tional Research Council's Space Science Board, later told *Science*.

The agency has not yet decided precisely which experiments will be canceled, says Rosendhal. Some preference will be given to those disciplines, such as life sciences, that are uniquely tied to the manned capability of the shuttle. "But it's a very, very cruel choice," he says. "By January, we were finally ready to start delivering on promises we made years ago [about doing science aboard the shuttle]. Now it's inevitable that some experiments that have been well planned and that are well under way will have to be dropped."

The Spacelab decision comes only a few months after the Ulysses solar polar mission and the Galileo mission to Jupiter were thrown into limbo by NASA's cancellation of the Centaur upper stage, which was to launch the spacecraft from the shuttle's payload bay (*Science*, 4 July, p. 21). Coupled with launch delays of 30 to 40 months even for missions that do fly, these actions guarantee that post-Challenger space science is in for a painful period of retrenchment.

On the other hand, the news is not all bad. During the period of stand-down, for example, Rosendhal and his colleagues in the space science office hope to divert a substantial amount of money into what they call a "vitality package." This would include more development money for new instruments and small payloads, enhanced funding of inexpensive suborbital flights, enhanced funding for data analysis, and several similar efforts, all designed to help investigators produce scientific results in the near term. "Somehow," says Rosendhal, "we have to sustain the vitality of the program over the next few years."

This vitality initiative should be of some comfort to the community, since many space scientists have been calling for an increase in these areas for years. "It's clear that [the Spacelab decision] is very depressing," says Louis Lanzerotti of Bell Laboratories, chairman of NASA's Space and Earth Science Advisory Committee. "But if this situation allows us to recognize that the basic underpinnings are important, then in a perverse way it could be good for space science."

Meanwhile, Burton I. Edelson, NASA's associate administrator for space science and applications, has been getting high marks from the scientific community for his role as an activist in the agency's post-Challenger planning efforts. "I can't say in any way that we're better off than we were before," he says. "But given that we're here, I'm using the situation as an opportunity to reassert that the prime goals of NASA are science and exploration. In recent years we've focused on making the shuttle cost effective. But that's not the end goal. And the same thing goes for the space station: it shouldn't be just 'the logical next step,' or 'a permanent manned presence in space.' It should be a tool to help us do useful things."

In particular, Edelson has argued vigorously for retaining at least one third of the available payloads for space science and applications once the shuttle starts flying again. He has also lobbied for major new space science initiatives beginning in fiscal year 1988—"if we want missions in the 1990's, we have to start now," he says—and for expendable rockets to launch scientific payloads that do not require the shuttle.

It remains to be seen whether these efforts will produce any concrete results in the agency's fiscal year 1988 budget, which is now being negotiated with the White House. From all reports, however, NASA Administrator James C. Fletcher has been very receptive. ■ **M. MITCHELL WALDROP**

Underground Tests Used In Laser Fusion Effort

For the first time, it has been officially disclosed that underground nuclear explosions are being used to support research in inertial confinement fusion (ICF) This laser-based technology has been pursued since the early 1960's primarily as a defense research program aimed at developing a method of modeling thermonuclear reactions on a tiny scale. The drive to successfully ignite a deuterium-tritium pellet with a laser also has been supported because of its potential application in generating electricity.

The House Science and Technology Committee, in its report on the fiscal year 1987 authorization bill for civilian energy programs,* states that explosions at the Nevada test site have provided data for the laser fusion program. This admission goes a long way in explaining how some advances in the research program have been achieved. The laser fusion research effort received high marks in a recent National Academy of Sciences review† chaired by William Happer, Jr., a physicist at Princeton University. Conducted under contract for the Office of Science and Technology Policy, which was reacting to a request by Congress, the publicly released version of the report left much unexplained. This is not surprising, since many program activities are classified.

In particular, the Academy report, issued in March, did not specify how some data were being obtained on the behavior of targets—deuterium-tritium pellets—subject to bombardment by x-rays. The Happer report did make it clear that no aboveground laser or particle-beam research facility in the United States is currently capable of delivering anything close to the 1 to 10 megajoules of short-wavelength power needed to ignite a capsule.

How, then, are program scientists making so much progress in understanding such critical issues as target fabrication, uniform illumination of capsules within black body shells (hohlraums), or controlling hydrodynamic instabilities in a target? A large body of data has indeed been obtained by facilities such as the Nova laser at Lawrence Livermore National Laboratory (LLNL). But some of the most significant results, according to the Happer report, have been gathered under the classified Centurion-Halite programs conducted by Los Alamos National Laboratory and LLNL, respectively.

These results are being produced with bomb-driven, raw radiation that is transformed into x-rays with hohlraums that contain deuterium-tritium targets. X-ray lasers produced with nuclear explosions are not being used to ignite targets directly at this time. The Academy review suggests that target ignition and thermonuclear burn can be reached within 5 years.

While the Happer report recommends that the Centurion-Halite research should be aggressively pursued and that budgets should stay level at around $150 million annually, some researchers are worried that progress could be slowed by a test-ban agreement with the Soviet government. The Soviets have called for a complete suspension in the detonation of nuclear devices. Researchers say they are under pressure to accelerate their experiments. If they cannot be completed in the event of a full test ban, then the government may have to build a costly next generation laser or particle-beam machine sooner than anticipated, if laser fusion research is to be pursued.

As for Congress' admission that underground nuclear explosions at the Nevada test site are a key tool for data acquisition in the research effort, a Department of Energy program official declined to discuss it. Scientists working in the field, however, hope it will prod government classifiers to strip away unnecessary secrecy related to the broader ICF research program. ■

MARK CRAWFORD

**Department of Energy Civilian Energy Programs Authorization Act for Fiscal Year 1987*, House of Representatives Report 99–719, Part I. Requests for copies should be submitted to the Senate Document Room, Hart Senate Office Building, Room B-04, Washington, DC 20510–7106.

†*Review of the Department of Energy's Inertial Confinement Fusion Program*, National Academy Press, 2101 Constitution Ave., N.W., Washington, DC 20418.