

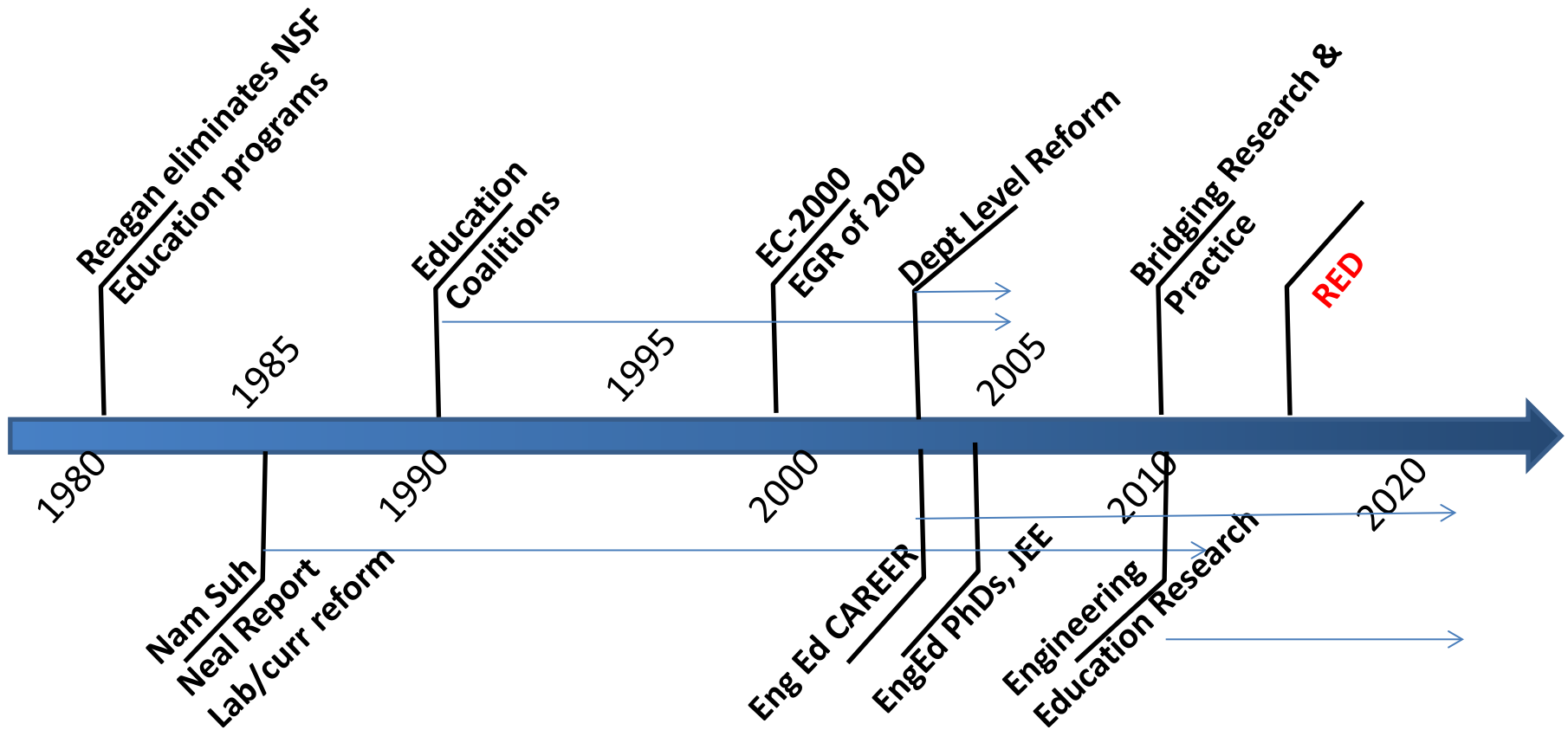
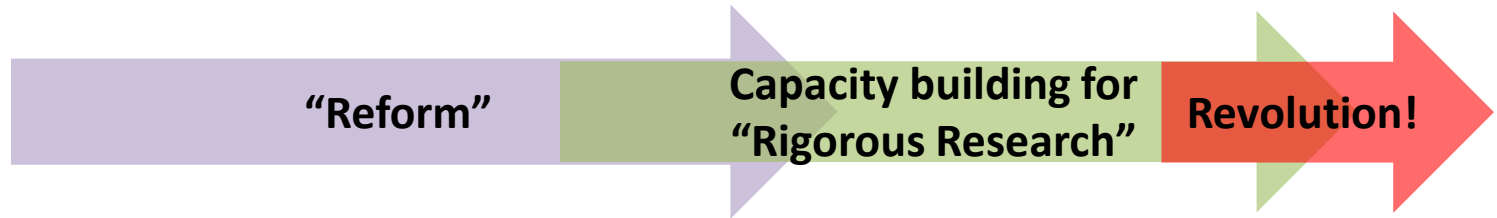
# Revolutionizing engineering and computer science Departments (RED)

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Engineering Education

ENG Advisory Comm  
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# NSF Engineering Education History





# NSF Education Initiatives

- Professional Formation of Engineers (PFE)
  - The formal and informal processes and value systems by which people become engineers.
  - “To form is more ontological than to instruct or educate, for one’s entire being is at stake.”
- Improving Undergraduate STEM Education (IUSE)
  - The key guiding principle of IUSE is to ensure focused, strategic investments that address the greatest challenges in U.S. undergraduate STEM education.

# Engineering Education at NSF

- EEC Programs
  - RED
  - Research in the Formation of Engineers
  - Research Initiation in Engineering Formation
  - Broadening Participation in Engineering
  - REU and RET
  - Workforce development component of ERC
- EHR programs
  - IUSE:EHR; Engaged Student Learning, Institutional and Community Transformation
  - EHR Core
- Crosscutting programs
  - Cyberlearning
  - Cultivating Cultures of Ethical STEM



# Inputs to RED

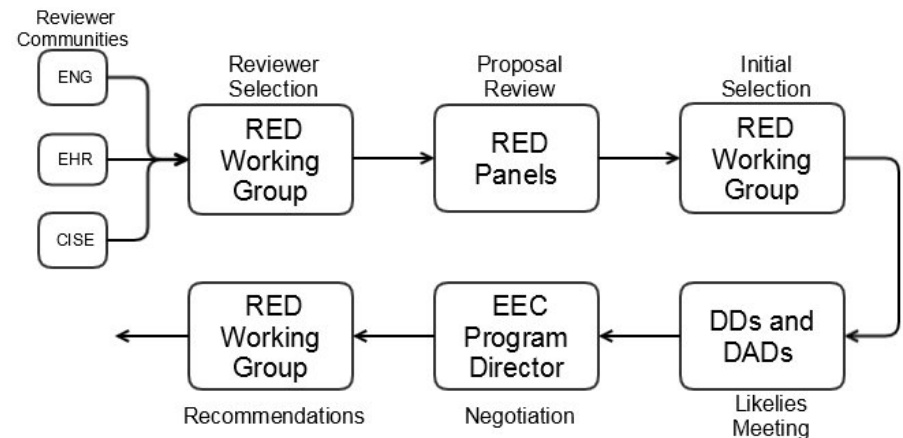
- Engineering Coalitions
  - Reform of first year, senior capstone design
  - Key role of learning communities and faculty engagement with engineering education research
  - Scholarship of teaching not always valued in faculty reward structure
- Department Level Reform
  - Primarily pedagogical changes
  - Local reform, little systemic change
- EEC 2013 COV Report
  - Develop programs focused on implementation at test sites
  - Support larger scale projects to transform the academy



# Cross-Directorate Activity

- RED Working Group members
  - Kamau Bobb, CISE/CNS
  - Glenn Larson, ENG/IIP
  - William Olbricht, ENG/CBET
  - Zhijian Pei, ENG/CMMI
  - Yvette Weatherton, EHR/DUE
- Other staff
  - Daphney Jean, AAAS Fellow
  - LaTanya Sanders-Peak, Program Specialist
  - Susan Watson, Program Specialist

- Funding
  - ENG: \$5M
  - EHR: \$5M
  - CISE: \$2M



# RED Goals

- Support student success in attaining professional formation
- Broaden participation through cultures of inclusion
- Disseminate successful change processes nationally



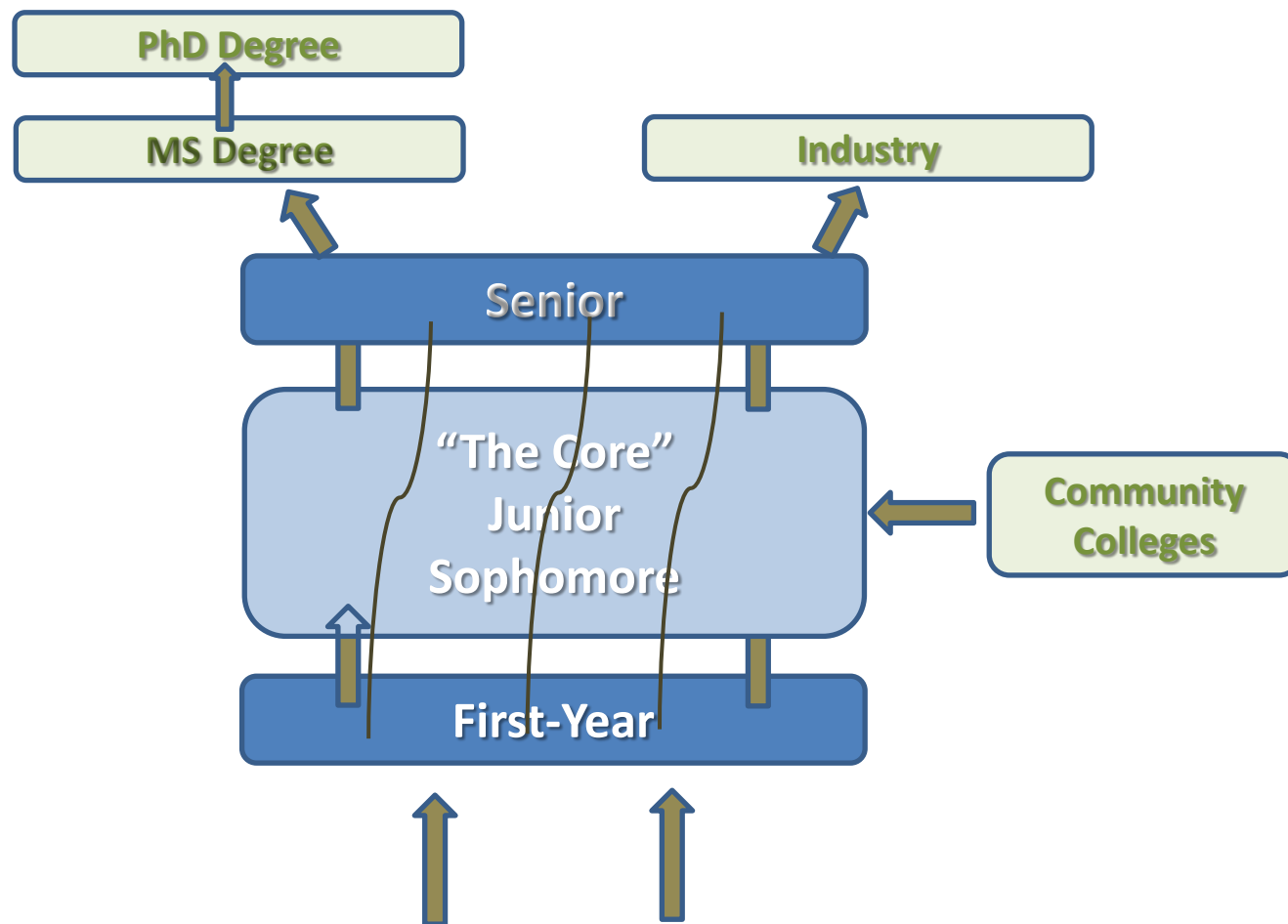
# RED Outcomes

- Fund programs that can serve as exemplars of change
- Revolutionary change to middle two years of undergraduate curriculum
- Connect engineering education research and practice
- Contribute to the literature on change

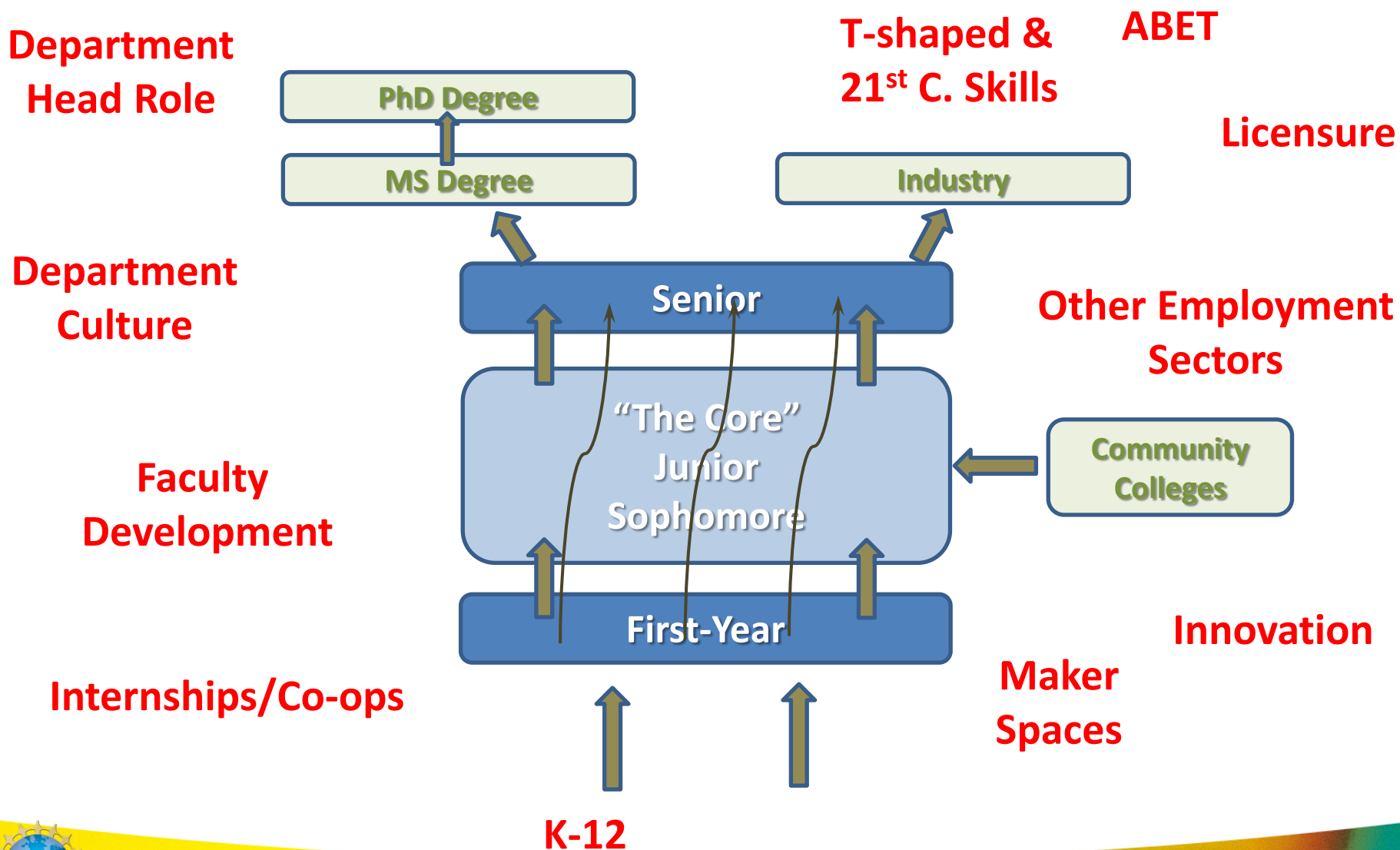





# RED “target point”: the Core



# RED “target point”: the Core



# Key Elements of RED

- Vision
  - Department Chair as PI
  - Appropriate Team
  - Institutional Commitment
  - Connection to Professional Practice
  - Faculty Development Plan
  - Potential for Success and Scalability
  - Connection to Research on Engineering Education
  - Scaling and Adaptation
- 

# RED Visions

- **Arizona State Poly:** Additive Innovation: An Educational Ecosystem of Making and Risk Taking
- **Colorado State ECE:** Revolutionizing Roles to Reimagine Integrated Systems of Engineering Formation
- **Oregon State Chem, Bio, and Env Eng:** Shifting Departmental Culture to Re-Situate Learning and Instruction
- **Purdue ME:** An Engineering Education Skunkworks to Spark Departmental Revolution
- **UNC Charlotte CS:** The Connected Learner: Design Patterns for Transforming Computing and Informatics Education
- **University of San Diego School of Engineering:** Developing Changemaking Engineers





# Creating a Cohort

- EAGER award made to a team from Rose-Hulman and U. Washington
  - Rose-Hulman, Making Academic Change Happen (MACH)
    - Providing resources on change to assist the teams
    - Convening regular teleconferences to discuss challenges and successes
  - U. Washington, Center for Workforce Development
    - Conducting research on the change process across the projects
    - Will provide case studies on how to manage change effectively



# Questions for Discussion

- What is the right role for NSF in the engineering education space?
  - How can NSF help RED awardees transfer results to other institutions, and motivate other institutions to adopt the new knowledge/model?
  - How can NSF sponsor the application and further development of RED-generated knowledge across a range of institutions?
  - What metrics are most important to evaluate the progress of a RED-sponsored project and the RED program overall?
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