Lean Product
Creation

Art Hyde
Global Product Development System
April 7, 2006
Lean Product Creation

1. Overview

2. Key Elements

3. Challenges
Lean PC Research of Toyota

Al Ward concept of “Set-based Recursive Design” @ M.I.T. (1980s)


Japan Auto Studies (1991-97)
- U.S./Japanese auto case studies
- Discovered mainly Toyota and Suppliers Set-based
- "Second Toyota Paradox" (introduced Set based concepts)
- Detailed study of Toyota vs Chrysler (Durward Sobek)
- “Functional Build/Assembly Variation Research by Pat Hammett”

Detailed study of Toyota versus N.A. body development process by James Morgan (1999 to present)
- Coherent P/D system made up of mutually supportive elements
- Product Development as a critical lean manufacturing enabler
- Model of lean product development
An integrated system...

**Process**
- Customer-defined value
- Front-Loaded
- Leveled PD Flow
- Adherence to Rigorous Standards

**Tools**
- Adapt tools to fit process & people
- Align thru visual communication
- Facilitate organization learning & standards

**People**
- Strong Chief Engineers
- Balance expertise & integration
- Towering technical competence
- Integrated suppliers
- Built in learning & improvement

... to satisfy customers & shareholders

Source: Morgan & Liker, 2006
Lean requires full “Enterprise” commitment
High Performance Product Creation

Toyota vs. U.S. Automaker Engineering Changes

Number of Changes

Start of Development Program

Start of Production

U.S. OEM

Toyota

Front-Load Failure Mode Discovery & Resolution

Improve Customer Response

Copyright Optiprise, Inc.
Foundation Principle

ACT

PLAN

CHECK

DO

Culture

Source: W. Edward Deming
At Ford, Lean Product Creation was developed and is being implemented globally:

**Global Lean Product Creation**

**Global**  **Product Development**  **System**
High Performance Product Creation

An integrated system...

Process
- Customer-defined value
- Front-Loaded
- Leveled PD Flow
- Adherence to Rigorous Standards

... to satisfy customers & shareholders

Source:
Morgan & Liker, 2006
Value Stream Mapping

Remove Work That Does Not Add Customer Value

- Visualize the entire process
- Identify the sources of waste
- Serves as a common language
- Identifies "hidden" interrelationships

Source:
Rother & Shook, 1998
Process Mapping to Understand Stations & Interactions

GPDS v2.1 work-in-progress (6-10-2005) Grouped by Workstream
# In-Station Process Control

**Process Sheet #: VG-T-04**

**Process Sheet name: Develop Upper Body Mechanical Package & Data(V2)**

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Level 1 Deliverable Metrics/Methods</th>
<th>Level 2 Deliverable Metrics/Methods</th>
<th>Level 3 Deliverable Metrics/Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Upper Body (UP) Mechanical Package: V2-Level 3D Data/Structure List, Non-Geometric Data and Engineering Data</td>
<td>Mech Pkg Block Summary</td>
<td>VVT Tool</td>
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<tr>
<td>D2</td>
<td>Upper Body V2 Open Issues Resolution Work Plan</td>
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<td>N/A</td>
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<td>D3</td>
<td>Upper Body V2 Failure Mode Avoidance Status-Vehicle Summary Status</td>
<td>Upper Body V2 Failure Mode Avoidance Status-PMT Detail Summary Status</td>
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<tr>
<td>D4</td>
<td>Upper Body V2 Perfect Drawing Plan (PDP’s) for New-tooled End- PDP &amp; VM - Level 1</td>
<td>Upper Body V2 Perfect Drawing Plan (PDP’s) PMT Detail Summary</td>
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<tr>
<td>D5</td>
<td>Upper Body V2 Verification Matrices (VM’s) for New-tooled End-Items PDP &amp; VM-Level 1</td>
<td>Upper Body V2 Verification Matrices (VM’s) PMT Detail Summary Status</td>
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<tr>
<td>D6</td>
<td>Upper Body V2 Program Campaign Prevention Status</td>
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<tr>
<td>D7</td>
<td>Upper Body V2 Analytical Functional Attribute Target Status</td>
<td>CAE Can Do/Must Do List</td>
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<tr>
<td>D8</td>
<td>Upper Body V2 E/E (Electrical/Electronic) Control System Integration Data and Integration Status</td>
<td>Upper Body V2 E/E (Electrical/Electronic) Control System Integration Data and Integration - Level 2</td>
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</tr>
</tbody>
</table>

*Prevent rework flowing downstream*

*Fix at point of “escape”*

*Stabilize cycle time & establish “pull”*

---

Courtesy of Ford Motor Company
“Deadlines, not Assessments”

- Events are achieved when criteria satisfied
- If not on-time, take action to maintain balance

Milestone & Gateway Discipline

Architecture Decisions  System Decisions  Component Decisions  Integration Gateways  Validation  Prototype Validation

Work

System Balance

Resources

Quality
Completeness
- Completion of all elements of design & validation for a given component

Facilitates:
- Change at the right time
- Reduced rework
- Stability downstream
- Aligned cross-functional involvement

Compatibility
- Resolution of interfaces with mating components & subsystems
Facilitates:

• Powertrain & Platform Reuse
• Better Launch Validation Confidence for Higher Risk Systems
• Moves High-Touch Systems/Attributes Closer to the Customer
Early Failure Mode Detection

- Standards (reflecting Lessons Learned)
- Design Reviews
- CAE Analysis
- Component/System Testing
- Vehicle Testing

![Diagram showing Early Failure Mode Detection with timelines and detection events in FMEA.](image-url)
Comprehensive & Rigorous Standards

Standardized Manufacturing Processes

CRITICAL FOR LEAN MANUFACTURING SUPPORT

Product Design Checklists and Guidelines

<table>
<thead>
<tr>
<th>Product Area</th>
<th>Product Requirements</th>
<th>D2558 Status (OK or X)</th>
<th>D3360 Potential Quality Concern</th>
<th>Product Design Engineer Comments (if requirements cannot be satisfied) &amp; Cost Impact</th>
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<tbody>
<tr>
<td>Dog Leg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Desired location</td>
<td>OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. 30mm max. depth</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. Class A radius 6.5R</td>
<td>OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D. Class A radius 5.5R</td>
<td>OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>E. Angle open 3 deg minimum</td>
<td>OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ZONE A: No directly visible ZONE B: No directly visible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3A concern</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheel Arch</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Flanged 2(3) 3 deg open (cut if need)</td>
<td>OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. Class A 8.5R cut radius 2.3R</td>
<td>OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. Flange max. flange</td>
<td>OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D. No holes in wheel arch flange</td>
<td>OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Flange 5 deg open (P)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. Flange length must: OK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. 2.5F radius</td>
<td>OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1A concern</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nose</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Minimum ST radius: OK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. Flange open 3 deg. min. (P)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. Flange length must: OK</td>
<td>OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D. 3 mm radius min. at 20°F</td>
<td>OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1A concern</td>
<td></td>
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</tbody>
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An integrated system... to satisfy customers & shareholders

People
- Strong Chief Engineers
- Balance expertise & integration
- Towering technical competence
- Integrated suppliers
- Built in learning & improvement

Source: Morgan & Liker, 2006
<table>
<thead>
<tr>
<th>Cultural Characteristics</th>
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<tbody>
<tr>
<td>TOYOTA</td>
<td>U. S.</td>
</tr>
<tr>
<td>Technical Excellence</td>
<td>Business Excellence</td>
</tr>
<tr>
<td>Process Discipline and Work Ethic</td>
<td>Results Focus</td>
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<tr>
<td>Every Day Kaizen</td>
<td>New Initiatives</td>
</tr>
<tr>
<td>Go See</td>
<td>Tech Aided Engineering</td>
</tr>
<tr>
<td>Planning and Detailed Execution</td>
<td>“Just Do It”</td>
</tr>
<tr>
<td>Learning DNA</td>
<td>“No Problem”</td>
</tr>
</tbody>
</table>
Developing Competence

In addition to technical competence, build process competence

Process Overview

Manager-led Cascade
- Functional groups
- Global audience engaged in product creation

- Expands on awareness cascade; includes process enablers, key milestones, and functional integration.
- Describes process and outlines business case.
- Includes high-level overview of program scalability and implementation process.
- Leverages local management participation to provide organizational focus.
- Attendance tracked/histories updated
- Launch – 2nd Quarter 2005

Web-based Training
- Global audience
- All employees
- Supplier partners

- Introduces Global Product Development System (GPDS)
- Describes the need to move from current processes to GPDS
- Highlights key process changes
- Outlines relationship with existing processes changes
- Describes roll out plan. Includes messages from key management and highlights the importance of GPDS.
- Histories not updated/ count of participation by Organization
- Launch – 1st Quarter 2005

Milestone Activities

SME-led Training
- Functional groups
- Global audience engaged in product creation

- Includes seven modules
- Provides foundation for workplace application learning
- Describes how GPDS impacts quality, timing, culture, and supplier relationships
- Emphasizes interdependency between functional areas
- Explains job roles and responsibilities in terms of “give” (inputs) and “gets” (outputs) along the GPDS milestones
- Explains process in terms of deliverables, function, and activities
- Leverages examples and discussions specific to program teams
- Attendance tracked and/or histories updated
- Launch – 4th Q 2005

Enabler Training

Provides training on key GPDS enablers (Perfect Drawing Plan, CATIA V5, etc.). Launch – TBD.

Leadership and Change Management Support

Successful transition from current processes to GPDS is dependent upon effective leadership at all levels of the organization.
Data-Driven Lessons

Learning is the Key

Analysis of Changes after Analytic Verification

(A) Attributes
- Change assumption: 3%
- Related with other parts ECN: 4%
- Others do not specified: 12%

(B) Reliability
- Operation feels: 8%
- Appearance: 53%
- Others marketability: 16%
- Door/Lid Clearance: 3%
- Squeak/Rattle: 13%

(C) Concern raised in production (internal)
- Deformation (Heat): 34%
- Corrosion: 2%
- Water/Dust intrusion: 8%
- Practical Safety: 27%
- Others: 19%

(D) Interference/Careless notes in drawing
- Careless Notes on drawing: 66%
- Wiring Harness: 9%
- Others: 25%
- Trim(6), INST Panel(3), Front Door(3)

Vehicle Assembly: 72%
- Wiring Harness(28)
- Trim(13)
- Seat Belt(9)

Paint: 4%
- Plastic: 2%
- Stamping: 13%
- Body Assembly: 8%

Others marketability: 16%
- Trim(20), INST Panel(12), Outer Mirror(8)
- Sealing: 10%
- Others: 19%

Practical Safety: 27%
- Trim(20)
- INST Panel(12)
- Seat(2)
- Outer Mirror(8)
An integrated system…

... to satisfy customers & shareholders

**Tools**

- Adapt tools to fit process & people
- Align thru visual communication
- Facilitate organization learning & standards

**Source:**
Morgan & Liker, 2006
Visualization Tool Sets

- Advanced Bill of Material
- Configured Product Structure and Design in Context (CATIA V5 and IDEAS)
- TCe / CATIA V5 Enhancements
- FOE Integration
- Volvo / J &LR Integration
**Simple Tools for Engineers**

**Synchronization**

*Engineer tool of choice:*  
Microsoft Excel

**Completeness**

(Perfect Drawing Plan)

**Compatibility**

Verification Matrix  
DPA Checklist

---

<table>
<thead>
<tr>
<th>Engineer tool of choice:</th>
<th>Microsoft Excel</th>
</tr>
</thead>
</table>
Enabler Group by Process Phases

**Phase 1**
Annual Process and Program Compatibility through <PS>

- PCP Enhancement (NE.12.001)
- Basic Design Division (NE.12.031)
- Product & Process Alignment (NE.12.091)
- Joint Platforms Program (NE.12.051)
- Annual Benchmarking (NE.12.011)
- Task Cycle Planning Enhancements (NE.12.031)
- Pre-program Finance (NE.12.081)
- Advanced Engineering (NE.12.091)

**Phase 2**
Annual Process and Program Compatibility through <PTCC>

- Target Alignment and System Selection (NE.12.005)
- Multiple Alternative Studies (Set Based) (NE.06.001)
- Front load Eng. resource for benchmarking (NE.06.001)
- Adopt Mazda 100% Pre-PS to PTA (NE.06.001)
- Develop 1st Engineering Concept (NE.06.001.C)

**Phase 3**
Design Maturity Compatibility & Completeness through <EC>

- Geometry Creation and Delivery (NE.10.005)
- Two Phase (UP & UN) Development (NE.08.001)
- M1 & Final Data Judgment (NE.08.004)

**Phase 4**
Prototype Procurement, Build, & Testing

- Joint/Platform Program (NE.12.007)
- Manufacturing Readiness and Launch (NE.12.012)
- Workload smoothing & Staggered derivatives (NE.12.012)

**Phase 5**
Manufacturing Readiness and Launch

- Functional Evaluation Process (NE.04.XXX)
- 3D Solid Pattern Molding (NE.03.001)
- Virtual Stamping Process Verification (NE.09.001)

**Tools**

- UP Mechanical Package (NE.08.XXX)

**People**

- Pre-program Finance (NE.12.081)
- Pre-program Engineering (NE.12.091)

**Process**

- Bill of Process (NE.12.061)
- Robust & Compatible Output at PS (NE.12.011)
- Upfront CAE Analysis (NE.12.061)
- Detailed Scheduling System for Stamping (NE.09.001)
When engineers join programs, GPDS has an unaccustomed “square wave” of activity:

- On-Time Resources even more imperative
- Deliver quality through detailed planning
- Focus accountability with authority
Challenges

Reducing tooling lead time:

- Internal expertise has atrophied
- Past experience drives “cushions”
- Legacy business structure reduces flexibility
- Critical to maintain compatibility between long and short lead tools

<table>
<thead>
<tr>
<th>Present Ford Experience</th>
<th>Tooling Data</th>
<th>5.5 Months</th>
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<tbody>
<tr>
<td>2006 – ’07mid Plan</td>
<td></td>
<td>3.5 Months</td>
</tr>
<tr>
<td>2007mid – ? Plan</td>
<td></td>
<td>2.5 Months</td>
</tr>
</tbody>
</table>
Perceived Competence

1. **SHOCK**
   - Surprise, in extreme cases, panic and "Immobilization".
   - A mismatch between expectations and reality.

2. **DENIAL**
   - Disagree that change is necessary. Retreat/withdrawal, "False" competence, blocking

3. **AWARENESS**
   - Perceive that change is necessary. Understand own competence.

4. **ACCEPTANCE**
   - Recognize the change is reality. "Let go" of past comfortable attitudes.

5. **EXPERIMENTATION**

6. **SEARCH**
   - Looking for meaning. Understanding reasons for success and failure. New models/personal theories created

7. **INTEGRATION**
   - Incorporation of new principals, skills and behaviors

**Implementation Change Management**

- **Challenges**
  - Incorporation of new principals, skills and behaviors
  - Understanding reasons for success and failure. New models/personal theories created
Backup
"Way Forward" Strategy

Strong Brands

Go Common
Go Simple
Go Lean
Together

Satisfied Customers
GPDS goals are to improve capability:

1. Time to market
2. Launch quality
3. Resource efficiency
4. Shared Technology Programs
Global “Best Practice” starting point is Mazda:

1. 8 - 14 months faster
2. 10 - 30% better durability
3. Among the leaders in design/style
4. 40 - 75% more resource efficient
5. Fastest rate of improvement
NEW PROCESS ENABLES TRANSITION OF RESOURCES TO TIMELY UPSTREAM EFFORTS

Closing the Gap in Product Creation

**Existing Process**

- 10% Plan
- 55-60% Execute New Product
- 30-35% Rework
  - 10% Launch
  - 10% Current model quality
  - 10% Current model cost reduction

**Product Creation**

- Limited output; inconsistent execution

**New Process**

- 15% Plan
- 75% Execute New Product
- 5-10% Rework

**Product Creation**

- Great Products, More Products, Faster

**Better allocation of engineering resources upstream delivering:**

**Better quality, lower cost, and faster product delivery**
# Platform Content

<table>
<thead>
<tr>
<th>Under Body</th>
<th>Front Structure</th>
<th>Floor</th>
<th>Crossmembers</th>
<th>Dash Lower</th>
<th>Seat Frames</th>
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</thead>
<tbody>
<tr>
<td>Chassis</td>
<td>Frames</td>
<td>Suspension</td>
<td>Brakes</td>
<td>Steering</td>
<td>Controls</td>
</tr>
<tr>
<td>Powertrain</td>
<td>Engine</td>
<td>Transmission</td>
<td>Mounts</td>
<td>Fuel</td>
<td>Exhaust</td>
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<td></td>
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<td>Intake</td>
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<td>Cooling</td>
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<tr>
<td>Electrical</td>
<td>Charging</td>
<td>Distribution</td>
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<td>Controls</td>
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</table>

![Platform Content Diagram](image-url)
### Platform Attributes

<table>
<thead>
<tr>
<th>Examples:</th>
<th>Full Vehicle Attributes</th>
<th>Under Body Sub-Attributes</th>
</tr>
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<tbody>
<tr>
<td><strong>Safety</strong></td>
<td>Ø Occupant Kinematics</td>
<td>Ø Front Crash Pulse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ø Steering Column Collapse</td>
</tr>
<tr>
<td><strong>Durability</strong></td>
<td>Ø High Mileage</td>
<td>Ø Frame Structure</td>
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<tr>
<td></td>
<td></td>
<td>Ø Suspension Structure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ø Steering Structure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ø Brake Structure</td>
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<tr>
<td><strong>NVH</strong></td>
<td>Ø Road Noise</td>
<td>Ø Structural-Borne Transfer Functions</td>
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<tr>
<td></td>
<td></td>
<td>Ø Tire Generated Noise</td>
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<td><strong>P&amp;E</strong></td>
<td>Ø Fuel Economy</td>
<td>Ø Friction</td>
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<tr>
<td></td>
<td></td>
<td>Ø Parasitic Losses</td>
</tr>
</tbody>
</table>

Validation Experience Correlates Full Vehicle CAE Models & Attribute Assessments
Toyota Engineering Activity During Early Product Design Phases

Conventional Process (Prior to 1980's)

Third FL Initiative (On-Going: Planned Trajectory)

Source: Hagas, 2000

Source: Thomke and Fujimoto, 2000
Program Upfront Compatibility

Concept Design

Bill of Materials

Weight

Attributes

Cost

Resources

Suppliers

Timing

Manufacturing
### Set-Based Decisions

**Primary: Column EPAS**

**Alternative 1: Single Pinion EPAS**

**Alternative 2: Dual Pinion EPAS**

### Implications:
- Cost
- Weight
- Geometry
- Manufacturing
- Timing
- Prototypes
- Resources
- Functional Attributes
- Compliance with Standards
- Quality

### Cross Functional Study:
- Product Engineer (Lead)
- Advanced Engineering
- Supplier
- Manufacturing
- Attribute Leaders
- CAE
- Testing

### Steering System:
- Column
- Motor
- Module
- Sensors
- Wheel
- Gear
- Tie Rods
- Wheels /Tires

### Functional Assessment:

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Date</th>
<th>Engineer</th>
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<tbody>
<tr>
<td>Part/System Name</td>
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<tr>
<td>Recommendation</td>
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<tr>
<td>Baseline Part Design</td>
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<tr>
<td>Alternative 1 Design</td>
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<tr>
<td>Comparator:</td>
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<tr>
<td>Alternative 2 Design</td>
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<tr>
<td>Comparator:</td>
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</table>

<table>
<thead>
<tr>
<th>Description</th>
<th># of Units</th>
<th>Weight (lb)</th>
<th>Cost ($)</th>
<th>Change from Baseline Part</th>
<th>Weight (lb)</th>
<th>Cost ($)</th>
<th>Change from Baseline Part</th>
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<tbody>
<tr>
<td>Total Cost &amp; Weight per Vehicle</td>
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<td>$0.00</td>
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<td>$0.00</td>
<td>0.0</td>
<td>$0.00</td>
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### Underhood:
- Instrument Panel

### Instrument Panel:
- Column
- Motor
- Module
- Sensors
- Wheel
- Gear
- Tie Rods
- Wheels /Tires
Component Design Compatibility

Vehicle Requirements Tests
System Requirements Tests
Component Requirements Tests
Supplier Commitment
Prototype Release

Supply Base & Manufacturing Plans

Architecture Decisions
System Decisions
Component Decisions

Design Cost / Weight
Development Plan

Integration Gateways
Prototype Validation

Surrogate CAD
Resolve Interfaces
Vehicle CAD
Detail CAD
Countermeasures

Geometry
Functional Attributes
Manufacturing Facility

Integration Dimensions

Vehicle Requirements Tests
System Requirements Tests
Component Requirements Tests
Supplier Commitment
Prototype Release

Surrogate CAD
Resolve Interfaces
Vehicle CAD
Detail CAD
Countermeasures
Digital Pre-Assembly (DPA)

Key Points:

- Block Layout manages all geometry on a geographic basis
- DPA Plans developed by Block Layout; assigned to Engineers
- Rapid closure of issues leading up to Data Judgment
- Drives overall program CAD data integrity
Engineering Compatibility Tools

Test Requirements
- SetK
- Program Specific Geometric Requirements
- DPA Lists
- etc.

Digital Testing Processes

Vehicle Verification Tool
- Stores Test Requirements (SetK, DPA, CC,...)
- Stores Test Results Linked to Defined Tests
- Imports Data from Various Sources
- GPDS and Block Structure Capability
- Block Leader Review/Signoff
- Functional Activity Review/Signoff
- Supports the GPDS DPA Plan
- Report Generation Exports

Results / Reporting

Reporting Outputs
- Multiple Reporting Formats Available
  - Taizen/EXCEL
  - Block Leaders Own Results
  - Program Status by Blocks
  - Cadence Determined by Program
  - Link to AIMIS
Flexible Capacity

- BODY STYLING (Multiple Clay Models)
- SUPPLIERS
- TRACERS
- TECHNICIANS
- CORE ENGINEERS

# AssociatesAssigned to Project

Months

Final Release

Clay Freeze
3 Types of Hansei Events

1. Post-Mortem Reflection: Program summary learning event.

2. Major Program Event Reflection: Held at critical program milestones to reflect on program status and learning opportunities close to actual event.

Ford

GPDS

Height @ Curb = 1416

925/934 2720 1121

1084 194 769 297