NASA astronaut who helped deploy the HST, "The US does not have the capability to do something like this, and if we used the Russian TORU system [used for docking with the ISS], the spacecraft docking speed [0.6–1 meter per second] is fast enough to severely damage the HST, potentially making it uncontrollable."

If the HST mission is to be continued, the Bahcall panel suggests fitting new instruments in both SM4 (whose launch is planned for 2004 or early 2005) and the later SM5, but only if the SM5 instruments are approved in a peer-reviewed competition. Otherwise, the panel suggests delaying SM4 to 2006 and, if possible, fitting the propulsion module during that flight. If no shuttle servicing missions are available, the panel's last choice is to use an unmanned craft to install the propulsion module.

When Kinney asked the audience at the 31 July meeting which NASA programs they would be willing to eliminate in exchange for extending the HST's lifetime, there was silence. The consensus seemed to be that NASA could approach Congress for more money. But, said Kinney, "Congress can never provide enough money for everything that the science community would like to do. . . . And do you want Congress deciding the science program instead of the science community?"

Paul Guinnessy

Virgo Gears Up to Wait for Gravitational Waves

The latest detector to join the hunt for gravitational waves is the €76 million ($86 million) Virgo, an Italian–French collaboration near Pisa that celebrated its inauguration and started testing at the end of July. "The curious thing is, these detectors do classical physics experiments, yet—as a network—they can get quantum mechanical information about the graviton's spin," says Barry Barish, director of the Laser Interferometer Gravitational Wave Observatory (LIGO), a similar US project (see the article by Barish and Rainer Weiss in PHYSICS TODAY, October 1999, page 44).

Virgo, like LIGO, is a Michelson–Morley interferometer. Virgo's two perpendicular arms are each three kilometers long; LIGO's two interferometers have arms four kilometers long. A laser beam is split and sent down both arms, reflected, and later recombined. An impinging gravitational wave would, by nudging the end mirrors outward and inward, stretch one arm and squeeze the other. The difference in the path lengths introduces a phase shift, which in turn affects the interference pattern and reveals the traces of the gravitational wave.

Gravitational waves are ripples in spacetime caused by accelerating masses. They have never been directly observed but have been inferred from observations of a binary pulsar whose period of rotation is shrinking at a rate consistent with losing energy through gravitational wave radiation. A gravitational wave from a local galactic supernova explosion, for example, might move the Virgo mirrors by 10^{-18} meters, says Adalberto Giazotto, the detector's scientific coordinator. One aim, he says, is to pick up signals from the Virgo cluster of galaxies, which is about 1000 times farther away than the edge of our galaxy.

The experiment's virtue is its isolation from seismic noise: Fancy compound pendulums housed in 10-meter-tall towers isolate Virgo's optical

VIRGO COLLABORATION

Virgo (below) is poised to search for gravitational waves. The view down one of Virgo's arms is shown at left.

components. The resulting sensitivity at low frequencies, down to about 10 Hz, is advantageous for observing dynamic processes. "Take the coalescing binary system of a neutron star," says Giazotto. "It goes faster and faster as it coalesces. But if you can start observing when the frequency is lower, it gives you a longer observation time." LIGO can detect signals only as low as about 50 Hz, but with interferometers in Hanford, Washington, and Livingston, Louisiana, says Barish, "we have the advantage of doing a coincidence [measurement]." The LIGO team plans to upgrade their experiment's sensitivity at low frequencies.

The plan is to eventually link the various gravitational wave interferometers to form a global network. A German–British team is working on a 600-meter interferometer called GEO; Japan's 300-meter TAMA was the first gravitational wave interferometer to come on line, in 1995; and Australia has one in the works. Says Giazotto, "A network operation of all the detectors will increase the true detection of gravitational waves and pinpoint their origins." **Toni Feder**

Atkinson Arrives as State Department Science Adviser

State Department science adviser Norman Neureiter is stepping down in mid-September and will be succeeded by George Atkinson, a University of Arizona chemist.

"This was a three-year appointment and my term is up," Neureiter said. "I've invested a lot of energy and commitment into this job and a key part of my legacy was assuring that the position be passed on and become institutionalized." With the appointment of Atkinson, Neureiter said, "we've succeeded in doing that."

Atkinson, who became the first American Institute of Physics fellow at the State Department two years ago, said he was attracted to the science adviser position because of "the foundation that Norm and his staff have created. They've put us in a position where science is recognized as important within the department."

That wasn't the case when Neureiter first took the job on the heels of a 1999 report by the National Research Council—an agency of the National Academy of Sciences—that was critical of the decade-long decline in scientific literacy within the State Department (see PHYSICS TODAY, November 2000, page 44). The NRC recommended the creation of the science adviser position, which was then offered to Neureiter, a linguist, Fulbright scholar, and former vice president of Texas Instruments Inc, Asia.

"Norm has put an enormous amount of energy into the job, 60 to 80 hours a week, and he's gotten an excellent degree of exposure and visibility," said John Boright, the executive director of the NAS office of international affairs. Neureiter spent more time than NRC officials anticipated working on "operational issues," such as ITER, the international thermonuclear experimental reactor project, "but the areas where he was investing his efforts were important," Boright said.

The decision to continue the science adviser position came after an internal evaluation of Neureiter's impact. While he is pleased that the position is being institutionalized, Neureiter said neither he nor Atkinson can take the reemergence of science in the department as a done deal. "Eternal vigilance is the price of survival," he said.

"It's like pushing a ball uphill," Atkinson added. "We've reached the point where the gradient isn't as steep as it was, but that doesn't mean there still isn't a gradient and the ball can roll back down the hill."

During his fellowship, Atkinson worked in several State Department bureaus and traveled to a host of embassies in an effort to bring together an international mix of policymakers and scientists to look at key science issues.

His goals are to continue Neureiter's successful efforts to increase the number of fellowships and internships that bring scientists into the department. He also hopes to bring more senior scientists into the department and its embassies; each would spend a year working on international policy

JIM DAWSON