

synergistic approach to the study of the inner heliosphere that will involve coordinated observations of the solar interior and atmosphere and the formation, release, evolution and propagation of coronal mass ejections toward Earth."

Later in the decade, overlap from the SDO, ATST, Magnetospheric Multiscale project (a cluster of four spacecraft), Frequency Agile Solar Radio telescope, and NSF's Relocatable Atmospheric Observatory "will form the intellectual basis for a comprehensive investigation of magnetic reconnection in the dense plasma of the solar atmosphere and the tenuous plasmas of geospace."

NOAA's role should grow

The committee also recommended that NOAA be responsible for operating the next satellite that collects solar wind data at the L1 Lagrangian point. NASA's ACE spacecraft currently has that task. The L1 recommendation is one in a series of recommendations that would increase NOAA's role in developing better monitoring and predictive abilities related to space weather. The National Space Weather program was established in the mid-1990s to study the Sun-Earth interaction and environment, but given the vulnerability of the US electrical power system and other systems to disruption by solar activity, more needs to be done, the report says.

NASA, NSF, and the other agencies affected by the report were expected to be briefed in September and hadn't yet reacted to the recommendations, Lanzerotti said. Burch noted that science missions in the report "may not be exactly what [the federal agencies] want to do or the sequence they want to do them in, but I think overall it's going to be very helpful."

In addition to the projects, the committee recommended programs to improve technology so "future science objectives" in solar and space physics can be met. NASA is urged to "assign high priority to the development of advanced propulsion and power technologies required for the exploration of the outer planets, inner and outer heliosphere, and local interstellar medium." Finally, the report does something few other science overview reports have done—it gives specific cost estimates for each of the projects recommended. The committee allowed \$650 million for the solar probe mission, and the Geospace Network project is estimated at \$400 million.

The price for the multi-spacecraft Solar Wind Sentinels mission is set at \$300 million, while the Small Instrument Distributed Ground Network, an NSF program to provide ionospheric and upper atmospheric measurements, should cost about \$5 million per year.

"We felt it was mandatory to make reasonable costing estimates," Lanzerotti said. "There is no question we could fall on our face on some of these costs, but we've also said if something really gets outrageous [in cost], then we'll have to rethink where it fits in the queue of projects." **JIM DAWSON**

NAS Finds No Flaws in Nuclear Treaty

The National Academy of Sciences has issued a report concluding that the "main technical concerns raised about the Comprehensive Nuclear Test Ban Treaty (CTBT)... are all manageable." *Technical Issues Related to the Comprehensive Nuclear Test Ban Treaty* was written over a two-year period by 11 members of the NAS committee on international security and arms control. The panel of scientists, arms control experts, and former national laboratory and industry executives was chaired by John Holdren of Harvard University. The report concludes that "verification capabilities for the treaty are better than generally supposed, adversaries could not significantly advance their nuclear weapons capabilities through tests below the threshold of detection, and the United States has the technical capabilities to maintain confidence in the safety and reliability of its existing weapons stockpile without periodic tests." The State Department is currently evaluating the report, which is available at <http://www.nap.edu/html/ctbt>.

The report was commissioned by the Clinton administration to look at questions that arose when the US Senate refused to ratify the CTBT in October 1999. The US was among the first of 165 nations to sign the 1996 CTBT, which will come into force after ratification by the 44 countries that currently possess either nuclear weapons or nuclear reactors. To date, 31 of these countries have ratified the CTBT, including France, Russia, and the UK. The Bush administration, though, has made clear that it does not intend to push for ratification by the Senate. The current administration views the treaty as unverifiable and as constraining the US's ability to

develop and test new nuclear weapons, especially new low-yield tactical warheads that could destroy hardened targets such as underground bunkers. The Bush administration requested \$15.5 million in the 2003 defense budget to analyze options for developing such weapons.

In addition to prohibiting nuclear test explosions in the atmosphere, underground, under the oceans, and in space, the CTBT would establish a network of several hundred monitoring stations using seismological, hydroacoustic, infrasound, and radionuclide sensors to help monitor compliance, and would provide for inspections of suspected test sites. The CTBT would permit R&D and design activities by the nuclear weapons states, but outlaw experiments that produce a nuclear explosion.

The report's conclusion that the US can maintain the weapons stockpile without nuclear testing differs from the conclusion of the Bush administration's nuclear posture review. That classified document asserts that the US may have to resume testing to maintain the reliability of its nuclear stockpile and calls for a reduction from years to months in the preparation time needed to resume testing. The US has not performed a nuclear test in 10 years, although it has conducted at least 17 subcritical tests—the most recent in August—which are allowed under the CTBT.

The solution to dealing with age-related defects in weapons, says the NAS report, is rigorous surveillance coupled with the remanufacture of warheads to their original specifications when problems are discovered. In fact, the safety and reliability of the stockpile are better now than when testing ceased, says the report, which calls for revamping the Department of Energy's manufacturing capabilities and further strengthening evaluations of the warheads. If unforeseen problems should emerge in the stockpile that could not be resolved without nuclear tests, the US would still have the option of withdrawing from the treaty, the report notes.

The network of monitoring stations within the CTBT verification regime is the only system through which the US can confirm "with high confidence in all environments" that no tests with yields above 1–2 kilotons are being conducted anywhere. In some cases of particular potential concern, such as Russia's Novaya Zemlya test site, even lower yields—down to 10 tons—could be "reliably detected," according to the report.

The report concedes that highly experienced nuclear weapons states—the US, Russia, the UK, France, and the People's Republic of China—might be able to use sophisticated masking techniques to hide a blast of 1 or 2 kilotons. But such constrained nuclear testing would not add significantly to the nuclear weapons capabilities those states already possess, the report says. Other nuclear weapons states—notably India and Pakistan—and those aspiring to develop nuclear weapons capabilities, such as Iraq, would not be able to reliably test below the detection threshold without the help of one of the more experienced states, the report says. The results of such tests alone would not be enough to enable such states to develop advanced nuclear weapons, the report adds. But, cautions the report, some types of simple and relatively heavy and inefficient fission weapons could be developed without any nuclear testing at all.

The report concludes that “the worst-case scenario under a no-CTBT regime poses far bigger threats to US security interests—sophisticated nuclear weapons systems in the hands of many more adversaries—than the worst-case scenario of clandestine testing in a CTBT regime, within the constraints posed by the monitoring system.”

The NAS panel was not asked to reach a conclusion as to whether the US should ratify the treaty. “Answering that question requires taking into account a wider array of issues—not just the technical ones we addressed but also military and political issues that were outside our mandate,” says Holdren. “But understanding of the technical issues is certainly an essential ingredient of the informed public and policymaker discussion that must precede a ratification decision, and we hope our report will help provide this.”

PAUL GUINNESSY

Radiation Assessment at Risk

For nearly half a century, the United Nations Scientific Committee on the Effects of Atomic Radiation has been an influential resource on radiation sources and their effects on human health and the environment. But if its budget is not resuscitated, UNSCEAR's data compilation and evaluation activities will grind to a halt.

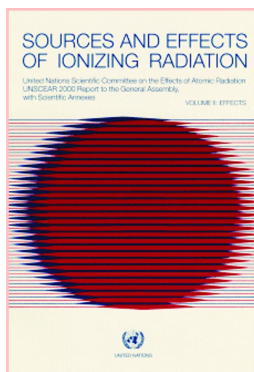
UNSCEAR's budget, \$674 000 for the two-year period 2002–03, is roughly half of what it was a decade

ago. Because of the crunch, UNSCEAR cancelled its annual meeting this spring and will instead meet just once, in January, during the current two-year budget period. But hardest hit is the portion of UNSCEAR's budget that covers travel and honoraria for outside consultants: 10 years ago, it was \$180 000; by 2000–01, it had shrunk to \$52 000; and for 2002–03, it was further chopped in half. “We can't run on that,” says Norman Gentner, scientific secretary for UNSCEAR, which is based in Vienna, Austria, and has 21 member countries. “[The consultants] are world-level people. They get a pittance. It's become impossible to function.”

UNSCEAR assembles experts who comb through and analyze the literature on such topics as the health effects of the Chernobyl accident, non-cancer mortality from ionizing radiation, and the risks associated with radiation-based medical procedures. Their work forms the core of the tomes the committee puts out every few years. The International Atomic Energy Agency, the International Commission on Radiological Protection, and other international and national bodies use data from UNSCEAR in setting safety standards and making policies, says the committee's chair, Joyce Lipsztein, a radiation protection scientist at Brazil's National Atomic Energy Commission. “UNSCEAR is not biased. It's just scientific, not political. That's why it's so valuable.”

The squeeze on UNSCEAR's budget is part of a broader belt-tightening at the UN, Gentner says. UNSCEAR was especially vulnerable because during the last negotiating phase, which took place before Gentner came on board, it was without a leader. The committee comes under the umbrella of the UN Environment Programme, and UNSCEAR members and others describe the UNEP–UNSCEAR relationship in terms ranging from “neutral” to “benign neglect” to “a divorce would help.” Last year, the UN complimented UNSCEAR's work and directed UNEP “to continue providing support for the effective conduct of the work of the Scientific Committee and for the dissemination of its findings to the General Assembly, the scientific community and the public.” But, says Lipsztein, “that hasn't happened.”

More than neglect is at work, says Poland's representative to UNSCEAR,



UNSCEAR's reports on the sources and effects of ionizing radiation come out every few years.

Zbigniew Jaworowski of the Central Laboratory for Radiological Protection in Warsaw. “UNSCEAR dared in 2000 to state that practically no adverse radiation effects were observed among the post-Soviet population ex-

posed to Chernobyl radiation, and that no genetic effects have been observed in the children of Hiroshima and Nagasaki survivors. As a result, UNSCEAR's activities have been all but stopped, and there are real prospects that UNSCEAR could disappear,” he says.

While politicians may not always like UNSCEAR's conclusions, says Lipsztein, “among scientists, they are not controversial.” At a General Assembly this month, Brazil's mission to the UN will try to bring attention to UNSCEAR's plight. “Without the appropriate funding, UNSCEAR cannot continue,” says Lipsztein. For countries around the world, she adds, “that would be like not buying insurance.”

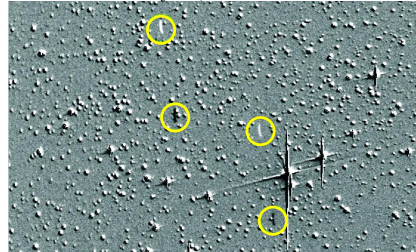
TONI FEDER

Contour Is Lost in Space

The \$159 million Comet Nucleus Tour (Contour) spacecraft, which NASA launched in June to rendezvous with three comets, apparently broke into pieces in August. “There was a big problem with firing the solid rocket booster,” says Robert Farquhar, mission director at the Johns Hopkins University Applied Physics Laboratory (APL).

Contour spent two months in a highly elliptical orbit before attempting to leave Earth's gravitational well, but after it fired its main booster to break orbit, NASA lost radio con-

SPACEWATCH PROJECT, UNIVERSITY OF ARIZONA



TRACKS (highlighted in yellow) might indicate possible Contour debris.