Understanding Discontinuous Technologies using Model-Based Systems Engineering (MBSE) Activity Diagrams

Presented at NDIA's 21st Annual Systems Engineering Conference

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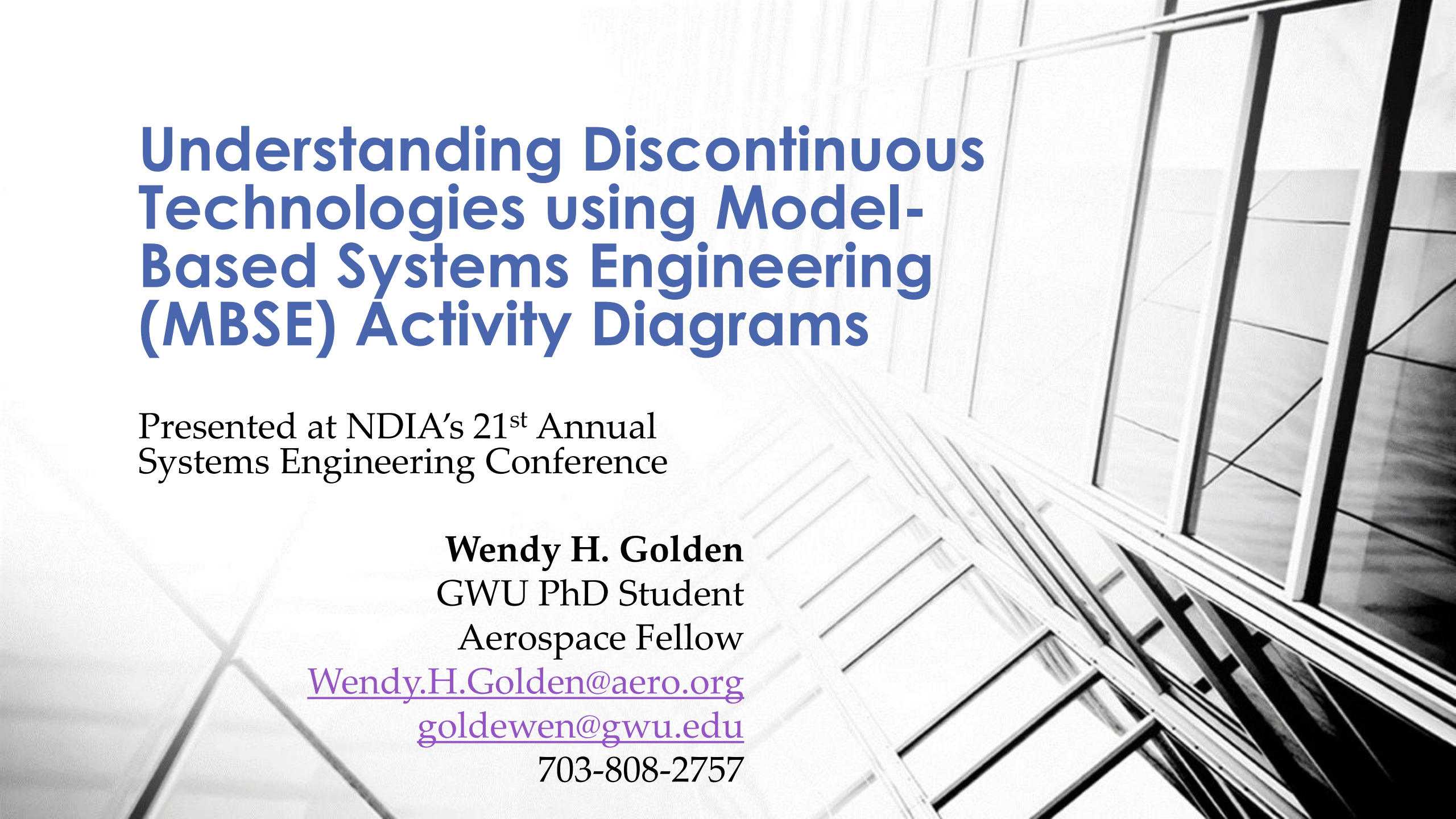


Outline

- Establishing the Terminology and Overview
- Goal and Objective
- Relevant Example
- Methodology
- Contact Information
- Questions
- Backups

Establishing Terminology and Overview

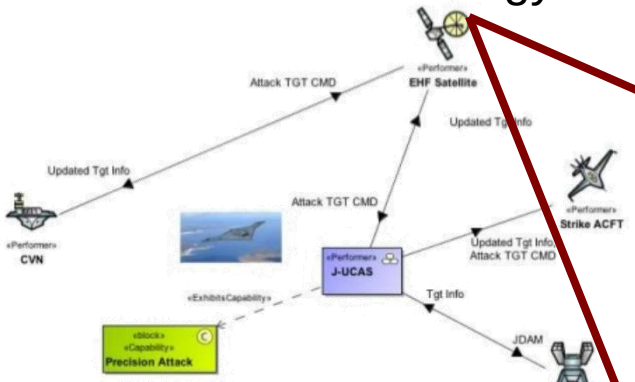
- **Discontinuous Technology** – "shifting from one technological learning curve to a more attractive technological learning curve, thereby obtaining a substantial gain in one or more performance metrics [45], [99], [103]. … Discontinuous technology might not have an adverse effect on the existing technology base of the firm."[26]
- **Disruptive Technology** – "A new product or service that enters at the low end of the market and gradually moves up-market, displacing existing, established products."[5]
  - Disruptive technologies are discontinuous, but discontinuous technologies are not necessarily disruptive.
- **Radical Technology (Globally and Locally)**– "…refer to inventions that do not cite any precedent technology (i.e., prior art), thereby representing a true pioneering creation in the economy."[12]
- **Breakthrough Technology** – a significant or sudden advance, development, etc.[27]
- **Model Based Systems Engineering (MBSE)** (also known as Digital Engineering) –
  - "a holistic, **systems engineering** approach centered on the evolving system model, which serves as the "sole source of truth" about the system. It comprises system specification, design, validation, and configuration management"[3]
  - "Formalized application of modeling to support system requirements, design, analysis, verification, and validation activities"[6]
- **Activity Diagrams** – "the most complete representations of behavior. Part of the behavioral (logical architecture) representation set, they unambiguously represent the flow of control through sequencing of activities and constructs as well as the data interactions overlaid to present a more complete picture"[25]

Goal and Objective

- **Goal:** To use MBSE to characterize and understand the behaviors and risks associated with discontinuous technologies as they relate to adaptability and resilience to support trade-off analysis for readiness levels.
  - Currently there are no activity diagrams supporting system readiness levels and maturity for trade-off analysis in adaptability and resilience for discontinuous technologies
- **Objective:** Assess and track the maturity of commercial applications for the systems models and behaviors of discontinuous technologies is a major issue in satellite development.

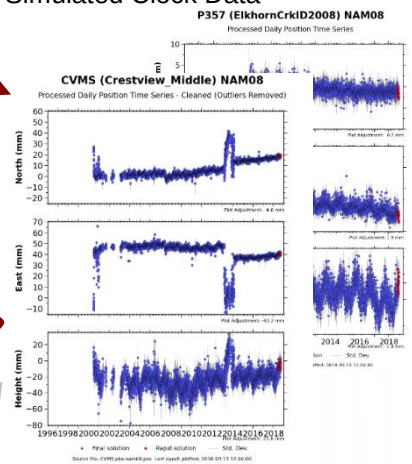
Relevant Example

Discontinuous Technology: Satellite Clock for Precision Targeting

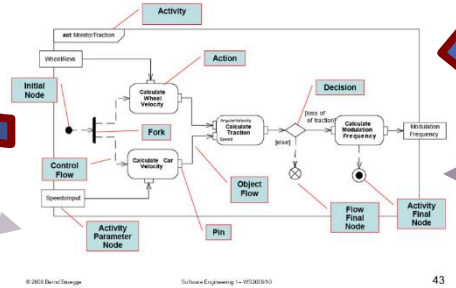


Reference: MTSI briefing OV-2 J-JUCAS

Simulated Clock Data

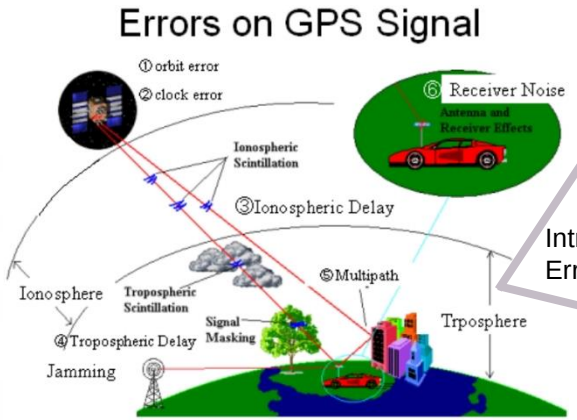


Activity Diagram Clock**s** –
Connected to Complex Satellite System



Introduce Errors

Environmental and Industry Activities



Indicators of Discontinuous Technology Adoption

1. Initial Performance Level
2. System constraints
3. Modifications to Existing Framework (Built into Activity diagram)
4. Ability to replicate for other discontinuous technologies (e.g., data from printer updates)
5. Lifecycle assessment for the technology
6. Output: SRL level for the system, Adaptations to the system to incorporate new clocking, Failure indicators based on system expected behaviors with recommended modifications to remain resilient

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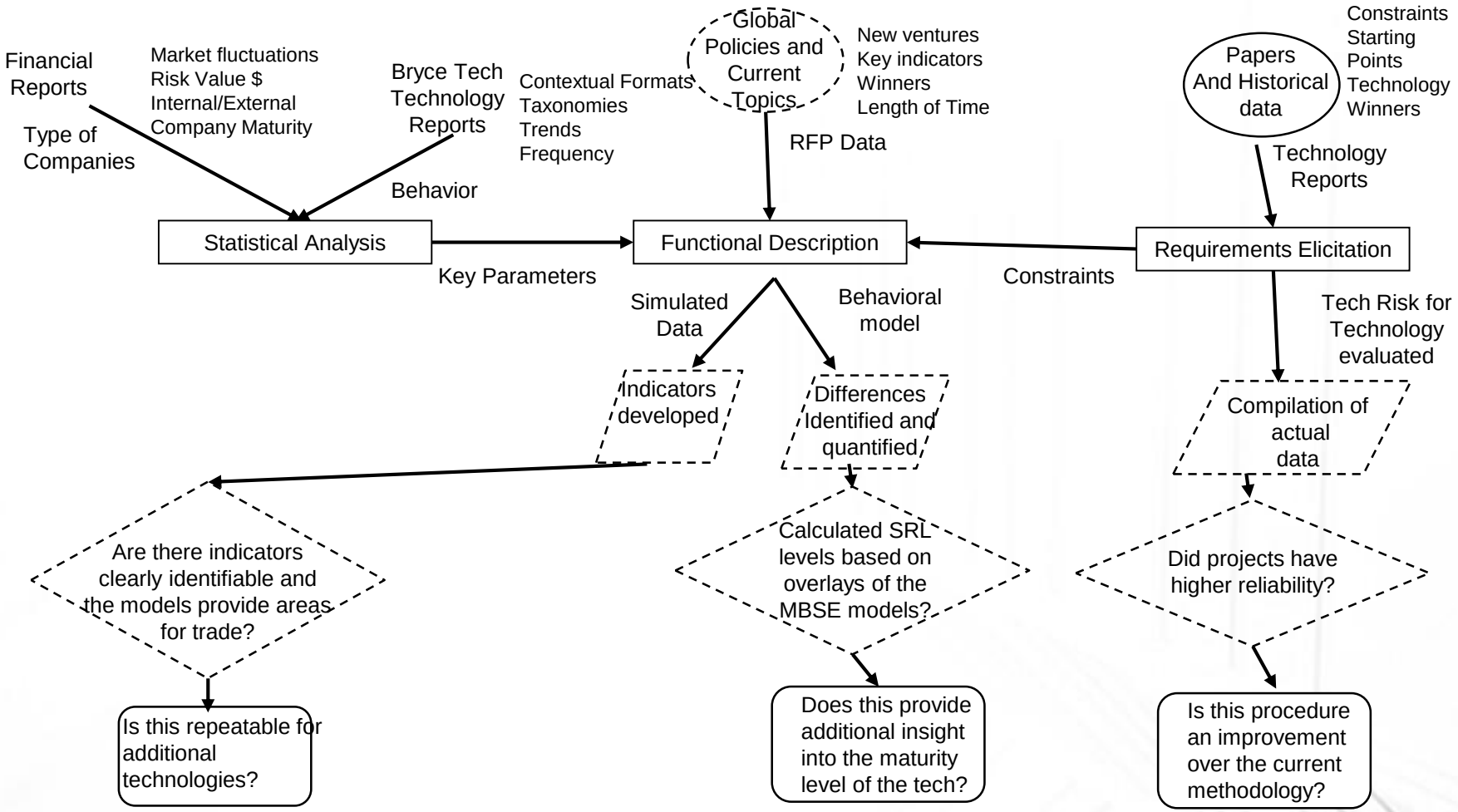
Methodology



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Questions?

Backups

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