HIGH-ENERGY PHYSICS

Thrashing Out a Compromise on the LHC

After 6 months of tough financial bargaining over the fate of the Large Hadron Collider (LHC), officials at CERN, Europe's particle physics center, were cautiously optimistic earlier this week that its member countries would approve the SFr2.6 billion ($2 billion) project today. A decision had been due since June, when CERN's Director General Christopher Llewellyn Smith put the proposal to the center's council. But tight financial conditions in Germany and the United Kingdom led to acrimonious discussions over costs and contributions. Now an agreement looks to be in sight for today's council meeting. "We are converging on a proposal," says physicist Maurice Bourquin of the University of Geneva, one of Switzerland's representatives on the council.

The final agreement may be a bitter pill for high-energy physicists to swallow, however. Germany has stipulated that it will only take part if a very strict ceiling is imposed on CERN's budget for the duration of the project. And member countries have also insisted that CERN not include hoped-for contributions from nonmember countries such as the United States and Japan in the budget calculations. Under those constraints, it may take until 2008—5 years longer than predicted—to complete the giant accelerator, which should provide a glimpse of physics beyond the currently accepted Standard Model of fundamental particles and forces.

The LHC originally looked like a bargain. Because it would use an existing 27-kilometer tunnel, CERN management proposed building it without any budget increases except those needed to match inflation. To eke out the budget, however, management planned to cut some other programs and secure $370 million in contributions from nonmember countries.

This proposal stalled when Germany and the United Kingdom argued that France and Switzerland, which will host the lab, should make additional payments totaling more than SFr250 million over and above their normal subscriptions to CERN because they gain more from employment and industrial contracts than other member countries do. In mid-November Germany raised another hurdle by proposing that inflationary increases in CERN's budget be frozen until 1998, after which they should not exceed 1% per year, and that CERN should make deeper cuts in current programs. But at the same time, Germany relaxed its demand for additional payments from France and Switzerland to a total of SFr170 million.

These new conditions led to a flurry of activity over the past month, and as *Science* went to press, national delegations were involved in the final hectic round of discussions prior to the council meeting. "It seems the German conditions cannot be avoided," says Maurice Jacob, adviser to Llewellyn Smith on member state affairs.

But some compromises were in the air. CERN sources say that France and Switzerland were offering SFr140 million in additional payments, and while Germany was holding out for SFr160 million, many participants thought the issue was close to resolution. Germany also looked likely to win some form of ceiling on CERN's budget, which CERN sources say might entail cuts in technology R&D programs and in services to visiting scientists from member countries.

The budget ceiling will take a toll on the project, however. "It can still be built under these constraints ... but it will be harder, and it will take longer," says University of Heidelberg physicist Klaus Tittel, a former council member.

To lessen the scientific impact of the 5-year slowdown, CERN management is thinking of building the accelerator in two phases. The plan would have two thirds of the superconducting bending magnets in place by 2003, achieving a beam energy of 10 teraelectron volts (TeV). The remaining hardware would be installed by 2008, bringing the machine to its full power of 14 TeV. But the wait would still be painful, because many physicists think that the full beam energy will be needed to achieve one of the LHC's main goals: finding the postulated Higgs boson, which should help explain why particles have mass.

There is some light at the end of the tunnel, however. Under the scheme now on the table, any money received from nonmember states will go toward speeding up construction. And that puts extra pressure on today's council meeting to approve the project. Otherwise, says Jacob, "the U.S. and Japan may lose interest; they have programs of their own. We have to move fast."

–Daniel Clery

U.S.–RUSSIAN SPACE EFFORTS

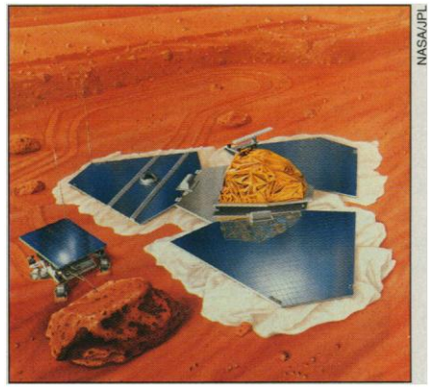
To Mars, But Not Together

A coordinated scientific assault on Mars, planned for the latter half of the decade, has been promoted by Russian and U.S. politicians as a sign of growing cooperation between former enemies. But if the status of Mars Together, as the mission has been dubbed, is supposed to mirror relations between the two countries, then perhaps U.S. Vice President Al Gore and Russian Prime Minister Viktor Chernomyrdin should just wave to each other from across the table when they meet this week in Moscow. The reason? Officials from both sides say the two nations have quietly decided to shelve plans for an ambitious joint mission in 1998 that was to be the start of Mars Together and instead go their separate—and cheaper—ways for at least the next several years.

"The program will be postponed, maybe to the beginning of the next century," says one Russian diplomat. "We don't have the money to finance two projects at once." Russian space scientists have proposed a variety of astrophysics missions, he says, and "our financial problems are so severe that the Russian Space Agency cannot fund both."

Scrambling to put the best face on an unhappy situation, Robert Clarke, chief of international relations for the National Aeronautics and Space Administration (NASA), says a revamped joint program could come in 2001 or later. "It was becoming clear that budgetary pressures in Russia were calling into question the Mars Together program. But we still see a lot of room for a joint program" after the turn of the century, Clarke said shortly before leaving earlier this week for Moscow. In the meantime, he notes, Russian scientists could serve as co-investigators or even principal investigators for NASA missions.

The original plan was to launch a series of U.S.–Russian spacecraft to Mars, starting in 1998, carrying Russian rovers and sophisticated U.S. scientific instruments aboard large Russian rockets. But some Mars watchers say it is too soon to sound the death knell for the joint effort. "I think they are jumping the gun," says Louis Friedman, executive director of Pasadena's nonprofit Planetary Society, which is involved in the proposed mission. Friedman was especially concerned about the possible impact of the statements by U.S. and Russian officials on a parliamentary review this week of the Russian Space Agency's budget. He added that



NASA/JPL

All alone. NASA still plans to have a compact rover explore the Martian surface.

he believes Gore and Chernomyrdin may make a vague but positive statement about Mars exploration that would leave the door open for a 1998 launch.

Clarke says the 1998 date could be saved if Russia comes up with the money, but that, in the meantime, NASA must press on with its own program. "We are very sympathetic to their plight, and we don't want to do anything to undercut them," he adds.

The demise of a 1998 Mars Together effort won't halt exploration of the planet, however. In December 1996 NASA intends to launch the $170 million Mars Pathfinder mission. When it reaches Mars, a small scientific package outfitted with meteorological instruments and spectrometers will parachute to the ground in the Chryse Planitia region and open up like a flower petal to expose solar arrays to the dusty Martian sunlight. A tiny 35-pound rover will roll off the spacecraft to explore the surrounding terrain. Meanwhile, a U.S. global surveyor mission launched in November 1996 will orbit above, gathering topographical data for planetary scientists. A second surveyor and a lander could also be sent to the planet in 1998.

Russia, for its part, intends to launch a spacecraft in 1996 carrying a host of Russian, European, and U.S. scientific instruments. An orbiter would circle the planet and drop two small robotic stations as well as missile-shaped penetrators that would bore into the ground and relay back data. "The Russians have told us that Mars '96 will go off on schedule," says Clarke. One European official, however, is skeptical of that timetable. "That and 50 cents will get you a cup of coffee," he says, adding that he expects Russia will postpone the mission. The mission was originally set for launch this year before budget problems forced a delay.

At the Moscow meeting, Gore and Chernomyrdin were also expected to agree to set up a space biomedical research center run by Moscow State University and the University of Houston. "The idea is to have a mechanism to bring medical technology developed in space down to Earth," says Clarke. "We'll use this center as an incubator for private industry in Russia and to give our medical community better access to Russian data and technology."

The two leaders also have plans for closer cooperation in Earth observation. NASA wants to give Russian scientists access to its information system containing remote sensing images in exchange for Russian agreement to distribute data widely and at a low cost. Russian scientists would also be encouraged to contribute their data sets. In addition, Russia would launch upgraded versions of first the U.S. Stratospheric Aerosol and Gas Experiment and, a few years later, the U.S. Total Ozone Mapping Spectrometer.

–Andrew Lawler

HUMAN GENOME SCIENCES

The Company That Genome Researchers Love to Hate

Sitting in an office with an expansive view of old farms and meadows that are rapidly being chopped up into research parks, William Haseltine, chair of Human Genome Sciences Inc. (HGS) of Rockville, Maryland, isn't modest about his company's achievements. "We are the Balboa of human genes," Haseltine says. "We are the first to see this new horizon," he continues, describing a landscape surveyed by HGS that, in his estimate, contains 50,000 to 70,000 genes.

Over the past 2 years, Haseltine's company has pursued an aggressive search for DNA expressed in human tissue, and now, he says, it has filled its data banks with sequences representing about 85% of the entire suite of human genes. Haseltine believes HGS has laid its hands on the main prize of human genetics: sequences that can identify most of the expressed genes and the means to locate those genes on the chromosomes.

You might think that these achievements would be hailed by the genome community as a major advance toward the goals of the Human Genome Project. But that's not so. In fact, HGS and its nonprofit partner, The Institute for Genomic Research (TIGR), are widely viewed as the bad boys of genetic research. Many academic researchers dismiss the science done by HGS and TIGR, calling it "cream skimming." They view it not so much as exploration but as land grabbing. And TIGR's director, J. Craig Venter, is still feeling the bruises from a public disparagement in 1992 by James Watson, then director of the federal genome program. Watson quipped that "virtually any monkey" could obtain gene sequences by the methods Venter and Haseltine have adopted, although Watson later said he regretted that remark.

More recently, HGS caused a furor by insisting that researchers who plan to use information from HGS-TIGR data banks sign over to the company commercial rights to any discoveries that result (*Science*, 14 October, p. 208). This move could impede public-private collaborations on one of the goals of the Human Genome Project—construction of a map of the genome that pinpoints the location of genes. HGS and TIGR are offering information that could help build such a map, but academic researchers are leery of the terms (see box on p. 1802).

Indeed, feelings are running so high in the genome community that a move is afoot—encouraged by federal officials—that would undermine the value of HGS-TIGR's work by duplicating it and making it public. And this possibility isn't so far-fetched, because the Patent Office has ruled that the type of data HGS-TIGR has amassed—sequences of gene fragments—is not patentable. Already, several academic researchers and companies are chipping away at HGS-TIGR's monopoly by depositing sequences in public data banks, and the Merck Pharmaceutical Co. announced in October that it plans to bankroll a public sequencing venture (see letter on p. 1790). Some observers, including Harold Varmus, director of the National Institutes of Health (NIH), say it's only a matter of time before the commercial value of HGS's data is eroded. This puts HGS under the gun to promote its database and get outside help in identifying patentable ideas.

The criticism may be driven partly by envy, however, for HGS and TIGR have put together a formidable research tool. Haseltine rattles off examples of the advances the database has already made possible. One is the well-known discovery last spring of a human DNA repair gene involved in colon cancer, identified through a rapid search of HGS's data by in-house and academic geneticists, including Burt Vogelstein of Johns Hopkins University. Another discovery, not yet published, came about when Tomas Lindahl of the Imperial Cancer Research Fund in London dipped into the data. With the company's help, Lindahl may have located another DNA repair gene involved in a lethal immune disorder.

And this is just a glimmer of what lies ahead, according to HGS biologist Kenneth Carter. He says HGS staffers have already identified 10 human DNA repair genes and mapped six of them to megabase-long regions on human chromosomes. Carter and his colleagues say they are identifying thousands of DNA sequences never described before: keys to new proteases, kinases, phosphatases, transcription factors, and others.