Extending digital engineering from the component to the mission level

Extending digital engineering from the component to the mission level with digital mission engineering





Global Product Data Interoperability Summit | 2019

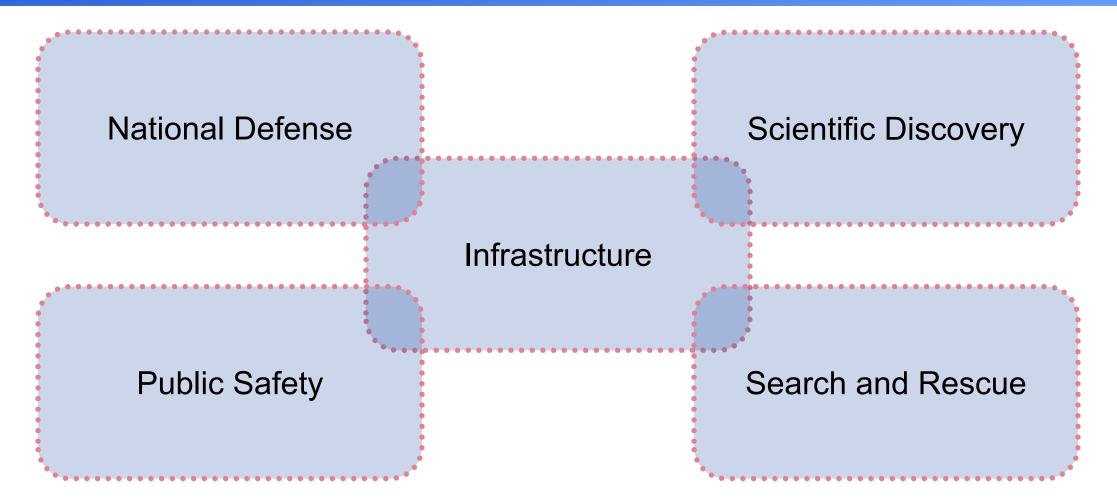
Important assignment emphasizing:

Timeliness

- Performance quality
- Reliability



Mission Areas





Mission Engineering

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Planning, analyzing, organizing, and integrating capabilities to achieve desired mission objectives*



Mission Environment

Environment Digital Twin

- Environment
- Measures of effectiveness

Functionality

Functional Digital Twin

• Performance characteristics

Logical Digital Twin

- Architecture
- Automated decision (software)
- Tactics, Techniques, and Procedures (human)

Decision Making

Mission Environment

Environment Digital Twin

- Environment
- Measures of effectiveness

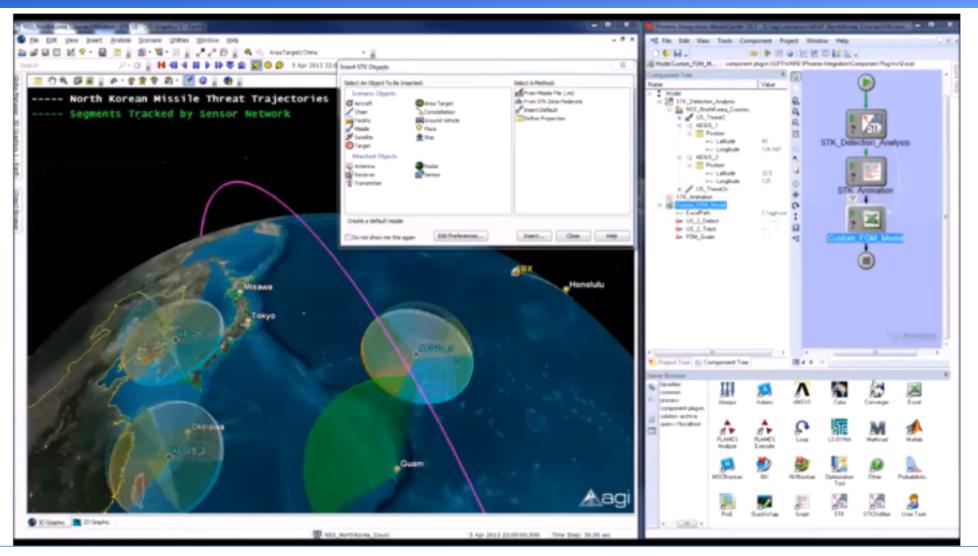


Functional Digital TwinPerformance characteristics

Digital Mission Engineering (DME)

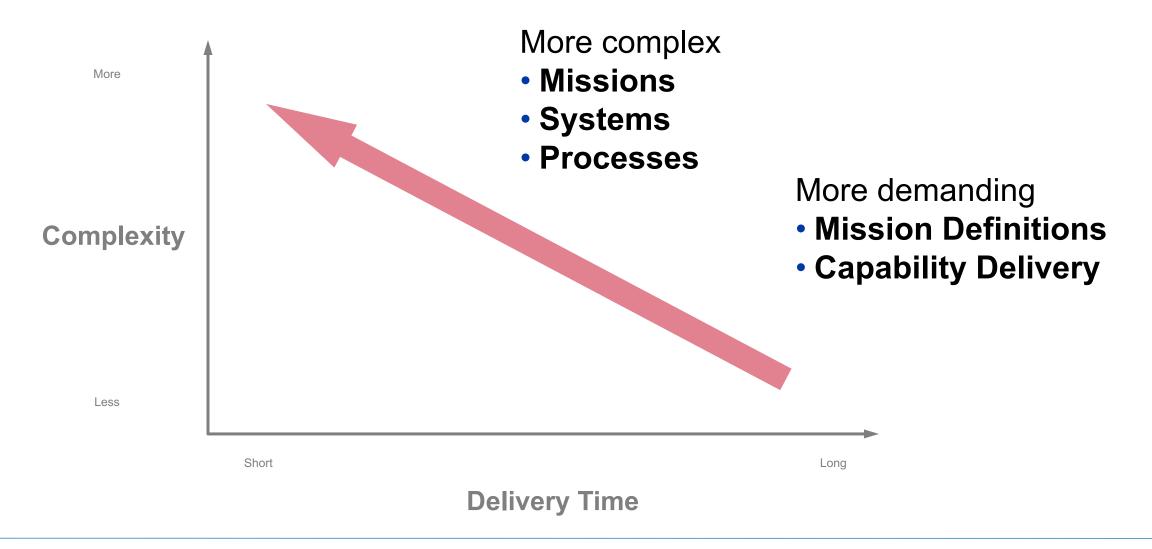


Multi-Domain Example





Why DME is Important Now





Next Track in 14 hrs 26 min. JASAT-2 (SSN.38332) Residual Ratios Typical Tracking Interval: 10:06:00 - 17:55:00

GeoBox

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131.8

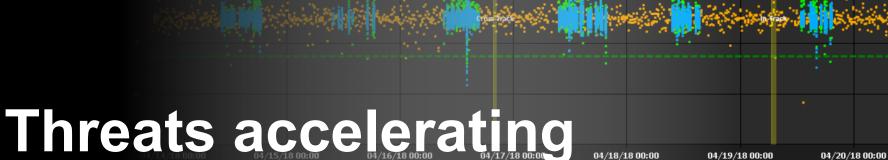
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National Defense

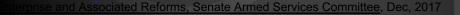


Show Jobs

Refresh



Capability delivery in "Industrial Age"*





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AT-2 (SSN.38332)

Longitude

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131.84

2018-04-27 19:00:00 🔲 🗸

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History

— Predict

2018-04-09 11:00:00

Scientific Discovery

Global Product Data Interoperability Summi

Declining funding More science from existing investments

1900

1920

1940

1960

Year

The Atlantic, 2017

2000

Ph.D. Graduates

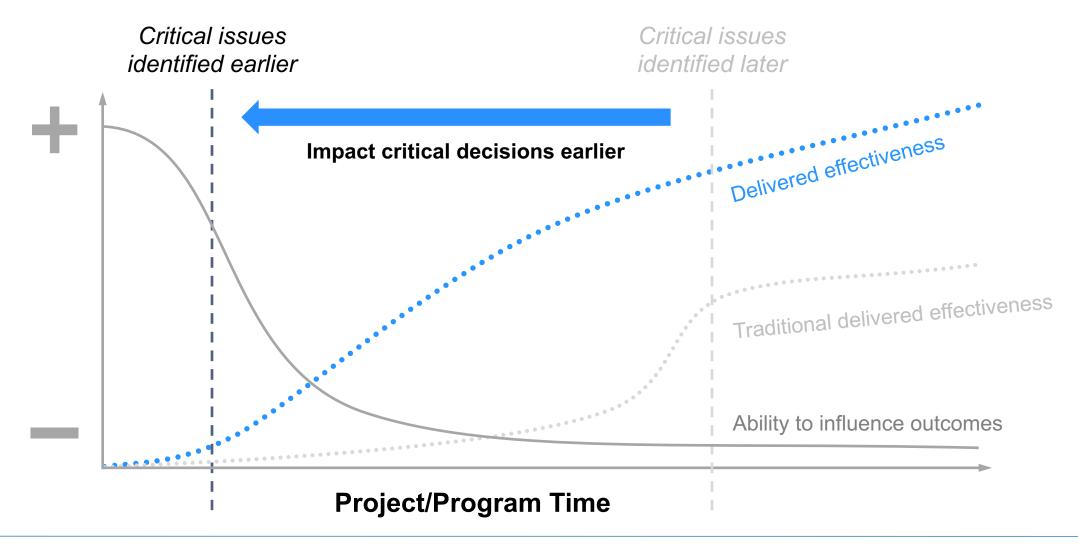
1980

Publications

Funding

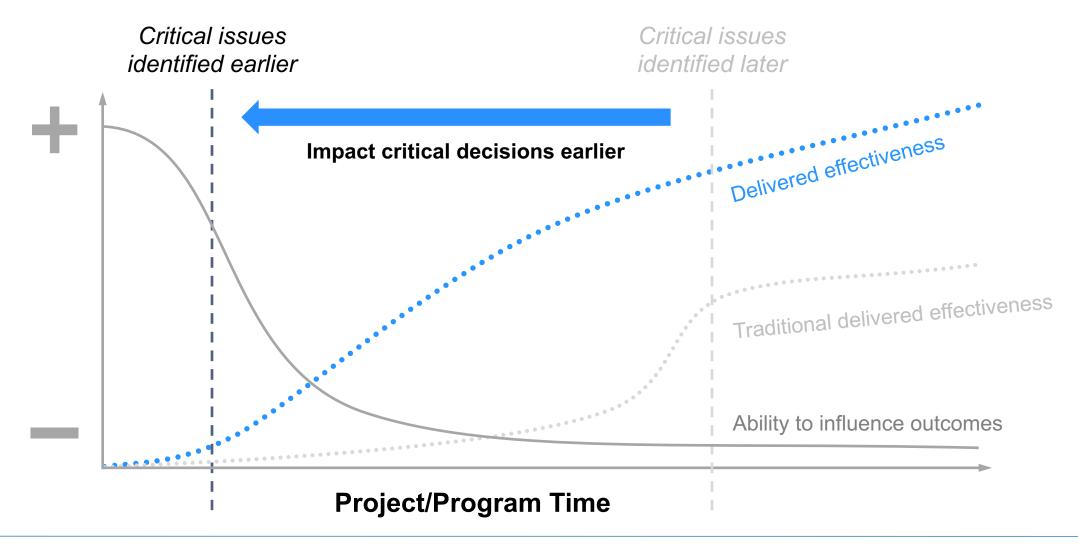


Influence-Effectiveness Curve



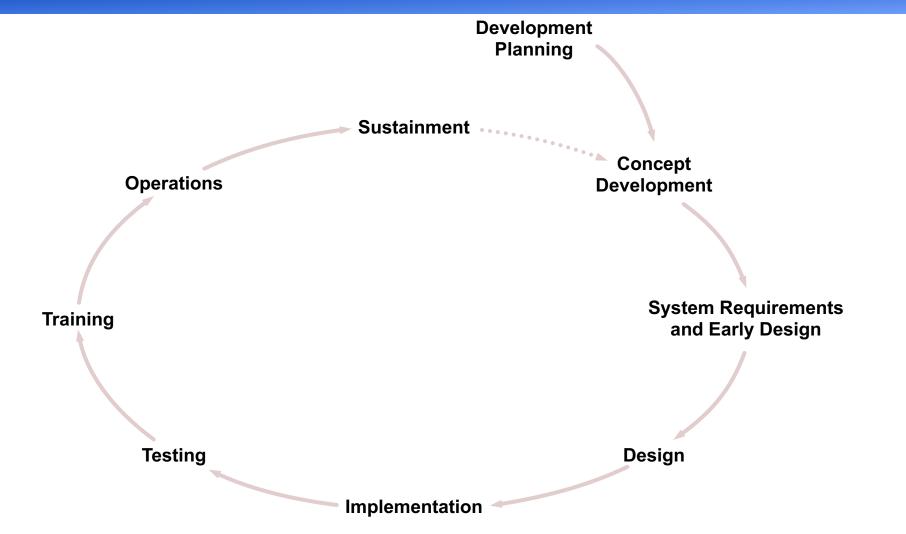


Influence-Effectiveness Curve



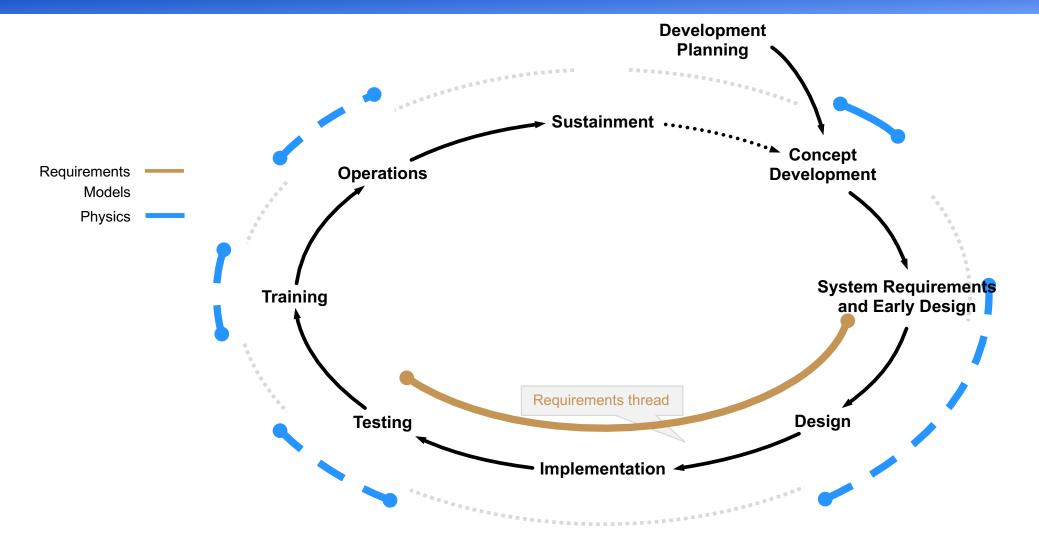


Need for DME: Life Cycle Perspective





Need for DME: Life Cycle Perspective



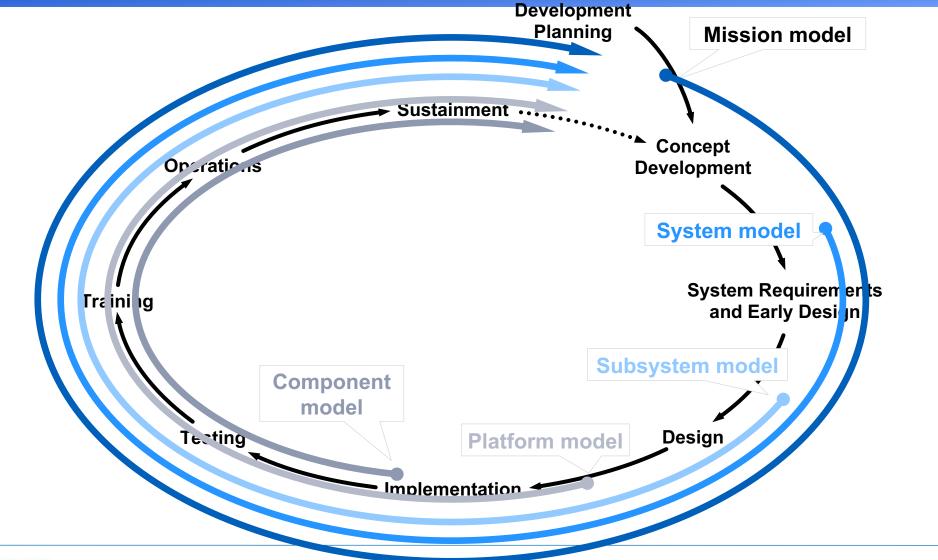


Aircraft Test and Evaluation

No persistent mission model Little tool integration Low test-point density 30% – 50% re-fly rates

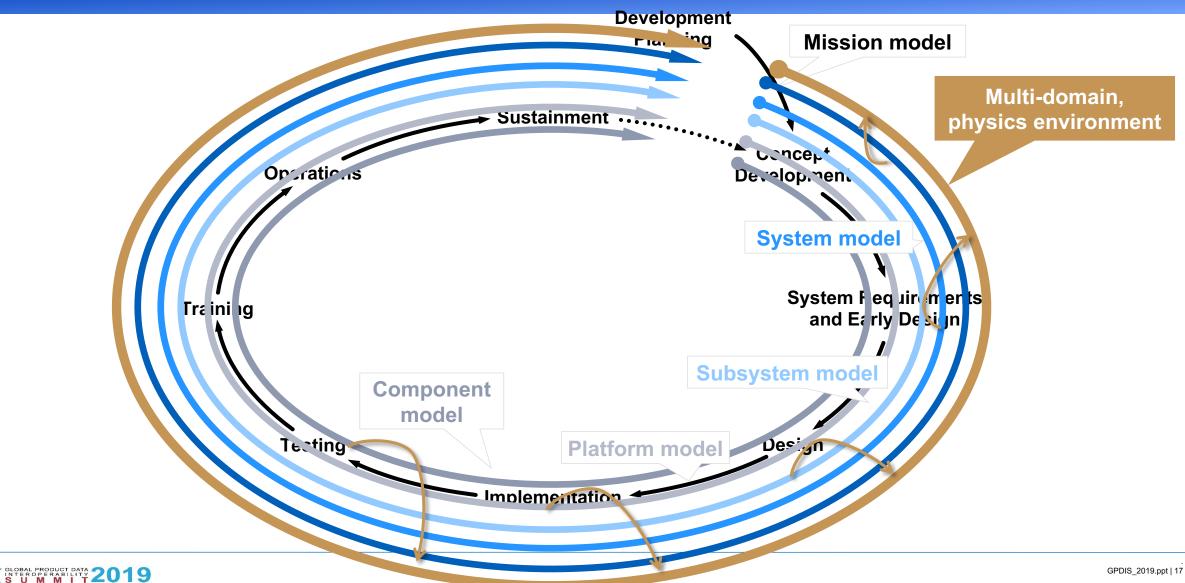


Need for DME: The Vision





Need for DME: The Vision



Representative Acceleration

Tool reinvention – 24% of SE time

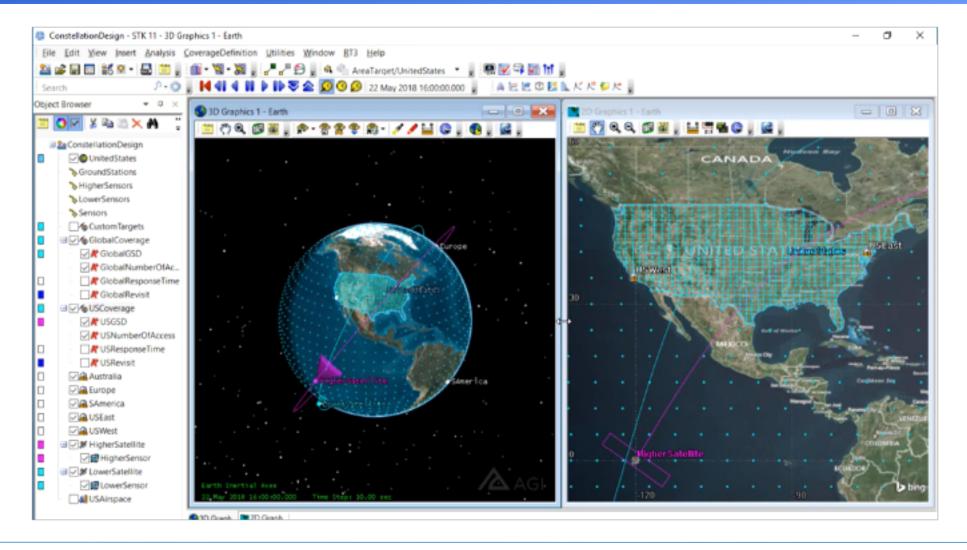
Model recreation – 30% - 50%

Lack of tool integration – 6x delay*

Overall ~2.5× – 6× delivery acceleration

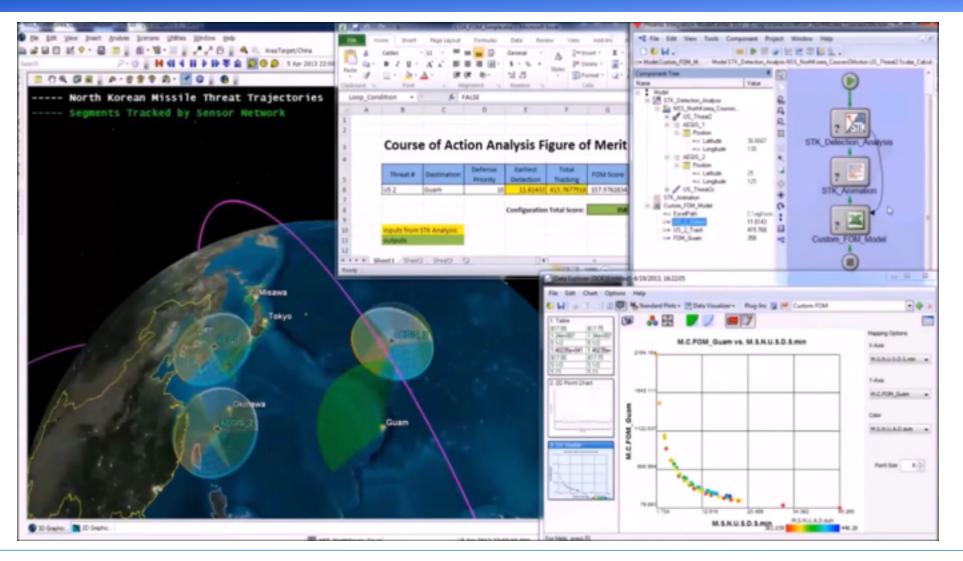


Systems Engineering Example





Systems Engineering Example



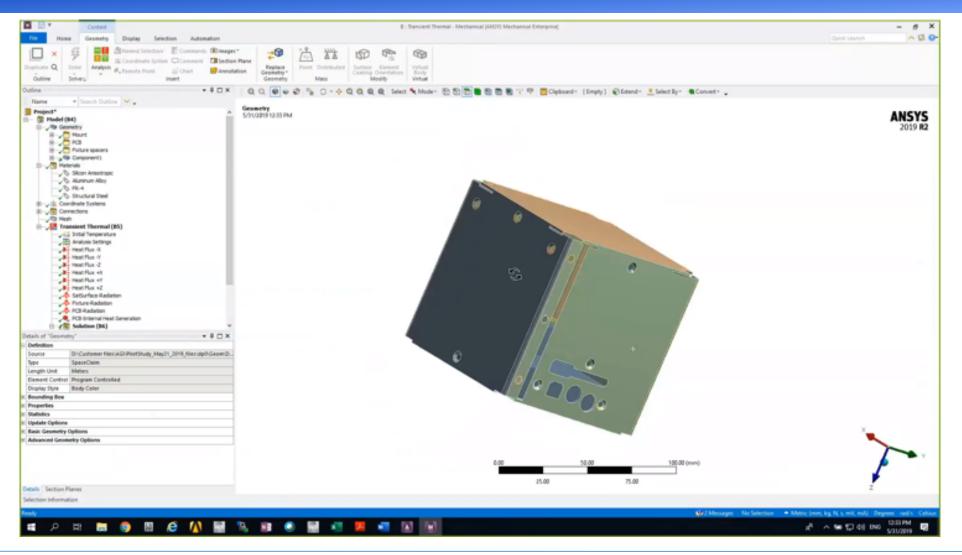


Test Planning Example





Engineering Design Example





Pre-Integration Example*

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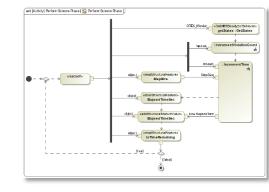
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2. Initiate simulation from
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🦞 Process Integration MISE Analyzer

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3. Step through the mission simulation.



4. Point to external analysis tools.

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7. Display simulation results for each time step.

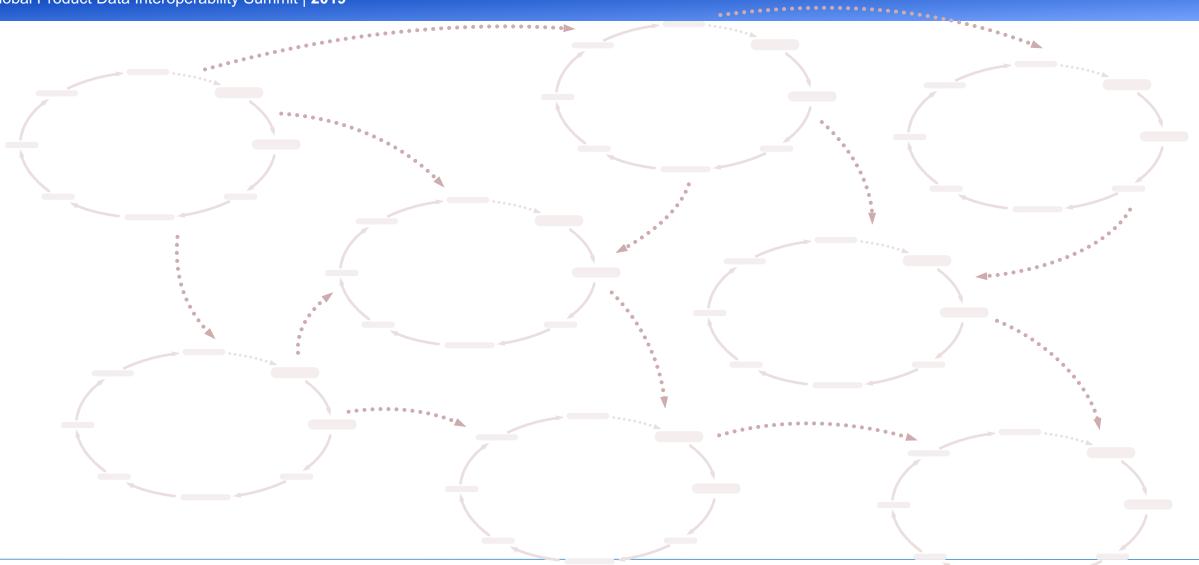
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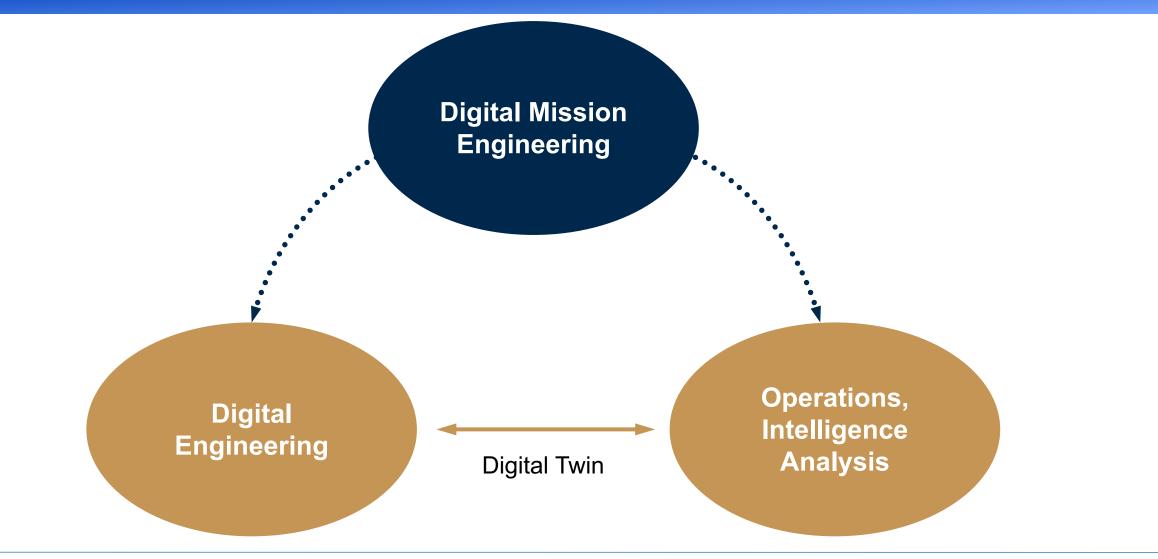
5. Retrieve parameter values from STK

Beyond Digital Engineering





Operations Analysis





Operations Analysis: Strait of Hormuz

< 4-hour forensic analysis

RQ-4B_Globalhawk

"From-scratch" model construction



See "Strait of Hormuz Simulation," and "Strait of Hormuz Simulation Update," AGI, 2019

Operations Analysis: Strait of Hormuz





Digital Mission Engineering

Critical decisions earlier

2.5x – 6x acceleration

Digital Engineering

Ecosystem integration

Operations and Analysis



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