

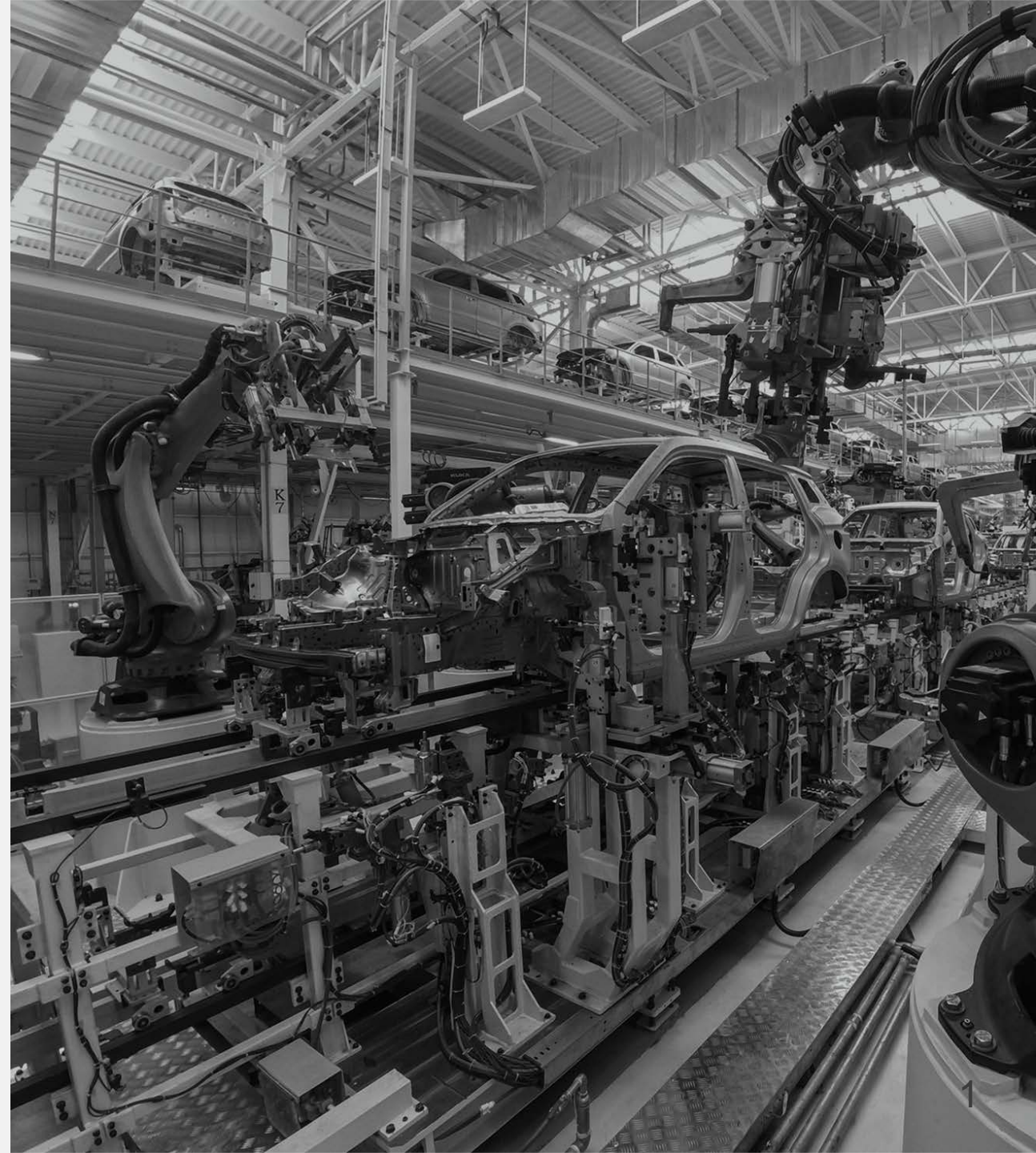


MODEL-BASED ENTERPRISE SUMMIT 2018

ENGINEERING CHANGE NOTICE COST IMPROVEMENTS

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PRESENTATION AGENDA



Engineering Change Overview

Change Process

Automating Change Detection

Intuitive Reporting

Cost of Changes

Summary



ENGINEERING CHANGE LEXICON

Engineering Change

(synonymous)

- (EC) Engineering Change
- **(ECN) Engineering Change Notice** 
- (ECO) Engineering Change Order
- (CO) Change Order

Change Request

(synonymous)

- **Engineering Change Request** 
- Change Request

- (ECP) Engineering Change Proposal
- (ECB) Engineering Change Board¹
- (TTP) Transition to Production²

¹Approval authority for issuing ECN

²The process that brings a change or new product into production on the shop floor



ENGINEERING CHANGE TERMS

Engineering
Change
Process

Starts when ECR is created

“Scoper” is assigned to determine justification and the scope of the request

ECN “Scoper”
(title may vary)

A person who identifies all things affected by an ECR

Plans all aspects of the request change and presents to ECB

After approval, initiates and supports TTP to incorporate the ECN



ENGINEERING CHANGE TERMS

Change
Incorporation

The process of scoping and planning and executing an ECN

Change
Review Board

Management positions that authorize a change to be incorporated

Usually comprised of Design Engineering, Manufacturing Engineering, Operations Planning, QC, CM and Procurement leads.

May include Logistics, Tech data, others as required and determined by the ECN “Scoper”



REASONS FOR CHANGE

Including, but not limited to

Design Mistake (Form, Fit, Function)

- Requirements incorrect or changed
- Material Specification incorrect or unavailable
- Design error not caught until testing

TTP Mistake

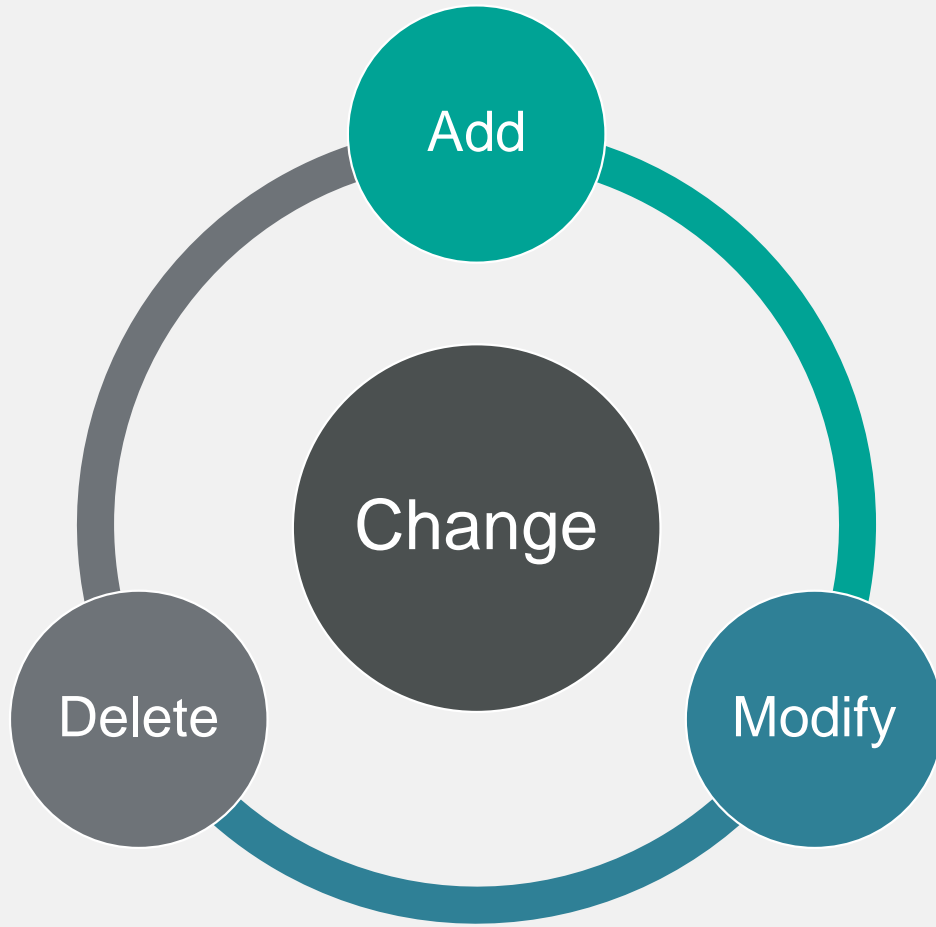
- MBOM Definition
- Material not available
- Work Instruction error
- Tool design error

Safety

- End user safety issue
- Manufacturing production process issue

TYPES OF CHANGES

How will the change effect the product





HANGING PAPER

Hanging Paper is the process of defining and approving a change, but not incorporating it into the documentation. Instead, defining the product definition as “This Drawing/Model plus this unincorporated but approved change” .

https://www.cmpic.com/PDFs/CMTrends_Issue11_2012_12a.pdf



High Tech Tools, Prehistoric Processes

by A. Larry Gurule
CMPIC



Why?

Some hang paper/redline because it takes too long to get documentation updated. This is usually the case in environments where there are a lot of corrective action-type changes and they just do not have the staff to manage the avalanche of changes (why that happens is another story).

Some hang paper because they have not budgeted for, or scheduled, the updating of documents as part of their change implementation planning.

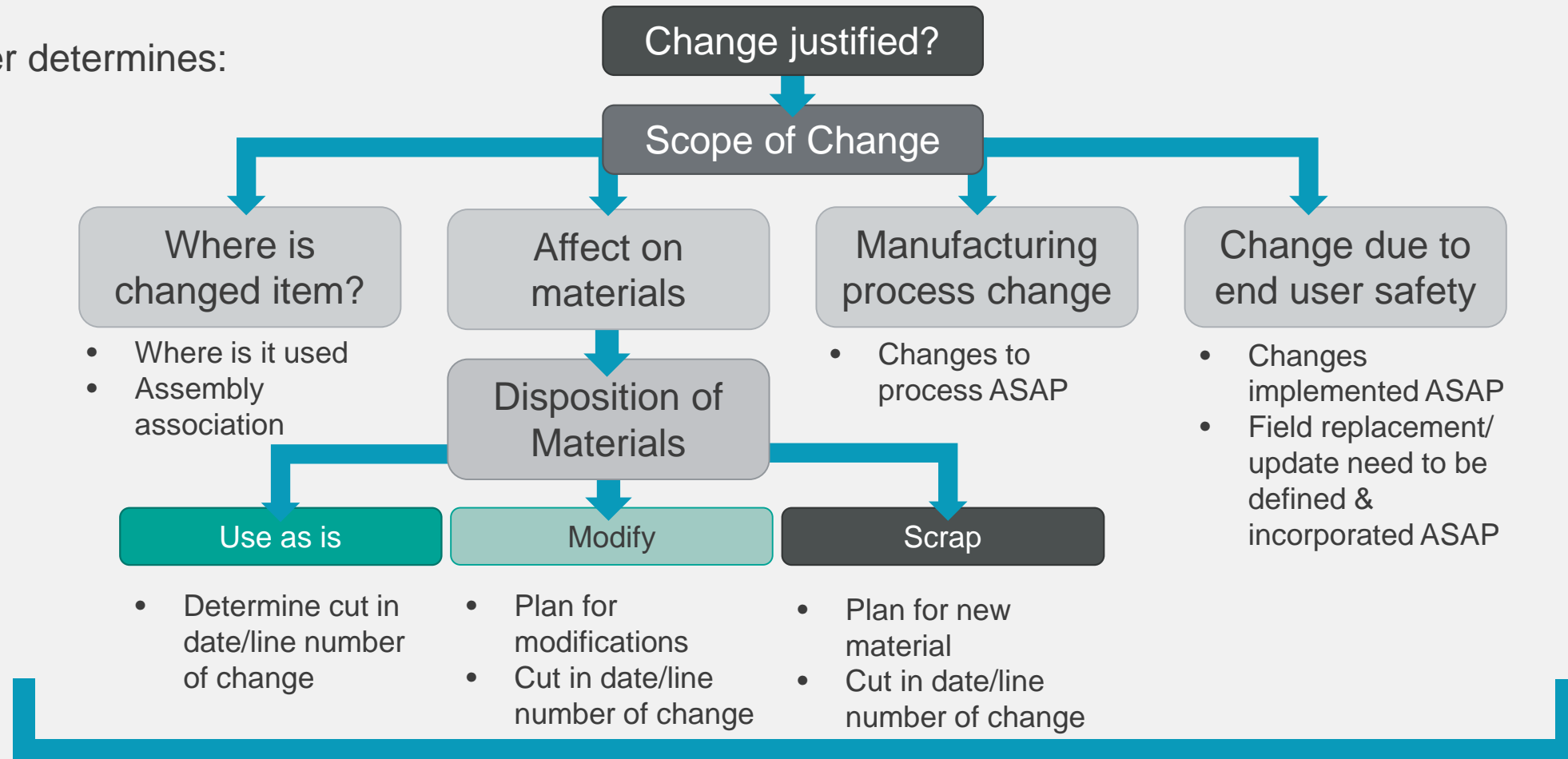
Some do it because they have always done it that way (which was more the norm in pre-automated tool days).

In some organizations the ability to readily access, easily understand, and work with valid documentation is being compromised. As a result, we can expect an unacceptable level of corrective action that affects productivity.



CHANGE SCOPING PROCESS

Scoper determines:



Continued...



CHANGE SCOPING PROCESS

Engineer determines:

Plans all actions required to TTP

Prepares ECP for ECB Review

Submits the ECP and TTP plan to the ECB

If approved

Leads the TDP through normal production

Modifies MBOM
Request MRP for change

Work with
Configuration
Management to
update TDP

Develops
approved ECN

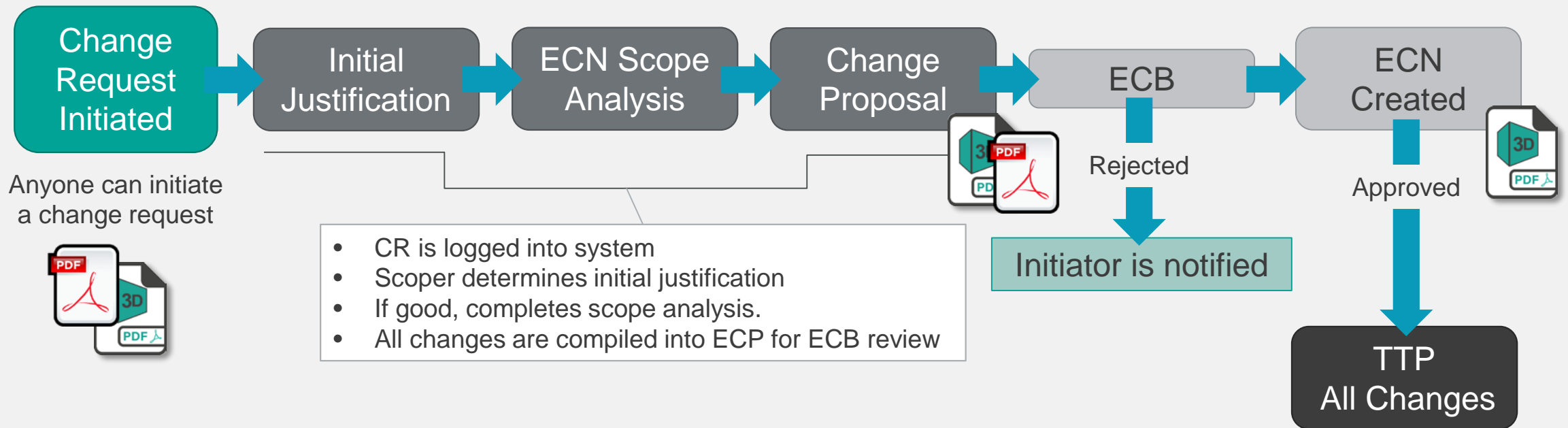
Send work
orders to Tool
Design & CNC
programming

Work with:

- Quality Control
- Procurement/Buyers
- Suppliers
- Other departments



CHANGE PROCESS





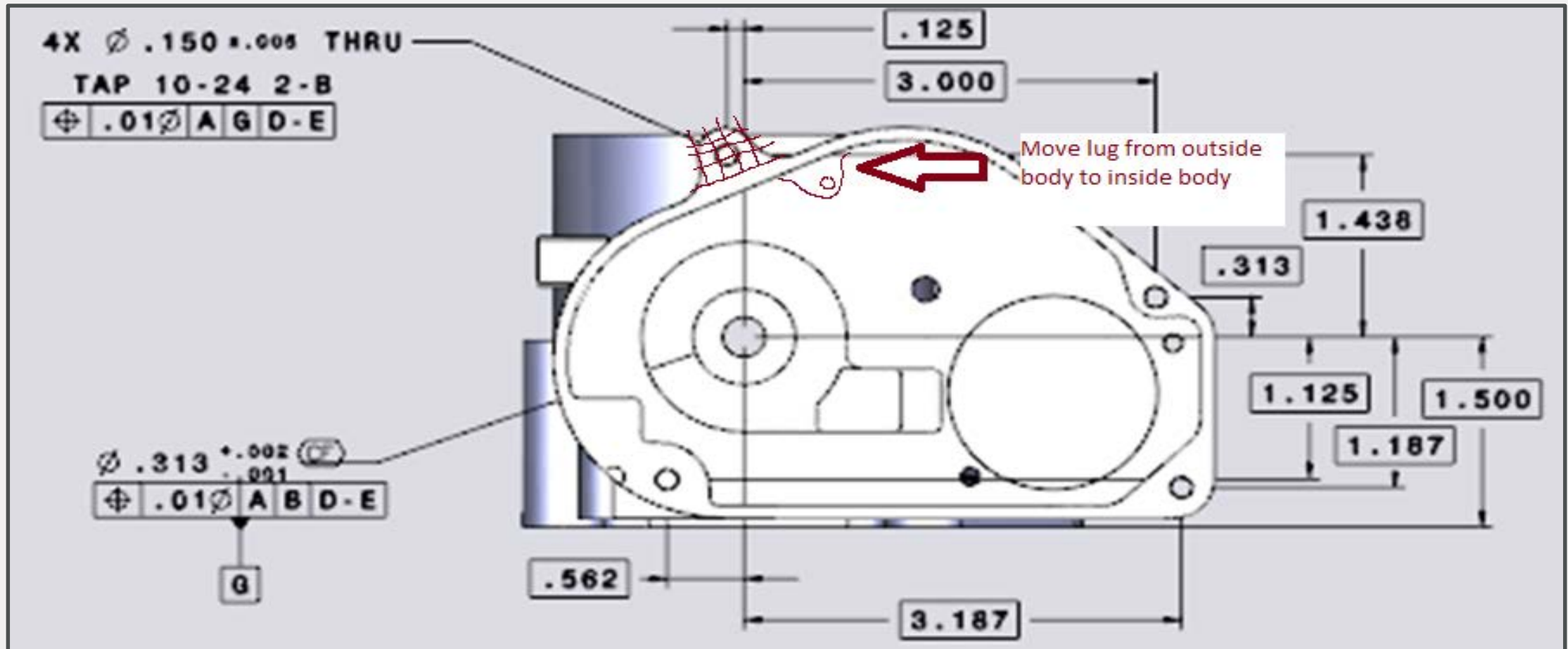
TYPICAL CHANGE PROCESS

How will the change effect the product

- Anyone can start the change process



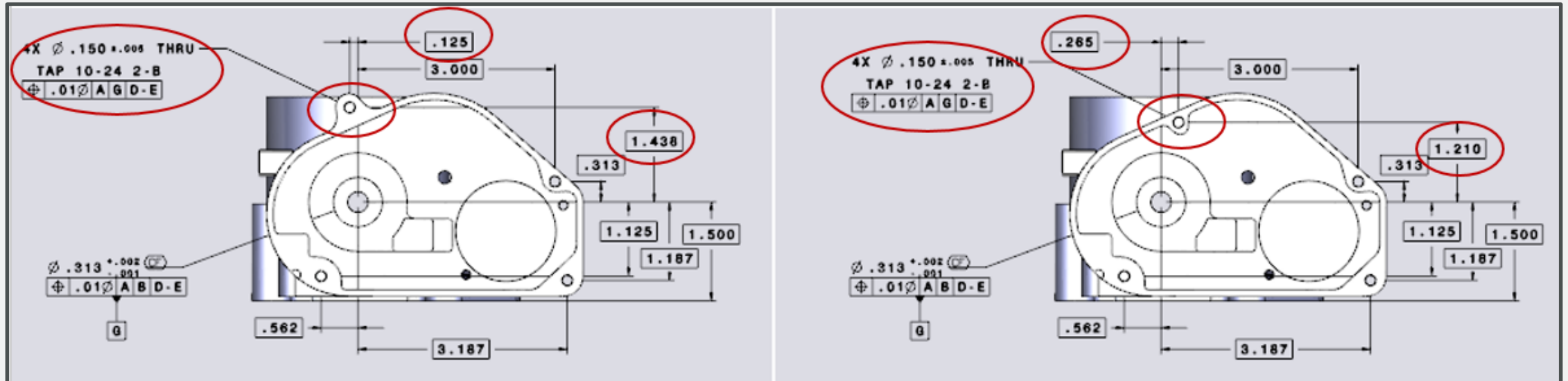
ENGINEERING CHANGE PROPOSAL





ENGINEERING CHANGE ORDER / NOTICE

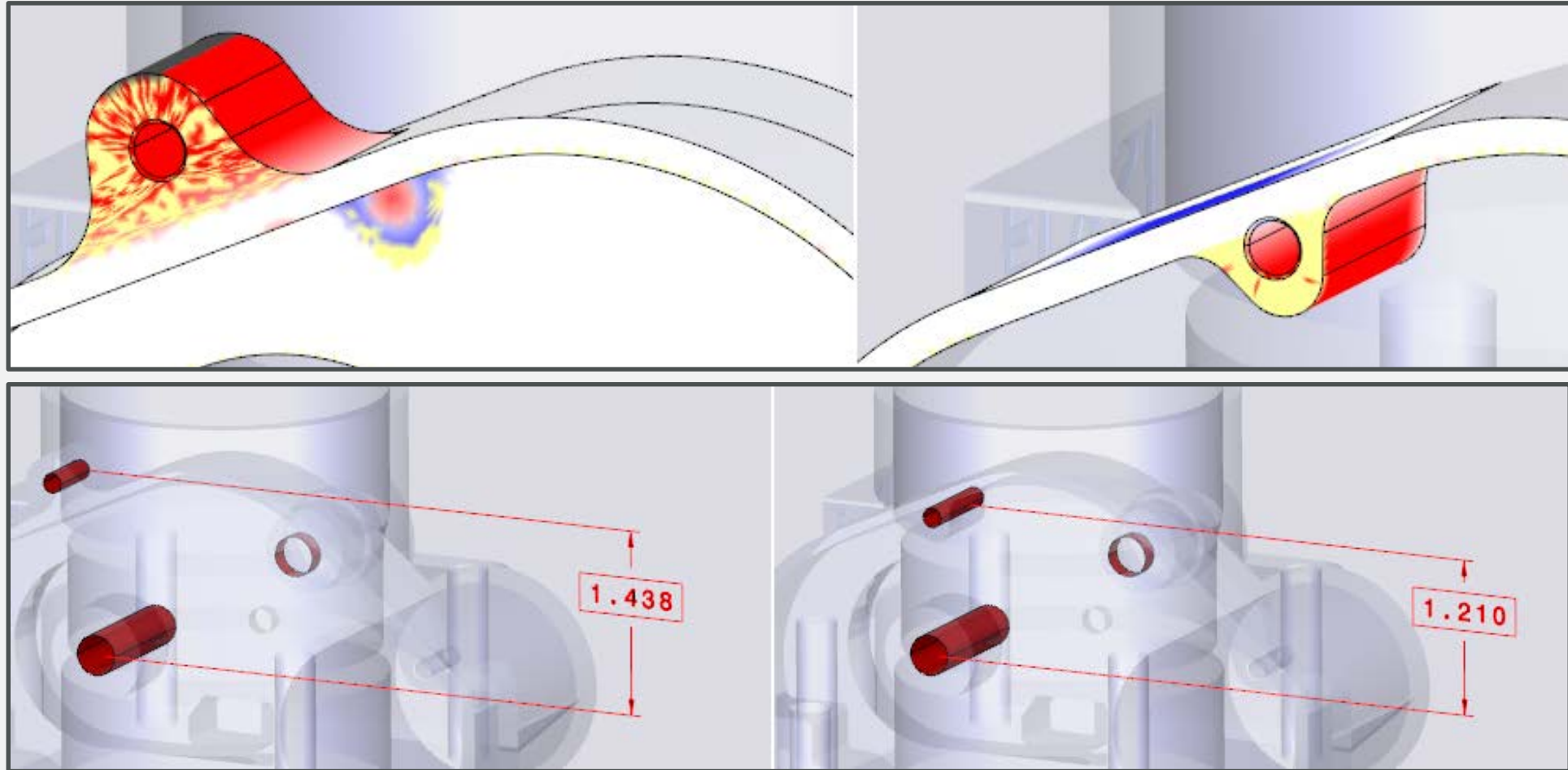
Engineering Change Notice			
Effectivity Date	Effectivity Serial NO.		ECN NO.
ORIGINAL Part Number/Name	REV NO.	PART Description	
NEW Part Number/Name	REV NO.	PART Description	





AUTOMATIC DETECTION & HIGHLIGHTING

Including Semantic Representation





DIFFERENCES REPORTING

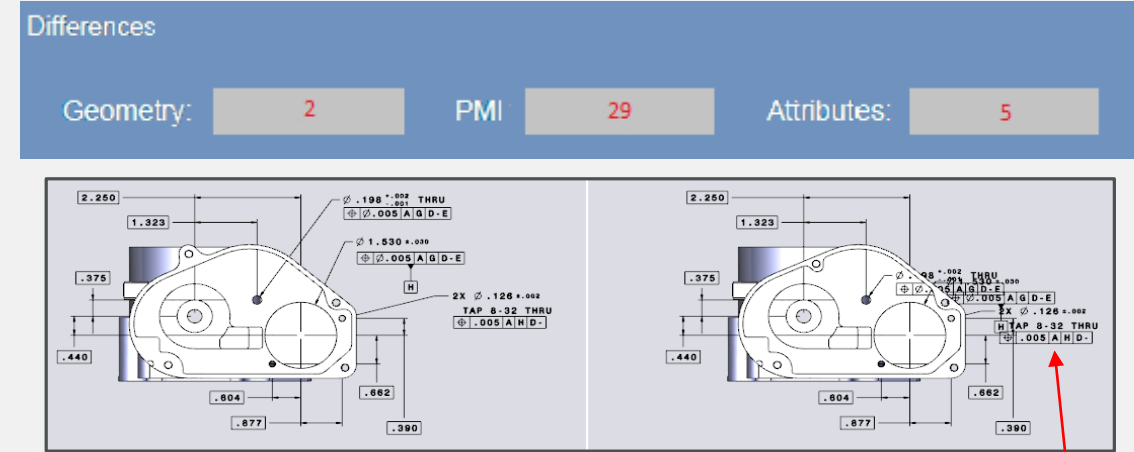
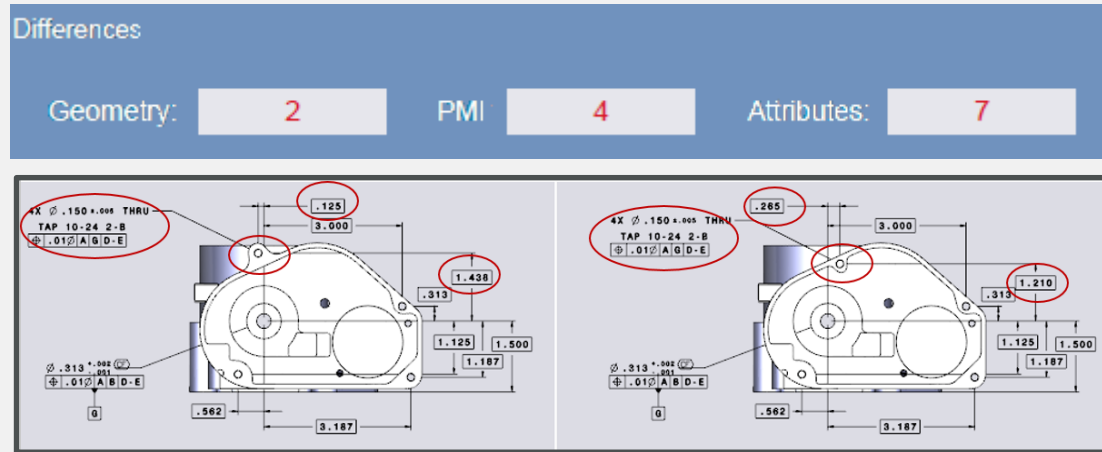
Including Attributes & Metadata



Name	<input type="checkbox"/>	V5R26-TBM-MBD-R00	V5R26-TBM-MBD-R01
Part number	<input type="checkbox"/>	V5R26-TBM-MBD-R00	V5R26-TBM-MBD-R01
Revision	<input type="checkbox"/>	00	01



UNINTENDED CHANGES



Sloppy design work caused the 3D annotations to move

Unintended changes will also be discovered while using V&V routines to check that the change was completed as defined. Strict modeling practices need to be followed in order to achieve a change report that only includes the changes that were defined as needed.



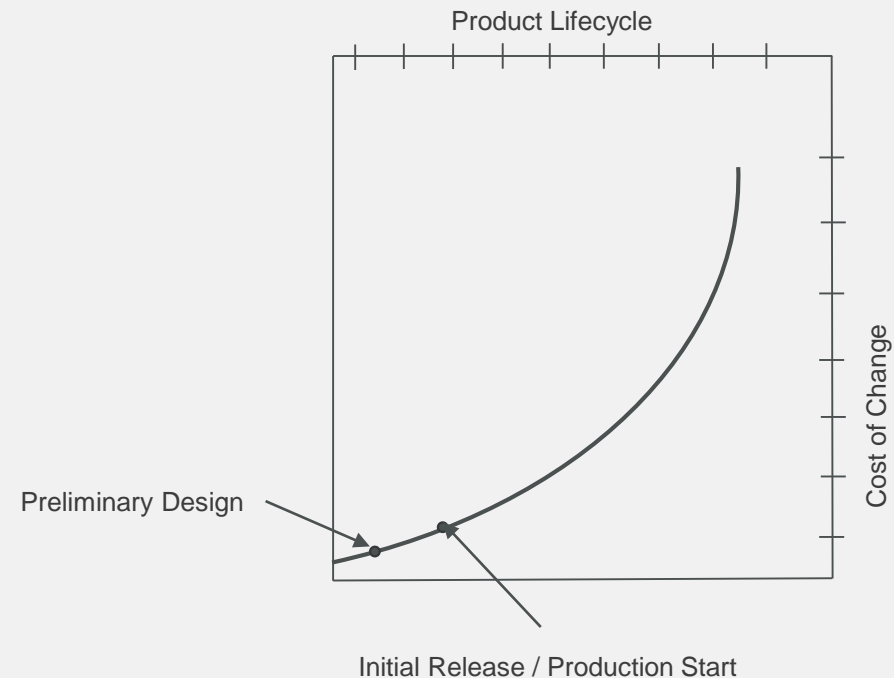
COST OF CHANGE

The cost of change is less expensive within the early Product Lifecycle, prior to Initial Release and Production Start.

After Production Start, incorporating changes can be extremely costly



Goal: *Improve cost and process control to prevent disaster.*





COST IMPACTORS (CONT'D)

- People
 - Scoper
 - Designer
 - Manufacturing Planner
 - CNC Programmer
 - Machinist
 - Weld/Fabricators
 - Quality
 - Purchasing
 - Packaging
 - Safety
 - Etc.
- Time
 - Hardware/Software
 - Tools
 - Materials
 - Schedules

Customers have shared that engineering changes can cost \$xx,xxx ~ \$x,xxx,xxx from scrap/re-work from poorly documented changes.



COST IMPACTORS

Manual vs. Automated

- **Time & accuracy** to *record* changes
 - Disconnect between drawings and models
 - Limited spacing for documentation
 - Ambiguous markings
 - Completion of recording
- **Time & accuracy** to *interpret* changes
 - Ambiguous markings
 - Incomplete detail
 - Unintended omissions of changes
 - Unintended additional impacted changes



BENEFITS TO AUTOMATED DETECTION & REPORTING

- Detections are automated
 - No omissions
- Unintended changes captured
- Interpretation is intuitive
 - 3D & math is Multi-cultural/lingual
- Quality of communication
 - Improved relationships:
 - Design-Manufacturing
 - OEM-Supplier
- Time-to-market improves
- Cost improves





QUESTIONS?

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