Russia launches S&T university

The top-down initiative aims to be interdisciplinary and international and to breed entrepreneurship.

SKOLTECH

HERZOG & DE MEURON

An artist's rendering of the Skolkovo Institute of Science and Technology. Above, Russian Federation deputy prime minister Vladislav Surkov, chair of the university's board of trustees, is flanked by Skoltech president Edward Crawley (right) and Victor Vekselberg (left), head of the Skolkovo Foundation.

How does a university rise from nothing to become a global dynamo? Russia's Skolkovo Institute of Science and Technology (Skoltech) is approaching the task through interactions with the high-tech innovation city where the graduate-level university is located and by engaging the help of MIT and other established institutions.

Edward Crawley, who left his MIT faculty position in the department of aeronautics and astronautics to become Skoltech's president, says the endeavor "has a somewhat unique role in the cluster of new universities"—for example, in Saudi Arabia, Singapore, Korea, Japan, and New York City—in that "it's designed from the ground up not just to train talent, but also to be an engine of economic growth. It's about developing S&T [science and technology], commercializing innovations, and having other forms of social impact." Skoltech will draw on Russia's strength in science, and is intended to foster an economic shift from dependence on the extraction of oil and other natural resources to development of technical know-how and startup companies. The aim is to grow to 1200 master's and PhD students, 300 postdocs, and 200 faculty members by the end of the decade.

Skoltech gets started with more than $500 million of the $3 billion the government is putting into the Skolkovo Innovation Center, launched nearly three years ago in the Moscow suburb of Skolkovo. The innovation center—known as "Innograd" and as Russia's Silicon Valley—is home to more than 650 startups and has attracted global companies like Siemens, IBM, Microsoft, and EADS (the European Aeronautic Defence and Space Company) to set up laboratories. Tax and import–export rules in the innovation city are relaxed, which could help not only companies but also scientists throughout Russia, says Sergey Kiselev, a biologist at the Vavilov Institute of General Genetics in Moscow and a leader in one of the university's first international research centers. "It's very difficult to get consumables for research," he says. "It takes three to six months to have some reagent from outside Russia. It should be faster and cheaper [to order through] Skolkovo."

Each international research center is a collaboration among Skoltech, an established Russian institution, and a foreign university, and involves both research and a commitment by the partners to help hire faculty and build up Skoltech. The idea is to make the new university a leader in specific fields. Of 15 planned centers, 3 were announced in October; they are in stem cell research, in RNA therapeutics and infectious diseases, and in electrochemical energy storage. The centers are funded up to $12 million a year for five years. Partner research groups are selected competitively, although MIT is guaranteed a spot in five of them. Overall, Skoltech is focusing on five areas: information, biomedicine, space, energy, and civilian nuclear S&T.

Skoltech's first 20 students matriculated this past fall. Because the university's own facilities won't be ready until fall 2014, the students are starting off at MIT, ETH Zürich, Imperial College London, and Hong Kong University of Science and Technology. The first faculty hires are spending a year at MIT, which has about 70 faculty members involved in planning nearly every aspect of Skoltech, including curricula, faculty recruitment, campus design, and administrative structure.

Toni Feder

US nuclear plants getting Fukushima-inspired safety upgrades

A year and a half after the disaster at Japan's Fukushima Daiichi nuclear plant, Hurricane Sandy pounded the East Coast of the US, flooding the country's oldest operating nuclear plant, Oyster Creek, and cutting off power to it. Unlike Fukushima, though, generators at the New Jersey plant weren't inundated and coolant continued to flow in the reactor, which was already down for maintenance. Three other reactors in the Northeast tripped offline during the storm, but power to the sites wasn't interrupted.


PAUL GUINNESSY

Allison Macfarlane

The March 2011 nuclear incident in Japan (see PHYSICS TODAY, May 2011, page 18) prompted the US Nuclear Regulatory Commission (NRC) to order that several steps be taken to bolster the safety of US reactors in the event of natural disasters. Acting on a set of recommendations developed by its Japan Near-Term Task Force, the NRC instructed reactor operators to deploy additional generators and other equipment, both onsite and at nearby offsite locations, to ensure that backup power, coolant systems, and other vital equipment will remain operational if power from the grid is lost for days or even weeks in a disaster.

In addition, the 21 US boiling-water reactors with containment systems similar to the Fukushima BWRs must be equipped by 2016 with containment vents that can cope with the increased pressure and temperature of steam generated early in an accident and can withstand possible fires and small explosions if the vents are used to release hydrogen later in an accident. The upgraded vents must be capable of operation even if the reactor loses all electrical power or if other hazardous conditions exist. The NRC also mandated that thermometers and water-level gauges be installed in the spent-fuel storage pools of all plants.

"Most plants are well down the path of acquiring the new equipment" required by the orders, says Allison Macfarlane, who became NRC chairman in July 2012. "We also issued some letters requesting both seismic reevaluations and seismic and flooding walk-downs at plants, so that we can carefully reevaluate the seismic and flooding hazards at all the US plants."

NRC commissioners have begun grappling with the task force's longer-term recommendations from the Fukushima review, including the question of whether operators should be required to reduce the quantity of spent fuel in their storage pools. Although fresh spent fuel is hot and must be kept in pools upon removal from reactors, it can be moved after five years into dry storage in steel-and-concrete casks. "We are in the process of looking at the issue of maybe moving some of the spent fuel faster or de-densifying" the material, Macfarlane says. "It's at the beginning stages and I can't tell you when we'll have an answer now." At Fukushima, operators were concerned that the loss of power and coolant would cause water in the ponds to boil off and leave spent fuel exposed to the air, with potentially disastrous results. Although that did not occur, nuclear safety experts continue to worry in particular about the spent fuel at Fukushima's reactor 4, which holds the greatest number of fuel assemblies and was damaged in a hydrogen explosion. The fear is that the exposed spent fuel could burn and release copious amounts of fission products.

The NRC has asked reactor operators to reevaluate their respective seismic and flooding hazards and to reexamine their communications and staffing plans for emergencies. Macfarlane, a geologist, says that the NRC, in cooperation with the Electric Power Research Institute and the Department of Energy, has drafted a new seismic source map covering the two-thirds of the continental US from the eastern edge of the Rockies to the Atlantic Ocean. Seismic sources are one piece of information that goes into analyzing the potential for ground motions at a particular location. "You need seismic sources, you need an estimate of the periodicity of earthquakes, and then you need an understanding of the particular situation at a site: what kind of sediments are there, what kind of rocks are there, what kind of structures are in the rocks, et cetera. That will give you a sense of what kind of ground motions exist," she explains.

Since western states' geology is too heterogeneous to be covered in a similar map, the NRC has instructed operators of each of that region's four nuclear plants to draw up their own individual source maps. Should seismic evaluations find that earthquake risks are greater than previously thought, reactor facilities can be reinforced.

The broadest and most far-reaching recommendation from the task force was to replace the NRC's patchwork of regulations, pieced together over decades, with "a logical, systematic, and coherent regulatory framework for adequate protection that appropriately balances defense-in-depth and risk considerations." The NRC, Macfarlane says, directed its staff to provide options for how to proceed with that recommendation by next month.

David Kramer

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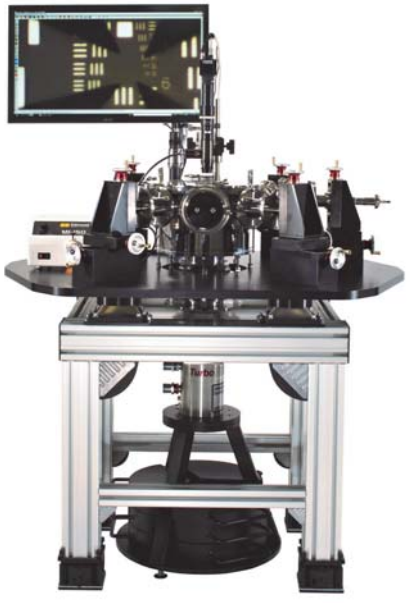

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