Missile Operations and Support Simulation (MOSS) Method

Raytheon

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Missile Operations and Support Simulation (MOSS) Method

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Modeling Objective:
Model and Analyze Hardware Stockpile over Multiple years or Program Life-Cycle to Predict Repair, Readiness, Cost, etc…

- Basic Needs
- Solution through MOSS
- Follow-on Work

Basic Needs to Assess Stockpile Life-Cycle Repair, Readiness, Cost, etc…

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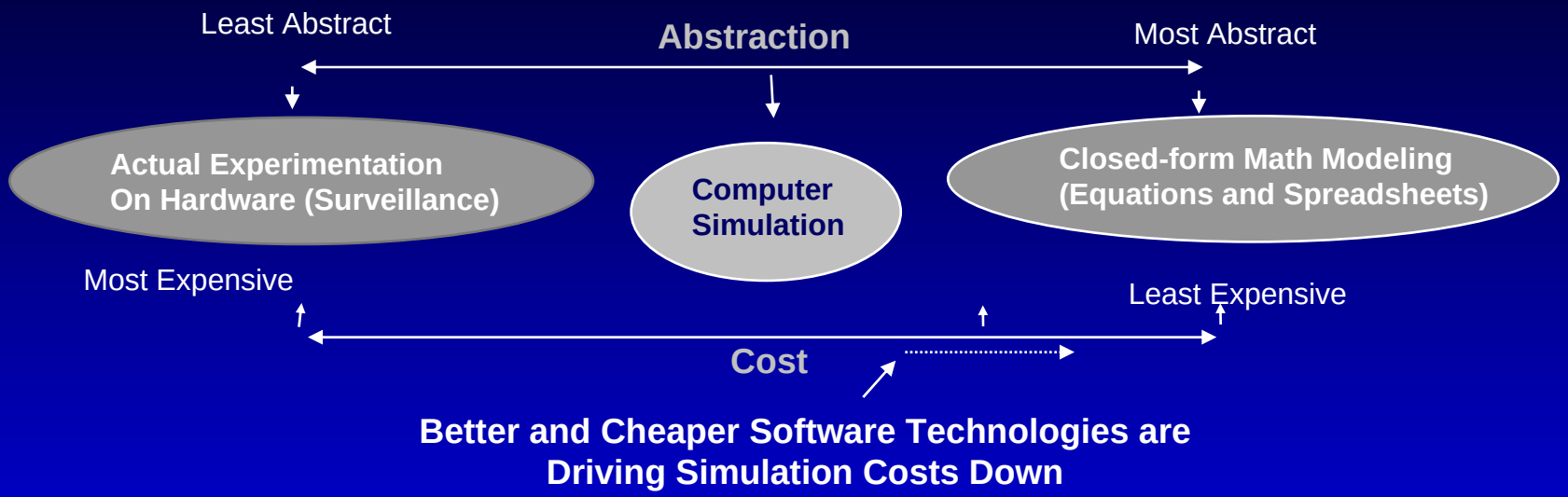
Account for…

- Maintenance, Testing, Training, Operational Tempos
- Dynamically Changing Utilization of Inventories
- Hardware Reliability in Diverse Environments
- Reliability Growth and Wear-out
- Upgrade / Retrofit Programs
- Effectiveness of Test Equipment
- Expediency of Logistics Supply and Transport Chain

Factors Interact to Affect
Repair, Readiness and Cost

Discrete Event Simulation Path



Benefits

- Systems Approach
- Track/Update Items through Process
- Easily Characterize Random Variables
- Easy to Capture System Dynamics
- Easy to Characterize Complicated Process Flows

Cons

- Non-Repeatable Model Build
- Difficult Validation & Verification
- Still Relatively High Cost

Logistics Modeling and Simulation with MOSS

MOSS : Raytheon Simulation-Based Method for Modeling O&S Processes of Military Fielded Inventory

Purpose – Predictive Analyses

- Readiness of Inventory (Stored & Deployed)
- Estimate O&S Cost
- Logistics Pipeline Capacity Requirements
- High Fidelity Estimate of Depot Returns over System Life-Cycle for Maintenance Planning and Warranty Analysis

Elements of MOSS

Common Attributes, Common Blocks, and Sub-Models

- Common Attributes : Characteristics of Missile–Items that are Prevalent for Most Missile O&S Systems
- Common Blocks: Provide Functionality that is Prevalent in Most O&S Systems. Stored in Libraries
- Sub-Models: General Arrangements of Common Blocks that provide Higher Level, More Complex Functionality

Common Blocks, Attributes and Sub-models provide Pre-Validated Mathematics, Are Re-Usable and Streamline O&S Modeling

Also Promote Model Repeatability

Common Blocks of MOSS To Help Define Static Logistics Network

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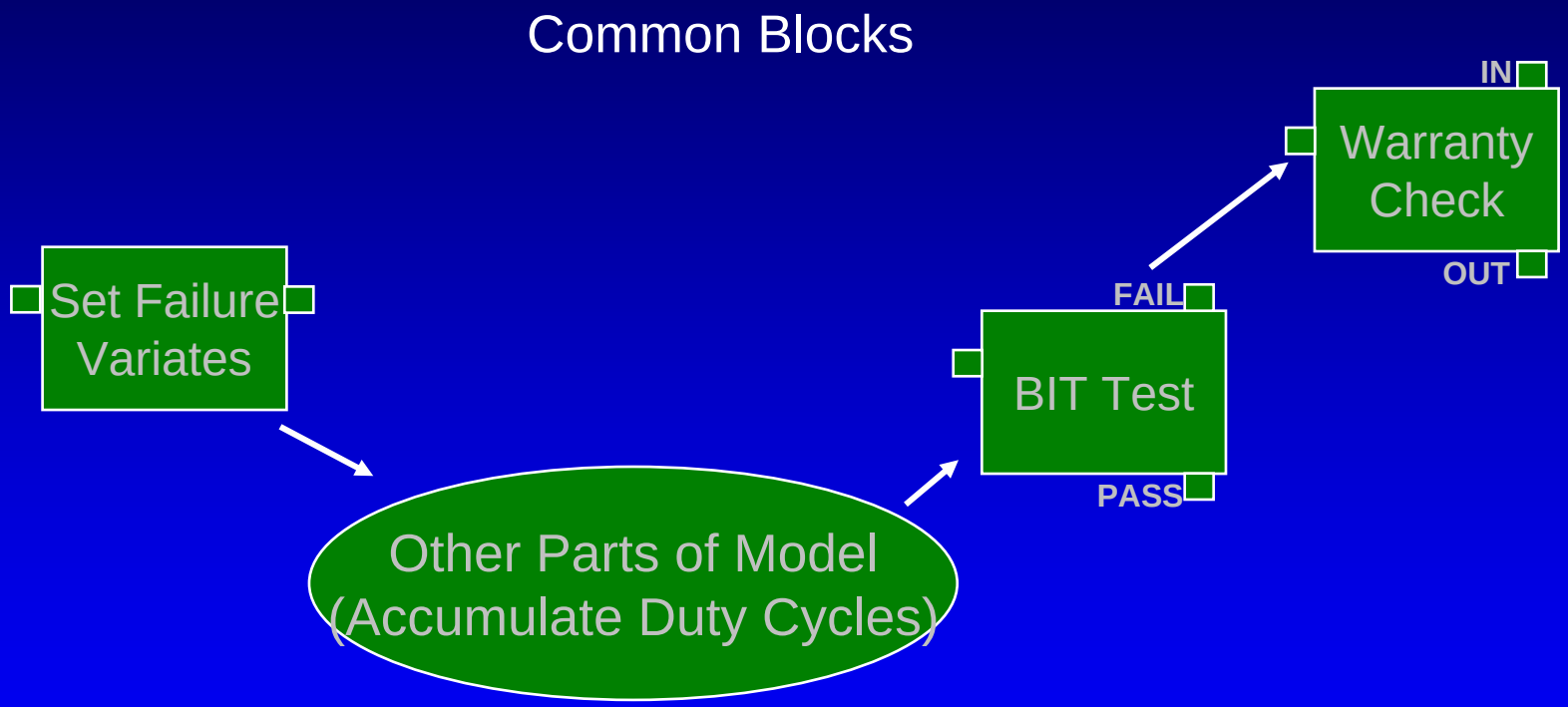

Common Blocks Contain Pre-Validated Logic and Math, and They Are Stored in Libraries to Promote Re-Use

MOSS Modeled System
An Example

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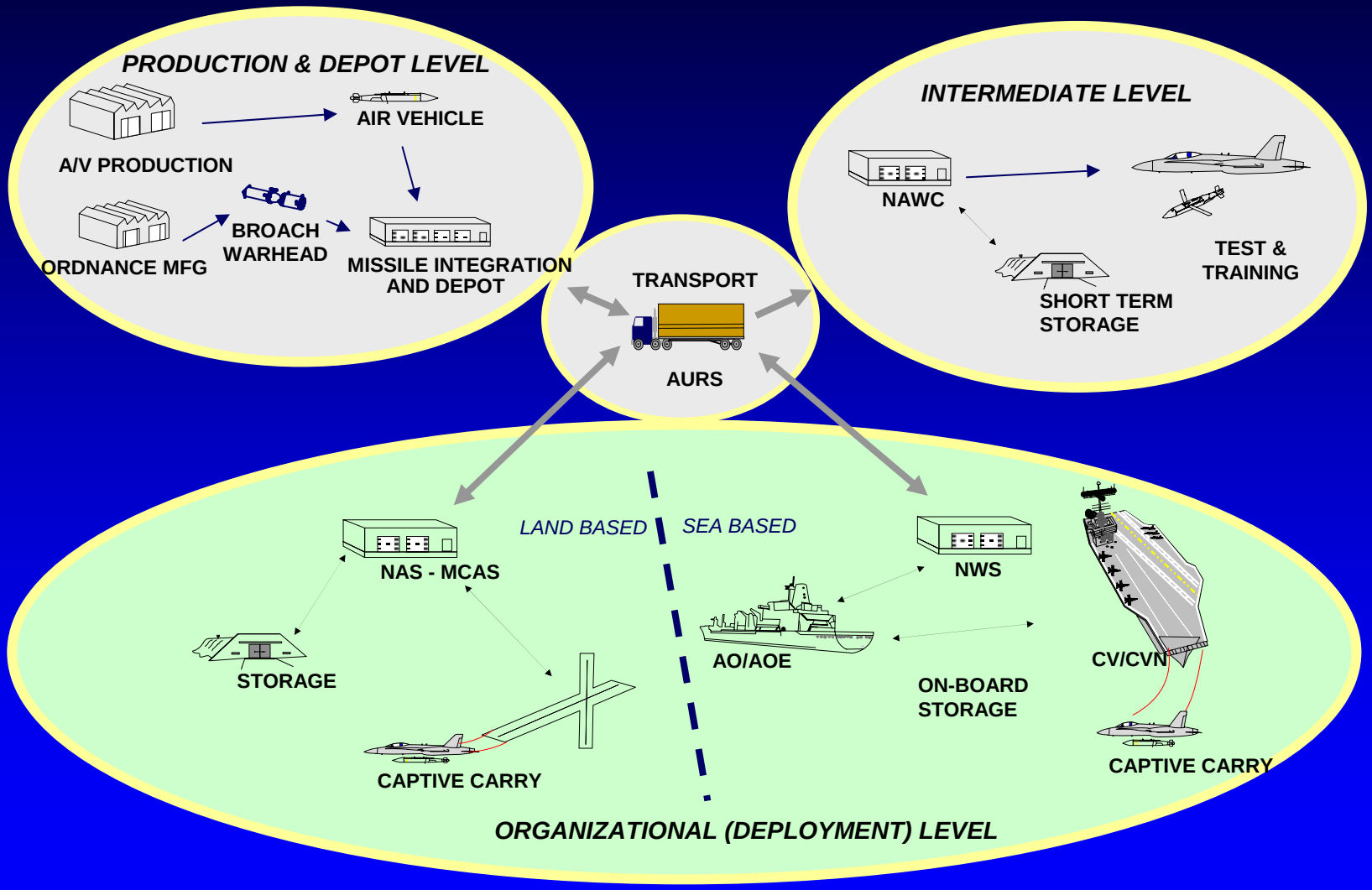
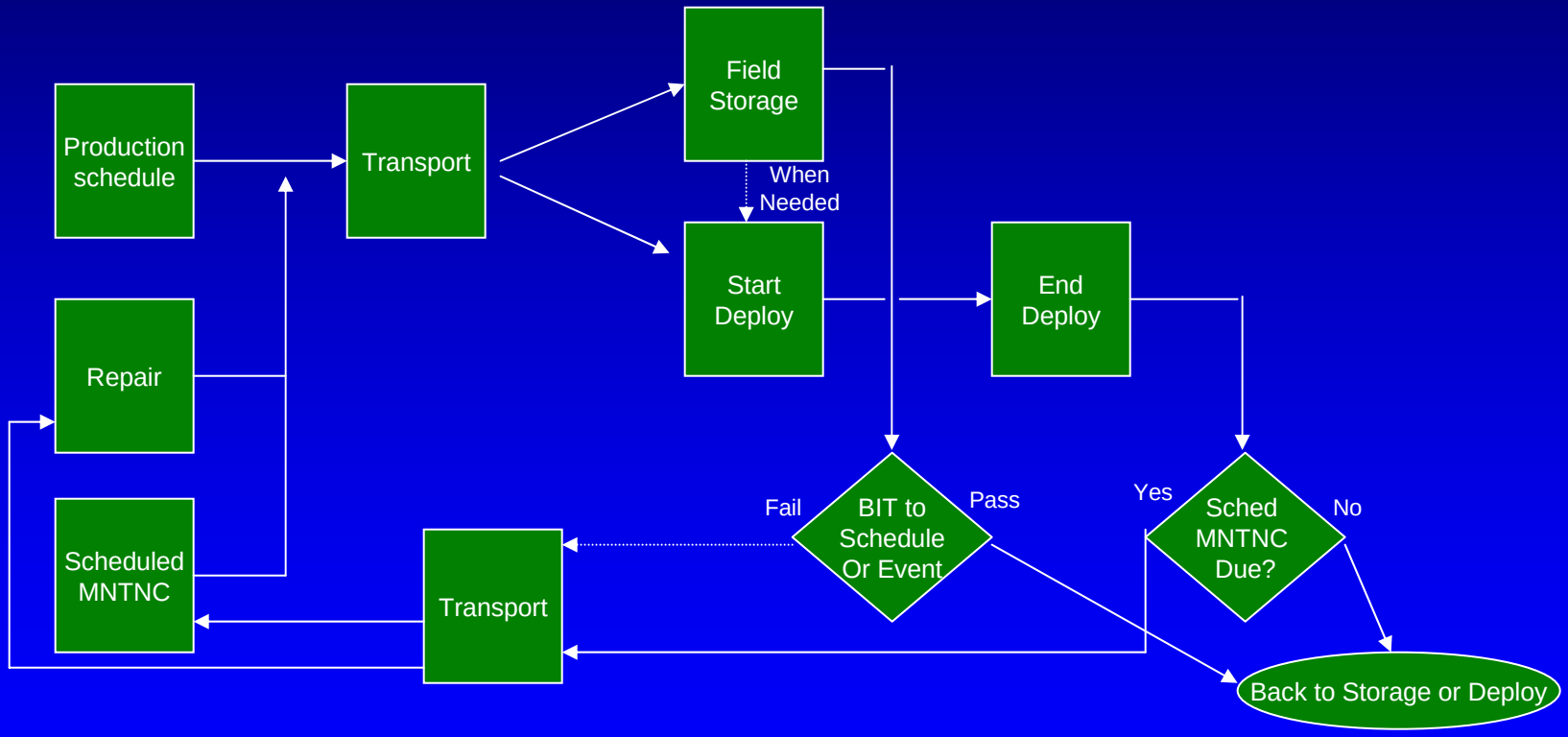


Life Cycle States/Environments

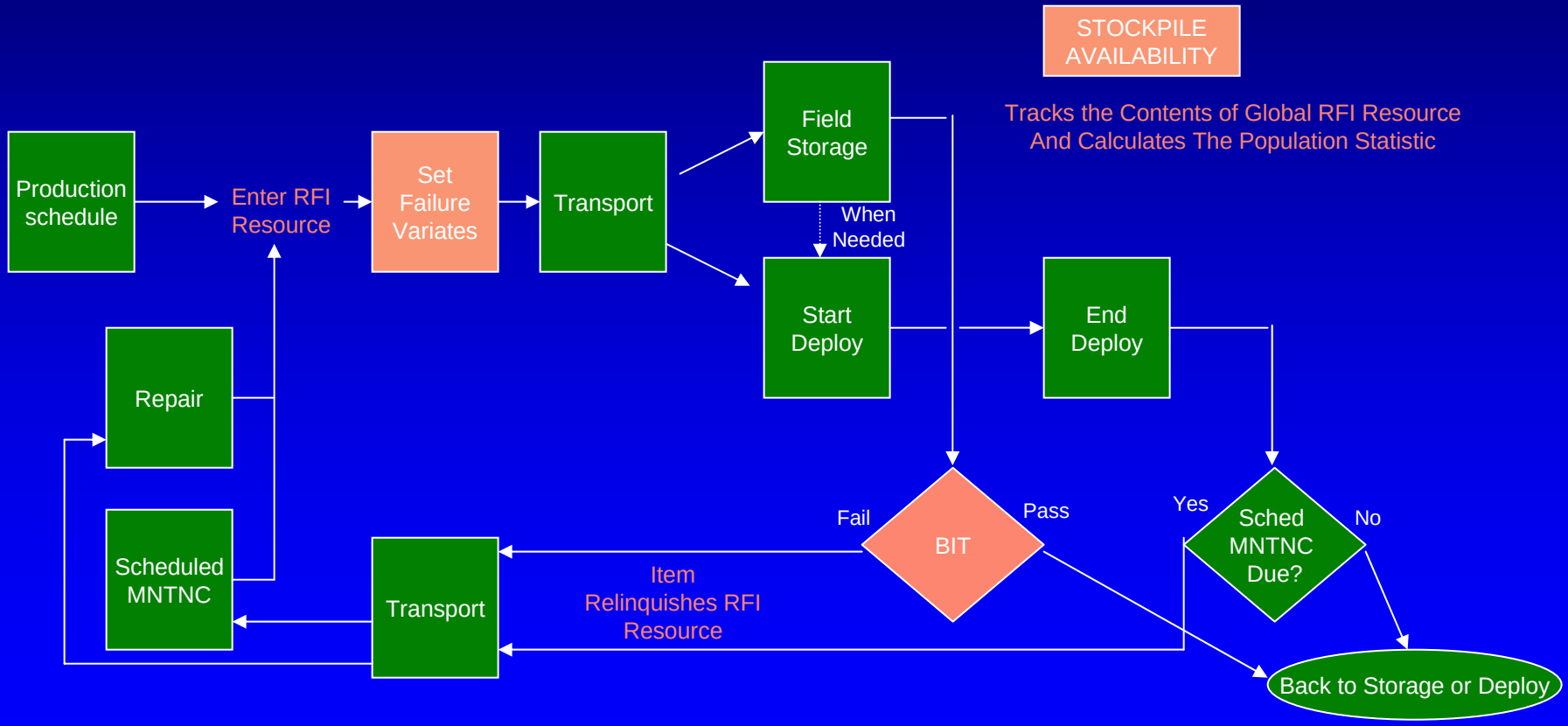
MOSS Broad-Block Approach

Model the Static Life Cycle Network from Flow Diagram



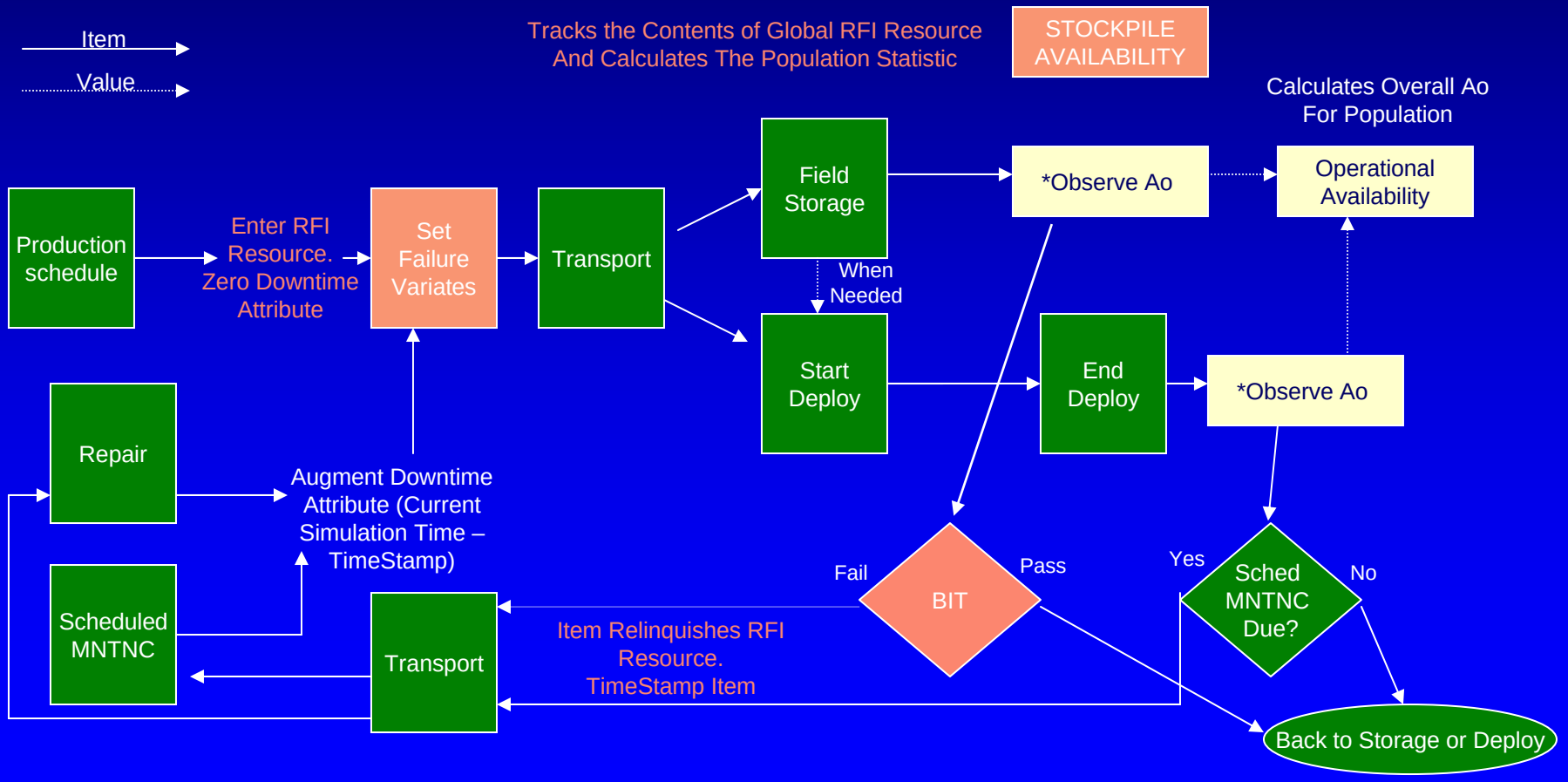
MOSS Broad-Block Approach → Apply Sub Models (Arranged Common Blocks) for Specific Functionality

Sub-Model for Stockpile Availability Applied



MOSS Broad-Block Approach → Apply Sub Models (Arranged Common Blocks) for Specific Functionality

Now Apply Sub-Model for Operational Availability



MOSS Method Addresses Needs

1) Larger-Scope System Approach Compared to Spreadsheets and Equations
   - Can Track and Update Items as They Move through Process
   - Can Easily Characterize Random Variables
2) Easy to Capture Dynamic State Changes
3) Easy to Characterize Complicated Process Flows
4) Standardized Logistics Tool Set in Pull-Down Menu
5) Tools are Pre-validated
6) Tool Set Induces Repeatable Structure, Level of Detail, and Speed of Creation for Future Models

NEEDS		
	Maintenance, Testing, Training, Operational Tempos	1) 2) 3)
	Dynamically Changing Utilization of Inventories	2) 3)
	Hardware Reliability in Diverse Environments	1) 3)
	Reliability Growth and Wear-out	1) 2)
	Upgrade / Retrofit Programs	1) 2)
	Effectiveness of Test Equipment	3) 4)
	Expediency of Logistics Supply and Transport Chain	1)
	Non-Repeatable Model Build	4) 6)
	Validation & Verification	5)
	Cost	4) 5) 6)

Benefits of MOSS - Summary

"Environmental Fidelity" equates to High Fidelity Prediction

- Tracks and Accumulates Time Spent in Various Environments for Each Item in the Inventory. Accurate Estimate of Duty Cycle → Accurate Failure Prediction

Integration of Analyses

- Sub Models for Failure Prediction, Warranty Failures, Availability Analysis, Spares and More → Consistency Between Different Studies in the O&S Arena.

Re-usable and Repeatable

- Common Blocks are Pre-defined, Pre-validated and Stored in Pull-Down Library. Attributes and Sub Models are Pre-defined

"Transparent" Interface

- MOSS Models are Designed For Making the System more Understandable Through use of Time-based Statistics and Charts, Graphics, Hierarchy and Animation.

The Act of Building Models with the MOSS Method Aids and Promotes Model Verification and Validation

Follow-On Work: Enable Direct Life-Cycle / Mission Trade Analyses

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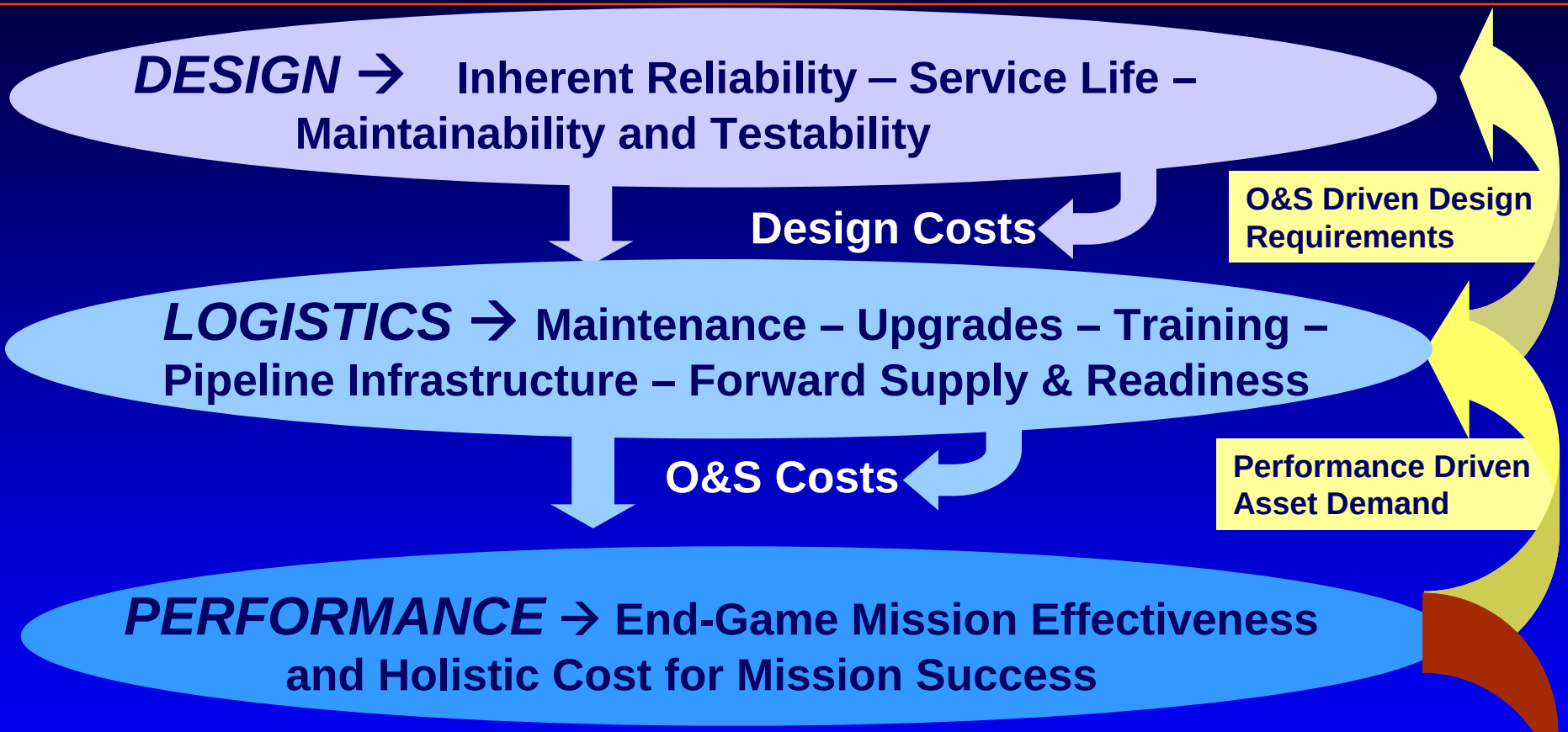

Benefit: "Cradle-to-Target" Insight into Performance & Cost Shortfall: Vertical Chain. Real World can be Horizontal

Follow-On Work: Integrate Logistics Modeling with Other Initiatives

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Integrate Logistics / Mission Performance Modeling and Simulation

Example : Total Asset Visibility and Prognostics could Update Predictive Models with Actual Field Data