER SUBSYSTEM**

Rice University is in the process of subcontracting for the design and construction of a satellite PCM encoder subsystem including one breadboard, one prototype and three flight units. Also in connection with the project, Rice is requesting fixed-price proposals for the design and construction of a satellite command distribution unit, sequencer and power switching subsystem including one breadboard, one prototype and three flight units.

Contact: Department of Space Science, Rice University, P. O. Box 1892, Houston, Tex. 77001, Telephone: (713) JA 8-4141, TWX: (713) 571-1481, Attn: George Stephenson, Space Science Facilities. Reference: NASA contract: NAS6-1061. Due date: Feb. 24.

SATURN-TYPE VEHICLES SPECIAL FLOW PROBLEMS STUDY

NASA-Marshall has a requirement for a numerical solution of special flow problems related to **SATURN**-type vehicles.

Contact: NASA, Marshall Space Flight Center, Huntsville, Ala. Reference: RFQ 1-6-75-00105. Due date: Mar. 3.

ROCKET NOZZLE THROAT INSERT

NASA-Lewis is requesting proposals for rocket nozzle throat inserts.

Contact: Lewis Research Center, 21000 Brookpark Rd., Cleveland, Ohio 44135, Telephone: (216) 433-4000, Extension 522. Reference: IFB C-303879. Due date: Mar. 3.

HIGH-VACUUM SCATTERING CHAMBER

NASA-Goddard is requesting bids for one high-vacuum scattering chamber in modular form.

Contact: NASA, Goddard Space Flight Center, Greenbelt, Md. 20771, Attn: Douglas Mackinnon, Contract Negotiator, Telephone: (301) 982-5834, SGD/Howard Q. Mann, Contracting Officer. Reference: RFP PC611-82378-111. Due date: Mar. 1.

NASA NEGOTIATIONS

J. R. M. Bege Co., Arlington, Va., --with Washington for flexible lines in manned space operations.

Lockheed Propulsion Co., --with Western Operations for a study of fluid-controlled solid propellant rocket motors.

Bolt, Beranek and Newman, Inc., Cambridge, Mass., --with Cambridge for research to develop new techniques for identification of human pilot dynamic response characteristics.