Database-centric Production Control Systems

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Product Manager
Autodesk
Biography

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Matt Thorn is a Product Manager for Composites Manufacturing at Autodesk. He received his BS in mechanical engineering and mathematics from Rutgers University and Stockton University respectively after completing a 5-year dual degree program. Matt began his expertise in advanced manufacturing with Magestic Systems, a company that was then acquired by Autodesk in July 2014. With the Tru product portfolio, Matt continues to innovate in the composite hand layup and automated layup industries.
Overview

• Enterprise Production
• Material Asset Tracking
• “Lights Out” Automation
Enterprise Production
Enterprise Production Hierarchy

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Enterprise Production Workflow
• SAP feeds Job Order and Inventory Info
• Master DB distributes information to each facility
• Client DBs filter out Role Specific data into unique client environments
Enterprise Role Representations

Business

Engineering

Production
Setting up business rules

Foreign Keys
- Set up Facilities and Machine Groups

Machine Management
- Set up Machine List, Mach Groups, Facility, Mach Info, Mach Settings
- 20 machines at Auburn facility
- MGroups need to match SAP nomenclature
- Need to procure Mach Info data from Boeing

Facility Staging Tables
- Material, Inventory, Production Order, Pick Request, Pick Confirmation
- All read-only
Engineering

- Setting up feeds, speeds, nesting defaults, importing NNS
- Foreign Keys
- Set up Facilities and Machine Groups
Production

- Visualize everything sent to machine (SENT status)
- Receives Nest Plot (with barcode) and plates from inventory
- Tracking and documenting cutting operation from start to finish
  - Partial or Complete cut
- Reviewing nests
- Editing machine selection for nests as required
- Reposting for new machine
- Sending new NC to machine
Nest Lifecycle

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pre-nested

- parts are added to order
  - SAP Order Inputs
  - Order Numbers
  - Priorities
  - Due Dates
  - Facilities
  - Engineering Parts
  - Assembly Information
  - Inventory

scheduled

- parts are ready for nesting
  - Material Grouping
  - Machine Capacity Planning
  - Order Lifecycle Management

rejected/staged

- the nest is created
  - Tooling Optimization
  - Post Processing
  - Cutting Optimization

sent

- parts are ready to be cut
  - SAP Inventory Updates
  - Re-allocation of Inventory
  - Cutting and Labeling Operations

cut

- parts are cut
  - Remnant Materials enter Inventory
  - SAP Order Updated
  - Parts move to Assembly Process
Material Asset Tracking
Materials

- Coils
- Carbon Fiber
- Metal plates
- Concrete
- Honeycomb/sandwich panels
- Grating
- Honeycomb
- Fiber Glass
- Foam
- Bars – Extrusions - Rods
Material Asset Tracking

- Expiration dates for all plies
- In/Out time for all plies
- Remaining shelf life for plies
- Which Roll Each Ply Came From
Workflow for Material Asset Tracking
Material Storage

Freezer station
1. Automated freezer
2. Software driven
3. Feeds data to TruNest
Material Processing

Cutter station
1. Orders from ERP
2. RFID shows roll
3. Post for cutter
4. Bar code label
5. Bag label to printer
Layup/Assembly

Layup station

1. Come from cutter or freezer
2. Bar code kit bag
3. Bar code tool
4. Trash / Transfer plies
Additional Processing

1. Bar code from tool
2. 4 autoclave
3. Prep station
4. IN status
5. Stops timer after 3 hours

<table>
<thead>
<tr>
<th>Roll name</th>
<th>Material</th>
<th>Quantity</th>
<th>Width</th>
<th>Time remaining</th>
<th>Expiration date</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATP0000001</td>
<td>ZZZZb960e</td>
<td>100</td>
<td>1270</td>
<td>222</td>
<td>12/31/2016</td>
</tr>
<tr>
<td>ATP0000002</td>
<td>ZZZZb960e</td>
<td>60</td>
<td>1270</td>
<td>162</td>
<td>12/31/2016</td>
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<tr>
<td>ATP0000003</td>
<td>ZZZZb960e</td>
<td>90</td>
<td>1080</td>
<td>992</td>
<td>12/31/2016</td>
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<td>ATP0000004</td>
<td>ZZZZb96048</td>
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<td>264</td>
<td>4/30/2017</td>
</tr>
<tr>
<td>ATP0000005</td>
<td>ZZZZb96048</td>
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<td>1270</td>
<td>926</td>
<td>4/30/2017</td>
</tr>
<tr>
<td>ATP0000006</td>
<td>ZZZZb96048</td>
<td>109</td>
<td>1080</td>
<td>453</td>
<td>4/30/2017</td>
</tr>
</tbody>
</table>
TruNest with Cloud Production Management
### Work Instructions in the cloud

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#### Job instruction: Customer order IMT1638

<table>
<thead>
<tr>
<th>JI #</th>
<th>End Product</th>
<th>Quantity</th>
<th>WIP Jobsheets</th>
<th>All Jobsheets</th>
<th>Created By</th>
<th>Creation Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>#7008</td>
<td>LMAM23009</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Anthony Muzzillo</td>
<td>Nov 10, 2016</td>
</tr>
</tbody>
</table>

**Details**

One customer order containing all the kits required to create a complete part

<table>
<thead>
<tr>
<th>TASK</th>
<th>10</th>
<th>Task Name</th>
<th>Workstation</th>
<th>Task Details</th>
<th>Estimated Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>TASK</td>
<td>20</td>
<td>Remove roll from freezer...</td>
<td>Material Freezer</td>
<td>remove roll from freezer. this must be done at least one time</td>
<td>00:00 hh:mm</td>
</tr>
<tr>
<td>TASK</td>
<td>30</td>
<td>Load roll at cutting t...</td>
<td>GFM Ply Cutter</td>
<td>roll will be loaded on machine holder. this will take place after the previous task</td>
<td>00:05 hh:mm</td>
</tr>
<tr>
<td>TASK</td>
<td>40</td>
<td>Cut nest on material ...</td>
<td>GFM Ply Cutter</td>
<td>Load NC file for order that corresponds to roll on</td>
<td>01:00 hh:mm</td>
</tr>
<tr>
<td>TASK</td>
<td>50</td>
<td>Create ply kit bag</td>
<td>GFM Ply Cutter</td>
<td>Operator retrieves plastic bag with label on it for future reference</td>
<td>00:05 hh:mm</td>
</tr>
<tr>
<td>TASK</td>
<td>60</td>
<td>Unload cut plies to kl...</td>
<td>GFM Ply Cutter</td>
<td>each ply is scanned with bar code reader as it is</td>
<td>00:10 hh:mm</td>
</tr>
</tbody>
</table>

| TASK  | 60   | Trash / Transfer plies    | GFM Ply Cutter | Any plies that were not cut correctly are scanned                          | 00:10 hh:mm    |

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## Shop Floor Management in the cloud

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#### Manage > Workstations

<table>
<thead>
<tr>
<th>Workstation Name</th>
<th>Description</th>
<th>Modification Date</th>
<th>Creation Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material Freezer</td>
<td>Robot controlled for original material roll (lot), or ply kits</td>
<td>Nov 7, 2016</td>
<td>Nov 7, 2016</td>
</tr>
<tr>
<td>Autoclave station</td>
<td>Autoclave 1</td>
<td>Nov 7, 2016</td>
<td>Nov 7, 2016</td>
</tr>
<tr>
<td>Hand Layup Station</td>
<td>Station in clean room with laser projection assist. Data fed by TruPlan</td>
<td>Nov 7, 2016</td>
<td>Nov 7, 2016</td>
</tr>
</tbody>
</table>
“Lights Out” Automation
Automation Frameworks

• Nesting and Cutting Optimization
• Tooling Automation
• Software Automation Utilities
Nesting and Cutting Optimizations

- Common Line Punching
- Automatic Part Tabbing
- Nest Around, Above, or In Clamp Zones
- Automatic Clamp Repositioning
- Skeleton Cutting
- Detect & Destruct Floating Scrap
- Leverage Special Tooling
- Embossing & Labeling
- Reduce Number of Tool Changes
- Remnant Tracking
Nesting and Cutting Optimizations

- Common Line Punching
- Automatic Part Tabbing
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- Remnant Tracking
On The Fly Programming

- Common Line Punching
- Automatic Part Tabbing
- Nest Around, Above, or In Clamp Zones
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- Skeleton Cutting
- Detect & Destruct Floating Scrap
- Leverage Special Tooling
- Embossing & Labeling
- Reduce Number of Tool Changes
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Cutting machines: self contained factory
Software Automation Utilities
Questions?

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