



9.2 ORGANIZATIONAL STRUCTURE AND CENTER MANAGEMENT

The Center Director faces a number of challenges at the start of an Engineering Research Center's life cycle. Initial task delegation and staffing decisions are vitally important to smooth operation and sustained success. The Director must determine which management and operations functions to delegate during the planning stages and through the start-up phase of the ERC, as well as the level of delegation. A multi-university ERC Director also encounters the significant challenges of delegating responsibilities for campus-level activity coordination. The initial decisions regarding the fundamental operating structure of the ERC are crucial to determining its success and ensuring active collaboration among programs, thrust areas, and institutions.

9.2.1 Identifying and Forming the Center Leadership Team

At its inception, an ERC is often strongly reflective of the Director's personal vision. The Director usually has initiated the effort and recruited the key researchers. Often, the Director brings a strong background of experience in leading large, well-funded research efforts such as a single campus-based research group. When making the transition to a newly-funded ERC, the Director must be willing and able to integrate personal goals with the Center concept, and to delegate responsibilities within the Center as it begins to progress toward the first important National Science Foundation (NSF) review. Three pivotal decisions faced by a new ERC Director include: selection and cultivation of the leadership team, delegation of various responsibilities to the leadership team, and distribution of leadership responsibilities across campuses.

During the ERC proposal process, it is critical that the senior-level university administration be recruited first, so as to ensure commitment, entice career-minded individuals to participate, and develop the support structure for partnership in all facets of the Center. Strong relationships between the Center and the lead university administration are also important to ensure establishment of similar support structures on partner campuses. As this process occurs, it is important to aggregate administration supporters under a common governing or advisory organization so that the support is nurtured and maintained throughout the life of the Center. This governing body should also be actively engaged in responding to issues and challenges raised by industry or through the NSF review process, so that resources particular to individual institutions are appropriately leveraged and concerns are addressed across institutional boundaries. Throughout its lifetime, the ERC should be envisioned and promoted as a permanent part of the participating universities and their individual strategic plans.

When forming the leadership team, the Director must consider the long-term Center life cycle, assessing the commitment of individuals to the success of the *Center* rather than to their individual goals, as well as the ability of those individuals to collaborate effectively over the long-term. Leadership roles for individuals geographically separate from the lead institution should be clearly enumerated, documented, and periodically reviewed to ensure effective management and collaboration. The Director must also recognize that the original leadership group will affect the future nature of the Center and the evolution of the strategic plan. As part of the long-term view of the Center, the Director must consider the eventual transition of top leadership and cultivate, throughout the life of the Center, an environment and synergy in which this transition can be made successfully.

As part of the recruitment and selection process, the Director must seek out specific talents and personality characteristics that are essential for the success of the team. An informed Director will recruit individuals with a team mind-set, a reputation for successful relationship-building with colleagues and university administration, and an established reputation for research leadership. Individuals with unique talents and who are prepared to be a part of the team top the list of recruits and can serve as catalysts for recruiting others, both in their home institutions and Center-wide. Recruiting talented individuals also requires the ability to balance *œ lone rangers* and talented team players, realizing that personality characteristics are deeply ingrained and ultimately will affect the productivity and overall success of the Center. The Director must be mindful that diversity in the leadership team is essential and best seeded early. It is also essential that all leadership team members understand that the likelihood of organizational and personnel changes during the life span of the Center is quite high, and that the concept of the Center must be sufficiently broad to incorporate these changes.

The role of the Deputy Director in a multi-university ERC leadership team is vital to the success of the Director and the Center. The Deputy Director should augment the expertise of the Director in terms of the core research thrusts of the Center. The two primary authors of the center need to build the breadth and depth of the Center's focus. Ideally the Deputy is a senior faculty member, often at a different partner institution. Such an arrangement cements the involvement of both institutions in the Center. The ERC will function more effectively if the Deputy can step in for the Director when needed. The more credible the Deputy is as a leader, the more flexible the management



structure can be. If the Deputy can manage, lead, and be responsible for several key strategic goals of the Center, the Center can move forward more effectively with its strategic plan.

CASE STUDY: *Bahaa Saleh is the Deputy Director for CenSSIS. He is a senior faculty member at BostonUniversity (BU), while the Center is led by NortheasternUniversity. Prof. Saleh is the leader of one of the fundamental science research thrusts dealing with advanced sensing concepts. He is also responsible for overseeing the development of a unifying framework for subsurface sensing and imaging systems. This framework is a key long-range system-level strategic research deliverable for the Center. Moreover, he is leading the development of an undergraduate textbook on subsurface sensing and imaging concepts. This is a key education deliverable of the Center. As the Chair of BU's Electrical and Computer Engineering Department, Prof. Saleh has significant administrative experience and the seniority to provide leadership to the center when the Director is unable to do so.*

9.2.2 Establishing Institutional Partnerships

In a multi-institution ERC, it is essential to develop and foster strong administrative relationships within and among the cooperating colleges and departments of the partner institutions so that the vision and the strategic research and diversity plans can be implemented and can evolve as needed. Therefore, successful commitment from partner universities throughout the lifetime of the ERC is key to institutionalization and is essential for the survival of the Center after graduation from the ERC program.

As keeper of the ERC vision, the Director is best suited to promote the Center's driving concepts and to garner support for external institutions as partners. The intimate involvement of other academic departments within the lead university and partner universities at inception is vital, building toward critical reviews. Senior administrative support of the lead and partner institutions is necessary for establishing long-term institutional partnerships, and an intercampus Governing Board (GB) or similar organization can be quite useful in engaging these constituencies to sustain the Center. Such a Board can and should play an important role in establishing a common set of practices and procedures to maintain intercampus research and education endeavors, including intellectual property (IP), distance learning, and student and faculty exchange. In such cases, working relationship agreements should be formalized, signed by all parties, and recorded. The resulting agreements should be accessible and reviewed periodically as a group.

CASE STUDY: *The Center for Power Electronics Systems (CPES) Memorandum of Understanding (MOU) established a pool of industrial funds from which to select and apply for patents.*

As the number of new technologies generated by CPES grew, it became apparent that the established IP evaluation process was cumbersome and inefficient. Missed deadlines resulted in valuable technologies becoming part of the public domain. After considerable exploration and negotiation, Dr. Fred Lee, CPES Director, proposed a potential remedy to industry and officials at the partner universities. The essence of the idea was to streamline the IP review procedure and expedite the IP protection process by utilizing pooled resources from participants. The idea evolved into an agreement for implementation of a system to pool resources for the protection of selected technologies and is now known as the Intellectual Property Protection Fund (IPPF). An IPPF agreement offers participants the undisputed IP advantage of a nonexclusive, nontransferable, royalty-free license after a two-year exclusivity period. Companies that choose not to participate in the IPPF option continue to follow the standard procedure to gain access to CPES technologies. If IPPF pool participants and non-IPPF participants are interested in protecting the same technology, the cost is equally shared. Since the implementation of IPPF, 20 companies have participated to provide protection for 24 CPES technologies.

Examples of basic agreements and other organizational documents include: Strategic Plan, Operations Policies and Procedures manuals, Industry Consortium Agreements, Intellectual Property Agreements, Curriculum Cross-Listing Agreements, Student/Faculty Exchange Program Agreements, Course Credit Earnings/Transfer Agreements, and a Student Leadership Council Constitution. Examples of these documents can be found in other chapters of the Best Practices Manual or obtained from other ERCs.



9.2.3 Initial Strategic Planning: Organizational Considerations

A first task of the newly-assembled leadership team is to review, develop, and refine the initial strategic plan to address the research, education, outreach, and diversity missions of the ERC. The initial strategic plan is usually the result of a collaborative effort and a democratic process. During this process, the Center leadership team must ensure that the plan maintains a systems focus and addresses development of all programmatic components, focusing particular attention on those areas that will be benchmarked as a part of the Center's reviews by NSF and industry. In a multi-institution Center, the process may involve discussion and input from faculty and staff, advisory groups, and ultimately, review by representatives from each participating institution prior to submission to NSF for approval. A facilitator or consultant might be useful in this process. The Center's organizational structure could also include a Research or Technical Director who can assist the Center Director in review and implementation of the research strategic plan.

The strategic plan should be viewed as a living document and updated regularly to reflect changing priorities during the Center's life cycle. The Director develops a systematic plan to revisit the strategic plan with the leadership team and Center Principal Investigators (PIs) on a regular basis, so that input from review panels and advisory bodies can be incorporated as appropriate. The Center may also form new outreach initiatives with academic institutions and/or government laboratories. These relationships will likely provide an opportunity to incorporate new expertise into the Center's programs, including the strategic plan. It is therefore essential to develop a well-defined mechanism to review the progress of programs, individual projects, and thrust areas as part of the funding allocation process, and to review and revise the strategic plan to reflect the evolution of the Center's work and inter-institutional connectivity over time. Factors for consideration include the channels and means of collecting internal input, as well as engaging Center faculty, thrust and program leaders, and industry and scientific advisory groups.

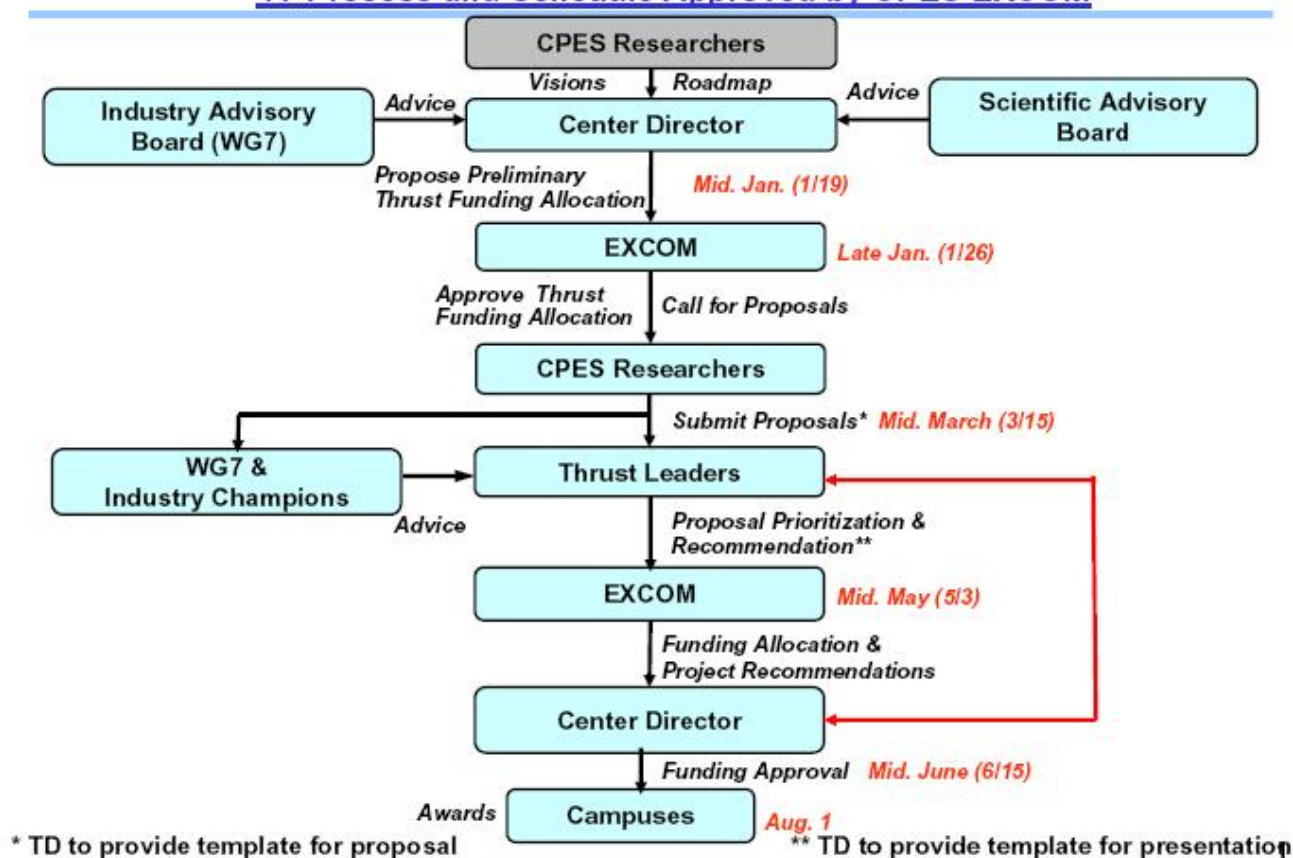
In managing a large multi-disciplinary research program, it is very important that each team member in each task/thrust/program understands the integrated system goals and is able to relate individual research activities to the overall Center research objectives. Each individual is a part of the ongoing communication effort that must occur to ensure that there is a mutual understanding among all participants, from the malleable student to the seasoned researcher.

Case Study: CPES uses many tools to facilitate an integrated culture. The development of an all-encompassing roadmap that clearly delineates the interdependencies among the thrusts and is supported by milestones and benchmarks at each thrust level is the single most powerful tool. This roadmap is reviewed, discussed, and updated as part of an annual CPES Research Retreat that involves all faculty research leaders from all the partner campuses. Further, weekly project meetings attended by all faculty and students involved provide an opportunity for the students to reinforce understanding of the overall activities and to foster team collaboration. The key to success is frequent and productive communication and interaction among all Center members, using telephone and web conferencing tools. These interactions establish a basis for individual appreciation of outcomes that are achievable when acting as part of the team.



Proposal Review and Award Processes

Y7 Process and Schedule Approved by CPES EXCOM



9.2.4 Allocation of Funds

Establishing budgets/funding allocations is a major process that must be addressed at the Center Executive Committee level and requires time to refine. Funding cannot be allocated on either a pro forma or entitlement basis. In addition to the concerns of allocations across programs, disciplines, and research thrust areas, multi-university Centers also face the unique challenge of reviewing and allocating budgets across institutions. Cost-sharing commitments must be made and met at each institution, while remaining balanced against expected and actual outcomes. In a multi-university environment, it is therefore necessary to develop a process which addresses all internal parties such as thrust leaders, campus directors, program directors, and PIs, while also reflecting the input of the Industrial Advisory Board (IAB) and the Scientific Advisory Board (SAB), as well as other applicable external consultants or stakeholders. The Director's role is critical to ensure that the process and outcomes reflect the multi-institutional nature of the ERC. In particular, the Director's perspective is instrumental in ensuring that the research review process considers not only technical connectivity within and among projects and thrusts, but also supports ongoing intercampus connectivity.

Fig. 9.2.1 Sample Research Review Process Flow Chart

Figure 9.2.1 shows the research proposal review and funding process at CPES. The timeline allows for input from the five campuses of this Center and their representatives on the Center's Executive Committee (ExCom).

9.2.5 Principles and Practices for Managing the Multi-university Center



Overcoming geographic, institutional, and cultural distances within a multi-university Center requires open and regular communication at all levels. The cultivation and maintenance of relationships is a priority throughout the life of the Center. Achieving collaboration toward a common goal (and suppressing unproductive competition) is largely dependent on the Director and is a task that grows exponentially with the number of involved individuals. While the Director should avoid processes that are excessively democratic, consensus decision-making methods and implementation are fundamental to fostering an open and constructive environment within the Center. Essential staff members can play a vital role in supporting this environment by their responsiveness and flexibility.

From Center inception, the Director should be mindful that participation in an ERC will require attitude adjustments and a deep level of personal commitment from all participants. Key faculty must commit to a substantial administrative load, including strategic planning, cross-campus project coordination and reporting, as well as administration of their own research projects. Given the administrative complexities and the need to develop programs and relationships consistently over time, long-term commitment of these faculty members is essential to Center success. Commitment to long-range planning and outcomes is required of participants at all levels. For participating faculty, transformation of the individual PI mindset to one of interdisciplinary team play is a challenge. In multi-university ERCs, participation is as a Center partner, rather than as a separate institution involved in a Center. Being an ERC partner is a cultivated behavior.

Data collection, interpretation, presentation, and access pose significant challenges in multi-institution ERCs. The lead institution should be prepared to provide technical infrastructure to facilitate this information exchange; to interpret and clarify reporting guidelines for individuals and offices at lead, core partner, and outreach institutions; and to identify common platforms for intercampus communication. Scheduling across time zones and multiple faculty class schedules is often challenging. For this reason, it is best to establish in advance long-range schedules for critical meetings.

9.2.6 Planning and Delivering on Diversity Goals

From the establishment of a Center, gender equity and ethnic diversity need to be embedded in the education and outreach goals as well as the faculty and staff recruitment goals. During the first year the Diversity Coordinator needs to convene an Education and Diversity Advisory Board (EDAB) (or the equivalent) representing the Center's partner institutions and strategic corporate partners, and supplemented by nationally recognized experts in these fields. The EDAB or a subset needs to develop a strategic plan for diversity across all the partner institutions and to integrate key elements of the plan into strategic planning discussions of the Center's Executive Committee.

During the second year, the EDAB or subset should develop a strategic planning process to help the Director set realistic goals and workable strategies for significantly increasing diversity in Center laboratories and classrooms. The core of the process is the development of a Strategic Plan for Diversity. Key elements of this plan are:

Get accurate baseline data and set realistic five-year diversity goals for increases in the percentage of females and racial and ethnic minorities represented among the Center's faculty, graduate students, and undergraduate students

- Designate strategic activities that will assist in reaching established goals
- Provide sufficient resources to adequately fund designated activities
- Develop a flexible funding strategy for efficient deployment of resources
- Establish specific patterns of responsibility and accountability
- Collect accurate annual data (separately by partner institution, and totals for the ERC)
- Supplement annual data-gathering with interim reporting requirements as needed
- Create a mechanism for the diversity program to report to key stakeholders at both lead and partner institutions, such as the Governing Board or Advisory Board.
- Leverage existing institution-level initiatives at lead, core partner, and outreach institutions
- Engage in continuing project evaluation.

CASE STUDY: *The CenSSIS six-year results demonstrate that if a strategic planning process is applied to increasing the numbers of females and minorities in an ERC, increasing diversity is possible. For example:*

- *The number of female faculty increased from 6 (13%) in Year One to 18 (30%) in Year Six. The number of minority*



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faculty increased from 7 (12%) in Year One to 19 (31%) in Year Six.

- *The number of female graduate students increased from 9 (23%) in Year One to 34 in Year Six. The number of minority graduate students increased from 10 (8%) in Year Four to 31 (28%) in Year Six.*
- *The number of female undergraduate students increased from 37 (41%) in Year 5 to 38 (41%) in Year Six.*

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