entirely to the Rocky Flats plant, 16 miles northwest of Denver. In 1992, however, DOE shut Rocky Flats down after the Federal Bureau of Investigation found a scandal-riddled plant dangerously contaminated with hazardous and radioactive waste. That left the United States with no industrial-level capacity to manufacture replacement pits for the nation's aging nuclear stockpile.

LANL's TA-55 facility was the logical place to transfer that function. It was already producing a dozen pits a year, mainly for underground nuclear tests in Nevada. But at first LANL Director Sig Hecker blanched at the proposal, worrying that a weapons production role would crowd out research and scare away talented scientists. That was before the painful downsizing last year, when 1000 LANL employees lost their jobs. Retooling TA-55 for pit manufacturing would bring $100 million to LANL. Another $200 million would be used for previously planned refurbishment of TA-55. DOE estimates the task will create 138 jobs during construction and 260 jobs during operation. Now LANL officials sound far less concerned.

"We have no problem whatsoever with stepping up to 20 to 50 [pits] a year," says Hanson. "But we want to make sure it's synergistic with R&D and it doesn't swamp R&D." Any more than 50 would begin to impact on research by appropriating floor space and personnel, said Joe Martz, a plutonium chemist and group leader for weapon component technology.

The laboratory plans to make changes in Rocky Flats' pit manufacturing process, says Tim Neal, LANL's program manager for materials and process technology. In the past, pits were made through a process called "wrought-ing," in which workers stretched, flattened, and rolled plutonium into hollow spheres, like bakers kneading dough. LANL wants to move toward pouring molten plutonium into molds, a process that would cut down on plutonium shavings and machine contact.

But this kind of production work has never been a great draw for top researchers, warns Ray Kidder, a retired LLNL physicist. If it remains small, it will do no harm, Kidder says, but if it squeezes real research funds out of a constrained budget, it will prove counterproductive. And, with a wary eye on the mess at Rocky Flats, citizens groups are openly cringing at a return to LANL's roots. "I think it's bad news for the people of Los Alamos," said LeRoy Moore, a longtime Rocky Flats watchdog and consultant for the Rocky Mountain Peace Center in Boulder, Colorado.

–Jonathan Weisman

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SCIENCE AND THE PUBLIC

Putting Museumgoers in Scientists' Shoes

BOSTON—Walk the halls of this city's Museum of Science today and you'll be bombarded by questions: Can a thin, disk-shaped clownfish maneuver more nimbly than a long, torpedo-shaped shark? Do bricks fall any faster than basketballs? Do styrofoam cups really keep coffee hot longer than paper ones?

"Investigate!" an interactive exhibit opening today at the museum, is long on such questions—but short on answers. That's because it's trying to put museumgoers in scientists' shoes. Visitors will "do the kinds of things scientists and engineers do when they are carrying out research," explains Lawrence Bell, the museum's vice president of exhibits, "as opposed to simply referring to science's authoritative answers." So visitors will formulate hypotheses, then test them and compare their own conclusions with those left behind by previous visitors. They'll emerge, museum officials hope, with a better understanding of how scientific habits of mind can be of use in their everyday lives—knowledge many educators believe is at the core of "scientific literacy."

The new attraction, developed by exhibit planners Mary Dussault and Susan Sunbury and funded largely by a $1.6 million grant from the National Science Foundation (NSF), boasts a solar car workshop and racetrack, a mock archaeological dig, and a high-tech re-creation of Galileo's legendary Tower-of-Pisa gravity experiment. One kitchenlike area simply presents visitors with a selection of cups, fans, hot and cold water, and computerized thermometers, leaving them to think up their own ways of plumbing the basics of heat and conduction.

While the exhibit isn't the first to give museumgoers hands-on access to the events, artifacts, and apparatus that are the stuff of science, many museum professionals say it goes farther than any comparable exhibit toward simulating, and hence demystifying, the scientific process. "It combines more experiences into one and involves visitors in a very rich way," says J. Shipley Newlin Jr., director of physical sciences and technology at the Science Museum of Minnesota in St. Paul.

BOSTON MUSEUM OF SCIENCE

Racing hypotheses. On this solar car track, visitors to Boston's Museum of Science can change light levels and wheel sizes to see the effects on car speed.

The project's roots, Bell explains, are in the science literacy movement of the late 1980s, which argued that critical thought and the ability to explore questions are more important than learning answers by rote. And while museums such as the Ontario Science Center and San Francisco's Exploratorium have long featured hands-on exhibits that allow visitors to probe physical phenomena such as waves and electricity, "the emphasis was more on understanding those concepts than on understanding the variables you are manipulating in the process," says Robert Russell of Informal Science Inc., a Washington, D.C., consulting firm, and a former officer in NSF's Informal Science Education Program.

Now in Boston, visitors get to manipulate those variables. In one area, museumgoers can study the hydrodynamics of fish physique by making variously shaped rubber fishes race through tanks of water. By comparing the fishes' performance in the 100-centimeter dash or their cornering ability in a maze, budding biomechanicists can gain some idea of the specialized talents evolved by real fishes with these body shapes. More advanced users can make quantitative comparisons, attaching the fishes to electronic strain gauges in a special laminar-flow tank to measure the water resistance they create.

How does the exhibit's picture of the scientific process stack up against the real thing? To David Barrett, an ocean engineer at the Massachusetts Institute of Technology who advised the museum on the construction of the fish tanks, "it's an accurate depiction of what we do. We just do it with more precise equipment."

Planners at other science centers say they'll be watching the Boston effort closely. "It's difficult to communicate process using an exhibit, but Boston is a museum that has approached this topic very seriously and systematically, and I'm hoping that they'll be successful," says Patty McNamara, director of project development at Chicago's Adler Planetarium and Science Center. "That's experience we want to draw on." And if they do, says Barrett, it's also experience that can be widely shared: "Science and engineering are the world's biggest sandbox. It would be a shame if only scientists and engineers got to play in it."

–Wade Roush