Once a component—say, a magnet—has been accepted at the ITER site, the IO applies a set number of credits toward the party's contribution. But for any given item, China or India would receive the same number of credits as the US or a European nation, even though China's or India's procurement costs could be one-half to one-third the costs in the US or Europe.

Deliberate duplication

Another ITER feature is blamed for cost growth. When the parties determined who would contribute what to the project, each looked to get a piece of the high-tech componentry. "Instead of being given to one party, they have been carved up into little bits so that every member could qualify their industries for these particular challenges," says Haange. In what Hawryluk described as "the biggest procurement of its type ever conducted in the history of mankind," 750 tons of niobium–tin superconductor for ITER's magnets was divvied up among six of the seven parties to make. "The parties said we know we're not going to be efficient doing this, but nonetheless, for the development of our scientific or industrial base, we want to develop those components," says Hawryluk. "They chose to do that, but they are doing it at their own expense. That's what makes cost associated with ITER a lot trickier than with a normal project."

Haange says new management processes and procedures have been implemented to minimize further schedule slippages and cost growth. The IO, which is responsible for procuring the massive cryogenic plant and some other items, has been operating under a capped budget for several years. Last year a new group called the "unique ITER team" was established to connect top officials at Cadarache with the heads of the domestic agencies.

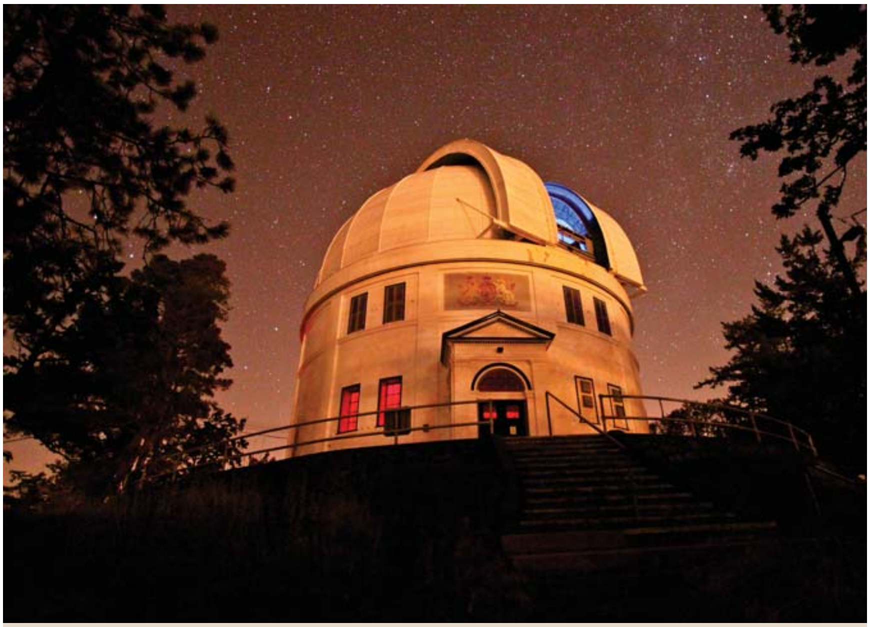
If the US were to leave ITER, the project would likely survive; but no one involved wants to see that. "On paper, ITER without the US could succeed, with quite a bit of delay and impact," says Hawryluk. "We have a lot of key technology, experience to bring to the party, and we really make an impact. I think in the scientific areas, we probably do more than our 9% contribution."

"Is it possible to [build ITER]? Yes it is; piece by piece it's happening," says Cowley. "I'm convinced we can build ITER now, but we've got to be patient." He observes that the US "tends to like international projects where it has a major role, and for ITER it doesn't have a major role." But he adds, "to the rest of us ITER partners, the US is critical, because some of the best science and engineering goes on in the US." **David Kramer**

Business emphasis at research council has Canada's scientists concerned

In bolstering industry, the NRC aims for innovation and economic gain. Will isolation from research developments also result?

Canada is restructuring its National Research Council, which does in-house scientific research, funds external projects, and provides services to industry, to focus mainly on industry. The move is motivated by a wide recognition that Canada lags other countries in innovation, according to NRC president John McDougall. "We want to fill the gaps between discovery and things in the marketplace." But researchers worry about the repercussions of what they see as yet another in a series of slaps the government has dealt science (see PHYSICS TODAY, July 2012, page 20).



NATIONAL RESEARCH COUNCIL OF CANADA

Many scientists are asking if the future is safe for basic science—such as this telescope at the Dominion National Observatory in Victoria, British Columbia—at the National Research Council of Canada.

Unveiled on 7 May, the new structure of the NRC has been in the making since the release nearly two years ago of the government-commissioned report *Innovation Canada: A Call to Action*, which said Canada should identify strategic areas, streamline its interactions with companies, and focus more on commercialization. The NRC response includes a reorganization from 21 independent institutes into 12 R&D portfolios falling into the three categories of engineering, emerging technologies, and life sciences. In the process, the NRC has shed at least two institutes: A medical diagnostics center in Manitoba was closed, and in April the Canadian Neutron Beam Centre was transferred to Atomic Energy of Canada. "This refocused NRC, with a business-led innovation mission, is pivotal to the future of Canadian jobs, economic growth, and our long-term prosperity," said Gary Goodyear, minister of state for science and technology.

Tools for industry

A key feature of the refocused NRC will be large industrial R&D projects. The first one, announced on 10 May, will explore using algae to convert carbon dioxide emissions from Alberta's oil sands into such things as biofuel and animal feed. Some 40 projects are to be launched over the next year; each will feature a partnership with industry and receive annual government funding ranging from a few million dollars to nearly Can$20 million (roughly $19.5 million). “These projects are longer term, higher risk,” says McDougall. “We are trying to ensure that industry can stay competitive by providing the technologies that industry will need.”

About Can$350 million of the council’s Can$900 million budget will go to those large projects and technical services combined. With technical services, the NRC sells access to equipment that is too specialized or expensive for companies to own. Examples include wind tunnels to test the aerodynamics of aircraft and bridges, and a climate chamber for testing vehicle performance in conditions from desert to arctic.

The NRC is also ramping up its industrial research assistance program, through which it provides financial and advisory support to small and medium enterprises. Funding for that doubled to Can$220 million this year. And, comparable to budgets of recent years, about Can$150 million will go to basic research and to maintain the national scientific infrastructure already under the council’s purview, including TRIUMF, the particle and nuclear physics lab in Vancouver; astronomical facilities in Victoria and Penticton, British Columbia; and a metrology facility in Ottawa, Ontario.

Risks and rewards

Although no one disputes the benefits of boosting innovation, many in the research community worry that in focusing on short-term, industry-driven goals, the NRC risks losing its capacity in basic research. Says Gabor Kunstatter, president of the Canadian Association of Physicists, “We like to point to canola oil. It’s a triumph of Canadian research and was developed over decades. If the NRC had had a short-term focus, there’s a good chance it would never have happened.” The canola industry generates Can$15 billion annually for Canada.

The community is still smarting over restrictions on talking to the press that the government put on its employees about two years ago, and it has also watched the number of peer-reviewed publications coming out of the NRC decline. Now physicists and astronomers are asking how participation in the Thirty Meter Telescope and the Square Kilometer Array might be affected, given that the NRC’s Herzberg Institute of Astrophysics coordinates Canada’s involvement in those and other international projects. The restructuring at NRC, says Kunstatter, “is a net loss for basic science. It’s a fairly major blow.”

The NRC has traditionally maintained measurement standards and helped industry. But as the council’s focus on industry sharpens, says physicist Paul Corkum, “you have to worry about isolation from other aspects of science in Canada and internationally.” He points to the NRC–University of Ottawa Joint Attosecond Laboratory, which he heads, as a “superb” approach to keep the NRC connected to the broader science community.

Goodyear compares the refocused NRC to Germany’s Fraunhofer organization, a network of applications-oriented institutes. “In some sense that’s fine,” says Simon Fraser University biophysicist John Bechhoefer. “But what they don’t say is that Germany still has and funds the Max Planck Institutes. We don’t have anything like the Max Planck.”

Toni Feder

Smaller is better for Arctic radar scattering facility

In converting from a set of cumbersome radar dishes to an agile arrangement of dipoles, the European Incoherent Scatter Scientific Association (EISCAT) is angling to study the atmosphere at the highest spatial and temporal resolutions to date.

Construction on EISCAT_3D, as the project is called, is to begin next year, pending funding from the six partners. Norway and Sweden each plan to pony up about a quarter of the €130 million ($170 million) tab, with Finland, the UK, China, and Japan covering the rest. If all goes as planned, observations could start in 2016, with the full EISCAT_3D up and running in 2019. Significantly, the project has the stamp of approval of the European roadmap for large scientific infrastructure.

The current EISCAT mainland transmitters send up UHF and VHF electromagnetic waves—around 931 MHz and 224 MHz, respectively—that scatter off electrons at altitudes from about 50 km to 2000 km. By analyzing the signals that return, scientists learn about the densities, temperatures, composition, and dynamics of the ionospheric plasma. The two huge transmitters are located outside of Tromsø, Norway, with receivers there and in Kiruna, Sweden, and Sodankylä, Finland. Vectors for ion motion can be obtained by combining observations from multiple sites.

With EISCAT_3D, the receivers and transmitters would be replaced by arrays of 10 000 crossed dipoles. Controlled electronically rather than mechanically, the arrays make possible

L.–G. VANHAINEN, EISCAT SCIENTIFIC ASSOCIATION, KIRUNA, SWEDEN

A test array for EISCAT_3D set up near the current 32-meter dish in Kiruna, Sweden.