

Response to the LAC Review of the Ward Center for Nuclear Sciences

Compiled by

Mary Jaye Bruce
Aegean Dendrochronology Project

[Full texts of letters from members of the Cornell faculty responding to the LAC Review can be found on the Faculty Senate web page's "On-Line Forum" at:
<http://www.cornell.edu/UniversityFaculty/OnLineForum.html>]

[This summary is endorsed by: Neil W. Ashcroft, James M. Burlitch, K. Bingham Cady, John J. Chiment, David A. Hammer, Francis A. Kallfelz, Robert W. Kay, Peter Ian Kuniholm, Norman R. Scott, Kenan Ünlü]

A hallmark of a great university is the depth and breadth of its infrastructure that supports research and teaching. With this in mind, the Ward Center was created in January 1997 with the following objectives, as stated in its Charter:

"The central mission of the Ward Center for Nuclear Sciences is to provide safe analytical and testing facilities in support of the research and education activities of faculty, staff and students at Cornell University. Its resources are also available to users outside Cornell as part of the public service functions of the University, symbolized by its status as the Land Grant University of the State of New York. In support of this central mission, technical staff of the Center will:

- * Teach users how to carry out experiments safely,*
- * Develop and enhance the Center's analytical and testing capabilities,*
- * Stay abreast of latest developments in the field, and*
- * Meet the requirements for the licensing of the facility by New York State and the federal government.*

Faculty, research staff, graduate and undergraduate students from all Colleges of the University will have access to the Center's facilities."

We seriously question the depth and wisdom of the recent report of the Local Advisory Committee's (LAC) "Review of Ward Center" as presented to the Vice-Provost for Research. While we appreciate that much hard work went into preparing this recommendation, the report lacks clear and in some cases factual information, it ignores virtually all reports presented by the Center's director Dr. Kenan Ünlü, and overall it fails to envision the basic needs of our society and nation as they face continually increasing demands on energy, as well as the huge educational, technological, and industrial challenges that might address those demands.

In 1996, a momentous step was taken in recognition of the breadth of the use of the Ward Laboratory to researchers across campus, and a University Center was formed. K. Bingham Cady, Professor of Theoretical and Applied Mechanics who writes of the history of the Ward Research Reactor and the transformation of this facility into a University Center, tells that this Center was to be a model created in response to the realization that small laboratories open only to select groups of users are no longer financially viable. The vision was to convert the Ward Laboratory to a University Center that would provide the breadth of radiation services of the laboratory to all faculty and staff without charge, promote research contracts from across the University by cooperating in joint proposals, and all the while provide teaching and research services to all members of the University community. Also, as part of the Land-Grant mission of the University, the Center would continue to provide irradiation services to nearby corporations, which would help support the Center financially. An annual subsidy of \$200,000 was awarded to the Center by the College of Engineering for fiscal years 1997 through 1999, with a stipulation "that any funding for the Center subsequent to July 1999 from the General Purpose Budget be drawn from then-existing appropriations of the several Colleges from which come the faculty and student users of the Center, by agreement with the relevant Deans." For fiscal years 2000 and 2001 the Center's subsidy was provided both by the College of Engineering and by the Provost's office. This formula set forth in the Senate resolution that established the Center was not followed.

The Ward Center has operated as an "open center" for research, service, and teaching. After the death of Dr. David Clark, Dr. Kenan Ünlü was brought to the university in 1998 to direct the future course of the Center, and indeed, his report on the Center's accomplishments since 1998 shows steady, even dramatic, strides in improving the facility and expanding its capabilities, all of which has required obtaining funds in the form of peer-reviewed grants before these expansions could even begin. In three years, the Ward Center funding from federal sources has increased from \$29K in fiscal year 1997/1998 to near \$623K in 2000/2001, with \$971K pending in grant proposals. And, not surprisingly, as the facility has grown, the user base has grown, too. Current and past users of the Ward Center include faculty from Physics, Geology, Soils Science, Veterinary Medicine, Chemistry, Archaeology, History of Art, Art, Civil Engineering, Chemical Engineering, Materials Science, Textiles and Apparel, Agricultural Engineering, and the H. F. Johnson Museum of Art. Please note that the breadth of users goes far beyond those in the "hard" sciences; one largely unspoken asset of this University Center is that it has gathered researchers from the humanities. How many times have we heard the rhetoric claiming the need to somehow bridge the widening ideological, to say nothing of financial, gap between the sciences and humanities? Here we have an analytical center that is succeeding in exactly this kind of integration. Many of these departments have comparatively minuscule budgets and will never be able to engender faculty dedicated to helping maintain this facility; nor should they be expected to. Still and all, where will this type of researcher go? With what other analytical means can materials such as ancient artifacts, paintings, tree-rings, even soils, be analyzed without being destroyed?

In the four years since its inception, research endeavors at the Center have indeed increased. As one example, there is full implementation of a new dedicated system for the analysis and counting of heavy metals in tree-rings, as part of the Aegean Dendrochronology Project's research into past global climate based on volcanic signals captured in the trees. Dendrochronological research led by Prof. Peter Ian Kuniholm, History of Art & Archaeology, has been performed on campus since the 1970's. The idea of using the Center's reactor to analyze these dated tree-rings for the chemical properties that they hold could not have emerged without the active collaboration of Ünlü and Kuniholm. Besides the facility now in place at the Center to perform this analysis (\$41,500, NSF Archaeometry grant), collaboration in the form of an integrated work-plan and major grant proposal (\$589,200, NSF Paleoclimate) to analyze the results of these findings involves seven faculty members from the departments of Earth and Atmospheric Sciences, the Boyce Thompson Institute, the USDA Plant, Soil and Nutrition Laboratory, Materials Science, and History of Art & Archaeology. In addition, wood-preparation work is performed by three undergraduates, and funding for preliminary analysis is in the works for two post-docs and a technician. In this way, the statistic that implies that Kuniholm's tree-ring work involves just one researcher expands to 16 from literally across the whole campus.

Similarly, in the field of cancer research, a huge potential exists to use the Center's unique capability to study Boron Neutron Capture Therapy (BNCT). Francis Kallfelz, the James Law Professor of Medicine at the New York State College of Veterinary Medicine at Cornell, writes that, while this important cancer research is not being actively pursued nationally, as the Committee noted, research is being pursued internationally with current active programs underway in Europe and Japan. "Further," he writes, "the literature on this modality states that Cornell's TRIGA reactor may be uniquely capable in performing this research." In other words, a few other research reactors in this country are as ideally suited for this research. Kallfelz goes on to say that "while there is no medical school on campus in Ithaca, there is one at a sister state-supported medical school, the NYS Health Science Center at Syracuse, which is within an hour's drive from the Ward Center. Further, we do have the College of Veterinary Medicine on campus. This college recently initiated a major new program in comparative oncology, and with this, considerable opportunity exists for collaborative efforts with the Ward Center in the development of BNCT for the treatment of tumors in animals, perhaps the precursor to development of viable treatment modalities for human beings." This is an area in which Cornell has the potential to be not only a national leader, but a true international player in this highly significant research.

The number and quality of the research programs available at the Ward Center deserve remark. All university research reactors are certainly not the same. While it is true that some users may be able to transfer their analyses to other facilities, many will not, because for many services there is no other place to go, not just in New York State--where Ward is the only functioning research reactor--but nationwide. The Center's TRIGA reactor performs Neutron Activation Analysis, Fast Neutron Irradiation, Neutron Radiography in the forms of Real Time Radiography and Film Radiography, and is a Cold Neutron Source Facility, one of only two in the country. The cold-neutron source

based Prompt Gamma Activation Analysis will be a major asset to the Ward Center because measurement of bulk hydrogen and boron content of technologically important materials will be possible. A conventional Neutron Depth Profiling (NDP) facility has been developed to measure depth versus concentration of some light elements in semiconductors, metals and alloys. The components of the conventional NDP systems are being tested. Both plans and research funds exist for the development of a Time-of-Flight NDP system. This facility, which will offer a nondestructive diagnostic tool for materials science and nanotechnology, will be the first TOF-NDP facility in the world. The philosophy behind the building of these programs is: a) build up the facility, b) expand its operations, and c) users will come. Please visit the Ward Center for Nuclear Sciences web site at <http://www.osp.cornell.edu/vpr/ward/wcns.html> for clear explanations of the applications of these techniques.

It is important to keep in mind that the mission of the Ward Center for Nuclear Sciences is not the same as that of a department of Nuclear Engineering, as seems to be implied by the LAC in many of their key points. Nor is the function of the Center in any way dependent on an existing Nuclear Engineering department. To state otherwise shows a lack of understanding of what a service facility does. Is a library, which is a service facility for all campus users, dependent on a department of Library Science to make its existence viable? Hardly. The Committee's reasoning is that since there is no department of Nuclear Engineering, a research reactor has no purpose at Cornell. This equation works only if we turn it around: a Nuclear Engineering department at any university is made far stronger if a research reactor exists to foster its research. As Prof. Cady has pointed out in his letter to the Committee, while Cornell may not have plans at present to strengthen its educational efforts in nuclear engineering, by eliminating the Ward Center, it will lose the opportunity to build such a program in an existing academic department in the future.

Prof. David Hammer, the J. Carlton Ward Professor of Nuclear Energy Engineering, writes that "regarding the number of NS&E graduate students, I believe that Cornell students from Physics, Applied Physics, and the various engineering disciplines will begin to come into the field as MEng students again if the Vice Provost for Research makes a positive statement about the future of the Ward Center as a result of the present review. At the present time, students are discouraged from joining the graduate field because 'the word' is that the university is going to eliminate the program. Professor Ünlü has two new MS/Ph.D. students and research funds for two more. Prof. Cady has one Ph.D. student in Nuclear Science and Engineering and has two Ph.D. students affiliated with the Center from Theoretical and Applied Engineering. These students will provide the 'in house' group which, together with all of the student users from other departments, will encourage additional students to enter the program....they just need a little bit of encouragement from the administration that the Ward Center will continue to be there for them."

Prof. James Burlitch, Chemistry and Chemical Biology, writes in an open letter to colleagues in the Faculty Senate that, as a University Center, the Ward Center for Nuclear Sciences serves an unusually large constituency of students. "In 1999-2000, for example

the Ward Center's TRIGA reactor provided 225.6 hours of reactor operations for irradiation of materials with neutrons for nine Cornell research groups for activation analysis (primarily) and radiography (Ward Center for Nuclear Sciences Report, September 2000). Six graduate students received training and technical assistance in these experiments; some of the experiments such as those in radiography are unique in their capabilities. In that year also, at no extra cost to the Colleges, 558 undergraduate students were taught nuclear-based techniques for analysis in portions of eight courses at the Center. Well-rounded students need to be informed about nuclear science."

The LAC Report acknowledges this, but does not find that this usage is significant to warrant the facility's continuing educational mission, that "...the evidence...does not indicate that the TRIGA reactor is having an important, major impact as a user facility for the Cornell community, either in research or in academics, that is proportional with the overall cost of maintaining and operating Ward Center." To this, Prof. Burlitch responds: "Other than qualitative arguments that reflect the opinion of the Committee members, little justification is given for such a damning assessment. What are the above services really worth to the faculty, staff, and students of Cornell? At commercial rates, the irradiations in support of research would cost approximately \$90,240 (225.6 hours x (\$250/hour, reactor + \$150/hour, staff)). It is difficult to put a dollar figure on the graduate student and postdoc training, which could not have been obtained at a commercial facility. There is, however, real value in experimenters learning the technique and having direct control over their experiments; such control at a remote site is impractical if not impossible."

Because undergraduate education is a substantial component of the activities at the Ward Center, why not put a price tag on it? Prof. Burlitch has calculated that in 1999-2000, 558 undergraduate students were taught nuclear-based techniques for analysis in portions of eight courses at the Center, or 1,776 hours of instruction. The value in class time is \$101,232 [1,776 hours x \$57/hour tuition]. "Thus, not counting the graduate student training, the value of the services provided by Ward Center to the Cornell community in 1999-2000 was \$191,472. The direct supplement to the Center from the University was \$200,000, which is commensurate with the value of services provided," says Burlitch.

Even though Cornell's Engineering College discontinued its department of Nuclear Engineering, nuclear science has again become a national priority, and this is not likely to be a passing phase. Prof. Robert Kay, Earth and Atmospheric Sciences, writes that, since national funding initiatives focused on biotechnology and information science have resulted in Cornell research initiatives in these disciplines, now that it appears the Nuclear Science has become a national priority, is it not appropriate for Cornell to examine initiatives in this area? Why is Cornell, a leading research institution, eliminating something that could turn out to be a huge future asset? Kay writes: "There are very few universities that are in Cornell's position to pursue such initiatives. In this light it makes sense to consider the fate of the Center with a vision greater than the local, inward-looking vision that the Committee has taken. The relevant review should not be just of the present program and the present local faculty users, but an evaluation of the prospects for a future that would involve broadening the scope to respond to

Congressional and funding agency-defined national needs and consequent funding increases." Dr. John Bernard, director of MIT's Nuclear Reactor Laboratory, has expressed in his letter strongly supporting the Ward research reactor that "Cornell is not alone in the quandary of what to do. Every university administration that operates a reactor is undergoing an introspective examination such as that which you are undertaking. I would hope that each university does not act alone, look inward, and decide to close its facility based on the lack of faculty usage. Rather I would hope that each administration would look outward and join with its peers to make the case to the U.S. Department of Energy (DOE) for the potential research value that these university research reactors represent."

With or without Cornell's input, the DOE has both listened and acted. Right now (14 Feb 2001), on the floor of the US Senate is a bipartisan bill (S.245) "Department of Energy University Nuclear Science and Engineering Act" that proposes to provide \$240 million in funding to university research reactors over the next five years. This more than quadruples DOE's budget for direct support of university research reactors. The Ward Center, which has had tremendous support by DOE who recognizes its huge and unique research potential, is expected to be a primary beneficiary of these funds, along with MIT and Michigan. According to Prof. Cady, with these funds, the Ward Center has the potential, in the very near future, to become a national Center for nuclear research, and may indeed be the first center at Cornell that will not require a university subsidy.

The Center's mission toward industry is almost totally dismissed by the Committee in their report, where it is stated that "Some faculty expressed the sentiment that the use by industry, even in a Land-Grant college, should be in some way connected to faculty programs; this is not the case at Ward." So much for Eastman Kodak, Corning, Imaging and Sensing Technologies, Cosense, GE-Reuter Stokes, Northrop Grumman, Intersil, and Westinghouse, leaders in their technological fields, who state in their support of Ward Center that they would not be able to provide such excellent service to their customers if this key facility were disbanded. Proximity, unique capabilities, and quality of service were the overall reasons given.

Prof. Neil Ashcroft, Horace White Professor of Physics, and Prof. Bingham Cady have both commented on the real estate footprint that the Ward Center now occupies on a campus desperate for space. Prof. Ashcroft writes that "All space has some intrinsic value, but it is far from clear to me that space once occupied by a reactor (even one of low power) could be plausibly used for other purposes on any time scale considered practical in an academic setting." It may be important for the Faculty Senate to know that those at the Center expect the TRIGA reactor to be operational for another 20 years, but not much beyond that. Prof. Cady and Dr. Ünlü are especially concerned that the LAC and the Faculty Senate be aware that the dismantling of a facility of this kind requires much time and planning, and is far more complicated than simply removing the fuel rods. For instance, such a facility will take at least five years for dismantling, and perhaps longer, depending upon EPA findings, before anything else can be built on the site. The Committee has written that it believes that, if the facility is to be closed, "sooner is better than later. It will be cheaper, safer and easier." However, because only a

few TRIGA reactors have yet been dismantled, Prof. Cady comments that this is simply not true. In this instance, it makes sense to wait for experience. Ünlü and Cady also worry at the clear misunderstanding behind the recommendation that the Cobalt-60 gamma source be moved to another facility at the time of the decommissioning of the TRIGA reactor. Why, they ask, would Cornell consider spending at least \$4million to tear down a perfectly working facility, and another \$4-5million to build another facility capable of holding the Cobalt-60 gamma source? Why not spend \$0 and leave things as they are?

Prof. Ashcroft recently writes "Some time ago, I was asked to provide commentary on the situation from my perspective (then) as Director of the Cornell Center for Materials Research. Since Advanced Materials is one of the major thrust areas for the future, as announced by the University, it occurred to me that this matter should be looked at from the standpoint of future promise. There is very substantial capital and other investment in this Center and it struck me then, as it does now, that if there is indeed promise for resurgence in matters nuclear, and DOE seems to strongly hold that this is the case, then precipitous closure now may not be well advised. And given the shutdown costs are quoted as being in the vicinity of \$4 millions (we will be fortunate if we can do this for so "little") the case for continuance of a well funded center looks even more compelling if funding is considered to be a key issue."

Truly the potential of the Ward Center for future research is only now being fully realized. More and more we see scientific research coming out of its isolated specializations and broadening into integrated, interdisciplinary endeavors that cross traditional boundaries. The Center is caught in a damning paradox: without administrative faith in the mission and potential of this facility, such integrated research--which can truly not be done elsewhere on campus, or anywhere in the Northeast for that matter, not even for a fee--will not be fostered. Yet, right now, when the status of the Center is at its brightest in years, the support is in danger of being withdrawn. It seems that at some point between 1998 and 2000, the vision so clearly endorsed by the University Board of Trustees just two years earlier in their decision to open the Ward Center as a University Service Laboratory has become myopic, the idea of "service" diminished and withdrawn. And this withdrawal has been made in a frighteningly precipitous fashion. Why the hurry? Why the sudden need to hasten the closure of a facility that faces such potential and is totally irreplaceable? Even the Director of the DOE's Office of Nuclear Energy, Science and Technology, William Magwood IV, in his third and fourth letters to Cornell writes that "we hope that universities with research reactors contemplating decommissioning will delay any decisions until the Department can issue a new strategy," which he foresaw being issued by March or early April 2001. In a way it seems as though the Center is being shut down with such haste to prevent the possibility of future success, to prevent its users from seeing these potentials, both scientific and financial, bear fruit.

To claim that this facility's main purpose is in Cornell's past shows not only blindness to the current breadth of research being performed there, but also to the unique capabilities of this particular research reactor. While Cornell has no plans at present to strengthen its

nuclear engineering educational efforts, we will lose this option if the Center is closed. What we request from the Faculty Senate, and the Cornell administration, is time. In three to five years, we will all know more clearly what the future of nuclear science, as well as our nuclear services, holds in store for us as a university, a country, and in the world. To decommission a Center that has the potential, within even a year, to become a vital University asset shows huge short-sightedness on the part of the Committee, and would be a huge detriment to Cornell's leadership role as an international research institution and as a responsible leader of science in the world community.