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NASA DATA RELAY SATELLITE NETWORK SOUGHT BY EIGHT. Eight firms--Lockheed Missiles & Space, Hydro Space Systems, Booz-Allen Applied Research, RCA-Princeton, Hughes-Space Systems, GE, TRW Systems, and Systems Sciences Corp.--have responded to NASA-Washington's RFP for a six-month feasibility and preliminary design study of a system of data relay satellites to be positioned in synchronous orbits and supported by a network of ground stations (SPACE Daily, Jan. 17 & 18). The system, identified as the Orbiting Data Relay Network (ODRN), will transmit two-way voice and data communications between space vehicles and mission control centers (unlike ComSat's **APOLLO**-support (**BLUE BIRD**) satellites, which will relay signals between ground stations).

The spacecraft that will communicate via ODRN will be within 10,000 nautical miles of Earth. ORDN will have one satellite over each major ocean initially and will operate almost around the clock when necessary. Houston, Goddard, and JPL will be the primary centers to use the network. The contractor chosen from the above eight will recommend the overall system design and stipulate certain electronic requirements.

ETR MANAGEMENT CONSOLIDATION DECISION CRITICIZED. The Subcommittee on Special Investigations of the House Armed Services Committee has issued a report critical of the DOD decision to consolidate Eastern Test Range management services under the AFSC's Missile Test Center at Patrick Air Force Base.

The report charges that the Defense Department at first claimed that consolidating the management services would cut costs. Pan American World Airways has been under contract to the Air Force to supply various services and operate a variety of facilities at ETR, and it was claimed during hearings in September (SPACE Daily, Sept. 10 & 13) that a gradual reduction in PanAm forces at the test range would result in an annual recurring saving of $500,000 and a reduction of supply line items would bring about a $10 million savings. Later the DOD said that the consolidation was dictated instead by military necessity.

The subcommittee report concludes that: "In point of fact, the Air Force does not know how much money will be saved by consolidation or even if any money will actually be saved at all...Any substantial savings by consolidation are inevitably tied to a reduction in the number of personnel . . . The Air Force does not know at this point in time exactly how many people it will need to run a centralized supply system." The report goes on to say, "In brief, there has been no 'proof' of saving, only clear evidence that the process of decision making must be improved."

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Chairman Porter Hardy Jr. (D-Va.), said in issuing the criticism: "Although the Air Force originally claimed that their takeover of the supply management...would promote economy, it appears, from the facts which we developed during our investigation that because of the inadequacy of the Air Force pre-planning such a claim belongs more in the category of wishful thinking than sound business judgment."

HEARINGS BY HOUSE SPACE SUBCOMMITTEES SCHEDULED. Leading off a round of House Space Subcommittee hearings starting this week is Rep. Emilio Q. Daddario's (D-Conn.) Subcommittee on Science, Research and Development meeting in executive session this Wednesday. Thursday, February 17, Space Sciences and Applications will meet, followed on Friday by a Manned Space Flight hearing (SPACE Daily, Feb. 4).

Next week Rep. Joseph E. Karth (D-Minn.), chairman of the Space Sciences Subcommittee, has scheduled hearings on the NASA budget, Monday, February 21, through Thursday, February 24. Rep. Olin E. Teague's (D-Tex.) Manned Space Flight Subcommittee and the Subcommittee on Advanced Research and Technology, under the chairmanship of Rep. Ken Hechler (D-W.Va.) will meet Wednesday, the 23rd through Friday, the 25th.

FLORIDA OPPOSES CALIFORNIA MOL BASE. The recent public announcement by President Johnson that the **MOL** manned launches would be flown out of the Western Test Range (WTR) at Vandenburg, California, instead of the **TITAN III-C** Integrated Transfer and Launch (ITL) facilities at Cape Kennedy (SPACE Daily, June 17, '64) has sparked growing opposition to the plan among Florida Congressmen and Senators. Senator Clinton P. Anderson (D-NM), Chairman of the Senate Space Committee, at the request of Senator Spessard L. Holland (D-Fla.), a member of the Committee, has scheduled special Hearings on the subject on February 24 to determine the validity of the AF's justification for duplicate facilities. The DOD and Air Force will be represented and DOD Director of Research and Engineering John S. Foster, Jr. is expected to appear.

Senator Holland, in preparation for the Hearings, has asked the AF and DOD to brief the members of the Florida delegation on Tuesday, February 15. Senator George A. Smathers (D-Fla.), Rep. Robert L. F. Sikes (D-Fla.), Rep. Edward J. Gurney (R-Fla.), and Rep. Charles E. Bennett (D-Fla.) will attend the briefing.

Rep. Gurney, whose district includes Cape Kennedy, has been active in questioning General Bernard Schriever during the recent House **MOL/AA** Hearings but indicated that no satisfactory explanation of the plan has been presented. The major AF reasons given for the duplicate facilities is that a WTR launch facility will enable them to put the **MOL** in a polar orbit which is desirable for a surveillance mission and if the **MOL** was launched into a polar orbit from Cape Kennedy, it would result in a loss of payload weight capability.

Gurney argues that NASA presently launches satellites into polar orbit and plans to launch its **AA** Space Station flights into a polar orbit from Cape Kennedy; that the loss of payload capability will be well within the limits set for the missions; and if the AF intended to launch the **MOL** from WTR why did they build the ITL facility in Florida in the first place?

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TITAN III Kennedy Pads Not Intended For Man. The AF contends that the $150 million ITL facilities at Cape Kennedy were built for the multi-purpose missions of the **TITAN II, IIIA, IIIB, IIIC,** and **IIID**; that one of those missions is the early unmanned **MOL** test shots; but that the installation was never intended for the manned **MOL** launches. The **TITAN**, and the ITL, were planned long before the **MOL** was approved and the WTR facilities are planned to be just a simple operation, not the complicated ITL type installation.

The Air Force has planned all along to have **TITAN III** facilities at both ETR and WTR (SPACE Daily, Sept. 30, '64 and Aug. 5, '65) and awarded a contract to Martin to design, develop, activate and test the **TITAN III** complex (PALC 2, Pad 3 at Vandenberg AFB) last fall (SPACE Daily, Oct. 18). Although the pad will initially be a single assembly-on-pad operation, it will later be converted into a second ITL complex, and preparations for modification of the pad are well underway (SPACE Daily, Jun. 17, 1964).

The Florida Influence. The Florida Congressional Delegation, however, has a strong influence on the program: Senator Holland is on the Senate Space Committee and the Appropriations Committee; Senator Smathers is a member of the Senate Finance Committee; Rep. Sikes is Chairman of the Military Construction Appropriations Subcommittee; Rep. Bennett is a high ranking member of the Armed Forces Committee; and Reps Fuqua and Gurney are both members of the House Space Committee.

The Governor of Florida, Hayden Burns (D) has also joined the controversy, commenting that "at this critical time when substantial funds are needed for defense purposes, it is important that all additional costs caused by duplication of effort and facilities be eliminated."

BROWN BUILDS LSSM MODEL FOR MARSHALL. Brown Engineering has completed fabrication of a full-size test model of the Local Scientific Survey Module (**LSSM**) mobile lunar craft for NASA-Marshall. The model will be used to study the relationship of space-suit-clad astronauts to an actual vehicle and the integration of power, telemetry, navigation and crew life equipment on the module.

Brown's work was done in its role as prime technical contractor to Marshall's Propulsion and Vehicle Engineering Laboratory. The **LSSM** is being studied in depth for NASA-Marshall by Boeing and Bendix. Separate reports on **LSSM** design were submitted by the two companies last fall (SPACE Daily, Sept. 9). Current **LSSM** phase is to end in May. Envisioned is a 750-1500 pound vehicle capable of carrying an astronaut plus scientific payload or two astronauts on a five mile line-of-sight radius in 2-6 hour excursions (SPACE Daily, Oct. 1).

The test vehicle, built by Brown's Space Vehicle Division/Advanced Studies Department, was assembled from various spare parts and resembles a stripped-down hotrod. The module's lightweight tubular frame would be collapsed for its voyage to the Moon. Its four wheels and balloon type tires are four feet high. The astronaut's seat is forward. A roll bar protects passengers in the event the vehicle overturns or collides with another object. A dish shape antenna is attached to the top of the roll bar. The vehicle, to be wheel driven by motors powered by either fuel cells or batteries, will have an average speed of five miles per hour. The vehicle is capable of carrying two astronauts and scientific equipment. The model was designed and built for the Advanced Studies Office of Marshall's Propulsion and Vehicle Engineering Laboratory.

THIRD NERVA TEST SUCCESSFUL. The third in the recent series of "bootstrap" start tests of the **NERVA** (Nuclear Engine for Rocket Vehicle Applications) (SPACE Daily, Feb. 7) engine was successfully held on Friday. The engine operated at 340 megawatts for eight minutes, producing around 17,000 pounds of thrust. The test was a further demonstration of the **NERVA**'s ability to start itself, on signal, under simulated space conditions: this test demonstrated that **NERVA** could start with the reactor control drums in a preset position to explore the possiblity of using simplified reactor control systems.

POSEIDON GUIDANCE STUDY TO RAYTHEON. Naval Weapons Laboratory is in the process of awarding an R&D contract to Raytheon, guidance prime for **POLARIS**, to study an offset Earth center guidance system for the **POSEIDON**.

D-1A LAUNCH PUSHED FROM FRIDAY TO SATURDAY. France's second satellite, **D-1A**, initially set for launch last Friday (SPACE Daily, Jan. 7 & Feb. 7), then planned for Thursday (SPACE Daily, Feb. 9), was finally scheduled for Friday, but a faulty umbilical release prevented the liftoff. If the trouble was cleared up as expected, the launch took place on Saturday. The launch site is the Hammaguir range in Algeria.

SA-201 (SATURN IB) LAUNCH SLIPS TO FEB. 23. The first **SATURN IB** launch, SA-201, originally scheduled for February 22 (SPACE Daily, Feb. 2), has been postponed one day until February 23. The postponement came as the result of the "wet mock" practice launch countdown (SPACE Daily, Feb. 9) which indicated the need "to lengthen the time allocated for space vehicle propellant loading period."

AIA INTERNATIONAL SERVICE COMMITTEES REORGANIZATION

The Aerospace Industries Association has reorganized partially its International Service committees and elected officers to head these committees during 1966.

The organizational changes included redesignation of the Trade Development Committee to the International Civil Committee. The other committee will continue to be known as the International Military and Space Committee. In addition a new chairmanship--chairman-finance--was created as a part of the Executive Committee.

Named to head the International Committee were Robert Baer, president, United Aircraft International, and J. R. Baker, corporate director, North American Aviation-International Office. Baer has been elected chairman and Baker has been named vice chairman. Harry H. Mitchell, treasurer of Douglas, will fill the chairman-finance position on the committee. Named a honorary chairman was Harvey Gaylord, president of Bell Aerospace and a member of the AIA board of governors.

R. G. McCune, director of foreign programs, Washington Area, Lockheed, will head the Military and Space Committee. Heading the Civil Committee will be Michael G. Neuburger, vice president-export sales, Beech Aircraft. Both McCune and Neuburger will serve as members of the International Committee.

Dr. Gerald W. Johnson, a former Defense Department atomic energy advisor, has been appointed Director of Naval Laboratories.

NASA SUPPORTING RESEARCH BUDGET BREAKDOWN (A Special Report)

Within the NASA FY 1967 budget requests (SPACE Daily, Jan. 25 & 26) are a number of general categories for Supporting Research and Technology, totaling $681 million. Continuing with SPACE Daily's annual practice of presenting segments of the NASA budget in detail breakdown, the following listing separates into the general categories the $681 million SR&T line items (SR&T for FY '1966 was about $700 million, SPACE Daily, Feb. 8 & 9, '65).

MANNED SPACE FLIGHT SUPPORTING RESEARCH
(In millions)

	FY 1965	FY 1966	FY 1967
GEMINI			
none			
APOLLO			
Engine Development	$166.3	$134.1	$111.0
H-1	6.5	6.4	5.5
RL-10	14.4	1.9	---
F-1	62.3	41.2	41.0
J-2	49.1	41.8	37.9
Propellants & related engine support	33.8	42.8	26.6
APOLLO Mission Support	170.5	210.3	255.2
Operations	96.7	104.1	154.4
Systems Engineering	19.9	26.0	26.0
Supporting Development	53.9	32.2	32.9
APOLLO Applications	---	48.0	41.9
Advanced Missions			
Advanced Mission Studies	26.0	10.0	8.0

SPACE SCIENCE AND APPLICATIONS SUPPORTING RESEARCH
(In millions)

	FY 1965	FY 1966	FY 1967
Physics and Astronomy			
Supporting research and technology	$ 21.0	$ 23.8	$ 22.9
Particles & Fields	6.7	6.9	6.9
Ionosphere & Radio Physics	.988	1.3	1.3
Interplanetary Dust & Cometary Physics	.833	1.2	1.2
Solar Physics	2.4	2.8	2.8
Astronomy & Geodesy	2.9	3.3	3.3
Spacecraft Technology	.3	.35	.35
Interdisciplinary Space Science	2.2	2.8	2.8
Advanced Studies	.45	1.2	1.0
Manned Space Science	4.3	3.9	3.2

MORE

SPACE SCIENCE AND APPLICATIONS SUPPORTING RESEARCH-Contd
(In millions)

	FY 1965	FY 1966	FY 1967
Lunar and Planetary Exploration			
Supporting research and technology	$ 24.1	$ 38.6	$ 40.1
Lunar and Planetary Science	12.3	12.0	12.0
Advanced Technical Development	6.1	6.8	6.8
Advanced Studies	2.0	2.5	2.5
Manned Lunar Science	5.6	17.3	18.8
Sustaining University Program			
none			
Launch Vehicle Development			
Supporting research and technology	7.1	4.0	4.0
Advanced Studies	.842	.5	.5
Propulsion Technology	2.7	1.2	.6
Guidance, Control and Navigation	.285	.2	.5
Instrumentation and Electronics	.285	.02	---
Structures and Materials	.229	.6	.5
Vehicle Engineering	.13	1.4	1.9
Flox	2.6	---	---
Launch Vehicle Procurement			
none			
Bioscience			
Supporting research and technology	12.5	15.1	14.7
Exobiology	4.9	5.0	5.0
Environmental Biology	2.8	2.8	2.8
Behavioral Biology	2.1	2.1	2.1
Physical Biology	1.9	1.9	1.9
Automated Biological Laboratory	---	1.0	1.0
Planetary Quarantine	---	1.0	1.0
Bioscience Investigations for Manned Missions	.801	1.3	.9
Meteorological Satellite			
Supporting research and technology	7.3	8.3	9.1
Synchronous Meteorological Satellite	---	.145	---
Sensor Requirements and Evaluation	2.5	2.6	2.3
Meteorological Component Development	2.2	2.0	1.8
Meteorological Sensor Development	1.3	.496	.69
Advanced Systems & Components	.975	1.3	2.1
Advanced Studies	---	.1	.1
Applications for Manned Space Missions	.291	1.2	2.1

MORE

SPACE SCIENCE AND APPLICATIONS SUPPORTING RESEARCH-Contd

(In millions)

	FY 1965	FY 1966	FY 1967
Communications Satellites			
Supporting research and technology	$ 2.1	$ 4.5	$ 4.6
Communication and Navigation	.874	1.7	1.9
Applications Technology	.7	2.0	2.1
Advanced Mission Studies	.55	.8	.5
Data Analysis	---	---	.1

ADVANCED RESEARCH AND TECHNOLOGY SUPPORTING RESEARCH

(In millions)

	FY 1965	FY 1966	FY 1967
Basic Research			
Supporting research and technology	$ 21.2	$ 22.0	$ 23.0
Fluid Physics	7.8	8.0	8.2
Electronic Physics	4.0	4.4	4.8
Materials Research	8.0	8.2	8.5
Applied Mathematics	1.3	1.4	1.5
Space Vehicle Systems			
Supporting research and technology	25.7	26.0	28.7
Spacecraft Aerothermodynamics	5.7	6.2	5.3
Spacecraft Structures	5.8	6.2	6.7
Launch Vehicle Aerothermodynamics	1.5	.855	1.3
Launch Vehicle Structures	3.4	2.5	3.3
Space Vehicle Environmental Factors	8.0	8.0	10.8
Advanced Space Vehicle Concepts	.606	.5	---
Space Vehicle Design Criteria	.634	1.7	1.3
Electronic Systems			
Supporting research and technology	23.2	30.0	34.0
Guidance Systems	4.5	6.0	6.2
Control Systems	5.3	6.0	6.1
Communications	4.2	4.8	5.6
Tracking & Data Acquisition	2.9	3.5	3.7
Data Handling & Processing	3.2	3.6	4.1
Instrumentation	3.1	3.9	4.1
Electronic Techniques & Components	---	2.0	4.0
Human Factors Program			
Supporting research and technology	12.2	13.0	15.5
Human Research & Performance	3.9	5.1	6.1
Life Support & Protective Systems	5.5	4.5	5.8
Man Systems Integration	2.1	2.9	3.1
Advanced Concepts	.657	.5	.5

MORE

ADVANCED RESEARCH AND TECHNOLOGY SUPPORTING RESEARCH-Contd

(In millions)

	FY 1965	FY 1966	FY 1967
Nuclear Electric Systems			
Supporting research and technology	$ 36.8	$ 38.2	$ 37.0
Nuclear Electric Power	13.1	14.0	13.2
Electric Propulsion	9.9	10.0	9.8
Solar Power Generation	7.9	9.0	9.0
Chemical Power Generation	5.8	5.1	5.0
Nuclear Rockets			
Supporting research and technology	20.9	21.0	16.9
Rocket Reactor Research	13.1	14.2	11.7
Nuclear Rocket Engine Systems	6.3	5.1	3.9
Safety	.5	.5	.25
Vehicle Technology	1.0	1.1	1.0
Chemical Propulsion			
Supporting research and technology	24.8	33.5	33.5
Liquid Rocket Research & Advanced Technology	11.5	12.7	12.7
Liquid Rocket Experimental Engineering	6.1	12.2	12.2
Solid Rocket Research & Advanced Technology	5.0	5.0	5.0
Solid Rocket Experimental Engineering	2.2	3.5	3.5
Aeronautics			
Supporting research and technology	8.2	10.3	9.0
Aircraft Aerodynamics	1.3	2.3	1.6
Aircraft Loads & Structures	2.0	2.0	1.5
Air Breathing Propulsion	2.0	2.2	3.0
Aircraft Operating Problems	2.8	3.7	2.9

TRACKING AND DATA ACQUISITION SUPPORTING RESEARCH

(In millions)

	FY 1965	FY 1966	FY 1967
Tracking and Data Acquisition			
Supporting research and technology	$ 13.5	$ 13.8	$ 13.8
New Systems	1.6	1.2	.5
Integrated Systems Analysis, Development and Test	3.0	2.7	3.5
Antenna Subsystems	2.5	2.1	1.6
Transmitter & Receiver Subsystems	2.7	2.7	2.3
Data Handling and Control	1.7	2.4	2.1
Data Processing and Reduction	.78	1.2	2.1
Spacecraft Subsystems	1.2	1.5	1.7

NASA ADVANCED RESEARCH AND TECHNOLOGY FY '67--$278,300,000 (A Special Report)

Basic Research--$23,000,000

Fluid Physics: $8,200,000. Efficient design of spacecraft configurations and heat protection systems, of nozzles for air-breathing and rocket-fueled propulsion systems, and the ability to solve the communications blackout re-entry problem, all depend on a knowledge of non-equilibrium flow processes. Thus, an important part of the FY '67 research program in fluid physics is concerned with the determination of chemical reaction rates in flow situations of interest.

Gas surface interactions will be studied intensively. This is of great importance in such areas as the drag and heating of satellites, orbital lifetimes of satellites, the heating and thrust loss from control rockets in space, and the contamination of the lurain by rocket exhausts.

Increased emphasis will also be placed on: The flow of fluids having properties that differ greatly from conventional fluids and gases; and the investigation of plasma properties in their functional relation with system parameters.

Electrophysics: $4,800,000. Increased effort will be made in nuclear physics research. Detailed information on nucleon-nucleon reactions is needed to improve the design of the shielding material thus preventing radiation damage to equipment on a spacecraft. ERC will continue studies of the energy exchange processes in crystalline solids.

Materials: $8,500,000. Emphasis will be given to research on stress-corrosion cracking (titanium). Other areas to be studied: Low temperature polymers; non-wearing metals; electronic properties of materials for circuitry in communications devices. In FY '67 the general field of solid state physics will be expanded with particular emphasis on electronic properties.

Applied Mathematics: $1,500,000. Studies will be used to determine more accurately what trajectories could produce a successful lunar orbiting vehicle. Work will continue on more accurate and economical predictions of orbits and positions of Earth satellites and other space vehicles.

Space Vehicle Systems--$36,000,000

Supporting Research and Technology: $28,700,000.

(**Spacecraft Aerothermodynamics:** $5,346,000.) New efforts will be made to understand the exact nature of the processes governing the production and absorption of the radiant energy associated with re-entry. Substantial effort will be directed in FY '67 to the technology of advanced manned spacecraft having substantial maneuvering capability in the atmosphere--the **M2-F2** and **HL-10**.

Increased emphasis will be given to parachute and decelerator technology with special reference to: 1) the soft landing of instrument packages on Mars; 2) terminal descent over land area with control of flight for manned ballistic or semi-ballistic entry vehicles; and 3) recovery of launch vehicle stages. (No.'s 2 & 3 will involve advanced controllable gliding types of parachutes, i.e. the so-called limp paraglider.)

(**Spacecraft Structures:** $6,710,000.) Examples of studies include inflatable lunar shelters and large orbiting antennas for unmanned scientific missions. MORE

NASA ADVANCED RESEARCH AND TECHNOLOGY FY '67--$278,300,000-Contd.

Expanded effort will be directed in FY '67 to improved structures to withstand atmospheric entry. Another area of emphasis concerns planetary entry structures for use in Mars exploration.

Increased emphasis is required in the area of high frequency vibrations to provide more adequate techniques for coping with problems encountered in vibration environments encountered by spacecraft. Increased research is required for prolonged storage of cryogenic liquids, such as liquid hydrogen, in spacecraft.

(Launch Vehicle Aerothermodynamics: $1,300,000.) Testing of an electron gun technique (NASA-Marshall) to map the flow density and temperatures in the base region of a rocket for high altitude flight regimes is planned. Also in FY '67 efforts will be made to develop techniques applicable to inflight flow measurement on launch vehicles early in the launch trajectory after lift-off.

Research will be augmented on sound pressures experience on the vehicle and on the surrounding terrain during operation of large scale clustered rocket motors. Expanded effort will be made on recovery modes for advanced launch vehicles, and on evaluating the many possible concepts, sizes and configurations of future launch vehicles to indentify those of greatest interest for concentrated research investigation.

(Launch Vehicle Structures: $3,264,000.) Efforts are scheduled to provide more precise methods for predicting ground wind loads, applicable to primary structural design for most launch vehicles. Certain problems unique to the reuse of the larger and less dense structures of launch vehicles must be studied in FY '67. Particular attention will be focused upon substantially different configurations for future generations of launch vehicles.

A general purpose computer program is being developed for the analysis of complex space vehicles structures, and should be completed and in use by the end of FY '67. It will be used by all NASA centers and will be available to industry.

(Space Vehicle Environmental Factors: $10,805,000.) Research will be performed to determine radiation effects on engineering properties of sensitive spacecraft materials, devices and components and to increase the understanding of radiation damage to permit development of improved radiation resistant materials and components. A continuing effort on shielding man from radiation will be required. Another area where studies will continue is on the characteristics of meteoroids and their hazards to spacecraft. This includes laboratory and flight experiments.

Research programs are planned in FY '67 on fluid dynamics as in fuel tanks near zero-gravity conditions. Testing of spacecraft thermal control coatings in space and in the laboratory will continue. Studies are also planned on problems associated with the creation, maintenance and measurement of simulated space vacuum.

(Space Vehicle Design Criteria: $1,275,000.) Fiscal 1967 funds will provide for continuing effort for the timely formulation of design criteria in each technical area where criteria are to be established--structures, propulsion, stability, guidance and control.

Lifting Body Flight and Landing Tests: $1,000,000. Funds in FY '67 will provide for the continuing aggressive and extensive flight test program for M-2 and HL-10.

MORE

NASA ADVANCED RESEARCH AND TECHNOLOGY FY '67--$278,300,000-Contd.

SCOUT Re-entry Project: $4,800,000. Emphasis is on the technologies of aerothermodynamics and high temperatures structures and thermal protection systems with the aim of correlating and extending research results obtained in laboratory facilities. In another area, configuration and instrumentation concepts will be developed, along with a velocity package, for launch to re-entry speeds of around 36,000 fps. This will be an intermediate step for programs involved with entry into the atmosphere of Venus and re-entry into the Earth's atmosphere on return from planetary flights.

Small Space Vehicle Flight Experiments: $1,500,000. The problem of developing parachute concepts and techniques for Mars landing will be studied by means of high altitude flight tests (NIKE). A second program will involve flight measurements of the performance of ablative heat shield materials. Recovery concepts will be investigated.

Electronic Systems--$36,800,000

Supporting Research and Technology: $34,000,000.

(Guidance Systems: $6,250,000.) Expansion of research on passive electromagnetic sensors is planned for this fiscal year. Increased efforts in active radar and laser devices are required to effect future rendezvous and planetary letdown portions of manned and unmanned missions.

(Control Systems: $6,150,000.) Intensive efforts will continue in the areas of mathematical modeling of both automatic and manual control performances. An expansion in development of control components is planned.

(Communications: $5,600,000.) Development efforts will be undertaken in FY '67 for space qualified 500 to 1000-watt tubes for future missions. Data from Re-entry Attenuation Measurements (RAM) flights will be evaluated. Studies of electronic devices utilizing the re-entry plasma will be studied. Techniques to maintain communications while entering the atmospheres of other planets will also be studied during FY '67.

Research into sources in the millimeter/submillimeter region useful for future deep space communications will be carried out. Studies will be made to select and develop optimum detection techniques for ground terminals for optical communications. Techniques to remotely monitor and control surface characteristics and the alignment of large primary segmented mirrors in space will be studied.

(Tracking and Data Acquistion: $3,700,000.) Experiments are being formulated during fiscal '67 for arraying of two 15-foot antennas to further identify scientific and operational problems of arrays of this type (NASA-Goddard). Means to erect large antennas in space are being investigated. Additional efforts will be directed towards achieving large apertures of optical frequencies. Tests will be conducted to determine the atmospheric and space environment effects on coherent optical transmission.

(Data Handling and Processing: $4,150,000.) Work will continue to develop techniques and systems for computer checking of launch vehicle readiness in the preliminary phase and to program and monitor launchings from Earth, other celestial bodies, or from orbit. Studies in the area of on-board picture storage and compression are planned.

MORE

NASA ADVANCED RESEARCH AND TECHNOLOGY FY '67--$278,300,000-Contd.

(Instrumentation: $4,150,000.) Principal efforts will be directed toward increasing instrument accuracy, extending measurement range, improving energy and signal conversion, reducing size and power consumption, and eliminating synergistic effects.

(Electronic Techniques and Components: $4,000,000.) Research into the area of the interconnection and assembly of microelectronic components is planned. Electronic component research will be expanded in fiscal '67. Studies of the effects of the environment on electronic circuit devices is planned.

Flight Projects: $2,800,000.

(RAM: $1,300,000.) Project **RAM** (Radio Attenuation Measurements) is designed to acquire understanding of the plasma generated by a spacecraft on re-entry and to determine means of eliminating communications blackout. Low velocity **RAM A** & **B** flights will give way to **RAM C**, designed to obtain data in the velocity range of 25,000 to 27,000 fps. **RAM C-A**, to test material addition and X-band telemetry concepts, will be launched during the third quarter of calendar '66; **RAM C-B**, designed to yield measurements of free-electron and ion concentrations, is set for the first quarter of calendar '67.

(SCANNER: $0.) While no funds are indicated, two experiments are planned on this horizon definition research program. Two experiments will be performed from sub-orbital ballistic trajectories using **TRAILBLAZER II** launch vehicles. Flight #1 is set for August and Flight #2 for November (NASA-Langley).

(Sextant Experiments: $500,000.) This program will involve experimental manual navigation measurements by astronauts in manned spacecraft **(GEMINI)**. The program is designed to provide knowledge of the effects of the spacecraft environment, including window optical distortion and actual celestial targets, on sighting accuracy capability.

(Earth Coverage Horizon Measurement: $1,000,000.) This program will extend limited results of **SCANNER** and supporting X-15 flights to a comprehensive measurement of the Earth's horizon radiance profile over a broad range of seasonal and climatic variations. Advanced studies will be expanded and completed, designed to identify flight experiments and techniques (NASA-Langley).

Human Factor Systems $17,000,000

NOA is $15,500,000 for supporting research and technology and $1,500,000 for small biotechnological flight projects. The total, $17,000,000, breaks down by NASA center like this: Houston--$1,100,000; Marshall--$300,000; Goddard--none; Jet Propulsion Lab--none; Ames--$5,830,000; Cambridge--$700,000; Edwards--$1,250,000; Langley--$5,000,000; Lewis--none; and Headquarters--$2,820,000.

Supporting Research and Technology: $15,500,000.

(Human Research and Performance: $6,080,000.) Special areas of interest are: (a) proton activity and potential danger to humans, (b) vestibular organ functions, effects thereon of long-term weightlessness, and possible related need for artificial gravity, (c) cardiovascular activity and effects thereon of environmental changes, (d) metabolism,

MORE

NASA ADVANCED RESEARCH AND TECHNOLOGY FY '67--$278,300,000-Contd.

and (e) possible effect of space conditions on human interaction with microbiological organisms.

(Life Support and Protection: $5,800,000.) Major concerns are regenerative life support systems and advanced space suits.

(Man-Systems Integration: $3.120 000.) Advanced multiman capsules will be experimented with to study human factors in most phases of space missions. Extravehicular activity and hardware, and astronaut performance and shelter on Moon, will continue to receive special attention.

(Advanced Concepts: $500,000.) Emphasis is on further integration of man and operational systems for future-generation missions. Examples: nonanthropometric space suits and nonconventional propulsion in lieu of walking.

(Small Biotechnological Flight Projects: $1,500,000.) Primary work is to verify concepts and solutions devised in ground-based research programs. Examples: frog otolith experiment, set to go aboard the fifth **SATURN IB** flight **(SA-205)**, to study adaptiveness of otolith organ to weightlessness; and nephelometer experiment, intended for **APOLLO** flight, to measure concentrations and sizes of dust particles within spacecraft.

Space Power and Electric Propulsion Systems--$42,500,000.

The New Obligational Authority desired is $37,000,000 for supporting research and technology and $5,500,000 for the **SNAP-8** program (no money requested for the **SERT** program). The total, $42,500,000, breaks down by NASA center thusly: Houston--$650,000; Marshall--$1,650,000; Goddard--$3,990,000; Jet Propulsion Lab--$6,050,-000; Ames--$50,000; Cambridge--$300,000; Langley--$700,000; Lewis--$26,065,000; Western Operations--none; and Headquarters--$3,045,000.

Supporting Research and Technology: $37,000,000.

(Nuclear-Electric Power: $13,180,000.) Major concerns are (a) Rankine-cycle alkali metal turbogenerator, (b) thermionic direct conversion, (c) Brayton gas turbogenerator, and (d) magnetohydrodynamics systems.

(Electric Propulsion: $9,850,000.) Major requirements are for system capability of long-duration operation (thousands of hours) and for high overall system efficiency.

(Solar power generation: $9,000,000.) Increased effort planned for better cell efficiency, weight, fabrication, and deployment. Power transistors and integrated circuits to be emphasized.

(Chemical power generation: $4,970,000.) Advanced **APOLLO**-type fuel cells and reliability test programs needed. Better batteries for high-power applications desired.

SNAP-8: $5,500,000.

FY '67 emphasis will be on component testing and supporting technology. Work on heat transfer, materials, system dynamics, and endurance instrumentation will be begun. Preliminary consideration of system behavior will be made.

Future Space Business

OV1 SUPPORT SERVICES

The Ballistic Systems Division has a requirement for the fabrication, integration, and launch support of aerospace research Orbital Vehicles (**OV1**) from Vandenberg Air Force Base.

Contact: Headquarters, Air Force Systems Command, Ballistic Systems Division (BSMKB), Norton Air Force Base, Calif. 92409. Due date: Feb. 21.

PROPELLANT TRANSFER THERMODYNAMICS STUDY

NASA-Marshall is preparing to fund a study on cryogenic container thermodynamics during propellant transfer.

Contact: Purchasing Office, Marshall Space Flight Center, NASA, Huntsville, Ala. 35812, Attn: PR-ES/G. Armstrong. Reference: RFQ 1-6-52-01115. Due date: Mar. 11.

ATMOSPHERE EFFECTS ON TRANSMITTED LASER BEAMS

NASA-Cambridge is initiating an investigation of the effects of the atmosphere on transmitted laser beams and an identification of the limitations that these atmospheric effects will impose on the design and capabilities of future optical communications systems.

Contact: NASA, Electronics Research Center, 575 Technology Square, Cambridge, Mass. 02139, Attn: Procurement Office. Reference: ERC/R&D 66-467. Due date: Feb. 21.

METEOROLOGICAL APPLICATIONS SENSOR RESEARCH

NASA-Cambridge is funding a program to conduct solid-state image sensor research for meteorological applications in the visible and infrared region of the electromagnetic spectrum.

Contact: NASA, Electronics Research Center, 575 Technology Square, Cambridge, Mass., Attn: Procurement Office. Reference: ERC/R&D 66-477. Due date: Feb. 21.

DOD NEGOTIATIONS

Hughes Aircraft--with Warner Robins Air Materiel for modification of 107 **ADAIM-4F** missiles to **AIM-4F** weapons system evaluator missiles.

North American Aviation, Rocketdyne Div.--with Ballistic Systems Div., AFSC for spare parts for the **ATLAS** propulsion subsystem in support of the **ABRES/NIKE ZEUS** program.

General Electric Co--with Ballistics Systems Div., AFSC for research and development of the **Mark 12** penetration aid system.

MORE

DOD NEGOTIATIONS-Contd.

Wetco Co., Research Div.--with Air Proving Ground Center for design study of the **HORNET** anti-tank missile warhead.

Adcole Corp.--with Hanscom Field R&D Contract Div., for research directed toward the design of circuits and package for a rocket borne mass spectrometer.

Heliodyne Corp.--with Army Missile Command, Redstone, for research in turbulent wake studies.

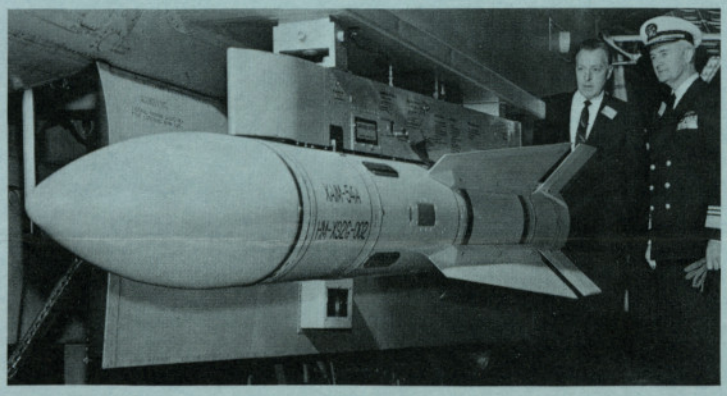
NASA NEGOTIATIONS

University of Michigan--with Marshall Space Flight Center for measuring the structure and variability of the upper atmosphere of the Earth.

Franklin Institute--with Wallops Station for engineering report covering the hazards involved in operation, handling and maintaining squibs at Wallops Station.

Aerosystems Co.--with Edwards Flight Research Center for **AGENA** rocket engine study.

PHOENIX UNVEILED



This is a "captive" flight model of the **PHOENIX** air-to-air missile Hughes is building for the Navy's F-111B aircraft. Here it is mounted on its launching rail, which is attached to the A3A jet plane that will serve as the test bed for the missile when its electronic systems are checked out during a captive flight. For that test, the aircraft will fly the missile's course while the missile remains on the rail. Shown are vice admiral Ignatius Galantin, chief of naval material, and Meade Livesay, associate Hughes manager for aeronautical systems. The picture was made at the Hughes plant in Culver City, Calif.

GD SAVES $1.5 MILLION IN CENTAUR PROGRAM

During the last quarter of last year, General Dynamics/Convair saved $1,500,000 through its cost reduction and value control project for the **CENTAUR** upper stage program. Fifteen employees have been credited for their contribution to that savings, which pushed the annual savings figure to $3 million. Special credit goes to O. C. Priest, whose suggestions saved $704,916.