

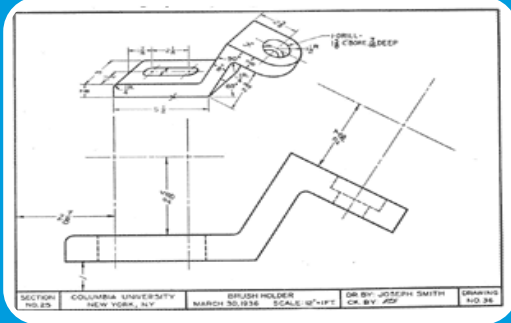
- Introduction
- PTC Windchill MPMLink Overview
- Process Plan
- Work Instruction
- MES
- Solar Turbines Customizations



A CULTURE OF CUSTOMER CARE

Solar Turbines

A Caterpillar Company



Eliminate Paper

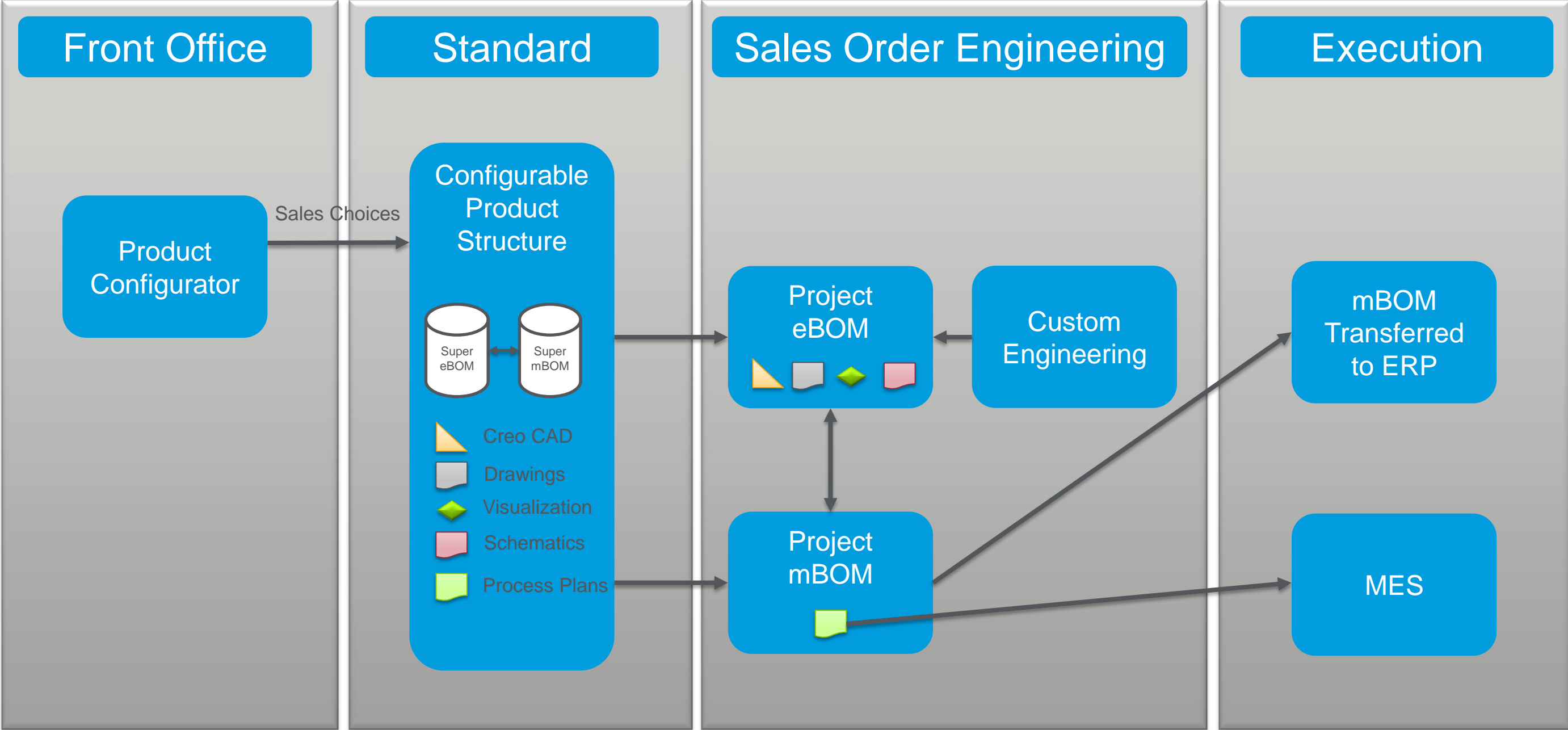


Work Instructions are
Up-To-Date



Time Savings

What is your manufacturing strategy?

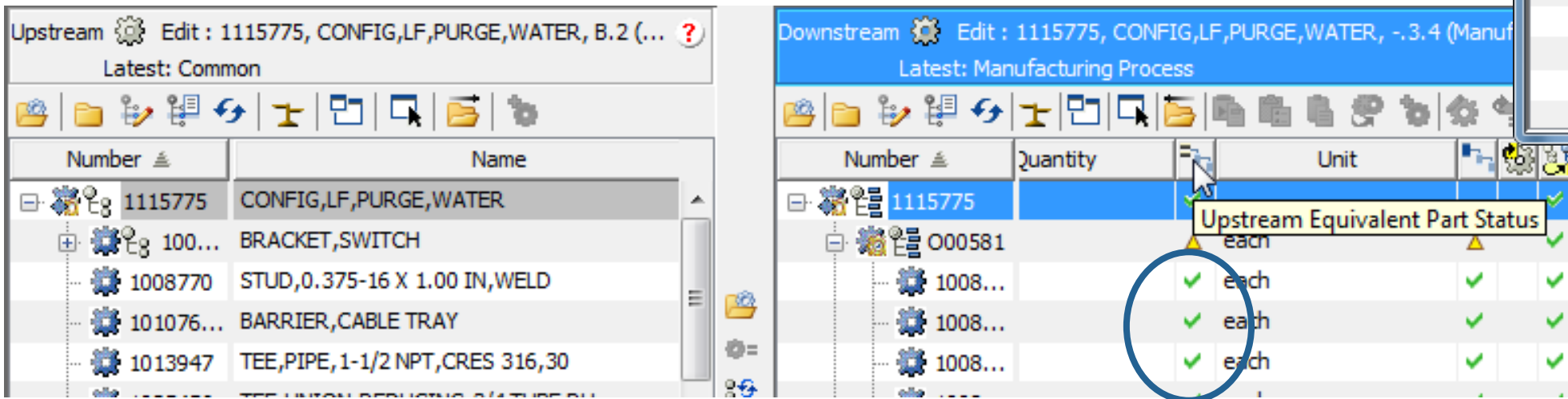
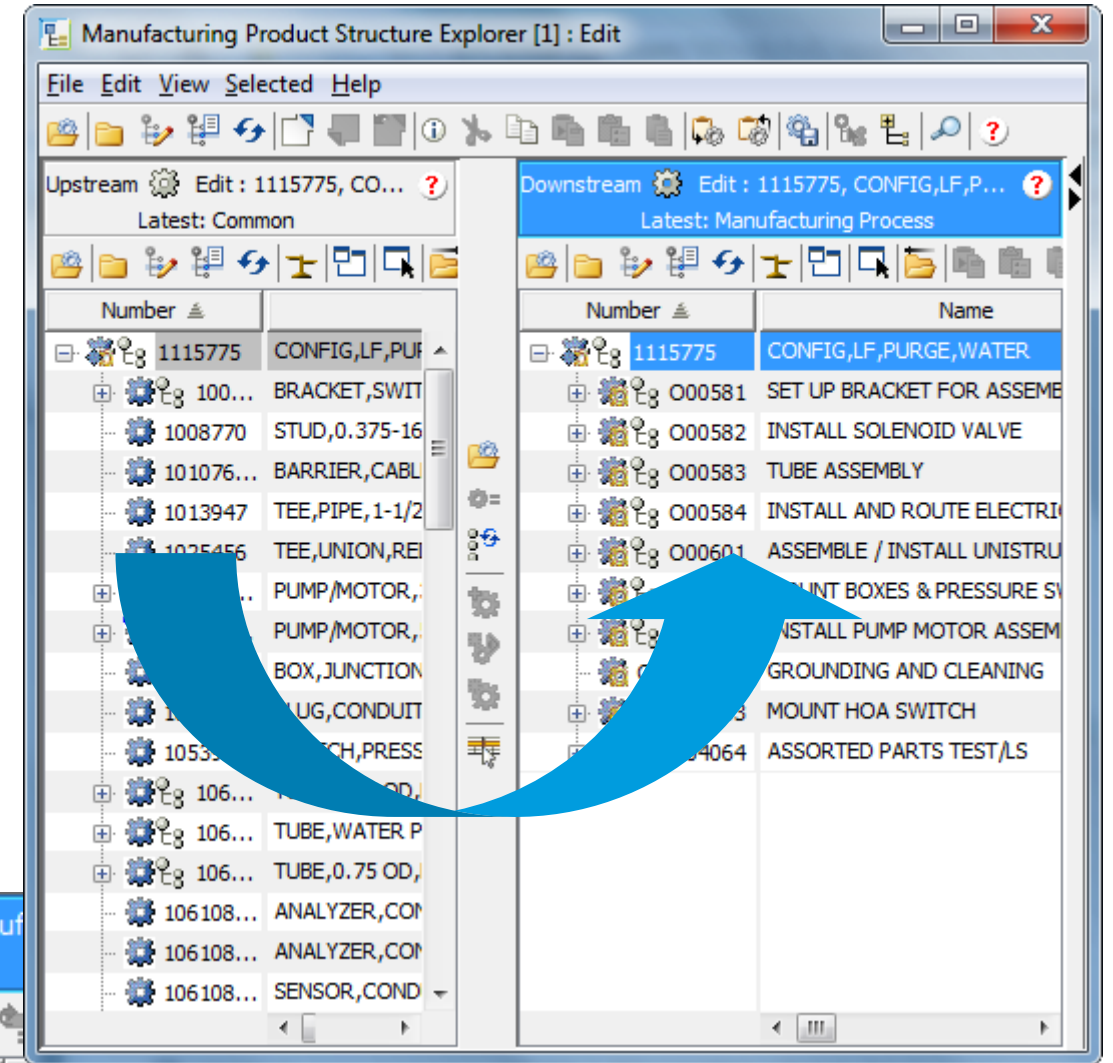


MPSE Defines Downstream View

- **Equivalence Link (EL) – Link Between Upstream and Downstream Object**
- **Equivalent Occurrence Link (EOL) – Link Between Individual Part Objects Which Passes Viewable, Location in 3D Space and Assigned Choices**
 - During drag and drop operations part objects create equivalence and occurrence links that link the manufacturing downstream view mBOM objects back to the common design upstream view eBOM
- **Phantom Operations – Solar Unique Object for Overloading a Configurable mBOM**
 - Part Occurrences Reside within an Operation that is Overloaded
 - Upon Configure of a Variant only the Parts will Remain for that Configuration and Can Be Allocated to the Variant Process Plan
- **Process Plan – Object that Collects Operation Information for an mBOM**

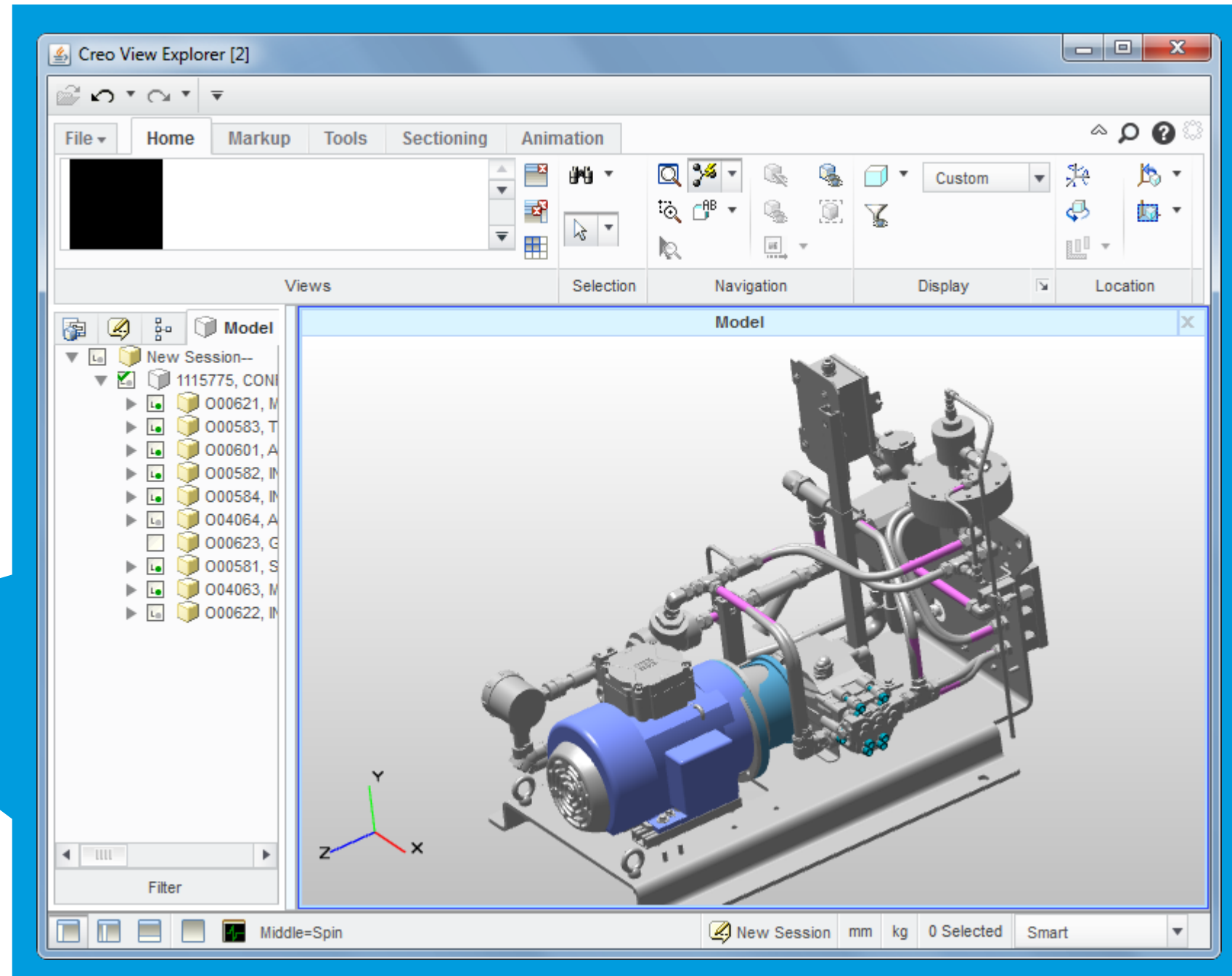
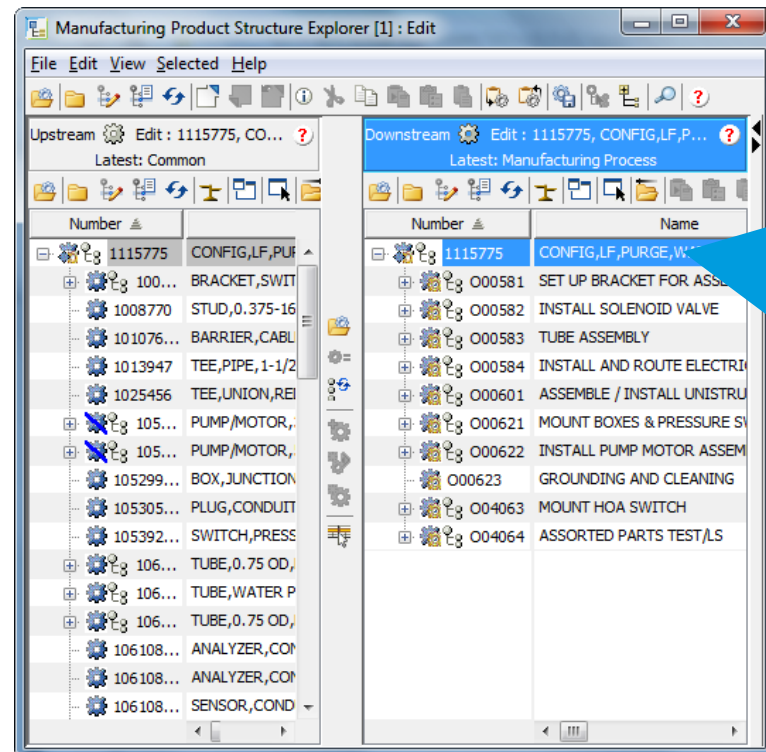
Manufacturing Product Structure Explorer

- Dragging Parts from eBOM to mBOM will Automatically Create EOL
- Can Restructure the mBOM Any Way that Suits Manufacturing
- A Green Check Shows the Upstream Status is Good



3D Visualization

- **Creo View from mBOM Structure**
 - Dynamically Loads the Windchill mBOM Structure in Creo View and Loads the Assembly From the Location Information from the eBOM

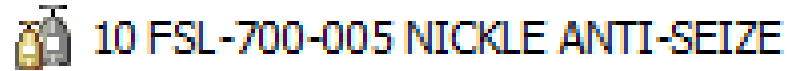


Information Stored Within Process Plan

- Allocated Parts

- BOM Parts
- Operated On Parts

- Resources



- Work Centers



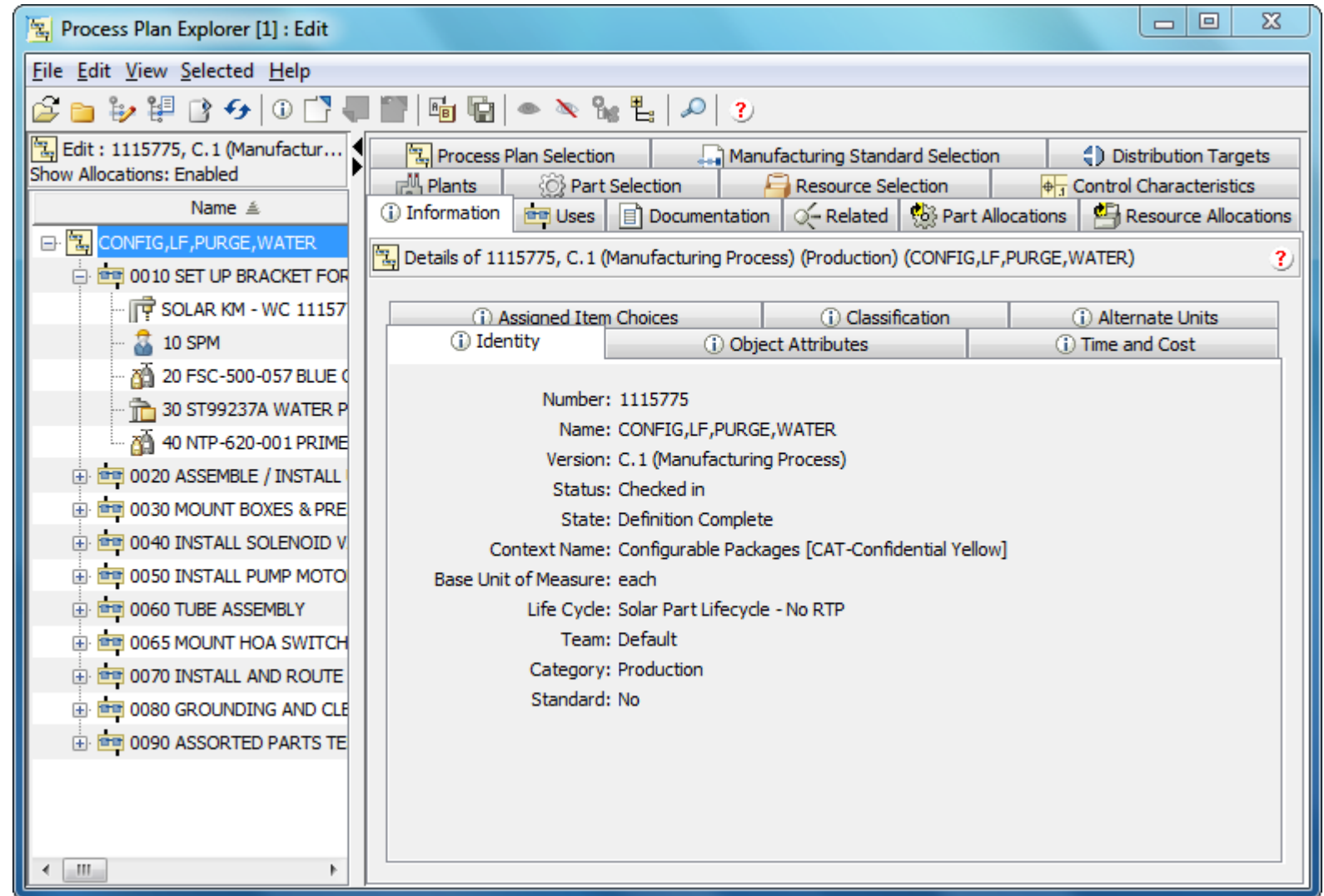
- Skill Sets



- Control Characteristics

| | | | |
|----------------|------------|-----|------------------|
| AE_DRIVEN_DIM8 | 0000000798 | Key | ZX 4.350 |
| AE_DRIVEN_DIM9 | 0000000799 | Key | ZX 10.350 |
| AE_GTOLD | 0000000800 | Key | ⊕ ∅ .003 (M) A C |

- Reference Documents



Output from Process Plan

- Work Instruction Contains a Consumable Report of the Process Plan
 - Header
 - Description
 - Allocated Parts with Links to Details Page of Each
 - Resources
 - Control Characteristics
- Includes Published Representation of Operation
- Each Operation Can Include As Many Annotations As Needed to Communicate Intent

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Solar Turbines
A Caterpillar Company

| NAME | NUMBER | VERSION | TYPE |
|---|---------------|----------------------------|------------|
| CONFIG.LF.PURGE.WATER | 1115775-ZT253 | -2 (Manufacturing Process) | Production |
| STATE: | In Work | STATUS: | Checked in |
| CONTEXT: Packaging Sales Order Linked [CAT-Confidential Yellow] | | | |

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Solar Turbines
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| CONFIG.LF.PURGE.WATER | 1115775-ZT253 | -2 (Manufacturing Process) | Production |
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| CONTEXT: Packaging Sales Order Linked [CAT-Confidential Yellow] | | | |

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[Filter Properties](#)

| OPERATION LABEL NUMBER 0050 | | | |
|-----------------------------|--------------|-------------|-----------------------------|
| NAME | NUMBER | VERSION | DESCRIPTION |
| INSTALL PUMP MOTOR ASSEMBLY | 000622-ZT253 | -4 (Common) | INSTALL PUMP MOTOR ASSEMBLY |

| WORK CENTER | MANUFACTURING CAPABILITY | SETUP TIME | PROCESSING TIME | MOVE TIME |
|---|--------------------------|------------|-----------------|-----------|
| SOLAR KM - LF PURGE WATER | | 0.0 min | 60.0 min | 0.0 min |

OPERATION LONG DESCRIPTION

- Using 2 x 6 ft. straps choke both ends of pump motor and lift evenly to place assembly on the bracket and unistruts.
- Align with unistruts and secure with hardware.
- Install all fittings to pump motor.
- Tighten all hardware, leave fittings loose for tubing later.

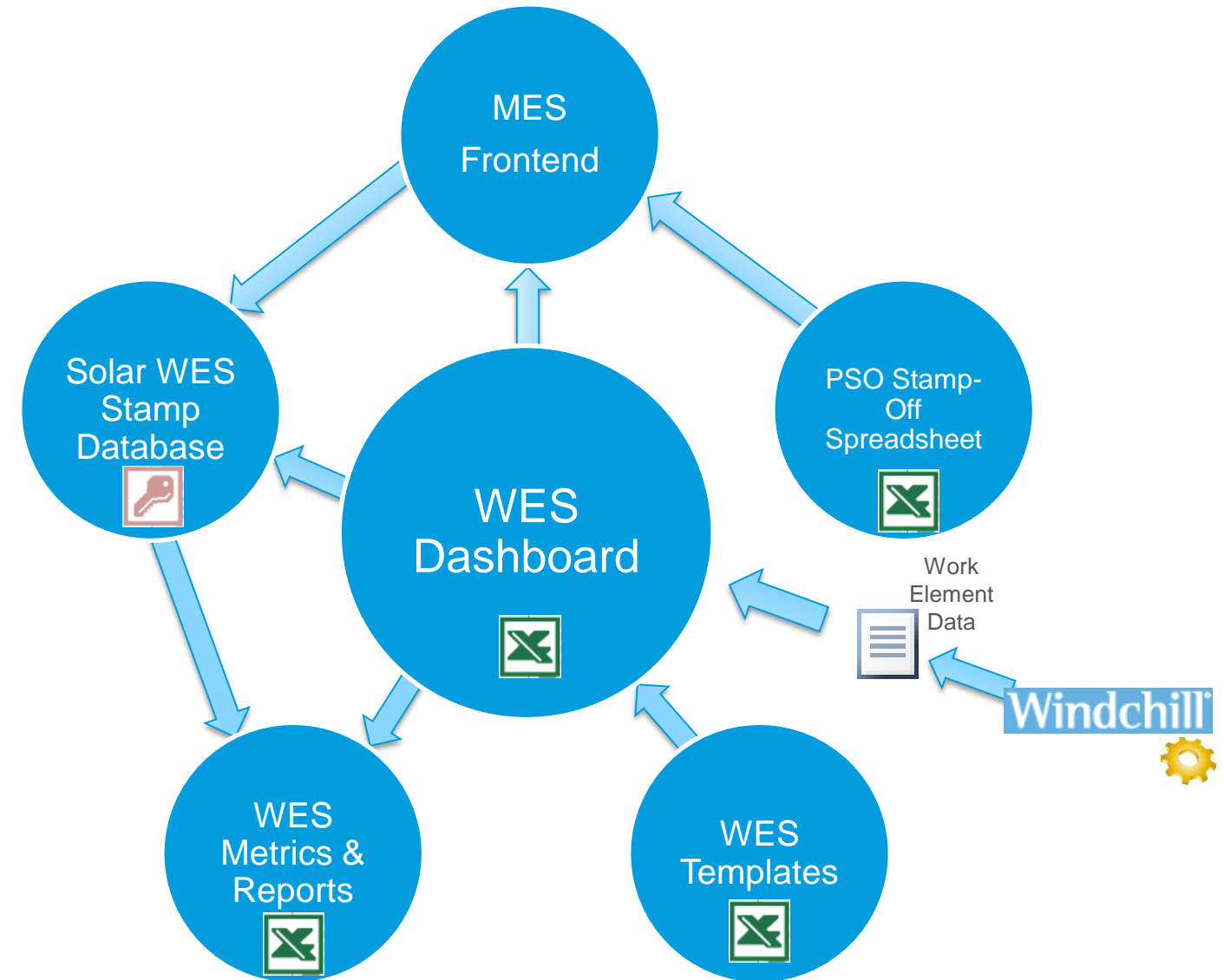
| ALLOCATED PARTS | | | | |
|---|----------|------------------|----------|------------------|
| RESOURCE NAME | NUMBER | TYPE | QUANTITY | ASSEMBLY CONTEXT |
| FSQ-300-079 MRN GR ANTI-SEIZE | R0035923 | Process Material | 1 each | |
| SPM | R0020825 | Skill | 1 each | |
| FSL-740-001 EXTR PRESS LUBE | R0020844 | Process Material | 1 each | |
| ENV-601 X 6FT NYLON STRAP | R0021663 | Tooling | 2 each | |

| DOCUMENT NAME | NUMBER | DISPLAYED |
|-------------------------------|---------------|-----------|
| GN / WI / QAS | GN / WI / QAS | No |

| CONTROL CHARACTERISTICS | NUMBER | DESCRIPTION | MODEL ITEM GRAPHICAL REPRESENTATION |
|-------------------------|--------|-------------|-------------------------------------|
| | | | |

| STATE | STATUS | INSPECTION INTERVAL | CREATED | UPDATED BY | UPDATE |
|---------|------------|---------------------|-------------------------|------------|-------------------------|
| In Work | Checked in | | 2015-06-05 09:14:37 PDT | Horn, Eric | 2015-06-05 09:31:19 PDT |

- Process Plan is an Input into the MES System
- Work Element Sheet (WES)
 - Sailboat Application Provides Front End User Access
 - Sign Offs on Operations are Logged in a Database
 - WES Templates and



- Manufacturing Interface to MES
- Work Elements Sheet has User Sign Off with Authentication

| Solar Turbines A Caterpillar Company | |
|---|----------------------------|
| PD Number: | zc001 |
| PD Name: | HM-BNE |
| Unit #: | 1 |
| Product Type: | T250/CS |
| PO #: | PG65413541321 |
| Op Label | Operation Description |
| 0010 | VERIFY P/N AND S/N |
| 0020 | SET FRAME ON WHEELS |
| 0040 | CLEAN TANK |
| 0060 | DRIP TRAY INST |
| 0080 | TANK INSTALLATION |
| 0100 | W/O DRAIN PLUG INSTALATION |
| 0120 | JACKING BOLT INSTALATION |
| Total Hours | |
| | 44.25 |

Solar Turbines
A Caterpillar Company

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Display Work Instruction Wizard

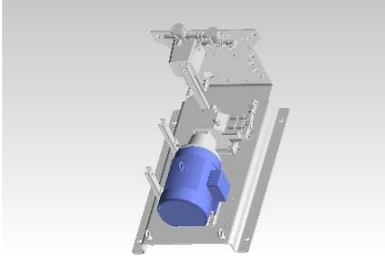
| NAME | NUMBER | VERSION | TYPE |
|---|---------------|---------|------------------------------------|
| CONFIG LF PURGE WATER | 1115775-ZT253 | -2 | (Manufacturing Process) Production |
| STATE: | In Work | STATUS: | Checked in |
| CONTEXT: Packaging Sales Order Linked [CAT-Confidential Yellow] | | | |

[Filter Properties](#)

OPERATION LABEL NUMBER 0050

| NAME | NUMBER | VERSION | DESCRIPTION |
|-----------------------------|-------------|-------------|-----------------------------|
| INSTALL PUMP MOTOR ASSEMBLY | 00622-ZT253 | -4 (Common) | INSTALL PUMP MOTOR ASSEMBLY |

| WORK CENTER | MANUFACTURING CAPABILITY | SETUP TIME | PROCESSING TIME | MOVE TIME |
|---------------------------|--------------------------|------------|-----------------|-----------|
| SOLAR KM - LF PURGE WATER | | 0.0 min | 60.0 min | 0.0 min |



OPERATION LONG DESCRIPTION

- Using 2 x 6 ft. straps choke both ends of pump motor and lift evenly to place assembly on the bracket and unistruts.
- Align with unistruts and secure with hardware.
- Install all fittings to pump motor.
- Tighten all hardware, leave fittings loose for tubing later.

| ALLOCATED PARTS | NUMBER | VERSION | QUANTITY | ASSEMBLY CONTEXT |
|---|----------|------------------|----------|------------------|
| RESOURCE NAME | NUMBER | TYPE | QUANTITY | |
| FSO-300-079 MRN OR ANTI-SEIZE | R0035923 | Process Material | 1 each | |
| SPM | R0020825 | Skill | 1 each | |
| FSL-740-001 EXTR PRESS LUBE | R0020844 | Process Material | 1 each | |
| EWL-601 X 6FT NYLON STRAP | R0021663 | Tooling | 2 each | |

| DOCUMENT NAME | NUMBER | DISPLAYED |
|-------------------------------|---------------|-----------------------------|
| GN / WI / QAS | GN / WI / QAS | <input type="checkbox"/> No |

| CONTROL CHARACTERISTICS | NUMBER | DESCRIPTION | MODEL ITEM GRAPHICAL REPRESENTATION |
|-------------------------|--------|-------------|-------------------------------------|
| | | | |

| STATE | STATUS | INSPECTION INTERVAL | CREATED | UPDATED BY | UPDATE |
|---------|------------|---------------------|-------------------------|------------|-------------------------|
| In Work | Checked in | | 2015-06-05 09:14:37 PDT | Horn, Eric | 2015-06-05 09:31:19 PDT |

Stamp Cancel

Password

PSO Package Build Assembly Interface v1.00 04/01/2013

Solar Turbines
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Category:

- Training
- eQC Folder

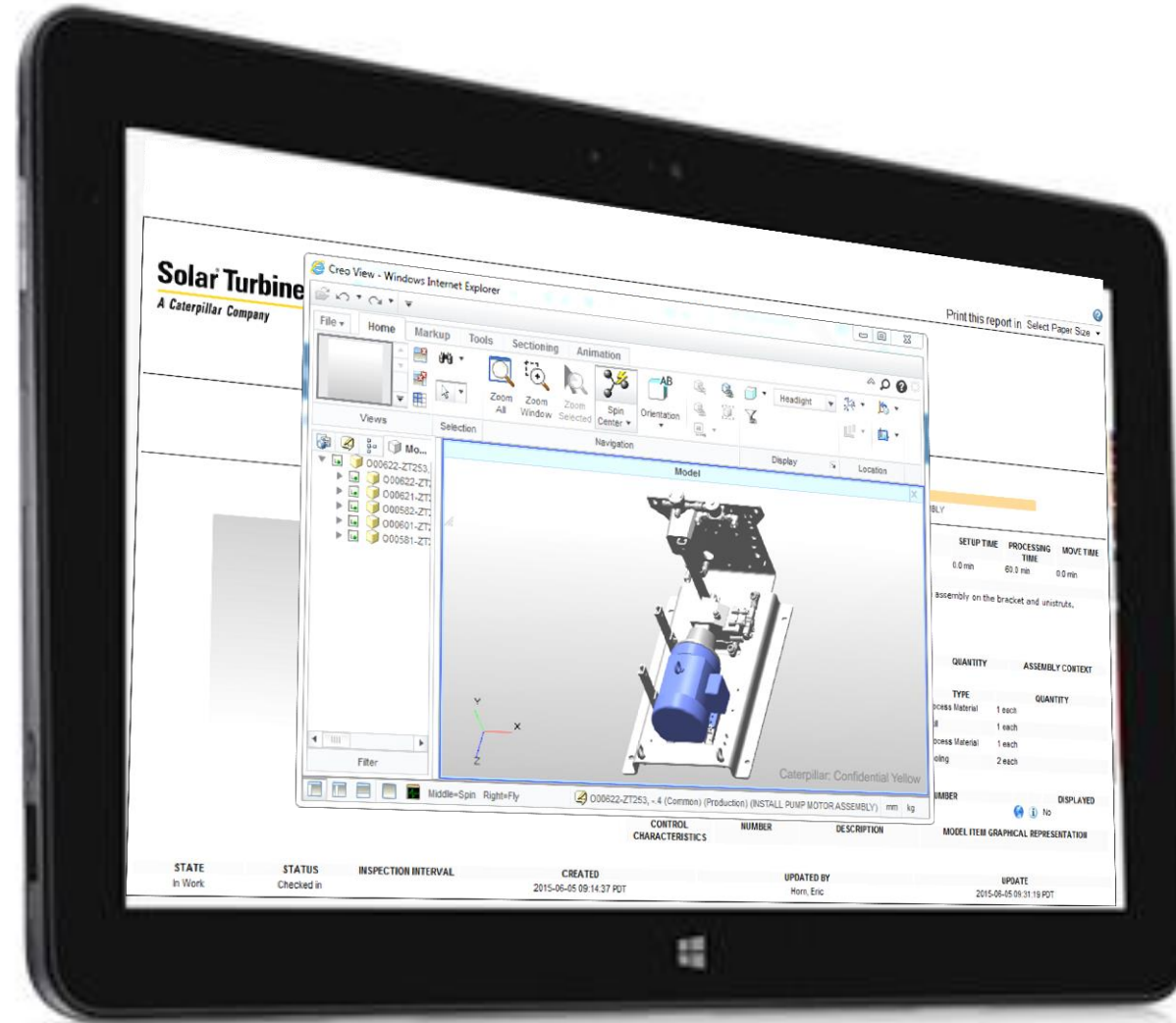
Sub-Folder:

Archived Test Files
 ZC002_EH-TEST-5_Taurus 60
 ZC012_ZC TEST 1_Taurus 60
 Taurus 60
 Taurus 60
 Centaur 50

File Name:

ZC439_CPD 430-1_AIR SUPPLY_WES.xls
 ZC439_CPD 430-1_CENTER BAY_WES.xls
 ZC439_CPD 430-1_COLUMN BUILD_WES.xls
 ZC439_CPD 430-1_DRIVEN FWD BAY_WES.xls
 ZC439_CPD 430-1_DRVN GEN BAY_WES.xls
 ZC439_CPD 430-1_ENCL HOOKUPS_WES.xls
 ZC439_CPD 430-1_ENCLOSURE PANELS_WES.xls
 ZC439_CPD 430-1_ENGINE BAY_WES.xls
 ZC439_CPD 430-1_ENGINE PREP_WES.xls
 ZC439_CPD 430-1_FINAL_WES.xls
 ZC439_CPD 430-1_FLAMEOUT_WES.xls
 ZC439_CPD 430-1_GAS FUEL BAY_WES.xls
 ZC439_CPD 430-1_GF MODULE_WES.xls
 ZC439_CPD 430-1_IGNITOR BOX_WES.xls
 ZC439_CPD 430-1_IGV ACTUATOR ELEC_WES.xls
 ZC439_CPD 430-1_IGV ACTUATOR FILTER_WES.xls
 ZC439_CPD 430-1_LIQ FUEL BAY_WES.xls
 ZC439_CPD 430-1_LO FILTERS_WES.xls
 ZC439_CPD 430-1_LO PREPOST_WES.xls
 ZC439_CPD 430-1_OG GEN CTRL BOX_WES.xls
 ZC439_CPD 430-1_OG TURBINE CTRL BOX_WES.xls
 ZC439_CPD 430-1_ROOF BUILD_WES.xls
 ZC439_CPD 430-1_T5 BOX_WES.xls
 ZC439_CPD 430-1_TANK MFG ZONE_WES.xls
 ZC439_CPD 430-1_WATER WASH_WES.xls

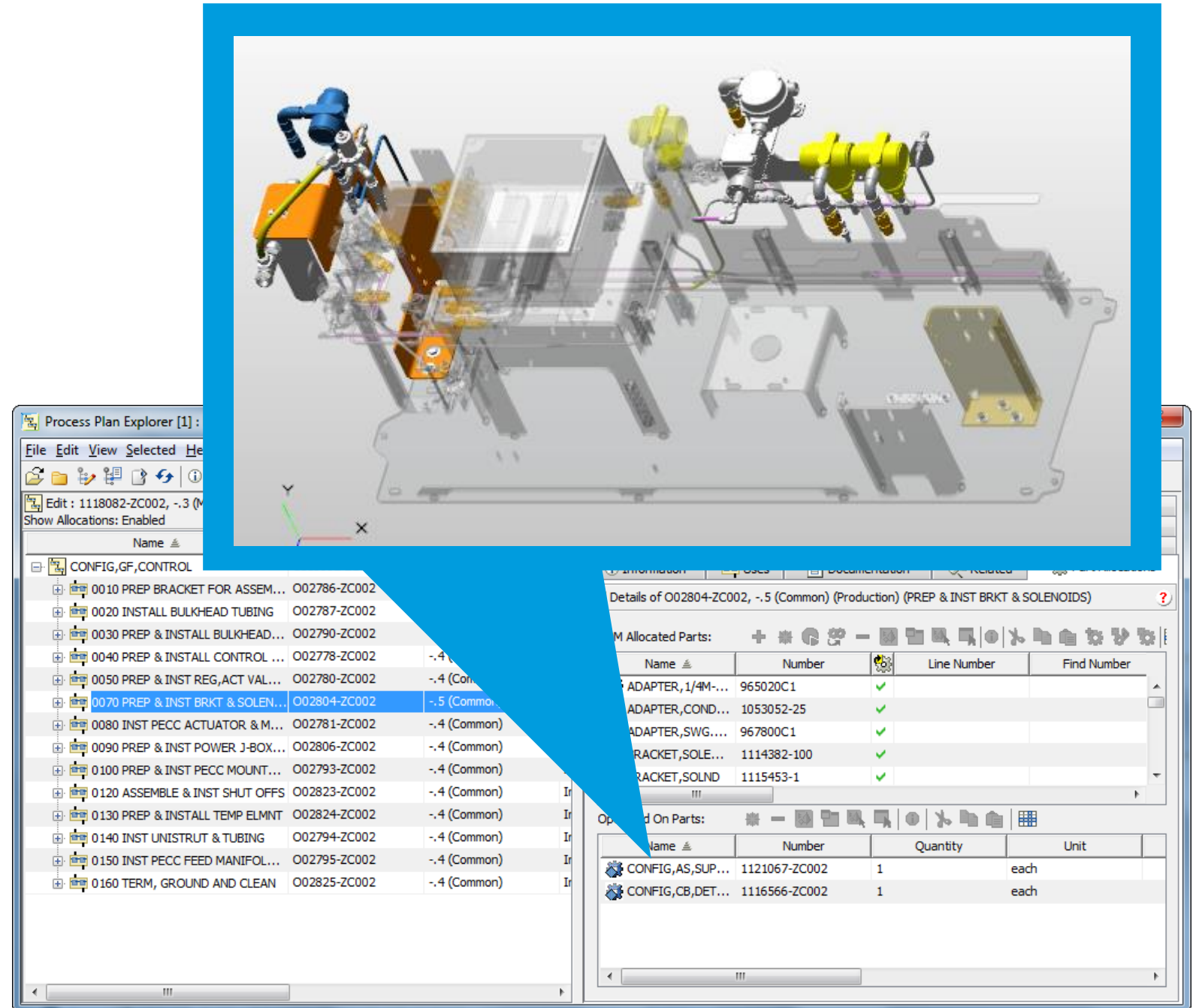
Mobile Platform using Windows 8.1 Professional



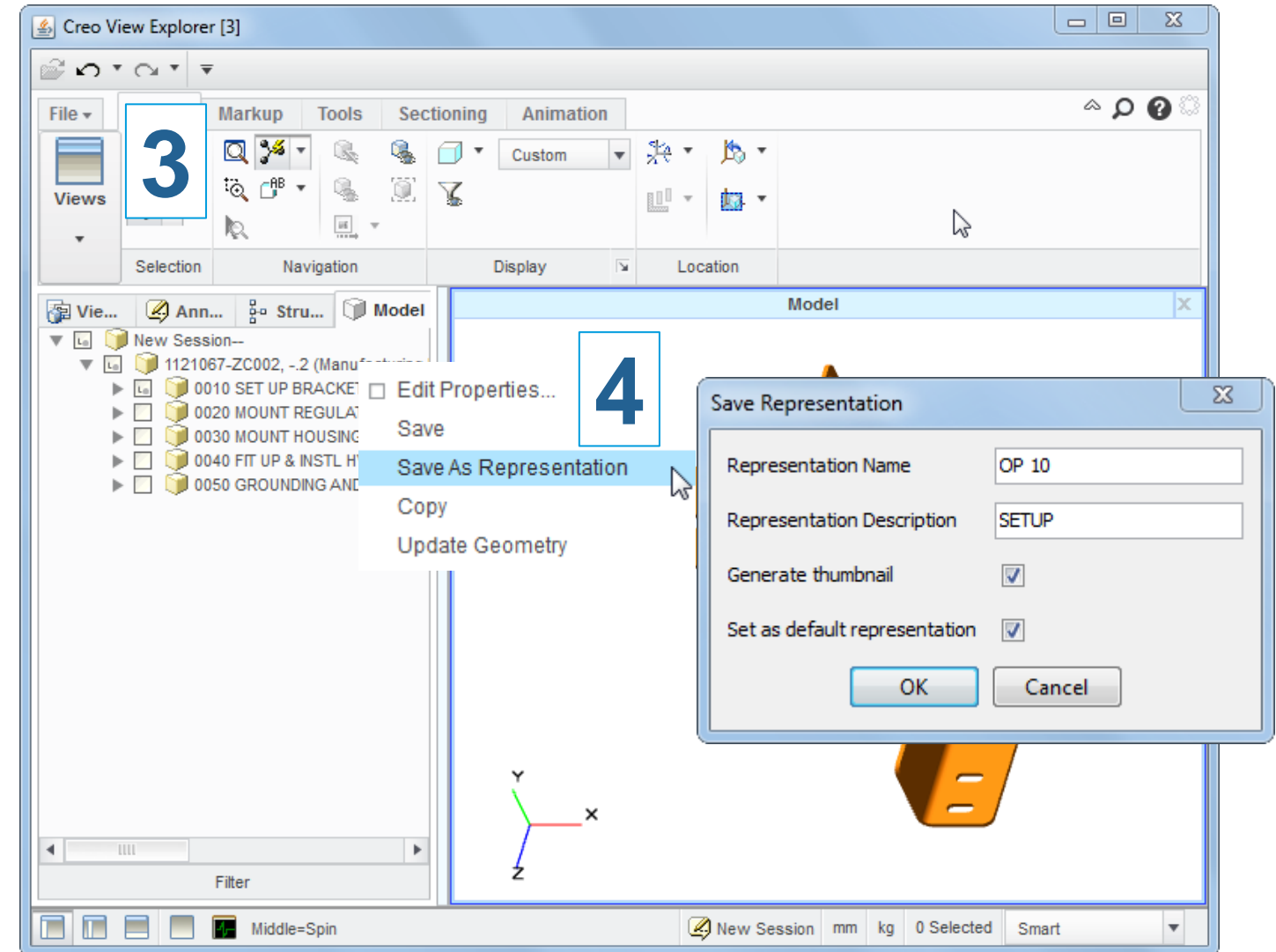
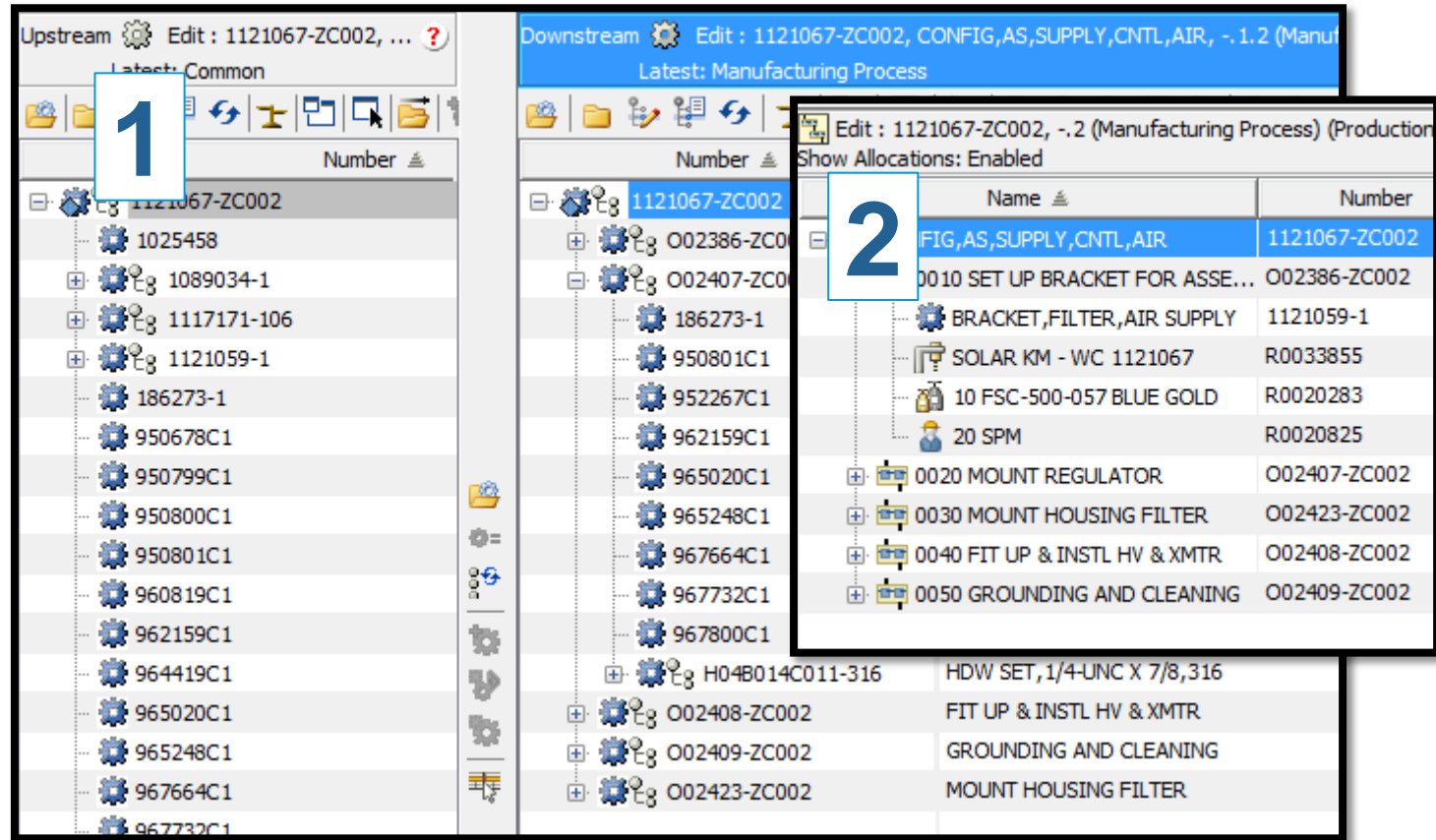
Solar Turbines Customizations

Providing “Background” Geometry

- The Operated on Part is Used to Add Additional Geometry to the Published Representation
 - Building a Bracket and Want to Show the Context of the Entire Product of Where this is Assembled
 - By Adding Configurable Operated on Parts to the Overloaded Structure, we are able to Leverage Configured Operated on Parts for each Sales Order
 - Must Use a Part that is Used within Context of the Product Downstream View



Manual Steps in Windchill 10.1



1. Open in MPSE
2. Open Process Plan
3. Load Operation Visual in Creo View Explorer
4. Save Representation for Each Operation

Automate Publishing for Each Operation

- Builds Temporary Part Structure for Each Operation
 - Adds Occurrences of Allocated Parts
 - Adds Occurrence of Operated on Part
 - Updates Location Information for Operated on Part
 - Adds Occurrences of Allocated Parts of All Previous Operations
- Submit Temporary Part to Publisher
- Copy Representation to Process Plan
- Engineer to Order
 - No 2 Process Plans to be Published Uniquely

Time Savings!!
From Hours to Minutes per Process Plan

Actions ▾ Process Plan - 1121067-ZC002, -.2 (Manufacturing P

Details Structure Related Changes History Solar Actions

Available Solar Action

Generate WorkF

All

ing Operations

| Process Plan Visual Status | | | |
|----------------------------|-----------------|-------------------|-------------------------|
| Operation Number | Operation Label | Publishing Status | Operation Visual Status |
| 0010 | O02786-EH001 | COMPLETED | COMPLETED |
| 0020 | O02787-EH001 | COMPLETED | COMPLETED |
| 0030 | O02790-EH001 | COMPLETED | COMPLETED |
| 0040 | O02778-EH001 | COMPLETED | COMPLETED |
| 0050 | O02780-EH001 | COMPLETED | COMPLETED |
| 0060 | O02792-EH001 | COMPLETED | COMPLETED |
| 0070 | O02804-EH001 | COMPLETED | COMPLETED |
| 0080 | O02781-EH001 | COMPLETED | COMPLETED |
| 0090 | O02806-EH001 | COMPLETED | COMPLETED |
| 0100 | O02793-EH001 | COMPLETED | COMPLETED |
| 0110 | O02782-EH001 | COMPLETED | COMPLETED |
| 0120 | O02823-EH001 | COMPLETED | COMPLETED |
| 0130 | O02824-EH001 | COMPLETED | COMPLETED |
| 0140 | O02794-EH001 | COMPLETED | COMPLETED |
| 0150 | O02795-EH001 | COMPLETED | COMPLETED |
| 0160 | O02825-EH001 | COMPLETED | COMPLETED |

Publish RePublish Copy To Operation Refresh WVS Job Monitor

- Problem: Getting Process Plan Information into the MES Tool
- Solution: Create an Export of information by Process Plan to Import into MES Tool
- Text File is a Delimited Format Which Includes:
 - Header Information
 - Operation on Each Line
 - URL to Windchill for Each Operation

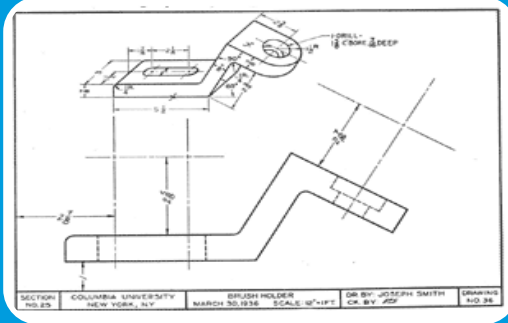
```

PD Number:|PD Name:|Product Type:|Line:|Publish Date:|Process Plan Version:
ZC002|ZC002|Taurus 60 / Generator Set||05/15/2015|-.3
Workcenter|Op Label|Op Description|Long Description|Op Number|Op Time (Min)|Gene
SOLAR KM - WC 1118082|0130|PREP & INSTALL TEMP ELMNT|- Verify component PNS.- As
SOLAR KM - WC 1118082|0120|ASSEMBLE & INST SHUT OFFS|- Install all components wi
SOLAR KM - WC 1118082|0150|INST PECC FEED MANIFOLD & FITT|- Verify manifold PN(s
SOLAR KM - WC 1118082|0030|PREP & INSTALL BULKHEAD XMTR|- Verify component PNS.-
SOLAR KM - WC 1118082|0010|PREP BRACKET FOR ASSEMBLY|- Verify bracket PN.- Use 2
SOLAR KM - WC 1118082|0040|PREP & INSTALL CONTROL J-BOX|- Verify J-box PN.- Asse
SOLAR KM - WC 1118082|0050|PREP & INST REG,ACT VALVE&TUBE|- Verify component PNS
SOLAR KM - WC 1118082|0020|INSTALL BULKHEAD TUBING|- Trim tubes to fit as requir
SOLAR KM - WC 1118082|0080|INST PECC ACTUATOR & MANIFOLDS|- Verify PECC actuator
SOLAR KM - WC 1118082|0140|INST UNISTRUT & TUBING|- Install last unistrut to GF
SOLAR KM - WC 1118082|0100|PREP & INST PECC MOUNTED XMTRS|- Verify bracket PNS.-
SOLAR KM - WC 1118082|0160|TERM, GROUND AND CLEAN|- Run wire as required.- Compl
SOLAR KM - WC 1118082|0090|PREP & INST POWER J-BOX & COND|- Verify J-box PN.- As
SOLAR KM - WC 1118082|0070|PREP & INST BRKT & SOLENOIDS|- Verify bracket PNS.- V
    
```

| Solar Turbines | | Project Work Elements Sheet | | | | |
|-----------------------|--------------------------------|------------------------------|-----------------------|--------------|-------|----------|
| A Caterpillar Company | | Taurus 60/Generator Set | | | | |
| PD Number: | ZC002 | Work Center: | SOLAR KM - WC 1118082 | | | |
| PD Name: | EH-TEST | Published By: | d47887 | | | |
| Unit #: | 5 | Publication Date: | 5/15/2015 | | | |
| Product Type: | Taurus 60/Generator Set | | -.3 | | | |
| PO #: | EH000012345 | | | | | |
| Op Label | Operation Description | Op Number | Planned Hours | Actual Hours | Stamp | Comments |
| 0030 | PREP & INSTALL BULKHEAD XMTR | O02790-ZC002 | 1.50 | | | |
| 0040 | PREP & INSTALL CONTROL J-BOX | O02778-ZC002 | 1.00 | | | |
| 0050 | PREP & INST REG,ACT VALVE&TUBE | O02780-ZC002 | 1.50 | | | |
| 0070 | PREP & INST BRKT & SOLENOIDS | O02804-ZC002 | 1.50 | | | |
| 0080 | INST PECC ACTUATOR & MANIFOLDS | O02781-ZC002 | 1.50 | | | |
| 0090 | PREP & INST POWER J-BOX & COND | O02806-ZC002 | 1.00 | | | |

- Problem: Viewing the Work Instructions will View All Operations At Once
- Solution: Custom JSP to Load Only a Single Operation at a Time
- Enables MES Tool to have a Link to Windchill to View a Single Operation
- <https://wctrain.solar.cat.com/Windchill/ptc1...mpml/LaunchCustomWlforOperation.jsp?oid=VR:com.ptc.windchill.mpml.problem:5646094201&ContainerOid=OR:wt.inf.library.WTLibrary:42...MPMOperation:5646094201&ContainerOid=>
 - Blue = Location of JSP in Windchill
 - Orange = Input to the JSP

**Operation Information is Always Live
And Up-To-Date in MES System!**



Eliminate Paper



Work Instructions are Up-To-Date



Time Savings



- Live Demo

- **Linked Data in Real Life:
How “Owner Links” Change Everything**
By Al Anderson & Dave Nelson
5pm Today
- **STOP Using Free Form Text for Part Naming**
By Daniel Betry
Tues 4pm



- Your feedback is valuable
- Don't miss out on the chance to provide your feedback
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