MultiCAD (I-deas, NX, Catia V5) & MultiSite Collaboration using Teamcenter Engineering

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Date:-30 April 2006
Company Profile

- Company Name: Mahindra & Mahindra Ltd.
- Division: Automotive Sector
- URL: [www.mahindraworld.com](http://www.mahindraworld.com)
- Location (s): India
- 2005 Revenues / Turnover: $ 3.0 Bn.
- Number of Employees: Approx. 15000
- Ownership profile (public / private): Public
Mahindra Group

Product and/or service lines

**Automotive Sector**
- Mahindra & Mahindra
  - Nasik: SUV
  - Kandivli: UV
  - Zaheerabad: LCV

**Farm Equipment**
- Mahindra Group Turnover $3 bn
  - Kandivli
  - Nagpur
  - Satellite
  - MUSA

**Trade & Fin**
- MMFSL
  - Mahindra Inter.
  - MSSC

**Infrastructure Development**
- MHRIL
  - GES
  - MIPL

**Information Technology**
- MB
  - MC
  - BPO

**MSAT**
- MES
  - Musco Steel
  - Musco Stampings
  - Sirolplast
  - Engines
  - Gears &

**Strategy**
- Niche - UV focus
- Exports growth
- Total solutions
- Global thrust
- Local
- MMFSL - reach 200 branches
- Focus semi-urban/rural mkt.
- For Auto/FES
- MHRIL-growth Gold Standard segment, launch silver GESCO increase managed
- Niche - Telecomm.
- SCm, SAP, BPO - focus on telecom
- Leverage low cost mfg. and engg. skills
Mahindra Group Global presence

- **USA**: Mahindra USA selling tractors in the US for over a decade; it sold 8000 for a 4% market share in 2004.
- **ITALY**: in mid 2004, M&M launched Scorpio, renamed Goa, in the country; will serve as Europe HQ for the company (next move: Spain and France).
- **SOUTH AFRICA**: M&M South Africa Pty. Ltd., a fully owned subsidiary, has sold over 2000 vehicles in less than 12 months; it will serve as a beachhead for the company’s African play.
- **URUGUAY**: M&M launched Bolero, renamed Simeron, in the country in early 2004 and sold 500 (the company is now eyeing Argentina and Brazil).
- **RUSSIA**: M&M hopes to use the country as its base for operations in CIS markets where it hopes to sell utility vehicles.
- **UKRAINE**: M&M’s door into the booming Eastern European agriculture market (next stop: Bulgaria and Romania).
- **CHINA**: M&M has an 80% stake in Jiangling Tractors (capacity: 15000 vehicles a year); apart from serving the booming Chinese market, this will be the company’s base for exports to West Asia, Australia and the US.
- **WEST ASIA**: M&M exports engine to Turkey, body shells to Iran and utility vehicles and tractors in the Arabian Peninsula.
Design scenario Between 1998 - 2004

- Multi site Design locations
- Global collaboration with suppliers
- Multiple Vehicle variants
- Implementation of Automated manufacturing lines
- New complex vehicle regulation norms & related process
PLM Tools used during 1998-2004

**Concept phase**
- Vehicle systems finalisation
- Styling data development

**Details design Phase**
- Component level design
- Alternative proposals design & analysis
- Manufacturability analysis
- Serviceability analysis
- System design specs finalisation
- Failure mode analysis

**Launch Phase**
- Releasing all components for production
- BOM creation (Design, Process, Service)
- Variants management
- Production Rampup

**Validation phase**
- CAE analysis - Vehicle & Component level
- Prototype development & validation
- Product concern management

**Post Launch phase**
- Engineering change management
- BOM management
- Standards management
- Part family management
- Standards management
- Regulatory data management

Tools:
- ALIAS
- CATIA V4
- IDEAS
- File System
- I-deas TDM
- TC Enterprise
- File System
- I-deas TDM
- TC Enterprise
- Hypermesh
- Nastran
- I-deas
- LS-Dyna
- File System
- TC Enterprise
- TC Enterprise
- SAP
CAD Limitations

Data exchange issues

• I-deas does not support multi TDM automatic data exchange
• Multiple Copies of Files/Parts all over the Sector get created - Single master cannot be maintained
• Limitation on controlling of object level access
• Difficult to Manage complex relationships of engineering data
• No data management system available for CATIA V4/ V5/ UGNX

Data translation issues

• Auto run Translators are not available for all the requirements
• No procedures/best practices established for translating the data using particular translator
• Use of different co-ordinate systems in & across vehicle programs and across different departments
Agenda

Challenges

Achievements

Technical details
MultiCAD & Multi site Challenges

Seamless CAD Integration

• With UG-NX for Powertrain development
• With Catia V5 for Body Design
• With I-deas for Legacy Data

Seamless Design Environment

• Multi site Design locations
• Global collaboration with suppliers
Design Team expectation

- The complete vehicle data from any CAD systems should be available in DMU for reviews
- The DMU should be available at all the sites
- Supplier Integration
- Elimination of 2 D Drawing
Expectations from Teamcenter Engineering?

- To manage CATIA V5, CATIA V4, I-deas & UG-NX data in single database
- To support MultiCAD DMU.
- To implement Content Migration Manager tool integrated with Engineering to migrate the existing feature based I-deas data to UG-NX
- To connect TC Engineering with TC Enterprise resulting seamless integration between CAD (PD) & PDM (Manufacturing, Vendor development etc...)
Design scenario from 2005

Teamcenter Engineering

MultiCAD Data Management

Teamcenter Enterprise

PDM

CAD

IDEAS

CATIA V4

CATIA V5

NX

ERP

SAP

TC Visualisation

Slide 12
Agenda

Challenges

Achievements

Technical details
How We Achieved the Expectations

- All Sites connected with Global i-MAN
- I-deas Manager, Catia Manager, NX Manager configured for CAD data management
- Data Synchronized across all sites
- Automatic data translation for Multi-CAD usage
- Effective use of PMI for 2D drawing elimination
- Access controls for group level & Project level data security
- Full service supplier integration
- Vehicle analysis for clearance, interference, serviceability & MRO applications
- Integration with Teamcenter Enterprise for part design, BOM Management, Variants management, Change management & document Management
Agenda

Challenges

Achievements

Technical details
• NX 4
• I-deas 11 M4
• Catia V5 R14 sp3
• Catia Manager 4.1.10
• I-deas manager 3.1.2.2
• Teamcenter Engineering 9.1.2.9
Systems Architecture

Corporate TC Enterprise Server
TC Enterprise Loc4 LAS Server
TC Enterprise Loc3 Server
TC Engineering Loc1 Server
TC Engineering Loc2 Server
TC Engineering Loc3 Server
TC Engineering Loc4 Server
TC Engineering Loc5 Server
Translation Server

Catia V5
UG-NX
I-deas
Translation Server

ODS & IDSM Server

IDSM Server

IDSM Server

IDSM Server

IDSM Server

IDSM Server
CAD Development using Catia & NX without DM

Using File System access controls

BIW Assy / Chassy assy.

Body Side / Side Member

Under Body / Suspension assy.

Closures / Steering assy.

Check Dir

WIP Dir

During Release

IN Data Dir
(Associate Data)

Control Data
(Studio)

Data is used by Designers
BIW Development - With Catia & TC Engg.

<table>
<thead>
<tr>
<th>Item ID and Description (Metaphase)</th>
<th>Release</th>
<th>NX Manager Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item ID</td>
<td>Rev</td>
<td>Description</td>
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<tr>
<td>---------</td>
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<td>0302AB0050N</td>
<td>001</td>
<td>Front Door Outer</td>
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<td>Front Door Inner</td>
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<tr>
<td>0301AB0040N</td>
<td>001</td>
<td>Front Door Hinges</td>
</tr>
</tbody>
</table>

Check Dir

PROJECT ABC – BIW ASSY

WIP Dir

DESIGN CONTEXT ASSEMBLY
FRONT DOOR INNER

CONTROL STRUCTURE

CLASS A
GLASS SURFACE
AB LINES
IN Data Dir & Control Data

Attribute Synchronization
Instance Collector
Design
Automated Data Translation & Sharing

NX Manager Loc1 ODS Server

Automated CAD BOM
Transfers

NX Manager Loc2 IDSM Server

Translation server
Running
Catia V5 to JT & Catia V4 to JT translators

Translation server
Running
UG - NX to JT I-deas to JT JT to Catia V5 Translators

Designer pastes required revisions of items into “TOLOC2 ” folder available into site1 for Catia V5 to JT conversion

Designer pastes required revisions of items into “TOLOC1 ” folder available into site2 for NX to JT & JT to V5 conversion
JT data is created after completion of the release process only. This ensures that all checks have been made & data is frozen for tessellation.

Important option set are

```plaintext
pmiOption = "PART_AND_ASM"
partMonitor = false
compression = true
advCompression = true
seamSewing = false
includeBrep = true
brepPrecision = "DOUBLE"
autoNameSanitize = true
deleteUnusedParts = false
updateChangedPartsOnly = false
verboseReporting = false
writeAsciiAssembly = false
singlePartsNoAssem = false
autoLowLODgeneration = true
smartLODgeneration = false
```
Catia V5 to JT Data translation

Catia to JT Configuration Options (key points)
• Include BREP
• All PMI (GD&T)

Important option set are
PartHierarchy = "collapsetopart"
Translate_Bodies = true
Translate_OpenBodies = "all"
Translate_Curves = false
Translate_Surfaces = true
Translate_Points = false
Translate_InactiveLayerEntities = false
Translate_NoShowEntities = false

JT is attached to the item revision with a relation as iman_rendering
Data migration from I-deas TDM to NX

Transfer data using PKG
3D Geometric Data Management

Engineering Design & Validation

Suppliers

Manufacturing Tooling Plant

Management Vehicle Prototype Review

Vehicle Definition (BOM, Configuration, Attributes, etc...)

PLM system (Teamcenter)
Advantages of PMI on 3D

- The time required to define PMI information is very less compared to create the drawing
- Save time required to search information in drawings
- Avoid case like, Part updated but not the drawing
- Feature identifications in 3D: class a surface, trim edges, Mating surface, change information, PLP, surface locators
- Automatic updates of parameters: weight, Surface area, mating area, painted area
- Automating process by creating templates using Powercopies, UDFs etc.
- Step towards Paperless Office
Access control list are defined in following order

- In Project(“ProjectID”) 
- Owning Group(“GroupPattern”) 
- Owning Group Has Security(“SecurityValue”)

Results

- Data is visible only to selected project members
- Very restricted access to Vendor personal
Data Sharing process with Tier 1 Suppliers

Method 1

Supplier to take data from HUB and publish data to Hub
Supplier’s ODS/IDSM is also on DMZ

Required item revisions of Site 2 & Site 1 are published for referring by both sites
Publish and store replica of items that will be shared with suppliers and partners
Data Sharing process with Tier 2 & Tier 3 Suppliers

Required item revisions of Site 2 & Site 1 published for referring by Site 1 & Site 2.

Supplier to import M&M data and export his (Supplier) data to FTP site.

Required data to be sent using object export for reference and Supplier data to be imported.
• Suppliers are sitting inside within LAN with Security
• Respective Suppliers can refer parts attached to their projects & to limited ref. Data.
• Object based ACLs’ are defined for data security
Multilocational Design reviews using Vis Mock-up

Designer from location 1 creates a conference, manually sends data, notifies participants and uses his/her computer as the conference host.

- Basic View Navigation
- Measurement
- 2D Markup
- Cross-section & Measure
- 3D Markup
- PMI
TC Engineering & TC Enterprise Integration

- New Part Creation
- Attribute Transfer
- JT Uploading
- Attribute Synchronization
- Revision Synchronization
• Defining attributes in NX Manager
  Material, Heat Treatment, Surface Treatment, …
• Defining attributes in NX PMI
  Significant, Critical Characteristics, Surface Finish …
• Attributes Synchronization
  NX PMI, NX Manager, Metaphase
• Attribute Transfer
  *.jt, *.prt
Multi CAD DMU

- DMU Structure contains all Project Data
- DMU includes all Project specific Variants of Engine- / Transmission, Body Styles, LHD- / RHD, etc.
- DMU is Data Pool for Simultaneous Design, Simulation, Analysis and Manufacturing Engineering activities
- Prototypes shown in separate Structures
JT Usability at diff. stages of Product Life Cycle

Vehicle DMU

Design

Kinematics

Ergonomics

Packaging

Styling

Supplier Integration

Assembly Line

Die Engineering

Simulation
DMU - Assembly Structure contains main vehicle variants

DMU Scorpio
- Engine
- Transmission
- Chassis
  - Steering
  - Suspension
    - Variant
      - Scorpio SLX
      - Scorpio Double CAB
      - Scorpio Single CAB
    - Axle
      - Tires, Wheels, Trim
      - Brakes
      - Frame Assembly
      - Mounts
      - Chassis Tools
      - HVAC + PT Cooling

Scorpio SLX
Scorpio Double CAB
Scorpio Single CAB
DMU Scorpio
CAD Managers – Benefits Achieved

Work in progress CAD support

- Familiar CAD User interface
- Extended Cad management
- Open, Save, Checkout/Check-In
- Synchronise, Release
- Attribute Mapping
- Create/Edit product structure
- Resolve Key Collisions
- Import / Export data
- Granular CAD relation support
- Support CAD Objects
MultiCAD – Benefits Achieved

MultiCAD product structure
- Embedded JT Visualization
- Digital Validation

CAD Tool Specific Features
- Inter-part relations
- Wave, MML
- Catia Published elements

Design in Context
- Use of JT for Non native CAD
- NX
- I-deas
- Catia V5
Results Achieved

- Realtime concurrent engineering in Multisite & MultiCAD data management
- Design process real-time across multiple locations
- Use of Visualization at manufacturing, CAE and Enterprise level
- Realtime DMU for design reviews
- Release process synchronization with TC Enterprise
- Supplier collaboration

Prototype Design & release time reduced by 30%
Thank You

Date:-30 April 2006