Technology Infrastructure Needs for Advanced Manufacturing Robotics and Automation

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 Troy Scott
 tjscott@rti.org
Economic Analysis of Technology Infrastructure Needs

For the Economic Analysis Office, National Institute of Standards and Technology (NIST)

Advanced Manufacturing Applications of:

- Smart Manufacturing Processes
- Additive Manufacturing (3D Printing and R2R)
- Advanced Robotics and Automation

Ask: What are the barriers to the development and adoption of new technologies in these areas, and how can NIST help to overcome these barriers?
Technology Infrastructure

Broad base of quasi-public good technologies and technical knowledge that supports firms’, universities’, and laboratories’ R&D

Three elements: infratechnologies, technology platforms, and proprietary technologies.

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- Technology platforms
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- **Infratechnologies**
- Technology platforms
- Proprietary technologies

  - Measurement and test methods
  - Standard reference materials
  - Scientific and engineering databases
  - Standards for physical and functional interfaces between components of systems technologies
  - **Examples for robotics?**
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- **Infratechnologies**
- **Technology platforms**
- **Proprietary technologies**

Precompetitive proofs of concept, foundational to a range of products or processes. For example:

- Complementary metal oxide semiconductor (1960s)
- Graphene or other “new” logic switch
- **Examples for robotics?**
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- Infratechnologies
- Technology platforms
- **Proprietary technologies**

  Commercialized products, processes, and services, which may be
  - derived from technology platforms
  - influenced by infratechnologies
Advanced Robots

- Are mobile (no longer bolted to the floor)
- Operate in unstructured or uncertain environments (autonomous)
- Are designed to manipulate or physically interact with their environment
- Are capable of achieving desired outcomes without needing a fully preprogrammed precise set of actions for achieving those outcomes
- Are able to safely perform tasks in intimate operation with humans or in extremely hazardous environments

This is where manufacturers now want to go with robotics.
What we have heard so far

- Standards and guidelines for safe human-robot interaction
  - Power-limiting or force-limiting
  - Speed and separation monitoring
- Sensing and perception for unstructured environments
  - Limitations of sensors and internal logic to react to sensory input
- Standard metrics and test protocols to characterize capabilities
  - Need for objective data on performance attributes of systems
- Universal standards for interoperability
  - Toward USB-like plug-and-play
  - PackML, a communication protocol like IPv6
- Intuitive interfaces
  - Need to make programming easier, reduce need for specialized training
Your insights are valuable

If you would like to share your insights and perspectives for this project, please contact me.

Troy Scott
tjscott@rti.org
919.541.7405

Thank you!