External Review of the Earth Research Institute
University of California, Santa Barbara
October 9-10, 2014

Executive summary

The Earth Research Institute (ERI) has fulfilled its mission of "Supporting research and education in the science of our solid, fluid, and living Earth" at the highest level. The ERI community (faculty, students and staff) is happy and morale is good. The ERI has already gone some distance toward dismantling the stove-pipes that exist in academia and that might be expected from the merging of two organized research units (ORUs). Most importantly, world-class research is being carried out under the auspices of ERI. Thus, the external review committee resoundingly supports the continuation of ERI.

In light of this past success and with the pending change of Director, it is an opportune time for the scientists of the ERI to consider how the Institute may position itself for continued success and enhanced scientific impact. The self-assessment is a first step on this path and, based on this document and our meetings with ERI personnel, we suggest that the ERI can excel well beyond its mission of supporting science by pursing the following goals:

1. Increase collaborations through development of strategic initiatives and targeted hires.
2. Incentivize cross-disciplinary and cross-unit faculty searches.
3. Use the widespread interest in and need for data curation as one means of stimulating interdisciplinary collaborations.
4. Provide bridging funds for research scientists funded entirely on "soft" money.
5. Increase opportunities for interaction across ERI at all levels.
6. Enhance efforts aimed at raising donations.
7. Improve space for housing equipment and labs.
8. Bolster ERI's future by planning for continuity within the staff and greater engagement of the advisory committee.
9. Minimize the bureaucratic burden placed on researchers.

Each of these recommendations is further elaborated upon below.

Background and Overview

The ERI was formed in 2010 by the merger of the Institute for Computational Earth System Science (ICESS – founded 1996 in Geography) and the Institute for Crustal Studies (ICS – founded in 1987 in Geological Science, now Earth Science). One hundred and thirty seven researchers have participated in the ERI since its inception. It currently consists of 49 tenure-track faculty members, 27 research

scientists and 18 Post-docs, mostly from the Departments of Geography, Earth Science, and the Bren School (but also hailing from the Departments of Physics; Environmental Studies; Ecology, Evolution and Marine Biology (EEMB); Chemistry and Biochemistry; Feminist Studies; and the Marine Science Institute (MSI)). The ERI also includes off-campus PIs, generally research scientists funded on federal grants administered by the ERI who have chosen to live elsewhere. The ERI administers two centers: a) The University of California Center for the Environmental Implications of Nanotechnology (UC CEIN), which is funded by the NSF and EPA (UCLA is the lead institution), and b) the Cheadle Center for Biodiversity and Ecological Restoration (CCBER), which helps implement restoration projects on the UCSB campus, curates specimens related to biodiversity, and runs educational and outreach programs, amongst other things. The CCBER is partially supported through an endowment.

Faculty members are hired and have their tenure homes in Departments and may choose to join the ERI. The stated mission of the ERI is "Supporting research and education in the science of our solid, fluid, and living Earth", which it does by providing administrative and computational support for faculty, research scientists and their post-docs and students. Prof. David Siegel, who has been Director of ERI since its founding, will be stepping down in the near future and an international search for a new Director was recently launched. This is its first external review since the ERI was created.

Research

The research of ERI is diverse and broadly organized around two themes: 1) examining the linkages of Earth system science with deep time; and 2) increasing understanding of Earth hazards impacts on society, and of society impacts on Earth. ERI PIs have raised significant funding towards meeting these scientific objectives, with annual award dollars >$8M/year since the Institute's inception. This translates into more than $100K/year per PI in grant funding, on average (counting the tenure-track faculty and research scientists, n = 76), and reflects an active and robust research community. The ERI faculty have received significant recognition, and include four members of the National Academy of Sciences, ten fellows of the American Geophysical Union, two fellows of the Ecological Society of America, and a number of other awards.

A concern raised in the self-study and echoed by the PI groups that met with our committee is declining federal grant dollars and the need for PIs to look beyond traditional sources of funding in order to maintain healthy research programs. This is particularly acute for research scientists funded on soft money. Associated with this, many of the most prominent faculty members in ERI are close to, or are already retired, and there has been an overall shrinkage in ERI faculty lines. Another concern voiced by some faculty and graduate students is the desire for greater exchange of ideas and more collaborations amongst ERI scientists. These issues are

addressed in our recommendations, below.

Recommendation #1: Increase collaborations across ERI through strategic planning and targeted searches.

The ERI has the potential to become an incubator for new collaborations and strategic initiatives. Such initiatives could lead to increased funding and could also translate into increased faculty lines.

Increased collaborations could be accomplished through strategic planning that

a. identifies areas ripe for development of new initiatives and cross-disciplinary hires (see also recommendation #3).
b. seeks replacement of faculty who are close to retirement.
c. seeks to recruit a couple of "big fish" to spearhead these initiatives (see also recommendation #2). Hiring of the new Director provides the first such opportunity. Giving the new Director the ability to make 1-2 additional hires to support these initiatives could help accomplish the above objectives. This should also help with recruitment for the Director position.

Recommendation #2: Incentivize cross-disciplinary and cross-unit faculty searches.

One difficulty faced by ERI is that the institute currently has little input on faculty searches, which are carried out entirely within Departments and Schools. We therefore recommend that a means be found to provide incentives to Departments and Schools to hire in areas related to ERI initiatives. Such incentives could include approving one or more senior searches of prominent scientists, and having such FTE's shared between two units – thereby preserving 0.5 FTE for a future search. Integrating ERI in the campus strategic planning could also assist in making such hires.

This would address the problem of succession planning for faculty. It should also help in recruitment and retention of Research Scientists.

Recommendation #3: Support and expand upon the existing data curation and handling initiative.

Although this initiative was presented as being focused on environmental data, it is clear that the thinking behind it transcends disciplinary boundaries as well as the ERI domain—*"an integrated digital collaboratory [...] within ERI and across campus, and with the US and international research communities."* We were particularly impressed by the description of a carefully crafted collaboration with the Library. This is, in our view, extremely positive. We were equally impressed by the presentation of the Cheadle Center for Biodiversity and Ecological Restoration (CCBER). This is an excellent example of management of physical (as opposed to digital) objects. We are familiar with only a very few such examples in the US (e.g.

SESAR at Columbia University) and are quite aware of the growing interest in such approaches on the part of organizations such as the Smithsonian Institution. There seems to exist a clear path forward for expanding upon the existing collaborations.

In much the same way that IT issues span all disciplines, data curation issues bridge the needs of very different research domains. As a result, this initiative could create additional opportunities for closer collaborations across diverse disciplines. We see potential benefits at many different levels:

a. This initiative addresses directly the OSTP directive of February 22, 2013 regarding public access to data and results derived from federally funded research. More importantly, it addresses the various mandates subsequently imposed by federal agencies (especially the NSF) requiring researchers to develop, apply and report on a data plan for any research grant.
b. Another fast growing trend is the concept of publishing data as an intellectual endeavor comparable to scholarly papers. Data science is rapidly becoming more visible and professional organizations such as the AGU are reviewing and adapting their data policies to maintain consistency with these trends.
c. Concomitantly, the emergence on many campuses of data science curricula reflects an educational need that the initiative could easily fill.
d. The concept, as presented, takes advantage of the historical talents and activities of ERI researchers in data collection and dissemination, spanning areas such as marine geophysics, geochemistry, seismology, and, more recently, sciences of the environment.
e. A coordinated, sustained focus on data curation is a natural way to bridge the various disciplines and units represented in ERI, and elsewhere on the UCSB campus.
f. We are confident that this initiative would nurture and enhance emerging collaborations of ERI researchers with colleagues at the University level, the national level and the international level.

In summary, we believe that the ERI data curation project is timely, well conceived, and very appropriate for a multi-disciplinary ORU. If it matures to its full potential, it could well make UCSB / ERI a very visible focal point nation-wide in this arena.

Recommendation #4: Provide bridging funds for Research Scientists and soft money technical staff.

Like most very productive research enterprises, ERI includes many researchers whose salaries are supported entirely on research Contracts and Grants. ERI has been particularly successful in attracting and retaining world-class science talent through this mechanism. Some of these researchers have built and sustained large programs in ERI, and have contributed significantly to the overall productivity of the Institute.

There are two concerns arising from the important contribution of soft-money researchers at ERI. First, the lack of institutional salary support for these scientists makes them vulnerable to gaps in funding, especially given the recent pressure on the federal research budget. Second, federal cost-accounting standards forbid these scientists from engaging in required scholarly activities such as reviewing papers, writing proposals, and mentoring students or postdocs, even though some of these scientists are quite senior and internationally renowned for their scholarly work. Neither ERI nor UCSB is unique in wrestling with these problems, which all major research universities and laboratories face.

Recruiting and retention of world-class researchers at ERI adds to both the scientific productivity of the Institute and to the indirect costs paid by the federal government to UCSB. Like other universities, UCSB must find a way to sustain this revenue stream. The Committee recommends that the ERI Director meet with UCSB Administration to explore creative methods for mitigating these problems. Other institutions have created bridge funds by banking a small percentage of indirect cost recovery to cover short interruptions in funding for soft-money researchers. An example that UCSB might investigate is the bridge funding support available at Lamont Doherty Earth Observatory.

Other universities have begun to recognize that long-term support of 100% salary from federal funds is technically forbidden by cost-accounting standards. It may be necessary to provide a minimum of salary support from institutional funds in order to meet federal audit requirements.

Finally, the Committee noted that some laboratories in ERI have established a business relationship in which they charge for services to other scientists either inside or outside of UCSB. There may be an opportunity to tap some of these funds to mitigate problems arising from 100% extramurally-funded researchers.

Recommendation #5: Increase opportunities for interactions across ERI, which will lead to greater collaborations. This can be promoted in a number of ways.

Examples include (but are not limited to):

a. Holding social events (e.g., BBQ, field/ocean trips, beach day) – such activities need not cost much.
b. Hold a PI retreat (which will also help with strategic planning).
c. Revamp the ERI seminar to include a once-a-month, all hands on deck talk by a PI that is targeted to the general public, highlighting why their science is cool.

Whenever appropriate, include students and postdocs in these activities.

Recommendation #6: Support closer coordination of ERI development activities with the rest of campus, including the Bren School.

One of ERI's stated goals is to reduce their current dependency on funding from Federal agencies. The Committee applauds this goal, but recognizes that the establishment of the necessary support infrastructure, and setting a sustainable collection of alternate funding sources requires a major effort, in which they will require substantial help from the UCSB campus. Such help could be as simple as making a connection with an appropriate person in the Development office who is tasked to work with ERI to identify and engage potential donors and foundations. Another possibility might be to strengthen the current Bren School development activities to include other ERI domains. (The committee thinks that the scope of the science done in ERI would potentially be of interest to donors concerned with the environment, global change, hazards, etc. – in other words, there is potentially a large untapped reservoir).

Although we recognize that a major portion of the budgetary burden faced by ERI is in the form of salary support for soft-money researchers, the Bren School example suggests that engaging donors to fund new buildings, including, especially, new laboratory space (a source of concern mentioned several times, e.g., renovation of Webb) is a viable way to improve the sustainability of the Institute. We note in particular that such gifts may be more attractive to existing or new donors, and have a direct impact on the sustainability of the research enterprise, by alleviating potential shortfalls in federal funding in the ERI disciplines.

Recommendation #7: Provide better space for laboratories and field staging areas.

The Committee notes that the problem of inadequate office and laboratory space was partly alleviated by the merger of ICESS and ICS to form ERI, but heard from every focus group about continuing space issues. There are substantive concerns about both the quantity and quality of space, particularly for analytical laboratories. It may be that new construction at UCSB will eventually mitigate some of these concerns, but analytical labs need physical stability and clean power, and must be protected against dust and contaminants. Some groups report difficulty of access into and out of existing space with heavy equipment. These constraints are already impacting some research groups at ERI and may also adversely affect recruitment of new faculty. Given the demographics of the senior PIs at ERI, it is imperative that UCSB provide physical infrastructure to welcome a new generation of scientists.

Recommendation #8: Bolster ERI's future by planning for continuity within the staff and greater engagement of the advisory committee.

The resounding message, from all stakeholders is that the administrative and IT support staff within ERI are exceptional. Kudos to the staff and those who hired them. However, it will be important for the ERI to plan for continuity within the staff, especially in the Managing Services Officer (MSO) position. We heard that many staff positions have backup with a second staff member sufficiently trained to fill in for a particular staff member should that person be absent or leave the position. It would be wise to begin to train a staff member who could perform a similar function

for the MSO.

The ERI Advisory Committee historically has met once a year, though two meetings occurred in the past academic year in preparation for the external review. The Advisory Committee plays an important function in providing advice to the director on a number of important issues (e.g., student support, staffing). Every report made by the committee since the inception of ERI includes a recommendation that the committee meet more frequently (e.g., quarterly). Our external review committee endorses this idea. The Advisory Committee could assist in the process of strategic planning mentioned in recommendation 1 (above), in implementation of other recommendations made herein, and in dealing with budgetary issues as they arise.

Recommendation #9: Minimize the bureaucratic burden placed on researchers.

We heard from a number of sources that relatively new, University-wide software packages have been burdensome for researchers (e.g., the "Gateway to hell"), requiring significant demands on their time -- time that could be much better spent doing research, writing grants, mentoring students and teaching. There also appears to be a general pattern developing of increasing bureaucratic demands being place on researchers through the adoption of such software packages. While this issue extends far beyond the ERI, there is a clear sense that the University is regressing rather than progressing by implementation of such procedures. We recommend that measures be taken to evaluate and lessen the bureaucratic demands placed on PIs.

Conclusions

ERI has accomplished its mission of support for education and research at UCSB with laudable skill and proficiency. Strategic planning to identify promising cross-disciplinary areas in which to invest should capitalize on the opportunity afforded by the search for a new Director. ERI is now poised to move beyond its current mission and to become an effective incubator of, and a world leader in cross-disciplinary research in environmental and Earth sciences.

External review committee members:

Roberta Rudnick, Chair, University of Maryland
Scott Denning, Colorado State University
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