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LTV TO ADAPT TERRIER LAUNCHER FOR SHIPBOARD LANCE. Ling-Temco-Vought, developers of the Army **LANCE** surface-to-surface missile system, has been contracted by the Naval Ordnance Test Station to adapt the **TERRIER** surface-to-air defense missile launch and launcher electronics to handle the **LANCE** in its planned role as BuWeps' shipboard "austere" missile (SPACE Daily, Oct. 12, '64 & Oct. 11, '65).

Recently the Naval Ordnance Station awarded a contract to Dynamics Research Corporation of Stoneham, Mass., for an analytical study of the feasibility of converting and adapting the **LANCE**, a short-range storable propellant replacement for the **HONEST JOHN**, for shipboard deployment.

BuWeps is seeking an austere missile system capable of accelerated development and procurement for deployment as both a defense and bombardment weapon. In one concept the missile would be installed aboard amphibious landing craft or similar low draft ships for close-in support of landing operations, for specialized bombardment missions and for defense of major bombardment missions. The attractiveness of the concept for engagements such as the Vietnam War is apparent.

NASA READY TO ISSUE DIRECT BROADCAST SATELLITE RFPS. NASA-Washington has prepared and is ready to issue the requests for proposals for the Direct FM Broadcast Satellite (SPACE Daily, Nov. 8 & 12). The issue may be made this week. It is not expected that NASA will ask for a satellite to be equipped with a nuclear power system but will stay within the near state-of-the-art of such systems as solar arrays. It is believed that direct radio broadcast to home receivers with such a satellite as the **DFMBS** can be a reality within four years.

KAMAN ENTERS LIFTING SPACE SHUTTLE FIELD. The Kaman AviDyne division of Kaman Aircraft has been awarded a contract by NASA-Ames for the investigation of the guidance and control concepts which could be employed during the terminal phases of the flight trajectory of lifting body space shuttle vehicles. In other space shuttle studies Ames has contracted for a review of the various concepts (SPACE Daily, Feb. 1) and for a means of providing protection equipment against reentry temperatures (SPACE Daily, March 9).

AF ADVANCED LIQUID BIDS FOR TOP REUSABLE ROLE. The Air Force's advanced development of a liquid rocket engine, funded at $8 million in FY '66 and

promised at least twice that in FY '67, is claimed as a system far superior to the NASA/Aerojet M-1 liquid hydrogen 1.5 million-pound thrust engine system suffering from want of development funding in FY '66 and without further encouragement in FY '67.

Although it will have less than 20 per cent the unit thrust of the M-1, the new engine's 250,000 pounds of thrust are seen as very attractive for upper stage clustering for reuseable launch vehicles in the 500,000-to-3-million-pound power level. Presently, the engine is defined as a liquid hydrogen fully integrated module with a toroidal combustor, transpiration-cooled, with a high pressure combustion engine chamber, an aerospike nozzle, and having a stage combustion cycle with an integral turbo-pump and high-efficiency injectors.

TWO ENGINES CHOSEN FOR DOUGLAS MORL STUDY. Resistojet and radioisotope rocket engine concepts have been selected for preliminary design development for the MORL (Manned Orbiting Research Laboratory) (SPACE Daily, April 26, '63). The selection was made by Douglas as part of the new, $100,000 study it is doing for NASA-Langley on advanced engine systems for MORL (SPACE Daily, Oct. 12). The preliminary design work is being subcontracted to Marquardt for the resistojet and to TRW Systems for the radioisotope thruster. Douglas cites the high specific impulse of the two engines as a major factor behind the selection.

In the original MORL power design study program (SPACE Daily, Sept. 16, '64) which called for the preliminary concept and integration mode examination of an isotope power system, Douglas issued a $130,000 subcontract to Garrett AiResearch for the design of a 10-kw output radioisotope heat source with a five-year mission capability (SPACE Daily, May 6). This system, which AiResearch has already demonstrated in a laboratory test model, would obtain a 20 per cent efficiency with argon as the working gas.

TRW Systems is developing the SNAP-POODLE radioisotope thruster for the AEC and the Air Force. A $60,000 contract was recently awarded by the Air Force for a design-demonstration of this nuclear power system which has already been discussed as a power system for manned orbiting laboratories (SPACE Daily, Aug. 2 & 31). Douglas, in parallel with the resistojet and radioisotope thruster studies, is investigating propellant tankage and feed system design and evaluating propellants such as hydrogen and ammonia. MORL is a 260-by-505-inch laboratory for housing up to nine men for extended periods in Earth orbit.

NEW POWER SYSTEM STUDIED FOR AA MISSIONS. The AEC has been studying a polonium-210 fueled isotope thermoelectric power system for the AAP (APOLLO Applications) program. The system, weighing less than present APOLLO fuel cells, within safe radiation levels for the crew, would provide 1.5 kilowatts. It is deemed capable of development within the lead time frame of the AA program (1968-72) and the cost limits and would meet man-rated reliability requirements. Such a system has been proposed also for the MOL, MORL and manned Mars missions. These larger power level requirements are being studied for power needs beyond the 1 kilowatt level, up to 5 kilowatts and include missions such as manned Mars considerations.

FIRST PRIME BOILERPLATE NOW IN USE. The first of six boilerplate models of the **SV-5D**, the developmental version of the Martin lifting space shuttle being developed for the AFSC Space Systems Division, has been completed and is now at Goodyear's Akron, Ohio, plant for compatibility checkouts with the body's recovery system. The bright orange, 7-foot-long model is identical in size and weight to the four flight models of **SV-5D** to be built for tests over the Western Test Range late next year. Those models will use **ATLAS SLVs**.

SV-5D is the configuration for SSD's **PRIME** program (Precision Recovery Including Maneuvering Entry). Martin-Baltimore won the **PRIME** contract in the summer of last year (SPACE Daily, July 23 and Aug. 18 & 19, '64) but just recently announced its choice of subcontractors (SPACE Daily, Oct. 28 and Nov. 1). **PRIME** is Phase II of the **START** program (Spacecraft Technology and Advanced Re-entry Tests), although **START** officially began with **PRIME** rather than with Phase I, **ASSET** (SPACE Daily, Mar. 4). The other five boilerplate models will be delivered to SSD.

COMSAT TO BREAK GROUND AT BREWSTER TERMINAL TOMORROW. Tomorrow morning at 11 AM PST, ground-breaking ceremonies will begin at ComSat's Brewster, Wash., ground station site. On hand will be Senators Warren Magnuson and Henry Jackson (both D), Representative Thomas Foley (D), ComSat Chairman James McCormack, and Robert Timm, executive secretary of the Washington Utilities Commission. The construction RFPs for Brewster are still out (SPACE Daily, Oct. 28 and Nov. 1).

VENUS II LAUNCHED. The Soviet Union launched its second officially known Venus probe Friday with the flight of **VENUS II**, scheduled to fly by the planet late next February. The first near-success of a Soviet Venus probe was launched on February 12, 1961, and is the one identified by them as **VENUS I**. However, there is now enough evidence to confirm such earlier reports that the first attempt at a Venus probe ended in failure after its Feb. 4, 1961, launch (SPACE Daily, Jan. 19 & Feb. 14, '61).

SOVIETS SAY PAYLOADS HEAVIER THAN PROTON TESTED. Soviet manned space flight official Maj. Gen. Nikolai Kamanin says his country has already tested spacecraft or packages heavier than **PROTON** I and II (26,901 pounds). He says further that the Soviet rocket vehicles "are and will continue to be the largest with the longest range." Soviet professor G. Petrovich in separate remarks claimed that a vehicle weighing 400 to 500 tons will be orbited by the end of the 1970s.

MCNAMARA CONFIRMS ESCALATION OF VIETNAM TROOPS. Defense Secretary Robert McNamara last Thursday laid the groundwork for the next increase in the number of troops to be sent to the Vietnam War, at the same time adhering to and confirming the earlier estimate and report (SPACE Daily, Aug. 2) that the number of troops would climb to 150,000 by winter, 200,000 before the month of January is out, and possibly as high as 250,000 by spring. The present level in Vietnam is 160,000.

ATS-B TO TEST SYNCHRONOUS METSAT

ATS-B, the first synchronous orbit, spin-stabilized Applications Technology Satellite (the **ATS-1** mission), to be launched about mid-1966, will carry a videcon-photomultiplier photographic experiment, the results of which could lead to a synchronous meteorological satellite system sometime before the end of this decade.

This is the experiment which the DOD has requested for a joint participation with the NASA and the Weather Bureau (SPACE Daily, Nov. 12). It is DOD, who, seeking real-time information of the weather over a theater of operations, believes total world-wide coverage can be obtained with synchronous weather satellites and one or two polar-orbiting supplements.

The discussions between NASA, the Weather Bureau's National Meteorological Satellite Center, and the DOD's Joint Meteorological Satellite Office are being carried out on a continuing weekly basis. These discussions have indicated that the Weather Bureau definitely concurs with the need of a synchronous satellite program and that the DOD feels that such a satellite would fulfill all its military requirements, something the **TOSS** (**TIROS** Operational Satellite System) does not. In response to this need by the Weather Bureau and DOD, the Weather Bureau asked NASA to include the videcon experiment on the first **ATS**.

Operating from about 19,000 miles out, the videcon-photomultiplier camera would be able to transmit pictures of the cloud cover over a stationary point on the Earth below it at least once every 20 minutes during daylight.

The **ATS-B** satellite will be a spin-stabilized general purpose research satellite carrying meteorological, communications, radiation damage and other experiments suitable for a synchronous, equatorial orbit.

VON BRAUN PROPOSES ONE-WAY MARS MISSION

Dr. Wernher von Braun, director of NASA-Marshall, has proposed a national post-**APOLLO** space program which is culminated with a one-way flight to Mars of 12 astronauts in 1984, to be picked up by another mission in 1986. The proposals, in the latest issue of the AIAA publication Astronautics & Aeronautics, is based upon a budget held at the present level and utilizing a two-year inventory of **SATURN Vs**.

The von Braun plan would include a 3-man flyby mission to Venus in 1975, a manned flyby of Mars in 1978 (SPACE Daily, Nov. 9) and an eight-man stop-over mission to Mars in 1982 which would land and pick up four of the crew.

Following these missions, in 1984, von Braun would use multiple **SATURN V** launches to place six Mars landing craft and propulsion systems in Earth orbit. The six craft would leave on their seven-month journey to Mars orbit linked together but would descend to the Martian surface individually. Four of the Mars Excursion Modules would carry cargo and two would carry 12 astronauts and the propulsion capability to place them back in Mars orbit 18 months later. A separate spacecraft, launched from Earth later, would pick up the Mars explorers in 1986 and return them to Earth. This system would give the 12-man team the necessary equipment needed for survival on Mars in exchange for the weight needed for a direct return. The proposal would utilize nuclear upper stages for both the outbound and return flights.

FIRST MOL ASTRONAUTS NAMED

Eight astronauts, six Air Force and two Navy pilots, have been named as the first contingent of a 20-man force which will be trained as **MOL** crew members (SPACE Daily, July 1 & Nov. 20, '64). The Air Force pilots are Maj. Michael J. Adams, Maj. Albert H. Crews, Capt. Richard E. Lawyer, Capt. Lachlan MacLeavy, Capt. F. Gregory Neubeck, and Capt. James M. Taylor. The Navy pilots are Lt. John L. Finley and Lt. Richard H. Truly.

APOLLO/SA-201 SM TO BE TEST FIRED TODAY

The number **SA-201 APOLLO** spacecraft Service Module, due to be launched aboard the first **SATURN IB** flight early next year (SPACE Daily, Aug. 12 & Sept. 9), was scheduled to undergo a 15-second static test firing Friday but had to be delayed until today due to "minor hardware problems."

QUIET SUN EXPLORER SET FOR 17TH

The **SOLAR EXPLORER,** a contribution of the United States to the International Quiet Sun Year program, will be launched from Wallops Island aboard a **SCOUT** vehicle into a 350/550-mile orbit on November 17 (SPACE Daily, Sept. 20). The satellite will make observations of the Sun during this period of minimum solar activity.

AOSO TO USE ZENITH VIDECON CAMERA

NASA-Goddard will negotiate with Zenith Radio for a $500,000 contract for development and construction of a prototype vidicon camera system to be integrated with an X-ray telescope for use on the **AOSO** (Advanced Orbiting Solar Observatory). The camera will convert X-ray telescope findings into visible pictures to be transmitted to ground stations. **AOSO,** under development by Fairchild-Hiller, is designed to study isolated or unusual solar activity.

S-II STAGE TESTED

North American Aviation has completed "ultimate" load tests up to 140 per cent of design limit pressures on the **SATURN V S-II** stage. The tests achieved a full 40 per cent margin of safety for the components under all stress loading conditions that could occur during pre-launch operations or in flight. The test gauged the stresses on the common bulkhead test tank.

FOUR BID ON PHOTOCHEMICAL LASER SYSTEMS R&D

Four companies--AVCO, GCA Technology Division of GCA Corp., General Precision Aerospace, and Hughes Research Laboratories--have submitted proposals to NASA-Cambridge for its study of photochemical laser converters. The Center invited 12 firms to bid on ERC/R&D 66-21 (SPACE Daily, Oct. 15).

ITT EARNINGS UP 11 PER CENT

ITT had sales of $1.2 billion for the first nine months of 1965, up from last year's $1.1 billion. Earnings increased 11 per cent from $46,501,000 to $52,066,000, marking the 25th consecutive quarter of advances in net earnings. Backlog reached an all-time high of $1.1 billion as of September 30, compared with the $1 billion recorded at the same time last year.

Harold S. Geneen, president and chairman of the board, reported that "The favorable financial results for the first nine months of the year, together with the continuing high level of economic activity in the areas served by ITT in the U.S. and by its worldwide subsidiaries, give every indication of a continuation of steady growth in sales and earnings we have experienced in recent years."

APPLIED PHYSICS' EARNINGS SET NEW RECORDS

Applied Physics Corporation of Monrovia, Calif., had sales of $5,631,111 for the first nine months of the calendar year, up from last year's $5,352,367. Earnings, which set a new record, were up five per cent from $356,789 to $375,340. Applied Physics designs and manufactures recording spectrophotometers and spectropolarimeters, vibrating reed electrometers and accessory equipment.

CUBIC RECEIVES $2.3 MILLION LOAN

Cubic Corporation has been granted a $2.3 million loan to finance expanded commercial and space/defense programs. Walter J. Zable, president and chairman of the board, said that "Bookings in 1965 are expected to reach $20 million, with an anticipated increase in 1966. The new financing is required for this growth." The note is due September 30, 1980.

BEECH TARGET PASSES COMPATIBILITY TEST

Beech Aircraft's AQM-37A supersonic missile target is now compatible with the Navy's F8 Crusader aircraft as well as with the F4 Phantom II and the A4 Skyhawk. The compatibility rating was earned during recent evaluations when the missile was launched from the F8.

The AQM-37A has been in production since the first half of 1961 for the Bureau of Naval Weapons. Over 750 of it have been delivered thus far, and it is presently in use by both Atlantic and Pacific fleets. Driven to supersonic speeds by a liquid, bipropellant engine, it is delivered fully fueled and flight-ready. Beech won the AQM-37A contract in mid-1959. Beech has developed a new series of supersonic target missiles identified as the **JAYHAWK** (SPACE Daily, Oct. 28).

Sidney Topol has been named manager of Raytheon's Communications and Data Processing Operation. Topol, who organized and directed the Telecommunications Division of the company's Italian affiliate, Selenia S.p.A., succeeds **William T. Welsh** who was promoted to vice president-government marketing.

WESTINGHOUSE PROPOSES SOLAR CELL REJUVENATOR

The Westinghouse Research Labs in Pittsburgh has devised a method of restoring life to satellite solar cells. Bombardment of such cells by the various radiation particles in space breaks down the silicon material in the cells and can curtail their power output by as much as 50 per cent in a matter of months. Experiments at the Labs have shown that agitating the silicon atoms with heat rejuvenates the cells by rebuilding their original configuration.

The heating would be accomplished in space by scanning the cells on command with a special Fresnel lens that would focus the Sun's rays on them temporarily to bring them to a temperature of about 850 degrees F. According to K. H. Sun, a Westinghouse physicist, "Experiments we have conducted with such a lens arrangement, using sunlight, show that about two minutes of heating, or annealing, restore a damaged solar cell to almost 100 per cent of its original output." He adds that the heating cycle can be repeated several times.

Dr. P. H. Fang of NASA-Goddard has also done research on cell restoration by heat treatment (SPACE Daily, Oct. 26).

AEROSPACE ASSETS/LIABILITIES DOWN SLIGHTLY

Aerospace Corporation, the non-profit organization established five years ago to assist the Air Force in the technical management of military space and ballistic missile systems programs, had assets and liabilities totaling $33,218,198 for FY 1965, down slightly from 1964's $33,677,381.

Air Force contracts represented 99.6 per cent of Aerospace's total gross income. Although the dollar value of the contracts decreased, the technical effort delivered to the Air Force was eight per cent over that delivered in FY '64. This was credited to a phase-out of all non-technical services previously rendered the AF and greater efficiency in internal support services for the firm's technical operations. At the same time the full range of overhead expenses has been under management surveillance. All such costs have been analyzed in order to utilize personnel and materials in the most efficient manner. As a result, there has been a steady fall in the overhead rate.

Aerospace earned $3,699,402 from its contracts during the year, of which $2,239,880 is the excess of income over aggregate expenditures. This amount has been applied primarily to corporate facilities, for which a final amortization of bank loans is required by July 1, 1973. The balance of the earnings has gone back into working capital.

SATURN V LOAD CELLS CALIBRATED

The National Bureau of Standards has completed precise calibration of four 12-million-pound capacity load cells made by Baldwin-Lima-Hamilton which will monitor weight and load changes on the **SATURN V** mobile service structure. The four cells, 28 inches high and 32 inches in diameter, are designed to fit in the support legs of the service structure.

William B. McLean, technical director of the Naval Ordnance Test Station, received the 1965 Rockefeller Public Service Award for his work developing the **SIDEWINDER**.

Future Space Business

LASER EFFECTS RESEARCH SUPPORTING SERVICES

The Aberdeen Proving Ground is soliciting proposals for a research and development program on supporting services for laser effects research. Examples of probable areas of interest are design and contruction of instrumentation needed in conjunction with laser effects studies and calibration and/or making operative such equipment.

The RFQ is geographically restricted to a radius of 80 miles of Aberdeen Proving Ground.

Contact: Procurement Division, Building 4603, Aberdeen Proving Ground, Md. Reference: RFQ-RD-APG-113-66. Due date: Dec. 13.

OCEAN SURFACE SURVEILLANCE CAPABILITY STUDY

The Naval Air Development Center is requesting bids for services and materials to conduct a study of current capability in ocean surface surveillance.

Contact: U.S. Naval Air Development Center, Johnsville, Warminster, Pa. Reference: RFQ-717Q. Due date: Dec. 9.

ARMY MISSILE PENETRATION AIDS STUDY

The Army Missile Command is funding a trajectory shaping study for Army missile penetration aids.

Contact: U.S. Army Missile Command, Redstone Arsenal, Ala., AMSM1-1Z(D), Attn: T. R. Moellers. Reference: RFQ AMSM1-1Z(D)-66 40. Due date: Nov. 22.

PROJECTILES VELOCITY MEASUREMENT DEVICE

Aberdeen Proving Ground is planning to procure a velocity analyzer, electronic doppler instrument for measuring and recording velocity of projectiles, complete with transmitter and receiving unit, analyzer unit and recording unit.

Contact: Procurement Division Building, 4603 Aberdeen Proving Ground, Md. Reference: IFB 66-145B. Due date: Dec. 8.

DOD NEGOTIATIONS

North American Aviation, Rocketdyne Division--with Air Force Ballistic Systems Division for logistic services to include storage preservation and maintenance of **ATLAS MA-3** propulsion subsystem tooling, equipment and spare parts.

Northrop Corp., Nortronics Division--with Aberdeen Proving Ground to conduct a basic study to design, fabricate, install and checkout a mobile service facility for a missile-borne self-contained tape recorder system.

NASA NEGOTIATIONS

Bell Aerospace Corp., Bell Aerosystems Co.--with Langley for service to landing control equipment at Wallops Island. The contract will include operation, maintenance, and assistance in modification.

DOD CONTRACTS

Army

General Dynamics/Pomona--$43,935 for settlement of engineering orders on **REDEYE** system equipment.

Dyna-Tech Inc., Tempe, Ariz.--$88,585 for infrared augmenters.

Navy

American Manufacturing Co., Fort Worth, Tex.--$2.7 million initial increment to a two-year $18.3 million contract for **SNAKEEYE** bomb bodies.

Johns Hopkins University, Applied Physics Laboratory--$21.3 million modification to an existing contract for continued research and development on guided missile systems.

Air Force

System Development Corp.--$14.3 million for design and development of softward portions of Electronic Systems Division programs and STP studies in support of the Air Force and friendly foreign governments.

NASA CONTRACTS

Lewis

Aerojet-General Corp., Solid Rocket Division--$1 million in incremental funding on contract NAS3-6284.

Goddard

Space-General Corp.--$45,800 for fabrication and refurbishment of **APACHE** recovery systems.

Planning Research Corp.--$48,229 for reliability study of the **RADIO ASTRONOMY EXPLORER**.

Ball Brothers Research Corp.--$57,500 for **OSO-F** experiment accommodation program.

G. T. Schjeldahl Co.--$43,827 for solar constant instrument.