



2.1 Introduction and Approach

2.1.1 Directing an ERC: Basic Principles

Directing an ERC requires considerable technical and managerial leadership talent. First, the Director is responsible for the vision and center-level strategic planning that determines the direction of each center and inspires loyalty to its objectives. Second, he/she is responsible for taking the lead in organizing and structuring the center, which includes selecting the executive and administrative management team; organizing the principle research thrust areas; structuring the center's educational, outreach, and industrial liaison efforts; and deciding on what to delegate and to whom. Delegation and staffing during the life cycle of an ERC is an issue of fundamental importance to the success of the center; and the center's structure will directly influence the center's success in research, education, and industrial participation.

In addition, there is clearly no single absolute and "correct" way to direct an ERC. There are, however, a series of choices that must be made as the process is undertaken, and each choice necessarily leads to a set of consequences. The cumulative experience of the people who have directed ERCs for varying lengths of time in the center's life cycle has shown that every committee that is set up, and every administrative structure that is developed, will affect the center in ways that can be anticipated, at least in general terms. There are certainly many research centers in American universities, but the objectives, key features, and funding pattern of the ERC Program through the cooperative agreement with NSF make these centers unique in several important ways. The directorship of an individual ERC is, therefore, a unique responsibility in the academic framework of the universities within which these centers are placed.

All the ERCs owe a debt of gratitude to the pioneering Directors of the early "classes" of ERCs, who paved the way for the Directors of the later classes to refine the ERC concept. Building on the experience of these first-generation ERC Directors, a second generation of Directors expanded upon the ERC concept to position their centers for success in the 21st century. The third generation of ERCs (Gen-3), beginning with proposals in 2008, have additional responsibilities to address decreased student interest in science and engineering and an increasingly global economy. Thus, in addition to the goals of preceding ERCs, Gen-3 ERCs were commissioned to educate students to be more creative, adaptable, and entrepreneurial, as well as to understand the value of teamwork and their place in a globally competitive workforce. Gen-3 ERCs are also expected to reduce the time from discovery to innovation through adoption of an "innovation ecosystem." Additionally, Gen-3 ERCs have expanded educational and outreach missions to show impact over the life of the ERC on place-based activities at targeted K-12 schools that serve underrepresented and economically disadvantaged youth, to encourage interest and careers in the STEM fields.

Just as there is no absolute and "correct" way to direct an ERC, there is no "model" of the ideal ERC Director. There are, however, a range of characteristics that are likely success factors and any given individual will be stronger in some of these than in others. In addition, the "ideal" profile will vary across different fields, universities, and industry bases.

The Director normally would be a tenured professor with a PhD degree in a relevant field of engineering or science and some management experience. He/she would have achieved widespread recognition in his or her field for scholarly and intellectual attainments. If a Director comes to the university from industry to lead the ERC, it could be problematical if he/she expects to use a more "directive" style of management at the university than the academic culture normally accepts.

In terms of leadership ability, five very important traits can be identified: 1) the ability to articulate a vision for the ERC that is shared with industry and the faculty and that is flexible enough to evolve over time with the developments of the ERC and the field; 2) a clear perception of the current status of the field and a vision of future advancements and a strategy to achieve them; 3) the ability to think at the systems level and integrate research from different fields to achieve a systems-level goal; 4) the ability to recognize intellectual needs and identify needed talents, both internal and external to the university faculty, and to form and sustain a cross-disciplinary team over time; and 5) the ability to lead without coercion. A Director will probably be someone who prefers to deal with the big picture, rather than with details, and who knows how to hire and delegate the detailed tasks. It is also quite useful if the individual is a skilled "salesman" in representing the center's needs and capabilities to potential sponsors in industry and government, as well as within the university. Again, the ability to articulate the vision of the



ERC and energize people to share in the vision for the ERC and its development is critical.

To that end, interpersonal skills that involve team building are valuable. Management in an academic environment is often a delicate operation, so it is strongly advisable that the Director be diplomatic, tactful, and empathetic as well as perceptive, alert, and determined. Given the enormous demands of the job and the personal self-sacrifices it entails, the ability to make a total commitment to the center is vital.

The prospective Director must have gathered together a group of colleagues and junior faculty in relevant fields who are willing to form the core of the ERC faculty team. It is also very important to have an industrial support base (or at least strong contacts) established through consulting, participation in a previous center, industry employment, etc. It is useful if the individual has good relations with the university and departmental administrators, although these relationships can be built after the center is established. Also valuable are other federal, state, and private support bases (e.g., foundations) beyond NSF.

The Director should understand the opportunity the ERC provides to change the educational/research culture of the engineering efforts of the university and the potential to impact the university beyond engineering. H/she should be interested in integrating the results of the ERC's systems perspective into the curriculum in new and innovative ways.

Finally, in terms of attitudes and personal orientation, an ERC Director should be a team-oriented coalition-builder who welcomes change, since technological and "cultural" change are what the ERCs are all about. The person's attitude toward the encouragement of women and underrepresented minorities to pursue engineering education and research must be genuinely positive. He/she should be oriented toward focused basic research that integrates science and engineering with long-term benefits for industry, because this is the fundamental rationale for the ERC Program. Finally, the Director should be oriented always toward achieving a center in which the integrated whole is greater than the sum of its individual parts.

In directing an ERC, a statement made by Professor Greg Carman, Director of the Center for Translational Applications of Multiferroic Systems (TANMS), based at UCLA, might be helpful advice to remember: *"I have always believed that life is more about the individual than the organization. If an organization is good, everyone contributes to the organization but no one is indispensable. Also the world does not fall apart if a member of the organization leaves; it is simply a natural occurrence that should represent an opportunity to make the organization stronger. In my world, the key is to make sure people enjoy what they are doing and to give them opportunities for growth. Furthermore, make sure that your employees have all the opportunities available to them and if there is a better position for them outside the organization, support them in getting this position—i.e., do not try to impede individual growth for the sake of the organization. I think this philosophy comes from managing students where they are not permanent employees but just staying long enough to learn a*



skill set and grow into more productive researchers outside. That is, if you want the best people you have to be prepared that some jobs in your organization are simply stepping-stones to where the individual will eventually be in their career.'

Because the success of an ERC must be measured in terms of the extent to which it has fulfilled the mandate set for these centers by NSF at their inception, it is useful to review their stated purposes. The primary goal of ERCs is to conduct innovative, cutting edge research to enhance the global competitiveness of American industry. Very direct and effective integration with industry is implicit in the charter of the ERCs; and the centers are to have a systems focus and to emphasize cross-disciplinary research and education. Consequently, an important change is envisioned in the education of young engineers—ERCs are to act as catalysts for the transformation of fundamental academic research in engineering into innovative technologies that industry can bring to commercial realization. That is, they will be centers that establish world leadership in emerging and important areas of research, in industrial relevance, and in cross-disciplinary education.

This chapter was prepared by a team of current and former ERC Directors (see Appendix A to this chapter). It is hoped that the suggestions made herein, although by no means absolute prescriptions, will provide new or prospective Center Directors with a greater sense of confidence in their decisions.

2.1.2 Chapter Organization and Objective

In an attempt to avoid duplication with other chapters of the ERC Best Practices Manual, this Center Leadership and Strategic Direction chapter will address the conception of an ERC, the daunting task of building and directing an ERC, and the set of decisions and actions that a new Director and Deputy Director must take, roughly in the sequence that they must make them. In doing so, it touches on subjects that are covered in much more detail in other chapters, such as Research Management (Chapter 3), Education Programs (Chapter 4); Industrial Collaboration and Innovation (Chapter 5), and Administrative Management (Chapter 6),

Early in the life of an ERC the Director must establish the ERCs vision and strategic direction, decide to what extent s/he will delegate responsibility for specific aspects of the center's operations, and must then hire or assign employees or faculty members to fulfill these functions. The initial management team and management structure is, by necessity, defined in the proposal and refined in the full proposal. Because not even the most heavily endowed universities can have all the high-caliber faculty in the right areas that are necessary to execute the strategic plan of a good ERC, faculty recruitment is the most potent weapon that the Director has in hand to shape the center. One of the Director's main contributions to the center will, therefore, often be in the area of faculty recruitment and replacement, both externally and on campus. This contribution will extend throughout the life of the center and will depend heavily on the relationships that s/he has built with contributing departments and with the university administration.

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