

only threatening to downgrade many of the Star Wars projects as a budgetary ploy to squeeze more funds out of Congress for 1986 or to get more written into the 1987 budget. But Abrahamson did not say he was threatening to cut back certain programs; he said he was cutting them back.

Among opponents of SDI, it was tempting to view Abrahamson's announcements as a setback for the program as a whole, in that some of the more highly trumpeted technologies were downgraded. But it would be rash to characterize the announcements as a victory for SDI "doves" over SDI "hawks." Richard Garwin of IBM notes that the kind of SDI program now taking shape is very much the kind favored by retired general Daniel O. Graham, who is regarded as one of the most hawkish Star Wars proponents.

Graham, like the President himself, has often expressed irritation about the

term "Star Wars," and it may indeed be fair to ask whether a system that relies mainly on more or less conventional rocket interceptors deserves to be associated with the far-out technologies of the George Lucas films. Garwin argues that "Star Wars" is still an appropriate label because, after all, the interceptors would be based in space, where they would be vulnerable to space mines and ASATs, so that war indeed would occur in space if such a system ever were used.

Regardless of how Abrahamson's announcements are interpreted or characterized, it seems apparent that the terms of the Star Wars debate have been substantially transformed. Early last year, Sidney Drell of SLAC observes, a Stanford workshop on Star Wars put considerable stress on its opposition to chemical lasers, which were very controversial at the time. Now, Drell points out, such concerns

are moot.

Drell, together with many other physicists ranging from Edward Teller to Garwin, has expressed skepticism about any ABM system that relies heavily on vulnerable space-based components. But he thinks ground-based free-electron lasers would make an excellent ASAT system, an observation he makes reluctantly because he opposes the development of ASATs capable of striking targets in high orbits.

It would be quite an irony if the weapon type that was generally thought of as the nation's future ASAT—infrared homing vehicles based on Earth—instead turned out to be based in space as the nation's principal ABM system, and the technology that was generally thought of as the basis for Star Wars—lasers based in space—turned out to be based on Earth as the nation's principal ASAT.

—WILLIAM SWEET

Countdown at NASA: Beggs steps aside for Graham

During its short life, the Army's Sergeant York battlefield antiaircraft gun failed every test of marksmanship. By the time the Pentagon canceled it on 27 August, the first major weapons program killed in two decades, the Sergeant York, also known as Divad (for division air-defense), had run up bills of \$1.8 billion. The gun would not start in cold weather, jammed in hot weather and often could not get its radar to tell trees or buildings from helicopters or airplanes. In death, however, the gun was capable of hitting a formidable target—James Montgomery Beggs, administrator of NASA.

Beggs was indicted by the Justice Department on 2 December on charges of conspiring with three others to defraud the Army of \$7.5 million in excess costs on the Sergeant York between 1978 and 1981, when he was executive vice president of General Dynamics Corp.

In June 1981 Beggs became the administrator of NASA, then a troubled agency already six months into the new Reagan Administration without a leader. Two months earlier the shuttle Columbia had flown for the first time, after more than two years of delays and supplemental appropriations that had nearly exhausted the patience of Congress and Administration budget managers. Beggs soon showed how competent he was, putting the \$10-billion shuttle program back on course with a record of 23 almost textbook-perfect flights.

Staving off OMB. Upon his arrival, NASA's five most important space-science missions, then in advanced stages of either development or plan-

ning, were threatened by David A. Stockman, director of the Office of Management and Budget. Stockman soon applied his ax to the US version of the Solar-Polar mission and was reported to be preparing to strike either the Galileo voyage to Jupiter or the mission to Halley's comet. Beggs is credited with not only fending off most cuts but winning Presidential and Congressional support for larger budgets and an ambitious new program, the \$10-billion space station.

Under Beggs, NASA lost only the comet mission, a loss, he recently told a Congressional committee, he "deeply regrets." But he managed to hold onto the German-American spacecraft named *Ulysses*, which is set to journey around the Sun, and the Galileo mission. He also insisted on greater cost-consciousness in building the \$1.2-bil-

lion Hubble Space Telescope, which is scheduled to be placed in space next August.

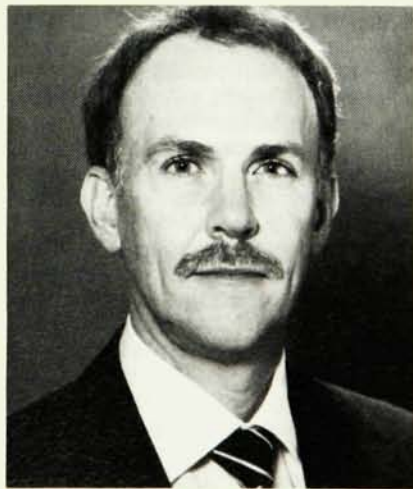
Though denying any wrongdoing in work on the Sergeant York prototype at General Dynamics, the nation's third-largest defense contractor, Beggs decided to step aside while the case is pending. The acting administrator is William R. Graham, who was confirmed by the Senate as NASA's deputy administrator on 18 November, only eight working days before Beggs's departure.

Think-tank physicist. Until Graham was named to fill it, the second chair at the space agency had been empty for more than a year—since Hans Mark left to become chancellor of the University of Texas system. Graham was co-founder and senior associate at R&D Associates, a science think tank in

BEGGS



GRAHAM



Marina Del Rey, California. He has been chairman of the President's General Advisory Committee on Arms Control and Disarmament since 1982 and serves as a consultant to the Defense Nuclear Agency. He holds a PhD in electrical engineering from Stanford University and has been a member of the physics staff at RAND Corp, a projects officer at the Air Force Weapons Laboratory at Kirtland Air Force Base and a technical-staff member at the Hughes Aircraft Corp Research Laboratory.

Graham has wanted the NASA post for years—even before Mark's appointment, according to sources at NASA. Since Mark's departure, Graham has

lobbied ardently for it—so much so, sources say, that he wangled an hour with Reagan to plead his case after Beggs had refused to accept him as deputy. Beggs argued that Graham lacked the proper background for the post. Reagan overrode Beggs's veto and named Graham on his own. At Graham's confirmation hearing, Senator Ernest Hollings, a South Carolina Democrat, expressed fears that the appointment presages the militarization of NASA—a development that many inside the agency and the Pentagon foresee happening, particularly if "Star Wars" research offers compelling reasons for forging a defensive shield in space.

—IRWIN GOODWIN

Space physicists issue report amid gloom

When the National Research Council's Committee on Solar and Space Physics sent its list of priorities for the next 15 years to NASA on 12 August, it recommended as its top item the International Solar Terrestrial Physics program. ISTP was planned in 1983 as a cooperative effort by the US, Japan and the European Space Agency on a series of six missions to study the Sun's oscillations and interactions of the Sun's plasma wind and magnetic field with Earth's magnetosphere and upper atmosphere. The first spacecraft is to be launched in 1989, with missions continuing into the mid-1990s. The other high priority is the Solar Optical Telescope, a high-resolution instrument scheduled to fly on the space station in the early 1990s and provide the basis of a solar observatory.

By blessing both projects in its report, *An Implementation Plan for Priorities in Solar-System Space Physics* (National Academy Press, 1985), the committee hoped to influence NASA and Congress as others have done—namely, with the Research Council's 1982 Field Report on astronomy (named after the study panel's chairman, George Field of Harvard) and the 1983 report by NASA's own Solar System Exploration Committee. The solar-physics report, however, was completed in a gloomy atmosphere: Its two leading missions are in the budgetary shadows.

SOT delay. Initiation of the ISTP mission was omitted from NASA's fiscal 1986 budget for space science. Then SOT suffered a sharp cut by Congress. SOT has been delayed repeatedly as NASA funneled more funds into completing the Hubble Space Telescope, which it considers scientifically more significant and publicly more glamorous. Even so, the Research Council panel urged the agency to take "immediate" action to develop SOT. The

panel noted that SOT is intended to focus on the Sun's surface oscillations, peculiar rotation and cyclical sunspots, thereby helping to advance the new field of helioseismology (PHYSICS TODAY, April 1982, page 25). It is plain to the panel that SOT and ISTP are likely to provide a better understanding of the effects of the Sun's activity and its plasma energy on the terrestrial environment, along with their possible implications for Earth's weather.

The other two major missions the committee recommends are in less danger just because they are further off. The long-heralded Solar Probe, targeted for launch in 1995, would skim to within four solar radii (about 3×10^6 km) of the Sun's surface to measure the sources of the solar wind in an unexplored region of the heliosphere. The Solar Polar Orbiter would set off in the year 2000 to soar above the poles of the sun to explore the three-dimensional characteristics of the heliosphere.

As it happened, the committee chairman, Stamatios M. Krimigis of The Johns Hopkins University, got a chance to explain the recommendations at hearings before the House Subcommittee on Space Science and Applications on 8 October. Seated beside James Van Allen of the University of Iowa, Krimigis was able to make his case with dramatic aplomb. "The program we envision," he said, "is scientifically challenging, technologically achievable and reflects the natural evolution of discoveries we made when this nation ventured into space. It was Jim Van Allen, using Aerobee sounding rockets, who first explored the Earth's magnetic field... Jim's presence here is a reminder that after opening a whole new world of space physics, we are resting on our laurels."

To give solar-system space physics more prominence within NASA, Krimigis told the five House members at

the hearing, the four separate divisions that now house aspects of the program need to be centralized in a new division at the agency. Moreover, the panel proposed that NASA boost its funding for solar-system space physics from \$300 million in fiscal 1986 to as much as \$400 million per year for the rest of the century. The prospect of this happening depends largely on whether ISTP and SOT actually go into development. It is unlikely that the committee's recommendations will be carried out in Washington's current state of financial restraint.

Possible starts. However, just when the outlook for the science seemed most dismal, NASA Administrator James M. Beggs offered hope. In preparing the agency's budget for fiscal 1987, Beggs is said to have killed the plan for a spacecraft to rendezvous with Comet Wild-2 (PHYSICS TODAY, November, page 38), which would have cost about \$800 million, and instead to have sought White House approval for new starts on ISTP and the TOPEX oceanography spacecraft. TOPEX, which is to be a joint effort with France, would be the first US satellite launched on the European Space Agency's Ariane booster. An impressive reason for advancing ISTP is that it involves Japan, with one satellite, and the US's principal allies in Europe, with two satellite systems, in fulfillment of an agreement signed in 1983. NASA has received reports that both government officials and space scientists at ESA and in Japan are angry over US delays in approving the project. In this connection, Krimigis told House members, "This program would serve to reestablish our credibility with our European allies, which was severely tested following the cancellation of our commitment to the International Solar Polar Mission four years ago."

What's more, the Defense Department has expressed some interest in ISTP in conjunction with research projects of the Air Force and the Strategic Defense Initiative, commonly known as "Star Wars." The US satellites could provide measurements of solar-wind parameters, which have not been available since the redirecting of NASA's ISEE-3 from the vicinity of Earth toward an encounter with Comet Giacobini-Zinner on 11 September. James Ionson, director of SDI's Innovative Science and Technology Office, speaks of using new Chemsat and Multiprobe spacecraft, along with the \$50 million NASA-Air Force Combined Release and Radiation Effects Satellite. These would release gas clouds into near-Earth orbits to examine how missiles might be concealed during reentry into Earth's atmosphere and how lasers perform when fired from the ground through dense clouds. Ionson also