

NSF Investments in Engineering Research Centers

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Engineering Research Centers (ERCs)

Creating Leading Technologies,

Educating Technology Leaders

Mission

- ❖ Discovery, dissemination, and employment of new knowledge and technologies and train a new generation of graduates in service to Industry and the Nation
 - First ERC created - 1985
 - To date 21 ERCs graduated

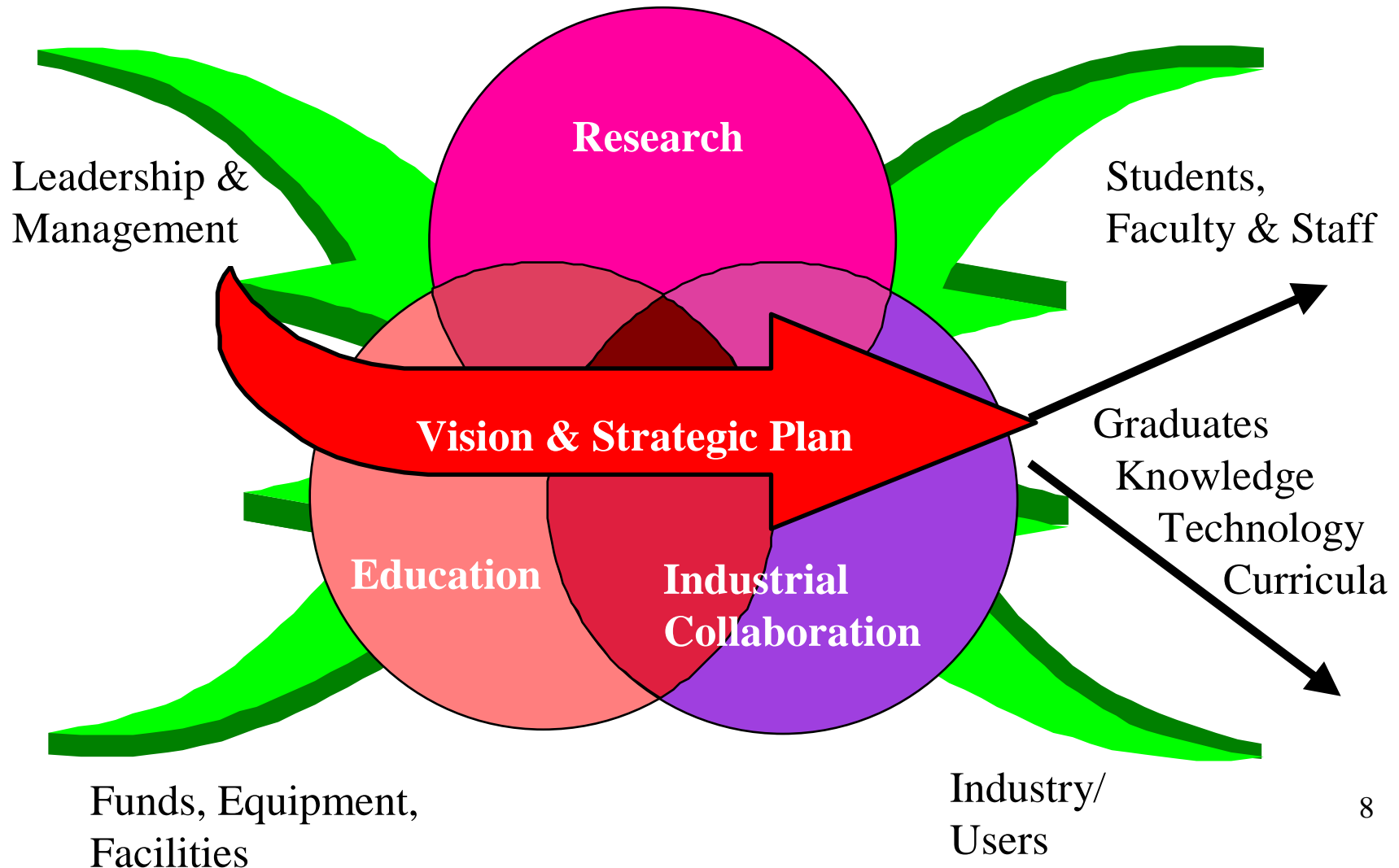
Technological areas of current ERCs

- ❑ Bioengineering - 6
- ❑ Manufacturing and Processes - 5
- ❑ Earthquake Engineering - 3
- ❑ Microelectronics Systems and Information Technology - 8

Goals of an ERC

- Create and sustain integrated, interdisciplinary research environment
- Engineered systems –oriented Research
- Educate a globally competitive and **diverse** engineering workforce
 - Partner academe and Industry synergistically to achieve the goals

An NSF Engineering Research Center A Complex, Interdependent System



Basic Structure of an ERC

- ❖ **Three-way partnership** involving academe, industry, and NSF (sometimes local, state, and other federal agencies)
- ❖ Multi-institutional structure
- ❖ Requirement of minority institution participation
- ❖ Sufficient infrastructure – commitment by lead institution and core partner institutions
- ❖ NSF annual contribution \$3m- \$4m for a maximum period of 10 years

EERC Strategic Framework

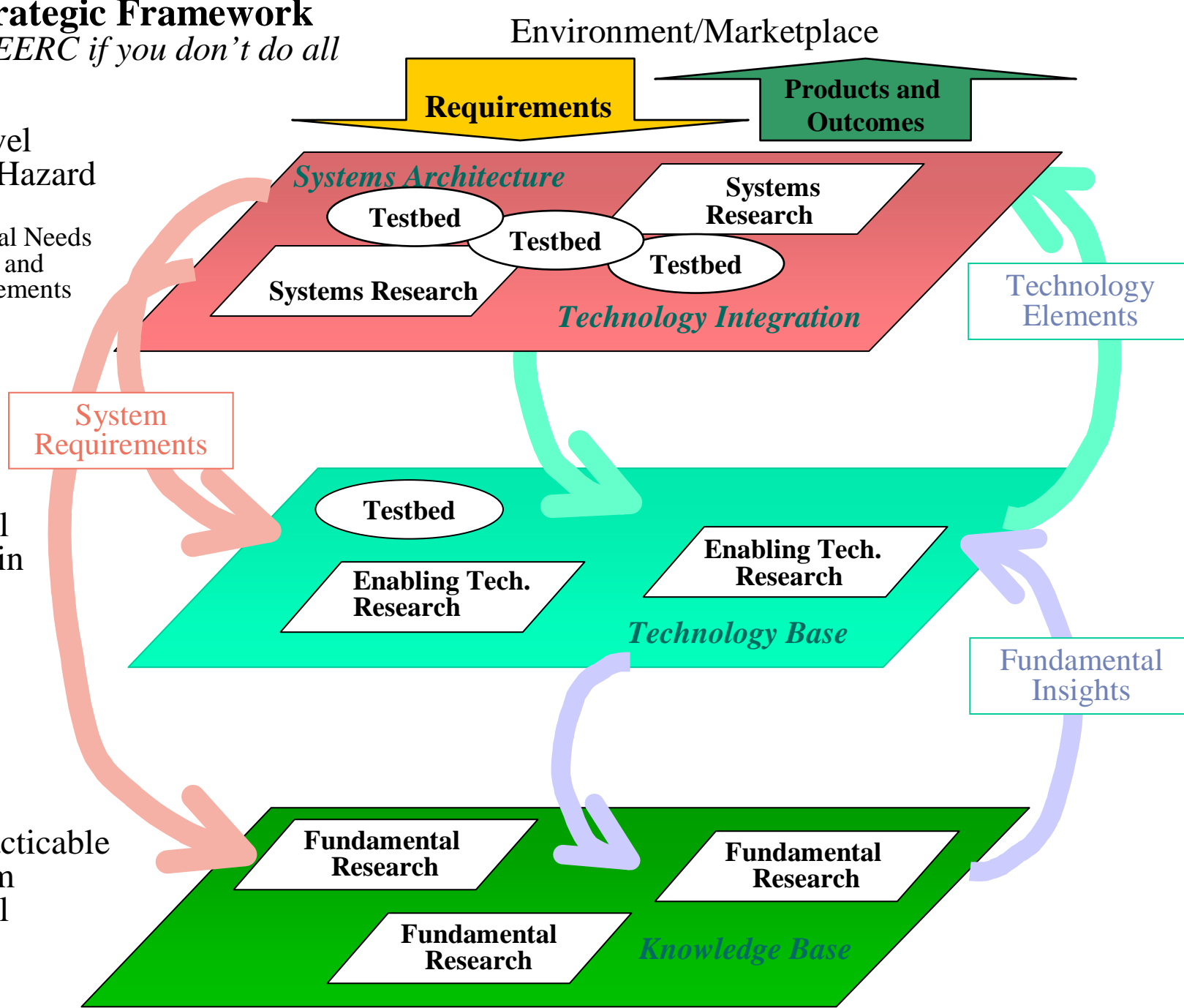
It's not an EERC if you don't do all three

Systems Level
Earthquake Hazard
Mitigation

- Identify Societal Needs
- Define System and System Requirements

Integrate
Fundamental
Knowledge in
Testable
Technology

Develop Practicable
Insights from
Fundamental
Knowledge

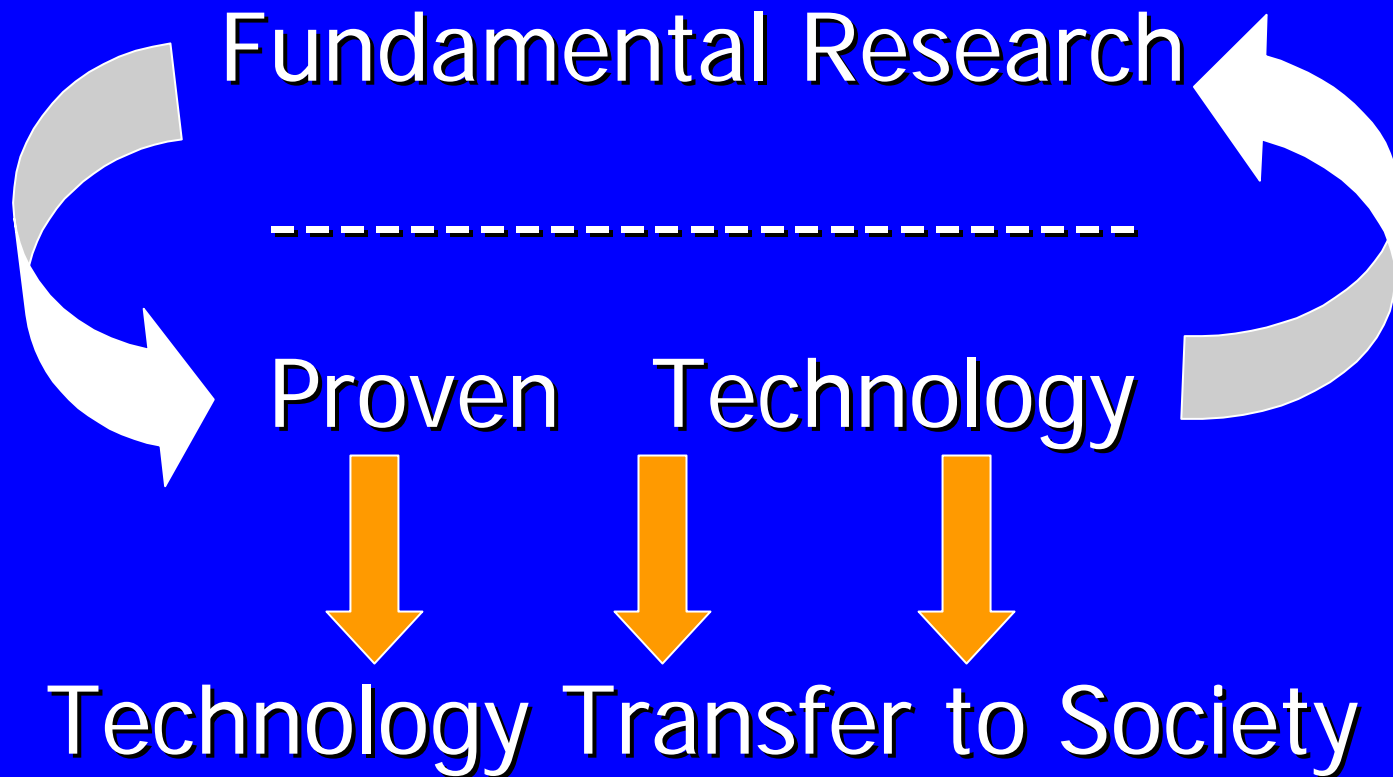


System Requirements

Technology Elements

Fundamental Insights

NSF – ERC Model



Common features of all ERCs

While each ERC is different, all share the following:

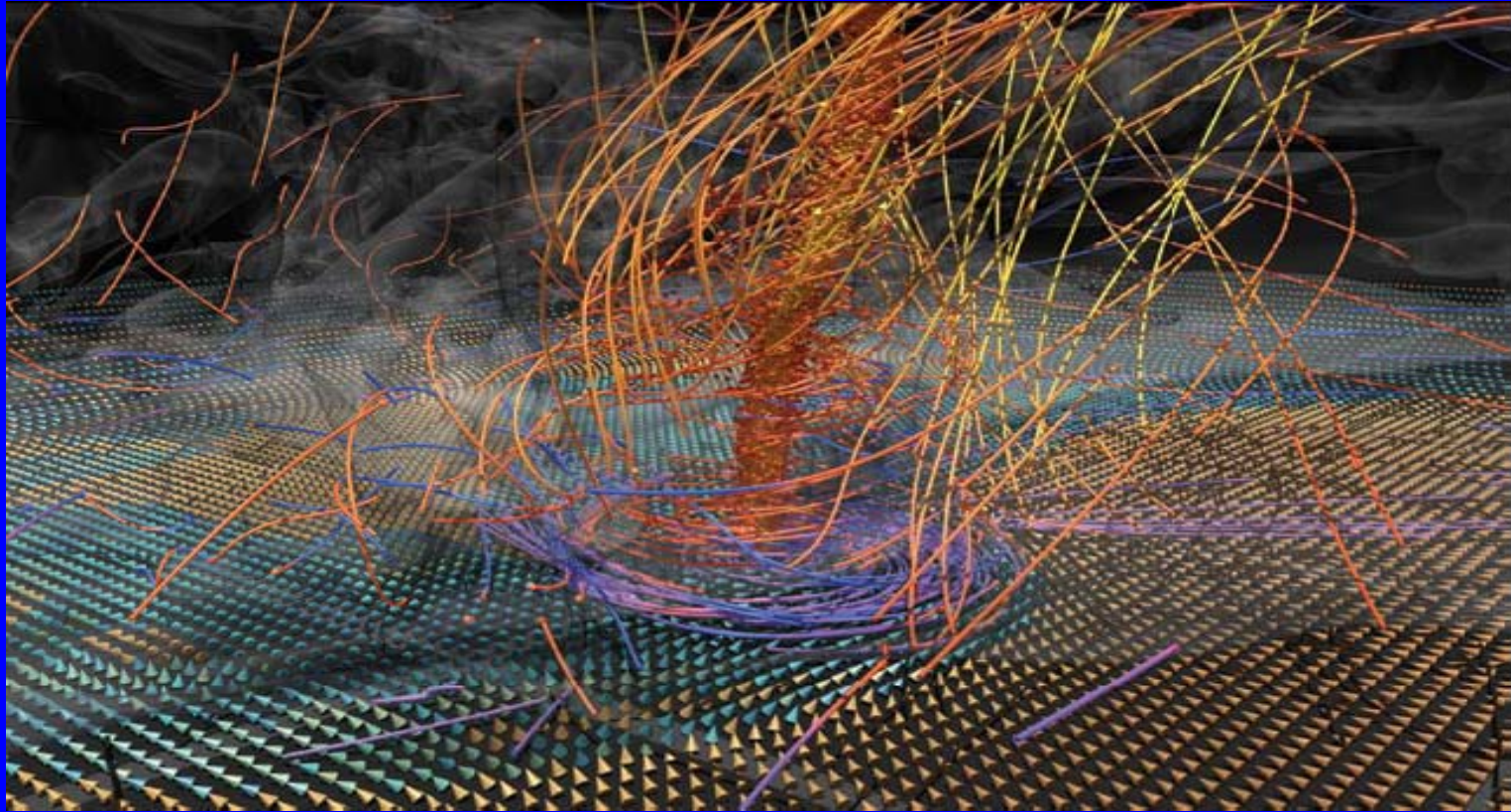
- A long-term strategic vision for an emerging engineered system with potential to spawn new industries or transform processes, service delivery or infrastructure systems;
- A strategic plan enabling the ERC to realize its vision by delivering advances in:
 - i. knowledge,
 - ii. technology,
 - iii. education and
 - iv. a diverse engineering workforce

- C. A research program integrating cross-disciplinary fundamental research to advance technology through proof-of-concept test beds designed to test theory in functioning systems;
- D. An education program that teams undergraduate and graduate students and integrates research results into curricula for pre-college and college students as well as practitioners;
- E. Outreach in research and education that enables a broad base of faculty, college-level undergraduate and graduate students, and pre-college students and their teachers;

- F. Partnership with industry and other practitioners to formulate and evolve the strategic research plan, strengthen the research and education programs, and speed technology transfer;and
- G. A diversity plan that includes efforts to increase the diversity of the ERC's students and faculty at all levels to exceed the national engineering-wide averages through active involvement of groups underrepresented in engineering.

Some Examples of NSF Investments

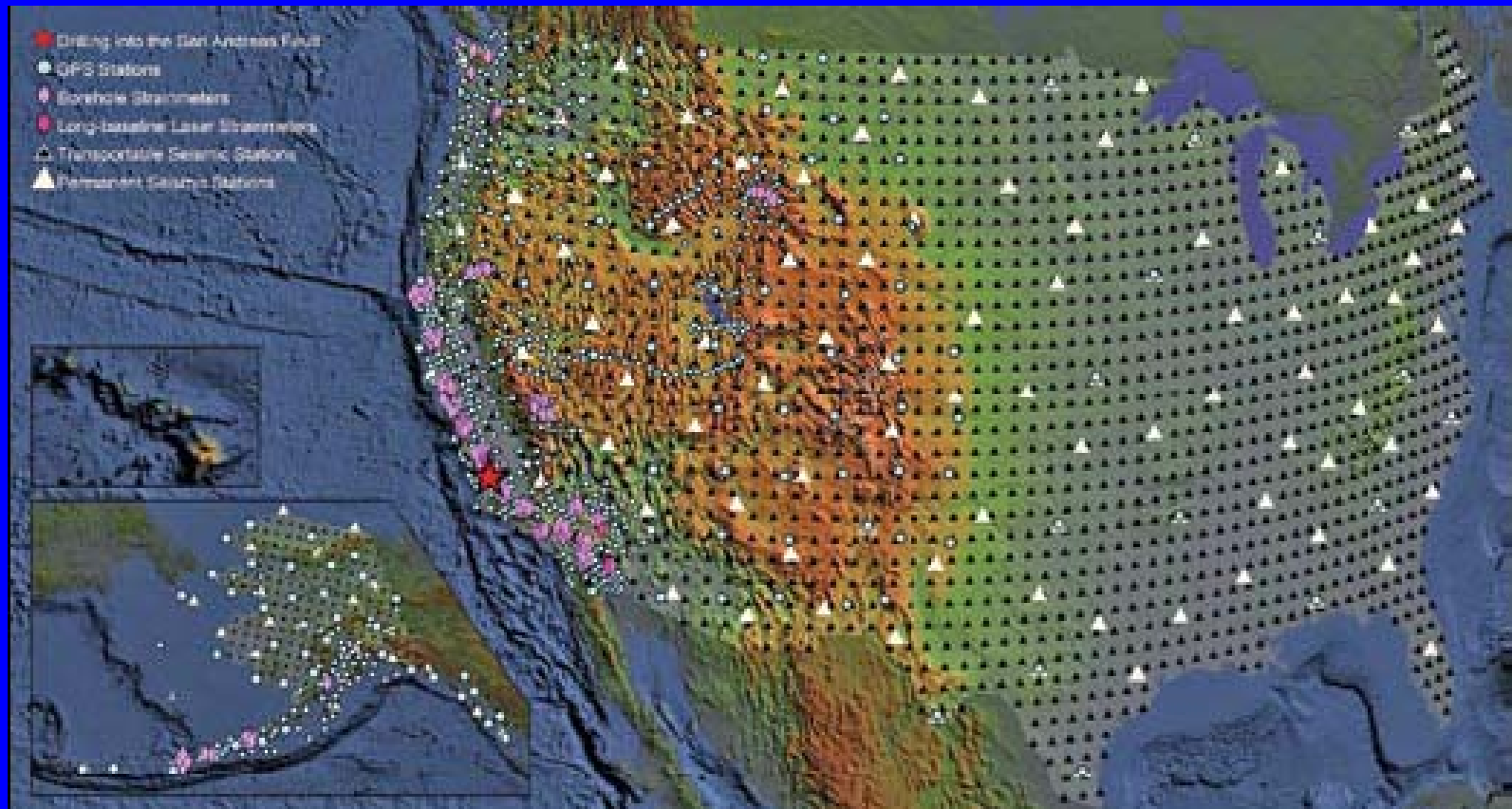
Complex Systems



Computer visualization techniques improve comprehension of complex phenomena such as the formation of tornadoes.

Some Examples of NSF Investments

Earthquake Science and Engineering



The EarthScope program's US Array will provide a comprehensive network of interconnected sensors to explore seismic activity.

NSF Investment – Earthquake Engineering Research

- ❖ Earthquake Engineering Research Centers:
 1. Three Earthquake Engineering Research Centers across US, each with a different focus within the larger seismic risk reduction research area (\$60m NSF funding support with *at least* \$60m matching funding – **past 10 yrs**)
 2. Developed a culture of interdisciplinary research specifically in earthquake engineering and social sciences

NSF Investment – Earthquake Engineering Research

3. Developed a systems level focus to research agenda in seismic risk reduction area
4. Influenced strong partnership with practitioners
5. Influenced code development towards performance based from prescription based
6. Development of new tools and methodologies for seismic hazard risk assessment
7. Influenced development of quantifiable measures of societal vulnerability to seismic hazard risk

NSF Investment – Earthquake Engineering Research

8. Advanced research in interdependencies of infrastructure systems
9. Influenced creating diverse engineering workforce appropriate for the profession
10. Created awareness and interest in earthquake engineering at K-12 level
11. Mentoring of students across three Earthquake Engineering Research Centers

NSF Investment – Earthquake Engineering Research

- Continuing dedicated funding through **NEES-R** in CMMI division
- Continuing annual funding through various programs in CMMI
- Continuing annual funding through other Directorates of NSF

In summary Earthquake Engineering Research has received substantial funding & continues to do so.

Future Expectations

- ❖ Continuity of the Center with:
 - A. Expanded vision
 - B. Financial strength
 - C. Integrated research
 - D. Profound contribution to the profession
 - E. Influence on the education
 - F. Emphasis on creating a globally competitive diverse workforce

*Research and its outcomes contributing to
Tangible and substantial societal benefit*

Thank You