



EXCAVATION for the Compact Muon Solenoid experiment contributed to the Large Hadron Collider's cost overrun.

its reputation for delivering on time and on budget," says Halliday.

Coping with overspending

The LHC tab swelled in part due to the added costs of the superconducting dipole magnets—CERN spent 150 million Swiss francs on unplanned prototypes, and magnet assembly climbed some 180 million Swiss francs higher than expected. (Sources close to the issue say the magnet makers inflated the prices.) Then there were computing costs for developing a vast data grid (120 million Swiss francs); civil engineering problems encountered in digging a cavern for the Compact Muon Solenoid (CMS), one of the two main LHC experiments (70 million Swiss francs); outside contractors (150 million Swiss francs); a shortfall in money from non-member states (50 million Swiss francs); a rise in CERN's contribution to the LHC detectors (50 million Swiss francs); and assorted smaller items.

Of the new bill, only 480 million Swiss francs is for things specified in the original LHC budget, says Director General Luciano Maiani. That's an overrun of about 18%. The rest of the roughly 30% in extra costs was supposed to be absorbed by CERN's general budget. "Though in absolute terms it is a large amount of money, it's not such an unusual or unforeseen thing," says Maiani. "I think that in the end, when we have a new plan, people will realize that this is part of the normal fight of a new big project."

With a combination of loans, austerity measures, and more money from member states, says Maiani, "we should be able to cope." But it will be tough: Loans would put CERN's future in hock. As for economies within CERN, belt-tightening has already

left the lab lean. "There's not much to be had there," says Cashmore, "and a lot of damage could be done to good programs." CERN is nonetheless considering slowing or stopping its non-LHC programs, which include the fixed-target and heavy-ion experiments at the Super Proton Synchrotron, the Antiproton Decelerator, and a neutrino beam to Italy's Gran Sasso National Laboratory.

While austerity measures are not likely to save much, they're necessary to regain the trust of the CERN council. "It is important that [CERN management is] seen to be making strenuous efforts to get back on budget," says Halliday.

More money from member states would be the simplest solution for CERN. An initial appeal for a 4% hike was not well received, but council members seem open to a smaller increase.

High-energy physicists worldwide worry that the budget crisis will postpone the LHC from starting in 2006. But Maiani says time will not be used as a contingency to draw out payment. "We would like to insist on that. A delay to ease the financial situation would not be acceptable," he says.

But many CERN scientists oppose sacrificing other experiments to the LHC, especially given that they suspect its schedule will slip in any case. "Building the LHC is the first priority, even to me," says Friedrich Dydak, who is involved in planning a neutrino factory at CERN. "But only half of the particle physics community wants to do LHC physics. Therefore a world laboratory like CERN should retain attraction also to the other half of the community." The LHC is the highest-energy accelerator in the world, so it has no competition, he adds. "A delay would be acceptable if

there is a non-LHC physics program that can ease the terrible prospect of not producing physics results for many years to come."

The CERN staff is more split now than it was five years ago, when members voluntarily accepted pay cuts and other belt-tightening measures to accommodate the LHC's squeezed budget (see *PHYSICS TODAY*, August 1997, page 51). This time, says one physicist, "there seems to be little will on the side of the personnel to make more sacrifices in order to bail out bad managers."

Diabolical timing

For the UK, says Halliday, "CERN's timing is diabolical, because we have just presented our budget request, which fixes funding through 2006. If we have to pay more for the LHC, that reduces our chances of getting funding for the e^+e^- linear collider."

"It's not a good time to ask for more money," admits Maiani. Among other demands on budgets, many European countries are beefing up security in the wake of the terrorist attacks in the US.

Despite the problems, the CERN management and council are intent on finding a solution. "I am certain that everybody involved will do everything not to endanger the LHC," says Schunck of Germany, the country that clamped down hardest on the CERN budget in 1996. Referring to the US cancellation of the Superconducting Super Collider in 1993, he adds, "We are not in an SSC situation."

TONI FEDER

Goldin Era Ends at NASA, Canada Picks New Space Chief

Dan Goldin, NASA's longest-serving chief administrator, announced his resignation in mid-October, just days before the results of an investigation into cost overruns of the International Space Station (ISS) were made public. In November, he joined the Council on Competitiveness, a group based in Washington, DC, that promotes American economic and business leadership.

Goldin is widely credited with revitalizing enthusiasm for space science exploration both within NASA and among the public (see *PHYSICS TODAY*, April 2001, page 25). He was instrumental in getting NASA to consider innovative technological solutions in an agency that was still reeling from the aftereffects of the 1986 Challenger

disaster. But he's probably best known for his mantra "faster, cheaper, better," which translates into a push to switch from costly spacecraft that took years to develop to smaller, more focused missions that could be launched for under \$500 million within 18 months of receiving funding approval. The Lunar Prospector, Deep Space 1, and the 1997 Mars Pathfinder missions are examples.

Goldin's departure comes on the cusp of NASA's biggest-ever financial crisis. The ISS is projected to be \$4.8 billion over budget, the human spaceflight program faces a \$1 billion shortfall in its budget for next year, and a \$500 million overrun in NASA's 1999 budget was discovered this fall. In response, this year NASA slashed 40% from the ISS science budget and reduced the space station's crew from seven to three.

Further fixes will follow from the ISS management and cost evaluation task force report, ordered by Goldin this past July to get the ISS back on track without new money. The task force recommends that NASA slash jobs and, to avoid future cost overruns, that the agency adopt strict accounting methods.

NASA's top job is proving hard to fill—by early November, an appointment by President Bush had been imminent for months. It was well known that Goldin didn't want to leave NASA, but the Bush administration had given him no indication that it wanted him to stay. Courtney Stadd, one of Goldin's possible successors and NASA's chief of staff, is temporarily running the day-to-day operations.

Meanwhile, north of the border, Marc Garneau has been appointed president of the Canadian Space Agency. Garneau, Canada's first astronaut, has a bachelor's degree in engineering physics and a PhD in engineering.

The CSA's annual budget of Can\$300 million (\$188 million) is just 1.5% of NASA's. Since 1999 the CSA has emphasized terrestrial applications, such as remote sensing, and closer strategic links among government, academia, and industry. Garneau succeeds Mac Evans, who retired after 35 years at the agency.

PAUL GUINNESSY

New Directors for NIST, NOAA

Two veterans of both science and government service were set to become the new directors of the National Oceanographic and Atmospheric Administration (NOAA) and NIST following their nominations by President Bush. Both men, retired Vice Admiral Conrad Lautenbacher and Purdue University nuclear engineer Arden Bement Jr, were awaiting what were expected to be quick confirmations by the Senate as PHYSICS TODAY went to press.

Bush selected Lautenbacher, who holds a PhD in applied mathematics from Harvard University, to become the new under secretary of commerce for oceans and atmosphere, the official title for NOAA's director. Lautenbacher, a 1964 graduate of the US Naval Academy, was the commander of the US Third Fleet, and advised the Joint Chiefs of Staff on the size and composition of US military forces. He served in both the Vietnam and Gulf Wars and is considered an expert in antisubmarine and anti-air warfare. Scott Gudes has been the acting director of NOAA since Bush took office.

In recent testimony before the

House Science subcommittee on research, Lautenbacher advocated greater study of the seas, telling representatives that only 5% of the world's oceans have been mapped and that "today we know more about other planets than we do about our ocean depths." He called for a wide range of oceanic research, including increased study of the link between the oceans and the atmosphere so that climate shifts such as El Niño and La Niña can be better understood.

Bement, the head of Purdue University's school of nuclear engineering, was chosen by Bush to be the director of NIST. Bement was the vice president of science and technology at TRW throughout the 1980s and before that served as the deputy under secretary of defense for research and engineering. He moved to Purdue in 1993, where he served for a time as the director of the Midwest Superconductivity Consortium.

"I can think of few people more deserving of the appointment," said Ray Kammer, NIST's director from 1997 through 2000. "Dr. Bement has been associated with NIST for the last 20 years in a variety of posts, including chairman of the Visiting Committee on Advanced Technology." The visiting committee makes recommenda-

Math Solution to Nobel Problem

Rumor has it that a century ago, when Alfred Nobel established his prestigious prizes, he shunned mathematics because his wife had jilted him for a mathematician. A good tale but, it turns out, a tall one. Still, mathematicians feel a pang of envy each fall when the Nobels roll around and their field never shares the limelight.

Now Norway has created an international math prize that could achieve Nobel stature. The Abel Prize will be bestowed annually beginning in 2003. Its purse is expected to be in the upper six digits—the annual earnings from the Norwegian government's endowment of roughly \$23 million.

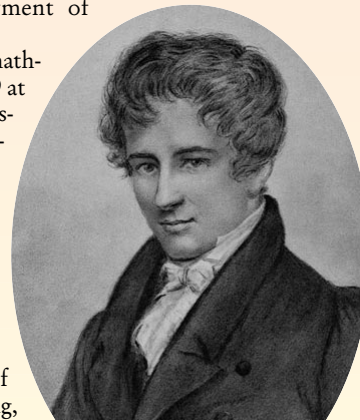
The new prize's namesake is Norwegian mathematician Niels Henrik Abel, who died in 1829 at age 26. He is best known for proving the impossibility of a general algebraic solution to quintic, or fifth-degree, equations, and for his work on elliptic integrals. Groups of commuting elements are called abelian groups in his honor.

In announcing the establishment of the Abel Prize, Norway's Prime Minister Jens Stoltenberg said the aims are "increased interest among young people to study science, strengthening of the country's research in the field of mathematics, increased awareness of Norway as a country of knowledge and learning, as well as positive international awareness."

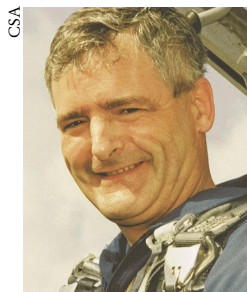
An Abel Prize was first proposed by Oscar II, the king of Norway and Sweden, in 1902, at the centenary of Abel's birth. It fell through when the union between the two countries was dissolved in 1905.

Until the Abel, the closest thing to a Nobel Prize in math was the Fields Medal, which is awarded every four years to mathematicians aged 40 or younger.

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NIELS HENRIK ABEL (1802–29), in a reproduction based on a painting by Johan Gørbitz.



GARNEAU