Software Development Applying MBD Process & Tools at Ford

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• MBD (Model Based Design) is a Common set of Processes, Tools and Methods for developing control/requirement models for simulation and/or code generation.

• MBD is designed to integrate with and enhance the current strategy/software development process used for production and research code development.

• MBD is a methodology used to design embedded software based on graphical models typically applied to control systems.
MBD Core Team is a centralized team that develops and deploys MBD Processes, Methods, and Tools for Ford globally.
Recognition of Growth & Benefits using MBD, as well as diverging MBD practices, created value proposition for establishing MBD Core Team.
TO DELIVER BEST IN INDUSTRY STANDARD MODEL BASED DESIGN PROCESS, TOOLS, METHODS, TRAINING AND USER SUPPORT AND TO BE THE VOICE OF THE CUSTOMER WITH PRODUCT VENDORS

To that end, the MBD team is leveraging agile methodology and continuous integration platform.
Key Roles of Ford MBD Core Team

- Define
  - Core MBD Team Defines MBD Requirements

- Design
  - Team of Experts Design MBD Software Process and Tools

- Support
  - Core MBD Team Supports User Base via Guidance & Training

- Deploy
  - Core MBD Team Deploys MBD Process/Tools to MBD User Base
Continuous Integration & Agile MBD Workflow

- Release MBD Tools
- Issue Management
- Develop Fix
- Execute Test Suite
- Write MATLAB Unit Test Case

Increased Efficiency, Higher Quality MBD Tools
What are Ford MBD Process/Tools?

Each step of Ford MBD Process applies MathWorks Tools at the foundation.

- Model Templates
- Model Configuration
- Modeling Style Guidelines
- Blocksets (FSAB, PCCN, ...)
- Example Models
- Requirement Traceability
- Parameter Management

Customizations are applied to base tools, however, to support Ford MBD Workflow.

- Model Utility Tools
- Model Checking Tools
- Code Generation Tools
- Documentation Tools
- Static Analysis Tools
- Design Verification

Global MBD Processes/Methods/Tools that allow engineer to follow Ford Recommended MBD Workflow
Ford MBD Tools Release Process

MBD Core Team delivers enhancements and fixes to existing MBD Tools on a Quarterly basis, supporting Production Users.
MBD Core Team: Single Voice to MathWorks

- Prioritize Ford Requests
- “Top 10”
- Provide Clarification on Requests
- Track Progress

MBD Core Team

- Powertrain
- Chassis
- Body
- Climate
- ADAS
- ....
MBD Tools Support for All Ford MBD Users

**Single MBD Tools Release Package Supports:**

- **Latest 3 MATLAB “b” versions**
  - Users encouraged to migrate every 3 years, at minimum

- **Multiple Model Architectures**
  - AUTOSAR, Export-function, Rate-Based

- **Compliance to Model Industry Standards**
  - MAAB Guidelines
  - Functional Safety
  - MISRA
  - AUTOSAR Style Guidelines

Some degree of flexibility required in MBD Tools to support multiple architectures, production timing, and model requirements.
- MathWorks Industry Model Testing (IMT) Process
- Early Product Testing (Pre-Releases)
- Evaluate new tools for alignment with Ford MBD workflow
- Identify & Fix issues prior to reaching Ford MBD end-users

MBD Core Team is responsible for testing new MATLAB releases and ensuring compatibility with Internal Ford MBD Tools.
Management of MBD Portfolio (MBD Vendor Tools)

- Manage Deployment of MBD Portfolio Tools, including MATLAB, for all Ford users
- Manage MBD Vendor Toolbox Usage
- Manage Enterprise Licensing Needs

Management of MBD Portfolio allows us to better take Advantage of Latest Tools to Support Desired MBD Workflow
Ford / MathWorks Collaboration

CREATING TOMORROW TOGETHER.....
Requirements for Common MBD

Challenges Along Way:

- MBD Process/Tools Maturity
- Gaining Commonality
  - Migrating Pre-established Processes
- Culture
  - Shift in Mindset
- Overcoming Silos

Common MBD

Strong Relationship with vendors

Engagement with Functional Teams

Centralized MBD team driving & advancing MBD

Functional Team Alignment

Enterprise-Wide Alignment to MBD Strategy
Key Learnings to Overcome Challenges

- **MBD Process / Tools Maturity**
  - Agile Methodology that allows support for Latest Emerging Technology

- **Gaining Commonality**
  - Dedicating time for hands-on user support & engagement

- **Culture Shift**
  - High-Level Champion to drive MBD globally

- **Overcoming Silos**
  - Cross-functional Governance / Steering Team Forums to steer Functional MBD Alignment
Common MBD Processes & Tools Not Only Benefit the Engineer, but the Entire Enterprise.

Proven MBD process allows Quicker Onboarding of new engineers.

Model Design Process allows for Earlier Simulation and Defect Detection.

Model Based Design at the Core

Common MBD Processes allow for Easier Integration of Component Models at System Level.

Common MBD Processes enable validation at all System-V layers, enabling early Validation of Requirements, System Design, Architecture, Component and Implementation.
Thank You!