actual explosive testing of our nuclear devices that we can ensure that our weapons are safe, reliable, effective, and survivable."

Objections might also be raised about sharing the U.S. monitoring technology with the Soviets and about the uncertain duration of the project. As originally conceived, the verification experiment would last only 6 months or so, while the moratorium would presumably last much longer.

Nonetheless, many experts consider the Soviet offer highly interesting. Herbert York, the principal U.S. negotiator for a comprehensive nuclear test ban during the Carter Administration, says that "it would be the most elaborate [verification] experiment in the Soviet Union that I'm aware of." During the negotiations, which were suspended by the Reagan Administration in 1981, both sides had tentatively agreed to install at least ten monitoring stations in each country, York says, but this would be done only after the treaty came into effect. "We did propose to put one station in the country on an experimental basis while the negotiations were going on, but they expressed a lot of doubt and never gave us a firm answer," he adds.

Paul Stokes, an engineer and verification expert at Sandia National Laboratory, praises the idea on strictly scientific grounds, as do several other government seismologists. "We simply do not know very much about seismic propagation, especially at high-frequency ranges," Stokes says. "Without the kind of information we can get from an experiment like this, we really won't ever know much about propagation in the Soviet Union. It makes good technical sense, but there clearly are substantial political problems."

The conditional Soviet acceptance of the proposal may be a topic of discussion between the superpowers on or about 25 July, when various officials meet in Geneva to discuss nuclear testing issues. The meeting, which was suggested by President Reagan, is apparently viewed by the Soviets as a forum to press for a resumption of bilateral test ban negotiations, while the Administration plans to press for new measures to verify compliance with an existing treaty that limits explosive yields to 150 kilotons. The leader of the U.S. delegation will be Robert Barker, a former official of Los Alamos National Laboratory who serves as a deputy assistant director of the Arms Control and Disarmament Agency. Barker is a forceful test ban opponent, and is presently awaiting Senate confirmation as the new special assistant to the Secretary of Defense for atomic energy, with overall responsibility for nuclear weapons production. ■

R. JEFFREY SMITH

NASA Responds to the Rogers Commission

The agency is reassessing its activities at every level; meanwhile, the shuttle may not fly again until 1988

In response to President Reagan's request for a 30-day progress report, the National Aeronautics and Space Administration (NASA) on 14 July released a summary of its efforts to carry out the recommendations of the Presidential Commission on the Space Shuttle Challenger Accident (the commission headed by former Secretary of State William P. Rogers). In releasing the report, agency administrator James C. Fletcher also announced that the target date for the next shuttle flight has been postponed from July 1987 until the first quarter of 1988, to allow ample time for redesigning and testing the solid rocket boosters that failed so catastrophically on 28 January. Echoing a widely held opinion in the space community, Fletcher admitted that the earlier date had been "a little optimistic." It remains to be seen how much this new delay will add to the rapidly growing backlog of military and civilian launches.

NASA has taken action on all of the Rogers Commission's nine major recommendations, said Fletcher. In the area of flight safety, for example:

■ *Solid rocket boosters.* On 24 March, shortly after taking over as head of the space shuttle program, Rear Admiral Richard Truly organized a team to redesign the solid rocket motor joint. The team includes personnel from several NASA centers, from industry, and from the astronaut office; it will be assisted by a 12-member expert advisory panel, which will include six members from outside NASA. In accordance with another Rogers Commission recommendation, meanwhile, the National Research Council has established an independent oversight group under H. Guyford Stever. This group will report directly to Fletcher.

At the moment, Truly and his engineers are confident that the required safety margins can be met by modifying the present joint design, which will allow the agency to use the booster hardware that it already has on hand. However, as a contingency in case the modified designs prove inadequate, says Truly, the booster team is also developing a totally new design that does not utilize existing hardware.

■ *Launch abort and crew escape.* On 7 April, NASA initiated a Shuttle Crew Egress and Escape Review and a Launch Abort Reassessment Team. Among other things, these studies will assess options for crew escape during controlled gliding flight. Final reports are due on 1 October.

■ *Landing safety.* A new Landing Safety Team has been established. The Rogers Commission made particular reference to the shuttle's tires, brakes, and nose-wheel steering, which have been safety concerns since long before the Challenger accident. New brakes are already under development; other systems will be reviewed and upgraded as necessary.

■ *Critical item review and hazard analysis.* On 13 March, NASA began a complete review of all shuttle failure modes, together with a reassessment of every piece of critical equipment on the shuttle. The goal is to catch any other potential disasters that may have slipped through the system the same way the infamous O-rings did. This activity will culminate in a comprehensive final review with NASA Headquarters beginning in March 1987.

In other actions, meanwhile, NASA has responded to the Rogers Commission's critique of the pressure to launch and the unrealistic flight schedule:

■ *Flight rate.* In March, NASA established a working group to assess the constraints on the shuttle flight schedule at the Kennedy Space Center, where the spacecraft and payloads are made ready for flight, and at the Johnson Space Center, where the shuttle crews are trained and the flight software is developed. This working group will report on 15 August. In parallel, the National Research Council is conducting an independent review of the shuttle flight schedule, and NASA headquarters is formulating a new policy on shuttle cargo manifests designed to minimize disruptive last-minute changes.

■ *Maintenance.* NASA is developing a new and comprehensive maintenance plan for the shuttle system. Furthermore, to stop the practice of removing parts from one orbiter to supply another, which has been a safety concern since the shuttle's early

flights, the agency is also assessing the inventory of spare parts it will need to support various flight rates.

Finally, NASA has addressed the larger issues of management:

■ *Safety organization.* On 8 July, Fletcher created the new post of Associate Administrator for Safety, Reliability, and Quality Assurance. The head of this office, George A. Rodney, will oversee these three functions in all NASA activities, including the shuttle program, and will report directly to Fletcher.

■ *Shuttle program management.* On 25 June, astronaut Robert Crippen was placed in charge of a fact-finding group that will assess the shuttle management structure. The group will report by 15 August; among other things, it will address such issues as internal communications within the shuttle organization and the proper role of astronauts in NASA management.

Meanwhile, although the Rogers Commission did not explicitly ask it, Fletcher has deputized General Sam Phillips, who served as general manager of the Apollo program, to do a top-to-bottom review of management throughout the agency. Phillips' influence is being felt already, although his final report is not due until the end of the year. It was at his suggestion, for example, that the space station program was recently reorganized to centralize authority at headquarters instead of diffusing it through the research centers.

Although neither the members nor the staff of the Rogers Commission have commented on the NASA response, it is clear that NASA's efforts to date are only a beginning. "[The implementation report] is an interesting snapshot of where they are right now," says John Pike, space policy analyst for the Federation of American Scientists, "But they've got a long way to go." Indeed, it remains to be seen just how far NASA is willing to go to reform itself. On the other hand, NASA officials do seem determined to do whatever they have to do to get their agency back on track. "We're certainly going to reexamine our management thoroughly," says NASA general manager Phillip Culbertson. "And I suspect we *will* make some fundamental changes." ■

M. MITCHELL WALDROP

Soviets Presented Plans For Chernobyl Study

Robert Gale is to be president of a new Armand Hammer foundation that will sponsor studies of Chernobyl victims

On 18 July, Robert Peter Gale, a bone marrow transplant specialist from the University of California at Los Angeles, and Armand Hammer, head of Occidental Petroleum, flew to Moscow on Hammer's private plane to present to the Soviets a plan for international cooperation in following Soviet victims of the Chernobyl accident. The idea is for scientists from several nations to work with the Soviets under the auspices of the newly established Armand Hammer Center for Advanced Studies in Nuclear Energy and Health. Hammer will be chairman of the center and Gale will be president.

Gale's most recent achievements contrast with certain difficulties he has had with the National Institutes of Health. Gale, head of the bone marrow transplantation unit at UCLA from 1977 until 1983, was reprimanded by the NIH in 1985 for violations of policies pertaining to research on human subjects.

Back in 1979, Gale treated a small number of cancer patients with bone marrow transplants based on what many UCLA staff members judged to be experimental protocols. However, Gale failed to obtain permission from the university's Human Subjects Protection Committee; nor did he get from his patients the kind of informed consent that is required for experimental therapy.

According to an NIH official who participated in the investigation of Gale's work, the issue in question was whether Gale, as a patient's physician, had the authority to decide when an experimental therapy became "standard" or "best available" treatment and therefore not subject to research guidelines, or whether that authority rests exclusively with the Human Subjects Protection Committee.

An NIH report on its investigation states that allegations against Gale first came to the NIH's attention through a newspaper report in 1981. When asked by the NIH committee about the allegations, Gale responded that only one, or at most two, of eight patients in question were being treated under NIH-funded protocols and that the treatment was not research and therefore not subject to review by the Human Subjects Protection Committee. "All or most of the patients were simply receiving 'best therapy,' " he wrote to the NIH investigating committee.

It also was alleged that three patients with leukemia were treated with experimental immunotherapy without the approval of the human subjects committee. Gale's reply was that he was not the principal investigator for this project and that any violations that occurred were not his responsibility.

The NIH report, which contains Gale's denials of wrongdoing, was not completed until 1985, when NIH director James B. Wyngaarden concurred in a decision to reprimand the UCLA doctor.

In his letter to Gale, Wyngaarden does, however, note circumstances that must be considered in rendering judgment, even though they do not excuse Gale's actions. Among them are these: "The UCLA human subject protection policies, administrative procedures, and practices operative during the period in which the infractions occurred were at the time imprecise," and "no evidence has been produced which indicates that human subjects were injured as a result of your noncompliance."

Wyngaarden then wrote in his letter that, "In view of the above considerations, NIH has not restricted your participation as a funded investigator or scientific advisor. I wish to emphasize, however, that we view the violations documented in OPRR's [Office for Protection from Research Risks] report as very serious."

In addition, NIH has instructed UCLA to "conduct an audit of randomly selected research records of patients for whom Dr. Gale had an ongoing responsibility." The audit must "assess compliance with institutional human subject protection policies." Furthermore, Wyngaarden wrote to UCLA, "until March 1, 1988, any institution with which Dr. Gale is or may become affiliated