Virtual Based Design

Dr. Michael Grieves
mgrieves@attglobal.net

Driving the Next Generation
Of Lean Thinking

Manufacturing the Virtual Ares

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Defining PLM

Product Lifecycle Management (PLM) is an integrated, information-driven approach comprised of people, processes/practices, and technology, to all aspects of a product's life and its environment, from its design through manufacture, deployment and maintenance—culminating in the product's removal from service and final disposal.

Source: PLM: Driving the Next Generation of Lean Thinking (McGraw-Hill, 2006)

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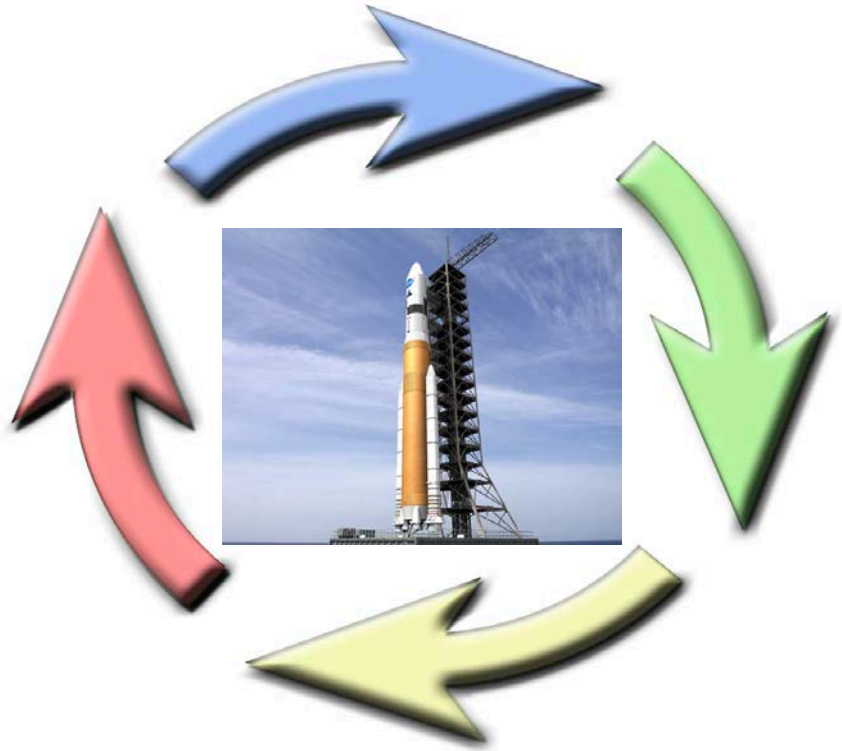
Source: Virtually Perfect: Driving Innovative and Lean Products through Product Lifecycle Management (2009)

PLM Premises

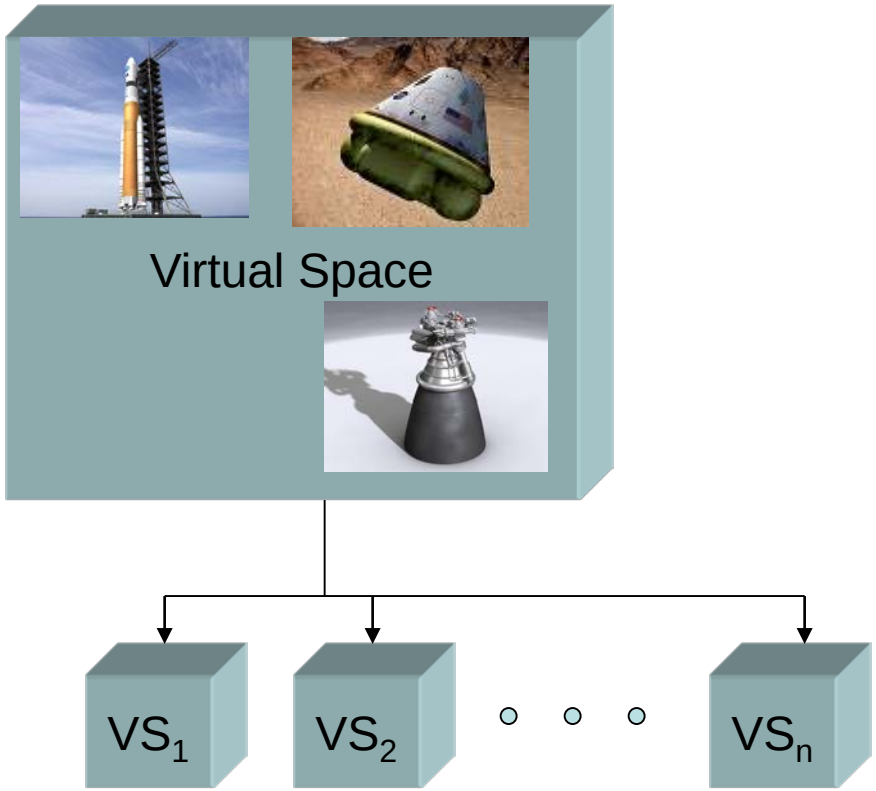
- Physical objects have an informational equivalent
- Information is a replacement for wasted physical resources
- Use bits instead of atoms until the last possible moment
- Replace atoms with bits wherever possible
- Duality of products: physical *and* virtual

Product Lifecycle – 4 Phases

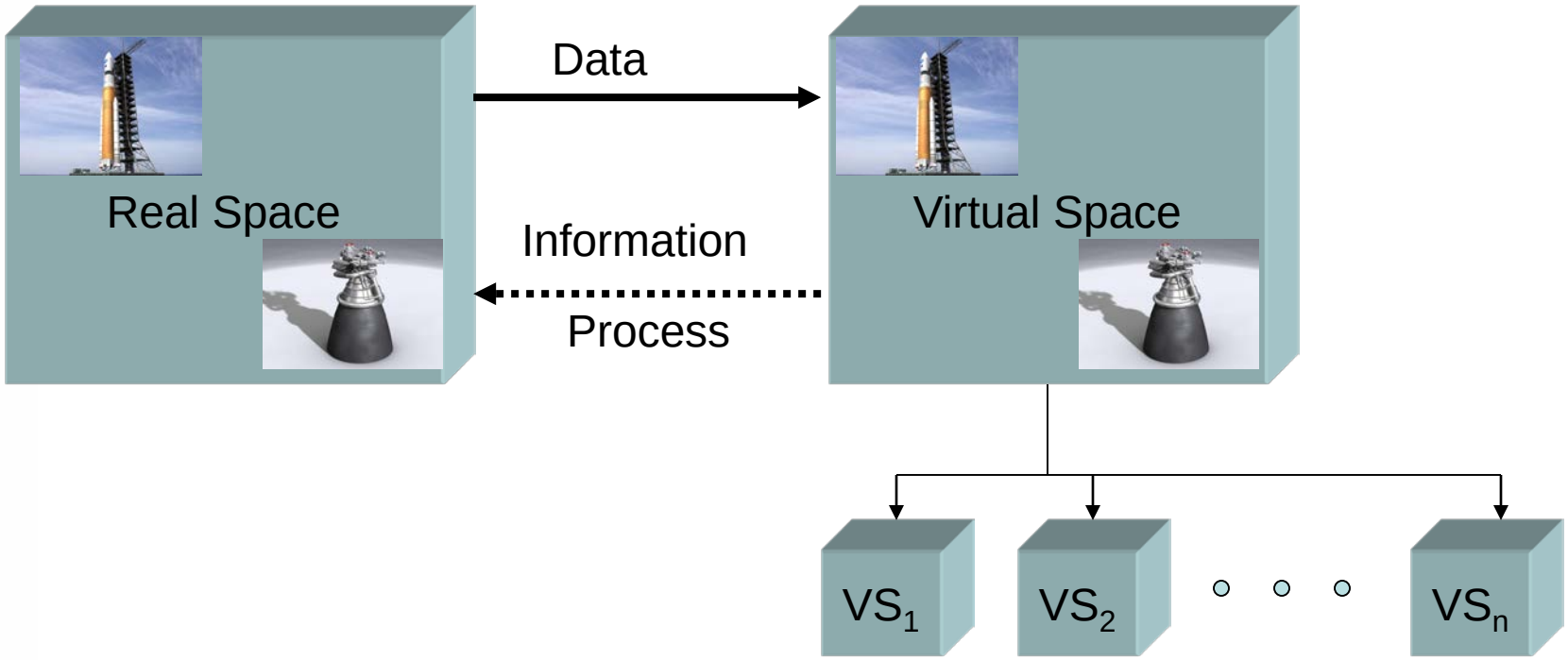


Working in Real Space

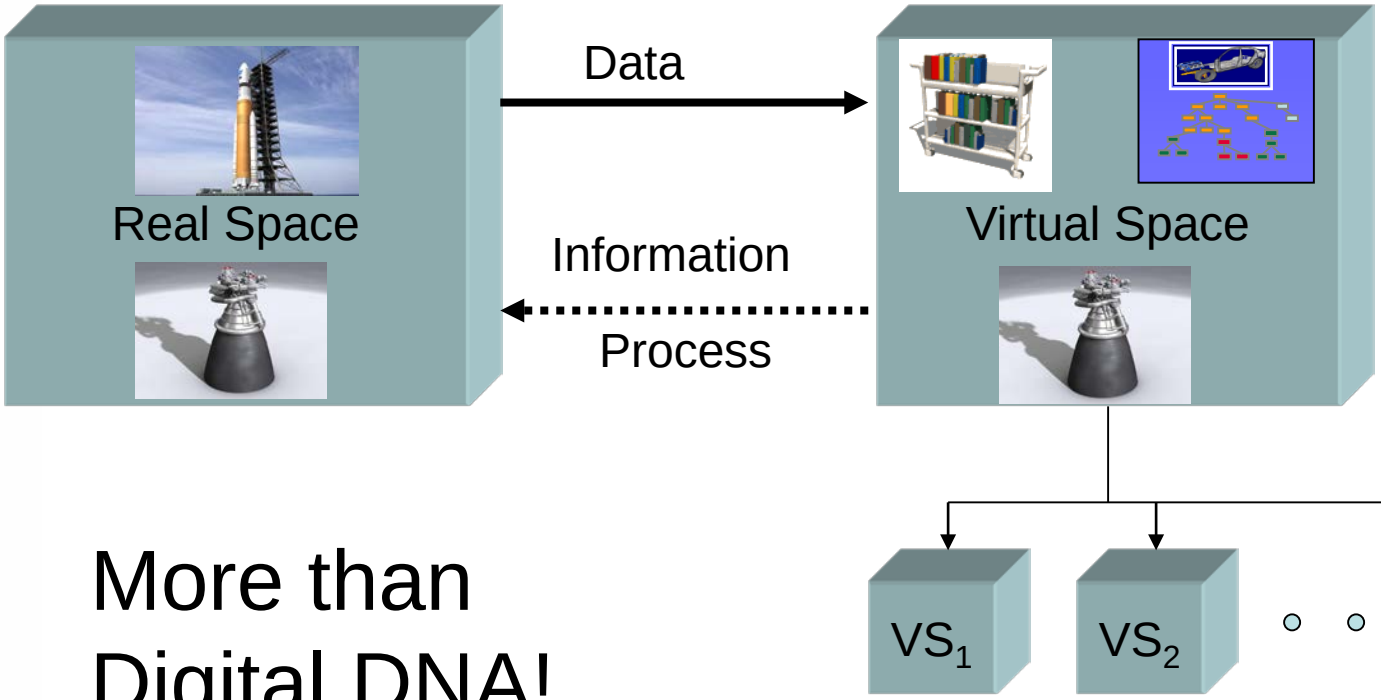
Working in Virtual Space(s)



Information Mirroring: Physical *and* Virtual Products

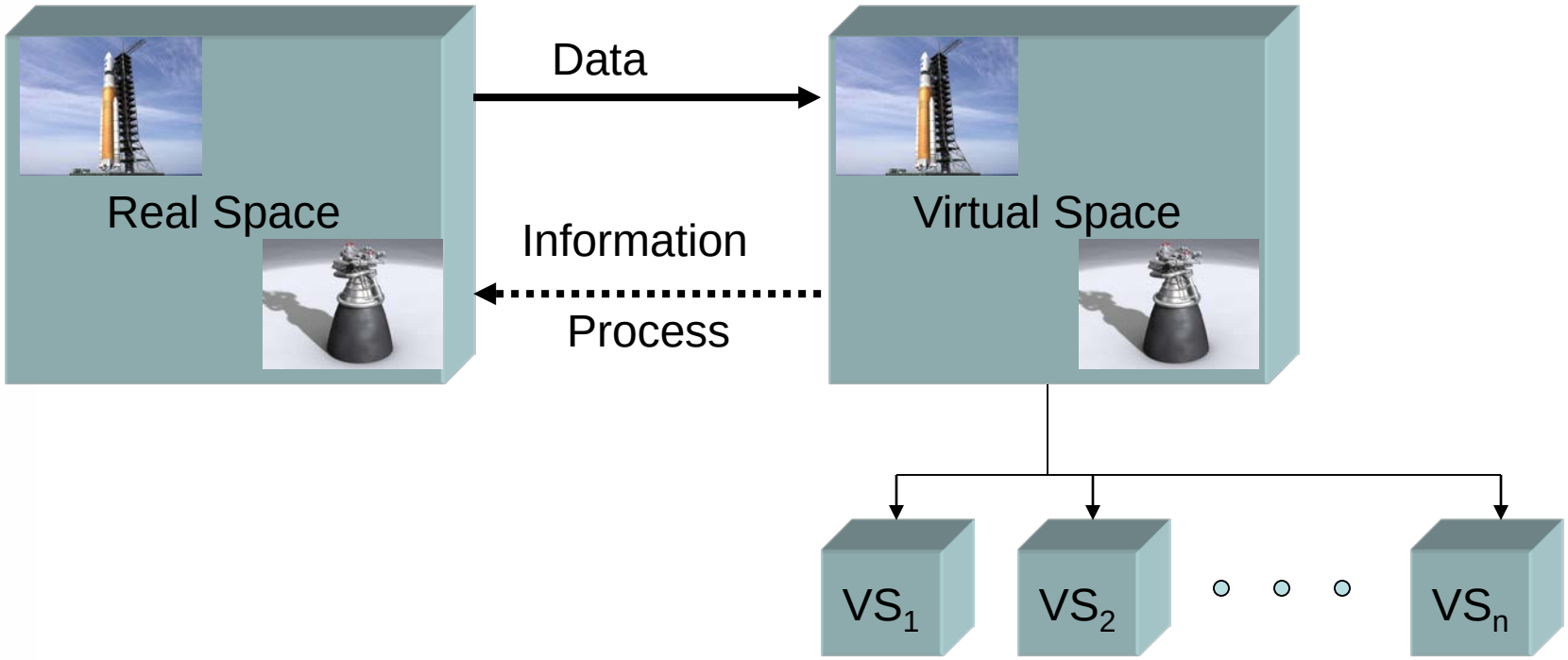


Informational Mirroring - History and Processes

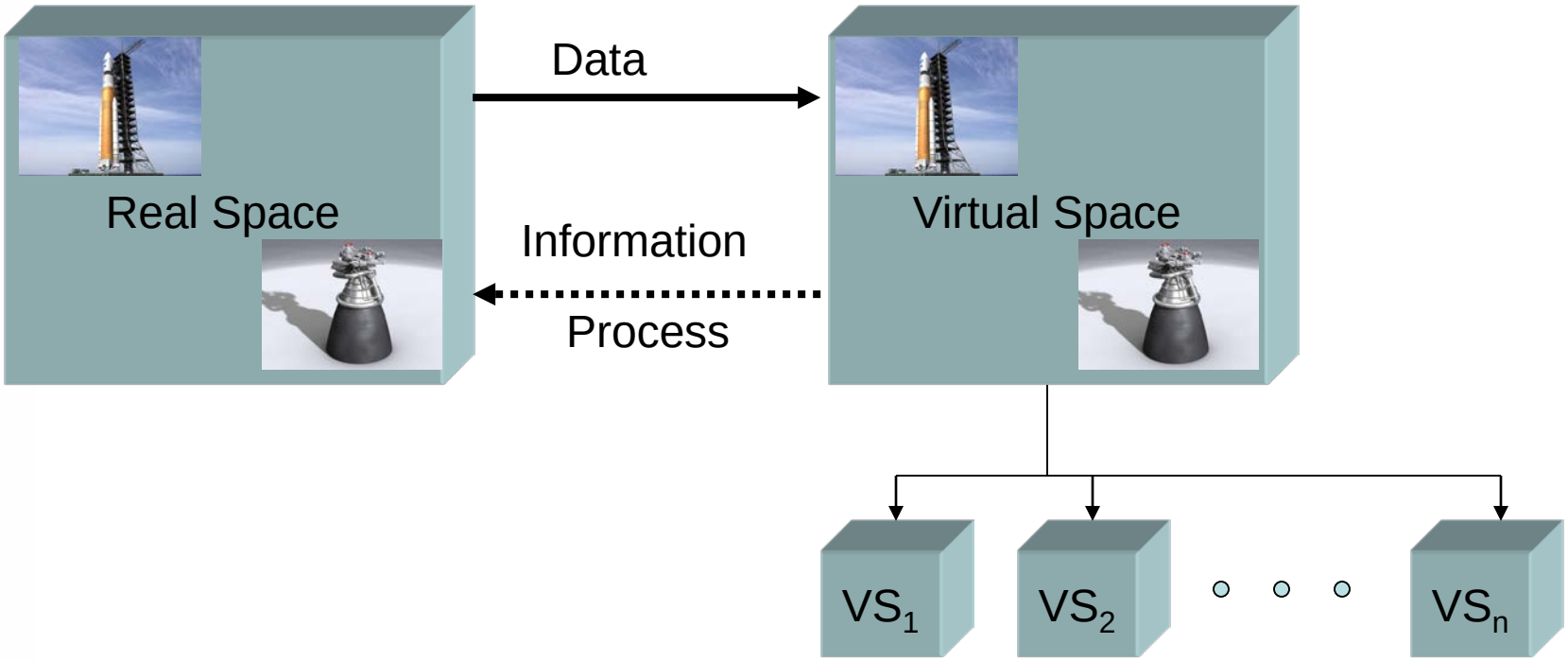


More than Digital DNA!

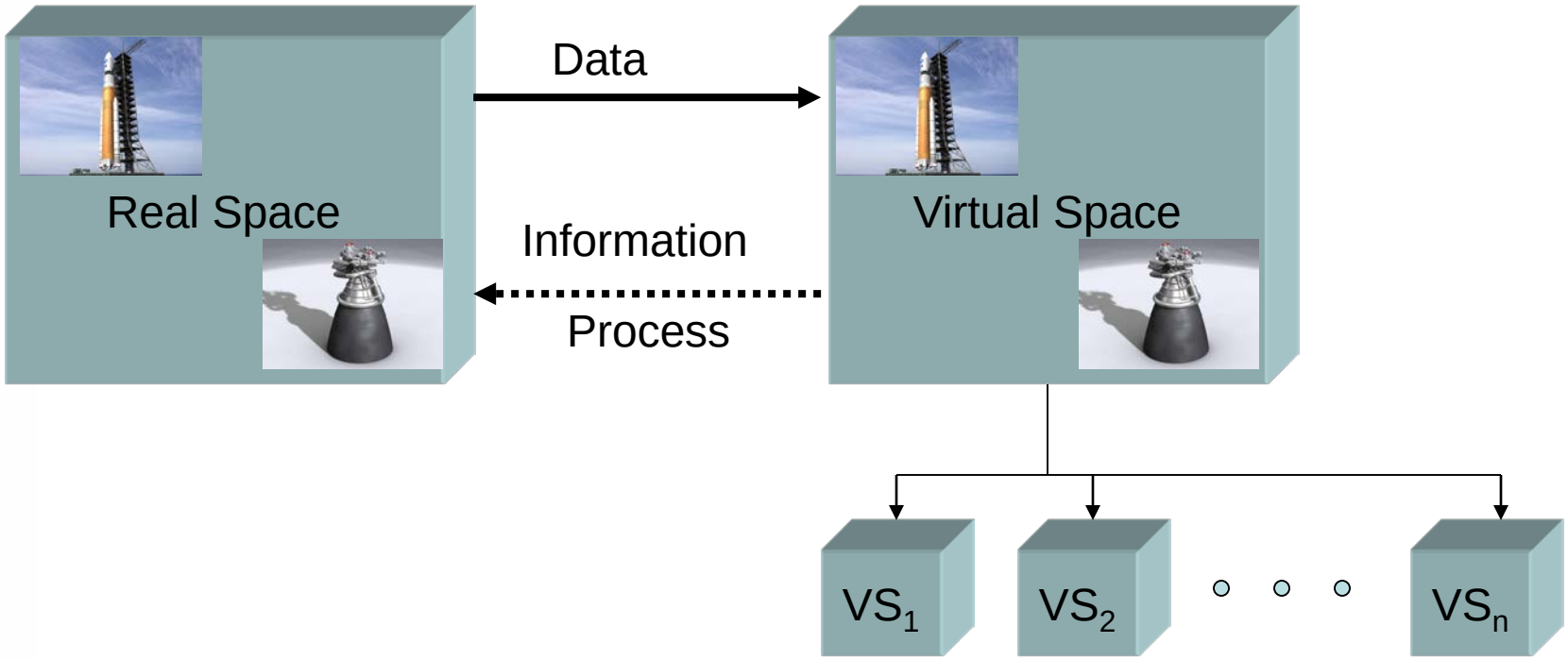
Create



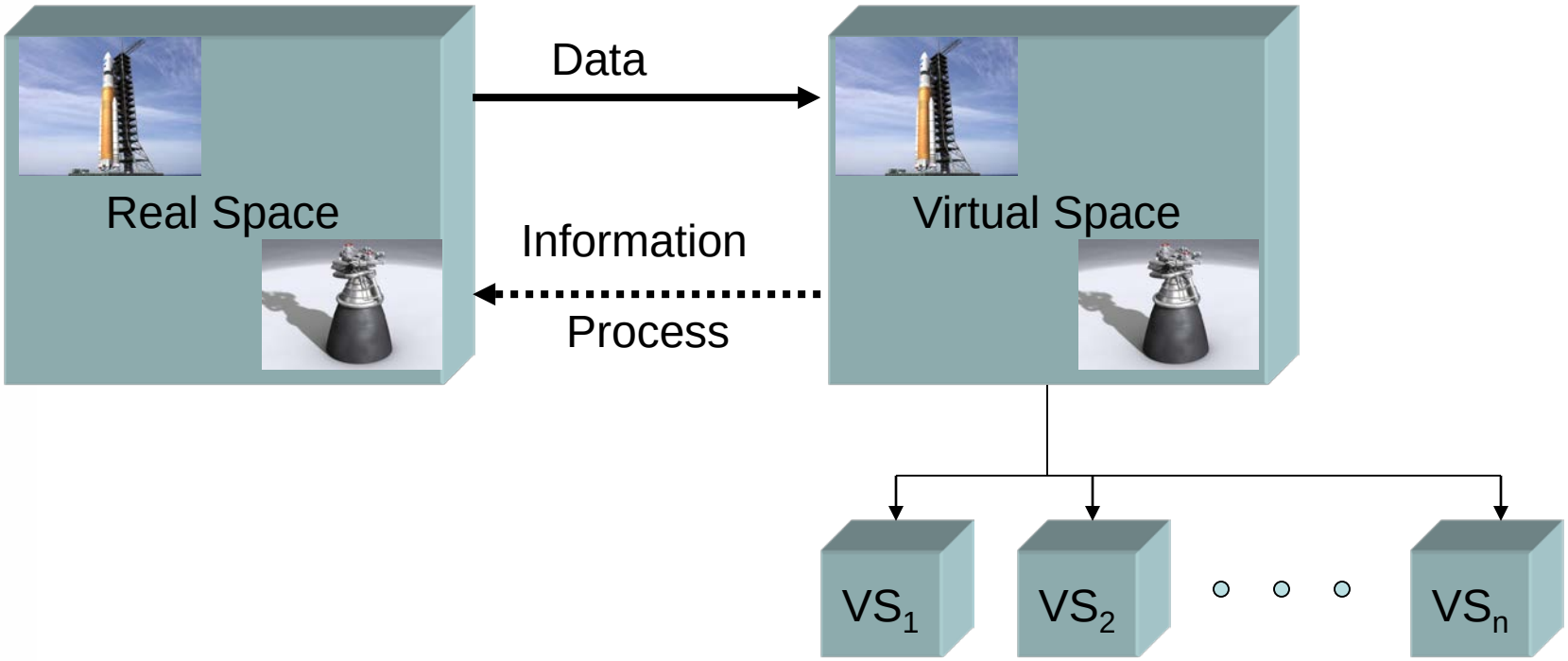
Build



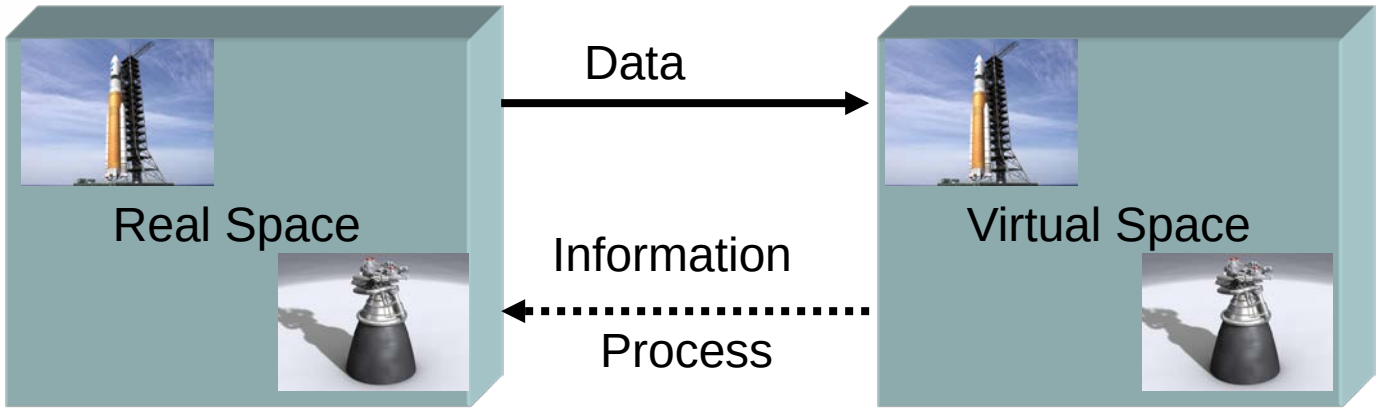
Support



Dispose

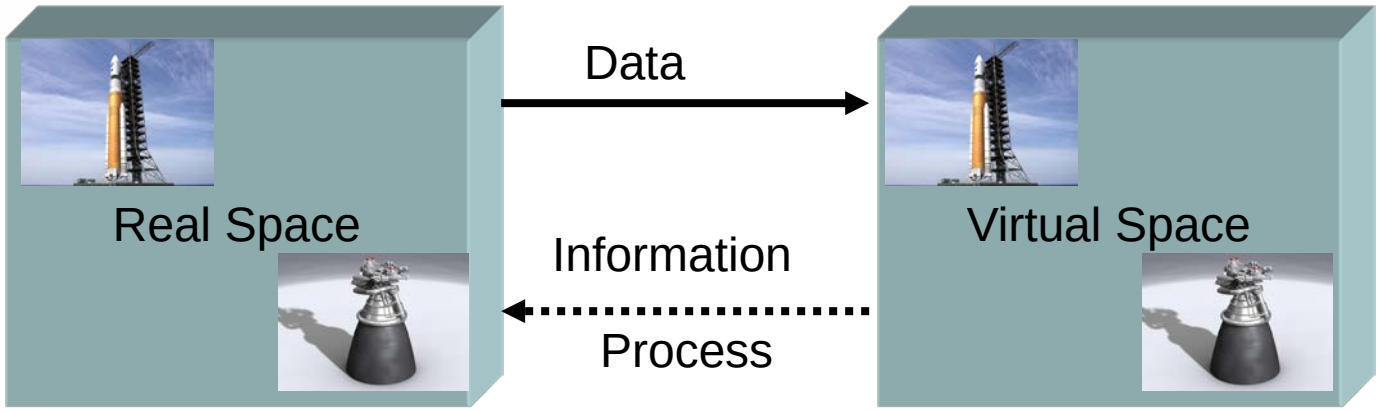


Build:
Build Plan



Goal:
Test Virtually
Validate Physically

Build: Execution



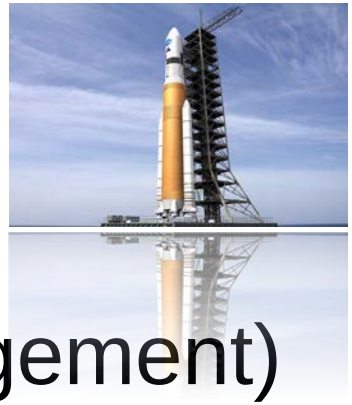
•Manufacturing Data Creation

Manufacturing Data Structuring

•Manufacturing Data Usage (MES)

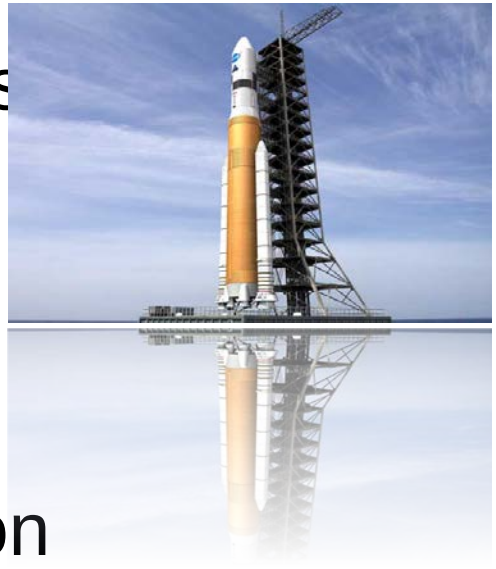
Virtual Ares Benefits: Build

- Efficiency
- Cost
- Time-to-Completion
- Quality (Specification Management)
- Visibility
- Traceability
- Manufacturing / Engineering communication and integration



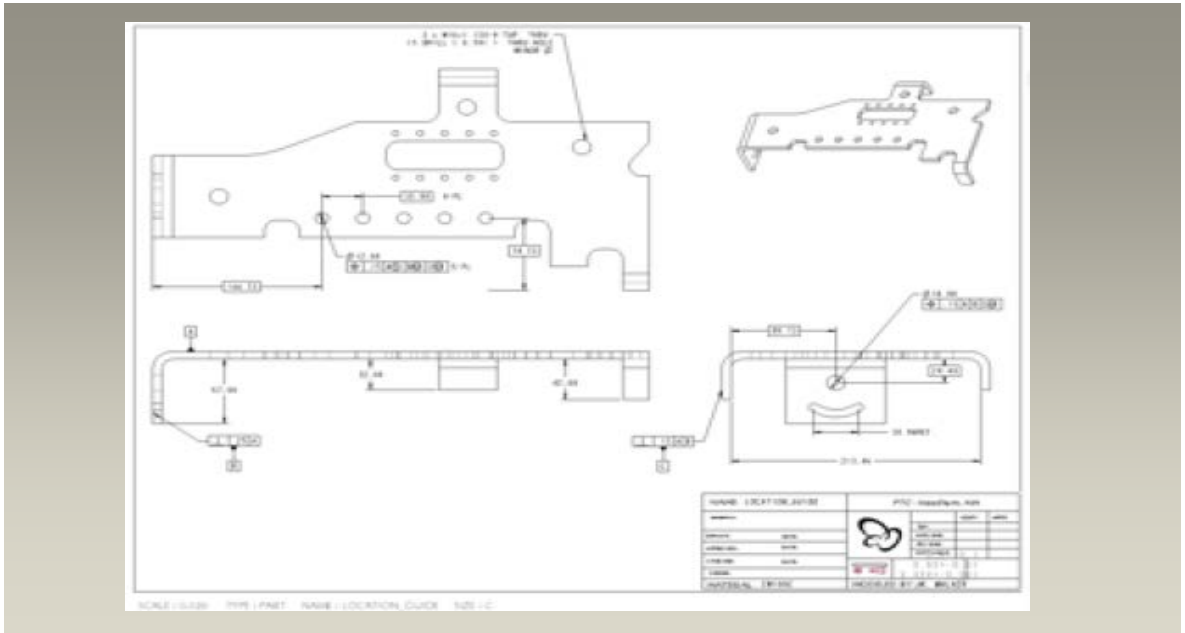
Virtual Ares Benefits: Support

- On-Orbit
  - Instantaneous info access
- Pre-flight
  - Time reduction
  - Cost reduction
  - Backup resource reduction



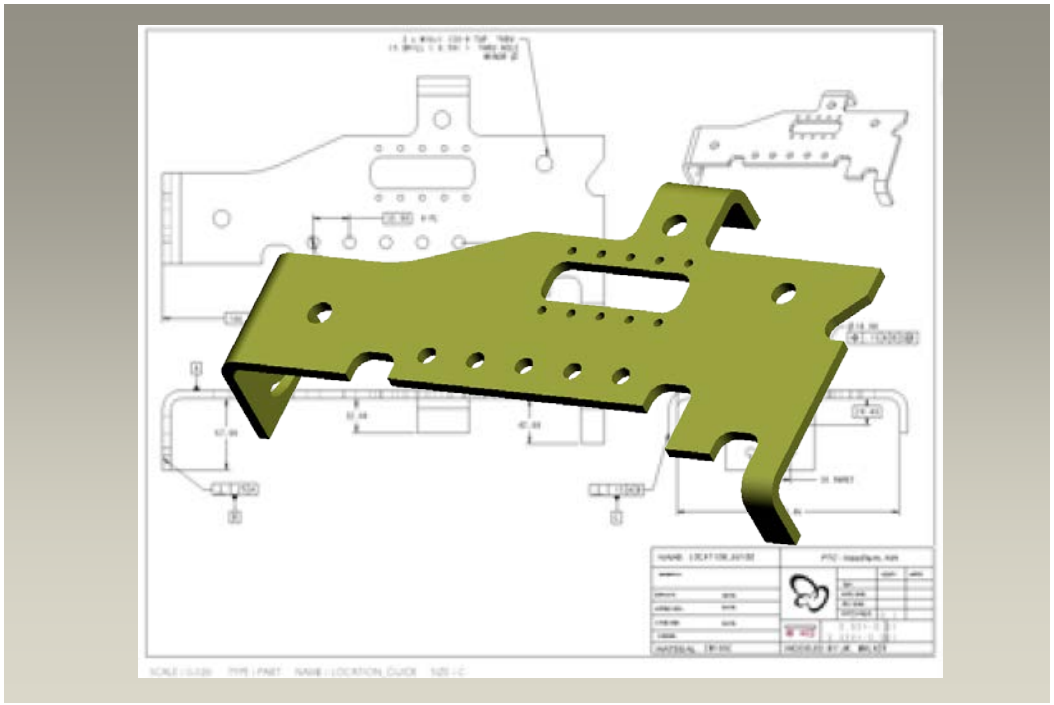
Virtual Product Evolution

Drawing-based



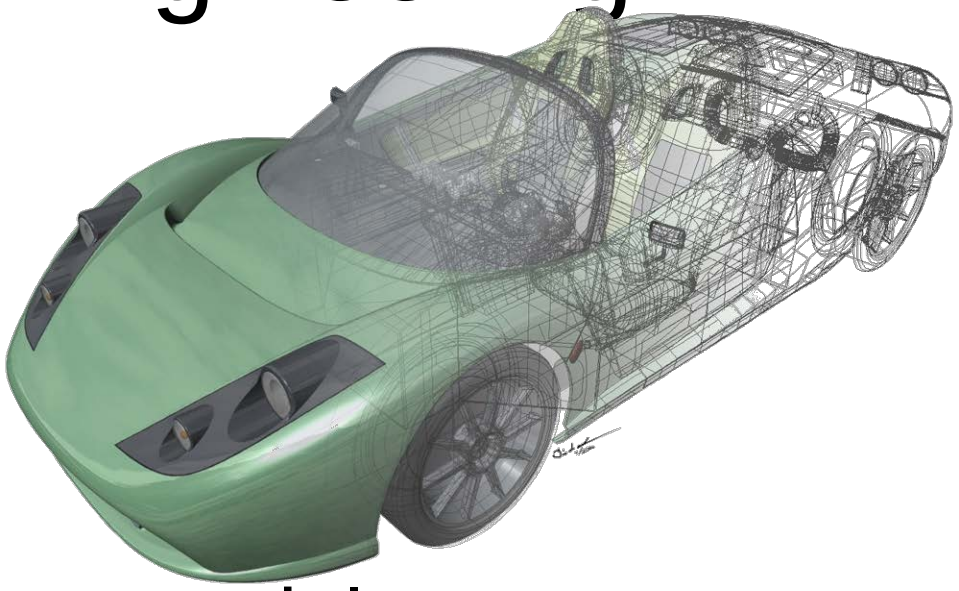
- Drawing-based components
- Controlled authoritive source

CAD-based



- Cad-based component drawings
- 2D➔3D
- Diminished authoritive sources

Model Based Design / Engineering

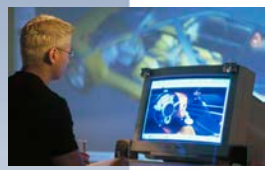


- 3D product models
- Re-emergence of authoritive sources (PLM)
- Emergent and inconsistent cross-functional integration

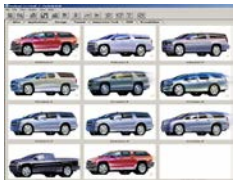
Virtual-based PLM

- 3D models & lifecycle data
- Authoritive sources
- Cross-functional integration

Example - GM Progression



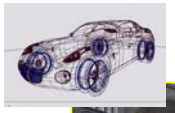
1 Design 2D/3D



2 Data Mgmt

3 Styling DMU

4 Model Quality & Iteration Capability



5 Math Made Visible

6 Advanced Visualization & Collaboration

Tool Integration

Research Project: Impact of MBD

- What has been impact of MBD on a) Resources and b) TTM?
- Issues
  - Control for functionality & quality
  - Adjust for adoption issues
- Method
  - Case study analysis and comparison

Thank You

Dr. Michael Grieves
Tel: (248)705-5787
Email: mgrieves@purdue.edu