ITER Impasse Illustrates Challenge of Site Selection

The more partners in a project, the more resources available, but the more complicated decision making becomes.

"We are blessed by having at least one. We are cursed by having more than one," says Princeton Plasma Physics Laboratory's Ned Sauthoff about the site candidates for ITER, for which he is the US planning officer. Since before Christmas, the ITER partners have been in a deadlock over where to site the $5 billion fusion reactor. Europe, China, and Russia insist on Cadarache, in the south of France, while Japan, South Korea, and the US vote for Rokkasho, in northern Japan.

Both locations passed muster by the ITER site evaluation team. But those who back Cadarache say licensing, cost, climate, local industry, technical, and other factors favor their site. In addition, European, and some American, fusion scientists worry that westerners will not want to serve extended tours of duty at the remote Japanese location.

That works both ways, as Gyung-Su Lee, director general of the Korean National Fusion R&D Center in Daejeon, south of Seoul, points out: "Korean people share more cultural background [with the Japanese than with Europeans]." In weighing the candidates, Lee says, his country's researchers favor Japan by a "slim margin." US Energy Secretary Spencer Abraham said in a speech last January that "the location of Rokkasho is superbly situated to receive the large materials need[ed] for ITER. [Japan has] outstanding scientific talent to contribute to the international team of scientists that would live and work in the area. . . ." Department of Energy (DOE) officials refused to comment further on the US preference for the Japanese site.

For several months, Europe and Japan have been discussing a "broader approach" in which the country that does not get ITER hosts a support facility—the International Fusion Materials Irradiation Facility. In June, both Europe and Japan upped the ante, offering to pay for nearly half of ITER plus half of the roughly $1.2 million IFMIF—if they host ITER. A shift in the alliance of the US or other nonhost ITER partners could also tip the balance, but so far no one is budging.

Generic problem

In the past, says Lee, countries had their own scientific facilities, and "could choose to work alone or together. But with ITER, or a new global linear collider, the world can only build one. The only way is to put our resources together." The deadlock, Lee adds, "is not a problem of ITER negotiations. It's generic."

Caltech's Barry Barish, who chairs a committee charged with deciding what technology a future multibillion-dollar linear collider should use, points to "two extremes in negotiating that have not worked." With ITER, he observes, "there is an impasse because everything was already agreed, and there are not very many things left to negotiate." The Superconducting Super Collider, famously canceled in 1993, lies at the other extreme, he says. In that case, the US settled on siting the accelerator in Waxahachie, Texas, before asking other countries to join the project. The SSC failed, he adds, "because it was a green-field site and because of the lack of getting international partners earlier." With the next collider, says Barish, "the idea is to find a solution in between those extremes, where the attraction of being host country can be traded off against other attractions."

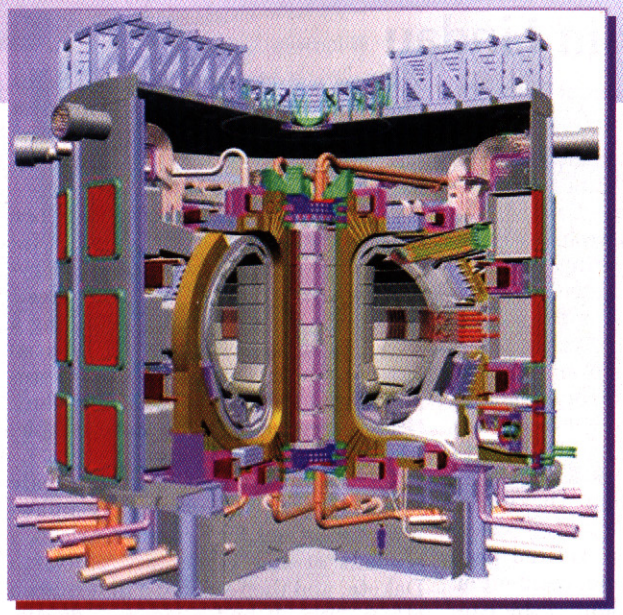
Indeed, site selection is often a thorny matter, even for scientific projects not as costly or international as ITER or the next-generation linear collider. Scientists might choose several sites that meet their scientific and technical criteria for atmospheric turbulence, shielding from cosmic radiation, seismicity, manmade vibrations, available space, and so on. Other factors that may enter the mix include accessibility to scientists from around the world—current visa restrictions make the US a trouble spot in this regard; licensing for nuclear materials; the desire for a green-field site versus the benefits of using existing roads and other infrastructure or revitalizing an existing facility; incentives offered by potential hosts; proximity to a university; the reputation of local K–12 schools; and jobs for spouses.

The interplay of these and other factors is specific to each project, but if the price tag is high enough, politics inevitably plays a role. To divvy up giant, one-of-a-kind scientific facilities among international participants, "the balance will have to be achieved by projects from several fields," says Burton Richter, former director of SLAC and past president of the International Union of Pure and Applied Physics. "The physicists ought to say what sites are acceptable, and the politicians should say which among those they want to accept."

Unique solutions

One project that rose successfully from a green-field site is Jefferson Lab in Newport News, Virginia. The DOE's decision to locate the accelerator lab there "came as a great surprise" to others vying for it, says Yale University's D. Allan Bromley, who chaired the lab's site selection committee. "MIT had been convinced that because they had the Bates accelerator lab, they'd be asked to expand. And an Illinois group was convinced that Fermilab and Argonne made them the right place." Newport News won out, Bromley says, because "the Southeastern Universities Research Association had committed themselves to provide something like 27 new senior faculty positions for scientists. It was that activity, together with the perceived lack of facilities in that part of the country, that made the decision easy."

Bringing science to underserved parts of the US was also key in NSF's decision to site one leg of the Laser Interferometer Gravitational Wave Observatory in Livingston, Louisiana; the other leg of the experiment is in Hanford, Washington. "A perfectly wonderful decision was made by Walter Massey at NSF," says MIT's Rainer Weiss, who has been involved with LIGO from the start. "The bottom line was that NSF and the gov-



How will the ITER siting stalemate be broken?
(Schematic courtesy of ITER.)

ernment had not put enough money into the South, and [Massey] thought this would be a good thing for the South and for the country." Apparently, it is: In Louisiana, says Barish, who directs the experiment, "LIGO gives a pride and visibility. The outreach things we do have a huge impact. Around Caltech, it just isn't the same."

Sometimes siting is driven by a forceful individual. Take Gran Sasso National Observatory, says George Kalmus, a senior UK particle physicist at the Rutherford Appleton Laboratory and former head of CERN's scientific policy committee. The underground lab near Rome, he says, "was the brainchild" of Antonino Zichichi, then president of Italy's National Institute for Nuclear Physics. "He was a powerful figure in science and politics. By dint of his personality and contacts, he got it approved. He had support, but without him, it wouldn't have happened."

Politics played an unexpected role in siting the Joint European Torus (JET). In the mid-1970s, the choice had been narrowed to Culham, UK, and Garching, Germany. According to fusion lore, the impasse was broken when Germany sought to thank the UK for help in rescuing passengers on a hijacked Lufthansa airliner. The hijackers, who commandeered the plane to Mogadishu, had demanded the release of members of the Baader–Meinhof terrorist group imprisoned in Germany. Paul Vandenplas, a professor emeritus at Belgium's Royal Military Academy and vice chair of the European Consultative Committee for Fusion, recalls the day in fall 1977 when he was in the office of Prime Minister Leo Tindemans, then the president of the European Council. The phone rang, says Vandenplas, and "the prime minister came back and said, 'JET is solved. [German Chancellor Helmut] Schmidt said he's giving up Garching to thank the British for the help they gave.' "

More than in most disciplines, facilities in astronomy must meet strong scientific constraints. Because optical and IR telescopes need to be at high, remote locations, possible sites are limited, and bidding battles—such as with ITER—seldom occur. Indeed, rather than put up the lion's share, a telescope host typically levies a tax in the form of some fraction of the observing time.

Still, siting telescopes is not based on scientific requirements alone. Tension is ongoing, for example, at Mauna Kea, Hawaii. In one camp are astronomers and those who want the economic stimulation that observatories bring to the state; in the other are those who oppose further development on the island volcano (see PHYSICS TODAY, January 2004, page 22).

In the US, opposition from environmental and indigenous groups has escalated "so that an otherwise desirable location can't be obtained because of red tape," says Caltech astronomer George Djorgovski, cochair of the committee in charge of site selection for the Thirty Meter Telescope. "Very few telescopes are going to be built in this country in future," adds Tony Beasley, who, as project manager, shepherded CARMA, the Combined Array for Research in Millimeter-wave Astronomy, through a turbulent site approval process in California. "The reality is that the environmental impact of astronomy projects is tiny," Beasley says. "A ski resort or mining company generates money, so they can afford to pay for lawyer after lawyer. Astronomy projects cannot afford to burn years and millions of dollars on environmental impact statements."

"My observation," says Kalmus, "is that [siting facilities] is very far from a logical or scientific process. It's more like a random walk conducted by politicians."

'A chess game'

Just how ITER's random walk will play out remains uncertain. But fusion scientists and policymakers are trying to understand the bind they're in—how they got there and how they might get out. Japan's vigorous pursuit to host ITER took Europe by surprise; a year before the standoff, someone involved in ITER negotiations for Europe told PHYSICS TODAY that "Japan will not defend their site up to the last" and "they have given us signs that financially they would not be ready to make a large effort." More recently, this source said that "the Japanese attitude changed substantially since the US started pushing them."

In Europe, US support for the Japanese site is widely interpreted as revenge for France's opposition to the war in Iraq. Some observers point to CERN in Europe and to the US's role in the International Space Station, and say it's only fair that Japan have ITER. More common, however, is linking the fate of ITER with that of a future linear collider. Here, the thinking is that if Japan gets ITER, the US has a better shot at hosting the collider.

The linear collider and ITER are not directly linked, and can't be, as they are not at the same stage of readiness, but it's generally assumed in the science community that the highest level of policymakers is taking the future collider into account in discussions about ITER. The two projects "are not uncorrelated," says Albrecht Wagner, the director of DESY, the German Electron Synchrotron in Hamburg, who is involved in planning for the linear collider. "It might be that the region that takes ITER will have all its resources tied up. It's like a chess game. I don't know how the game will develop."

Given the advances in remote control and data handling, says Steve Cowley, a fusion physicist at UCLA, "I ask myself, In 10 or 12 years from now, who will visit ITER? You can do it over the internet. I don't think it's terribly important anymore where things are sited." In any case, it's safe to say that fusion scientists mostly care more that ITER be built than where it is built.

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