

SIEMENS

Siemens – MADe Demonstration

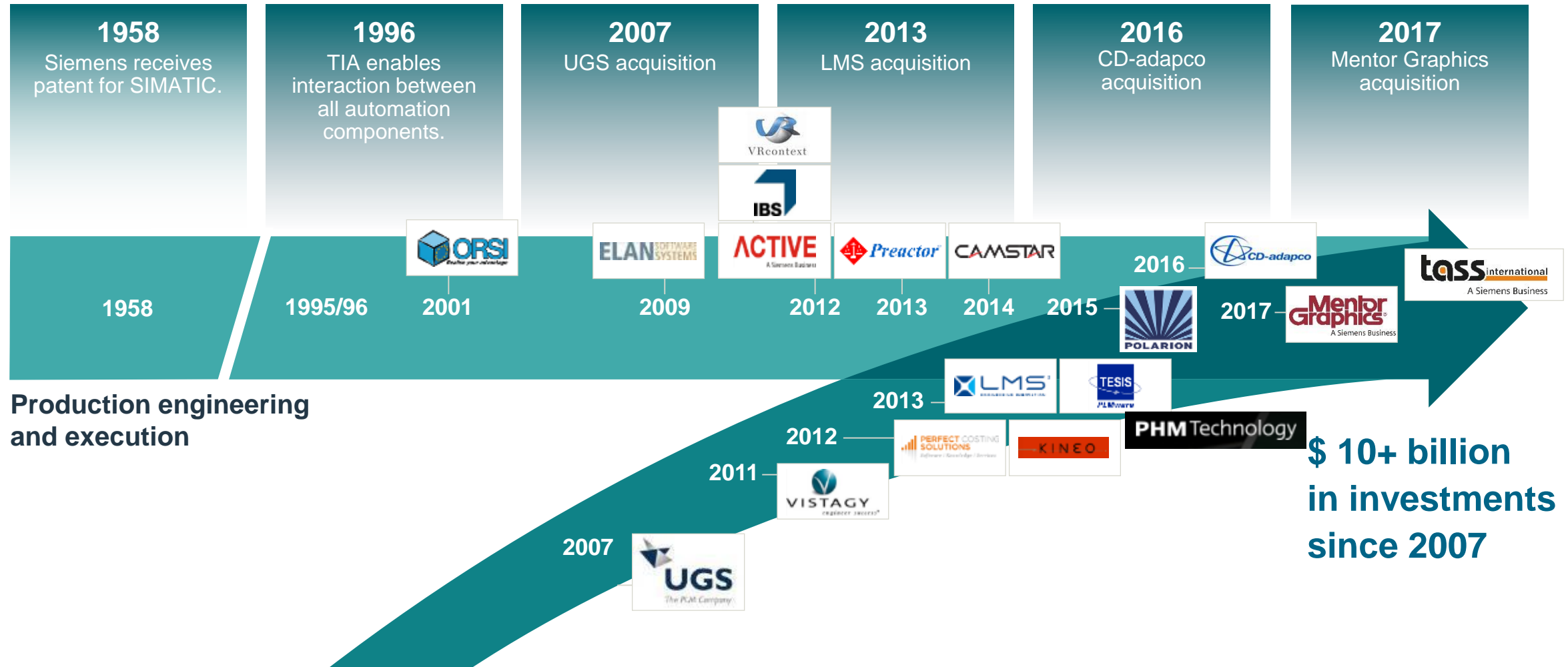
Model Driven Reliability Engineering

AGENDA



- Introductions
- PHM Introduction
- MADe Overview
- Use Case Walk Thru
- Summary

The Digital Factory business follows a long-term strategy with the systematic expansion of our portfolio



PHM Overview

- Siemens became an Equity Partner in PHM Technology as of February 2016
 - PHM Technology
 - Australian Company based in Melbourne
 - Maintenance Aware Design Environment (MADe)
 - ‘model-based’ engineering tools for the design, safety, reliability and health management of complex systems
 - MADe Modules
 - MADe
 - Safety and Risk Assessment
 - RAM
 - Prognostics and Health Management



BAE SYSTEMS
INSPIRED WORK



GENERAL DYNAMICS



MADe Overview - Modules

- Made Modules Overview
 - **MADe Module**
 - Create the functional block diagram
 - Assign functions to blocks
 - Assign failure diagrams to blocks
 - Observe flow perturbations
 - Observe flow responses

PHM – MADe - Modules

- Made Modules Overview Continued
 - **Safety and Risk Assessment Module**
 - Entering criticality factors using the Criticality & Reliability Editor
Analyzing criticality of the Functional Block Diagram (FBD) system model using:
 - FMEA Reports
 - FMECA Reports
 - Critical Item Analysis editor
 - Analyzing the FBD system model using Functional Fault Tree Analyses (FTA)

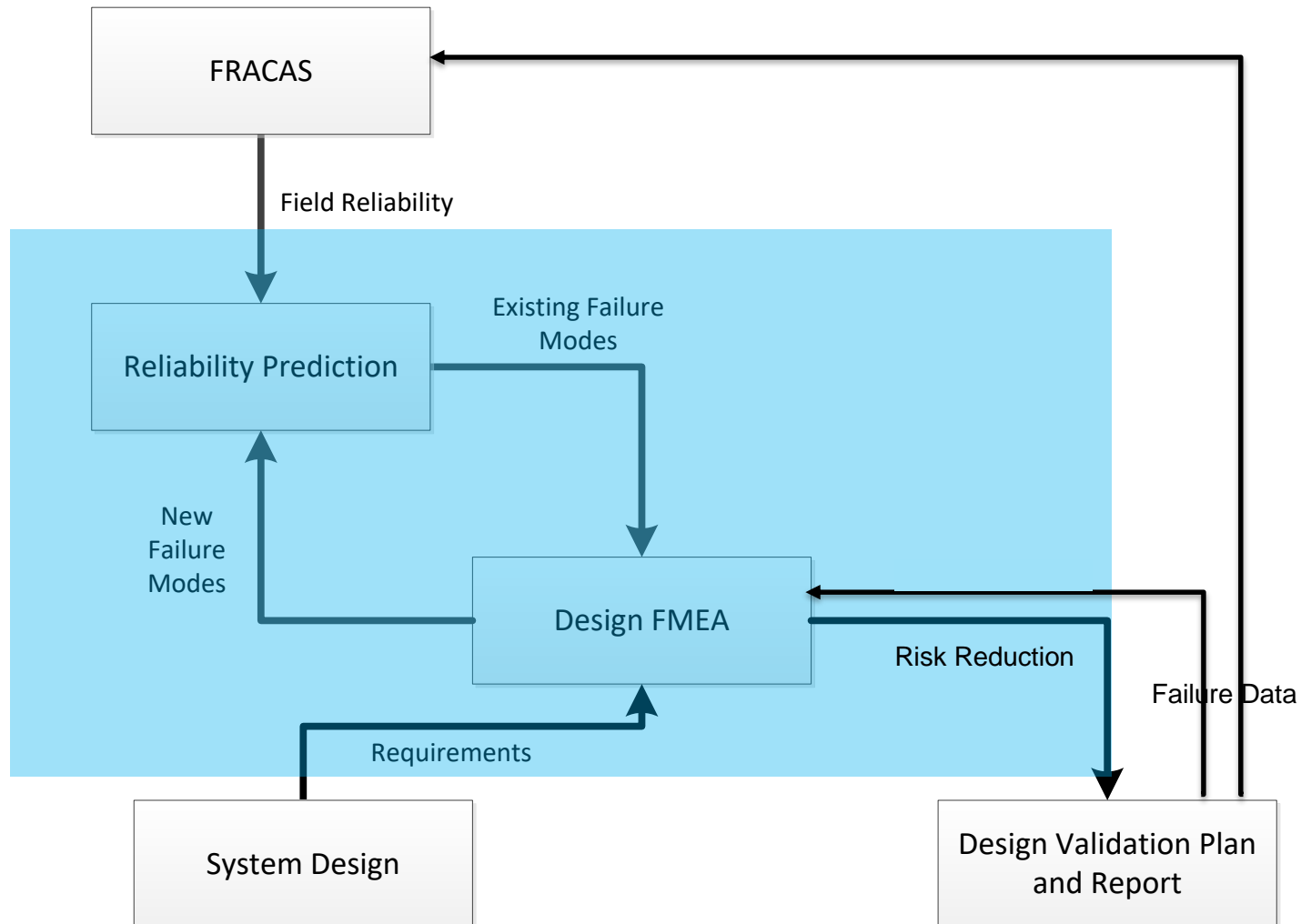
PHM – MADe - Modules

- Made Modules Overview Continued
 - **RAM Module**
 - Enter Reliability data for items/elements in the system model
 - Create Groupings for Availability/Reliability Block Diagram (ABD/RBD) Items
 - Conduct a Reliability analysis on RBD/ABD model
 - Conduct a Functional Fault Tree Analysis

PHM – MADe - Modules

- Made Modules Overview Continued
 - **PHM Module**
 - Analyzing a Functional Block Diagram (FBD) system to determine sensor test points
 - Modify existing sensor arrangements based on user knowledge or trade-offs
 - Optimizing sensor coverage using Sensor Sets
 - Enter or customize sensor information into a Sensor Library

Demonstration Focus Areas (MADe Module and RAM Module)



MADe Overview Flow

Create a New Project

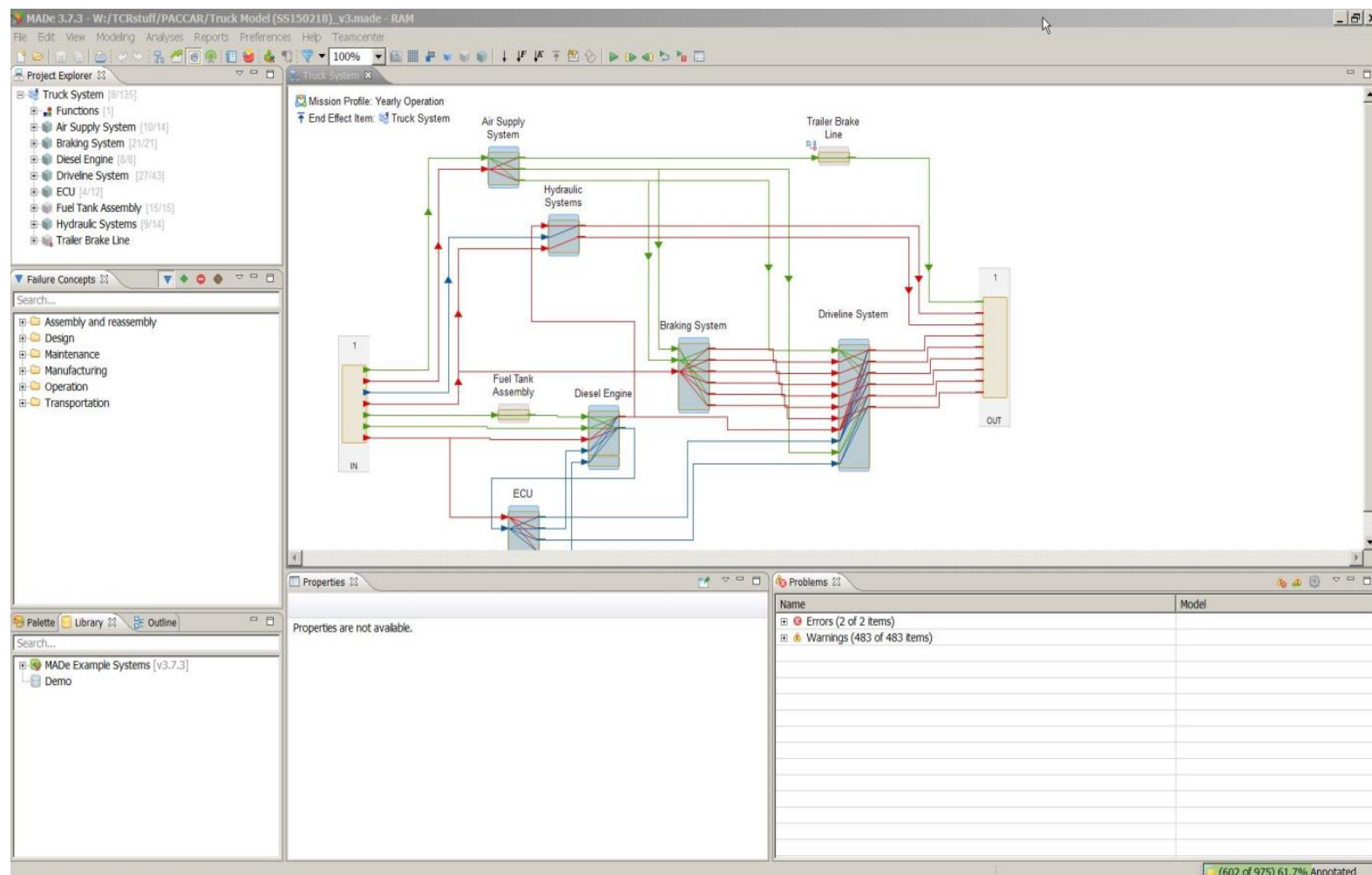
Create Functional Block Diagram

Create & Assign Failure Diagrams

Assign Criticality

Assign Occurrence, Severity & Detectability

Assign Historical Reliability



MADe Benefits

Create a New Project

Central Repository for Project Reliability Data

Create Functional Block Diagram

Facilitates organizational input and review

Create & Assign Failure Diagrams

Standard Failure Taxonomy – Consistency and Correctness

Assign Criticality

Integrated FMEA/FMECA

Assign Occurrence, Severity & Detectability

Integrated FMECA

Assign Historical Reliability

More Accurate Predictions

Use Case Walk Thru

Mission Profile

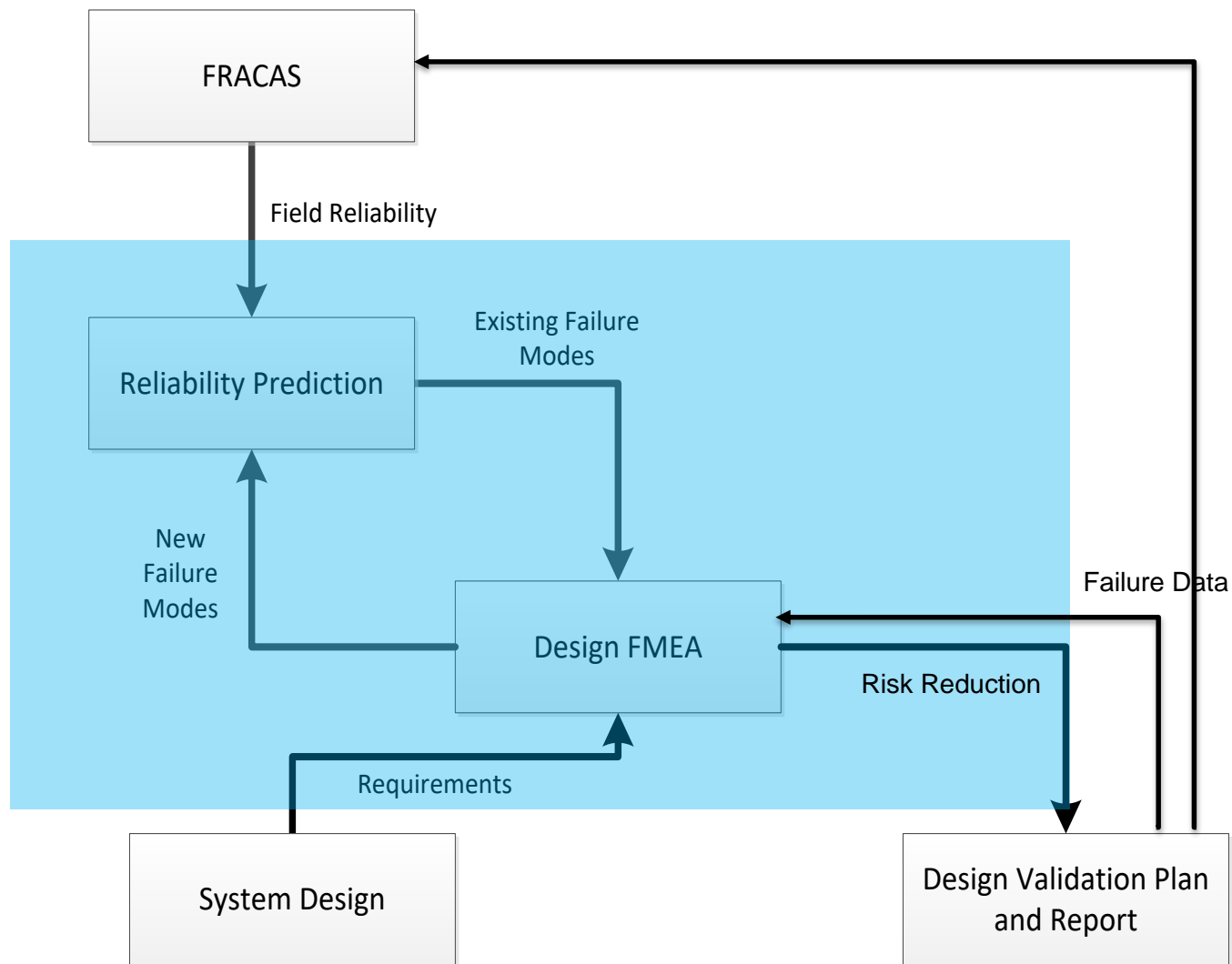
FMEA/Software
FMEA/Mechanical Fault Injection

Reliability Allocation

Update Reliability Allocation
with FRACAS Data

Reliability Block Diagram

Fault Trees



Use Case Summary and Benefits

Mission Profile

Analyze Mission Effects On System Reliability

FMEA/Software FMEA/Mechanical Fault Injection

Analyze Software Risk As Part Of Overall Mission Risk

Reliability Allocation

Reliability Prediction Based on Same Model Used to Analyze Risk (FMEA/FMECA)

Update Reliability Allocation with FRACAS Data

Leads To More Accurate Reliability Predictions

Reliability Block Diagram

Based on FBD Leading To Consistency Across Artifacts

Fault Trees

Based on FBD Leading To Consistency Across Artifacts

MADe Value

- **Standard Failure and Functions Taxonomy Leads to consistency and reuse.**
- **One tool to perform multiple analysis (RBD, FMEA, Fault Trees)**
- **Model based Reliability Provides for Better Understanding and Feedback**
- **MADe is a standalone product that has an available integration with Teamcenter. MADe does not require Teamcenter**
- **When Used With the Teamcenter Integration connectivity with DVP&R, Requirements, FRACAS(future capability) – Integrated Reliability Environment**
- **Siemens/PHM willing to work with companies to develop additional capability i.e. Confidence Level in support of DVP&R**

Thank you.