

## **ERC Industrial Advisory Board Chairs' Meeting**

**January 21, 1999  
Holiday Inn Arlington at Ballston**

This is an issue-oriented summary focusing on important points and suggestions made by the participants in discussion of a range of topics relating to the interaction between the Engineering Research Centers and industry. Participants included ERC Industrial Advisory Board (IAB) chairs and other representatives, some ERC industrial liaison officers, and NSF ERC Program staff.

The meeting began with a meeting charge from Marshall Lih, the Director of the Division of Engineering Education and Centers, and from Cheryl Cathey, the organizer of the meeting. This was followed by a presentation by Lynn Preston, the Leader of the ERC Program Team, on the ERC Program Core Concept. A series of briefings and discussions followed on:

- Strategic Planning -- Cheryl Cathey, ERC Program Director (PD)
- Industrial Benefits of ERC Membership -- Linda Parker, ERC Program Evaluation Analyst
- Oversight and SWOT Analysis by Industry -- John Hurt, ERC PD
- A Discussion with Eugene Wong, Assistant Director for Engineering
- Industry Support Levels -- Bill Neufeld, ERC Program Information Systems
- ERC Lifecycle and Self Sufficiency -- Lynn Preston
- Membership Relations -- Andy Branca, ERC Industrial Liaison Officer, University of Washington.

The main reason for the meeting, Marshall Lih said, was for NSF to obtain a “reality check” on the ERC Program’s progress and performance, especially with respect to expectations of the IAB and NSF. Differences between those sets of expectation would be explored; and expectations might be recalibrated as a result. NSF tries to hold such meetings with the IABs every 3-4 years. “Times are changing,” Lih said. Self-sufficiency is an increasingly difficult issue for ERCs and for the Program. Broadly speaking, NSF would like the opinion of IAB members on how to continue evolving the structure and characteristics of ERCs.

### **ERC CORE CONCEPT AND STRATEGIC PLANNING**

**Topic:** Is the ERCs’ focus on next-generation engineered systems still important from industry’s viewpoint?

The response, “What else is there!?” characterized the reaction of the participants. Given the long-range nature of engineered systems goals in ERCs, the consensus was that working more toward “intermediate subsystems” and medium-range outputs is increasingly important for ERCs. However, ERCs must keep a clear perspective on the higher-level systems view and they must demonstrate proof-of-concept. Therefore, the question, “What is a credible demonstration of an

engineered system in a university context?” is increasingly asked. Is it a simulation? Is it a realistic model system that can be imported by industry? In any case, ERCs can’t deliver to their customers a product that is ready-made; their output has to be adaptable to many diverse needs.

**Topic:** What are the IAB Chairs’ views of the NSF/ERC strategic planning process?

The IAB representatives asked whether NSF wants all ERCs to migrate towards the three-level strategic plan model that depicts how the engineered systems level of research drives and focuses fundamental and enabling technology research needed to achieve the systems-level deliverables of the ERC. Lynn Preston and Cheryl Cathey said that the figure displayed is a useful planning tool, at the conceptual level. But it has to be supported by milestone charts with more explicit time lines. When asked if a center must use that chart, Preston responded that the Program is still working with that chart; if a center is converging around another approach, she said, then by all means use that approach. The important issue is that the planning process be used to focus and integrate the ERC’s research to address the important barriers in the way of the systems-level advances -- a challenge in academia, where the culture encourages individual work versus integration along with a focus at the fundamental and, perhaps, the enabling technology level.

The question was asked whether a 10-year plan is necessary. Preston replied that it is appropriate to have a 10-year horizon; but, in reality, a 5-year time frame will be more realistic. In the end, the plan must be evolutionary and flexible for the ERC to both meet its goals and stay ahead of the field.

## **INDUSTRIAL BENEFITS OF ERC MEMBERSHIP**

Summarizing two recent studies of ERC outputs and interactions, NSF’s Linda Parker said that the most important recommendation made by ERC students was for more involvement with industry. Companies, for their part, said that the benefit of ERC interaction that they valued most highly was the ability to hire ERC students and graduates. Students who have cross-disciplinary experience, with a systems focus and experience in strategic planning for technology advances, make better employees. She concluded that ERCs may be marketing the prospective benefits of ERC membership too narrowly, keying on the companies’ initial interests and needs. Instead, the centers should market the full range of benefits they offer, including students and graduates, as well as the fact that membership is relatively inexpensive, given the leveraging from NSF and other sources.

**Topic:** What aspects of the ERCs attract and retain industry memberships?

The main focus here was on the fact that ERC-company interactions tend to be at the mentorship or technical level. Instead, IAB representatives said, the ERCs need to work at establishing themselves in the minds of mid- and higher-level company management as key organizations in the company’s own strategic plan. There were several ideas for how to do this:

- IAB representatives must take on a responsibility for constantly “selling” the ERC within the company at all levels, especially casting the ERC as an integral part of the company’s research effort.
- Center faculty should come to the company to give briefings on their work and how it fits within the company’s own goals.

- Arrange for ERC faculty and students to be invited to company training sessions and road shows.
- Solicit student internships for key corporate research projects. These help build capabilities and relationships, as long as the project is focused on center research goals as well.
- Arrange for top executives to visit the center.
- Each ERC should be asked to produce a one-page summary of their achievements, geared to CEOs, which the IAB reps would distribute strategically.

One serious concern affecting long-term support for ERCs is the tendency to focus corporate involvement through one person or one division. If that person leaves, often the ERC has to start over to develop another productive relationship and continued support by that firm. Some suggestions for overcoming this problem were made:

- ERCs should not accept a membership fee from only one department or division of the company; there should be contributions from across all or several departments. The objective here is to evolve to a relationship that doesn't depend on only one person in the company.
- Strive to achieve buy-in to the center at the systems level, not the product level.
- One idea is for the IAB rep to obtain a weekly upload (via web or telephone) on what's going on at the center, and to encourage colleagues throughout the company to "tune in" and connect with center faculty in an area of interest. Alternatively, the IAB rep can proactively update company colleagues via email about activities in the center.
- ERCs should hold workshops on topic areas and invite several members of the member firms, so as to broaden the base of communication with the ERC and the benefit to the firms.

Strong emphasis was placed on the fact that being an IAB representative really must be viewed as a part-time job, with large responsibilities for: frequent advocacy and marketing within the company; obtaining broad involvement across the company; and communicating needs for change to the ERC management. Retention of existing members is a much greater problem for ERCs than recruitment of new members. Losing the company's champion on the IAB is the single biggest threat to the ERC-industry interaction. An IAB rep not only must generate solid support for the ERC within the company, but should also bring along the next generation of IAB reps.

The question was raised whether ERCs provide their IABs with enough cogent information about the value they provide. If IAB reps find that the center's annual reports and other publications do not provide enough useful information, they should press the center for more.. Metrics of benefit should be developed by the ERC's member firms wherever possible. For example, one attendee noted that hiring ERC students saves in recruitment costs at least as much as the annual membership fee. Savings entailed in having a new hire become productive one year earlier may be as much as \$250,000. Figures like this are great recruiting "tools."

It was noted that the difficulty of retaining members is proportional to their geographic distance from the center. One suggestion for overcoming that problem was to hold weekly teleconferences with key faculty and company representatives. Another was to coordinate IAB meetings with other professional conferences so that participants can combine the two. One center assembles a "master calendar" of professional events in its field during the year for this purpose.

**Topic:** What products do the IAB chairs expect to see come out of an ERC, and at what stage?

This is always a tricky question because of the inherently different foci of academe and industry. Attendees said that early in the center's life, students and information are the main products they expect to see. Later on, intellectual property and the availability of a whole new type of graduate are expected. NSF's dilemma here is that ERCs are tempted to "churn around" at the Enabling Technology level of the strategic plan model because of pressure to produce deliverables for their members. The comment was made that a company that goes into an ERC with a 2-3-year view of the research should broaden its perspective on pay-back. Because of the differences in perspectives, it is important at the outset to develop a mutual trust between: an ERC and its members; NSF on the one hand and the ERC and its partners on the other; and among the ERC faculty and the center's management.

## **OVERSIGHT/SWOT ANALYSIS**

The Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis was first introduced into the ERC Program by Lynn Preston in 1997 as a result of watching the Georgia Tech Electronic Packaging ERC's IAB perform a SWOT analysis for its first meeting with an NSF site visit. Site visit teams were asked to carry out a SWOT analysis to produce a site visit report. When that proved effective, industrial partners were asked later in 1997 to carry out a SWOT analysis on their ERC as input to both the ERC and the site review team. It was hoped that the SWOT analysis process would strengthen the partnership between the ERC and its IAB and also would strengthen the partnership between NSF and industry, the two main investors in an ERC. The process has not been without controversy. John Hurt, an ERC PD, said that the university and the industrial partners first had to develop a trust that the SWOT analysis was not a threat to the ERC. NSF views weaknesses identified in the analysis not as a reason to kill a center, he said, but as an opportunity to help it improve. The purpose of formalized feedback in the form of a SWOT report from industry is to avoid getting only superficial endorsements of the center.

**Topic:** How does industry see the value of the SWOT analysis?

IAB representatives were positive about the value of the SWOT. They said that it helps to crystallize the IAB's grasp of how individual research thrusts fit into the whole fabric of the center. It is a useful vehicle for getting the IAB involved more broadly in center management (e.g., succession plans, the education process, etc.), beyond the merely technical. And it helps the companies converge as a group on what they are getting from the center vis-à-vis what they actually want to get.

Regarding the SWOT process itself, the ERC Program has devoted resources to enable the ERC PD to travel to the ERC and meet with the IAB to explain the SWOT process and be available for questions during the process. It is the responsibility of the PD to explain clearly to the IAB what the SWOT is, why it is conducted, and what is expected. The PD should be available to the IAB during the SWOT analysis to answer questions and clarify procedures. The actual SWOT analysis should be carried out in private, not involving the PD or the ERC staff, in order to have the most frank discussion possible.

Attendees said that NSF should not forbid the center director and deputy director to participate in the SWOT. If it works, it's fine; however, NSF staff voiced concern that this might tend to soften discussions of threats or serious weaknesses. It may be best to have the ERC leadership team join the IAB after the private meeting is completed.

**Topic:** Is "Threat" a good word for use in the SWOT?

IAB representatives generally view this term as constructive. It demands attention and focuses the IABs on their responsibility to help the center survive. They like the connection to the idea of a "SWAT Team." The key, again, is to develop an assurance on the part of the IAB that the identification of weaknesses and threats will not lead to "punishment" of the center by NSF.

**Topic:** SWOT procedural questions

NSF is continually looking at how well the SWOT process is working. They are as much concerned with the process as with the SWOT product. NSF staff asked the attendees if successive SWOTS at a given ERC pick up where the last one left off. In general, the answer was "yes." Generally, follow-up on a SWOT is through the yearly review. The IAB looks at where progress has been made during the year and updates the SWOT report. However, there must be room in the analysis for new considerations, new inputs. It is important to develop not only a SWOT product but also a process for evolving it.

NSF staff then asked how the new process, in which the IAB briefs the site visit team in advance on their findings, is working out. The response was that usually not enough IAB members can attend the site visit. If the ERC doesn't hold two IAB meetings a year, the date and time of the IAB meeting/SWOT analysis should overlap the date of the site visit. If the ERC holds two IAB meeting a year, then the SWOT can be carried out at the one that is not contiguous with the site visit and it can be presented by the industrial members later at the site visit.

For centers with a large number of members (say, more than 50), the question arose as to what process is used to produce a coherent, collective report. The consensus was that a committee of selected IAB representatives should prepare the first draft and then obtain input on it from the entire IAB. The SWOT cannot be a mere survey; it must involve intellectual interaction.

## **DISCUSSION WITH EUGENE WONG, ASSISTANT DIRECTOR FOR ENGINEERING**

Dr. Wong said that the ERC Program is one of the flagship programs at NSF, one that confers prestige and other benefits to awardees disproportionate to the actual level of funding. It's a highly successful program but is getting "somewhat long in the tooth," he said, and needs some improvements.

Dr. Wong sees four classes of problems emerging from the SWOT analyses:

- 1) Core purpose

- industrially relevant knowledge with impact
  - cross-cutting (synergy of cross-disciplinary teams)
  - large, complex problems (systems)
- 2) Ancillary objectives
- outreach
  - education integration
  - industrial liaison
- 3) Funding
- amount and duration
- 4) Topical focus in selecting new ERCs.

**Topic:** ERC core purpose

Dr. Wong believes that the first core purpose of the program was much harder to achieve than was expected (partly because the founder of the Program, former NSF Director Erich Bloch, came from industry and did not anticipate the difficulty in breaking such a large amount of new ground in academe). However, Wong said, the cross-cutting elements have been fairly easy to achieve. Regarding the systems focus, he said that there was a considerable amount of “wishful thinking” involved. In his view, those ERCs that have integrated their research thrusts into a specific project have achieved “ignition” – cohesion among the researchers. He believes that the distance between research areas should be fairly small if this is to occur.

A participant suggested that the core purpose of ERCs ought to be “to help industry improve or enhance its capabilities in the field of interest.”

**Topic:** Core and “Ancillary” objectives

ERCs have been very successful in achieving a much higher level of industrial interaction than was common in the past, and have also succeeded very well in integrating research and education. In both these areas, they have served as a pioneering model for many other engineering colleges and down through the academic levels, even to secondary schools.

However, he said, there is a sense that the ancillary objectives impose an excessive burden on the ERCs. Have they become too numerous and too important? Are they orthogonal or antagonistic to the primary mission of the ERCs in research? It may be that education, in particular, has become too predominant a focus of the centers and that the balance needs to be redressed.

Participants pointed out that education cannot be considered an ancillary mission of the ERCs since they are housed in universities and education is a fundamental mission of universities. They noted that education is a neutral ground for helping the ERCs to blend into universities, which have had a very different culture traditionally. Lynn Preston pointed out that some ERCs propose a heavy burden for themselves in outreach to K-12 and curriculum development, even though these are considered secondary goals in the ERC Program, because they see that NSF in general emphasizes these goals and they believe they have to do this to be competitive.

**Topic:** Funding

Regarding graduation from ERC Program support at the end of a 10-year term, Wong said that there is no chance that ERCs will become permanent institutions (at least with NSF funding). It is also quite unlikely that their duration will be increased; so length of funding is not an issue. However, he said, the level of funding is an issue. He believes the funding for ERCs is too low. There has been both normal cost inflation and also, on top of that, “research inflation” (the cost of research increases at a faster-than-normal rate). Funding for ERCs once seemed large, but no longer. NSF is now competing with DARPA and others for the best researchers, Wong said.

This has two ramifications. First, what we want and expect people to do in the ERCs is no longer possible with existing funding, so they look elsewhere. Second, NSF is losing many of the best people – especially in rapidly emerging fields – to other funding agencies. “If we are to remain a flagship program,” he said, “we have to attract stars.” We have to be ‘momentum players’ and be involved in the fastest-moving fields. Wong announced his intention to find ways to increase funding for the ERC Program. The question is, should it be in the form of a higher base or of increased supplemental funding?

Participants agreed enthusiastically that ERC funding should be increased. However, some pointed out that some ERCs have achieved much higher levels of funding from other sources besides NSF. They feel that NSF shouldn’t try to attract all the brightest stars in an area. Wong believes that NSF’s small budget hurts science in the United States. “Virtue is not its own reward.” He feels it is important for NSF to find its niche.

If new money is not available, perhaps the best way to increase ERC funding would be to fund fewer centers per competition.

Another idea would be to structure the funding differently, perhaps requiring a larger industrial match. In this case, the percentage of matching funds must differ across fields. One problem is what to do about matching funds in fields so new that there only a start-up industry, or in fields like construction or civil infrastructure where the firms are not accustomed to supporting research.

In general, the leverage requirement is controversial. Wong said that maybe it is best to support the best people, regardless of whether they happen to be good fundraisers.

One funding issue is the difficulty and expense of preparing an ERC proposal. Participants urged NSF to further simplify the process, using shorter proposals and preproposals.

**Topic:** Targeted focus – is it a good idea?

Wong said that there has never been a time when the future has been so predictable in technology. Fields take so long to develop that nothing that has not emerged already will affect us in the next 20 years. We know where the action will be, said:

- in microelectronics – integrated circuits and their extension into MEMS, chemical-biological-optical sensors, and processing advances
- in information technology – computing and communication have merged into the most important technology to appear in the past 50 years
- in biotechnology – the newest and deepest area. Wong believes that the hottest area will be in nanobiotechnology, with the ability to relate physical form to function.

However, he said, apart from making broad generalizations, no one knows how to prioritize major national needs. Decisions end up being driven by politics and market forces.

The question is: Should we do some controlling in terms of directions and topics? NSF as an agency is beginning to do it. The rest of the world already does. Wong believes the ERC Program should also.

Participants responded that some targeting would be acceptable, as long as NSF's vision for the areas chosen is strong and the goals are not too narrowly defined.

## **INDUSTRY SUPPORT LEVELS**

NSF's Bill Neufeld reported that there are now 604 distinct ERC industrial members; in 1997 they accounted for 28% of all ERC funding (slightly larger than NSF's 26%). This has been a relatively consistent proportion over the last several years.

**Topic:** Is the 2-level model of industry support (membership fees plus some project-level support) still effective?

The fee structures in use actually range across a wide spectrum, from centers that have only one low level (e.g., \$15K) to those with a range from \$5,000 to \$250K – and others where fees buy patent rights. One center has three fee levels, depending on whether payment is in cash, salary support, or in-kind contributions. Small companies get a deep discount.

Participants agreed that it is important to have flexibility in the fee structure – not only vertically through the structure but also over time. Each center should be free to develop its own fee structure. It was agreed that setting a minimum at a given center is good. Also, a center should be able to close its membership at a certain level.

Fundamental changes in the fee structure must be introduced gradually, and notifications made in advance.



Representatives of new ERCs asked how their centers can obtain information on models and structures in use at other centers. The Best Practices Manual, Ch. 5 (www.erc-assoc.org) has some of this information. A discussion will also be established on the new ERC website now under development, under the Industrial Forum section.

## **SELF SUFFICIENCY**

Lynn Preston noted that it takes a very positive attitude and a lot of energy on the part of an ERC and its host university for the center to survive graduation from ERC Program support. Failing in a recompetition bid slows that positive momentum. Consequently, many elect not to re compete.

Preston does not see NSF's self-sufficiency policy changing (as Eugene Wong confirmed).

**Topic:** What is the perspective of industry on the 10-year funding cycle for ERCs?

Preston asked whether NSF should refocus the ERC life span down to six years or should stay with the 10-year vision. The consensus of participants was that NSF should keep its 10-year commitment but take a close look at the center at year 6 and redirect its focus if necessary. Some participants wondered if 8 years might be preferable to 10. Preston also asked for input on a new policy to move back the start of phase-down of NSF support from year 9 to year 7. Concern was raised that faculty might begin to move out too soon.

Marshall Lih asked how NSF's pullout from a center at graduation would affect the companies' willingness to stay in the center as members. The response was that companies care mainly about leveraging their research funds; they don't care if the leveraging funds come from NSF or elsewhere.

## **MEMBERSHIP RELATIONS**

**Topic:** How well do university intellectual property (IP) policies fit with industry needs?

It was agreed that university IP policies are a continuing problem. ERCs should be able to have different IP policies from the university as a whole. IP policies in multi-university ERCs pose an even more serious problem. Attendees agreed that participating universities must agree to a common policy.

A wide variety of arrangements currently exist. The consensus was that more flexibility is needed here than in any other area of ERC operations. It should be noted that the ERC Program does not stipulate IP policy to the ERCs but does promote sharing of policies among the ERCs. A new ERC website under development will provide a forum for such sharing.

The higher an ERC's effort moves upward in the three-planar strategic plan structure, the closer it approaches a commercial engineering system. At this level, intellectual property issues become trickier. The Bayh-Dole Act allows universities to retain title to any invention developed with the use of government funds. The question was asked whether ERCs should charge member companies royalties for center-developed technologies. The consensus was that they should not.

It is necessary to be wary of government funds being used for private-company advantage. There is a danger of this even in supporting individual projects through the ERCs.

IP policy is an area that can benefit from information-sharing on the erc-assoc website.

**Topic:** How should industry representatives sell the ERC program to upper management? What kind of information is needed?

Some centers use several layers of IABs for different purposes, including an executive-level group. The key is how to present the center's work appropriately to top management. If the CEO is a marketing person, the presentation has to be tailored in marketing terms.

It was suggested that NSF might consider describing the ERC Program in publications that top managers read, such as *Wall Street Week*, *Fortune*, and *Business Week*.

In addition, as mentioned earlier, each ERC should be asked to produce a one-page summary of its achievements, geared to CEOs. The ERCs should use their in-house newsletter writer/editor to help give this short document punch. Attached to the summary might be a listing of all current and past ERCs, to demonstrate the good company each ERC is in.

**Topic:** What should the role of the ERC Industrial Liaison Officer be?

A primary role should be to help the company representatives sell the ERC to upper management. The dual experience of most of these individuals in industry and academe allows them to act as a "glue" or connector between the companies and the faculty.