

WASHINGTON REPORTS

In Pep Talks to Staffs, Richardson and Colwell Outline New Directions for Research Agencies

The leadership changed at two of the nation's principal scientific research agencies in August. At the Department of Energy (DOE), Bill Richardson, a former Democratic congressman from New Mexico and ambassador to the United Nations, took command as secretary, and at the National Science Foundation (NSF), Rita Rossi Colwell, a microbiologist at the University of Maryland, began a six-year term as director. Within a two-week period, each delivered an inaugural address of sorts to their staff and the press. There were certain similarities and some obvious differences between the two messages, which, in their own way, could be characterized as pep talks.

On 27 August, halfway through his first day on the job, Richardson spoke to a jam-packed DOE auditorium and, by closed-circuit television, to employees at labs and offices outside Washington. "My main message is that I will be accessible to you," he said, "and that I intend the Department of Energy to be the best department in the Cabinet." In his confirmation hearing before the Senate Energy and Natural Resources Committee at the end of July (see *PHYSICS TODAY*, September, page 45), Richardson had noted that DOE had been on the hit list of freshman Republicans, who tried to dismantle the agency on more than one occasion. He told the senators that attempts to eliminate the department had lowered DOE employee morale.

To the DOE staff, Richardson spoke with his customary enthusiasm. "There's nothing wrong with the department that can't be fixed with what is right with this department. . . . In the few weeks I have been in and out of here, I have come to appreciate how good you are, and I'm excited about working with you," he said. "One of my highest priorities at the department will be to let the American people know the many ways in which we serve them and to determine how we can serve them better."

He went on to identify a half-dozen contributions of DOE:

▷ "We serve the American people every time we certify that the nation's nuclear stockpile is safe, secure and reliable;

▷ "We serve them every time we go



RICHARDSON: Excited about fixing DOE.

into Russia to secure dangerous nuclear weapons;

▷ "We serve them every time we clean up and close down a former nuclear weapons production site;

▷ "We serve them every time we make a breakthrough on an energy-efficient technology that will help us tackle the challenge of global climate change;

▷ "We serve them every time we ask Congress to pass legislation that will bring down the cost of electricity and give people a choice;

▷ "We serve them every time one of our scientists is recognized for innova-



COLWELL: Coming home to NSF.

tions that will have a revolutionary impact on society."

During his tenure, he said, he expects the department to take the lead in some of the White House's highest priorities, such as global climate change, Caspian Sea oil development, nuclear nonproliferation and the Comprehensive Test Ban Treaty.

When he called for questions at the end of his talk, one of the first related to DOE's belated efforts to clean up nuclear waste. Most questions at Richardson's confirmation hearing had also centered on this issue. As a congressman from New Mexico, he had fought against opening DOE's Waste Isolation Pilot Plant (WIPP) in his state. But he has now changed his mind and accepted the Administration's position on opening WIPP. Though the facility has been certified safe by the Environmental Protection Agency, Richardson said he still believes it essential that residents of New Mexico retain "their proper oversight."

Later, in a session with news reporters, Richardson said, "My objective here is to bring a sense of activism to the department [and] restore its luster, which it has lost."

Colwell, by contrast, spoke to a staff that has welcomed the impressive increase in NSF's appropriation by Congress in the past year and is expecting an even larger budget in fiscal 1999. She addressed an all-hands reception in the marble-floored atrium of the NSF building in Arlington, Virginia, on 8 September. The term "all-hands" was chosen by Colwell, who, with her husband, Jack, a physicist at the National Institute of Standards and Technology, race their sailboat in the Chesapeake Bay. Some 500 staffers crowded the atrium and its balconies for Colwell's remarks.

She said she knew NSF well and that "coming here to become director is like coming home. I feel very, very comfortable here. NSF has been a central part of my professional life." She has headed NSF committees, served on the National Science Board in the 1980s and received foundation support for her work in microbiology for over two decades. (Her research at the University of Maryland also has been funded by DOE, the National Institutes of Health and the Naval Research Laboratory.)

Her talk resembled Richardson's in style and content. She heaped praise on "an extraordinary organization that is staffed by exceptional people." The "dedication and professionalism" of the staff impress her. "You are dynamic and interesting people."

A few hours later, before the DC Science Writers Association, Colwell was more forthcoming about the direction she would take. She advocated cross-disciplinary research, which relies on interconnections among the fields of mathematics, physics, chemistry, biology, materials science, engineering and even the social and behavioral sciences. "Our broader grasp of these interconnections provides tremendous advantage for preventive, not remedial, solutions," she said. "As this perspective increases, our collective power to generate insight grows proportionately."

Like Richardson, she listed her priorities for the agency. Unlike Richardson, she ranked them:

▷ Science and engineering education—principally grades K through 12. "America's continuing leadership will depend more on the caliber of its human resource than on any other resource. It will not be enough to have a top layer of scientific elite, and another of mediocrity below. And the situation is only worsened by widespread public science illiteracy."

▷ Biocomplexity—reaching well beyond biodiversity. "When we speak of sustaining biodiversity, we mean primarily maintaining the plant and animal diversity of the planet, itself a very important goal. . . . We must do that, but also discover the complex chemical, biological and social interactions that comprise our planet's systems. From these subtle but very sophisticated interrelationships, we can tease out the fundamental principles of sustainability. Our survival as a human species and the ecological survival of the entire planet depend on our ability to achieve what is truly an interdisciplinary task."

▷ Information technology—the new age of exploration. "The first age of exploration spanned approximately two centuries. Our new era is in its infancy. . . . Contributions from information science and technology will create whole new disciplines and fields of knowledge, trigger new industries and find new worlds, literally and figuratively."

In speaking to her staff that afternoon, Colwell had revealed a comic sense about her new job. To celebrate her new career in Washington, she told her staff, friends had presented her with two books: *Aesop's Fables* and Lewis Carroll's *Alice in Wonderland*.

IRWIN GOODWIN

Once Lost in Space, SOHO Is Found; NASA and ESA Struggle to Revive It

Space satellites rarely attract public notice until things go wrong. So it is with the Solar and Heliospheric Observatory (SOHO), which had been revolutionizing the study of the Sun in its two-and-one-half years in orbit when controllers at NASA's Goddard Space Flight Center lost contact with the \$1 billion spacecraft early in the morning of 25 June, during routine maneuvers and calibrations. For more than a month, SOHO was spinning in space, without power to communicate or operate the 12 scientific instruments on board. But, on 23 July, by the ingenious use of the National Astronomy and Ionospheric Center's 305 m radiotelescope at Arecibo in Puerto Rico to transmit a radar signal toward SOHO and with the 70 m dish of NASA's Deep Space Network in Goldstone, California, acting as a receiver, SOHO was located and tracked. Then began a series of actions to revive the dormant satellite. On 3 September, at a press briefing held simultaneously at NASA headquarters in Washington and the European Space Agency (ESA) in Paris, Roger Bonnet, ESA's science director, announced that SOHO was no longer doomed. He was optimistic that it would be completely healthy by October, "as a result of a dramatic rescue operation."

SOHO, a joint venture of ESA and NASA, was launched in December 1995 as part of the International Solar-Terrestrial Physics Program. Positioned 1.6 million km sunward of Earth, at the Lagrangian L1 point, where the gravitational pulls of Earth and Sun are in balance, the spacecraft became fully operational in April 1996. Until it went mute, SOHO's instruments, built in the US, France, Germany and Finland, provided scientists with many dazzling discoveries: huge tornadoes in the solar atmosphere, 51 comets passing near the Sun or plunging right into it; "rivers" of charged particles on the Sun's surface, and the first detection of sunquakes deep inside.

Although the spacecraft was designed to operate for only two years, SOHO was functioning so well that project scientists had hoped to extend the mission to 2003, as the Sun goes through a period of maximum activity that is expected to peak in 2001.

"We had no idea if we would ever be in touch with SOHO again," said Joe Gurman, a Goddard project scientist. "We knew it was a race against time, because without power to receive or send communications and without

direction to reorient itself, it wouldn't be long before SOHO's orbit decayed. But if we can restore the spacecraft to its original healthy condition, there is every likelihood that it will provide data to the year 2003."

The spacecraft's health will not be known until the solar panels are generating power and the instruments are thawed. The critical maneuver is the relay of signals to fire the rocket thruster motors to put SOHO back into the correct position facing the Sun. The final test will be to switch on the 12 instruments, which were designed to operate at -20°C , and discover how many survived the extreme cold of as much as -200°C in deep space.

The cause of SOHO's near demise was the subject of a NASA-ESA investigation board, which released its final report on 3 September. The board blamed the controllers who lost contact with the craft during a series of recalibrations that normally take 48 hours but were compressed into 24 hours so that scientists would not lose a day of data. The errors occurred in turning off one of three gyroscopes during routine "momentum management," when thrusters are fired to hold the spacecraft steady while a set of wheels, which maintain the spacecraft's attitude by counteracting external torques, is slowed down. As soon as this procedure was completed, the gyro told SOHO—incorrectly—that the spacecraft was spinning 20 times too fast. The system went into a safeguard mode called Emergency Sun Reacquisition, which kicks in automatically when an anomaly is detected in the craft's orientation.

From there on, the troubles cascaded. To save wear and tear, the computer shuts down another gyro while the wheels are braked. But because an essential command sequence had been omitted from on-board software during a rewrite last year, the first gyro failed to come back on, unknown to the controllers. The control team did not check the status of the craft to bring it back on line and used new software that had not been adequately tested and was in conflict with another gyro. When instrument readings didn't gibe, the controllers made a snap decision that the first gyro was faulty and turned it off. Without the gyros, the thrusters fired to stabilize the spacecraft. The false readings triggered continuous firings and SOHO began spinning faster and faster, preventing the solar panels from collecting