

XR: VR, AR, MR, and
Extended Realities

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MAY 14-16, 2019

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Engineering Application workshop



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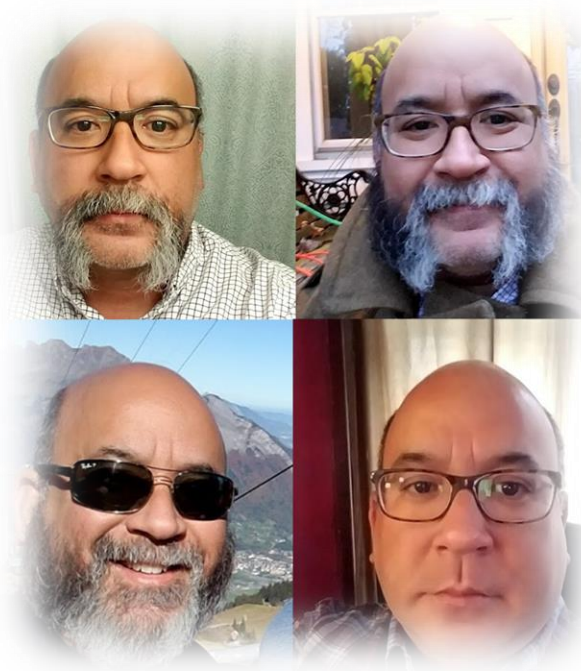


XR: VR, AR, MR, and Extended Realities

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Manufacturing Market Development and Strategist

ESI Group



Agenda

- Introduction
 - Definitions and Capabilities
 - Compare/Contrast
 - Consumer xR
 - Enterprise xR
- Product Lifecycles
 - * *Workshop Exercise: Where do we each fit?*
 - Product Development
 - Manufacturing Value Stream
 - Service and Maintenance
 - xR capabilities alignment
 - * Which xR technologies are relevant to me?
- Value to Manufacturing Enterprises
 - Job-to-be-done
 - Practical applications
 - * *Workshop Exercise: What's in it for me?*
 - What should we look into
- Summary and conclusions

Definitions

- Virtual Reality (VR) is an interactive computer-generated experience taking place **within a simulated environment**
 - First Person Simulations/Games
 - Driving and Flight Simulators
 - Immersive Stereoscopic Visualization
 - Head Mounted Displays



Virtual Reality?



Definitions

- Augmented reality (AR) is an interactive experience of a real-world environment where the **objects that reside in the real-world are "augmented"** by computer-generated perceptual information
 - Types
 - Annotative (labels, pop-ups, etc)
 - Spatial
 - Mode of delivery
 - Projected
 - Handheld
 - Wearable

Augmented Reality



Definitions

- Mixed reality (MR), or hybrid reality, is the merging of real and virtual worlds to produce new environments and visualizations where physical and digital objects co-exist and interact in real time

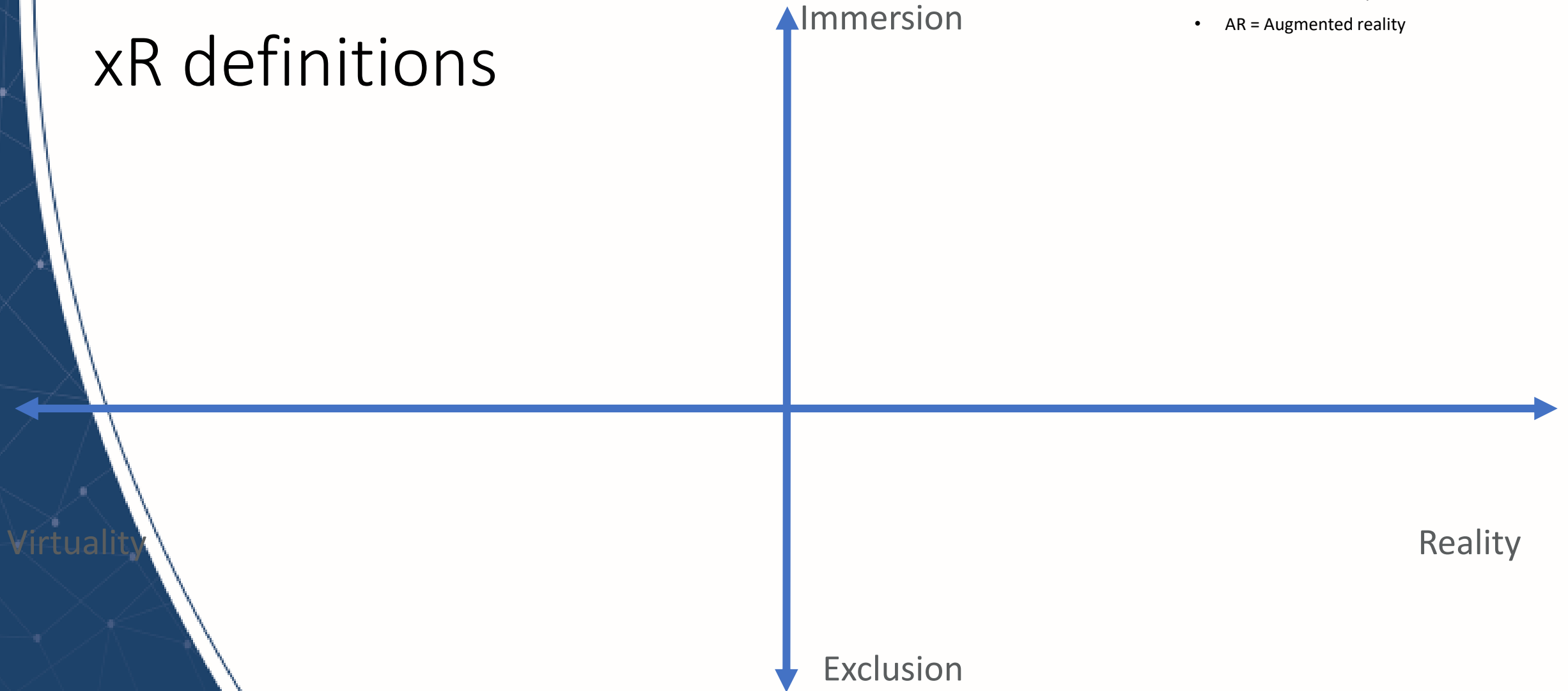
Mixed Reality



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xR definitions

- xR = Extended Reality
- VR = Virtual Reality
- MR = Mixed Reality
- AR = Augmented reality



Virtuality

Reality

Exclusion

Immersion

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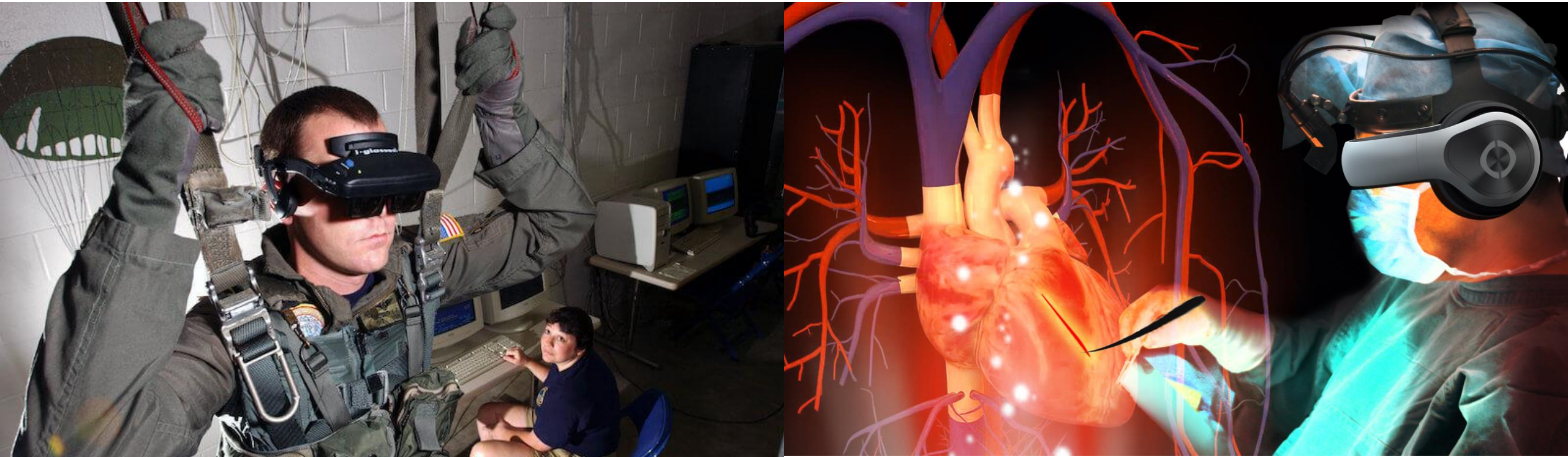
Consumer use and marketing

Let's agree that we are not talking about media, entertainment, or consumer uses



Training and Education

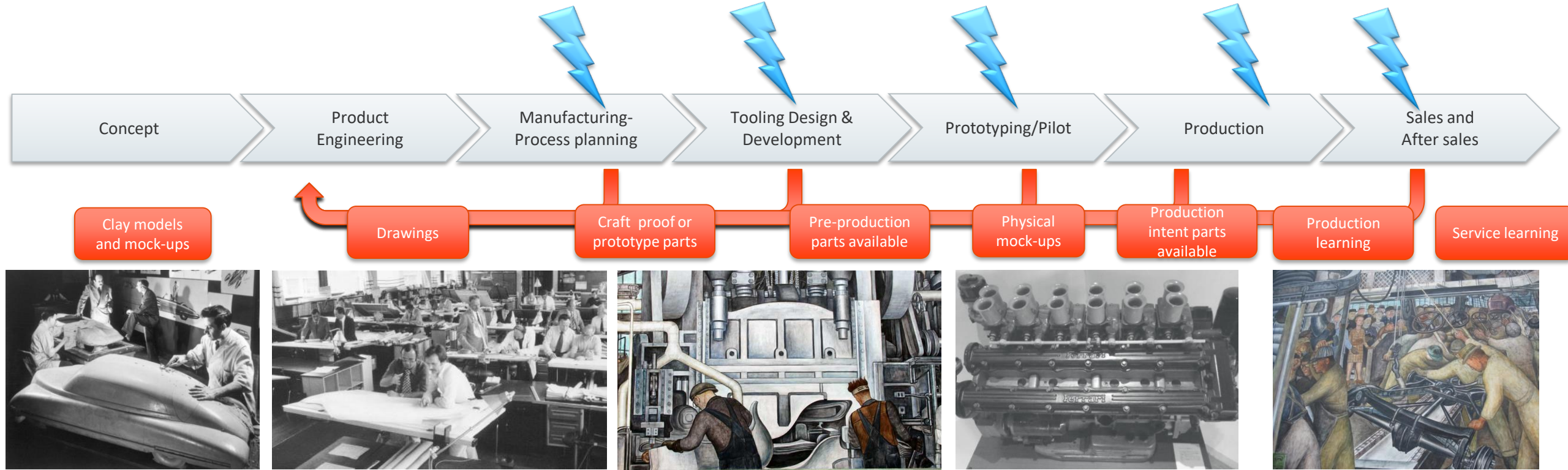
- Valid *downstream* use-cases
- Do not influence manufacturing or engineering decision, represent the outcome of engineering or planning activities



The “bad-old-days”

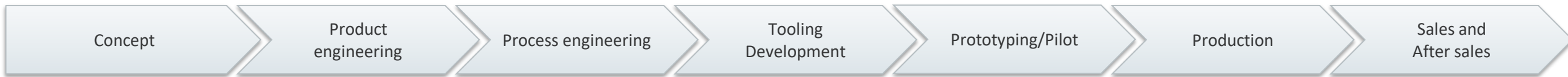
T – 72 months (or more)

SOP



Product Life Cycle

Exercise and Discussion: Where do you fit?



- Using the index card / sticky-notes
 - Indicate the start and end of your workflow
 - Using different card indicate the source of your input or supplier of you data/geometry/parts
 - Using a third card indicate your customer or outputs of your work

Product Life Cycle

Product still being designed
Processes pending

Concept

Product
engineering

Process engineering

Tooling
Development

Prototyping/Pilot

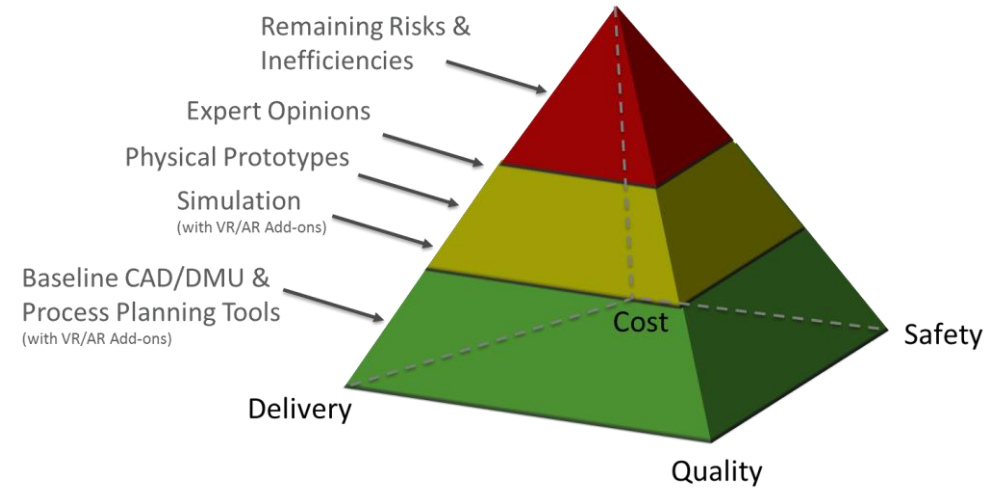
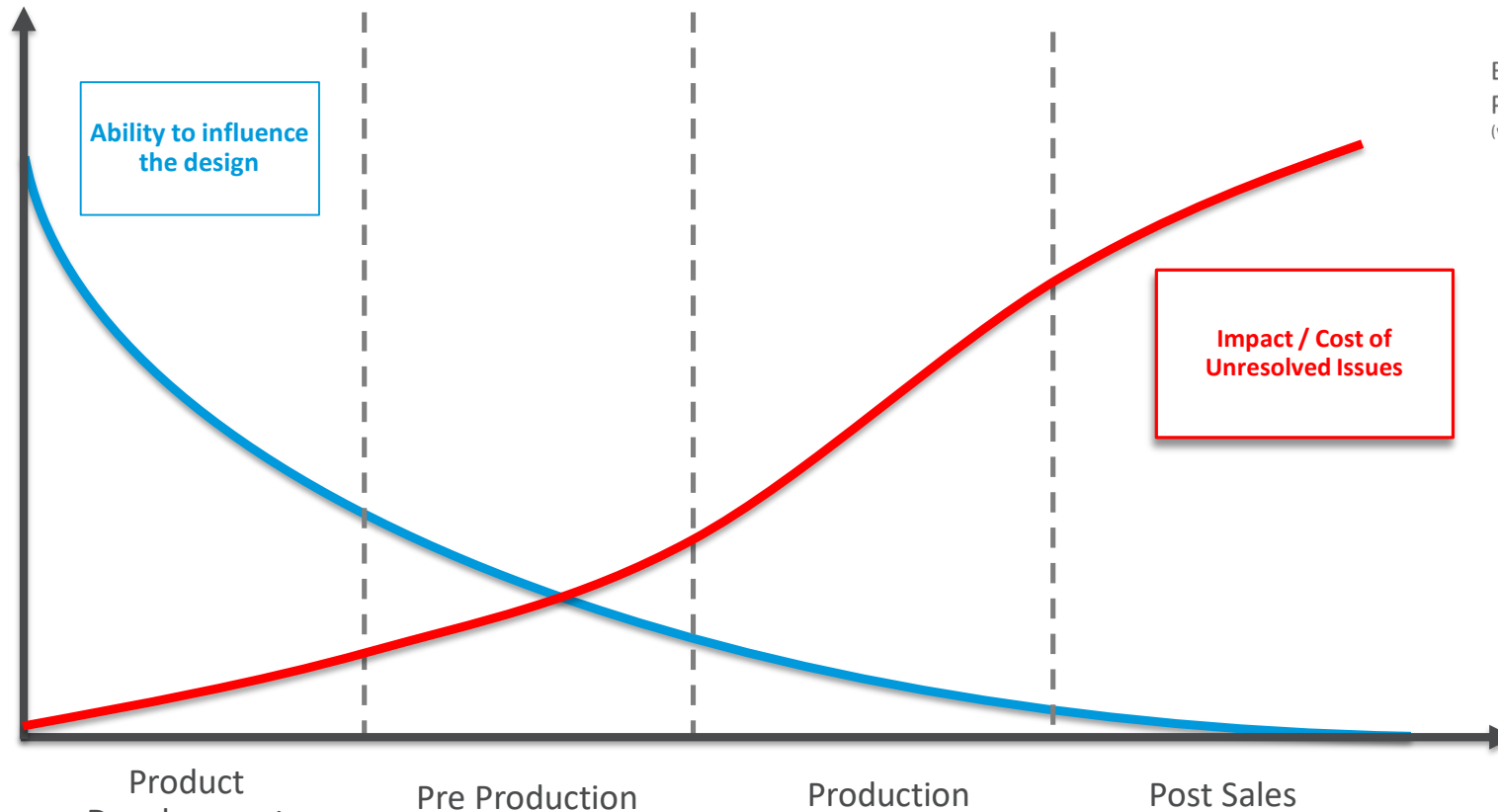
Production

Sales and
After sales

Product Design "Frozen"
Process Planning

Product Launched
Processes is fixed

The Challenge of Integration Engineering



Product Life Cycle

Concept

Product
engineering

Process engineering

Tooling
Development

Prototyping/Pilot

Production

Sales and
After sales

From Physical to Virtual Prototyping

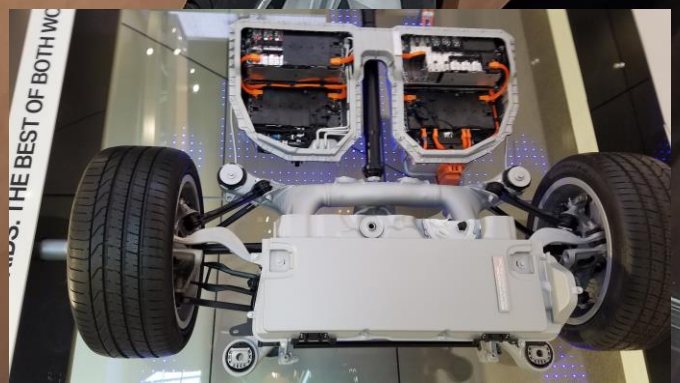
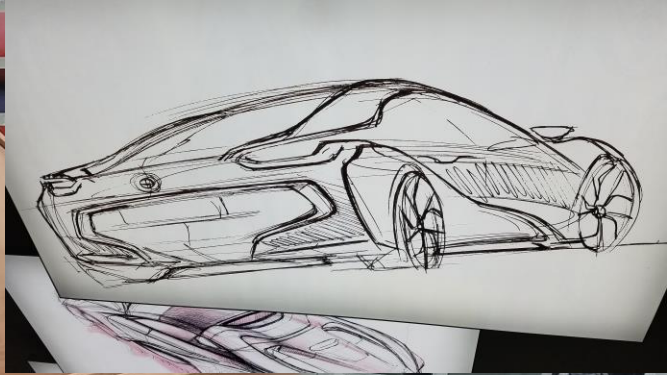


- Toyota Motor Corporation Global website
http://www.toyota-global.com/company/history_of_toyota

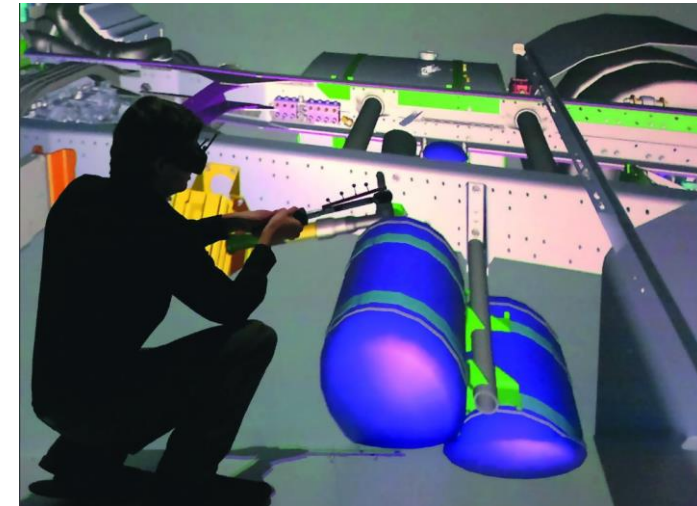
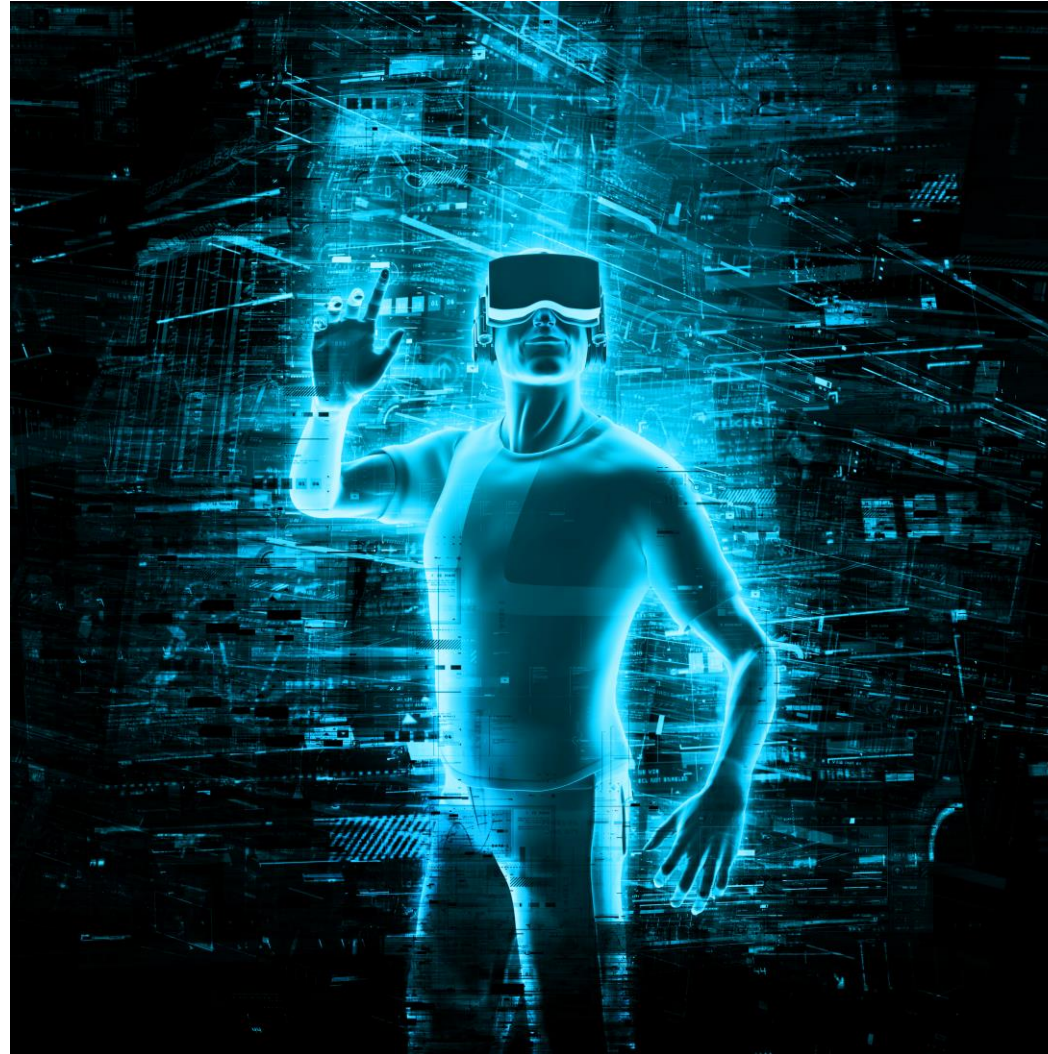


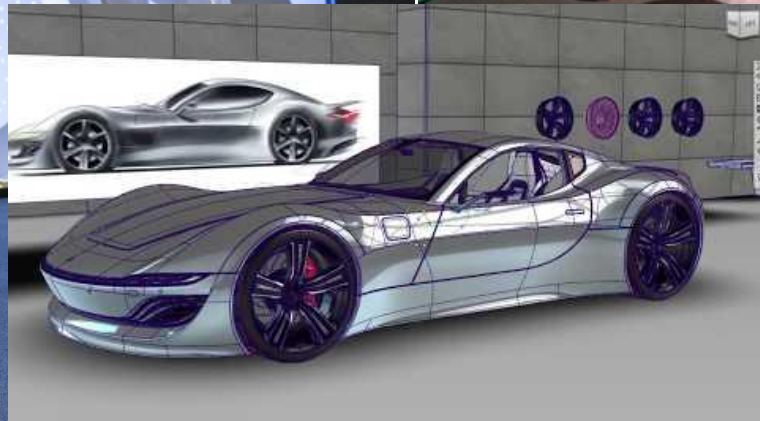
- Engineering.com
<http://www.engineering.com/ElectronicsDesign/ElectronicsDesignArticles/ArticleID/13292/ESI-Kicks-Out-Virtual-Reality-Software-ICIDO-102.aspx>

Physical Models for Design



Virtual Reality applied in Design and Engineering

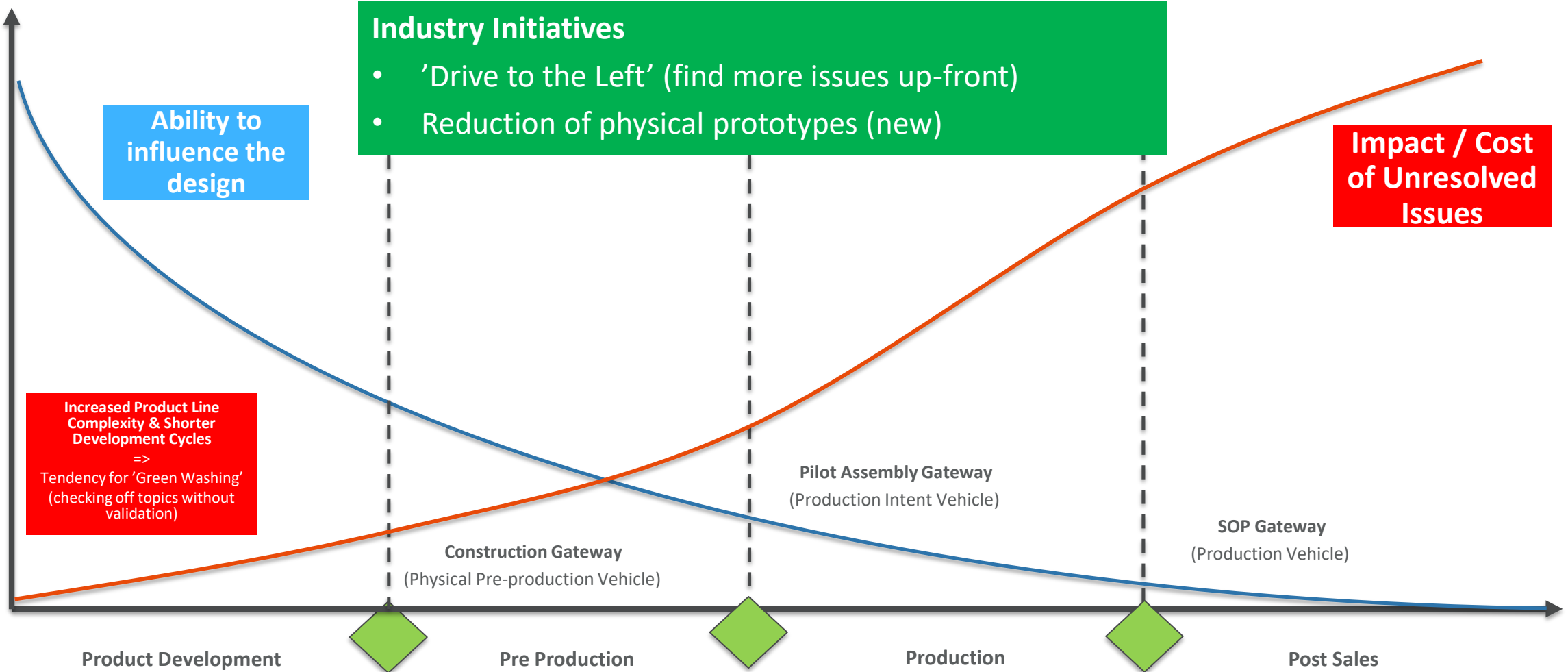




Integration: Operator Requirements Engineering



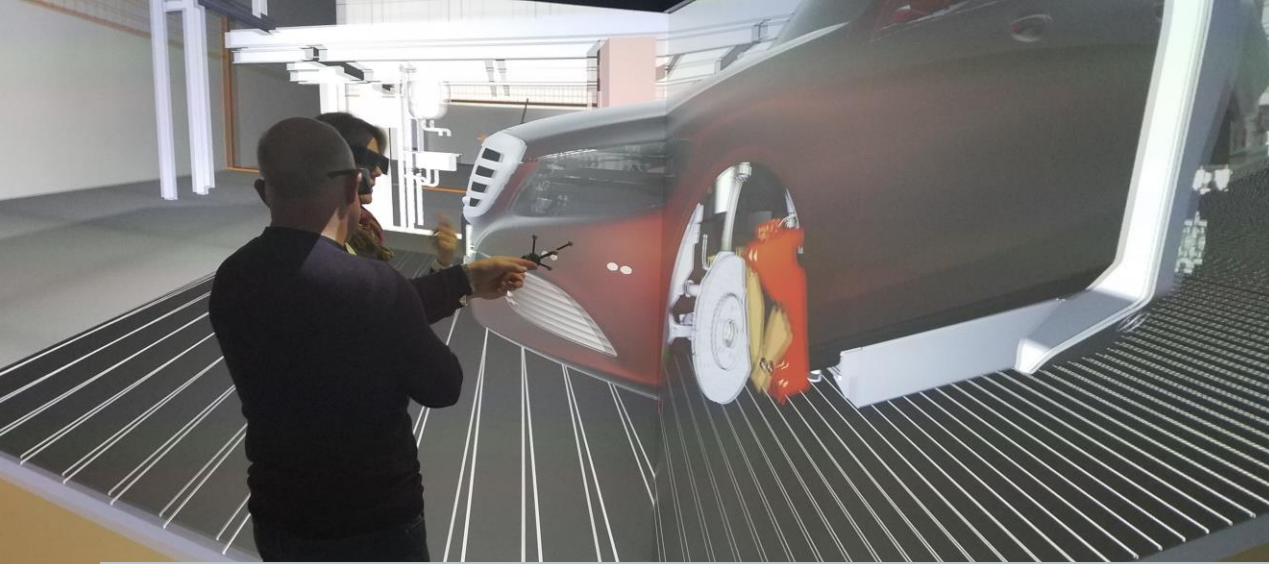
Practical Build Milestone Reviews





Using Virtual Prototypes – Delivery modes

- On screen reviews
- Projected VR
 - Powerwall
 - CAVE
- Handheld Devices
 - Tablets
 - Phones
- Head-mounted displays
 - Tethered
 - Stand-alone
 - Virtual Reality
 - “Mixed reality”
 - Augmented reality

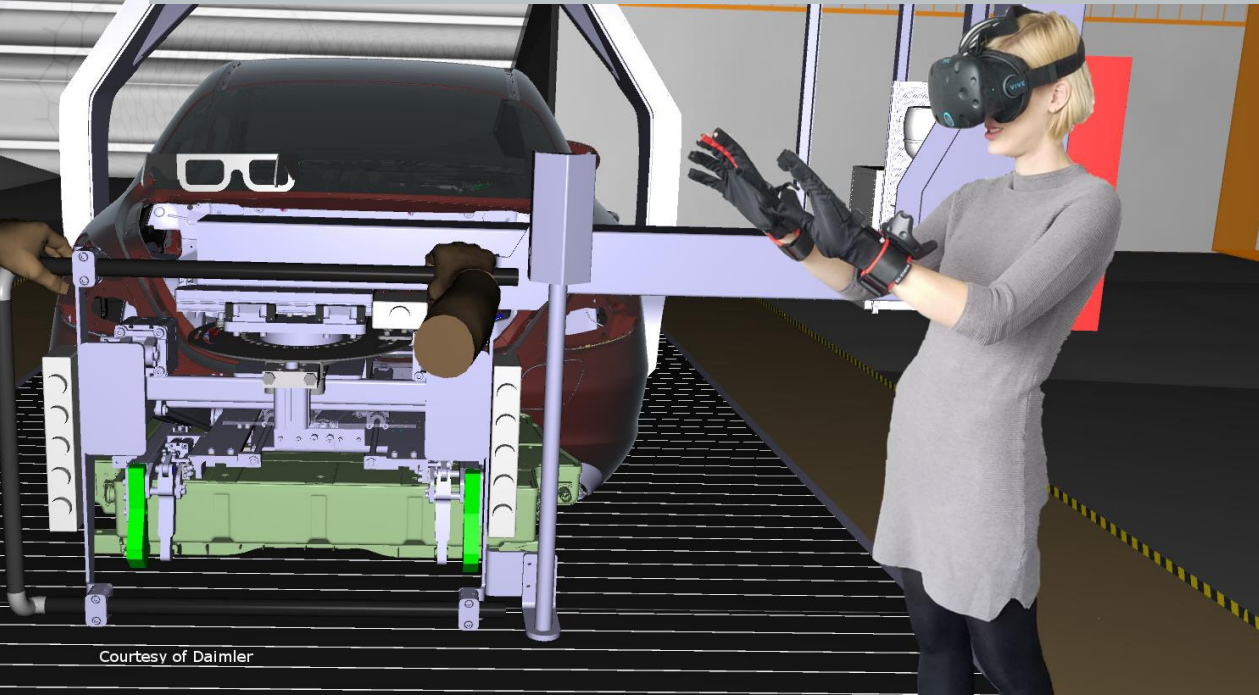


Wide Immersion or Projected Virtual Reality



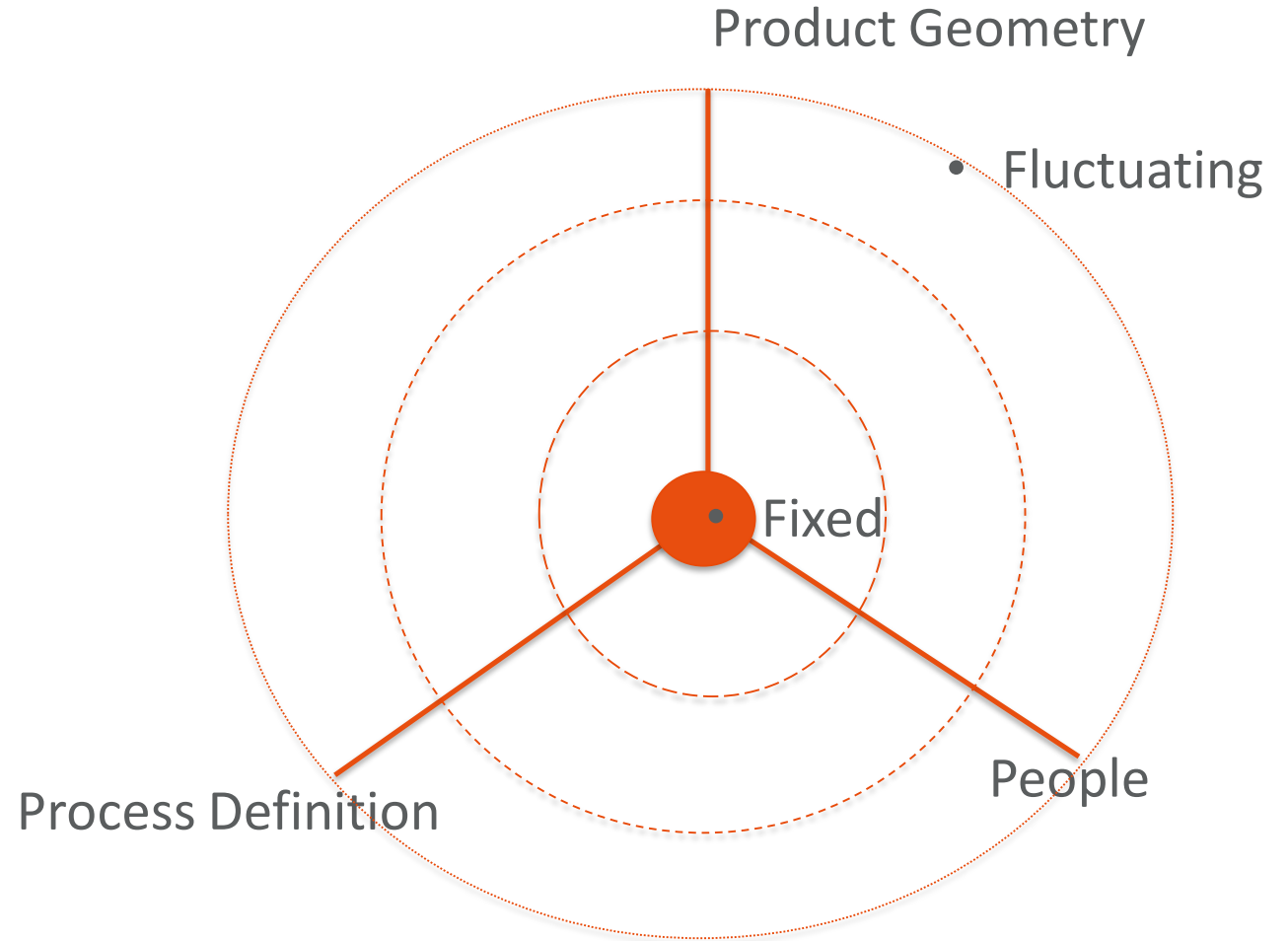


Head Mounted Displays



xR Solution Radar

- Consider where you are in the value stream from product concept to post-launch and whether the following aspects are fixed or in flux regarding decisions to be made
 - Product Design, Product Geometry
 - Process (operation, manufacturing, or service)
 - People (demographics, population)



Concept

Product engineering

Process engineering

Tooling Development

Prototyping/Pilot

Production

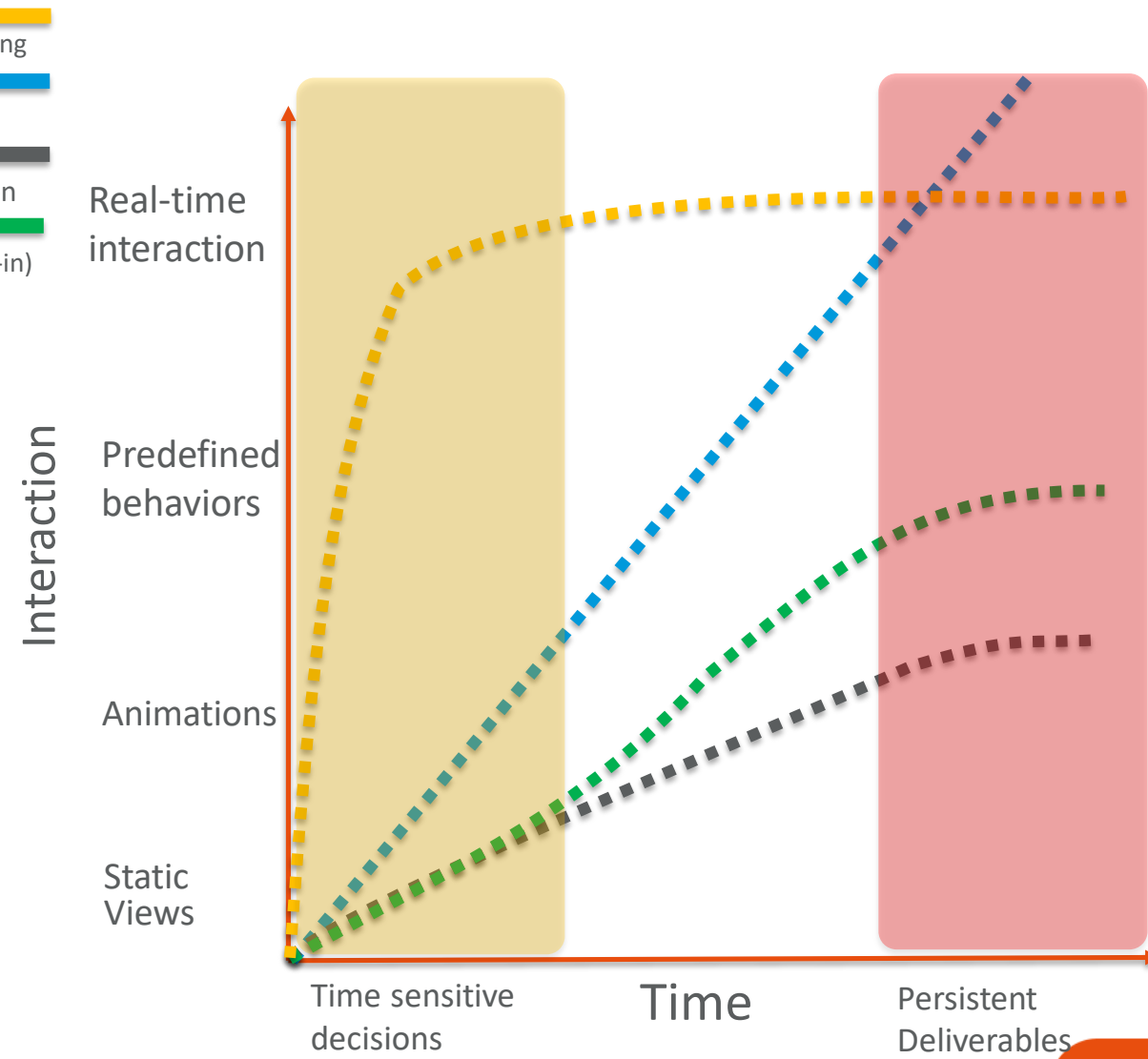
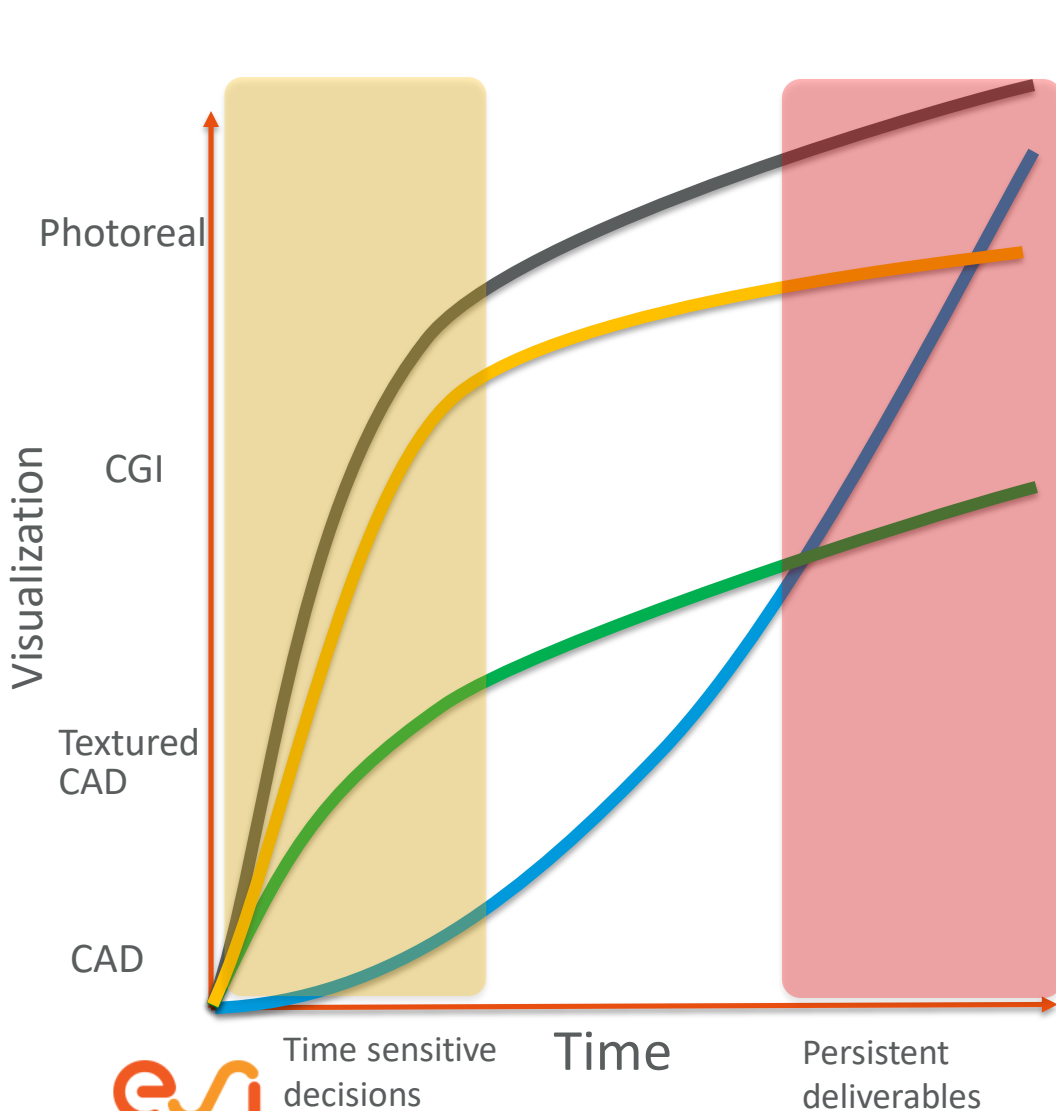
Sales and After sales



Virtual Reality – Geometry and Spatial Computing Solutions

- CAD/DMU Embedded Visualization
- CAD/DMU Plug-in or Accelerated Visualization
- Engineering Virtual Integration
- Stand-alone Professional Visualization
- Game-engine Developed Application

Time to immersive experience: Visual Fidelity & Interaction





Manufacturing Engineering and impact on Value Stream

Engineering



Manufacturing Engineering

Production Operations



In-Service



Profits

Key Production KPIs



Safety, Quality, Delivery, Cost

Product

Process-Resources

Design for Performance
Design for Manufacturing
Design for Assembly
Design for Service

Cost

Time

Time to Product Rol

Time & Cost to Start of Production (SoP)

Ramp-up Time & Cost to Volume & Handover

Operate
Maintain
Decommission

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Addressable Manufacturing Engineering and Service Planning

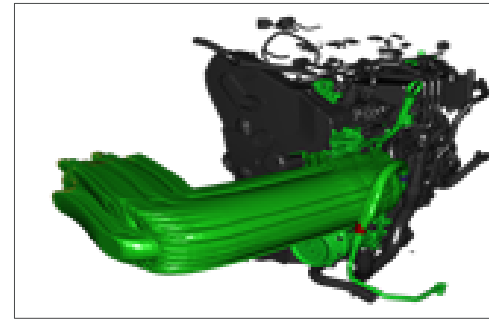
**Product
Packaging &
Clearances**



**Wiring & Cabling
Integration &
Clearances**



**Component
Installation &
Removal**



**Operator & Tooling
Clearances,
Reachability &
Visibility**



**Process
Validation &
Optimization**



**Tooling &
Equipment
Validation**



**Operator
Ergonomics &
Safety Validation**



**Workspace
Validation &
Optimization**



**Process
Familiarization &
Communication**

GPU TECHNOLOGY CONFERENCE

Presented by  NVIDIA.

SILICON VALLEY MAY 8-11, 2017

EXPLORE VIRTUAL AND AUGMENTED REALITY

VISUALIZE WHAT'S NEXT



xR Spectrum for Collaboration

Group On-site

Individual

Remote Multi-site

Part/Component

Environment

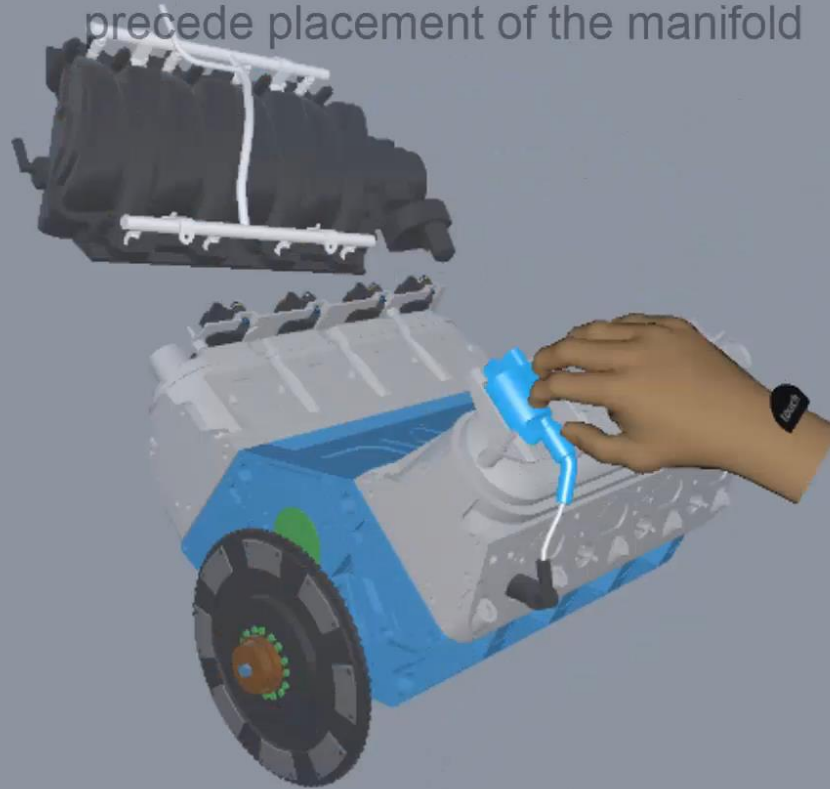




Launch and Post-launch

- Once all (most) of the decisions have been fixed for product design and manufacturing launch...

As a conclusion assembly process should reflect that installing the head cover should precede placement of the manifold

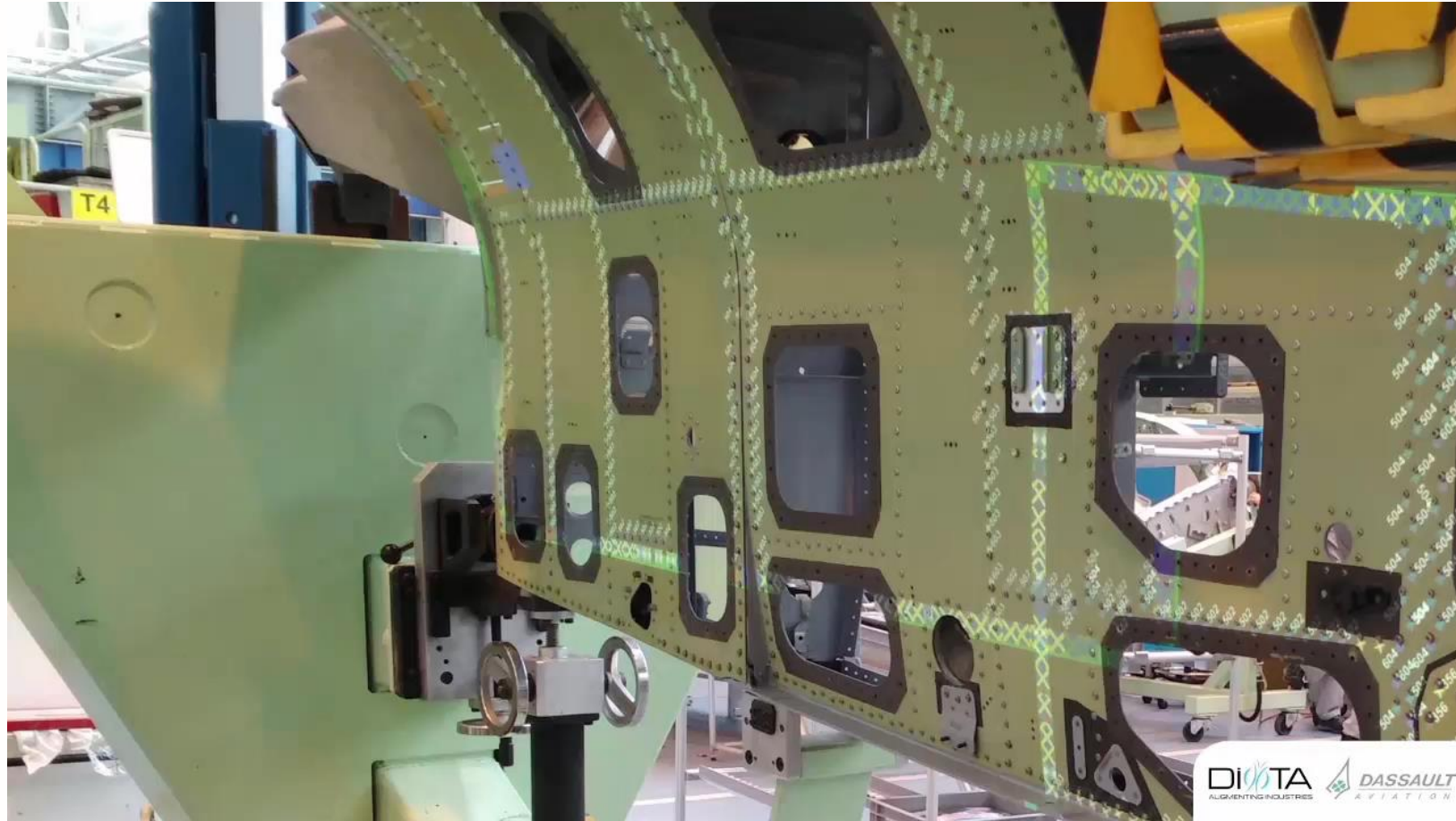


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Augmented reality

- Where is the material coming from?
- How is this different than printed manuals or PDF?
- How has the information been validated?
- Is access to the information consistently required?

Summary and Conclusions

- xR is valuable for the manufacturing enterprise, but all xR is not created equal
- xR technology should be implemented based on the availability/volatility of necessary information
- xR technology applies to a wide array of display and interaction formats that all aim to facilitate information transfer using digital data
- xR applied without considering the above will be technology for its own sake, consider what decisions or information transfer requires facilitation before narrowing down technology applications

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Thank You
For more information please visit:
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