

SPACE BUSINESS

Daily

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AF ORDERS SEVEN-SEGMENT 120'S FOR MOL'S TITAN III-C. Air Force Space Systems Division has given the go-ahead to United Technology to begin initial development work on the seven-segment solid motors for the **TITAN III-C** which will launch the AF's **MOL** (Manned Orbiting Laboratory).

Decision to switch from the standard five-segment 120-inch strap-ons to the seven-segment version was formally announced by President Johnson in his space report earlier this month although the necessity and the technical decision was made months earlier (SPACE Daily, Sept. 29). Strong consideration and vigorous proposals have been made for the use of two 156-inch strap-ons to the **TITAN**. But this plan has been postponed by the DOD decision to give the AF only \$2 million, instead of the \$12 million it wanted, for the 156 in its FY '67 budget. (See SPACE Daily, Oct. 21 and Feb. 25.)

The seven-segment **TITAN III-C** strap-ons will produce more thrust and have a greater payload orbiting capability than the five-segment **TITAN III-C** (which can place 27,000 pounds in Earth orbit) but will not have the capability of the **TITAN/156** combination (44,000 pounds in Earth orbit) (SPACE Daily, Feb. 17 & Feb. 4, '64). The AF wanted to use the 156 strap-ons to give **MOL** the ability to grow. The seven-segment 120 (with submerged nozzle--SPACE Daily, Sept. 29--) is the maximum configuration for the 120-inch motor; thus the **MOL** will be contained within the booster's limited weight-carrying capability. An advanced **MOL** will require a new launch system.

DADDARIO CONCERNED BY AA DEFERRAL. Representative Emilio Q. Daddario (D-Conn.), acting chairman of the House Manned Space Flight Subcommittee, has voiced his "concern" over the plans for furthering the **AA** (**APOLLO** Applications) concept presented to the subcommittee by Dr. George Mueller, associate NASA administrator for manned space flight.

Daddario felt that the **AA** program as presented lacks the necessary definition to allow the detailed presentation and time scheduling needed to draw public support for the program. (D. Brainerd Holmes, former director of the NASA manned efforts, recently voiced an identical concern before the National Space Club (SPACE Daily, Feb. 15)).

Referring to Mueller's testimony which indicated that the manpower in the **APOLLO** program is beginning to shift to other areas of the economy as **APOLLO** R&D phases out, Daddario expressed some concern about whether or not a program such as this can be "put on the shelf." He said he was convinced that we can put (**AA**) off for a year "but I am not yet convinced that this is the most efficient way" in which to conduct the program.

DOD RFP FOR TACTICAL COMSAT DUE THIS SPRING. The Defense Department's research and engineering office will approach industry in April or May for proposals for an operational communications satellite system to handle tactical messages between many types of warring units. The Army, Navy, and Air Force are presently preparing system requirements and will report to the DR&E staff early in the spring. The report will cover primarily costs and performance parameters.

The operational tactical system will be as simple, reliable, and rugged as this decade's technology can provide. It will use a yet undetermined number of synchronous, high-power satellites that can process "secure voice signals" and teletype transmissions and that will be "jam proof." Highly mobile ground stations of diverse applications will support the payloads. Present plans are particularly concerned with developing a small station whose antenna is only two or three feet in diameter and that can be readily deployed on a jeep. Other stations being envisioned are for three-quarter-ton trucks, tanks, aircraft, ships, and submarines.

The system will become operational as early in the next decade as is feasible. Between now and then, three prelude programs will be completed to gain the experience and know-how necessary to the use of the operational system.

The first program is a series of experiments with the **LESs** (Lincoln Experimental Satellites). **LES I**, launched on the third **TITAN III-A** a year ago, and **LES II**, launched on the fourth and last **III-A** last spring, were largely for testing comsat techniques and hardware. **III** and **IV** rode the third **TITAN III-C** last December 21, which failed to orbit its payloads properly because a control valve on the Transtage malfunctioned. The two satellites, in an elliptical instead of near-synchronous orbit, are thus of limited service but are at least, according to the DOD, "a first step" toward the operational system. **LES V** will ride a **TITAN III-C** next January (originally December: SPACE Daily, Feb. 2) to permit the three military services to test ground stations for teletype transmissions. SAC communications will also be tested.

The other two programs are the **IDCSP** and **ADCSP** (Initial and Advanced Defense Communications Satellite Projects). The former will have 22 satellites (plus two special gravity gradient satellites) in near-synchronous orbits (SPACE Daily, Jan. 14) and will be implemented in the middle of May when the fourth **TITAN III-C** puts seven of the 22 and one of the two into orbit (SPACE Daily, Jan. 19 and Feb. 15). The fifth **III-C**, intended for a summer launch, will carry seven **IDCSP** packages and the other **GGTS** (Gravity Gradient Test Satellite), thus leaving the sixth **III-C** the remaining eight **IDCSP** payloads.

The **IDCSP** system will be supported by the two gateway military ground stations at Fort Dix, N.J., and Camp Roberts, Calif., by semitransportable Mark IB stations from Hughes, by transportable Mark V terminals from Radiation, by British stations (SPACE Daily, Feb. 3), and by various other aeronautical and marine systems, including Hughes shipboard sets.

The **ADCSP** (SPACE Daily, June 16), now under evaluation and awaiting the CDP (Contract Definition Phase) (SPACE Daily, Nov. 22 and Jan. 26), will be the interim step between **LES/IDCSP** experiments and the operational system. Like the Initial system, the Advanced will handle voice and teletype signals between ground stations. The DOD would like to implement it as soon as possible, but the CDP is not expected to begin until the latter half of this year, and '69 appears to be the likely launch period unless the project

MORE

can be expedited. The proposals under evaluation were submitted by ComSat, Hughes, TRW, RCA, Philco, and GE.

Communications via the operational system will be between planes, ships, submarines, combat units, assorted fixed ground stations, and any combination of those things. No present plans exist for equipping a single soldier with a receiver or transceiver, but this is a possibility. To make practical use of the operational network, in-the-field groups will probably have to be at least five miles apart and unable to satisfactorily employ line-of-sight "walkie talkie" systems.

COMSAT MULTIPLEX RFP DUE SOON. ComSat's RFP for multiplex or interface equipment (SPACE Daily, Aug. 20), the last basic procurement action for the Corporation's two incipient ground stations, will probably appear this week or next. It was originally intended to be issued early last month at the latest (SPACE Daily, Dec. 6), but ComSat thought it better to wait until the controversy (SPACE Daily, July 7 and Jan. 5) over the ownership and location of the interface facilities was settled before seeking the interface hardware. The settlement came last week when the FCC decided the facilities will be situated at the stations, not in nearby gateway cities, and thus will be the property and responsibility of ComSat, not of the common carriers (SPACE Daily, Feb. 24).

SATURN IB LAUNCH POSTPONED AGAIN. The rescheduled Friday (Feb. 25) launch of the first **SATURN IB**, carrying an **APOLLO** spacecraft, was postponed by NASA on Thursday due to adverse weather conditions. It was the third postponement in three days of the launch. NASA, Friday, was still considering plans for a Saturday launch.

AGENA TESTING RESUMES. Testing of the **AGENA** stage was resumed at the Arnold Engineering Center, Tullahoma, Tenn., Friday in preparation for the upcoming **GEMINI VIII/AGENA** docking flight. Testing had been halted following an explosion of a prototype **AGENA** earlier this month (SPACE Daily, Feb. 15). NASA says it will use **AGENA** for the scheduled March 15 flight. A \$500,000 back-up, McDonnell's Augmented Target Docking Adapter (**ATDA**), has been readied for the mission, however.

NORTHROP TESTS LAND RECOVERY PARACHUTE. First aerial drop test of a new, controllable gliding parachute, which may be used in ground landings of future spacecraft, has been conducted by Northrop-Ventura for NASA-Houston.

The 56-foot cloverleaf-shaped parachute, designed for use with a 5000-pound vehicle, will offer a gliding range of up to two feet for each foot of vertical descent and a capability by which a descending spacecraft could be steered to a pre-determined landing site. The recent test, conducted at the DOD Parachute Facility at El Centro, Calif., was designed only to demonstrate deployment and opening characteristics of the parachute. Later drop tests will demonstrate guidance and control techniques.

Dr. Harper Q. North, president of the Electronic Industries Association, has been chosen by the EIA Board of Directors to receive the 1966 Medal of Honor at the Association's Government Industry Dinner March 9.

SPACE INTERCEPTOR MISSILE IS SUPER ZEUS. SIM, the (exoatmospheric) Space Interceptor Missile (SPACE Daily, Jan. 28), designed for long range in-space area interceptor defense against sophisticated ballistic missiles, is identified by DOD as the **DM15X2**. It is further identified as a "new extended range **ZEUS**" which is longer and heavier than the present **ZEUS** and employs two solid propellant booster motors. It would carry a nuclear warhead, be guided with ground based, high speed computer controlled radars.

Defense Secretary McNamara has described this missile system as a basic and vital component of the light anti-ballistic missile system for providing an area defense around a limited number of cities to counter a Red Chinese ICBM threat which is believed possible by 1975 (SPACE Daily, Dec. 16 & Jan. 26). — It is estimated that such a system will cost, for a 5-year operational period, including initial investment, \$8-10.5 billion (SPACE Daily, Jan. 28).

SENATE TO HEAR WEBB/SEAMANS TODAY. The Senate Space Committee will open its authorization hearings today with testimony by NASA administrator James E. Webb and deputy administrator Robert C. Seamans, Jr. Associate administrators George E. Mueller (Manned Space Flight), Homer E. Newell (Space Sciences and Applications), Mac C. Adams (Advanced Research and Technology), Edmund C. Buckley (Tracking and Data Acquisition) accompanied possibly by Harold Finger, director of the NASA-AEC Space Nuclear Propulsion Office, will be heard on Tuesday, Wednesday and Thursday.

NASA STUDIES DUAL-GAS SPACECRAFT ATMOSPHERE. A number of inert gases are being studied by NASA-Ames for use in two-gas cabin-atmosphere systems required for very long space flights. While the use of pure oxygen at reduced pressure has proved successful in short-duration space flights, animal tests have indicated that pulmonary damage can be caused by long-term breathing of pure oxygen. Experimental techniques have been developed by NASA to study the effects of various atmosphere mixtures on animals. Complementary studies by DOD are providing data using humans. The dual-gas system has been successfully used by the Soviet Union in its manned space flight program.

SNAP 8 WILL REQUIRE \$8-10 MILLION IN FY '68.

Harold B. Finger, director of NASA's Office of Nuclear Systems and Space Power, has told the House Space Committee's Subcommittee on Advanced Research and Technology that \$8-10 million will be required in fiscal year 1968 to keep **SNAP 8** development on schedule. Finger said that, although NASA and the Bureau of the Budget attempted to cancel the **SNAP 8** nuclear power source in FY '66, he believes that "The time will come when power levels of this sort (approximately 50 kilowatts) will be needed." At the present time, there are no approved missions in this area, and the **SNAP 8** has been kept at a low development level. Rep. John W. Davis (D-Ga.) showed interest in Earth-bound applications of the **SNAP 8**. He was told that while no use has been found for the entire power source, there is a possibility that the individual components and the reactor may find individual applications.

MORE

SNAP 8 WILL REQUIRE \$8-10 MILLION IN FY '68-Contd

Chairman Ken Hechler (D-W.Va.) told Finger that, in his opinion, there is danger in allowing technology, such as had been employed in the development of the **SNAP 8**, to remain on the shelf.

SNAP 8 May Be Used For DBS

When asked whether the **SNAP 8** might be used as a power source for the Direct Broadcast Satellite (**DBS**), Finger said that the power source will be ready for use about 1975, and there is doubt as to whether it will be ready in time to be used aboard the **DBS**. In-house studies have found that the **DBS** will require a power source of 10-50 kilowatts, which fits well within the range of the **SNAP 8**.

Concern was expressed over the possibility of the space power systems family growing too big for available funding. Finger said that his office is working to provide technology in all areas without going into advanced hardware. Programs are being evaluated before funding for advanced hardware is decided on.

LOCKHEED TO BUILD JAVELINS FOR REENTRY TESTS

The Naval Ordnance Test Station at China Lake, Calif., has awarded Lockheed Propulsion a \$300,000 contract for 98 solid-propellant **JAVELIN II** rocket motors to propel a special sled for testing missile reentry systems. The company says this contract "marks the first time Lockheed Propulsion has fabricated the entire motor in house from an off-the-shelf design." To date Lockheed has provided over 400 **JAVELIN** motors. **II** is the successor to **I** and **III**, which have been used for sleds and sounding rockets.

CAL STUDYING LUNAR ORBITER PHOTO ANALYSIS

The means of evaluating the quality of the photographs **LUNAR ORBITER** will take this summer are being investigated by Cornell Aeronautical Lab under a \$40,000 NASA-Langley contract. Techniques are being devised to measure topographic pictorial quality factors. **LUNAR ORBITER**'s entire photographic system, plus photos taken by the **RANGER** spacecraft, are being studied. The **ORBITER** is being developed by Boeing Aerospace, which was preparing the ground test models last fall (SPACE Daily, Nov. 29).

D-1A NAMED DIAPASON

The French Minister of Science has named the second Franco payload (SPACE Daily, Feb. 21) **DIAPASON**, a musical term that means "standard of pitch" (e.g. a tuning fork). Two other names had been suggested (SPACE Daily, Feb. 17). The satellite's approximate orbital elements are 312/1707 miles, 34 degrees, and 118 minutes.

BUNKER-RAMO GETS SPACE VIBRATOR

Bunker-Ramo's Product Assurance Test Facility now includes a vibration simulator for testing space systems under operational conditions.

MCNAMARA'S POSITION FY 1967 -- II

(The following is Part II of SPACE Daily's annual detailed breakdown of Defense Secretary McNamara's funding position for space and missile projects for the new fiscal year.)

SPACE -- II

Air Force Exploratory Development. More than \$200 million of this program which is budgeted for a total of \$316 million is earmarked for space investigations or related technologies. These include: inertial guidance, spaceborne computer techniques, navigation sensors, missile target identification, terminal guidance, secure telemetric transmissions, rocket pumps, nozzles and combustion chamber improvement, bio-astronautics, improvement of photographic and infrared surveillance, and over-the-horizon electronics. An additional \$97 million is requested for laboratory support for the exploratory development program.

Project DEFENDER. This exploratory development of ARPA for ballistic missile defense is budgeted for \$119 million for FY '67. About \$48 million of this amount is slated to go for re-entry measurements such as Project **PRESS** (Pacific Range Electromagnetic Signature Studies). About \$24 million will be spent on investigations of electromagnetic devices for improving and economizing missile defense systems which includes high frequency over-the-horizon radar techniques. The remaining approximately \$47 million will be concerned with penetration aids and the missile interceptor technology (principally in the **UPSTAGE/HIBEX** (high acceleration missile intercept) category). Some money in this category is going for ionospheric physics for application to long range radars for missile and satellite defense.

X-15. This rocket research plane will continue DOD experiments with a \$6 million budget for the new fiscal year.

MISSILES

NIKE X (ZEUS/SPRINT/SIM). The **NIKE X** program, a vastly reoriented ABM effort (SPACE Daily, Jan. 28), is budgeted for \$447 million for development of the high acceleration **SPRINT** missile, the MSR (missile site radar), the austere multi-function phase array radar (TACMAR), for **NIKE ZEUS** testing, and the new exoatmospheric (space) interceptor missile (**SIM**) (See report elsewhere in this issue.).

NIKE ZEUS Targets. This program has a budget of \$8 million for the targets that ride aboard **ATLAS** missiles to intercept at Kwajalein.

LANCE. This missile system, slated for procurement in FY '67, will use \$19 million in FY '66 money for production tooling and advance production engineering.

Shipboard LANCE. Otherwise known as Landing Force Support Weapon, the Shipboard **LANCE** (SPACE Daily, Oct. 12, '64 & Jan. 25) is budgeted at \$2 million for flight testing in a sea environment.

CHAPARRAL. Procurement of this surface-to-air missile is assured with a funding request of \$62 million.

MCNAMARA'S POSITION FY 1967 -- II-Contd

MISSILES-Contd

ASMS. The Advanced Surface-to-air Missile System, for eventual replacement of the **TERRIER-TARTAR-TALOS** family, has a budget of \$2 million, i.e., the missile has been delayed another year in anticipation that a more advanced system is possible. DOD is going forward first with **SAM-D** using the **ASMS** technology. **SAM-D** is approved for engineering development on the assumption that the current contract definition will be successfully completed.

Advanced ARM. Looking beyond the **ARM I**, which is an anti-radiation missile beyond the present **SHRIKE**, is programmed for \$4 million.

Advanced Sea-Based Deterrent. A \$3 million item is provided for Augmented Thrust Propulsion as a continuation of the work on the advanced sea-based deterrent concepts.

Advanced ICBM. The Advanced ICBM will continue to be studied in various technological and operational concepts with a \$10 million budget for FY'67.

Advanced ASM Technology. Formerly known as Tactical Missile Guidance Development, this program provides for the development of both all-weather and fair weather command and automatic guidance techniques for missiles directed against ground targets. An \$8 million budget is provided.

NASA TO UTILIZE ELECTRIC PROPULSION SYSTEMS IN ATS

Mac C. Adams, NASA associate administrator of Advanced Research and Technology, has told Congress that NASA is planning to apply electric propulsion for satellite attitude control in the near future. The systems are being considered for attitude control of an Advanced Technology Satellite and also may be used in earlier programs.

LANGLEY DEVELOPING EXTRAVEHICULAR JET SHOE

NASA-Langley is exploring the possibility of developing a jet shoe concept where small thrusters on the foot would produce thrust perpendicular to the sole of the foot for propelling astronauts in extravehicular missions. The technique is envisioned desirable for freeing the astronaut's hands for extravehicular work. The research is being conducted under the \$3.12 million Man-Systems Integration program of NASA's Advanced Research and Technology (SPACE Daily, Feb. 14, p. 274).

COSMOS 110 Dogs In Good Condition. The Soviets said the two dogs aboard **COSMOS 110**, launched into a 115.94/561.72 mile, 51.54 degree orbit Tuesday, Feb. 22, were alive and in good condition Friday evening. If the dogs are testing spacecraft systems for a future circumlunar mission (SPACE Daily, Feb. 24) they might be brought down tomorrow after equaling the time in orbit for such a flight. Also, the next opportunity for a Soviet lunar mission arrives about Wednesday.

MINUTEMAN Fired In Salvo. Thursday afternoon, Feb. 24, the Air Force launched two **MINUTEMAN ICBMs** in a salvo test from Vandenberg.

LOCKHEED M&S TO INCREASE PERSONNEL

Increased work on the **POSEIDON** missile and other programs will dictate an increase of 1500 to 2000 personnel this year, Lockheed Missiles & Space Co. says. Current employment is 23,750.

In addition to missile work, the company noted that it has diversified "beyond anything we envisioned several years ago." Included: Man-in-space laboratory, under-sea exploration, post-**APOLLO** development, land vehicles, medical management systems, and state-wide information systems.

ASTROSYSTEMS INTERNATIONAL ACQUIRES FROST ELECTRONICS

Astrosystems International (Fairfield, N.J.) has acquired the assets of Frost Electronics Corp., a developer and manufacturer of industrial photoelectric controls. Frost will be operated as a wholly owned subsidiary of the research and development organization and will retain its existing sales representative structure.

CSC ACQUIRES ALFRED POLITZ RESEARCH

Computer Sciences Corp. has acquired Alfred Politz Research (New York, N.Y.) for CSC common stock. Politz Research conducts consumer and industrial research and makes recommendations for marketing and advertising programs. It also conducts studies to determine advertising effectiveness of various media.

Fletcher Jones, president of Computer Sciences, says that CSC's acquisition of Politz is another step toward development of a total capability in the information sciences

BURROUGHS SALES/EARNINGS ESTABLISH NEW RECORD

Burroughs' sales for 1965 reached \$459,413,662, up 17 per cent from last year's \$392,462,319. Earnings rose 71 per cent from \$10,212,245 to \$17,527,948. Sales and net income were the highest in Burroughs' 80-year history. Company officials predict that total net earnings for 1966 will exceed those of 1965 by approximately 25 per cent.

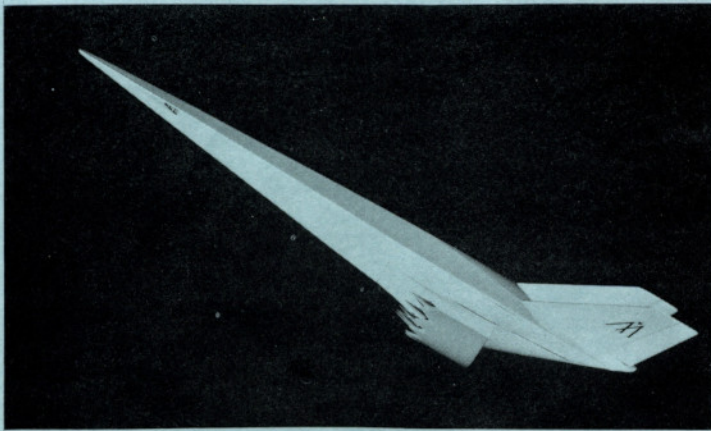
KAMAN EARNINGS UP 12 PER CENT

Kaman Aircraft's sales for 1965 were \$51,292,959, compared to \$56,828,343 in 1964. Earnings rose 12 per cent from \$948,829 to \$1,071,917. Charles H. Kaman, president, predicts that sales will continue their upward trend during the remainder of 1966, and earnings will continue to be good.

CONDEC EARNINGS UP 44 PER CENT

Condec Corp. (Stamford, Conn.) had sales of \$20,685,000 for the six months ended January 31, compared with the \$17,373,000 for the same period last year. Earnings rose 44 per cent from \$453,000 to \$654,000, setting a new record for the company.

NASA BUILDING NEW FACILITY FOR RAMJET EXPERIMENTATION



NASA will extend its investigation of ramjet engine technology in fiscal '67 with a new \$2 million facility to be built at the Lewis Research Center, designed to conduct fundamental research into ramjet operation in the Mach 5 to Mach 7 range. Funds for the new facility are included in NASA's \$16 million Construction of Facilities Budget for Lewis (SPACE Daily, Jan. 26). Work at the facility will include research on inlets, supersonic combustion, nozzles and cooling at hypersonic speeds.

Another \$2 million is being asked by NASA for its "hypersonic ramjet experiment" (SPACE Daily, Jan. 25). Three contractors--Garrett, GE and Marquardt--have been working on a hypersonic ramjet engine for NASA-Langley for about one year. Preliminary

reports are expected next month with contractor selection by late spring (SPACE Daily, Feb. 21).

The program calls for the hypersonic ramjet to be flight tested on the **X-15**. (See SPACE Daily, July 2, '63.) Picture at top is an artist's conception prepared by Marquardt showing its ramjet (known as **SCRAMJET**, and being developed for AF--SPACE Daily, Feb. 17) mounted underneath the aft fuselage of the **X-15**. (Marquardt, which was prime contractor for the early **LACE** (Liquid Air Cycle Engine) ramjet (SPACE Daily, June 28, '63), was awarded the initial contract to study the integration of **X-15** with "an air-breathing engine" (SPACE Daily, July 2, '63). The study was conducted for NASA-Edwards under a sole source contract.)

The engine specified by NASA-Langley will weigh 800 pounds with dimensions compatible with mounting beneath **X-15**. Liquid hydrogen fuel was specified for the engine which will be capable of operating at flight speeds between Mach 3 and Mach 8 (SPACE Daily, April 6, '65).

The hypersonic ramjet is envisioned for hypersonic transport aircraft, for boosters and for spacecraft flying within the atmosphere (**SPACE PLANE**). Picture below is an artist's conception by Marquardt of its in-atmosphere spacecraft.

Dr. John W. Andersen has been appointed director of research and development of HITCO (Gardena, Calif.). Andersen was formerly vice president and director of engineering for the Advanced Programs Division of the G. T. Schjeldahl Co.

Future Space Business**OGO-F LYMAN-ALPHA EXPERIMENT**

The Space Systems Division is initiating a research program for a lyman-alpha experiment. The experiment is intended to be flown on NASA's OGO-F satellite. The purpose of the experiment is to measure ultraviolet radiation scattered from extended Earthhydrogen atmosphere. The technique involves sky scanning filtering and grating optics.

Contact: Headquarters, Space Systems Division (SSD) (AFSC), Los Angeles Air Force Station (LAAFS), Air Force Unit Post Office, Los Angeles, Calif. 90045, Attn: T. Schaus (SSKB). Due date: Mar. 7.

TROPOSPHERIC SCATTER COMMUNICATIONS SYSTEM

The Navy Purchasing Office is planning to fund a program to engineer, furnish, install and test a replacement tropospheric scatter communication system for the presently installed link between NAVCOMMSTA Spain and NAVRADSTA Moron, Spain. The system will consist of two terminals.

The following firms have been invited to bid for Step II: Page Communications Engineers, ITT Federal Electric Corp., and Litton System-Westrex Communication.

Contact: U. S. Navy Purchasing Office, Washington Navy Yard, Washington, D.C. 20390. Reference: IFB 600-628-66. Due date: Mar. 7.

RADAR VULNERABILITY STUDY

The Army is requesting proposals for services necessary to perform a classified study of vulnerability of radar installations. The study is to be completed 12 months from effective date of award.

Contact: Department of the Army, Defense Supply Service, Washington, Room 1D 245, The Pentagon, Washington, D.C. 20310, Attn: Garth Phillips, Telephone: (202) OXford 5-5461. Due date: Mar. 2.

ADVANCED PENETRATION TECHNIQUES STUDY

The Army is initiating a study program to develop advanced penetration techniques.

Contact: Department of the Army, Defense Supply Service, Washington, Room 1D 245, The Pentagon, Washington, D.C. 20310. Due date: Mar. 7.

SIX-DEGREE-OF-FREEDOM LINKAGES

The Air Force Systems Engineering Group is initiating research, development and installation of improved mechanical linkages for the six-degree-of-freedom motion device located at Wright-Patterson Air Force Base, Ohio.

Contact: Directorate of R&D Procurement, Systems Engineering Group (RTD) Wright-Patterson Air Force Base, Ohio. 45433, Attn: SEKOC. Reference: RFP No. 63056. Due date: Mar. 6.

MORE

Future Space Business * Contd.**TRACKING ACCURACY REQUIREMENTS STUDY**

NASA-Marshall is requesting quotations for a research study on tracking accuracy requirements.

Contact: Purchasing Office, PR-ES, Marshall Space Flight Center, NASA, Huntsville, Ala. 35812. Reference: RFQ 1-6-75-00110. Due date: Mar. 21.

NASA NEGOTIATIONS

Northrop Nortronics--with Electronics Research Center for study of transfer characteristics of a moving plasma as they affect antenna response.

Applied Research Div., Litton Systems--with Headquarters for investigation of extra-terrestrial dust at 140,000 feet.

Westinghouse Electric Corp.--with Langley for improvement of the oxygen partial pressure system.

Lockheed Missiles and Space--with Marshall Space Flight Center for study of orbital drag coefficients for unusual vehicle configurations.

Technidyne--with Marshall Space Flight Center for continued development of an ultrasonic tube connection tool for the purpose of providing a "no leak" condition of space vehicle flared tubing connection while in position.

NASA CONTRACTS**Goddard**

Westinghouse Electric Corp.--\$72,900 for gravity gradient stabilization system elements and antenna structures.

Houston

General Precision--\$30,230 for orbital position indicator.

General Electric Co.--\$39,500 for study of optimum soft-landing trajectories.

TRW--\$55,300 for accelerator modification equipment.

Western Operations

Dynamic Science Corp.--\$47,770 for effect of additives on the ignition delay time of hyperbolic propellants.

Dynamics Science Corp.--\$113,152 for biopropellant instability model and steady-state model for thermally unstable fuels.