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(NASA-News-Release-78-1) NEW EXPERIMENTS SELECTED FOR 1980 OPERATIONAL SHUTTLE FLIGHT (National Aeronautics and Space Administration) 17 p CSCL 22A

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NEW EXPERIMENTS SELECTED FOR 1980 OPERATIONAL SHUTTLE FLIGHT

Sixteen new experiments in space technology have been selected for NASA's Long Duration Exposure Facility (LDEF) mission, currently scheduled as the payload for the first operational flight of the Space Shuttle in 1980.

These experiments join seven other technology experiments selected earlier this year.

LDEF, managed by NASA's Langley Research Center, Hampton, Va., is a reusable, unmanned, free-flying structure on which many different technical and scientific experiments can be mounted in special trays.

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LDEF provides an easy and economical way to conduct primarily passive experiments in Earth orbit.

The 16 new experiments were chosen from 190 candidates submitted to NASA in answer to an announcement of opportunity distributed in June 1976. Candidates came from industry, government institutions, universities, individual researchers and eight foreign countries.

Investigators for the experiments selected to date represent six universitites, six private companies or research institutes and five NASA research centers. Seven of the experiments are from France, two from England and one from Canada.

With selection of these new experiments, 80 per cent of LDEF's experiment trays are now filled with research projects. The remaining 20 per cent of experiment space will contain micrometeoroid detection panels, designed to measure the number and variety of tiny meteoroid particles in Earth orbit.

Experiments were selected for their research and development value, their compatibility with LDEF and other experiments and the cost of the effort.

Some experiments could not be accommodated because of NASA budget limitations. However, these experimenters have been offered the opportunity to have their experiments flown aboard LDEF if their periments are provided at no cost to NASA.

Technical areas represented by the experiments include materials, thermal control coatings, detectors, power, micrometeoroids, electronics, lubrication, optics and space debris detection.

After launch inside the Shuttle Orbiter's cargo bay from NASA's Kennedy Space Center in Florida, LDEF will be placed in a circular Earth orbit of at least 330 kilometers (270 miles) with an inclination to the equator of 28.5 degrees.

LDEF will remain in orbit from six to 12 months while its experiments are exposed to the environment of space. At the end of its mission, it will be retrieved by the Orbiter and returned to Earth. Experiments will be returned to their investigators for data analysis.

The Shuttle is scheduled to begin a series of six operational test flights in 1979. Once these are completed, operational flights will begin. LDEF is currently planned as the payload for the first operational flight in 1980.

Newly selected experiments and their principal investigators are:

• Influence of Extended Exposure in Space on Mechanical Properties of High-Toughness Graphite-Epoxy Composite Material. Investigator: Dr. David K. Felbeck, University of Michigan, Ann Arbor, Mich.

These composites are promising candidates to replace aluminum alloys for structural use in space vehicles. Before they can be used with confidence for extended space flights, however, the behavior of their mechanical properties must be determined, when exposed to space for long periods.

• Atomic Oxygen Stimulated Outgassing. Investigators: Dr. Robert L. Scott, Jr., Southern University, Baton Rouge, La., and Roger C. Linton, NASA Marshall Space Flight Center, Huntsville, Ala.

The effect of oxygen impingement on thermal control surfaces in near-Earth orbit will be investigated with regard to the production of optically damaging outgassing products. The bi-directional reflectance of selected coating will be measured before and after space exposure. Data will help determine if atomic oxygen impingement was a major factor in unexplained Skylab contamination by providing an understanding of the effect of atomic oxygen on thermal control surfaces.

• Space Testing of Holographic Data Storage Crystals. Investigators: Drs. Thomas K. Gaylord and W. Russell Callan, Georgia Institute of Technology, Atlanta, Ga.

The effect of long space exposure on electro-optic crystals, for use in ultra high capacity space data storage and retrieval systems, will be tested. Information will help in the development of high-bit-capacity recorder and memory systems.

• Space Plasma-High Voltage Drainage. Investigator: Dr. J. M. Sellen, Jr., TRW Defense and Space Systems Group, Redondo Beach, Calif.

This experiment is a determination of long-term current drainage properties of thin dielectric films subjected to high-level electric stress in the presence of the ambient plasma in space and solar radiation. Observed behavior of these films will establish allowable long-term electric stress levels for such films, as applied to solar array and spacecraft thermal control coating materials.

• Passive Exposure of Earth Radiation Budget Experiment Components. Investigators: John R. Hickey and Francis J. Griffin, Eppley Laboratory, Inc., Newport, R.I.

Earth Radiation Budget (ERB) experiments require accuracies in solar and Earth flux radiation measurements in fractional percentages.

To assure that these high-accuracy devices are measuring real variations and are not responding to changes induced by the space environment, the devices should be radiometrically tested, after exposure, to the best approximation of the orbital environment. Because the ERB experiment has been operational on Nimbus 6 since July 1975 and will be operational on Nimbus G and because in-flight calibration is difficult for solar and Earth-flux channels, this experiment will include exposure, retrieval and resubmittal for radiometric calibration of ERB channel components. Corrections may later be applied to ERB results, and information will also be obtained to help select components for future solar and ERB experiments.

• Advanced Solar Array Technology. Investigators: Edward M. Gaddy and James A. Bass, NASA Goddard Space Flight Center, Greenbelt, Md.

The experiment will test and qualify for space flight advanced solar array components, and test conductive epoxy bonding techniques, filterless cover glasses and high-efficiency solar cells, to increase the efficiency and cost effectiveness of satellite solar arrays.

- <u>Space Evaluation of Advanced Solar Array</u>.

Investigators: Ms. Ann Whitaker, Charles F. Smith and Leighton E. Young, NASA Marshall Space Flight Center, Huntsville, Ala.

This experiment will determine the effects of space on mechanical, electrical and optical properties of candidate lightweight solar array materials such as those needed for a space station, a satellite power station and solar electric propulsion solar arrays. Data obtained on the combined effects of ultraviolet, penetrating radiation and vacuum on these material properties will allow spacecraft manufacturers to design solar arrays with more predictable lifetimes.

- <u>Solar Array Materials and Assembly Techniques Evaluation</u>. Investigator: Ernest N. Costogue, NASA Jet Propulsion Laboratory, Pasadena, Calif.

This experiment will allow accurate determination and prediction of the performance characteristics of space solar array candidate materials and assembly techniques when exposed to space. The materials and techniques are essential for high-power, ultra-lightweight solar arrays for future solar-powered planetary missions, space power station applications and low-power arrays for lunar and planetary missions. Data will reveal those materials and techniques that are compatible with space, and accurate predictions of their performance can be projected for future space missions.

• <u>Evaluation of Long-Duration Exposure to Natural Space Environment on Graphite-Polyimide Mechanical Properties</u>. Investigator: J. H. Powell, Rockwell International, Tulsa, Okla.

• <u>Evaluation of Long-Duration Exposure to Natural Space Environment on Space Shuttle Payload Bay Door Graphite-Epoxy Mechanical Properties</u>. Investigator: D. W. Welch, Rockwell International, Tulsa, Okla.

These two experiments will establish and evaluate the effects of long space exposure on the mechanical properties of graphite-polyimide (addition and condensation) as applied to pre-cured and co-cured laminates and of payload bay door graphite-epoxy (sandwich panels and laminates). There are no specific data on the effects of the near-Earth orbital environment on graphite-polyimide materials systems. Flight data will enhance confidence to apply this relatively high-temperature, advanced composite matrix system for present and future applications. Allowables for graphite-epoxy have been established, based on pseudo environments. This experiment will confirm the validity of previous tests or identify correction factors for application to future structures.

• Study of Factors Determining Radiation Sensitivity of Quartz Crystal Oscillators. Investigator: Dr. John D. Venables, Martin Marietta Corp., Baltimore, Md.

Radiation-induced frequency drifts and acoustic absorption in quartz crystals oscillators must be minimized to avoid undesirable variations in high-precision clocks in satellites and missiles. The experiment will obtain information on predicting and improving the radiation sensitivity of these oscillators. The effects of exposure to an orbital radiation environment will be compared with results from a transmission electron microscope.

• Multiple Foil Microabrasion Package. Investigators: Dr. J. A. M. McDonnell, Dr. D. G. Ashworth, W.C. Carey, Dr. R. P. Flavill and R. C. Jennison, University of Kent, Canterbury, United Kingdom.

This a passive evaluation of the near-Earth pico-particle environment by penetration of micron thickness multiple foil arrays. Definition of the micron penetration spectrum will provide technological environmental definition and design guides for long-term, near-Earth missions. In addition, the mechanics and efficiency of meteor "bumpers" will be evaluated from multiple foils.

Reliable definition of the size, velocity and distribution of the near-Earth solid particle environment and particle composition analysis will supersede all other accumulated passive experiments.

• Exposure to Space Radiation of High-Performance Infrared Multilayer Filters. Investigators: Dr. J. S. Seeley and R. Hunneman, University of Reading, United Kingdom.

This experiment will expose to space radiation infrared multilayer interference filters of novel design, construction and manufacture, which are useful in sensing atmospheric temperature and composition. Optical behavior of these filters under radiation is not known and is critical to their performance.

• French Cooperative Passive Payload. Investigators: J. F. Crifo and J. M. Berset, Centre National de la Recherche, Scientifique, Laboratoire de Physique Stellaire et Planetaire, Verriers-le-Buisson, France; J. Bourrieau, Dr. J. C. Mandeville and A. Paillous, ONERA/DERTS, Toulouse, Cedex, France; J. Flamand, ISA Longjumeau, France; and A. Malherbe, MATRA, Rueil Cedex, France.

This payload is comprised of a single LDEF tray containing five electronics and two materials experiments.

These experiments will include space exposure of the following components: optical thin metal filters and evaporated cathodes for extreme ultraviolet photometry; coated optical components, rules and holographic gratings; thermal control coatings and materials; optical solar reflectors; and optical fibers and thin film optical circuits. The payload also includes a dust and debris impact analysis experiment.

- The Effect of Space Environment Exposure on the Properties of Polymer Matrix Composite Materials. Investigators: Drs. R. C. Tennyson and J. S. Hansen, University of Toronto, Ontario, Canada.

The experiment will determine the effect of various lengths of space exposure on mechanical properties of selected lightweight composite materials, including graphite, boron, s-glass and PRD-49. Property degradation caused by matrix breakdown, outgassing, thermal stresses and internal void cracks must be known about these materials. Actual specimen test results from space will be correlated with ground test data at ambient conditions and in a thermal-vacuum chamber.

● <u>Synergistic Effects of Space Environment on the Properties of Metallized Dielectrics</u>. Investigators: Drs. R. J. DeIasi and T. Hilgeman and Mr. M. L. Rossi, Grumman Aerospace Corp., Bethpage, N.Y.

The practical implementation of lightweight space structures depends largely on identifying low cost, high strength/weight materials that are not degraded by the space environment. The objective of this experiment is to determine the separate and combined effects of the space environment on the mechanical, electrical, spectral and microstructural properties of metallized dielectrics. This experiment provides a realistic approach toward qualifying these materials for space applications by determining the effect of temperature and thermal cycling, high vacuum and UV radiation, as well as preliminary data on the effect of ionizing radiation.

The previously selected experiments are:

● <u>Orbital Lubrication Experiment</u>. Investigator: B. J. Perrin, Ball Brothers Research Corp., Boulder, Colo.

The experiment will evaluate the cumulative effects of space on qualified lubricant oils.

Eight fluid lubricants with current or high potential use in space mechanisms will be analyzed to obtain preflight baseline data, impregnated into porous discs and ball bearings, subjected to space exposure during the LDEF flight, and analyzed after the flight to determine space induced changes. Measurements of mass loss due to outgassing in vacuum and surface creep will also be obtained and observations of the amount, distribution and effects of recondensed outgassed lubricant on typical surfaces of critical hardware will be evaluated. Lubricant performance in ball bearing assemblies will be investigated.

The experiment relies on the stable characteristics of the lubricants. Small changes caused by space exposure are important to such physical behavior as friction and surface wetting. Radiation effects are virtually unknown. Results from this experiment will provide useful data for the selection of lubricants and mechanical design requirements for future oil lubricated space mechanisms.

- Effects of Long-Duration Exposure on Active Optical Systems Components. Investigators: D. M. Blue and J. J. Gallagher, Georgia Institute of Technology, Atlanta.

The effects of space exposure will be measured on the performance of lasers, radiation detectors and other optical components, to identify any degradation and to establish guides for component selection. Although no components will be active during the mission, some may be biased.

- Space Debris Experiment. Investigator: Donald H. Humes, NASA Langley Research Center, Hampton, Va.

Future spacecraft, because of their sizes and space lifetimes, will be damaged by meteoroids. This experiment will expose passive targets of several different configurations to meteoroid impacts and, after recovery, establish if impact damages are the same as predicted from lower velocity impact tests performed in laboratories.

- Fiber Optic Experiment. Investigator: Dr. Alan R. Johnston, NASA Jet Propulsion Laboratory, Pasadena, Calif.

Tremendous volumes of data from applications satellites are expected by the year 2000. Fiber optic transmission lines will be required for future satellites because of their large band widths, lack of electro-magnetic interference problems, low weight and cost and safety. The experiment will determine long-term degradation of fiber optic data transmission equipment and test designs for mounting techniques, terminal coupling and sheaths.

• Advanced Photovoltaics. Investigators: Henry W. Brandhorst, Jr., A. F. Forestieri and D. T. Bernatowicz, NASA Lewis Research Center, Cleveland, Ohio.

This experiment is to provide the space testing needed for the acceptance of the new low cost solar cells and solar arrays being developed and to improve the correlation of space and ground test results. The experiment will investigate the effect of space exposure on new solar cell and array materials, evaluate their performances, measure long-time variations in spectral content of sunlight and calibrate solar cells for space use.

• Thermal Control Surfaces (Both Active and Passive.) Investigators (Active): Donald R. Wilkes and H. M. King, NASA Marshall Space Flight Center, Huntsville, Ala. Investigator (Passive): Wayne Slemp, NASA Langley Research Center, Hampton, Va.

These two experiments will determine the effects of space exposure on new coatings being developed for spacecraft thermal control. The passive experiment will use samples of paints, other coatings and second-surface mirrors, some exposed in a tray to all environments of the mission, and some exposed in the control canister only to specific environments.

Spectral reflectance of the samples will be measured before and after the mission. The active samples will be mounted on an indexing wheel with a reflectometer that will periodically record reflectance values in space.

A drawing to illustrate this news release will be distributed without charge only to media representatives in the United States. It may be obtained by writing or phoning:

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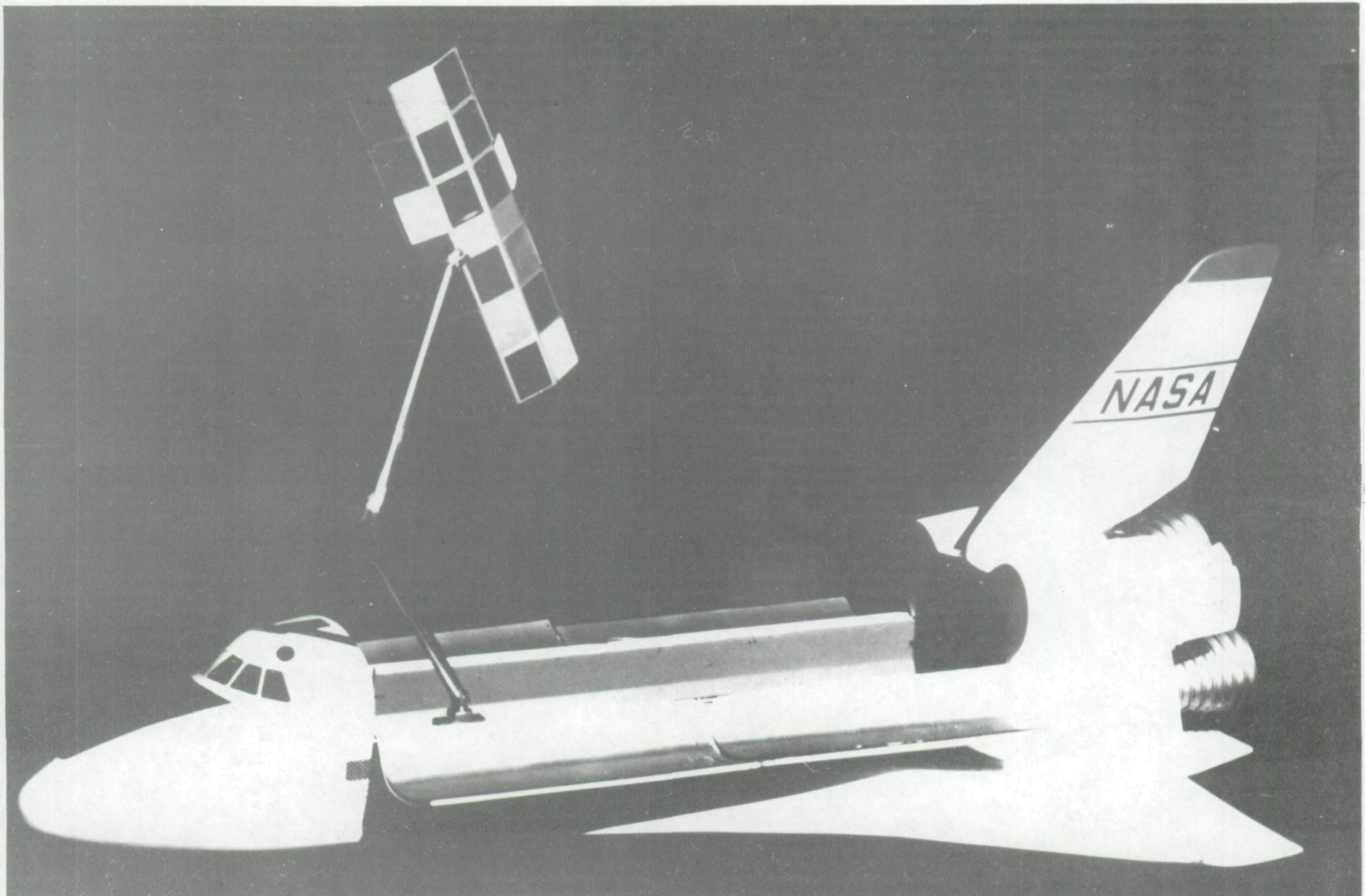

Model showing Long Duration Exposure Facility (LDEF) being deployed in space from the NASA Space Shuttle Orbiter. LDEF, managed by NASA's Langley Research Center, Hampton, Va., is a reusable, unmanned, free-flying structure on which many different technical and scientific experiments can be mounted in special trays. LDEF provides an easy and economical way to conduct primarily passive experiments in Earth orbit. NASA Photo: 77-H-756