

# Knowledge Aware Engineering

Why placing knowledge in  
the flow of work will be a  
game changing  
engineering capability

## GLOBAL PRODUCT DATA INTEROPERABILITY **SUMMIT** 2016



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## Jeff Moffa

Jeff has been an innovative leader in the field of Engineering Knowledge Management and Intelligent Design Automation for the past fifteen years and is the author of the whitepaper 'Knowledge Aware Engineering'.

Jeff is currently the President of Auros Knowledge Systems where he heads the business, research, and product development teams.

Prior to Emergent Systems, Jeff worked at Ford Motor Company in the Advanced Manufacturing Technology Development organization leading several Design Automation and Knowledge Systems projects.

Jeff has a BS Mechanical Engineering from Miami University and earned his an MBA from Michigan State University's Eli Broad Graduate School of Management.

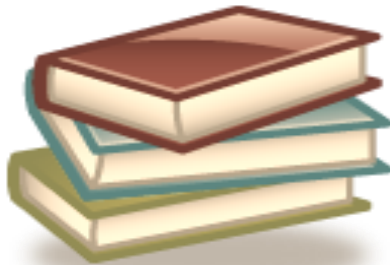
# What is the point ?

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- + Increase engineering efficiency
- + Prevention of past mistakes
- + Build and improve competency over time
- + Consistency and robustness of engineering outcomes

>> Managing Technical Knowledge is critical <<

## Document Centric



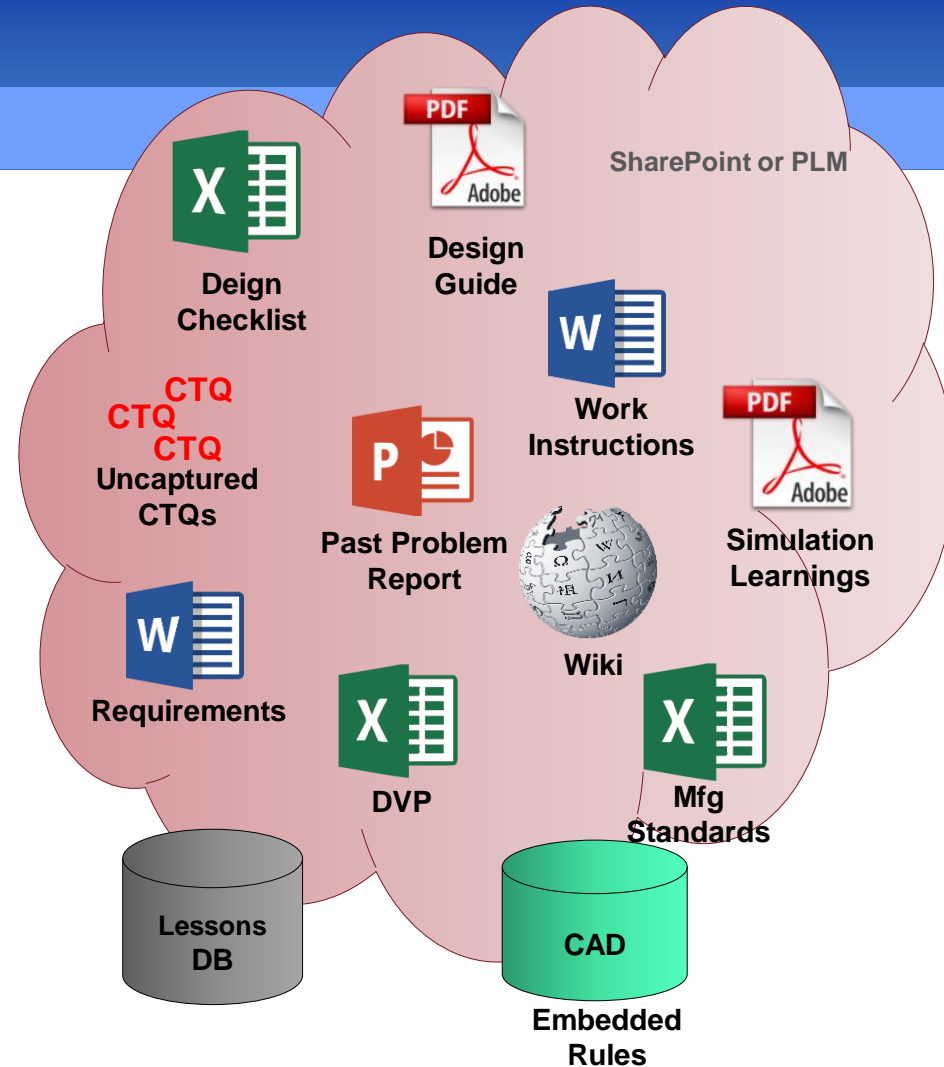
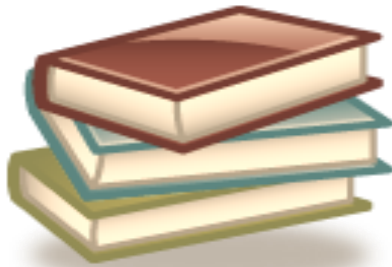
*Library Model*

>> Past Approaches are passive, ineffective <<

# Existing Approaches

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## Document Centric

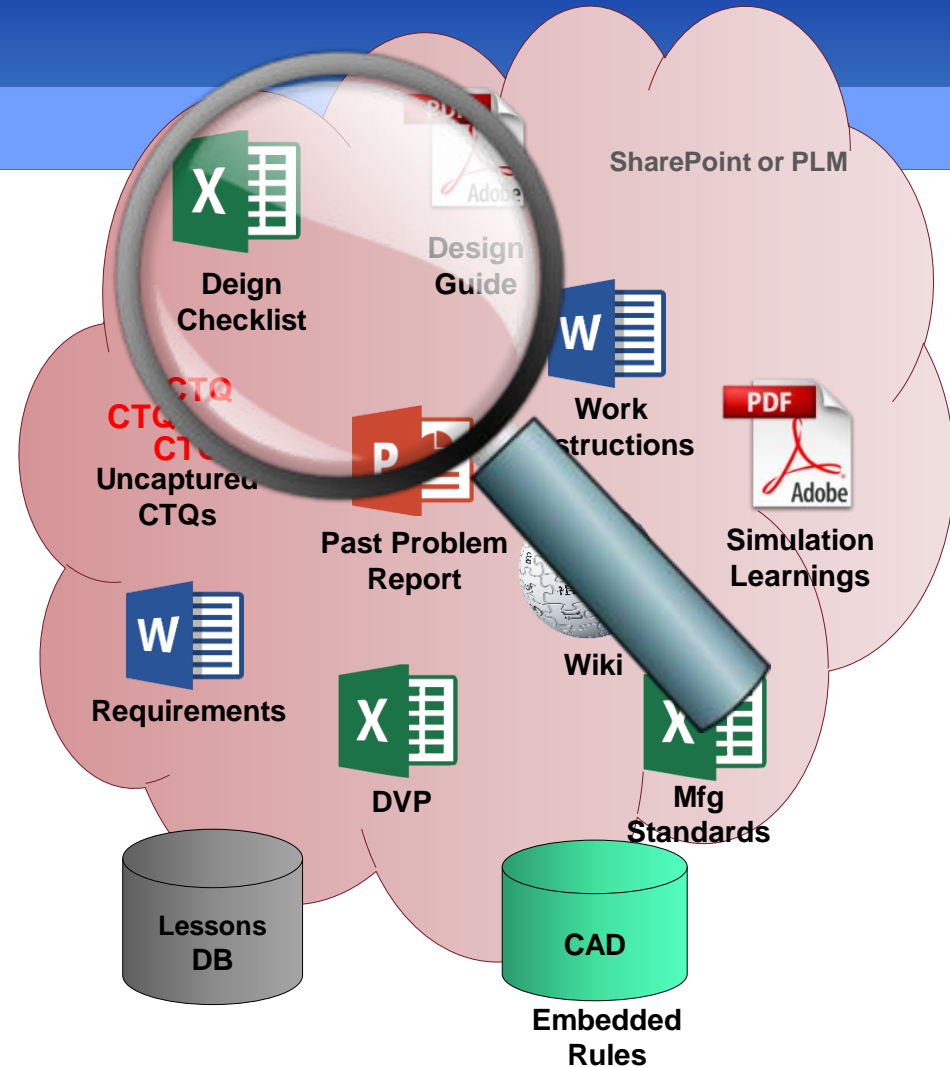


>> Virtualized, but still passive, ineffective <<

# Existing Approaches

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## Document Centric

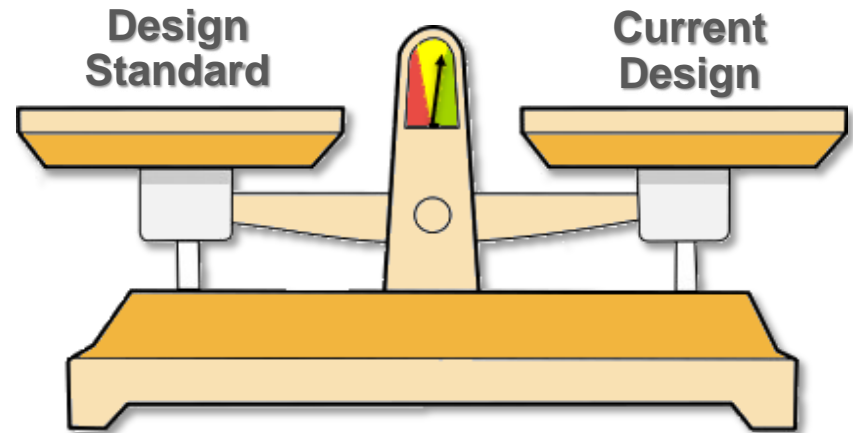
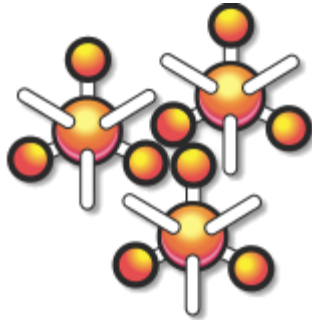


>> Virtualized, but still passive, ineffective <<

# Auros: 'Knowledge Aware' difference

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## Assessment Centric



*Appraisal Model*

>> Auros places Knowledge in-the-flow of work <<

# Auros: Value to you

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Certainty in Knowledge re-use



Continuous Product & Process Validation,  
Verification, & Evaluation



Closed-loop Enterprise Learning and Knowledge  
Sharing

>> Auros is an *active* knowledge system that places  
knowledge in-the-flow of work <<



# Auros: Knowledge Aware Engineering

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Predictive Analytics

**Continuous  
Validation**



Issue Management



Assessment Control

Reuse

Instance

Acquisition

Generalized



Knowledge Packet



Community

**Knowledge  
Capture**




Team Collaboration



**Knowledge in-the-flow Services**

# Auros Core Technology



Knowledge Packet

K-PAC Detail View - Google Chrome

https://demo.aurosks.com/kpac/view/DEMO-2

Product Design Standard

K-PAC Detail View

Export Action Proximity Search Reports Edit Details Relations Connections

DEMO-2

K-PAC Title

Description

Additional Information

Value Table

Min Locator Pin Engagement	Max Locator Pin Engagement
0.45*part_thk	0.6*part_thk
mm	mm
Minimum	Maximum

Other Info

Measurement Ref.

Justification

K-PAC Type

Number of Results: 0

K-PAC Detail View - Google Chrome

https://demo.aurosks.com/kpac/view/DEMO-49

Method

K-PAC Detail View

Export Action Proximity Search Reports Edit Method Details Relations Connections

Layout Settings Executable Mode

Tree

- DEMO-49
  - Coarse System Model
  - Hinged Opening
  - Swing Study
  - Framed Insert Structure
  - Torsional Analysis
  - System Model Standards Validation

Description

Hinged Opening

1 : a jointed or flexible device on which a door, lid, or other swinging part turns

b : a flexible ligamentous joint

c : a small piece of thin gummed paper used in fastening a postage stamp in an album

2 : a determining factor : TURNING POINT

Coarse System Model

Hinged Opening

Framed Insert Structure

Swing Study

Torsional Analysis

System Model Standards Validation

Images

hinge.png

80% Use mouse wheel to zoom

>> K-PACs are the ideal way to manage all technical knowledge <<

# Auros Core Technology

Global



Assessment Control

Auros Assessment - Google Chrome  
52.0.31.57/jsp/clGridView.jsp?idx=3271

Project Code: Project A  
Tree Path: Project A \ PPCS 3

PRODUCT & PROCESS CHECK SHEET Assessment (Grid) View

Status: Evaluation Ready

Manage Filter Combo Filter Views Advanced View Options Issues Reports AC Approvals Multi Sort Set Defaults

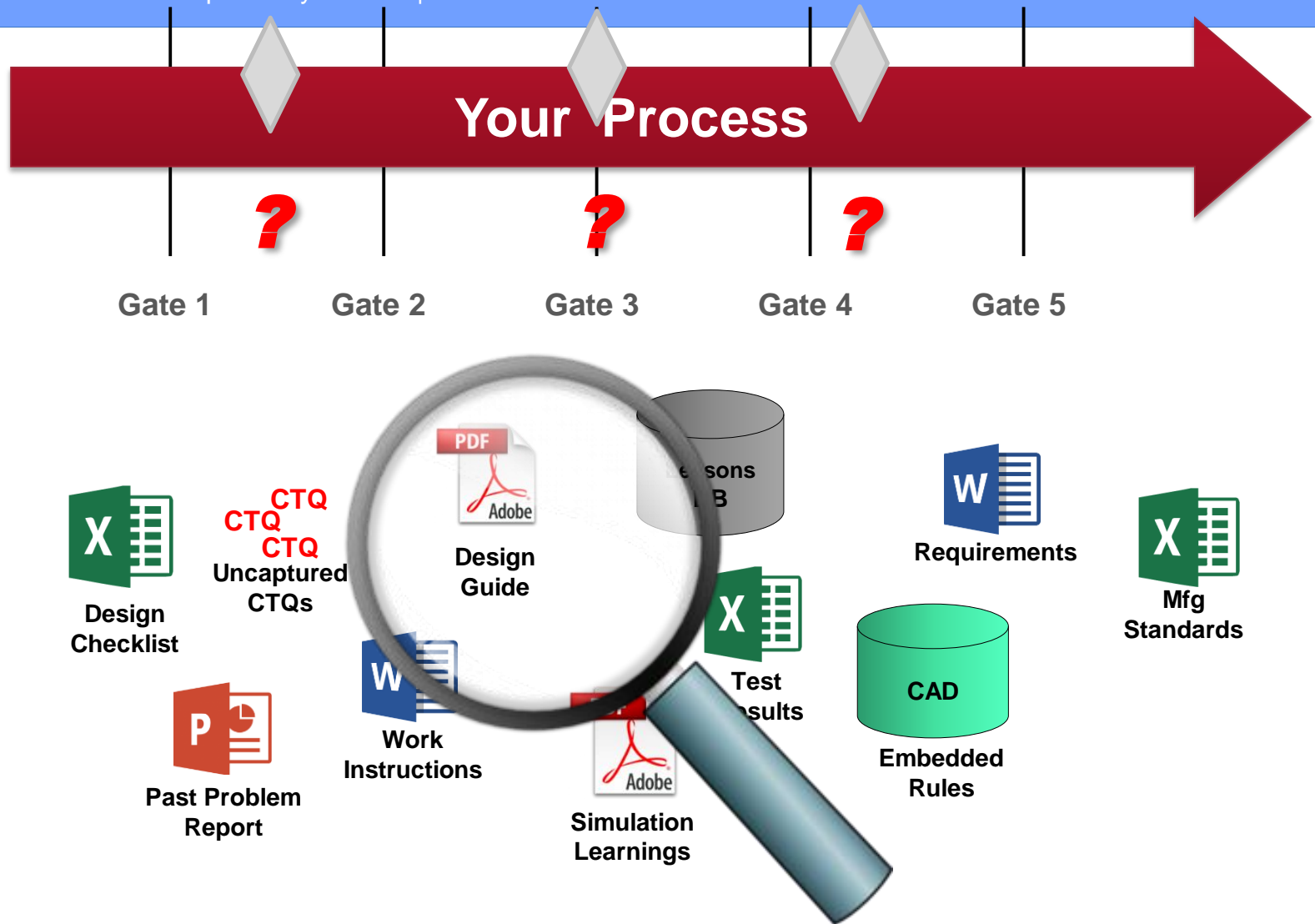
Descriptor: Faurecia - AC - PPCS 3

Group By	Conformance State	Status	Description	Discussion	Multimedia	Last Modified On	Last Modified By	Approval
<b>Domain - Topic</b>								
INJECTION								
BACK-INJECTION								
DECORATIVE TRIM								
PPCS-65	NE							
	Yes							
	No	V1	If In Mould technology selected, is it validated by GTS?	o Hoffa, Jeff(jmoffa), 06-Nov-2015 - Lorem ipsum dolor sit amet, est probo prima doctus et, dico posse.	06-Nov-2015 21:46:56	Hoffa, Jeff(jmoffa)	1	0,0 View
	WIP							
PPCS-66	NE							
	Yes							
	No	V1	If Insert Moulding technology selected, is it validated by GTS?	o Hoffa, Jeff(jmoffa), 06-Nov-2015 - Lorem ipsum dolor sit amet, est ex saepe denique nominat, in nisl nonumy pri. Vix ei animal feugiat deserunt. Et eam dicta admodum, ne soluta tempor epicuri mae. Tation dignissim vituperatoribus ei oed, magna ignota libris quo eu. Eu solum soleat gubergren pro, viris utraque definitionem no pri?	06-Nov-2015 21:52:29	Hoffa, Jeff(jmoffa)	1	0,0 View
	WIP							
PPCS-67	NE							
	Yes							
	No	V1	If deco part selected, is it validated by GTS?	o Hoffa, Jeff(jmoffa), 06-Nov-2015 - Lorem ipsum dolor sit amet, altera voluptaria eam ne, porro possit iuvaret ex vis. Soluta definiebas vis tell Cu vel postea.	06-Nov-2015 21:50:41	Hoffa, Jeff(jmoffa)	1	0,0 View
	WIP							
PPCS-54	NE							
	Yes							
	No	V1	Has alternative product design been considered?		06-Nov-2015 21:46:03	Hoffa, Jeff(jmoffa)	0	0,0 View
	WIP							
<b>GAS ASSISTED INJECTION</b>								

>> Knowledge is assessed continuously – everywhere <<

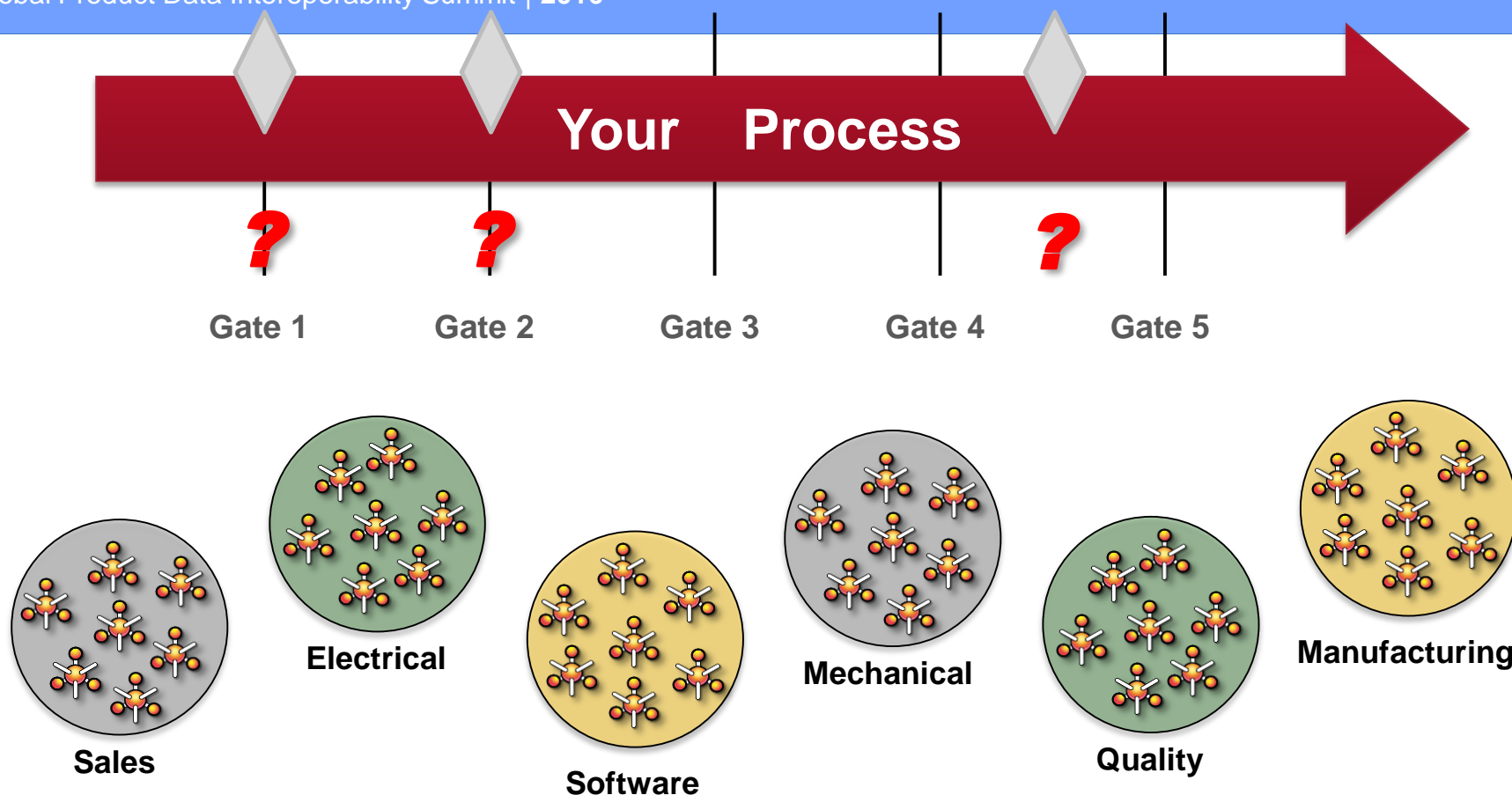
# Knowledge Aware Engineering

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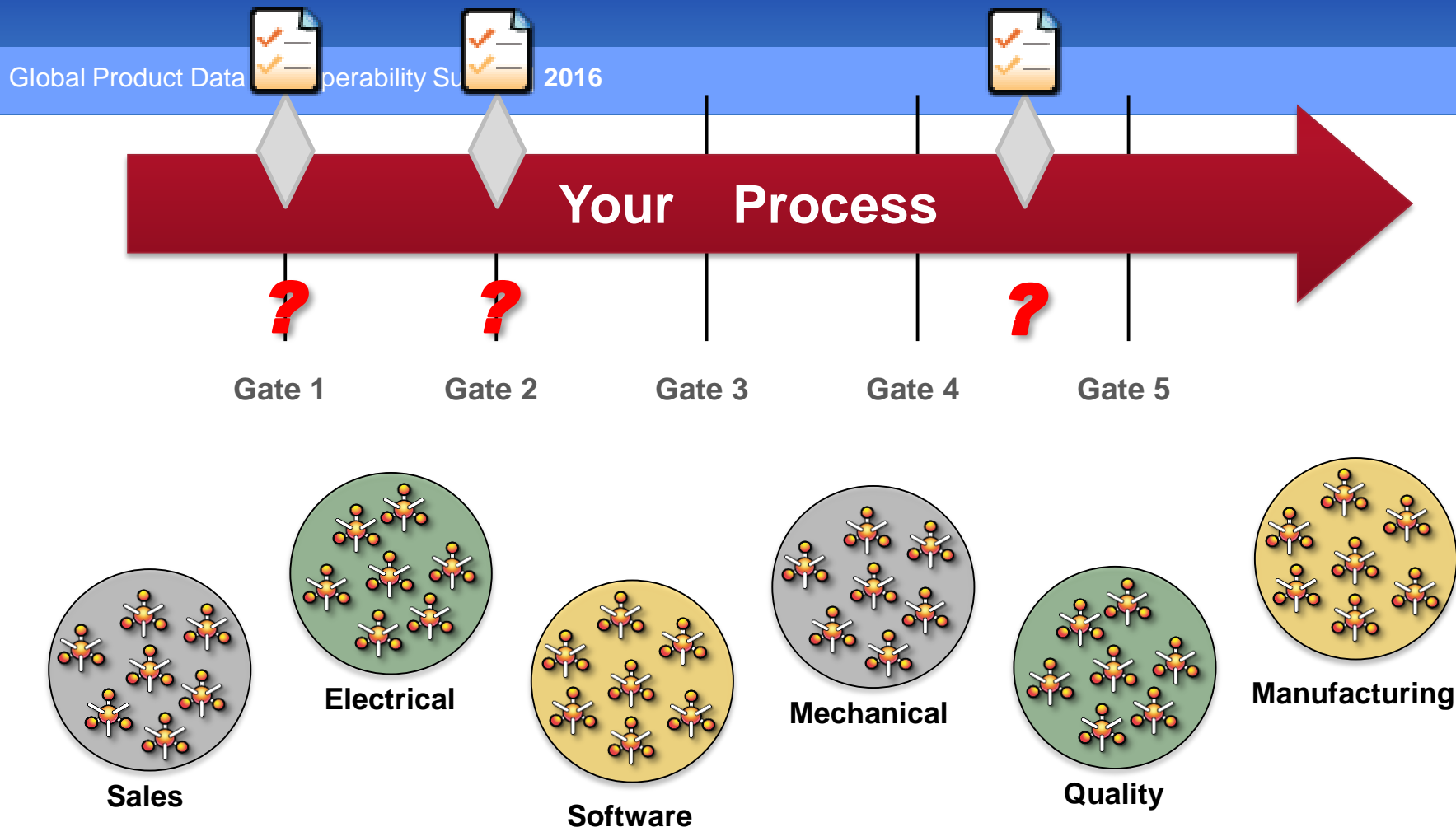
# Auros Assessment Controls ensure critical knowledge is delivered

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>> Assessment Controls deliver Knowledge in-the-flow of Work <<

# Auros Assessment Controls ensure critical knowledge is delivered

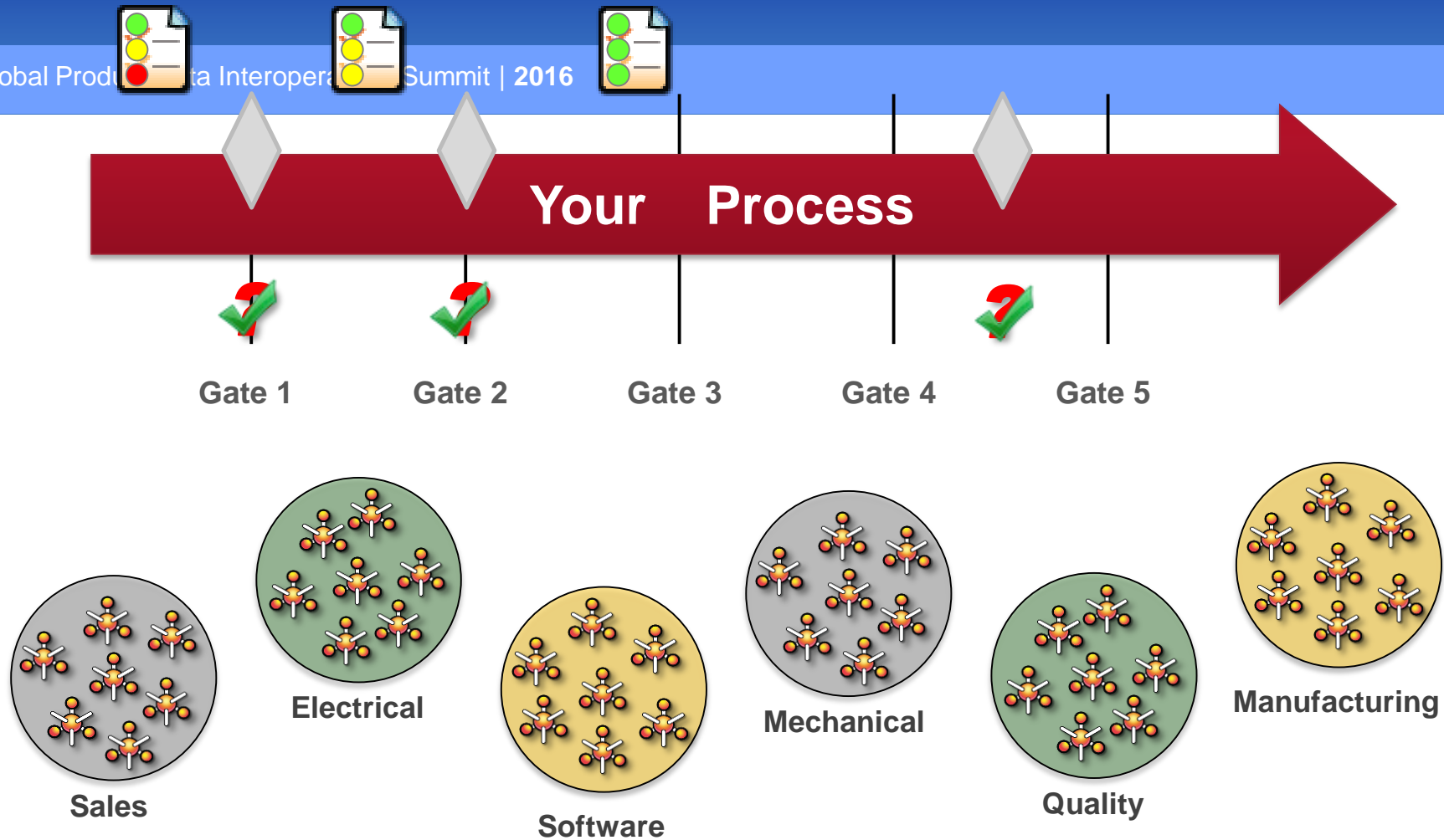


>> Assessment Controls deliver Knowledge in-the-flow of Work <<



# Auros Assessment Controls ensure critical knowledge is delivered

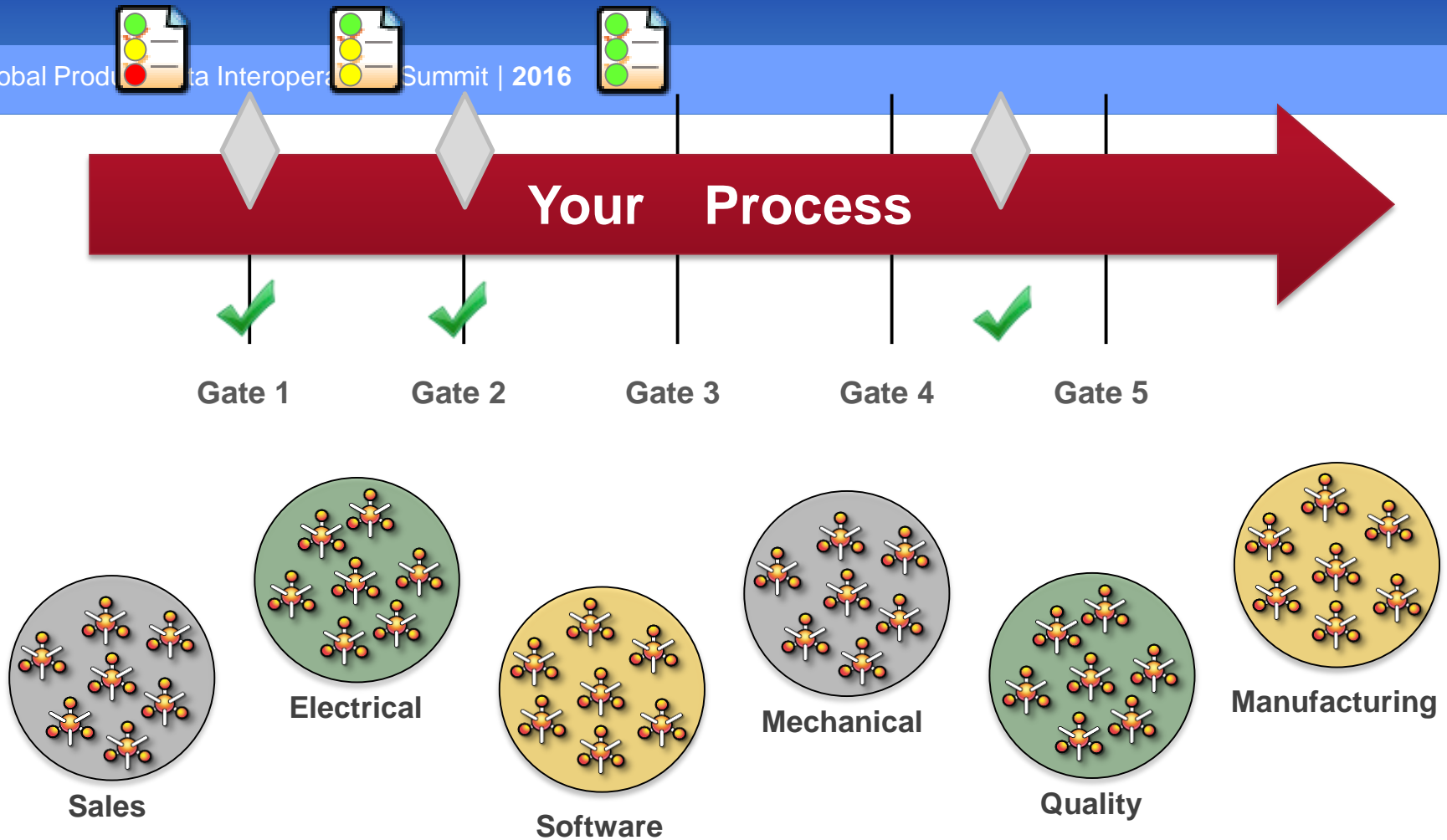
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>> Assessment Controls deliver Knowledge in-the-flow of Work <<

# Auros Assessment Controls ensure critical knowledge is delivered

Global Product Data Interoperability Summit | 2016

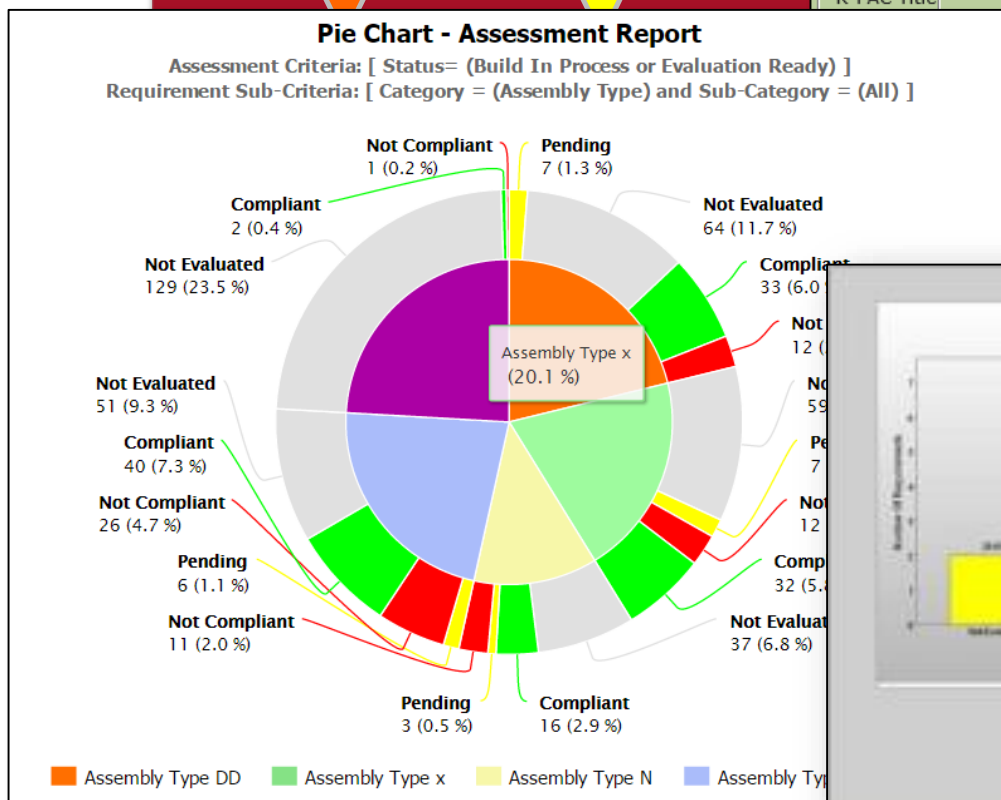


>> Assessment Controls deliver Knowledge in-the-flow of Work <<



# Auros Assessment Controls ensure critical knowledge is delivered

Global Product Data Interoperability Summit 2016



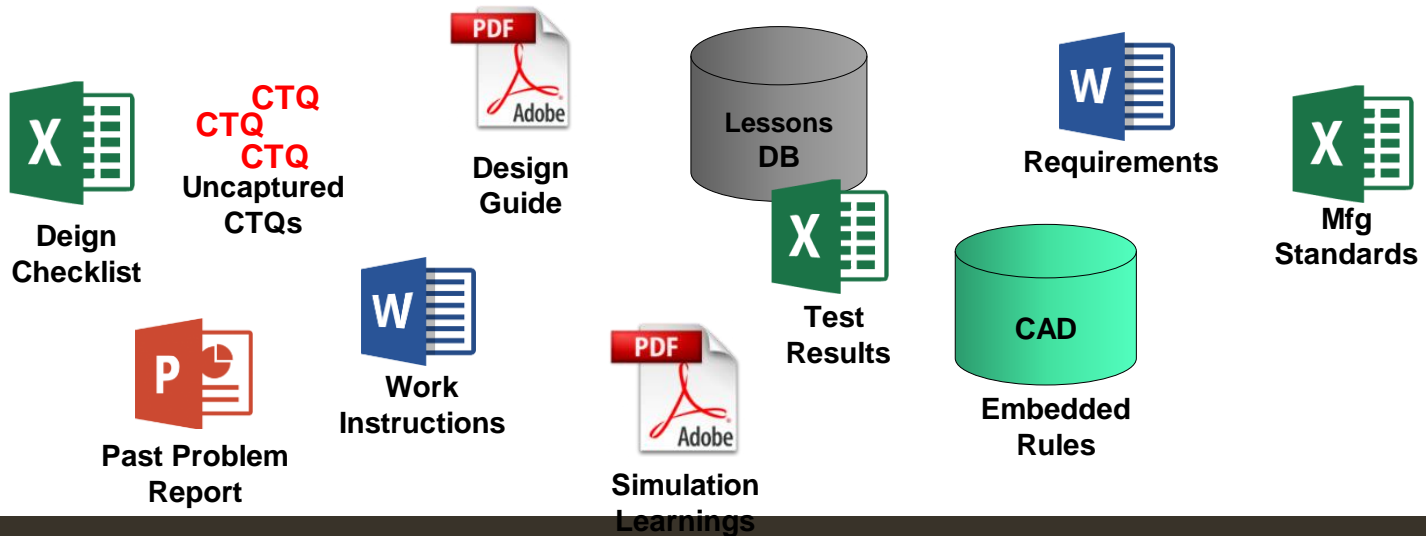
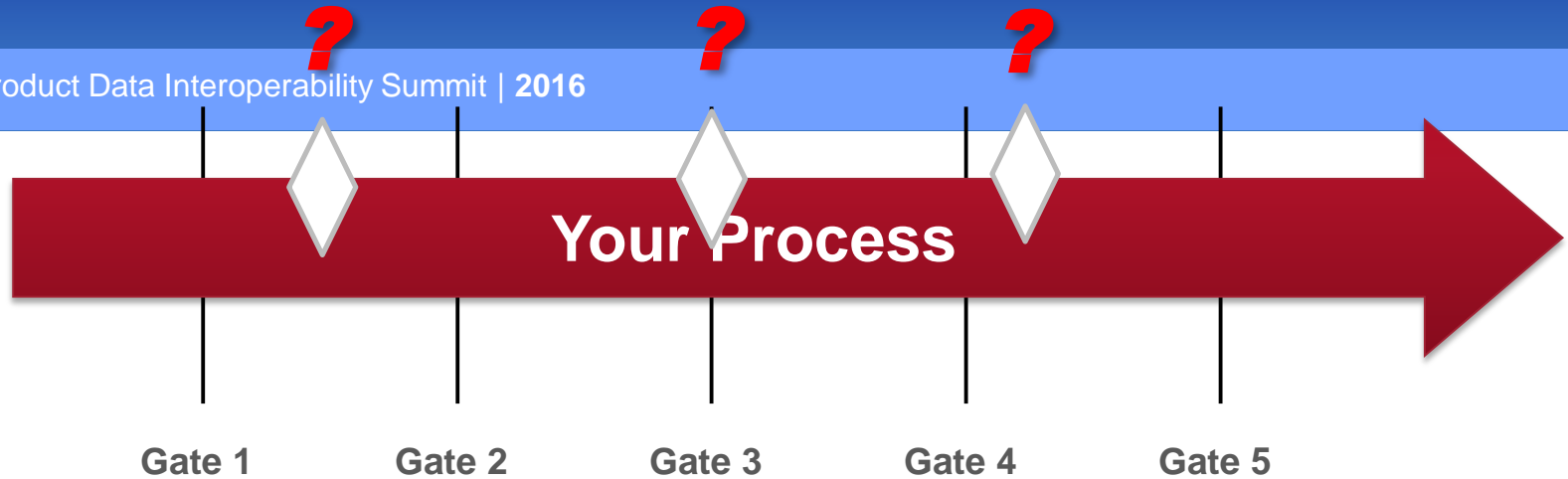
K-PAC Title	Part Name	Denoxtronic 2.2							
		CK_66	CK_66	CK_66	CK_66	CK_66	CK_66	CK_66	CK_66
	ics Cable Harness	Conform	Conform	Conform	Conform	Conform	Conform	Conform	Conform
	ics Cable Harness	Conform	Conform	Conform	Conform	Conform	Conform	Conform	Conform
	ising Module	Not Evaluate	Conform	Conform	Conform	Not Evaluate	Conform	Conform	Conform
	ics Cable Harness	Conform	Conform	Conform	Conform	Conform	Conform	Conform	Conform



>> Assessment Controls deliver Knowledge in-the-flow of Work <<

# Auros: Knowledge Aware Engineering

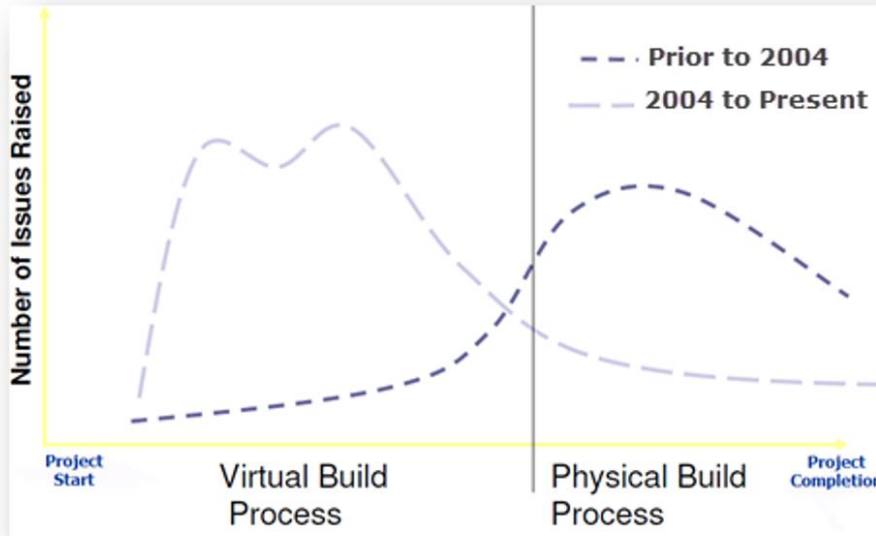
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Document are inherently separated from the flow of work

# Auros Value: Measured Value at Ford

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*"We have a set of Design Standards that we constantly update... Design Standards are the first line of defense, if you know that you have realizable Design Standards you certainly want to repeat those over and over again. And we have what we call a 'Checklist' ; where everything that we learned from a mistake in the past and we create a counter measure to it, goes into that Checklist, and we go through a series of checks in the very early stages, in terms of the making sure we have right design and right content."*

**Bennie Fowler**  
Group VP of Global Quality

<http://www.autoline.tv/show/1413?play>

>> Auros has a proven track record of high impact and value <<

# Auros Value: Measured Value at GM



GM implemented Auros in late 2010:

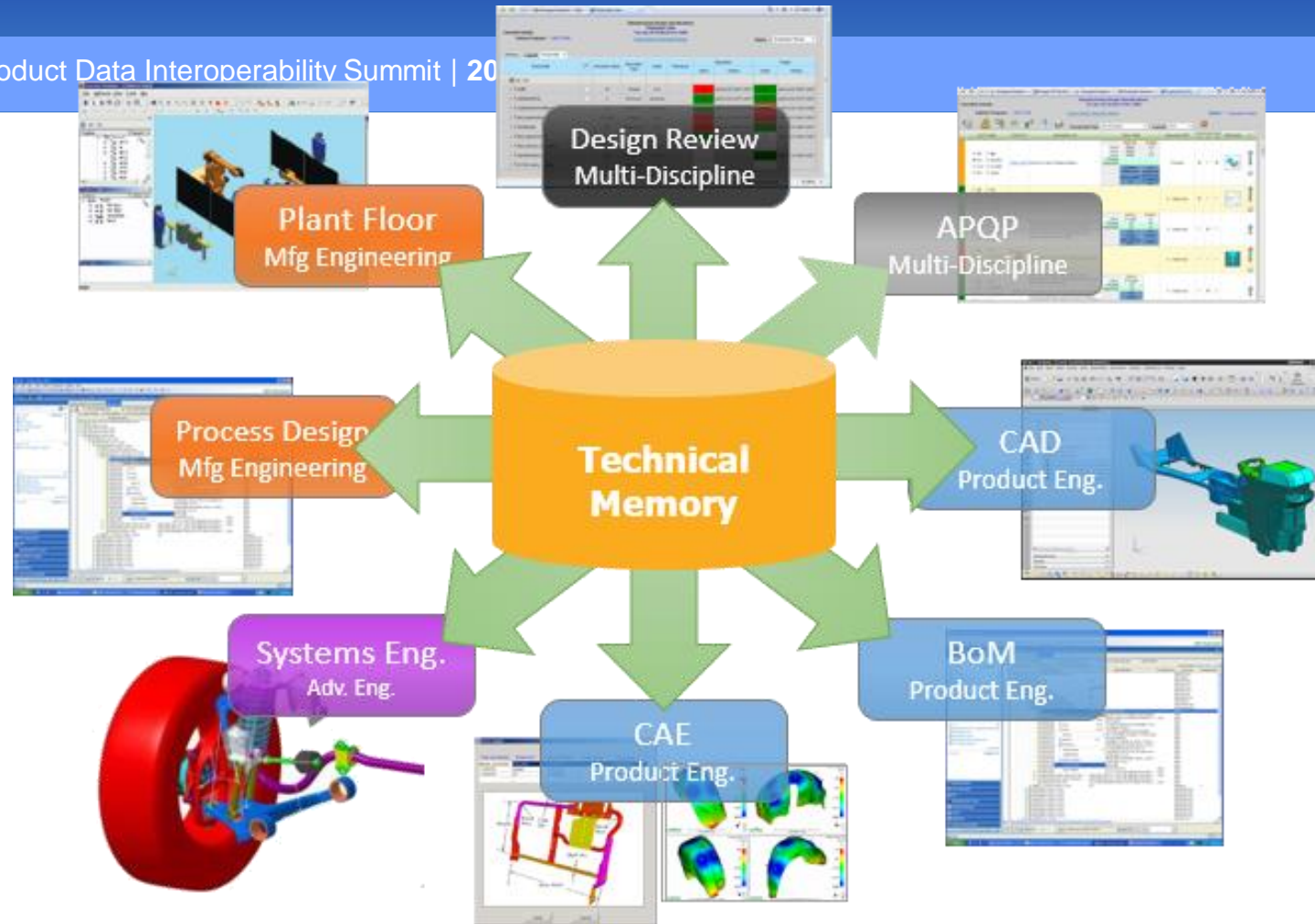
- 200% increase in the number of K-PACs
- 150% increase of active users



→ Auros has a proven track record of high impact and value

# Auros Value: Auros is Enterprise

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>> Auros 'in-the-flow of work' is an Enterprise-wide solution <<



# Auros Software is developed by Emergent Systems

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## ➤ Founded in 1997

## ➤ HQ in Dearborn, Michigan

- Global Team locations:
  - Dearborn, MI
  - Kharkiv, Ukraine
  - Hyderabad, India
- Service Partner Network:
  - Paris, France
  - Pune, India

## ➤ Large Customer/User Base

**34,000** ↑  
users - growing



**AIRBUS**

**NAVISTAR**

**CATERPILLAR**



**EATON**

**ROUSH®**



**BorgWarner**

>> Established Company with rapid growth <<

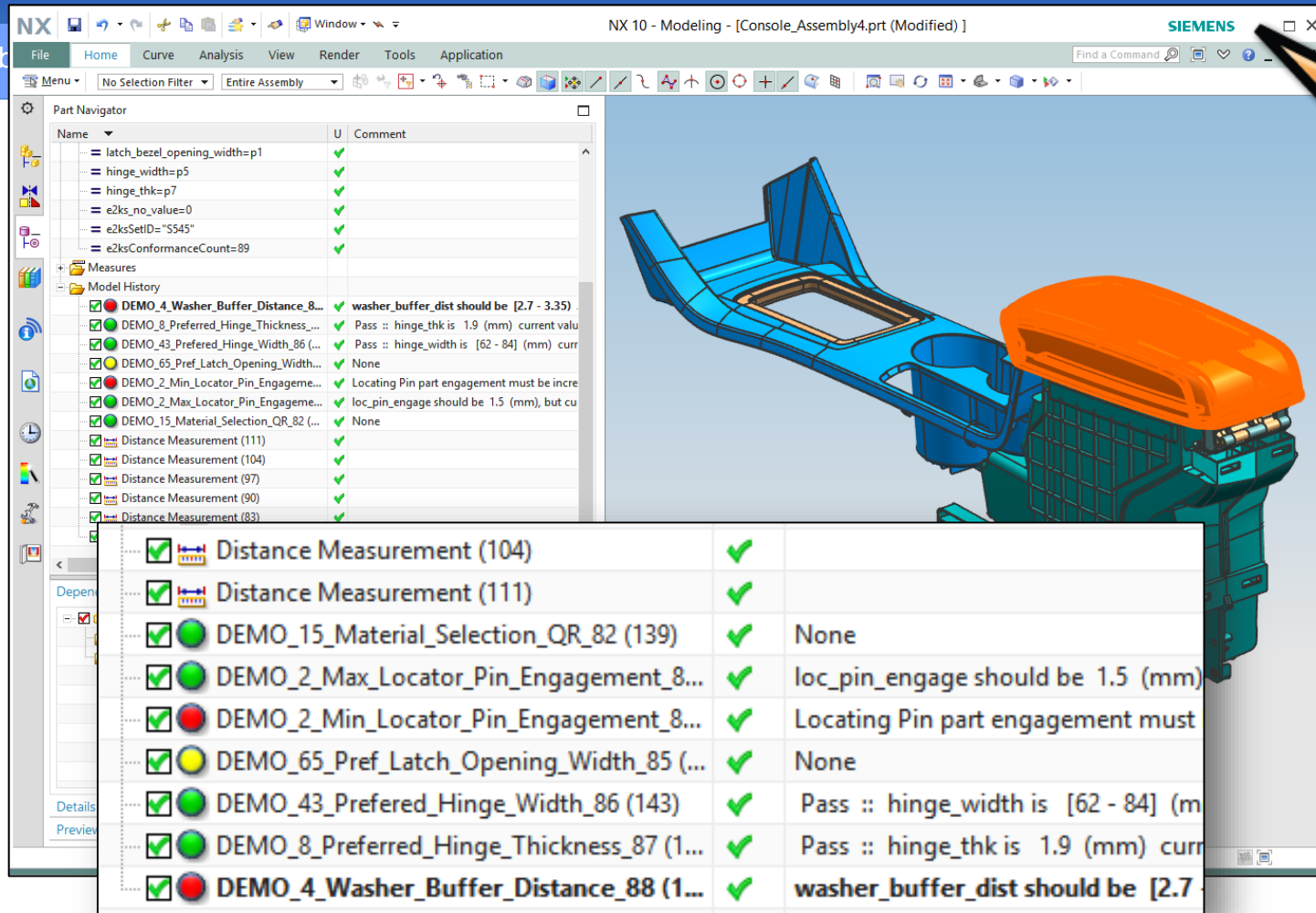




**Knowledge Best Shared**

# Auros Unique Features: Rules Engine

Glob



Part Navigator

Name	U	Comment
latch_bezel_opening_width=p1	✓	
hinge_width=p5	✓	
hinge_thk=p7	✓	
e2ks_no_value=0	✓	
e2ksSetID="S545"	✓	
e2ksConformanceCount=89	✓	

Measures

Model History

Name	U	Comment
DEMO_4_Washer_Buffer_Distance_8...	✓	washer_buffer_dist should be [2.7 - 3.35]
DEMO_8_Prefered_Hinge_Thickness_...	✓	Pass :: hinge_thk is 1.9 (mm) current valu
DEMO_43_Prefered_Hinge_Width_86 (...)	✓	Pass :: hinge_width is [62 - 84] (mm) curr
DEMO_65_Pref_Latch_Opening_Width...	✓	None
DEMO_2_Min_Locator_Pin_Engageme...	✓	Locating Pin part engagement must be incre
DEMO_2_Max_Locator_Pin_Engageme...	✓	loc_pin_engage should be 1.5 (mm), but cu
DEMO_15_Material_Selection_QR_82 (...)	✓	None
Distance Measurement (111)	✓	
Distance Measurement (104)	✓	
Distance Measurement (97)	✓	
Distance Measurement (90)	✓	
Distance Measurement (83)	✓	

Distance Measurement (104) ✓

Distance Measurement (111) ✓

DEMO\_15\_Material\_Selection\_QR\_82 (139) ✓ None

DEMO\_2\_Max\_Locator\_Pin\_Engagement\_8... ✓ loc\_pin\_engage should be 1.5 (mm)

DEMO\_2\_Min\_Locator\_Pin\_Engagement\_8... ✓ Locating Pin part engagement must

DEMO\_65\_Pref\_Latch\_Opening\_Width\_85 (... ) ✓ None

DEMO\_43\_Prefered\_Hinge\_Width\_86 (143) ✓ Pass :: hinge\_width is [62 - 84] (m

DEMO\_8\_Prefered\_Hinge\_Thickness\_87 (1... ) ✓ Pass :: hinge\_thk is 1.9 (mm) curr

DEMO\_4\_Washer\_Buffer\_Distance\_88 (1... ) ✓ washer\_buffer\_dist should be [2.7

>> Auros puts knowledge into the flow-of-work (e.g. CAD) <<



# Auros Unique Features: Look Across

With Auros, past solutions to issue are automatically connected to current context leading to deeper insights and faster problem solving. The grid below is a 'Reverse' assessment showing all past projects where knowledge was used.

**Product Design Standard**  
K-PAC Detail View

Export Action Proximity Search Reports Edit

Details Relations Connections

**DEMO-2**

**K-PAC Title** Desired Engagement of console locator Pins to Hinge  
**Description** Desired Engagement of console locator Pins to Hinge. Minimum and Maximum engagement length of locator.  
Design the locating feature to make contact with the mating component with the prescribed minimum engagement (plus chamfer) before any other contact during sub-assembly.  
(Not required for heat staked components.)  
**Additional Information**

**Value Table**  

Min Locator Pin Engagement	Max Locator Pin Engagement
0.45" part_thk	0.6" part_thk
mm	mm
Minimum loc_pin_engage	Maximum loc_pin_engage

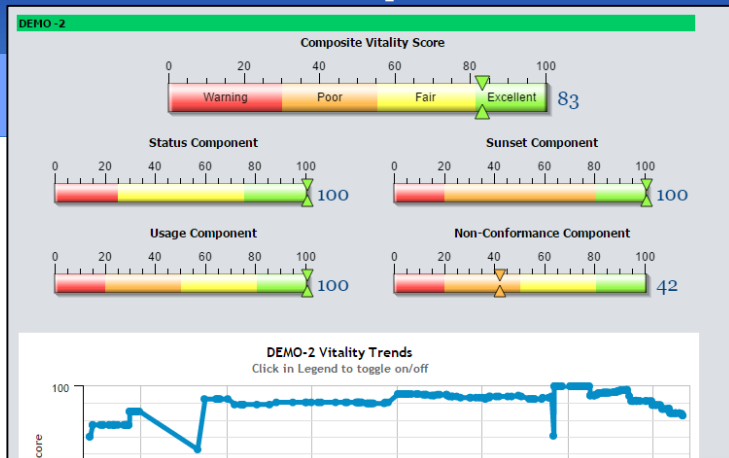
**Other Info**  
**Measurement Ref. Justification**  
**K-PAC Type**  
**Criticality**  
**K-PAC Status**  
Number of Results: 28

**Assessment Occurrences** :51 View most recent 10 Assessment Occurrences View  
Export Filter Column Chooser

Assessment ID	K-PAC Version	Pass-Fail	Program	Sub Project	Discussion	Creator	Last Modified On	Status Last Update	Last Modified By	Issues
<a href="#">DEMO-QK632 (#1-0)</a>	V 2 Latest	Not Evaluated	Project A	SubProject A		Boisvert, Steve(sboisve1)				0,0 <a href="#">View</a>
<a href="#">DEMO-QK623 (#1-0)</a>	V 2 Latest	Not Compliant	Project A	SubProject A		Boisvert, Steve(sboisve1)	07-Aug-2015 11:39:00	07-Aug-2015 11:39:00	e2ksAutoUpdate	0,0 <a href="#">View</a>
<a href="#">DEMO-QK622 (#1-0)</a>	V 2 Latest	Not Compliant	Project B	SubProject A		Boisvert, Steve(sboisve1)	06-Aug-2015 11:15:01	06-Aug-2015 11:15:01	e2ksAutoUpdate	0,0 <a href="#">View</a>
<a href="#">DEMO-QK614 (#1-0)</a>	V 2 Latest	Not Compliant	Project A	SubProject A	o Moffa, Jeff(jmoffa), 03-Sep-2015 - We need to reduce	Kullis, Josh(josh)	03-Sep-2015 10:09:08	03-Sep-2015 10:09:08	e2ksAutoUpdate	0,0 <a href="#">View</a>
<a href="#">DEMO-QK6593 (#1-0)</a>	V 2 Latest	Not Evaluated	Project D	SubProject A		Domke, Kurt(kurt.domke)				0,0 <a href="#">View</a>
<a href="#">DEMO-QK6525 (#1-0)</a>	V 2 Latest	Not Compliant	Project A	SubProject A		Kullis, Josh(josh)	29-Jun-2015 14:43:48	29-Jun-2015 14:43:48	e2ksAutoUpdate	0,0 <a href="#">View</a>
<a href="#">FPNL-QK6503 (#1-0)</a>	V 2 Latest	Not Evaluated	2011 C485	Instrument Cluster		Yedida, Venkata(venkata)				0,0 <a href="#">View</a>
<a href="#">DEMO-QK6494 (#1-0)</a>	V 2 Latest	Compliant	Project A	SubProject A		Kullis, Josh(josh)	26-May-2015 09:00:31	26-May-2015 09:00:31	e2ksAutoUpdate	0,0 <a href="#">View</a>
<a href="#">DEMO-QK6456 (#1-0)</a>	V 2 Latest	Not Compliant	Project E	Console_Assembly7		User, Webservices(api_user)	12-May-2015 14:58:39	12-May-2015 14:58:39	e2ksAutoUpdate	0,0 <a href="#">View</a>
<a href="#">DEMO-QK6454 (#1-0)</a>	V 2 Latest	Compliant	Project A	SubProject A		Boisvert, Steve(sboisve1)	12-May-2015 14:47:06	12-May-2015 14:47:06	e2ksAutoUpdate	0,0 <a href="#">View</a>

>> Auros allows users to connect with past similar projects/problems <<

# Auros Unique Features: Dynamic Knowledge Reports



16

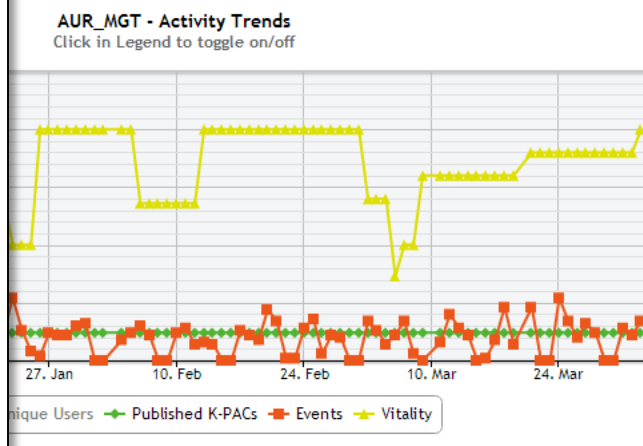
Count Report

Report Criteria: [ Status=(Build In Process or Evaluation Ready) ]

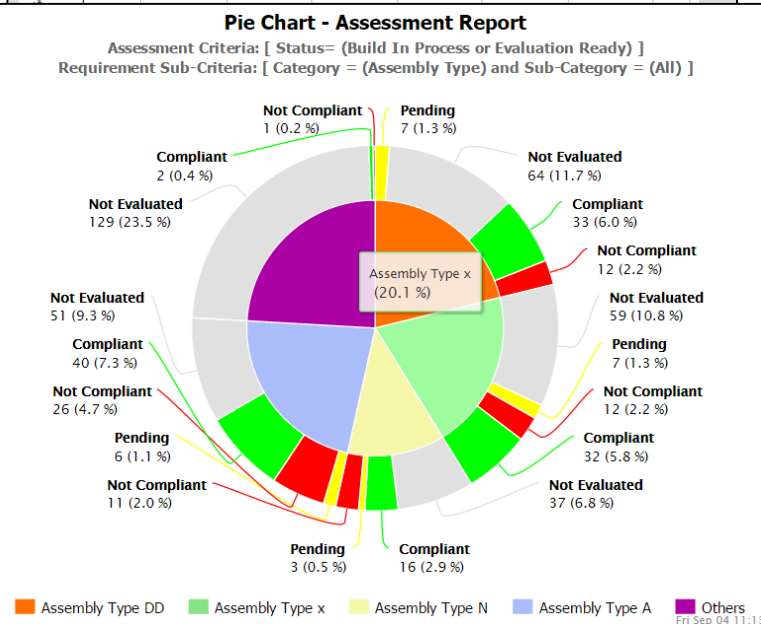
Requirement Sub-Criteria: [ Primary Sub-Category =(Project) and Secondary Sub-Category =(None) ]

	Total No. Of Assessments Made	Assessments Made	N/SCOR	NE	Red	Yellow	Green
Total Program *	329	99	0	230	29	9	61
PN760	1	1	0	0	1	0	0
Project A	159	23	0	136	10	0	13
Project B	61	12	0	49	5	0	7
Project C	9	3	0	6	2	0	1
Project D	64	26	0	38	4	4	18

K-PAC	K-PAC Title	Part Name	Denoxtronic 2.2							
			CK_66	CK_66	CK_66	CK_66	CK_66	CK_66	CK_66	CK_66
<a href="#">BOSCHFS-37 (#1)</a>	Temperature Sensor	Electronics Cable Harness	Conform	Conform	Conform	Conform	Conform	Conform	Conform	Conform
<a href="#">BOSCHFS-54 (#1)</a>	Plug Connection	Electronics Cable Harness	Conform	Conform	Conform	Conform	Conform	Conform	Conform	Conform
<a href="#">BOSCHFS-99 (#1)</a>	Electric Lines and Connectors	Dosing Module	Not Evaluate	Conform	Conform	Conform	Not Evaluate	Conform	Conform	Conform
<a href="#">BOSCHFS-31 (#1)</a>		Electronics Cable Harness	Conform	Conform	Conform	Conform	Conform	Conform	Conform	Conform



With Auros, reporting within and across projects for problem identification, status and roll-up is made easy. No XLS consolidation.



>> Auros provides a wide variety of reporting/analytics options <<

# Auros Unique Features: Proximity Search

The screenshot shows the Auros software interface with the 'Installation Guideline' window open. The 'Proximity Search' tab is active, displaying a search result for 'Bent Pipe Installation (Preferred)'. The result includes a description of the installation process and a list of related standards. The table below summarizes the search results:

K-PAC ID	Score	Title	Description
BOSCHFS-5	0.8590	Bent Pipe Installation (Preferred)	Injection of spray in axial direction into straight pipe part, or with small inclination angle into the bent direction as shown in Figure 19. Small inclination of spray (3...5°) towards the pipe axle to compensate spray deflection by exhaust gas flow. A mixer can help minimize deflection of the spray caused by the exhaust flow.
BOSCHFS-6	0.8590	Straight Pipe Installation	Use of a mixer in straight pipe applications is strongly recommended to reduce risk of wall wetting and formation of urea deposits in the exhaust pipe as shown in Figure 20.
DFPMTL-43	0.8408	Rationales of Selection of Pipe Leg.	Rationales of Selection of Pipe Leg.
DFPMTL-37	0.8301	If permanent padeye has to be used, lapped padeye is preferred	If permanent padeye has to be used, lapped padeye is preferred and do not install padeyes in way of block break
DFPMTL-61	0.8248	Install a doubler plate	Install a doubler plate between the silencer resilient mounts and the platform structure they rest on. This doubler plate to be pre-assembled with mounts brackets on ground. This allows for a more efficient and quicker installation of the silencers by preventing the use of temporary supports.
PIPE_DG-70	0.8049	Hargis Bend	If the distance between 2 bends is too short for the bending machine to complete both bends, excess material (Feed Length) can be added, then cut out after both bends have been completed. 1 butt weld will be needed to re-connect the 2 bent pieces of pipe, but this is cheaper, even with the wasted excess pipe, than using an elbow as this requires 2 butt welds and the cost of the fitting.

With Auros, engineering knowledge is automatically associated through purpose built semantic search.

- *No more duplicated standards*
- *Related standards are 'connected'*
- *Related issues are identified*

>> Auros automatically makes connections  
across related knowledge <<

# Auros Unique Features: Integrated Problem Solving

Combo Filter
Views
Advanced View Options
Issues
Reports
AC Approvals
Multi Sort
Set Defaults

Descriptor:

Conformance State	K-PAC ID	Status	K-PAC Title	Author	Discussion
NE	BOSCHFS-4	VS	General Installation Proposal	McEvilly, Sean(smce)	Moffa, Jeff(jmoffa), 04-Sep-2015 - Malis vivendum cu eam inimicus tincidunt est cu. Luptatum abhorreant sed cu, at qui blandit, at justo scripserit repudiandae qui. Cum eu mentitur patrioque. Vel quando fastidii contentiones eu. Sea simul cet Moffa, Jeff(jmoffa), 04-Sep-2015 - mnes argumentum labore maiorum eu sed, vel lobortis occurreret ex, et efficien
Pass					
AD					
Fail					
DP					
NE	BOSCHFS-7	VS	Muffler Installation	McEvilly, Sean(smce)	Moffa, Jeff(jmoffa), 04-Sep-2015 - Eum no numquam fastidii mazim utinam electram, nam quas autem te
Pass					
AD					
Fail					
DP					
NE	BOSCHFS-8	VS	Installation of Supply Module	McEvilly, Sean(smce)	
Pass					
AD					
Fail					
DP					
NE	BOSCHFS-12	VS	AdBlue Tank	McEvilly, Sean(smce)	Moffa, Jeff(jmoffa), 04-Sep-2015 - is eu vide consulatu de numquam qualisque eu vim. Moffa, Jeff(jmoffa), 04-Sep-2015 - Sonet delenit necesse no sea assum affert. Sumo quando convenire vel ea,
Pass					
AD					
Fail					
DP					
NE	BOSCHFS-17	VS	Debris Protection	McEvilly, Sean(smce)	
Pass					
AD					

Issue Id - 8011
Issue Status

Basic Issue Info

Project: S197\_2011  
Priority: 2-Medium Priority  
Problem Statement: "wear of the ballscrew spindle" in the face-grinding machine.  
Discussion: Axial run-out from face to inner bore 0 n.o.k. Nominal: 0.05 Ist: bis zu 0.1

Issue Creator: Moffa, Jeff(jmoffa)  
Assignee: Moffa, Jeff(jmoffa)  
Interested Parties: Kullis, Josh(josh.kullis), Boisvert, Steve(sboisve1)

Attachments

Thumbnail	File/Link	Short Description	Uploaded By	Uploaded On
	Filename_142049999197	No Description Found	Moffa, Jeff(jmoffa)	05-Jan-2015 18:19:19
	Filename_142050004056	No Description Found	Moffa, Jeff(jmoffa)	05-Jan-2015 18:20:16

3 Containment Actions

Containment Actions:

- Check of stock: No parts on stock at present
- Check customer stock: In the Herzogenaurach plant another lot with the same defect was found. In the Hirschaid plant no parts were on stock.
- Check of stock in transit to customer: At present there are no parts on the way to the Customer
- The stock parts of similar type 18, 19, 21 were checked also for the claimed defect. No defects were found on these.

Perf Effect: Check of maintenance plan at machineTech, discussion machine manufacturer Empirical with different clamp, forces Check of revision in ERP-system Empirical check, series of measurementCheck of revision in ERP-system 6 EngedA\%line-Abstellma\%nahme(n) / Implemented corrective action(s) EinfA\%hrungsdat

In Effect Date

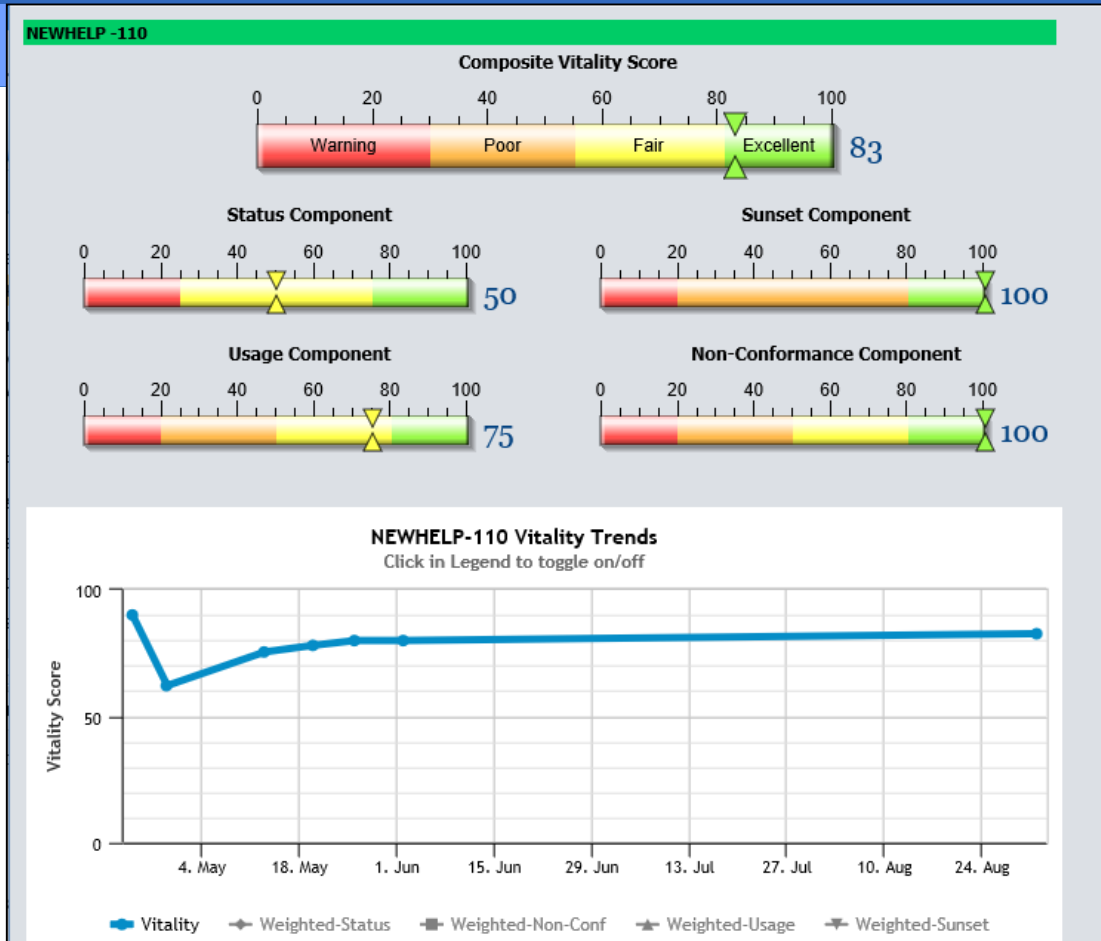
4 Corrective Actions  
5 Permanent Corrective Actions  
6 Implemented Actions  
7 Actions to Prevent Recurrence  
8 Congratulate Team and Feedback

Part Information

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>> Integrated problem solving (8-D, A3, issue Mgt) ties issues to knowledge and makes problem solving 'Knowledge Enabled' and efficient <<

# Auros Unique Features: Vitality



With Auros, Knowledge is statistically evaluated for quality or 'Vitality'

- *Experts do not have to review all standards, just standards where measured 'Vitality' has decayed*
- *End-users trust the knowledge when measured 'Vitality' is high*

>> Auros calculates the 'confidence of quality' of knowledge items <<



**Knowledge Best Shared**