



NSF Perspective

DOE Composites Workshop

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About the National Science Foundation



The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense..."

More info at www.nsf.gov

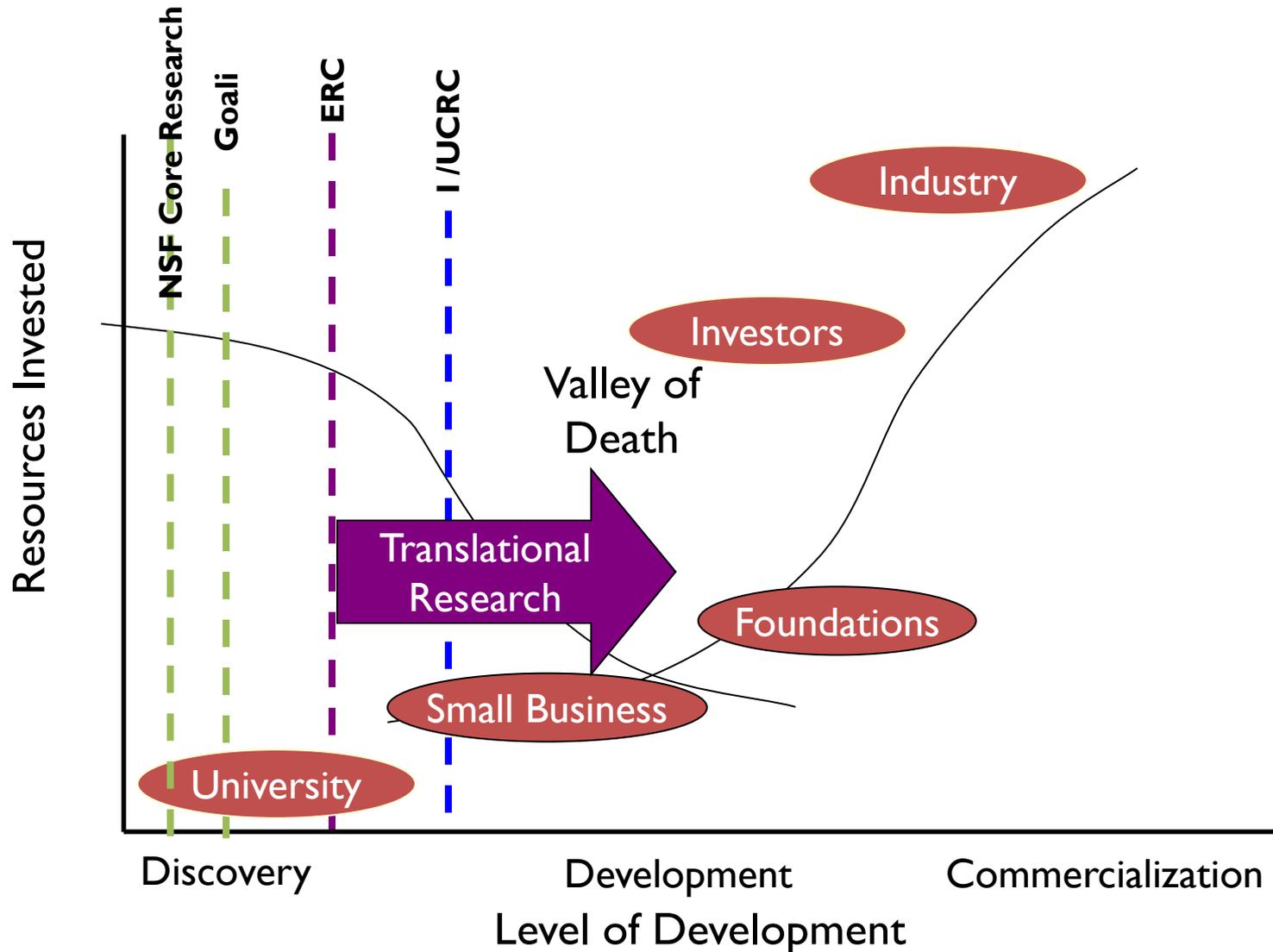


Advanced Manufacturing Research

Our role in the “ecosystem”

- NSF supports fundamental research and early innovation
- Historically NSF has supported frontier research that has led to transformational advances in manufacturing
 - Additive manufacturing grew out, in part, from basic research investments in the 70's/80's
 - MEMS enabled by fundamental research in mid-80s (NSF & DARPA)
- Present research extends traditional advances and builds upon convergence of trans-disciplinary advances
 - National Robotics Initiative (NRI): towards autonomous systems
 - Cyber-Physical Systems (CPS): smart manufacturing
 - Materials design (DMREF / Material Genome Initiative)
 - Materials Discovery
 - Processes
 - Bio-manufacturing
 - Sustainable Manufacturing
 - Nanomaterials and Nanomanufacturing

The Innovation Spectrum and Where NSF Programs Reside



Advanced Manufacturing Research

“How” we invest



- “Core” research programs: unsolicited research supported by individual programs from across NSF (opportunities for collaboration with industry (GOALI))*
- Solicitations and “Dear Colleague Letters” :Targeted research in specific areas generally crossing multiple Directorates (e.g. nanomanufacturing, national robotics initiative, cyberphysical systems, etc.)*
- Research Centers (I/UCRCs, ERCs, MRSECs, STCs, etc.)
- Innovation Programs (iCorps, Partnership for Innovation, etc.)
- Research Facilities: National Nanotechnology Infrastructure Network
- SBIR/STTR: Funding to commercialize promising technologies

* A complete list of relevant programs and solicitations can be found at www.nsf.gov



NSF-relevant questions for Proposed Research Projects (also stated: how we look at proposals)

- **Intellectual Merit**
 - Is the work research? Or is it development?
 - Are there fundamental knowledge gaps?
 - Are the barriers scientific or economic?
 - Of these, what are the most important basic research questions that need to be resolved?
 - What opportunities now exist? What's new?
- **Broader impacts of proposed research**
 - Education? Broadening Participation?
 - Translation of research into technological products?
 - Will it address national priorities?



Key Scientific Drivers Affecting Advanced Mfg. Research

- **Nano** –
 - Improving understanding and new tools at the atomic and molecular scales
 - Manipulation and design
- **Bio/Med** –
 - Interaction of engineered systems and biology at all scales – DNA to cells to organisms to eco-systems
 - Convergence of life sciences, physical sciences, and engineering
- **Computing** –
 - Computational modeling, simulation, optimization, pervasive in all fields of engineering
 - Networks and computation deeply integrated into engineered systems
- **Behavioral/economic/cognitive**
 - Human behavior in engineered systems and technology
 - Regulatory issues
- **Systems science** –
 - Multi-scale analysis, design, and optimization
 - Integration of engineered components (including cyber)
 - Range from nano to micro to macro
 - Few to billions
- *Design, creativity, aesthetics, ...*

Some open research challenges for composite materials and manufacturing



- Capturing relevant physics and chemistry to capture materials response – materials discovery through processing through service and end-of-life
- Theoretical models that will correctly describe the underlined physics (e.g. failure theories, process models, etc.)
- Appropriate and usable integrated computational analysis tools
- Linkage to Systems / Design / Optimization
- V&V Strategies; Design with uncertainty
- New approaches for education and training

What are some possible programs composites research at NSF?



- Support from multiple core research programs in the Division for Civil, Mechanical, and Manufacturing Innovation
 - <http://www.nsf.gov/div/index.jsp?div=CMMI>
- New Design of Engineered Materials Systems Program (DEMS)
 - http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504809
- Cross NSF program: Designing Materials to Revolutionize and Engineer our Future (DMREF)
 - <http://www.nsf.gov/pubs/2014/nsf14020/nsf14020.jsp>
- Cross NSF program: National Robotics Initiative
 - http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503641



NSF Industry-University and Innovation Programs Relevant to Advanced Manufacturing

- Grant Opportunities for Academic Liaison with Industry (GOALI)
Supports collaborations with Industry.
 - <http://www.nsf.gov/pubs/2012/nsf12513/nsf12513.htm>
- iCorps:
 - http://www.nsf.gov/news/special_reports/i-corps/

Centers:

- Engineering Research Centers (ERC)
 - http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5502&org=EEC
- Industry/University Cooperative Research Centers (I/UCRC)
 - <http://www.nsf.gov/eng/iip/iucrc/>

SBIR/STTR: <http://www.nsf.gov/eng/iip/sbir/>



Thank You!

Please visit www.nsf.gov for more information on NSF programs, funding opportunities, and active awards.