



# The Role of ENG in DDDAS

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# Dynamic Data Driven Applications Systems (DDDAS)

- DDDAS is a promising concept in which the computational and measurement aspects of a real-time simulation are dynamically integrated, creating new capabilities for analysis and prediction in complex systems
- The DDDAS concept holds the promise for accurate and reliable analysis and prediction capabilities that will enable decision making in complex systems
- Many areas of national importance are likely to benefit from DDDAS



# DDDAS Basic Building Blocks

- A hierarchy of heterogeneous simulation models
- A system to gather data from archival and dynamic sources
- Algorithms to analyze/predict system behavior by blending simulation models and data
- Algorithms to steer and control the data gathering and model validation processes
- The software infrastructure supporting model execution, data gathering, analysis/prediction and control algorithms



# Engineering in DDDAS

- Engineering investigators and students possess
  - Imagination and domain knowledge to help identify applications with societal impact
  - Domain knowledge to conceive and develop the appropriate simulation models
  - Experience with sophisticated measurement systems and sensor networks
  - Experience with elaborate strategies and algorithms for prediction, optimization, and control
- Partnerships with computer science colleagues are necessary for success



# Examples of Areas of Impact

- Hazard prevention, mitigation and response
  - Earthquakes, hurricanes, tornados, wild fires, floods, landslides, tsunamis, terrorist attacks
- Critical infrastructure systems
  - Condition monitoring and prediction of future capability
- Transportation of humans and goods
  - Safe, speedy, and cost effective transportation networks and vehicles (air, ground, space)
- Energy and environment
  - Safe and efficient power grids, safe and efficient operation of regional collections of buildings



# Examples of Areas of Impact

- Health
  - Reliable and cost effective health care systems with improved outcomes
- Enterprise-wide decision making
  - Coordination of dynamic distributed decisions for supply chains under uncertainty
- Next generation communication systems
  - Reliable wireless networks for homes and businesses