Introducing Capital® HarnessXC™
The Newest Member of the CHS Family

Embargoed Until October 16, 2006

Mentor Graphics
Integrated Electrical Systems Division
Agenda

- Mentor Graphics automotive strategy update
- CHS overview
- Wire harness design process
- New product: Capital HarnessXC
Mentor is Uniquely Positioned

- Harness Engineering & Manufacture
- Functional Modeling & Prototyping
- System Design and Mechatronics Simulation
- Network Design, Test, and Validation
- In-Vehicle Software
- System Integration & Physical Architecture
- Interconnect Design & Validation
- Module Design FPGA/PCB
- Functional Model & Prototyping
- System Design and Mechatronics Simulation
- Network Design, Test, and Validation
Mentor is Uniquely Positioned

- Mentor is uniquely positioned to provide comprehensive solutions for SystemVision & Simulink Integration.
- Our services include:
  - Harness Engineering & Manufacture
  - Module Design FPGA/PCB
  - Interconnect Design & Validation
  - Functional Modeling & Prototyping
  - Network Design, Test, and Validation
  - System Design and Mechatronics Simulation
  - In-Vehicle Software
  - System Integration & Physical Architecture
  - SystemVision & Simulink Integration
Mentor is Uniquely Positioned

New Wins
Including SAIC in China

- Module Design FPGA/PCB
- System Integration & Physical Architecture
- Interconnect Design & Validation
- Harness Engineering & Manufacture
- Functional Modeling & Prototyping
- Network Design, Test, and Validation
- System Design and Mechatronics Simulation
- In-Vehicle Software

Functional Modeling & Prototyping
Mentor is Uniquely Positioned

First AUTOSAR Compliant Network Design Tool & COM Stack for CAN, LIN & Flexray Protocol

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Interconnect Design & Validation

New Products 2006
Analysis & View Generation Tools

Harness Engineering & Manufacture

Functional Modeling & Prototyping

Network Design, Test, and Validation

System Design and Mechatronics Simulation

In-Vehicle Software

Module Design FPGA/PCB

System Integration & Physical Architecture
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October 16, 2006
Mentor Graphics Launches Capital HarnessXC

Harness Engineering & Manufacture

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System Integration & Physical Architecture

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October 16, 2006
Mentor Graphics Launches Capital HarnessXC
CHS Overview
Capital Harness Systems (CHS)

- What: integrated software suite for electrical system design
  - Transportation platforms: automotive, aerospace, rail

- Purpose: reduce design, manufacturing and warranty costs associated with vehicle electrical systems

- Covers extended flow
**CHS seeks to mend a largely broken flow**

Very little automation support for the physical design process

- Integration of logical systems into the vehicle & the creation of the electrical design system (EDS) is a largely manual task with little design automation, simulation or verification
- Work is drawing focused with significant waste of engineering talent

*System tools are disparate*

- Systems are created using many disconnected tools & vendors: consolidation and efficient re-use is hard

*Harness makers must accept data in many formats*

- Harness design costs rise because of OEM mandates to respect multiple formats within design responses

*Electrical design data is not managed as a flow*

- Various stages in the flow use disparate tools from multiple providers: severe disconnects appear at many key design interfaces
- Data enrichment is captured and change managed in an ad-hoc way

*Service groups are underserved*

- Today’s technology feeds service groups poorly
- New capabilities are need to integrate views and diagnostics support

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**System design**

**System integration**

**Harness engineering**
CHS Products
Share Common Data Repository

Enterprise Access to Designs and Design Data
Custom Reports and Diagram Synthesis

Enterprise Integration
Data Integration with Other Systems

Logical Systems Design
Connectivity of all Involved Systems

Physical Implementation
Electrical Distribution System (Wiring)

Harness Engineering
Design Completion, MBOM Creation and Costing

Harness Manufacturing
Factory Utilization of Design Data

Embedded Simulation and Analysis
Decision Support, Design Validation and Certification
Wire Harness Engineering Process

- Target: manufacturable wire harness design
  - Meets design requirements
  - Fully specified (100% MBOM)
  - Optimized and validated for manufacture
  - Documented

- Wire harness = complex assembly of components
  - May be thousands of components
  - May be hundreds of configurations for each harness ("derivatives")
Wire Harness Engineering Process

Inputs

① Wiring Data

② Mechanical Data

③ Configuration Data

④ Component Data

Engineering

- Design embellishment
- Automated engineering

Value-add

Outputs

① Engineering Drawings

② Reports

③ Feeds to Manufacturing, MRP...
Sources of Harness Design Cost

Inputs
1. Wiring Data
2. Manufacture Data
3. Component Data

Design embellishment complicates engineering processes and IT demands

Engineering
Design change happens constantly. Lack of data consistency causes quality errors & rework
Embellishment related engineering

Value-add

Outputs
1. Engineering Drawings
2. Reports
3. Feeds to Manufacturing, MRP...

Multiple outputs. Frequently in different formats. Inhibits reuse and further complicates IT environment
Productivity Issues

- 20% of engineering time is spent originating designs
- 80% of engineering time is spent changing designs

- 30% of engineering time is spent re-drawing diagrams
  - Re-drawing in response to design change
  - Re-drawing to different graphical format

“90% of our engineers’ time is spent doing validation, not creative design work…”

Head of E/E design,
Automotive OEM
Addressing Sources of Harness Design Cost

Support for common tools & processes

Support for multi-source design change

- Multiple inputs, usually from different sources: complicates engineering processes and IT demands
- Design change happens constantly: lack of data correlation, causes quality errors & rework
- Multiple outputs, frequently in different formats: hinders review and further complicates IT
- Feeds to manufacturing, ERP...
Capital® HarnessXC™

Introduction

Key Technologies Addressing Design Cost
Capital HarnessXC

- **Capital HarnessXC**: a new harness design tool that addresses key industry issues
  - Inefficient resource deployment & high IT costs caused by disparate tools & processes
  - Wasted time and design errors caused by poor management of design change

- **Key new technologies**
  - Data-driven graphical styling
  - Configurable design change rules

- **Rich design embellishment & automated engineering**

- **Core CHS product**
  - Seamless integration with other CHS design tools
  - Powerful data management & integration infrastructure
Capital HarnessXC

Look & feel is common with other CHS applications

Graphical design window + tree browser (different views of same data)

Project access

Harness design embellishment & engineering environment

Intelligent objects
Leveraging the Power of CHS

- Capital HarnessXC ships with the applications needed for enterprise deployment
Leveraging the Power of CHS – Multiple Inputs

- Capital Logic / Capital Integrator: seamless integration
  - Common object model and project management infrastructure

Neutral data input format examples:
- Harness XML and Project XML: native CHS formats
- Entry points for component library data, configuration logic …
- DSI: widely used, from previous Mentor Graphics product *
- KBL: emerging German harness design data standard *

* Available May 2007
Leveraging the Power of CHS – MCAD Input

- Uses CHS plug-and-socket integration architecture
  — Flexible: easy to add new MCAD integrations

- Standard integrations with CATIA V5, CATIA V4, UGS NX and I-deas

- 3D → 2D and change reconciliation technologies
Leveraging the Power of CHS – Data Reporting

- CHS is data-centric
  - All design data is stored in a relational database

- Capital HarnessXC includes CHS flexible data mining application
  - Queries can be configured and stored
  - Output formats can be styled

- CHS reporting is exposed to other enterprise applications as a web service
  - Or published as HTML, XML …
Capital HarnessXC

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Design Embellishment

- **Embellishment**: addition of design details not defined elsewhere
  - Examples: shield termination design; spot tape placement
  - Capital HarnessXC is a dedicated tool, managing all common harness objects

- **Target**: all design requirements defined
  - End product requirements defined, not every part number
  - Can act as part of contract OEM ↔ harness supplier
Automated Engineering

- Engineering: automated design completion & validation
  - Examples: terminal, plug & seal selection; wire length calculation; design rule checks

- Capital HarnessXC re-uses industry-leading engineering algorithms from previous product
  - Calculations are fully composite (all harness configuration derivatives automatically managed from parent)
  - Data accessible by other value-add CHS applications (example: Capital Costing)
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Drawing (Diagram) Style Management

- **Drawings are key artefacts**
  - Convey information via coded symbols, linestyles …
  - Many different drawing styles used

- **Drawings rendered via style engine that intelligently configures graphics**
  - Static styles (examples: font, text position, title block)
    - Content reflects design data
  - Dynamic styles that depend on design data
    - IF \( x \) THEN \( y \)
    - Styles may be stored and re-applied

- Many graphical formats supported from standard tool

- Design data is re-usable across multiple projects
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Design Cost – Change Management

- Design change is a daily event
- Changes originate from any of the design inputs, or from embellishment
- How to detect & control design change while preserving previous value-add?
Change Policy Management

- Defines how application responds to design changes
- Multiple change policies can be defined to support different flows
- Can be controlled at object (wire, connector, bundle …) or attribute (connector name, wire color …)
  - Changes classified as Create / Update / Delete
Summary

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More Ways for Mentor to Make a Difference