

NASA cuts back space-science programs

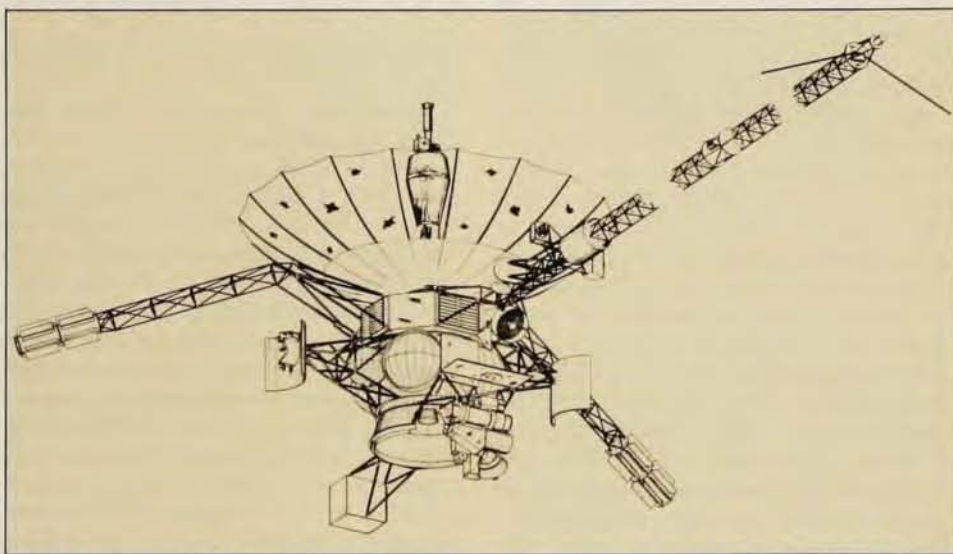
The budget that President Reagan sent to Congress for the National Aeronautics and Space Administration in Fiscal Year 1982 is a pared-down version of the earlier Carter Administration budget, providing for a 12½% increase over 1981. The lion's share of the budget will continue to go towards development of the Space Shuttle and its related systems. About half of NASA's R&D money will support this effort, which is labeled top priority.

The Shuttle program was largely left untouched by the budget trimmers, most of the burden of economizing falling on the space-science and remote-sensing programs. But at this writing the House subcommittee on space science and application, now headed by Ronnie Flippo (D-Ala.), was already attempting to remedy that. By taking about \$100 million out of certain programs, including \$60 million from the Shuttle development budget, the subcommittee was able to budget additional funds for space science and applications without asking for a larger NASA budget than Reagan had recommended. They added a total of \$30.6 million to the space-science budget and \$46 million to the space and terrestrial applications budget.

Space science. Space scientists have expressed deep concern over the 1982 spending levels proposed by the Reagan Administration. Reagan's revised budget calls for a 23% reduction in Carter's request for space science, to \$584 million. A. G. W. Cameron, chairman of the National Academy of Sciences Space Science Board, in testimony before the Flippo subcommittee, said that "If the proposals of the new Administration are accepted by Congress, there will be a gap from 1978 to at least 1984 in the effective start of new programs in space science."

Cameron's fellow board member Eugene H. Levy told us that he believes the budget represents "an inadvertent, but real, dismantling of American leadership in space science." Levy said that this process began several years ago, but that the last Carter budget would have provided the means to begin rectifying the situation.

The Reagan budget leaves un-



The Galileo orbiter, half of the Galileo mission to Jupiter. The orbiter and an atmospheric probe are scheduled for launch in 1985 from the Space Shuttle. Among the instruments the orbiter will carry are an ultraviolet spectrometer, a near-infrared mapping spectrometer, a photopolarimeter radiometer, a magnetometer, and plasma and plasma-wave instruments. Because a spinning spacecraft is required to investigate Jupiter's magnetosphere, while the imaging of Jupiter and its satellites requires a stable instrument platform, NASA designed a two-part orbiter, the bottom fifth of which can remain stable while the upper part spins. The atmospheric probe will transmit data to Earth via the orbiter for about 60 minutes during its descent. This will be the first orbiter and probe sent to an outer planet. The dish antenna is 4.8 m in diameter; because of its length only a portion of the magnetometer boom is shown.

changed the proposed levels of support for two major ongoing projects, the Space Telescope (PHYSICS TODAY, March, page 59) and the Galileo mission to Jupiter. But several important projects have been delayed, deferred or restructured, including the Gamma Ray Observatory, the Venus Orbiting Imaging Radar project and the International Solar Polar mission.

The Galileo mission, funded at \$108 million in 1982, is at this point the only ongoing planetary science program in full-scale development at NASA. Galileo, which consists of an orbiter and an atmospheric probe, has suffered several delays with resulting cost overruns in past years, largely attributable to problems in developing the Space Shuttle's launch system. The latest budget calls for yet another postponement in the launch date, from 1984 to 1985, when a Centaur rocket will launch the two craft from the Space Shuttle.

Carter's budget for the Gamma Ray

Observatory was \$52 million. Reagan reduced that budget to \$8 million, resulting in a two-year delay in the launch date, to 1988.

Reagan has reduced the budget for the initiation of the Venus Orbiting Imaging Radar mission to \$10 million, from \$40 million in the Carter budget. This will delay the launch of VOIR from 1986 to the next Venus window in 1988. The VOIR mission will fly advanced microwave instruments in orbit around Venus to permit for the first time mapping the surface of Venus through the planet's heavy clouds.

An additional area that was cut in the space science budget is experiments to be flown inside the European-built Spacelab in the Space Shuttle. Because of the new Administration's budget cuts, launch dates for all Spacelabs have been delayed. NASA had selected a number of principal investigators to perform physics and astronomy experiments on the later missions. With the budget cuts several of these experi-

ments have had to be terminated.

One Reagan budgetary decision may have an impact beyond the scope of the US space science community. Carter had budgeted \$58 million for the International Solar Polar Mission, a joint mission with the European Space Agency in which each agency would fly a spacecraft around opposite poles of the Sun, to explore the relationship between the outer atmosphere of the Sun and the interplanetary medium. President Reagan's budget forced NASA to drop the US spacecraft from the budget, leaving only \$5 million to provide instruments, tracking and support services for the European craft. According to Cameron, the elimination of the second spacecraft precludes the separation of spatial and temporal effects that related plasma observations to their point of origin in the corona. The cancelled US spacecraft also provided the only capability to observe the solar corona, interstellar hydrogen and helium, and low-energy solar and interstellar cosmic ray isotopes.

But the cancellation of the US spacecraft may have implications beyond the loss of science. "The effect this is going to have on the ability of the US to be taken credibly as a cooperative partner in future space science endeavors is devastating," according to Levy. Johannes Geiss, chairman of the Space Science Committee of the European Science Foundation, has stated that he fears that cancellation of half of ISPM "would lead to a serious setback in the evolving cooperation between US and European scientists."

The ESA has gone so far as to protest the move to the Department of State, equating the cancellation with a breach of contract. (Both ESA and NASA have already invested tens of millions of dollars in the second craft.) As of this writing, the State Department had not yet responded to the protest, but the Europeans were able to draw some solace from the Flippo subcommittee's recommendation that \$15 million be restored to the NASA budget to allow continuation of development of the second spacecraft.

Another important deletion made by the Reagan budget officials is the removal of all funding for the Solar Electric Propulsion System, which promised to provide a very low-thrust, solar-powered propulsion system suitable for some possible future deep-space mission of very long duration. \$18 million has been deleted from the Carter budget for SEPS, and \$7 million is being rescinded from the 1981 budget as well. According to the Space Science Board, without solar electric propulsion the ability to explore Saturn or any other outer planet by orbiters and probes would be severely degraded, and the US will not have the capability to achieve the major

NASA program changes

During last year's NASA budget conference between the House and Senate appropriations committees, the conference committee expressed alarm over what they saw as NASA's inability to anticipate cost overruns, and they resolved to do something about it. As a solution, they called upon the National Research Council to oversee NASA program changes; beginning this year, NRC will evaluate all "major" program changes before the Committee will consider approving them. By "major," the committee means those that involve more than \$100 million and that would delay the program involved by more than a year, increase the cost of the program by more than 25% or change the scientific objectives of the program. At first, the Research Council was reluctant to accept complete oversight responsibility for these major programs, but an acceptable compromise has been worked out: NRC will consider only the scientific and technological factors involved in the program change, leaving Congress to deal with all the other factors entering into the decision.

scientific objectives of a rendezvous with a comet or asteroid.

Applications. Reagan's request for space applications in the 1982 NASA budget is \$373 million, \$100 million less than Carter's request. Reagan took \$10 million from the budget for the Upper Atmosphere Research Satellite Experiments, which are to study the interactions among the chemistry, radiation and dynamics of the upper atmosphere, but Flippo's subcommittee has recommended restoring the money, bringing the budget for UARSE to \$15 million. It is understandable that Congress would restore support for UARSE, since it is part of a Congressionally mandated program to develop and carry out research, technology development and monitoring of the stratosphere and mesosphere.

A new Geological Applications Program, which would use remote sensing satellites to study geological resources that might contribute to the discovery of oil and gas deposits, was proposed by Carter but deleted by Reagan. The subcommittee is in favor of its restoration. The budget cuts also curtail development of the National Oceanic Sat-

ellite System, a triagency program initiated in Fiscal 1981 to demonstrate operational global observation of the world's oceans from space. NOSS was cancelled completely by the Reagan budget analysts.

Among the applications programs left intact by the new Administration are:

► The Landsat D satellite, scheduled for launch in the third quarter of 1982. Landsat, funded at \$83.9 million, will extend and improve observations of Earth resources from space.

► Earth Radiation Budget Experiments spacecraft development, funded at \$24 million. ERBE will measure energy exchanges between Earth and space.

► Work on the Halogen Occultation Experiment to measure energy, temperature, chemical constituents and winds during the next period of low sunspot activity, funded at \$7.5 million.

The FY 1981 applications budget will also suffer some "feedback" from the 1982 cuts; \$27 million has been diverted from the 1981 applications budget to make this year's budget consistent with next year's.

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DOD raises research budget for 1982

Among the many FY 1982 budgets that Congress is now considering is a request of \$716 million for basic research in the Department of Defense. According to DOD, approximately 44% of this will fund work at colleges and universities. DOD estimates that about \$88 million will be used for physics research, a 5% increase in real (inflation-corrected) dollars over this year's spending on physics projects. That is the smallest increase of all of the 13 basic research disciplines that the DOD identifies, but many of the other disciplines (such as electronics, which received a 16% increase after inflation) involve a large amount of physics as well. And the Pentagon funds a great deal of applied physics, too.

For example, DOD anticipates spending \$308 million to explore the techni-

cal feasibility of directed-energy weapons, including both high-energy laser weapons and particle-beam weapons. A 39% increase is planned for space-based laser defense system development, including large-aperture beam control technologies, and laser pointing and tracking technologies. The DOD particle-beam program funds both charged and neutral beams. The charged-particle beam program needs to demonstrate stable, predictable propagation of relativistic electron beams in the atmosphere. The purpose of neutral-particle beam research is to demonstrate the capability of generating low-divergence beams for potential space applications. Two important experimental tools for particle-beam research will be an Advanced Test Accelerator, under construction at Lawrence Livermore Labo-