ELYSIUM -
Global Interoperability Provider
Enabling the Digital Thread

James Martin  
Director of Business Development  
GPDIS – September 2015
James Martin

Global Product Data Interoperability Summit | 2015

• SDRC (Now Siemens PLM) - 1988-2001
  • Design, CAE, Data Management, Pre-Sales, Marketing, Open Ideas Product Manager, established ESTECH in Japan
  • At NISSAN for 5 years to start up SDRC engagement, rolled into Mazda C3P with FORD, Yamaha as a supplier, more
• ITI TranscenData - 2001-2009
  • Asia Pacific Partner Management, JAMA PDQ Engagements
  • Account Manager for Boeing, Lockheed, re-engaged A&D
  • Technical Marketing Manager – MBE, Standards, Validation
• Jotne - 2009-2014
  • President of Jotne North America operations
  • Strategy, Marketing, Deployment of PLCS solutions to the Aerospace & Defense + Building Information Management
• Elysium since 2014
  • Business Development, Marketing, Strategy
The ‘digital thread’ that integrates and drives modern design, manufacturing and product support processes can be exploited to reduce cycle time and achieve first pass success.

It is the only feasible way to deal with the complexity of today’s products.
Digital Thread Trending

• National Shipbuilding Research Program (NSRP) IT Panel name / focus change to “Digital Shipbuilding Panel”
  www.nsrp.org

• Lockheed Martin Digital Tapestry

• Model Based Enterprise
  www.model-based-enterprise.org
  SASIG Investigation of MBE initiatives
Elysium Background

Delivering digital data interoperability solutions for manufacturing collaboration via high quality, robust engineering software applications

• Global with 95+ employees - 60+ Developers
• Debt Free, Private, Profitable from the start
• Enabling digital thread solutions for 30+ years!
ELYSIUM keeps expert knowledge of all major CAD systems by making contracted partnership with all major vendors.

**AUTODESK**
- ADN Master Agreement,
  - Autodesk Inventor Certified Partner

**SIMULATION**
OEM Moldflow CADdoctor

**DASSAULT SYSTEMES**
- CATIA V5 CAA Adaptor Agreement
- CATIA V5 Interoperability Software Agreement
- DS V6 APS COMMUNITY PARTNER AGREEMENT

**DELmia**
OEM Translator

**ABAQUS**

**SIEMENS**
- NX Open
- JT Open
- I-DEAS Open
- SolidEdge Voyager Prog
- Parasolid

OEM I-DEAS Translator

**PTC**
- Pro/Toolkit Software License and Distribution Agreement

**creo elements/direct**
OEM Creo elements/direct Translator

**SPATIAL**
- InterOP
- ACIS

**SOLIDWORKS**
- Solution Partner
  - Research Partner

**CATIA (V5/V6)**
- X-CAD (V5/V6)
  - JT-Open
  - NX-Open

**I-DEAS Open**
- Pro/Toolkit
- InterOP
- ACIS
- Parasolid
- Inventor API
- etc.
Is your thread improving productivity and ROI?
Combination of three key technologies provides high quality 3D data translation.

Deep knowledge of various 3D-CAD systems enable to translate fully annotated MBE data.

Elysium's industry standards based PDQ check and geometry healing technology minimize errors.

Elysium core ENF capabilities provide the flexibility to read/map information generated to/from most CAD systems.
Elysium’s view of Interoperability

Component products to build custom and large scale digital data quality checking, validation, translation and optimization systems.

Support Full Annotated 3D Drawing Translation
Support Attribute Translation

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Support Attribute Translation
Support Full Annotated 3D Drawing Translation
Elysium Products

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- CADdoctor – User Interactive
  - Data healing, translation, PDQ Check, Comparison

- ASFALIS – Desktop or Enterprise
  - Conversion, Validation, Distribution. Mappings

- CADfeature – Native feature based translation
  - Drawing associativity, 3D MBE Parts, Product structure

- InfiPoints – Scanned Data Efficiency
  - Processing, Feature recognition, 2D/3D Interoperability

- CATIA V6/V5 to/from JT, NX, Creo Direct
Initial Quality of the Digital Thread

Initial quality assured via PDQ guidelines from JAMA, ISO Part 59, SASIG, MIL-STD-31000A, Boeing D6_51991_RevJ

ELYSIUM is deeply involved with the SASIG 3D Annotated Model Standard

ELYSIUM is a key member defining the ISO PDQ-S specification

Helped to establish MIL-STD-31000A
Work with Boeing D6_51991_RevJ
Geometry Quality Checking

Product Data Quality checking to assure high fidelity models for a digital enterprise

<table>
<thead>
<tr>
<th>Category</th>
<th>Errors</th>
<th>Severity</th>
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<td>Sliver face</td>
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<td>Edge direction</td>
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<td>Free edge</td>
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<tr>
<td>Gap: In loop</td>
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<tr>
<td>Gap: Edge and base surface</td>
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<td>Gap: 2D trimming curve</td>
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<tr>
<td>Intersecting loops</td>
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<td>Loop with self-intersection</td>
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<td>Serious</td>
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<td>Surface with self-intersection</td>
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<tr>
<td>Surface with small patches</td>
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<td>Serious</td>
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<tr>
<td>Curve with short segments</td>
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<tr>
<td>Surface with oscillations</td>
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Sophisticated Geometry Healing

Geometry healing capability creates optimal geometry for downstream consumption

- Tiny face removal and edge adjustment
- Face extension for gap filling
- Tiny edge removal and face extension
Geometry optimization provides geometry modification to get simplified 3D model for CAE, DMU etc.

- **Feature Recognition and Simplification**
  Automatically recognize geometric features like fillets from shape, and properly remove the features.

- **Flexible Geometry Deformation**
  Flexible shape deformation keeping curvature continuity and face quality.

- **Solid Envelope**
  Fill up inside of assembly model and make one solid model for size reduction and know-how protection.
Tessellation is part of the Digital Thread

Rich functions maintain STL and/or scanned data for CAE, RP, and reverse engineering purposes

**Polygon Quality Checking and Healing**
Support 10 checking items for polygon quality and healing for all error items.

**Polygon Lapping**
Create outer envelope shape from polygon assembly model automatically.

**Re-meshing Polygon**
Re-mesh polygon to have appropriate triangle size.

and more polygon optimizing functions ...
PMI/FTA Conversions

Translation of fully annotated digital models for CATIA V5, NX, Pro/ENGINEER and I-DEAS.

Fully Annotated 3D Model Translation
Supports both native PMI/FTA translation for representation and semantic information.

Flexible Mapping between PMI/FTA and Attributes
Enable to map specific annotation and attribute to others to recover non-supported entities at destination CAD.

Map spot weld point of CATIA V5 to user attribute of specific parts of Inventor which are automatically created as spot point symbol through translation.
Validation of the Digital Thread is Key

"Trust but Verify."
- Ronald Wilson Reagan
Validation is necessary to extend the thread for any conversion of digital data into other formats

Geometry Validation

PMI Validation

Drawing Validation
ECO Validating and Reporting

Difference List

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<th>Value</th>
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2

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<tr>
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<tr>
<td>Right Max Distance Coordinate</td>
<td>(59.43, 1.20, 90.98)</td>
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</table>
Feature based 3D data translator to support automatic feature translation and hybrid translation with feature and geometry.

- **Feature Writer**
  - Read feature tree from source CAD.
  - Map to feature tree of destination CAD.
  - Write out intermediate feature file.

- **Feature Reader**
  - Read intermediate feature file.
  - Re-built model from feature tree.

- **Feature Viewer**
  - View and Check the feature and corresponding geometry.

CADfeature is a semi-custom tool and Elysium supports the customer’s design methodologies. Proper mapping maintains the thread.
Migrating Fully Featured Models

Feature based 3D data translation enable the digital thread to maintain feature modification and design intent.

Full Automatic Translation
Automatically extract feature tree from source CAD, map the feature tree to destination CAD, and re-built 3D model at destination CAD with the

Hybrid Feature and Geometry Translation
1. Translate representation of fabricated material as geometry and definition of machining feature as feature tree.
2. Recover un-supported feature as B-Rep translation.

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Daimler and JT

- Elysium JT Translator is Daimler PLM 2015 compliant
- Masterdata support, JT Moniker, QEV Number, more
Upcoming Digital Touch Points

• STEP AP242 (Part of JT now, full in 2016)
• 3D PDF – PRC Format
• QIF – Quality Information Framework
  – Validation of MBE models down to the manufactured part via structured measurements
  – Overlapping with DMIS based Processes
1. 3D shape + GD&T + mold requirements by attributes

2. 3D shape + GD&T + mold requirements with detailed geometry

- Use MBD data to include tolerance and manufacturing requirements information
- These information shall be standard and model-based so that unnecessary re-input of information can be avoided and software automation in downstream process is possible.
- Deploy standard formats for data distribution so that users can select the most appropriate tools for each functionality

Measure

Compare measured points against CAD data. Judge OK/KO automatically

Feed back result to CAD

5. Test reports

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InfiPoints aims to offer a one stop solution for 3D point cloud data handling and analysis. Takes multiple steps into one digital thread.

1. Pre-Processing
   A) Registration
   B) Noise Reduction

2. Analysis
   A) Measurement
   B) CAD Comparison
   C) Interference Check

3. Modeling
   A) Pipe Modeling
   B) Plane Modeling

4. Output
   A) Fly-through Movie
   B) Drawing

Software: A, B, C, D
ROI Considerations

• When using an inferior interoperability solution, what problems are introduced?
• By not executing validation processes, what issues are getting overlooked?
• How much are you paying to maintain legacy CAD formats and IT systems?
• How efficient are your designers in getting data to/from CAE, prototyping, other formats?
• What is the real cost incurred by forcing your supply chain to use the same CAD format?
• Are your designers and engineers spending a great deal of time converting and pushing data?
Conclusions

• Elysium are the data interoperability experts for an assortment of domain areas.
• We deploy mature processes to assure a digital thread is maintained and validated
• Fully featured and associative migration works!
• The digital thread can start from non-traditional CAD/PLM sources, clouds, tessellation

Elysium together with our customers determine the ROI of introducing a digital thread process
Thank You

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