

erstwhile partner in the lurch. “We’re facing a situation where our partner is no longer available and those missions no longer can look like what they were described as in the decadal [survey],” notes Merkwowitz. NASA will continue through September to fund the LISA and IXO project teams, most of whose members are located at NASA’s Goddard Space Flight Center and the Jet Propulsion Laboratory. In the meantime, the agency will begin seeking input from the community about how to redirect its astrophysics program. But changes will have to await ESA’s selection process, Merkwowitz says. “If they choose the gravitational-wave mission, that would push us in one direction. If they choose a planetary mission, that would leave two of the astrophysics areas untouched.” It’s likely that the agency will request a study from the National Research Council about a year from now, he says.

Merkowitz sees no clear front-runner in the ESA contest. Europe’s proven experience with building x-ray observatories indicates that “it’s not a big stretch for them to come up with a really good x-ray machine,” he says. And NASA’s planetary science program has offered to contribute some instrumentation for Laplace, should ESA

choose to take that course.

Whatever mission ESA chooses, Merkwowitz says NASA shouldn’t be counted out as a participant. He says the two agencies have agreed that each of the three design teams will include a NASA representative, capable of speaking for the US scientific community and sufficiently versed in fiscal realities to be realistic about potential US contributions. Should ESA ask NASA to contribute as a minor partner, the US agency will want input from the science community first.

What’s been lost

If the LISA-like mission does win the ESA contest, it clearly will proceed more quickly without NASA as a partner. “Europe has money it wants to start spending in 2015, but it was clear that NASA wasn’t going to match that,” notes Phinney. He adds, “There was this problem of synchronizing, and I think it is probably easier to keep to a timetable if it’s one agency that is doing it.” Danzmann agrees: “Had ESA waited for NASA, LISA would not fly before 2025 or 2030.”

Since the NASA–ESA partnership was signed in 2004, ESA has been spending 5 to 10 times as much as NASA on LISA and *LISA Pathfinder*

and carrying out industrial studies. In FY 2011 NASA spent about \$3 million on LISA. Phinney, who personally wrote the first four of the seven versions of LISA’s science documentation, says that although the US has often been more important than Europe in the project’s science and data analysis, “Europe has come to completely dominate the hardware side.” More recently, he adds, “the contributions to the science and data side have become more nearly equal.”

Still, there is disappointment on both sides of the Atlantic on the ending of LISA as it was known. “It hurts to give up some of the science, because we have spent 19 years optimizing this mission concept,” says Danzmann. “The tragedy,” says Phinney, “is that unlike many other missions, LISA has been through many years of industrial studies. There were blueprints, flight hardware, and all kinds of stuff. Now, even if you descope only a little bit, you sort of lose all of that in designing a new mission. It’s a tragic waste.”

Phinney adds, “The mission was born and bred [in the US] and it’s sort of a shame that yet again, the US is dropping its technological and scientific leadership.”

David Kramer

Caribbean Science Foundation sets sail

Initial investment for the funding agency will come largely from the region’s diaspora scientists, from corporate sponsors, and from development banks.

A week-long trip to the Caribbean

in March was more business than pleasure for MIT electrical engineer Cardinal Warde, who spent his spring break courting potential backers for the region’s new science funding agency. The Barbados native is cofounder and interim executive director of the Caribbean Science Foundation (CSF), which launched last fall to promote “the aggressive development of Science, Technology and Innovation” in the tourism-dependent region.

This summer Warde will make stops in London, Toronto, and other enclaves of the Caribbean diaspora to solicit contributions to the \$13 million operating budget that the CSF has set for its first three years. “We will put the bulk of our money into entrepreneurial projects,” he says. “We need to pick the low-hanging fruit. The most expedient way forward is for us to let the developed world continue to do the basic research, which is expensive, and we’ll use [that knowledge] to get products to market quickly.”



IBM THOMAS J. WATSON RESEARCH CENTER

Jamaica native and North Carolina State University student Joseph Washington (left) and University of the West Indies student Jevon Beckles (right) from Trinidad and Tobago pose at the IBM Thomas J. Watson Research Center with their summer internship mentor, Nicholas Fuller. Connecting scientists like Fuller, a native of Trinidad and Tobago, with the Caribbean region’s best and brightest is one goal of the new Caribbean Science Foundation.

Other top CSF priorities include reforming the region's precollege science, technology, engineering, and math (STEM) education curricula and forging collaborations between university researchers and business owners in the Caribbean and abroad. The foundation also plans to dole out academic scholarships and to develop STEM education outreach efforts such as science fairs, TV programs, and exhibitions.

Ripe for high-tech R&D

Funds for the CSF will be directed to projects in member states of the Caribbean Community (CARICOM), the regional political alliance that comprises Haiti, Guyana, Suriname, Belize, and the 11 independent English-speaking island nations of the West Indies. Bound by a shared history and culture, CARICOM countries also share a postsecondary educational infrastructure built around the University of the West Indies (UWI), which has campuses in Jamaica, Trinidad and Tobago, and Barbados. In recent years CARICOM has also been moving toward a single-market, single-currency economy.

Warde says the Caribbean region is ripe for high-tech R&D in drug development that exploits the region's rich biodiversity; renewable energy, given the area's high exposure to the Sun and to trade winds; and information technology. "There's no reason why Google couldn't have been invented in Barbados," he says. "It doesn't take a lot of resources, manpower, or heavy equipment to start a software company."

Instead of relying on government support, the CSF will seek investment from regional development banks and from an organization that is mobilizing the 75–80% of college-educated professionals the World Bank estimates were born in the region but are living and working elsewhere. The Caribbean Diaspora for Science, Technology, and Innovation (CADSTI) was created in 2008 by Warde, other diaspora scientists, and scientists in the region. In addition to money, CADSTI will also provide technical and business advice to Caribbean researchers and entrepreneurs. Membership won't be limited to individuals born in the Caribbean, says Warde. "Anyone who wants to help" can join.

Businesses like Welectricity, based in Saint Vincent, will be eligible for the 15–20 "phase one" grants that Warde says will be offered once the CSF raises its first \$1 million. Welectricity's social Web tool, which tracks energy usage in the home, won a Best Idea for the Millennium award in the GE Ecomagination Challenge last year. In addition to capi-

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Sunny days year-round provide ideal conditions to develop innovative technology such as these grid-connected solar panels on this luxury home in Grenada, an island nation in the Caribbean.

tal, Caribbean entrepreneurs need access to external experts and markets, says Welectricity founder Herbert Samuel, who belongs to the Caribbean Research Innovation and Entrepreneurship Network, an online community with more than 400 members. "[We're] isolated from a lot of things that are needed at the critical early stage—adequate funding, suitable technical resources, and a significant network of enthusiastic early adopters and evangelists."

Trinidad and Tobago native Nicholas Fuller, a physicist at the IBM Thomas J. Watson Research Center in New York, says he's interested in serving as a

CADSTI consultant on the implementation of solar panels. "I think there's a lot more we could be doing to optimize the efficiency of solar farms in one or more locations in the Caribbean." Fuller volunteers as a mentor for the UWI–IBM research scholars program, which annually selects an undergraduate student from UWI's electrical and computer engineering departments for a summer internship at IBM.

Stephon Alexander, a cosmologist at Pennsylvania's Haverford College who also hails from Trinidad and Tobago, says the launch of the CSF and CADSTI has inspired him to revisit plans he

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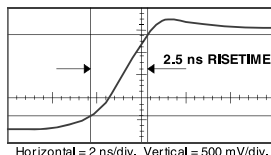
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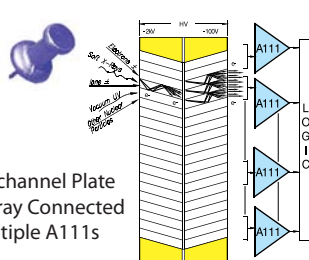
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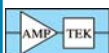


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drafted 10 years ago for a Caribbean theoretical sciences institute modeled after the Institute for Advanced Study in Princeton, New Jersey. "It's cheap to do that kind of science," says Alexander.

"The real Achilles' heel for the Caribbean [countries] is that they don't have enough scientists on the ground," says Khotso Mokhele, former president and CEO of South Africa's National Research Foundation. It was a 2006 report commissioned by the United Nations Educational, Scientific and Cultural Organization and CARICOM and authored by Mokhele that catalyzed the formation of the CSF. "The Caribbean diaspora is so huge that [CADSTI] could make a major contribution to science and technology in the region if they properly organize themselves," says Mokhele. But the university system, especially graduate research, also needs more support from the region's governments, "or the [diaspora] model won't work," he says.

One-legged stool

Regional universities and other existing scientific organizations can help get the

CSF off the ground, says Harold Ramkissoon, a UWI professor emeritus of applied mathematics who also co-founded the CSF and sits on its board. For example, "If CSF gets funding for science education projects, it could delegate [coordination of those projects] to Cariscience [a network of the region's university research departments] or the Caribbean Academy of Sciences," he says. The CSF has offered a spot on its board of directors to the Caribbean Council for Science and Technology, which coordinates CARICOM's science and technology policies.

Warde says he hopes to meet with the CARICOM heads of state to present his case for the CSF as a means of diversifying the region's economy. "Our economies in the Caribbean are like a stool with one leg," says Warde. Countries like Brazil and Singapore "are eating our lunch. They're gaining market share by developing advanced devices and products that are based on science and technology, and I think it's time we do something about that."

Jerme N. A. Matthews

US budget pact signals end to R&D growth

Additional spending cuts loom as lawmakers consider competing budget blueprints from Obama and the Republicans.

Federal R&D programs were spared major hits, and in some cases did quite well, under the last-minute spending agreement that was hammered out in April to avert a government shutdown. The accord reached between the Republican-led House of Representatives and President Obama nominally will reduce federal discretionary spending for fiscal year 2011 by \$37.6 billion, compared with FY 2010 appropriations. The compromise measure signed into law all but erased many of the dramatic reductions to basic research that the House had demanded in H. R. 1, the version of the continuing resolution (CR) that it had passed in February.

But the final CR that Obama signed into law marks the end of the sizable growth in federal research programs that the president had pushed through during his first two years in office, mainly through the stimulus spending of the American Recovery and Reinvestment Act. With his FY 2011 budget request, the president had hoped to squeeze through one more significant annual increase for science and technology (S&T). Congress never

completed consideration of that request, and until the mid-April pact, federal spending was left to continue at FY 2010 levels through a succession of short-term extensions. (See PHYSICS TODAY, April 2011, page 29.) But dozens of freshman House members forced that chamber, and ultimately the Senate and White House, to accept unprecedented budget cuts.

Many of the reductions that became law bore little resemblance to what the House budget cutters had proposed back in February. Nowhere was the vicissitude of the process more apparent than with the turn of fortune for the Department of Energy's (DOE's) \$4.9 billion Office of Science budget. Targeted by H. R. 1 for a cut of nearly \$900 million below FY 2010 levels, the basic research programs wound up trimmed just \$20 million. But the FY 2010 budget had included \$76 million in congressional earmarks. In the baseline budgeting process used by appropriators, that \$76 million was carried forward into FY 2011, even though lawmakers imposed a moratorium on earmarking. The net effect is that the Office of Science budget actually