1982 budget: Carter giveth and Reagan taketh away

In January, President Carter submitted his final budget to Congress. The Fiscal Year 1982 budget includes a 19% increase over 1981 for all research and development, and a 14% increase for basic research. By the Carter Administration's inflation projection (10% between FY 1981 and FY 1982) Carter left office claiming a continuous real growth for basic research during his four years in office.

But as this story went to press, President Reagan had just proposed a number of cuts in the 1982 budgets of NSF and NASA, including major cuts in Carter's requests for science and engineering education, for upgrading instruments at universities and for space studies. Included in Carter's budget proposals for R&D agencies are:

NSF. Physics at NSF would get a 15% increase under the Carter budget, with the extra money pretty evenly distributed across the various subfields. Astronomical sciences is slated for a 29% boost. Reagan has left these pretty much intact. But he has asked Congress to disregard several major Carter requests, most of them aimed at technological revitalization, including a new $75-million program to replace outdated equipment with modern apparatus at universities, a 90% rise in funding for university/industry cooperative research projects, an almost doubled small-business innovation program and a $6-million program to benefit women scientists that was passed by Congress last year.

DOE. Obligations for R&D would total $5.6 billion, only 8% more than the 1981 level. High-energy and nuclear physics would get increases of 18% and 24%, respectively. DOE plans to reduce funding for some near-term technologies such as geothermal, solar and nuclear, for which, DOE says, "commercial acceptance is expected to be accelerated significantly by the decontrol and rapid rise of energy prices."

NASA. It is estimated that R&D obligations will total $6.6 billion in 1982, 22% over 1981. Carter's NASA budget contained one new start, the Venus Orbiting Imaging Radar mission, but Reagan has deferred this mission, as well as several ongoing projects, such as the Galileo mission and the Gamma Ray Observatory. Overall, Reagan has reduced a $757-million space-sciences budget by $218 million.

DOD. Obligations for R&D would rise to $20 billion, an increase of $3.8 billion, or 23% over 1981. Defense department R&D money accounts for almost half of all Federal R&D money. Support for basic research would increase 16% over 1981.

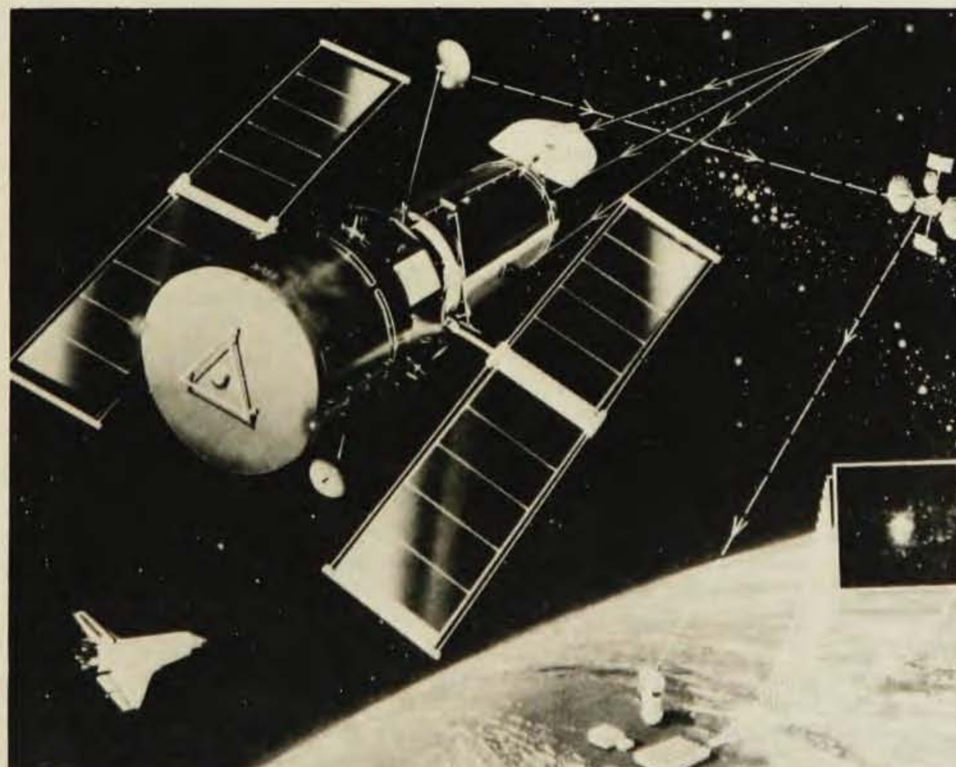
Among the R&D programs proposed in the 1982 budget are a number of interagency efforts, like the microelectronics and submicron science and technology program begun in 1980. This program involves DOE, NSF and the National Bureau of Standards. Combined obligations across the three agencies are estimated to total about $69 million in 1982.

A more detailed analysis of physics funding in the DOE, NASA, NSF and DOD budgets will appear in subsequent issues of PHYSICS TODAY. —MEJ

Space Telescope Institute

The National Aeronautics and Space Administration has selected the Association of Universities for Research in Astronomy, a consortium of 15 universities, to operate and maintain the Science Institute for the Space Telescope. The 96-inch Telescope, a cooperative effort of NASA and the European Space Agency, is scheduled for launch in early 1985 on the Space Shuttle. Its high resolution, increased sensitivity and relatively large aperture should allow it to resolve objects 50 times fainter than can be seen from Earth. It will also be able to study the ultraviolet region of the spectrum, which is mostly absorbed by the Earth's atmosphere.

The Institute, where astronomers will



NASA PHOTO

Space Telescope in orbit. Data from the Telescope will pass through a tracking and data relay satellite (upper right), a ground tracking station (lower right) and the Goddard Space Flight Center on its way to the Science Institute. Also shown is the Shuttle Orbiter (lower left).

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receive data from the orbiting telescope and its five auxiliary instruments, will be located at Johns Hopkins University in Baltimore, Maryland. NASA is negotiating a five-year, $24-million contract with AURA. AURA now manages the Kitt Peak National Observatory, the Cerro Tololo Inter-American Observatory in Chile and the Sacramento Peak Observatory in Sunspot, New Mexico. Data from the Telescope will be sent via the Tracking and Data Relay Satellite System and the NASA communications network to Goddard Space Flight Center in Greenbelt, Maryland, and then on to the Science Institute. Observation schedules will generally be preprogrammed to maximize the efficiency of the Space Telescope's movements.

NASA expects the Telescope to perform scientific investigations for at least 15 years. Present plans are to bring the telescope down approximately every five years for major refurbishment, which could include putting new instruments on board or giving the mirror a new reflective coat before relaunching it. Less major maintenance will be done by astronauts while the Telescope is in orbit.

The Institute will establish observation schedules, fund US user participation, evaluate the Telescope's performance and record and publicize the telescope's findings. According to David Welch, corporate staff executive of AURA, "We estimate that the institute will build to a staff of about 185, including approximately 40 astronomers, when it is at full operation." Arthur Code, Joel Stebbins Professor of Astronomy at the University of Wisconsin, Madison, an AURA board member, will serve as acting director of the Institute while the permanent director is being recruited. Both observers and Institute staff members are expected from the European Space Agency. Astronomers from other countries will also be invited to submit proposals for observing time.

Johns Hopkins offered land and financing for the building that will house the Institute, including a contribution of $2 million towards the cost of its construction. Hopkins will also provide some temporary staff members to help get the Institute underway quickly.

Johns Hopkins won out over several other proposed sites for the Institute. Among the front-runners were Johns Hopkins, Princeton University and Fermilab.

The Telescope. A detailed description of the Space Telescope, its instruments and its Science Institute has been prepared[1] by John Bahcall (Institute for Advanced Study) and C.R. O'Dell (Marshall Space Flight Center). Their paper, "The Space Telescope Observatory," is included in IAU Colloquium #54, available through the US Government Printing Office as NASA CP2111.

According to Bahcall and O'Dell, the telescope itself will use a Ritchey-Chrétien optical system. To make use of each orbit, it will employ an internal light-baffle system that will diminish the stray-light effects to acceptable levels. The Telescope will have three sources of information on its orientation: rate gyroscopes, star trackers and fine-guidance sensors. Using the gyroscopes, the Telescope will be able to re-orient itself to the vicinity of an object 90° away in 20 minutes or less. The star trackers then use bright stars to determine the pointing to a few arcminutes, which is sufficient to place the guide stars in the field of view of the fine-guidance system. The positioning of the fine guidance sensors can be set to an accuracy of 0.01 arcsec.

The Space Telescope is vastly superior to any orbiting telescopes launched by NASA so far. It is the first to exploit the high angular resolution possible in space. The Orbiting Astronomical Observatory, for example, which recently stopped operating after eight years, had only a 32-inch mirror and only one instrument, a photoelectric spectrometer. The Space Telescope is also far more versatile than OAO, having a better spectral resolution and a better range of acceptable stellar magnitudes. The Space Telescope can also boast a more sophisticated fine-guidance system. Three years ago NASA launched the International Ultraviolet Explorer satellite into a geosynchronous orbit. That contains only an 18-inch telescope, with relatively poor spectral resolution.

The five scientific instruments that the Space Telescope will carry on its first launch are: a wide-field/planetary camera, a faint-object camera, a faint-object spectrograph, a high-resolution spectrograph and high-speed photometer. In addition, the fine guidance system can be used for astrometric observations, effectively making it a sixth instrument. NASA anticipates that some of the instruments the Telescope carries will be changed every few years as better ones are designed. For example, while no infrared instrument will be aboard the Space Telescope on its first launch, all aspects of the Observatory are compatible with the possible future inclusion of an infrared instrument. The instruments are designed so that a suited astronaut operating from the Space Shuttle can remove or install a new instrument in orbit.

The wide-field mode of the wide-field/planetary camera will be used primarily for deep-sky surveys, and the planetary mode will provide high resolution imaging over a moderate field of view for faint sources or objects requiring a wide dynamic range and/or wavelengths beyond 6000 Å. NASA expects that this camera will provide more data than any of the other instruments. In both modes, the detectors are four charge-coupled device arrays. The incoming light can be directed onto either the four wide-field CCDs or the four planetary CCDs by means of a pyramid mirror that can be rotated about its apex. The wide-field camera will have a field of 2.7×2.7 arcmin^2, and the planetary camera will have a field of 1.2×1.2 arcmin^2. For special-purpose observations a large number of filters, transmission gratings and polarizers will be available. Among the many expected applications of this instrument are the search for extrasolar planets, synoptic studies of planetary atmospheres and a refining of the extragalactic distance scale.

The European Space Agency is building, among other components, the faint-object camera, which will complement the observations of the wide-field/planetary camera by providing a higher spatial resolution and a smaller field of view. The faint-object camera contains two independent camera systems, one operating at $f/96$ and one at $f/48$. The $f/96$ mode contains a coronagraphic facility which allows the camera to suppress light from bright objects while observing faint sources in the nearby field. The $f/48$ system provides a long slit (10×0.1 arcsec^2) for observing spectra of extended objects. This camera will also be equipped with a set of special-purpose filters. Among the possible applications of this camera are observations of RR Lyrae stars, Cepheids, bright supergiants, globular clusters and giant H II regions as distance indicators out to expansion velocities $\gtrsim 10^4$ km/sec and also the search for direct evidence that quasars and BL Lac objects are the brightest nuclei of faint galaxies.

The faint-object spectrograph will have three modes of varying spectral resolution: The moderate-resolution mode has $R = 10^3$, and a low-resolution mode will span the range from $R = 3\times10^2$ to $R = 20$ (the figure of merit R is $\lambda/\Delta\lambda$, where $\Delta\lambda$ is the wavelength resolution); there is also a nondispersed image that will be used for target acquisition. To maximize the signal from a nebulosity surrounding a stellar source (for example, a quasar that occurs in a galaxy), the faint-object spectrograph design incorporates special entrance apertures matched to the space telescope optics. Possible investigations using this instrument include high spatial resolution spectra of quasars, Seyfert and other active galactic nuclei, and ultraviolet spectropolarimetry of stars and reflection nebulae to help determine

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the origin of interstellar polarization, as well as spectropolarimetry of white dwarfs, quasars and Seyferts to help delineate the physical processes occurring in these objects.

The high-resolution spectrograph is a photon-counting instrument that will provide a resolving power equal to that of the largest ground-based Coudé spectrographs. It can perform moderate- and high-resolution spectroscopy in the region above 1100 Å. The high-resolution spectrograph, like the faint-object spectrograph, has three modes of varying spectral resolution. The primary observing modes are with a resolving power $R = 10^5$, by far the highest on the space telescope, and with $R = 2\times10^4$. Most of the numerous scientific programs that have been suggested so far for the high-resolution spectrograph involve these two primary modes. The moderate-resolution mode has $R = 2\times10^3$, similar to the faint-object spectrograph. The partial redundancy between the two instruments is intentional. The moderate-resolution mode of the high-resolution spectrograph will be used for target acquisition, for estimating exposure times at high resolution and to provide sensitivity in the short wavelength region where higher resolution spectroscopy is not feasible. Among the observations suggested for the high-resolution spectrograph are studies of the very local gas, dense clouds and previously undetected molecules in the interstellar medium and a measurement of the D/H ratio in Halley's comet.

The high-speed photometer is designed to provide accurate, time-resolved photometric observations over a wide wavelength range, as well as linear polarization measurements in the uv. It will be capable of resolving two events occurring more than 16 microseconds apart. Observations of rapidly varying sources over time scales this short are difficult or impossible to obtain from the ground because of atmospheric fluctuation. Events measured with the high-speed photometer can be related to ground-based time standards with an accuracy of at least 10 milliseconds. This instrument is designed to be the simplest of the five initially installed in the observatory. It contains no mechanical parts and relies entirely on the fine pointing of the spacecraft to place an astronomical target onto one of its approximately 100 combinations of filters and apertures. The high-speed photometer makes possible a number of important scientific programs, including measurement of the shortest time scales for variability of compact extragalactic sources, accurate brightness measurements of the zodiacal light and diffuse galactic light and the establishment of faint stellar calibration standards.

The telescope's fine-guidance system consists of three identical sensors, each having its own accessible area (60 arcmin^2). In normal operations two of the sensors will be used for fine pointing with the aid of prespecified guide stars. The third sensor will be available for astrometric measurements. The fine guidance system sensor consists of rotating mirrors that can place any star that is within their field of view on an interferometer. The system determines accurate relative positions to ± 0.002 arcseconds by making repeated short measurements. With the aid of neutral density filters, stars in the magnitude range of $4^m \lesssim m_v < 20^m$ should be measurable. A photometric precision of one percent will be achievable in ten minutes on a 17th magnitude (visual) star. The fine guidance system can be used on a number of astrometric problems, including the gathering of parallax information on nearby stars and possible unseen companions.

Originally, NASA planned to launch the Space Telescope in 1984, but several technical problems forced the launch date forward ten months. —MEJ

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Press is new president of National Academy

PRESS

Frank Press, who was science adviser to President Carter, will be the next president of the National Academy of Sciences. There had been some questions as to whether Press's election would violate the government's "revolving door" restriction prohibiting outgoing government officials from taking jobs with organizations that they were in a position to influence while holding their government posts. But a letter sent to the members of the Academy states that "After obtaining legal counsel from knowledgeable law firms and an advisory opinion from the Office of Ethics in Government . . . the Council concluded that the complications introduced by Mr. Press's recent service in the government would be minor."

Press will take office 1 July, succeeding Philip Handler, who will have held the presidency for 12 years, the maximum permitted by the Academy's bylaws.

A member of the Academy since 1958, Press has served on several study committees and has taken an active role in other Academy activities. He has been president of the Seismological Society of America and the American Geophysical Union. He was serving as professor and chairman of the Department of Earth and Planetary Sciences at MIT when, in 1977, President Carter appointed him as his science adviser and director of the Office of Science and Technology Policy.

Press received a PhD in geophysics from Columbia University in 1949. Faculty appointments followed at Columbia, Caltech, and MIT, the last in 1965. Among his many activities with the Federal government, he served with the Arms Control and Disarmament Agency (1961–64); as a member of the National Science Foundation's National Science Board (1970–76), and as a participant in the bilateral science agreement with the Soviet Union (1970–76).

His research interests have included crystal and mantle structure, earthquake mechanisms and elastic-wave propagation.

Group formed to promote academic fusion research

Fusion research faculty members have banded together to form the University Fusion Association, an organization intended "to promote the continued participation of university research groups in the fusion program." The establishment of the UFA occurred primarily as a response to a number of cutbacks in Federal funding for small academic fusion research projects made by Congress in the spring of 1979. The budget cuts, though restored since, convinced many fusion scientists that an organization was needed to look after their interests. A constitution has been adopted by the association's executive committee, which is headed by R.N. Sudan of Cornell University. Those interested in joining the University Fusion Association should contact Joyce Olive, 308 Upson Hall, Cornell University, Ithaca, N.Y. 14853. □