



SYSTEMS ENGINEERING
Research Center

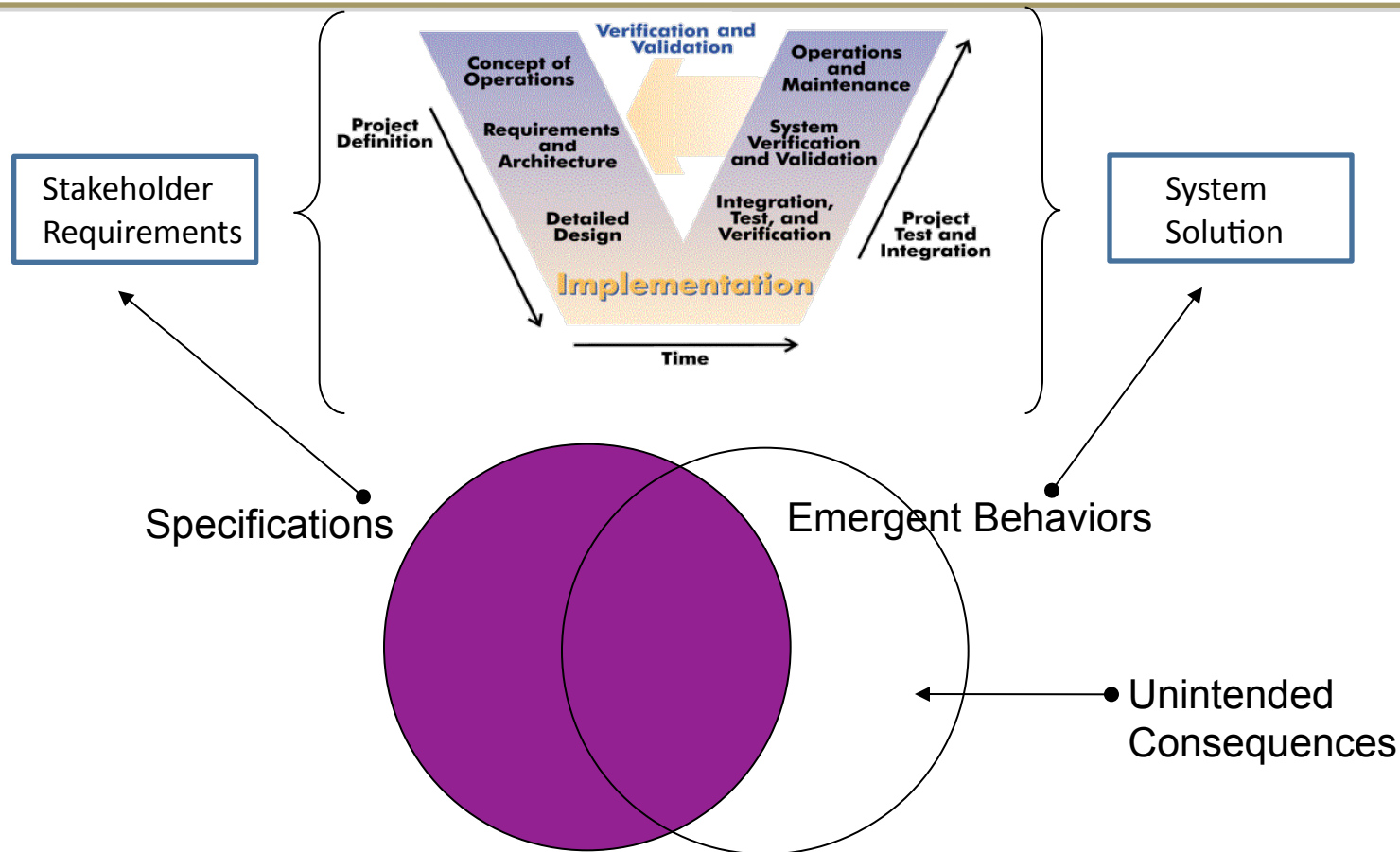
A US DoD University Affiliated Research Center

**SERC Research Council (RC) Panel:
The Future of Systems Engineering (SE) Research**

November 9, 2010

Barry Boehm, USC
Abhi Deshmukh, Texas A&M
Barry Horowitz, U. Virginia
[Bill Rouse, Georgia Tech]
Jon Wade, Stevens Institute

Moving from Newtonian to Hurwiczian SE



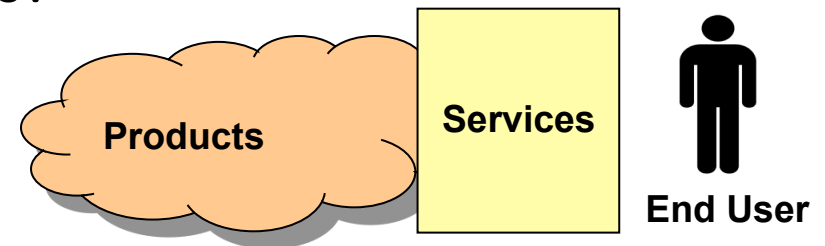
- What are the **fundamental limits** of prediction in SE approaches?
- Is there an equivalent of **Heisenberg Uncertainty Principle for SE**?
- What is the relationship between **predictability and SE mechanism**?
- Is there a **right mechanism (game) for a specific acquisition**?

Moving from Newtonian to Hurwiczian SE

- **Trends:** Coopetition; Global sourcing; Increasing complexity of systems and acquisition processes; Shorter product cycles
- **Need-capability gaps:** Errors in prediction, cost and schedule overruns, limited incentives to improve productivity
- **Research initiatives needed:**
 - Methods and tools to design SE mechanisms
 - Viewing evolutionary acquisition process as a series of games
 - Methods and tools to design optimal incentives
 - Incentive compatibility
 - Methods and tools for effective coopetition
 - Information and knowledge sharing with competitors

Next Generation Enterprises

- Are the following services or products?
 - Energy: Petroleum, Electricity
 - Computing: Laptop, TeraGrid
 - Music: CD, iTunes
 - Airplane Engines: Turbo-Prop, GE Jet Engine



- **There is plenty of room at the bottom**

(R. Feynman 1959)

- Nano-Bio convergent enterprises
- Measurement and control
- Redesigned supply networks

- **Healthcare enterprises**

- Individualized model of each human being for targeted healthcare
- Predictive healthcare
- Just-in-place therapeutics

- **New energy enterprises**

- Renewable sources
- Bio-based energy generation (algae)

- **Designing new services**

- CAD for services
- Scalability, customization and on-demand access

- **Personalized services**

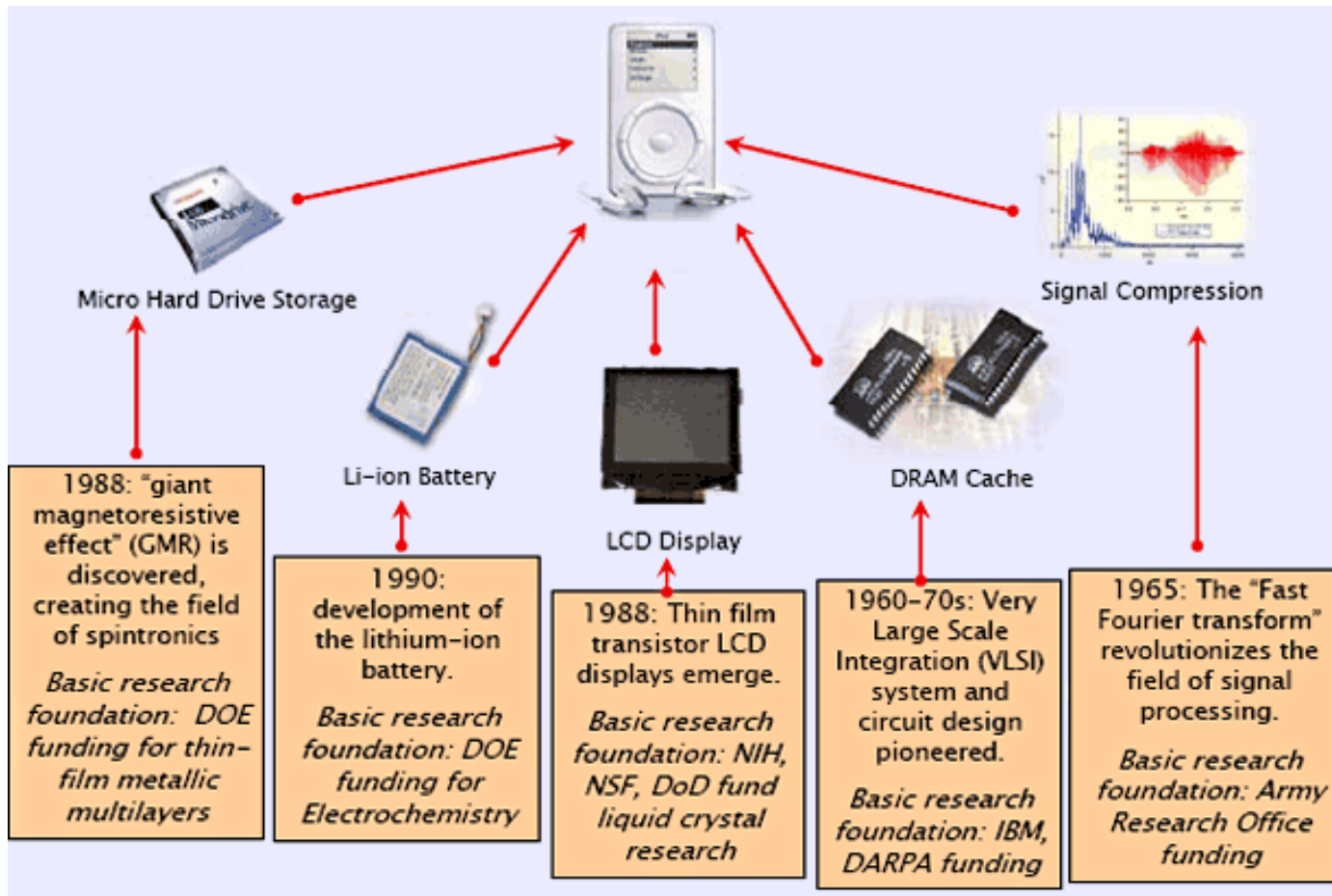
- Tailored computing
- University for one (you)

Next Generation Enterprises

- **Trends:** Close coupling between products and services; Personalization; Instantaneous delivery; Rapid concept – market – grave cycle
- **Need-capability gaps:** Long design cycles, expensive (and limited) infrastructure for global delivery; not affordable; difficult to manage
- **Research initiatives needed:**
 - Rapid design and fielding of coupled products and services
 - Next generation enterprise management methods
 - Global instantaneous delivery at competitive cost
 - New SE methods and processes for affordable acquisition of coupled products and services

Science of Innovation

Who is responsible for the iPod?



- Models of the Innovation Process
- Speeding the Discovery – Product Loop
- SE Mechanisms that Promote Innovation

