Funding facilities: Who's getting what

The University of Illinois estimates that it would need $400 million just to repair and renovate existing facilities on its two campuses in Urbana-Champaign and in Chicago. The Johns Hopkins University in Baltimore, contemplating the construction of a new physics and astronomy building, says it would cost about $35 million. According to university presidents represented in the Association of American Universities (AAU), just about every research university in the United States has similar needs and is facing difficulties in finding the funds to improve and expand its facilities. This shortfall has led to massive fund-raising efforts, the pursuit of agreements with industry, lobbying to get the federal government to allocate more funds for facilities, and in some cases, direct appeals to Congress to fund projects at particular institutions.

The small amount available for facilities construction in current federal agency budgets, says Paul E. Gray, Massachusetts Institute of Technology president, is less than 5 percent, in real terms, of what the federal government spent on university facilities 20 years ago. Last month, Rep. Robert A. Roe (D-N.J.) introduced a bill that would provide $2.5 billion over the next 10 years to build and refurbish research facilities. Under the proposed National Science Foundation (NSF) program, universities would be expected to raise from nonfederal sources an amount equal to any federal grant received. Furthermore, a minimum of 15 percent of the funds would be set aside for universities and colleges that received less than $10 million in total federal research and development funding in each of the previous two years. Last week at its annual meeting in Washington, D.C., the AAU, representing 54 of the largest U.S. research universities, went on record favoring the legislation.

"While the bill alone will not solve the problem," says Steven Muller, Johns Hopkins president, "it represents the beginning of a significant national recognition of a capital deficit in our universities, which threatens our national research effort."

One thing that may hurt the chances of the bill's passage is a NSF report released last September. Based on a "quick response" survey of doctorate-granting institutions, the report suggests that the facilities problem is much less serious and that the federal role in providing funds for facilities is much smaller than generally believed.

The AAU and eight other higher-education associations last month issued a critique of the report, labeling its conclusions "unwarranted and potentially misleading." The associations assess the same data and argue that "universities have far fewer research facilities than they need; the shortage of facilities limits the number, type and pace of research projects that can be undertaken; and the federal government is a major influence on the ability of institutions to realize research facilities." Some university officials suspect that the NSF report reflects a reluctance on the part of NSF to get involved in construction funding because funds may be taken away from research programs and because of the taint of pork-barrel politics.

Meanwhile, university leaders are concerned about the growing number of universities and colleges seeking funds by going directly to Congress. Last year, Congress directed the Department of Defense to spend $56 million on nine projects at specific universities and the Department of Energy to provide about $38 million for another eight projects (SN: 7/12/86, p.21).

"There are a significant number of [AAU] members ... who believe that earmarking by the Congress is perhaps the least satisfactory of all ways to make decisions as to where funds should be spent," says Muller. "Putting universities in the position of lobbying for congressional earmarks and engaging professional help for that purpose is a very undesirable way for institutions of higher education to behave or to be rewarded." On the other side, earmarking by members of Congress is nothing new, and peer or merit review is far from flawless.

A special committee established on behalf of six higher-education organizations to review the whole question, in a report issued earlier this month, suggests that the practice of pork-barrel funding may be unstoppable and is likely to increase. One way to curtail the practice, the report says, is for Congress to establish two sets of competitive programs for building campus research facilities. One would be for established research universities and the other for "research-oriented, developing institutions." Universities in the latter category have been among the more vocal critics of the present funding system because, they say, the present system seems to favor established universities.

Although the AAU has in the past taken a strong stand against circumventing the peer review process and going directly to Congress for funds, several of its own members have disregarded this position. With the issue still unresolved after a lengthy debate at its annual meeting, the association plans to poll its university members to get a better sense of how to handle the whole matter. "I doubt that we're close at this point to resolving the dispute," says Robert M. Rosenzweig, AAU president. Adds Muller, "This is a divisive, complicated issue."

– I. Peterson

Neutrino mass: A positive view

Consideration of the evidence from supernova 1987A now leads a number of physicists to conclude that neutrinos probably do have a rest mass, in contrast to previous work that interprets the evidence negatively. One group – Hong-Yee Chiu, Yoji Kondo and Kwing L. Chan of the NASA Goddard Space Flight Center in Greenbelt, Md. – finds a value of about 3.6 electron volts (eV) for a possible neutrino mass. Ramanath Cowsik of Washington University in St. Louis and a group at the Max Planck Institute in West Germany both say they find two values, 4 eV and 20 eV.

Neutrinos were originally thought to have zero rest mass. Recent theories of particle physics and cosmology would like them to have a small rest mass nevertheless. If neutrinos have a rest mass, those that leave the supernova with higher energy come to earth sooner than those with lower energy. If two neutrinos with different energies leave the supernova at the same time, the rest mass can be calculated from the difference in their arrival times.

Finding the proper neutrino pairs in the data is the trick: Nobody knows when a given neutrino left the supernova. Chiu's group paired each neutrino with every other and calculated trial masses. In this procedure the true pairs should show up by giving the same number every time; the false ones give a scatter of numbers. Such a repeated number – 3.6 eV – appeared. Kondo says there is a 3 percent chance this result is accidental, giving 97 percent confidence in the result. Chiu stresses, however, that there is "a 3 percent chance we are wrong."

Cowsik plotted energies and arrival times of the neutrinos on a logarithmic graph and used a pattern-recognition machine – "the best pattern-recognition machine in the world," he says – to find the correlations. He believes his two values, 4 and 20 eV, come from a mixture of two kinds of neutrino with two different rest masses being involved. Neutrinos come in three varieties or "flavors": electron neutrinos, muon neutrinos and tau neutrinos. The latest theories say that as a neutrino flies along, it can change from one flavor to another. Cowsik suggests that electron and tau neutrinos may be mixing together in this case.

The cosmological significance of all this, as Cowsik stresses, is that even with these tiny masses – for comparison, a proton's mass is almost a million eV – neutrinos would be the dominant form of matter in the universe, far outweighing anything we can see. They could make the universe close on itself, a condition that many cosmological theories favor.

– D. E. Thomsen