reported in January that Japan currently has 9.9 metric tons of plutonium separated from spent nuclear fuel within its borders. Another 35 tons of Japanese-owned plutonium was separated by reprocessing in France and the UK and remains in those countries.

Other delegation members on the Japan visit were Anatoli Diakov of the Moscow Institute of Physics and Technology; Edwin Lyman, a physicist with the Union of Concerned Scientists, Washington, DC; Gordon MacKerron, director of the science and technology policy research department at Sussex University, UK; M. V. Ramana, a physicist with Princeton's program on science and global security; Mycle Schneider, an independent nuclear consultant in Paris; Masafumi Takubo, an independent nuclear consultant in Japan; and Gordon Thompson, with the Institute for Resource and Security Studies, Cambridge, Massachusetts. Fumihiko Yoshida, an editorial writer with the newspaper *Asahi Shinbum,* also participated in the meetings.

David Kramer

New York City seeds tech campus

The new graduate school is intended to catalyze the city's industrial sector.

Cornell University and the Technion–Israel Institute of Technology will establish a graduate school for applied sciences and engineering on Roosevelt Island, a sliver of land in New York City's East River between Manhattan and Queens. On 19 December, in announcing the winners of a city-sponsored competition for the project, Mayor Michael Bloomberg said the campus will "educate tomorrow's entrepreneurs and create the jobs of the future." The city hopes CornellNYC Tech will become the heart of a broader set of initiatives to diversify the city's economy and transform the city "into the world capital of innovation for the 21st century," says Seth Pinsky, president of the nonprofit New York City Economic Development Corp.

"There is still a huge gap between the time scales of universities—decades and centuries—and the time-scale needs of the commercial sector," says Dan Huttenlocher, Cornell's dean of computing and information sciences and dean of the new campus. Cornell NYC Tech is designed to "address this gulf."

The CornellNYC Tech project is creating a buzz, but many details remain to be fleshed out. The plan is to build up over 30 years to some two million square feet of facilities, 280 faculty members, and 2500 students—which will nearly double the total number of engineering graduate students in the city. Old buildings, including a former smallpox hospital, will be razed, and new construction is set to start in two years. Move-in is scheduled for 2017. In the meantime, the first students are to start this fall in leased space. "This is a huge undertaking," says Pinsky. "And it's moving from 0 to 60 in what in the academic world is warp speed."

Tailoring academics

Academically, the new campus will be organized around flexible, interdisciplinary hubs. The first three are dubbed connective media, the built environment, and healthier life. "These hubs are tailored to the types of industries that already exist in New York City," says Craig Gotsman, the Technion's deputy senior vice president in charge of academic development for Cornell NYC Tech.

The hub themes may change over time "in response to changes in technology, and changes in the marketplace. It's very different from a traditional university campus," says Lance Collins, Cornell's dean of engineering. "We are bringing faculty together now to sharpen up definitions."

In the connective media hub, for example, researchers from computer science, electrical engineering, communications, information sciences, and other fields might work on topics related to advertising, media, entertainment, and banking. The built environment hub could involve work related to smart buildings, the electric grid, transportation, building facades, and the like. In the healthier life hub, work may involve epidemiological analyses, medical devices, and cyber-security of electronic medical records—but molecule design and pharmaceuticals were excluded in the city's call for proposals.

For the healthier life hub, an example mentioned in the winning proposal is multiphoton devices developed by Cornell biophysicists Watt Webb and Chris Xu. "One is a small and flexible endoscope that can be inserted through natural openings," says Xu. "The second is larger and rigid, and allows a doctor to examine surgical margins intraoperatively so they don't cut out more or less than necessary."

"Real goals in the real world"

To start with, faculty will come from the two home universities, and the first students will come from Cornell's upstate base in Ithaca. In the longer term, researchers from Cornell and the Technion may spend stints of several years at CornellNYC Tech; others may split their time between their home university and the new campus; and the campus will

COURTESY OF CORNELL UNIVERSITY AND SKIDMORE, OWINGS & MERRILL

An artist's rendering of the new applied sciences and engineering campus that Cornell University and the Technion–Israel Institute of Technology are creating on New York City's Roosevelt Island. One of the campus's first buildings will produce at least as much energy as it uses.

also hire. All faculty will be tenured through a traditional department at one of the home universities.

The new campus will offer master's and PhD degrees, and Cornell undergraduates will be able to apply to do research projects. Degrees may be through either or both of the founding universities; a mainstay of the academic program is expected to be a master's in applied sciences through the collaborative Technion–Cornell Innovation Institute. A significant portion of degree work will be an industrial project in collaboration with a company, says Gotsman. "From day one, students will feel they are a part of the industry—not just in R&D, but also in the commercial, marketing, and entrepreneurial aspects. We want the student to feel he's part of a start-up project with a real goal in the real world."

"Every student will be assigned a professional mentor," says Collins. "We are going to draw from our alumni base. We have thousands of people who would like to be mentors."

Prestige, spin-offs, and jobs

Cornell is responsible for raising funds for the new campus. In addition to $100 million in seed money and the 11-acre site from the city of New York, Cornell starts off with the largest single donation it has ever received, $350 million from alumnus Charles Feeney. The total running costs over 30 years will exceed $2 billion, to be paid through federal and corporate grants and contracts, philanthropy, and tuition.

Cornell provost Kent Fuchs notes that CornellNYC Tech is "organizationally similar" to the King Abdullah University of Science and Technology in Saudi Arabia (see PHYSICS TODAY, August 2007, page 33, and November 2009, page 24).

For the Technion, which "is a bit geographically isolated and wants to interact better with colleagues in the US and Europe," says Gotsman, it is advantageous to have a US presence. For Cornell, the Technion's track record in spin-off companies is a plus.

Making New York City into a successful locale for spin-offs "is not going to happen by itself," says Gotsman. "We don't want to wait 100 years or take the risk of its not happening. This campus is designed in order to make it happen." CornellNYC Tech has also promised to engage in outreach for schoolchildren and teachers.

According to an economic impact analysis carried out by the New York City Economic Development Corp, the new campus will create some 20 000 construction jobs and up to 8000 permanent jobs. Over the next 30 years, it will generate more than $23 billion in economic activity and some $1.4 billion in tax revenues. The corporation estimates that the campus will generate around 600 spin-off companies that will provide up to 30 000 permanent jobs.

Toni Feder

Tabled decision gains time for leap seconds

A US-led proposal to do away with leap seconds proved contentious enough for the radiocommunication sector of the International Telecommunication Union (ITU-R) to decide, at its January meeting in Geneva, to postpone any decision until 2015.

Leap seconds are inserted periodically to sync time as determined from Earth's rotation with time as measured by atomic clocks. Such clocks follow the international definition of the second: 9 192 631 770 periods of the quantum transition between two hyperfine ground-state levels of cesium-133.

The International Bureau of Weights and Measures in France uses information from hundreds of atomic clocks around the world to set Coordinated Universal Time (UTC); the International Earth Rotation and Reference Systems Service gives about six months' notice when a leap second will be added to keep the two times within 0.9 second of each other. Leap seconds are inserted on the last day of June or December just before midnight UTC—in the middle of the night in Europe, in the evening on the US East Coast, and during daytime business hours around the Pacific. The next leap second will be added on 30 June.

Since the first leap second 40 years ago—five years after adoption of the cesium time standard—one has been inserted on average every 18 months to make up for Earth's slowing rotation due to such things as exchanges of angular momentum in the Earth–Moon system, interactions between Earth's core and mantle, and large-scale weather patterns like El Niño. More frequent leap seconds are expected to be required in the future. (See the Quick Study in PHYSICS TODAY, November 2006, page 78.)

Astronomers vs. programmers

To a great extent, the leap-second debate pits astronomers against computer jocks, notes Richard Langley, who works on global navigation satellite systems at the University of New Brunswick. "For many purposes, this whole discussion is esoteric," says Rob Seaman, a software systems engineer at the National Optical Astronomy Observatory in Arizona: If Earth rotation time is disconnected from atomic time, it would be many millennia before night would turn to day. "But for astronomy and aerospace, [the disconnect] would become obvious quickly." One second of Earth's rotation corresponds to 15 seconds of arc on the sky; the full Moon is 1800 arcseconds across. Abandoning leap seconds, Seaman says, "will cost the astronomical community and various aerospace communities a lot of time and money to fix systems that are not currently broken."

Poul-Henning Kamp, an authority on UNIX and other computer systems and a self-employed programmer in Denmark, got involved in the debate when he worked on air traffic control systems. "A modern plane moves 1000 feet in one second," he says. "Suddenly leap seconds had a meaning. We have to fix software."

For air traffic control, financial transactions, assembly lines, and other computer-controlled processes, inserting a second can disrupt operations. Some assembly processes shut down—and may thereby lose money—to avoid problems, notes Kamp. Fundamentally, he says, "getting rid of leap seconds is an economic question."

Would it cost more to keep leap seconds or to drop them? Steve Allen, a programmer at the University of California's Lick Observatory, estimates that dropping leap seconds would cost the observatory about two person-years of effort. "It's a hunt for possible problems with software and hardware and procedures of telescope operations. It's a lot like the Y2K bug," he says. Either way, "many man-years of effort will be expended. There is no getting around

Adding an extra second to a day to sync Earth rotation time with atomic time can trip up software systems. But abolishing such leap seconds carries costs too.