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## EARTHCUBE LEADERSHIP

### Introduction

I offer here a few thoughts on establishing effective leadership for EarthCube, based on my experience in leadership roles<sup>1</sup> for three large-scale, highly collaborative NSF initiatives, two of which were under the Geosciences Directorate. All three—Unidata, DLESE and NSDL—were intended, like EarthCube, to yield “transformative” results, but their outcomes have been disturbingly varied. I attempt here to highlight leadership characteristics that are causally linked to the most successful outcomes, admitting that my views are subjective.

The chosen factors are by no means the only ones of importance. Indeed, EarthCube success will depend critically on engaging the Earth Cube “audience” or “users” in a manner that yields accountability, engenders a sense of “user ownership” and impels decision-making toward a user-centered vision. However, I think these aspects of governance are well covered in other white papers, notably those by Mohan Ramamurthy, David Arctur and Bruce Caron.

Hence I focus more narrowly on the definitions, traits and principles needed for the leadership of EarthCube *by designated people in a single organization*. This reflects my premise that EarthCube must avoid leadership ambiguities. Though I value deep community *engagement* in governance, I think EarthCube will yield diffuse, unimpressive, common-denominator outcomes unless its core leadership responsibilities are clearly assigned to a carefully selected organization where, paraphrasing Jim Collins [Collins 2001], the right people are on the bus.

I do not mean to imply that all funds should flow through one organization, but I do think all EarthCube funding should be contingent on recipient commitments to cooperate with the lead entity and to comply with EarthCube standards and policies, which presumably will be maintained and promoted by this organization.

### A Measurable Definition of EarthCube Success

Leadership discussions generally begin with notions of vision and mission, as I anticipate will grow out of the EarthCube process NSF has established. Beyond the obvious requirement that EarthCube’s vision should be well-defined and user-centered, I think a clear and measurable *definition of success* will help create a framework for accountability and effective leadership.

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<sup>1</sup> I was a principal investigator and (founding) director for Unidata from 1984 until 2002; I served on the steering committee for DLESE and was a co-principal investigator on grants for the DLESE Program Center; finally, I was a principal investigator and the first Executive Director for the NSDL Core Integration Team until 2005. This paper reflects personal experiences from those contexts and does not represent an OPeNDAP position.

This definition should be articulated soon, with a significant degree of community buy-in, and it should identify a *specified* audience. Personally, I think it ought to have an academic slant, embracing the full college- and university-level spectrum of students, educators and researchers in all NSF/ GEO disciplines, framing audience members as (potential) data creators as well as data users. NB: Ben Domenico's white paper on Data Interactive Publications suggests an interesting means by which a data user might, in a sense, become data producer.

Measurable success can include quantitative or qualitative metrics, and I favor having both. The former could include levels of uptake across the GEO disciplines (e.g., the fraction of the audience that is engaged or sees itself gaining EarthCube benefits). Qualitative metrics could be based on perceptions about the rate at which new understanding is gained (by researchers and students<sup>2</sup>) due to facilitated construction of knowledge from observed or synthesized data. Stated another way, beneficiaries of a successful EarthCube would spend less of their time solving problems in data access and use, and they would have fewer misunderstandings about the data they employ.

### **Assignment of EarthCube Leadership Responsibility**

Following a suitable selection process, I think EarthCube leadership should be assigned to a single entity that then holds overarching responsibility for success as above. The selection process should be designed to yield an organization and staff with the following traits:

- The organization should be—or, if newly formed, should exist within an entity that is already—well established, with records of financial stability and broad community service.
- The organization and the aspiring Director should exhibit success records in making simultaneous commitments to community governance and to effective leadership in the sense of this paper, including the five leadership principles spelled out in the following section.

### **Pertinent Leadership Principles**

In an article reflecting on NSDL [Fulker 2008], I drew comparisons with other NSF initiatives formed to yield *community-wide infrastructure, built with substantial amounts of (multidisciplinary) collaboration*. Specifically, I examined NSFnet [Leiner et al 2000], Unidata [Fulker et al 1997], DLESE [Mayhew 1999] and NSDL [Zia 2001], acknowledging that I knew the first less well than the others. Noting that NSFnet and Unidata gained substantially greater uptake across their target communities than DLESE or NSDL (over similar time periods), I published the subjective conclusion that this variability was directly related to *differences in the alignments of these projects with key leadership principles*<sup>3</sup>.

Though the causes for variable outcomes are surely complex, I rejected the temptation to attribute the lesser outcomes primarily to weakness of collaboration, thinking that collaboration difficulties, per se, probably were symptoms of deeper issues. That led me to look for leadership differences among the projects, and I found them (at least to my own satisfaction) by employing an analysis framework comprising the five leadership principles listed below. My thesis was that those

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<sup>2</sup> One of the great successes of Unidata in my view has been to avoid drawing lines that distinguish the infrastructure and data needs of researchers, educators and students.

<sup>3</sup> I acknowledged then, and do now, that I share culpability.

initiatives with greatest impact aligned more closely than the others with principles of leadership excellence (and better collaboration was simply a consequence).

The principles I chose—drawn from writings by Jim Collins in *Good to Great* and by Michael Treacy and Fred Wiersema in the *Harvard Business Review*—are as follows, in outline form.

1. **Disciplined Thought** [Collins 2001 pp 65-119]
  - Willingness to confront reality
  - A simple, coherent strategic concept
2. **Disciplined Action** [Collins 2001 pp 123-143]
  - Willingness to say “no”
  - Clear identification of who holds responsibilities
  - Advancement as a cumulative process
3. **Persistent Core** [Collins, pp 188-201]
  - An enduring purpose
  - Immutable core values (around which to advance)
4. **Primary alignment** with one of the following three value disciplines<sup>4</sup> (while attending to the other two) [Treacy & Wiersema 1993]
  - Operational Excellence
  - Customer Relations
  - Product Leadership

Assuming that my analysis was right and that EarthCube resembles the analyzed initiatives (i.e., it similarly aims to build community infrastructure via large-scale, multidisciplinary collaboration), then adherence to these principles should help the initiative’s impact be commensurate with the large investment NSF intends. I’m not yet prepared to make more specific suggestions on these principles, though I lean toward product leadership (i.e., innovation) as EarthCube’s primary value discipline. However, I do recommend fleshing out the details soon and employing them as evaluation criteria when selecting EarthCube’s lead organization and founding director.

## Resilience through EarthCube’s (Inevitably Difficult) Startup Phase

The NSF funding and program structure for EarthCube, as well as its governance mechanisms, should be designed for resilience despite the inevitable disappointments that accompany startup. Drawing on the history of large-scale NSF initiatives such as NSFnet and Unidata (or drawing on parallels to the early stages of new companies), significant progress toward EarthCube success will exhibit 4- to 8-year latencies, despite the bounty of technical solutions that already exist, as evidenced by the large numbers of white papers.

Resilience in the face of these latencies will require NSF to stay the course in respect to funding and leadership, even as it encounters dissatisfaction from various quarters. Furthermore, if

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<sup>4</sup>Though the Collins’ principles are largely self-explanatory, the one from Treacy-Wiersema deserves elaboration. They assert that every business must attend to all three of the listed value disciplines, but truly successful businesses consistently align their business decision with *one* of the three as *primary*. Oft-cited examples include:

- Walmart, aligning itself toward operational excellence (i.e., efficiency),
- IBM, aligning itself toward customer relations (i.e., intimate knowledge of customer needs) and
- Apple, aligning itself toward product leadership (i.e., innovation).

effective leadership requires saying “no” when the EarthCube risks departing from a “simple, coherent, strategic concept” (per the first two Collins’ principles), then NSF must be prepared to back such actions, even if unpopular.

## Outline of the Foregoing Recommendations

- **A Clear, Measurable Definition of Success in a Specified Target Audience** — This should be established early, with community buy-in.
  - The audience definition should embrace data creators and users across the spectrum of college-level students, educators and researchers in all GEO disciplines.
  - A quantitative definition of success could include high levels of uptake (i.e., many audience members being affected positively by EarthCube) across the GEO disciplines.
  - A qualitative definition could incorporate the ease by which knowledge may be constructed from observed or synthesized data that fall within EarthCube.
- **Clear Assignment of EarthCube Leadership** — This should go to a *single entity* holding overall responsibility for success as above. The selection process should yield an organization and staff:
  - That already is—or, if newly formed, falls within an entity that already is—well established, and has strong records of financial stability combined with broad community service.
  - That has a success record in simultaneous commitments to community governance and effective leadership (in the sense of this paper, including the leadership principles).
- **Enduring NSF Support for the Leadership Model** — This should anticipate significant latency and attendant disappointments in EarthCube success during startup, and it should include making EarthCube funding for other organizations contingent on cooperation with the lead entity as well as compliance with EarthCube standards and policies as maintained by the lead organization.

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