

Ride report: The going, not the goal

A comprehensive, decades-long study of the earth from space, continued planetary visits by unmanned spacecraft, a return to the moon that would have as many as 30 people at a time living there for months by 2010, and an inhabited outpost on Mars — all are appropriate goals for NASA's future, according to a report written by scientist-astronaut Sally Ride at the request of agency head James Fletcher. But the real question, Ride maintains, is far broader than that. "We must ask ourselves," she says, "Where do we want to be at the end of the century?" and "What do we have to do now to get there?"

Last fall, amid the dismay and confusion following the Challenger explosion, Fletcher announced a review of the agency's plans that he said would produce "a blueprint to guide the United States to a position of leadership among the spacefaring nations of earth." Words like "leadership," "excellence" and "productivity," however, have increasingly been perceived as mere administration buzzwords in recent years, even before the Challenger disaster and several other launch mishaps virtually grounded the U.S. space program. In June Ride was named acting head of a new NASA Office of Exploration, and her report now declares that "leadership cannot simply be proclaimed — it must be earned....The United States must have, and also be perceived as having, the ability to meet its goals and achieve its objectives."

The answer, she avers, is not merely to select missions and go after them, but to concentrate on a number of areas that will keep the options open: launch capability (including an unmanned cargo version of the shuttle that "should be developed immediately"), "rebuilding the nation's technology base" (in such areas as robotics, automation and advanced propulsion systems), life sciences research and planning for the evolution of the proposed (and controversial) U.S. space station.

Before Ride — who is now returning to academia at Stanford University — ever received Fletcher's request, the agency's Strategic Planning Council, made up of the heads of NASA's various field centers and the program administrators at headquarters, set forth three goals. These were to advance scientific knowledge of earth, the solar system and the universe beyond, to strengthen aeronautics and to "expand human presence beyond the earth" into the solar system. "Oddly enough," says Alan Ladwig of the Office of Exploration staff, "I don't believe that was ever a stated NASA goal before. 'Expanding the presence' was a thing we always did, but it was never stated as the goal."

Were the supernova's neutrinos pulsed?

Astrophysicists have managed to extract a great deal of information and suggestions from the small burst of neutrinos that came from Supernova 1987A and were recorded by the Kamiokande detector in Japan and the IMB detector in Ohio last February. The latest suggestion, reported in the Aug. 6 *NATURE*, is that the emission of the neutrinos was periodic.

The new analysis comes from Martin Harwit of Cornell University, Peter L. Biermann of the Max Planck Institute for Radioastronomy in Bonn, West Germany, Hinrich Meyer of the University of Wuppertal, West Germany, and Ira Wasserman of Cornell, who find a possible period of 8.9 milliseconds. "While the statistical significance of this period is marginal in each individual experiment," these observers remark, "the two sets of data are compatible." That makes them think they may be on to something.

If the periodicity is real, it would arise from rotation of the core of the exploding star. As the star explodes, its core collapses to a neutron star, and the collapse produces a lot of neutrinos. Theorists had imagined that the neutrinos come out equally in all directions. Periodicity indicates that they come instead from a particular spot or spots — "nozzles" is one word these

observers use to describe it. If the core rotated, the beam from such a nozzle would sweep around, giving the effect of pulses as it crossed the line of sight from earth.

As it happens, astrophysicists generally expect the core of a supernova to rotate. They expect it eventually to become a pulsar, a rotating neutron star, that gives off pulsed radio and maybe light signals because of the same kind of beaming effect. The apparent 8.9-millisecond period of the neutrinos would mean that that is the rotation period of the core and of the eventual pulsar. "We also note that $P=8.9$ ms is a reasonable period for very young pulsars," say the observers.

A further question is whether neutrinos have a very small rest mass. Physicists have believed that neutrinos have exactly zero rest mass, but new theoretical developments would give them a tiny rest mass. The mass, if it exists, can be estimated from the time of flight between SN 1987A and earth. Periodicity makes it possible to time the flight very accurately, and on the basis of the period they find, these observers calculate that the mass of the neutrino — if it exists — can be no more than 0.2 electron-volts, a number many times smaller than previous estimates.

— D. E. Thomsen

Four "leadership initiatives" were selected by the council for evaluation, and thus became the focus of Ride's report:

- Mission to planet earth: "A global observational system in space," it is to yield "a comprehensive scientific understanding of the entire earth system." Designed to operate for decades, it would include four polar-orbiting platforms, five in geostationary orbits over the equator, a variety of payloads in low-altitude orbits, some ground-based experiments and a huge, state-of-the-art "information management system" to handle all the data. Several other government agencies, including the National Oceanic and Atmospheric Administration and the National Science Foundation, would probably have significant roles, and other countries would participate. "Championing this initiative," says Ride, "would establish the United States at the forefront of a world-recognized need to understand our changing world."

- Exploration of the solar system: All four of the report's selected initiatives, according to the council, "should achieve major milestones within two decades," and the planetary missions cited by Ride are based on a list proposed a few years ago by NASA's Solar System Exploration Committee: a comet-rendezvous/as-teroid-flyby, the Cassini mission to orbit

Saturn and send a probe into the atmosphere of its moon Titan, and a trio of automated surface-roving Mars vehicles that would also deliver samples to "ascent" vehicles for return to earth.

- Outpost on the moon: This would involve an orbiting vehicle dispatched in the 1990s to seek a site for a subsequent inhabited station, the beginning of station construction from 2000 to 2005, and its expansion to a permanently occupied base from 2005 to 2010.

- Humans to Mars: Here, Ride departs from what the council had asked her to study. The request, she reports, was to evaluate three quick "sprint" missions, with astronauts exploring Mars for two weeks before returning to earth. But, she maintains, "there is considerable sentiment that Apollo was a dead-end venture, and we have little left to show for it." In the same vein, the report of President Reagan's National Commission on Space 15 months ago noted a recurring theme heard in its numerous public hearings that "our next goal for piloted space activity not be another Apollo — a one-shot foray or a political stunt." In fact, says Ride, "we should avoid a 'race to Mars,' and instead 'adopt a strategy of natural progression which leads, step by step, in an orderly, unhurried way, inexorably toward Mars.'"

— J. Eberhart