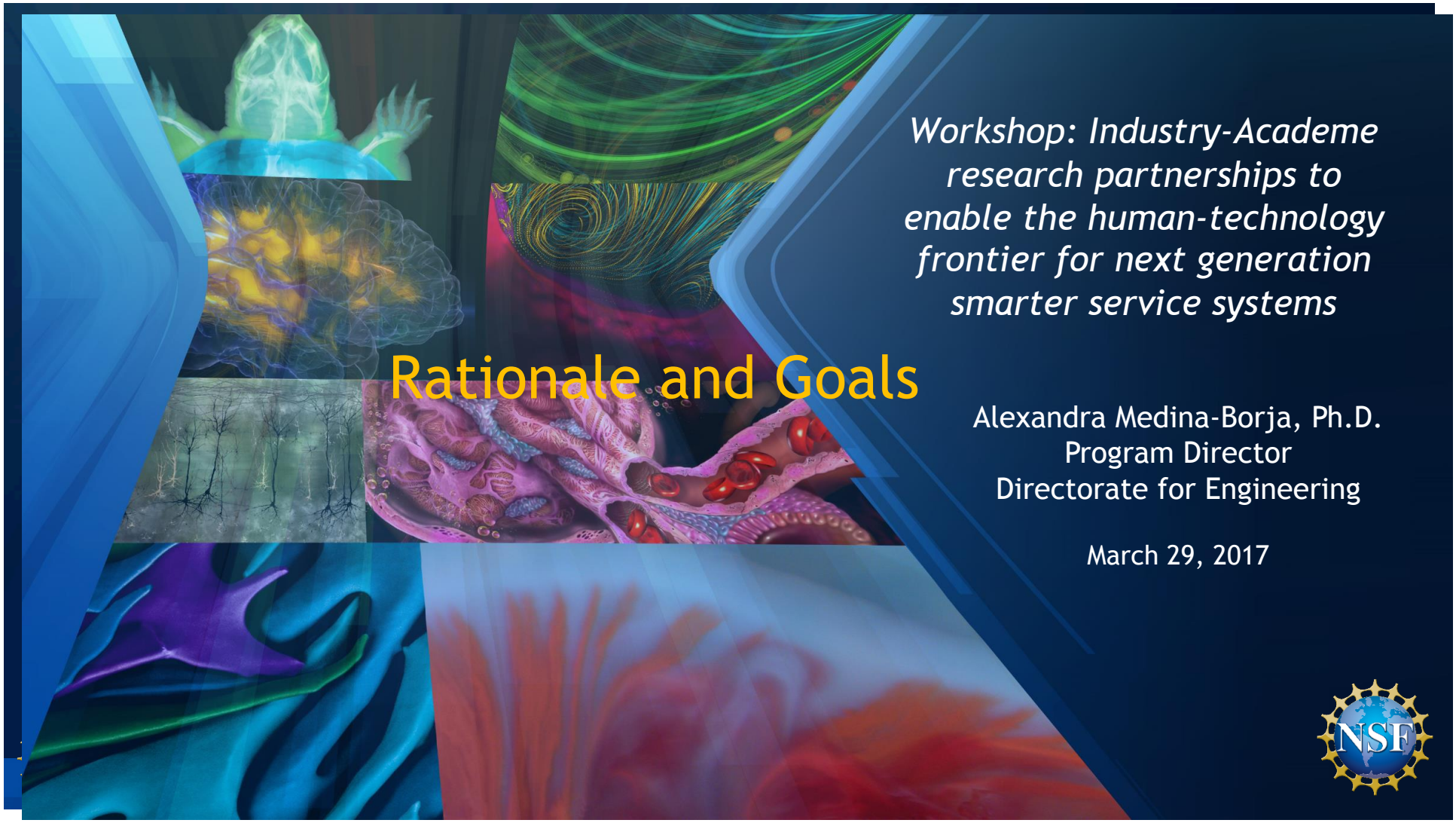
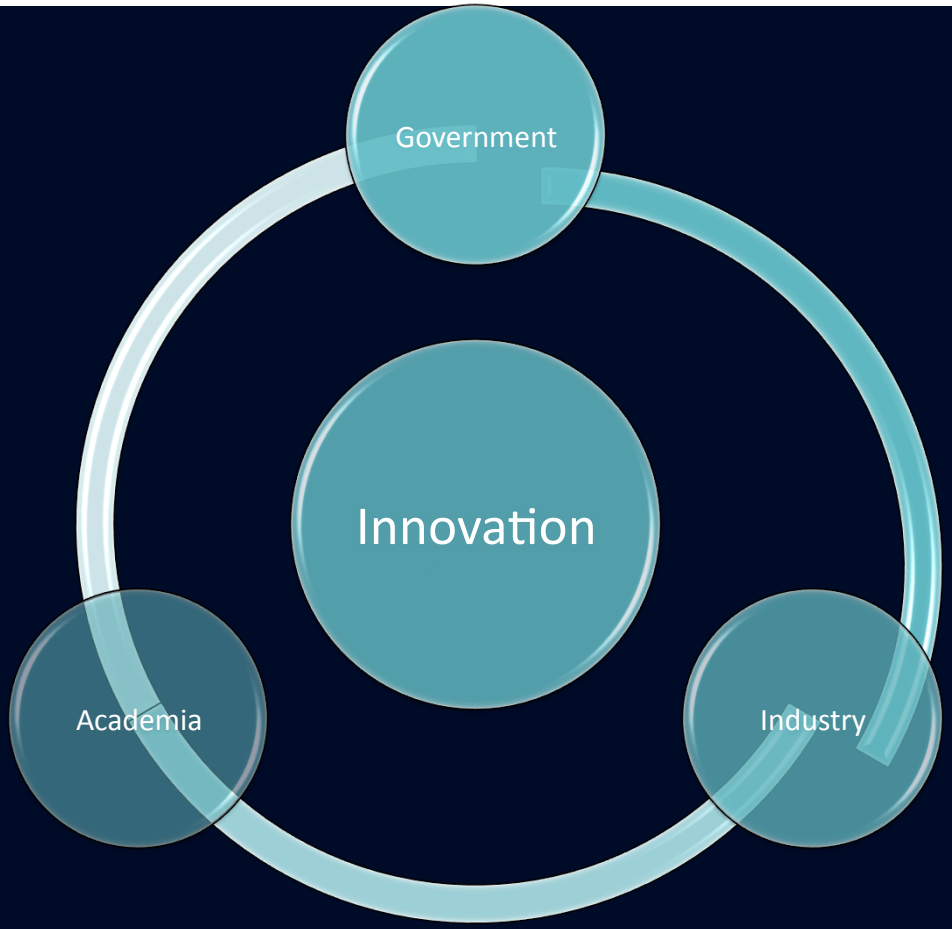


Workshop: Industry-Academe research partnerships to enable the human-technology frontier for next generation smarter service systems

Rationale and Goals

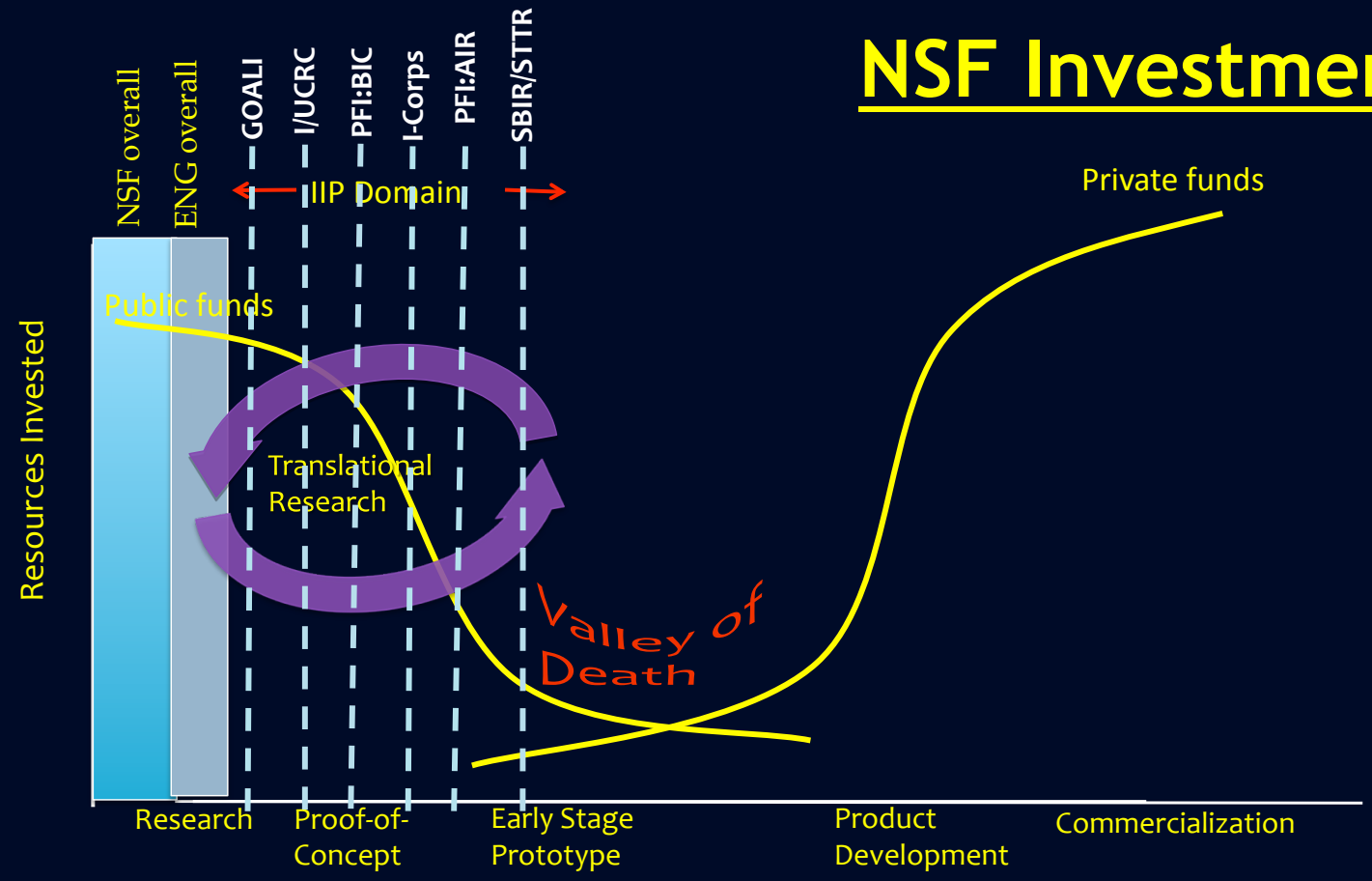
Alexandra Medina-Borja, Ph.D.
Program Director
Directorate for Engineering

March 29, 2017

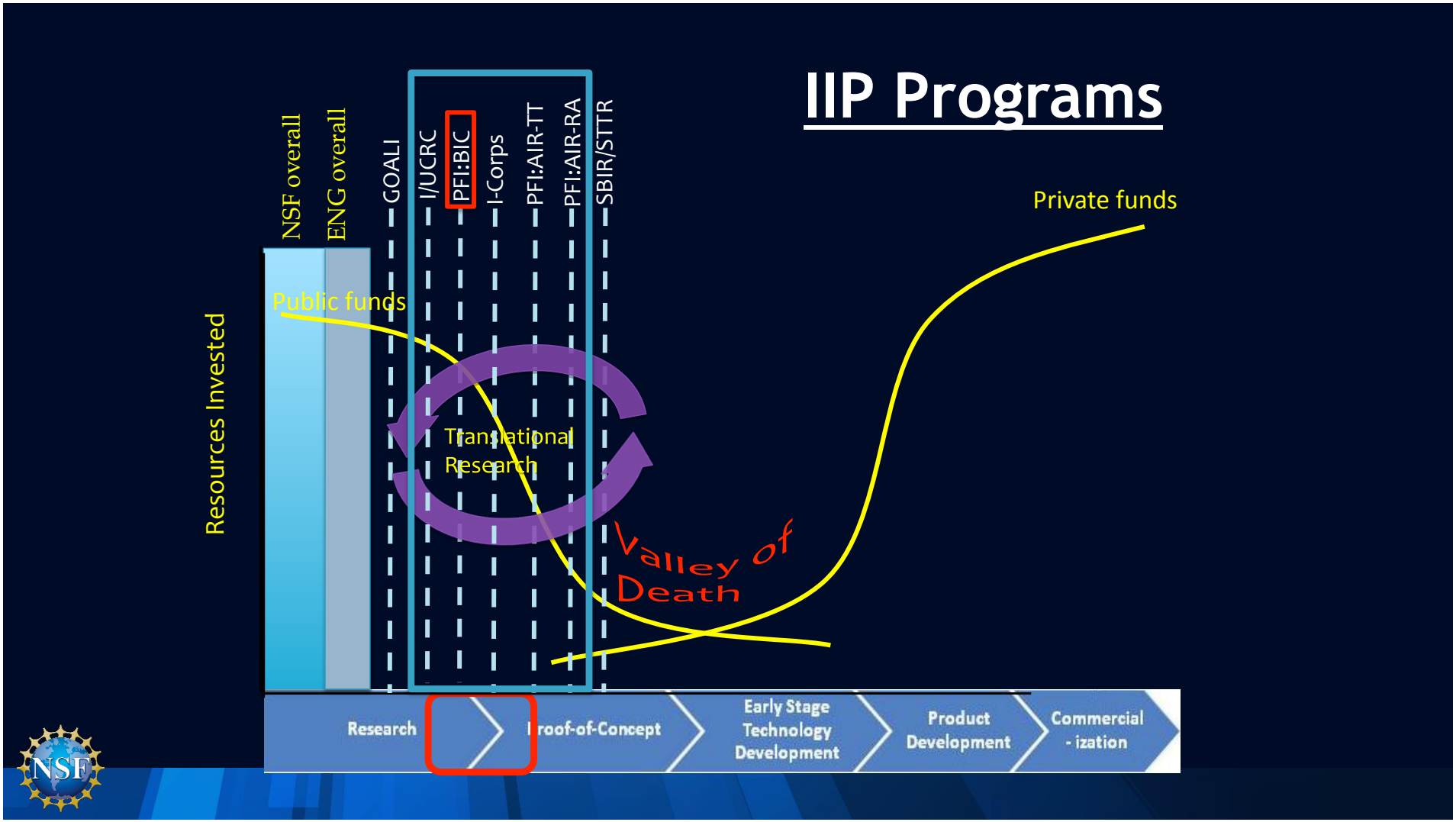


"Focus attention on research/technologies that neither industry nor academia are working on at the moment but that may be necessary to enable the next generation of service systems. " ISSIP workshop proposal

NSF Investments



IIP Programs



Past research investments are bearing fruit today

Wearable robotic glove restores independence for stroke victims

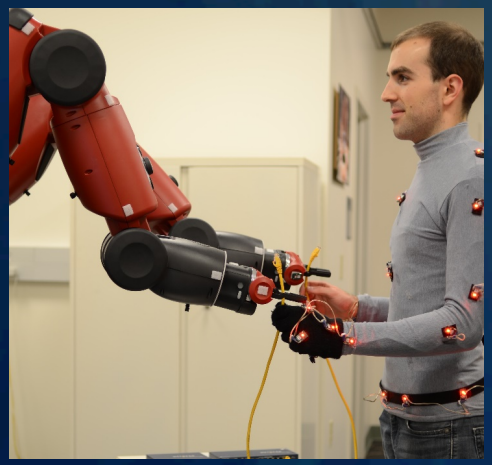
Transformative advances in manufacturing enable a new model for small business

Smart prosthetic arm and hand with sense of touch

NSF projects foster human-technology partnership

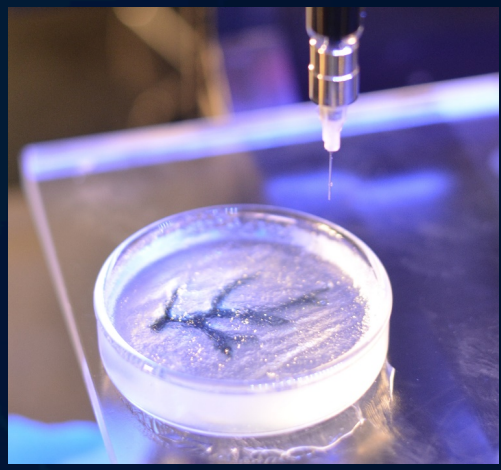
Today's investments will shape the future workplace

NSF recognizes the importance of meaningful work to the national quality of life



Cooperative robot learns to work with human partner

Intelligent meeting room increases productivity

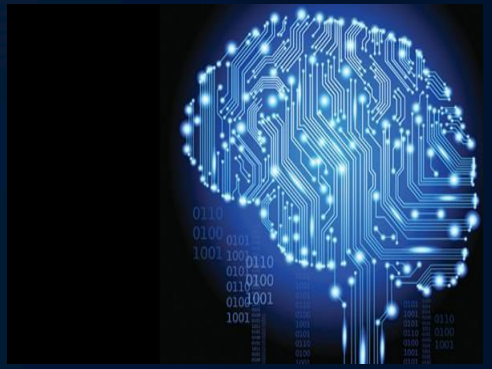


3D printing of complex, soft, and living materials

Machines → Smart Machines → Human Centered Cognitive Engineered Systems

- Achieve functionality
- Improve productivity/ consistency/ quality

- Achieve functionality
- Improve productivity/ consistency/ quality
- Has some learning/ decision making capacity



- Achieve functionality
- Improve productivity/ consistency/quality
- Has greater learning/decision making capacity
- Collaborate with humans
- Evolve in time as they learn

Short-term forces are driving technology innovation

WSJ

Carnegie Mellon Reels After Uber Lures Away Researchers

Uber staffs new tech center with researchers poached from its collaborator on self-driving technology

BBC NEWS

Japanese insurance firm replaces 34 staff with AI

CBS

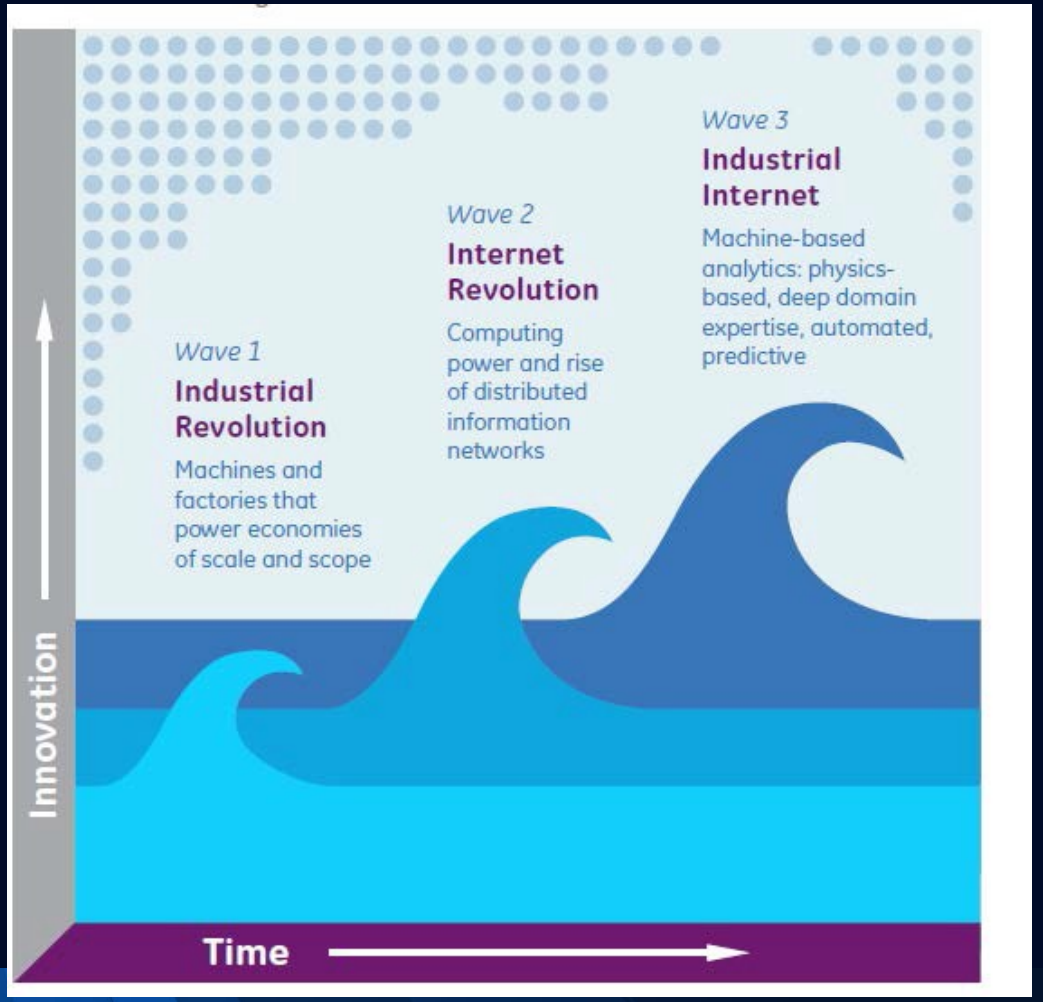
Uber Self-Driving Cars Hit The Streets Of Pittsburgh

The Atlantic

How to Protect Workers From Job-Stealing Robots

A long-term vision is urgently needed

"The deeper meshing of the digital world with the world of machines holds the potential to bring about profound transformation to global industry, and in turn to many aspects of daily life, including the way many of us do our jobs."

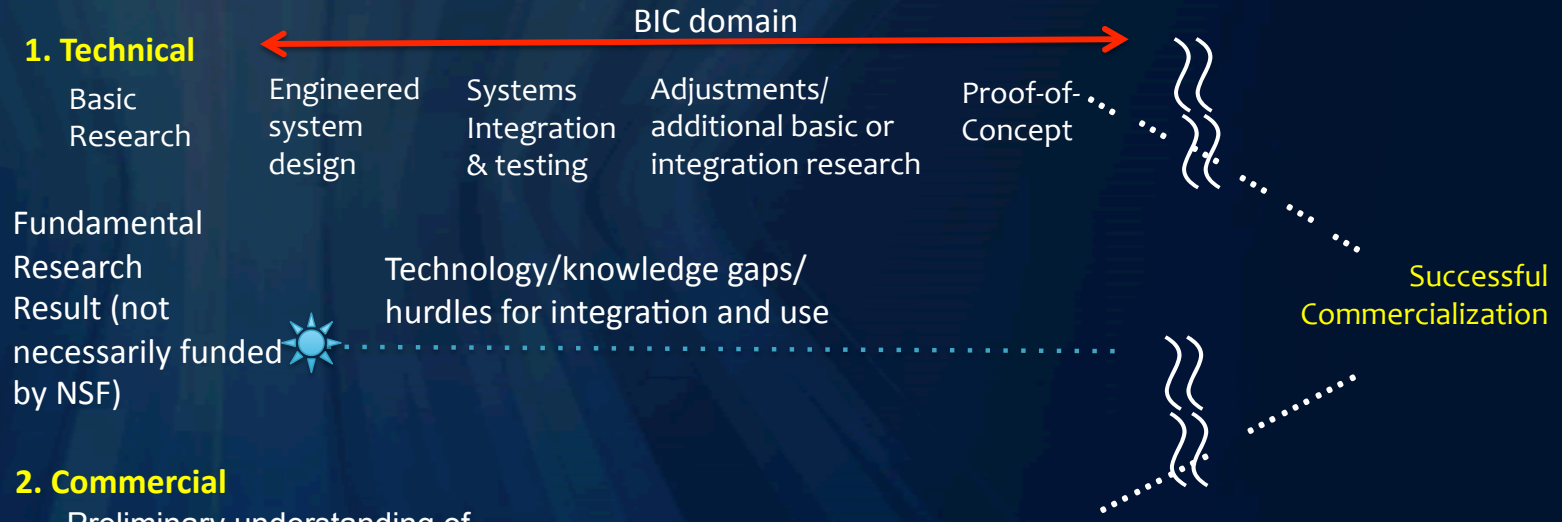


Source: Industrial Internet: Pushing Boundaries of Minds and Machines, GE.

NSF's Partnerships for Innovation Program

- 2002 to 2017 solicitation-based
- Lead: academic institution with industrial partners focusing on translational research
- At least 6 different solicitations/models for partnerships over the years
- Last 4 years focused on "human-centered" smart service systems

Partnerships for Innovation: Building Innovation Capacity in - Smart Service Systems



http://http://www.nsf.gov/eng/iip/pfi/bic.jsp

A [NEW] Service PARADIGM

- Any engineered system or artifact that interacts with, and provides a benefit to humans, is the facto providing a “service”
  - a metaphor for value-added interactions of humans with technology

Photo credits: mitre.org

Looking Ahead: Ten Big Ideas

Navigating the New Arctic

Harnessing Data for 21st Century Science and Engineering

Work at the Human-Technology Frontier: Shaping the Future

RESEARCH IDEAS

Understanding the Rules of Life: Predicting Phenotype

The Quantum Leap: Leading the Next Quantum Revolution

Windows on the Universe: The Era of Multi-messenger Astrophysics

PROCESS IDEAS

Growing Convergent Research at NSF

NSF-Includes: Enhancing Science and Engineering through Diversity

Mid-scale Research Infrastructure

NSF 2050: Seeding Innovation

Work at the Human-Technology Frontier: Shaping the Future

- A bold initiative to catalyze interdisciplinary science and engineering research at the intersection of behavioral and cognitive science, physics, mathematics and computer science and engineering to
  - understand and build the human-technology partnership;

Convergence of Disciplines

Engineering (electrical, mechanical, systems

Physical & Mathematical modeling and statistics

Behavioral, cognitive science

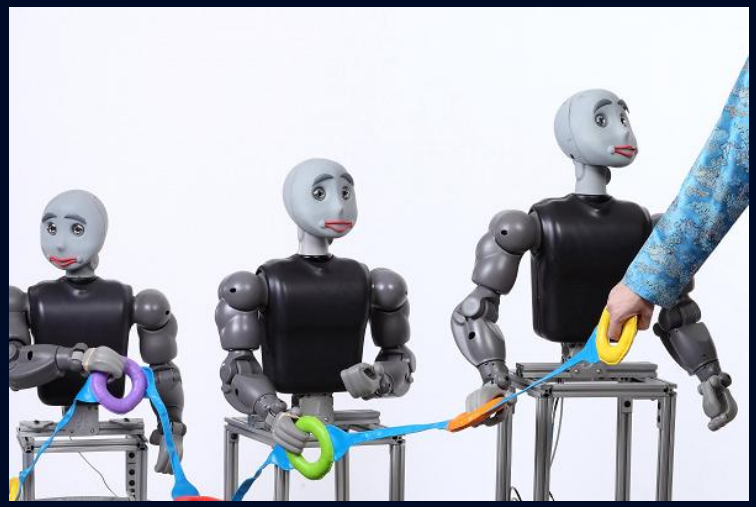
Computer and Information Systems

Human-computer interaction/ Human Factors Engineering

Theme 1. Human-Technology Symbiosis

Understanding and building a harmonious human-technology ecosystem

External electrical stimulation of leg muscles allows paraplegic individuals to cycle

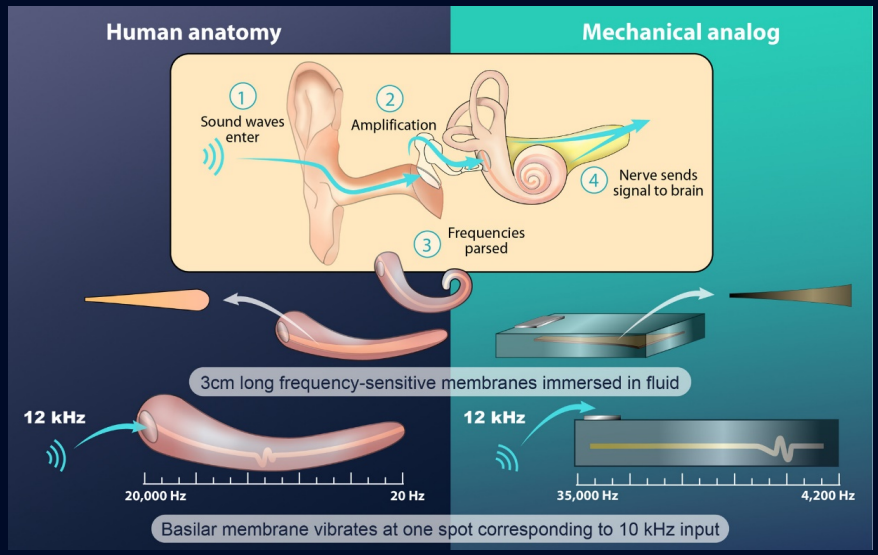


Expressive robots reach out to engage autistic children

Theme 2. Augmenting the Individual

Personalized technology for performance

Soft robotic exoskeleton for strength and endurance



Duplicating the acoustic performance of the human cochlea with a micro system

Theme 3. Fostering Lifelong and Pervasive Learning with Technology

Dashboard for teachers

Virtual reality training simulation

What research questions/ problems/themes require attention (that industry and academe are not yet doing) to move us towards a more genione human-technology partnership? What technologies need to be developed?

Questions or Comments?