NDIA

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2018 AUGMENTED REALITY WORKSHOP

October 3, 2018

The Waterford Reception Center

Springfield, VA

NDIA.org/ARWorkshop

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NDIA

WHO WE ARE

The National Defense Industrial Association is the trusted leader in defense and national security associations. As a 501(c)(3) corporate and individual membership association, NDIA engages thoughtful and innovative leaders to exchange ideas, information, and capabilities that lead to the development of the best policies, practices, products, and technologies to ensure the safety and security of our nation. NDIA's membership embodies the full spectrum of corporate, government, academic, and individual stakeholders who form a vigorous, responsive, and collaborative community in support of defense and national security. For more information, visit **NDIA.org**

CYBER-AUGMENTED OPERATIONS DIVISION

WHO WE ARE

The Cyber-Augmented Operations Division focuses on harnessing the power of cyber-related technologies (such as high-speed processing, agile spectrum electronics and information algorithms) to deliver speed and automation to create both tactical and operational advantages in military operations. CAO technologies will expand as innovators reveal the potential for cyberspace beyond support for intelligence and traditional military operations.

LEADERSHIP AND COMMITTEES

Lt Gen Robert Elder, USAF (Ret)
Division Chair

Maj Gen David Senty, USAF (Ret)
Vice Chair

Maj Gen Jim H. Keffer, USAF (Ret)
Advisor

Brig Gen Guy M. Walsh, USAF (Ret)
Advisor

Scott Goldstein, PhD
Advisor

Jeff Moulton
Advisor

EVENT INFORMATION

LOCATION

The Waterford Reception Center
6715 Commerce Street
Springfield, VA 22150

EVENT WEBSITE

NDIA.org/ARWorkshop

WIFI

Network: H20Guest
Password: waterfordguest

ATTIRE

Civilian: Business
Military: Uniform of the day

SURVEY AND PARTICIPANT LIST

You'll receive via email a survey and list of attendees (name and organization) after the conference. Please complete the survey, which helps make our event even more successful in the future.

EVENT CONTACT

General Event
Reneé Despot
Meeting Manager
(703) 247-2599
rdespot@ndia.org

Agenda
Daniel Lung
Program Coordinator, Program Development
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dlung@ndia.org

PLANNING COMMITTEE

Lauren Hamburg-Marble
Augmented Reality Business Development Lead, Newport News Shipbuilding (NNS)

Gregory Domer
Staff Engineer, Augmented Reality Consortium Lead, Honeywell FM&T

Jason Ingalls
Founder & CEO, Ingalls Information Security

SPEAKER GIFTS

In lieu of speaker gifts, a donation is being made to the Fisher House Foundation.

HARASSMENT STATEMENT

NDIA is committed to providing a professional environment free from physical, psychological and verbal harassment. NDIA will not tolerate harassment of any kind, including but not limited to harassment based on ethnicity, religion, disability, physical appearance, gender, or sexual orientation. This policy applies to all participants and attendees at NDIA conferences, meetings and events. Harassment includes offensive gestures and verbal comments, deliberate intimidation, stalking, following, inappropriate photography and recording, sustained disruption of talks or other events, inappropriate physical contact, and unwelcome attention. Participants requested to cease harassing behavior are expected to comply immediately, and failure will serve as grounds for revoking access to the NDIA event.

AGENDA

WEDNESDAY, OCTOBER 3

7:00 am – 4:30 pm — **REGISTRATION**
FOYER

7:00 – 8:00 am — **NETWORKING CONTINENTAL BREAKFAST**
MILLER BALLROOM

8:00 – 8:15 am — **WELCOME REMARKS**
SINGLETON BALLROOM

Dr. Heather Havens
Vice President, Program Development, NDIA

8:15 – 8:30 am — **GUEST SPEAKERS**
SINGLETON BALLROOM

Lauren Hamburg-Marble
Augmented Reality Business Development Lead, Newport News Shipbuilding (NNS)

Gregory Domer
Staff Engineer, Augmented Reality Consortium Lead, Honeywell FM&T

8:30 – 9:30 am — **PRODUCT DEMONSTRATION LIGHTNING ROUNDS**
SINGLETON BALLROOM

9:30 – 10:30 am — **IDENTIFYING OPPORTUNITIES FOR AR SOLUTIONS PANEL**
SINGLETON BALLROOM

Lauren Hamburg-Marble
Moderator

Augmented Reality Tool for Air Force Air Mobility Command (AMC) Aircraft Maintainers
Mike Smith
Senior Technical Specialist, ICF

Augmented Reality for Mission Planning and Rehearsal
Heather Roy
Research Psychologist, Human Research Engineering Directorate, ARL

Remote Collaboration with Mixed Reality
Raven Zachary
Founding Partner, Object Theory

Army RDECOM Chemical Biological Center, Practical Application of Augmented Reality
Don Lail, Jr.
Multimedia Specialist, Chemical-Biological Center, RDECOM

10:30 – 11:30 am — **PRODUCT DEMONSTRATIONS AND NETWORKING BREAK**
GIBSON BALLROOM

11:30 am – 12:30 pm — **DESIGN CONSIDERATIONS FOR AR PANEL**
SINGLETON BALLROOM

Gregory Domer
Moderator

Registration Considerations and Approaches for Augmented Reality
William Wright
Director, Integrated Systems, General Dynamics Applied Physical Sciences

Design and Development Considerations for Architecting and Scoping Mixed Reality Experiences and Solutions
Jason Renfroe
Creative Director, Microsoft

How to Select the Correct AR Device for the Solution
Jeffrey Fisher
Virtual Reality Lab Manager, National Institute for Aviation Research, Wichita State University

Reconciling the Science and Practice of Extended Reality Training
Janet Spruill
Vice President of Programs, Aptima, Inc.

12:30 – 1:30 pm — **LUNCH**
MILLER BALLROOM

1:30 – 2:30 pm — **PROJECT MANAGEMENT METHODS PANEL**
SINGLETON BALLROOM

Lauren Hamburg-Marble
Moderator

Improving Workforce Development Using Augmented Reality: An Agile Project Management Perspective
Mia Joe
Senior Project Manager, Educational Technology, Huntington Ingalls Industries, Newport News Shipbuilding

Where Do We Start? Key Considerations for Augmented Reality Applications in a Sensitive Environment
Shelley Peterson
Principal Investigator – AR/MR, Lockheed Martin

Standard Process for Augmented Reality Assisted Assembly
Paul Runyan
Electrical Engineer, Process Automation Group, Honeywell FM&T

2:30 – 3:30 pm

USER TESTING, ACCEPTANCE AND FEEDBACK PANEL

SINGLETON BALLROOM

Gregory Domer
Moderator

Augmented Reality Assisted Assembly: A Usability Study
Eric Cornwell
Electrical Engineer, Kansas City National Security Council

Augmented Reality for Energy Resilience
Brigitte Taylor
Senior Consultant, Booz Allen Hamilton

Joint and Coalition Warfighter Experiences in Augmented Reality
Kevin Seavey
Military Analyst, Joint Staff J6's Bold Quest Event

Practical AR Design Considerations
Richard Congdon
Solutions Architect, SAIC

3:30 – 4:30 pm

INFORMATION ASSURANCE AND CYBERSECURITY CHALLENGES FOR AR PANEL

SINGLETON BALLROOM

Jason Ingalls
Moderator

DoD Authorization Process for Augmented Reality
Brandi Pickett
Risk Management Consultant, Ingalls Information Security, LLC

Augmented Reality Design Considerations for Secure Environments
Joshua Burns
Simulations Engineer and Deputy Augmented Reality Consortium Lead, Honeywell FM&T

Augmented Reality Tools for Nuclear Facilities
Dr. David Mascarenas
Research Engineer, Los Alamos National Laboratory (LANL)

4:30 – 6:00 pm

PRODUCT DEMONSTRATIONS AND NETWORKING RECEPTION

GIBSON BALLROOM

The NDIA has a policy of strict compliance with federal and state antitrust laws. The antitrust laws prohibit competitors from engaging in actions that could result in an unreasonable restraint of trade. Consequently, NDIA members must avoid discussing certain topics when they are together at formal association membership, board, committee, and other meetings and in informal contacts with other industry members: prices, fees, rates, profit margins, or other terms or conditions of sale (including allowances, credit terms, and warranties); allocation of markets or customers or division of territories; or refusals to deal with or boycotts of suppliers, customers or other third parties, or topics that may lead participants not to deal with a particular supplier, customer or third party.

DEMONSTRATIONS

FULL ABSTRACT CITATIONS

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Spacemark, Augmented Reality Mobile App, Relevant to Two Areas of Focus: Emergency Management/Disaster Relief and Covert Communications

Burns, J.
Augmented Reality Design Considerations for Secure Environments

Burwell, J.
Development of an Augmented Reality Visual System for Air Crew Training

Caraway, E. • **Marina, J.**
LMI's Augmented Reality Solutions for Spatial Planning and Training

Congdon, R.
Practical AR Design Considerations

Cornwell, E.
Augmented Reality Assisted Assembly: A Usability Study

Fisher, J.
How to Select the Correct AR Device for the Solution

Hale, K. • **Johnston, M.**
AUGMENTOR, Using AR to Replicate Experts and Share Knowledge Across the Enterprise

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Improving Workforce Development Using Augmented Reality; An Agile Project Management Perspective

Lail, D.W.
Practical Application of Augmented Reality

Mascarenas, D.
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Peterson, S.
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Manifest - Bringing Mixed Reality to the Warfighter

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DoD Authorization Process for Augmented Reality

Renfroe, J. • **Cooper, P.** • **O'Brien, J.** • **Silverman, D.**
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Augmented Reality for Energy Resilience

Toppel, S. • **Martin, J.** • **Brooke, M.**
Improving Unit Readiness with High Fidelity Augmented Reality for Reduced Maintenance Errors and Time on Task

Wade, S. • **Baker, B.**
Augmented Reality Experiences and Smart-Connected Learning Environment

Wright, W.
Registration Considerations and Approaches for Augmented Reality

Wright, W. • **Heath, D.**
Markerless Augmented Reality for Inspection and Repair Operations

Zachary, R.
Remote Collaboration with Mixed Reality

PRODUCT DEMONSTRATION HOURS

NETWORKING BREAK
10:30 – 11:30 am

NETWORKING RECEPTION
4:30 – 6:00 pm

PRODUCT DEMONSTRATION DESCRIPTIONS

AVATAR PARTNERS, INC. TABLE 7

Improving Unit Readiness with High Fidelity Augmented Reality for Reduced Maintenance Errors and Time on Task

Presented by: CDR Scott Toppel

Product Description: The Augmented Reality Maintenance Aid (ARMA) demonstration uses a Hololens with Vuforia-enabled object tracking technology to walk a user through a wire trace, troubleshooting, and repair maintenance task.

BOHEMIA INTERACTIVE SIMULATIONS TABLE 2

Development of an Augmented Reality Visual System for Air Crew Training

Presented by: John Burwell

Product Description: The demo will feature videos of the Augmented Reality Visual System that will support pilot training.

BOOZ ALLEN HAMILTON TABLE 6

Manifest – Bringing Mixed Reality to the Warfighter

Presented by: Robert Piazza

Product Description: Users will build circuitry wearing Hololens using the Manifest application. Users will interact with video tutorials, step by step instructions, and augmented reality overlays, showing relevant circuit locations to complete this 3-5-minute task.

DESIGN INTERACTIVE, INC. TABLE 4

AUGMENTOR, Using AR to Replicate Experts and Share Knowledge Across the Enterprise

Presented by: Kelly Hale and Andres Lombana

Product Description: AUGMENTOR: Tool which affords creation of AR maintenance troubleshooting procedures for knowledge sharing. Attendees will see how easy it is to create videos, take pictures, and insert holograms for use in operational procedures and training modules.

GENERAL DYNAMICS APPLIED PHYSICAL SCIENCES TABLE 9

Markerless Augmented Reality for Inspection and Repair Operations

Presented by: David Heath

Product Description: This demonstration will describe how a simple tablet-based augmented reality application is helping Bath Iron Works decrease the costs associated with inspection and repair of shipboard equipment.

LOGISTICS MANAGEMENT INSTITUTE TABLE 5

LMI's Augmented Reality Solutions for Spatial Planning and Training

Presented by: Ethan Caraway

Product Description: LMI will demo the ARCP and ARCT applications on HoloLens to show how AR can provide cost effective ways to plan and train. Attendees will be able to experience demos through the headset and LMI will stream the experience to a display for a wider audience.

NEWPORT NEWS SHIPBUILDING TABLE 3

Improving Workforce Development Using Augmented Reality; An Agile Project Management Perspective

Presented by: Mia Joe and Aris Vincent Picardo

Product Description: The demonstration will provide a hands-on opportunity to experience three AR applications developed for the shipbuilding industry:

- Electrical Trainer AR application
- Absence of Voltage AR application
- JLG Boom Operator AR application

OBJECT THEORY TABLE 10

Remote Collaboration with Mixed Reality

Presented by: Raven Zachary

Product Description: Prism by Object Theory is a mixed reality application that allows collaboration in real time from remote locations. It includes support for customized avatars, display of 3D models at table top and true scale sizes, spatial audio chat, and annotations.

PTC TABLE 8

Augmented Reality Experiences and Smart-Connected Learning Environment

Presented by: John Parsons and David Segal

Product Description: The demonstration will showcase PTC Industrial Augmented Reality and Internet of Things solutions and best practices adopted in Aerospace and Defense industry.

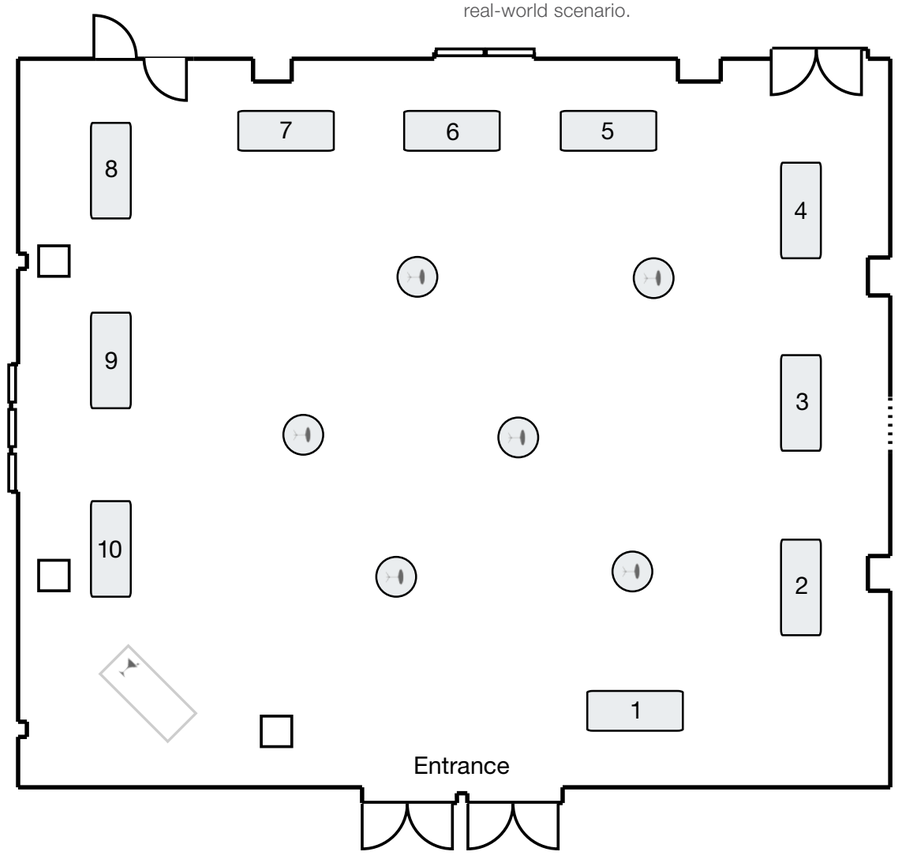
- Cirrus Jet AR preflight check and maintenance analysis
- F-16 AR Experience

SPACEMARK LABS, INC. TABLE 1

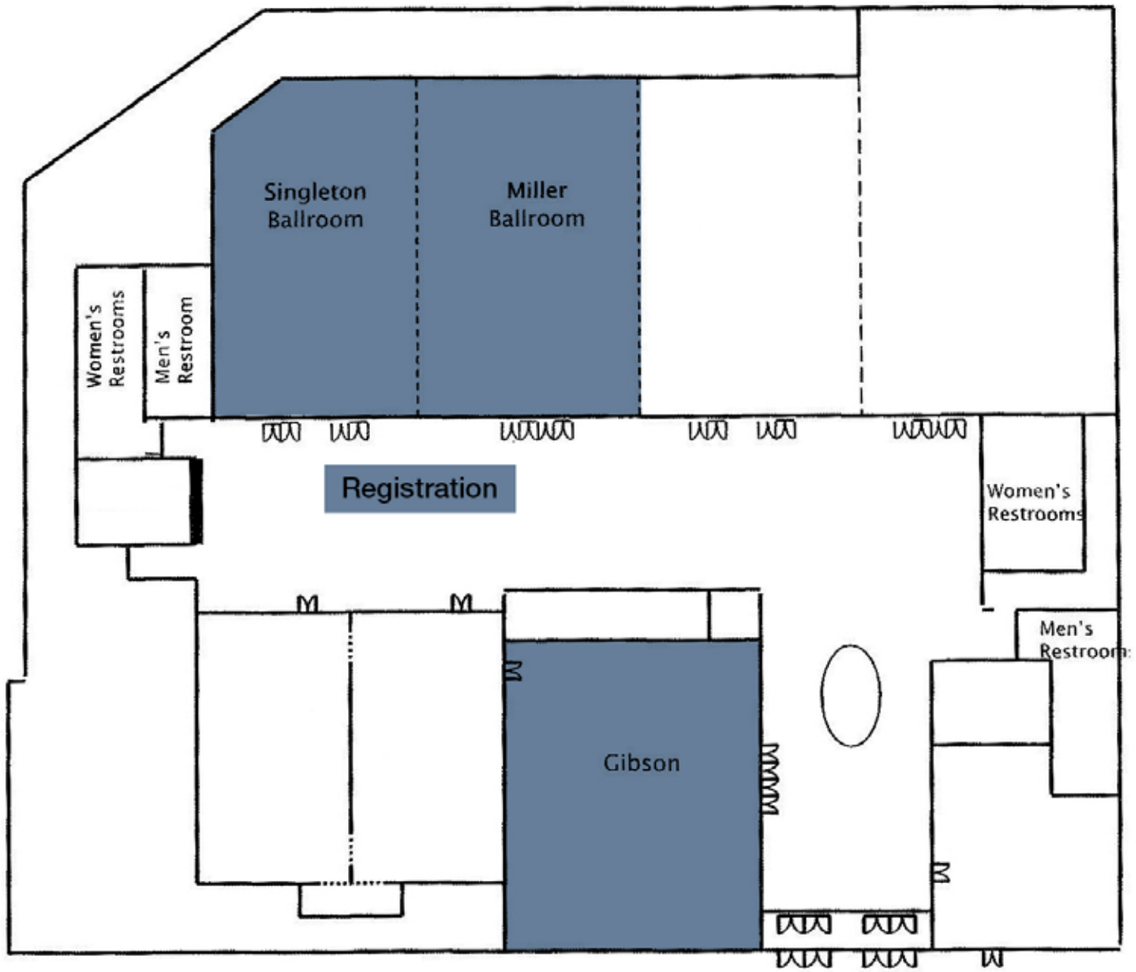
Spacemark, Augmented Reality Mobile App Relevant to Two Areas of Focus: Emergency Management/Disaster Relief and Covert Communications

Presented by: Juliette Blythe

Product Description: Utilizing 2 smart devices and 1 laptop, the audience will participate in the process of creating and viewing 'Marks' at both an individual and command level, as well as communication between the devices, simulating a real-world scenario.



VENUE MAP



NOTES

REGISTER TODAY

2018 CYBER-AUGMENTED OPERATIONS DIVISION FALL CONFERENCE

Learn about the most significant technological trends that affect military operations at the NDIA Cyber-Augmented Operations Division Fall Conference, November 1, at the MITRE Corporation. Session topics will cover key issues such as Contested Space Comm and PNT Alternatives, Agile Spectrum Ops/Electronic Warfare, Training for Operations in Contested Cyber Environments, and more.

This event will be held at the **SECRET//NOFORN** level.

November 1, 2018

The MITRE Corporation

McLean, VA

NDIA.org/CAO18

Spacemark™ Labs

Spacemark™

THE WORLD IS YOUR CANVAS

Spacemark™ Labs™

- Woman Owned Small Business
- Emergency Management / Disaster Relief Sectors
  - FEMA
  - State & Local
  - Army Corps of Engineers

Spacemark™ Labs™

- Stream-lined
  - Camera
  - GPS / Map
  - Texting

- Communication Bridge
  - Users in the Field (Smart Devices)
  - Command

Web EOC

- WebEOC is a web-based crisis management system designed for supporting the ICS method of response management for significant incidents, in addition to providing a unique toolset for supporting Daily Operations in the Regional Response Centers and the HQ Emergency Operations Center.
- **WebEOC** promotes situational awareness for crisis management and public safety officials.

Practical Design Considerations for AR

User Testing, Acceptance & Feedback

Presented by: R. Gardner Congdon

3 October 2018

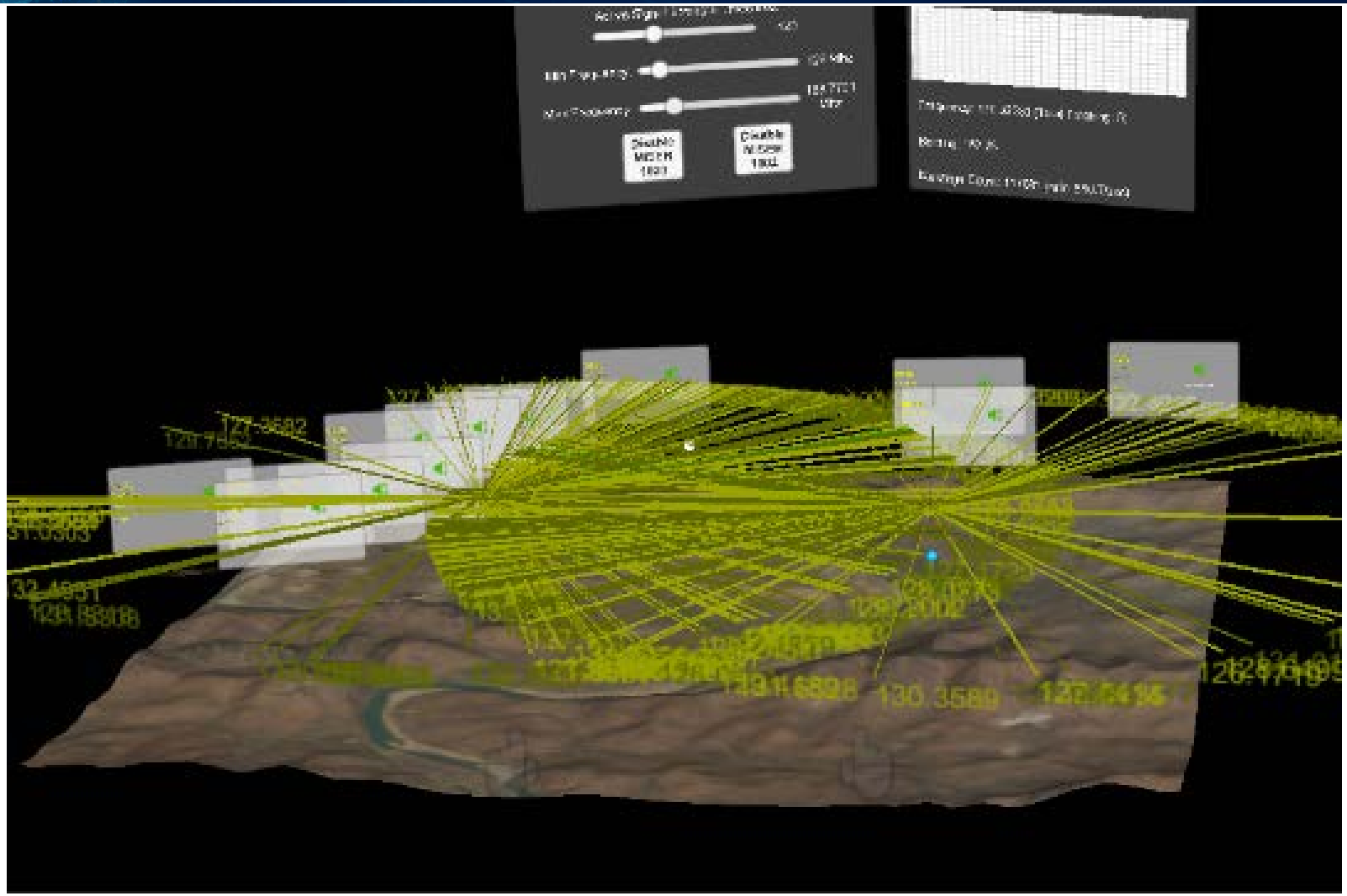
SAIC®

Background

- Serious Games since 2004
- Started in VR 1995
- SAIC's Big Timber Games, Seattle, WA
- Training, Education and Simulation using Game Tech & Methods
- Significant R&D investment in AR/VR/MR
- Several current DoD development contracts

SAIC®

PinPoint



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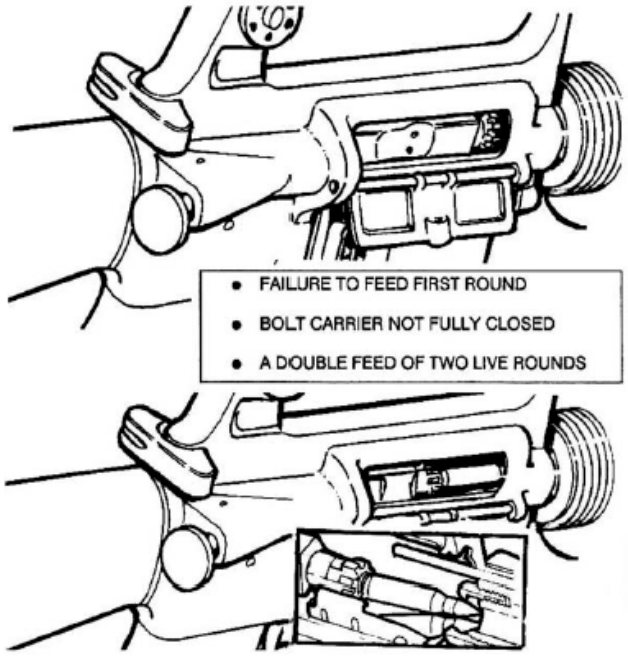
AR Design Considerations

Why are you using AR?



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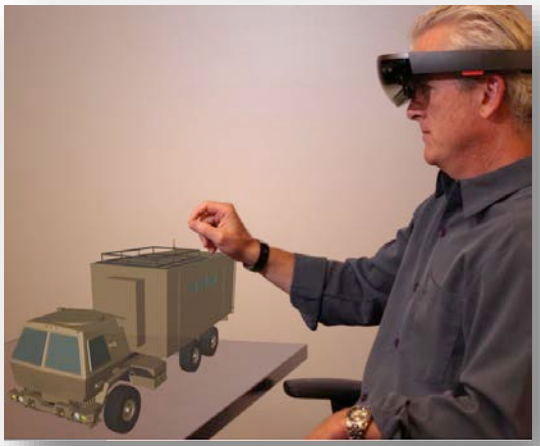
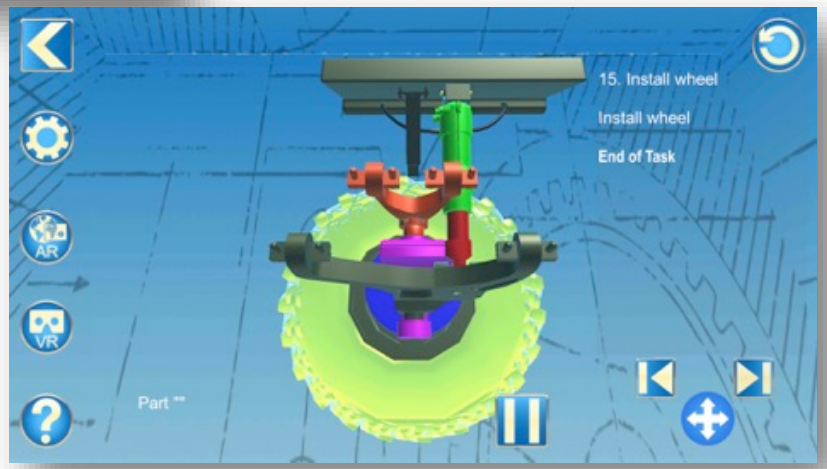
AR Design Considerations

Think through your use case!

AR Design Considerations

How will the user interact with the information?





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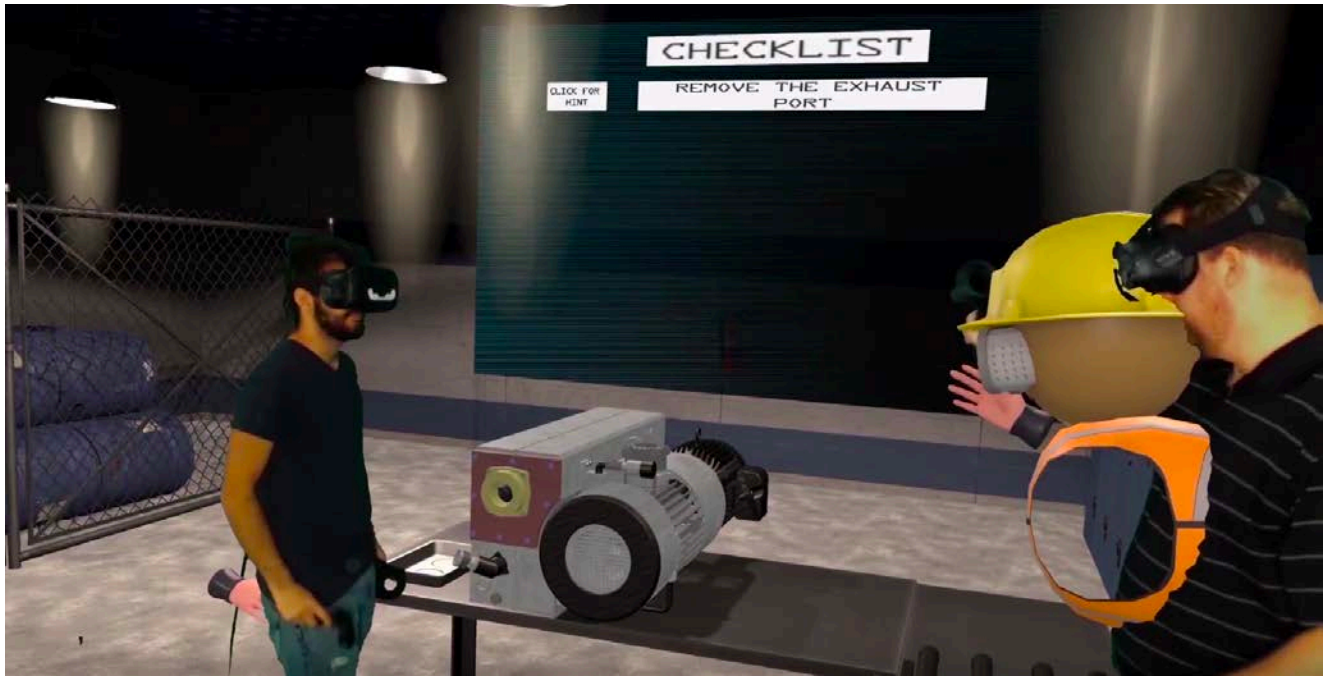
User Testing & Feedback

You've built it. Is anyone going to use it?

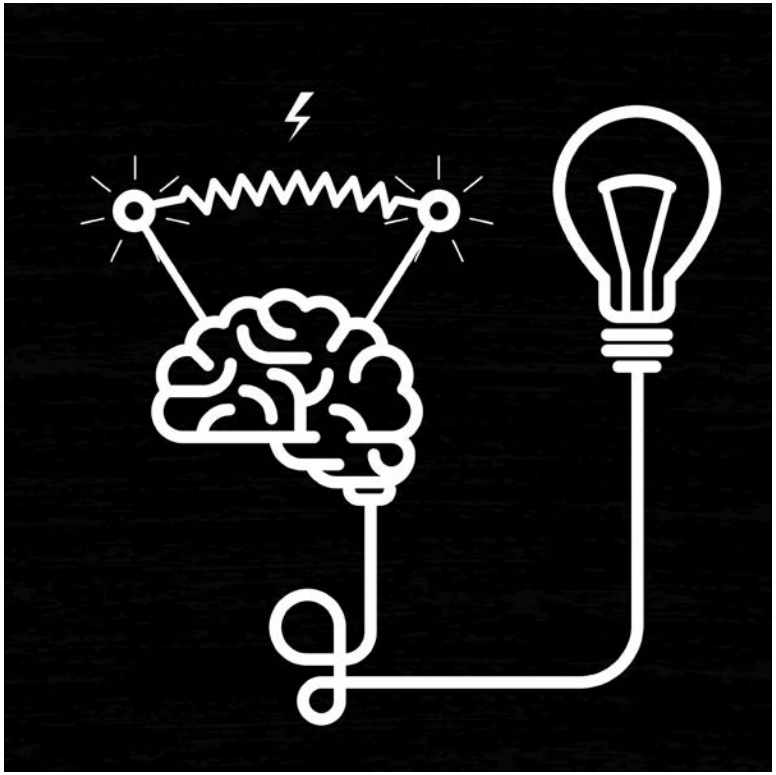
User Testing & Feedback: Observations

Find a User



User Testing & Feedback: Observations

Start getting/incorporating feedback as early as possible



User Testing & Feedback: Observations

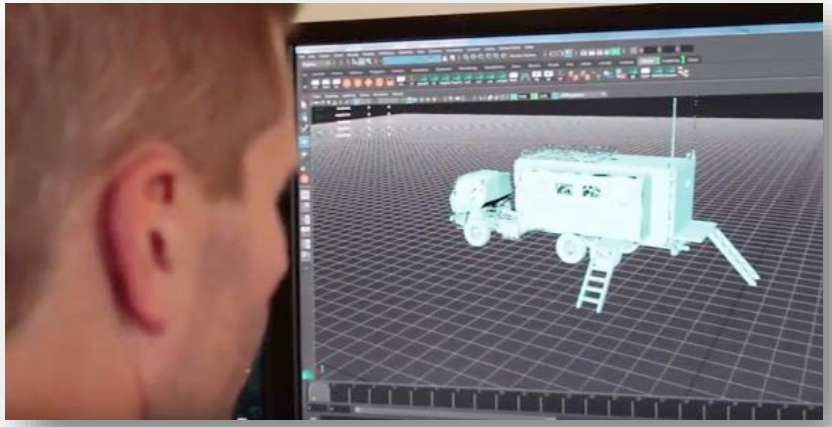
Get more users

Required Sample Size†

Population Size	Confidence = 95% Margin of Error				Confidence = 99% Margin of Error			
	5.0%	3.5%	2.5%	1.0%	5.0%	3.5%	2.5%	1.0%
10	10	10	10	10	10	10	10	10
20	19	20	20	20	19	20	20	20
30	28	29	29	30	29	29	30	30
50	44	47	48	50	47	48	49	50
75	63	69	72	74	67	71	73	75
100	80	89	94	99	87	93	96	99
150	108	126	137	148	122	135	142	149
200	132	160	177	196	154	174	186	198
250	152	190	215	244	182	211	229	246
300	169	217	251	291	207	246	270	295
400	196	265	318	384	250	309	348	391
500	217	306	377	475	285	365	421	485
600	234	340	432	565	315	416	490	579
700	248	370	481	653	341	462	554	672
800	260	396	526	739	363	503	615	763
1,000	278	440	606	906	399	575	727	943
1,200	291	474	674	1067	427	636	827	1119
1,500	306	515	759	1297	460	712	959	1376
2,000	322	563	869	1655	498	808	1141	1785
2,500	333	597	952	1984	524	879	1288	2173
3,500	346	641	1068	2565	558	977	1510	2890
5,000	357	678	1176	3288	586	1066	1734	3842
7,500	365	710	1275	4211	610	1147	1960	5165
10,000	370	727	1332	4899	622	1193	2098	6239
25,000	378	760	1448	6939	646	1285	2399	9972
50,000	381	772	1491	8056	655	1318	2520	12455
75,000	382	776	1506	8514	658	1330	2563	13583
100,000	383	778	1513	8762	659	1336	2585	14227
250,000	384	782	1527	9248	662	1347	2626	15555
500,000	384	783	1532	9423	663	1350	2640	16055
1,000,000	384	783	1534	9512	663	1352	2647	16317
2,500,000	384	784	1536	9567	663	1353	2651	16478
10,000,000	384	784	1536	9594	663	1354	2653	16560
100,000,000	384	784	1537	9603	663	1354	2654	16584
300,000,000	384	784	1537	9603	663	1354	2654	16586

User Testing & Feedback: Observations

Think about how to frame your ROI



SAIC®

Contact

Gardner Congdon

SAIC - Big Timber Games

gardner.congdon@saic.com


taq
tile


Booz
Allen

MANIFEST PRODUCT MISSION STATEMENT

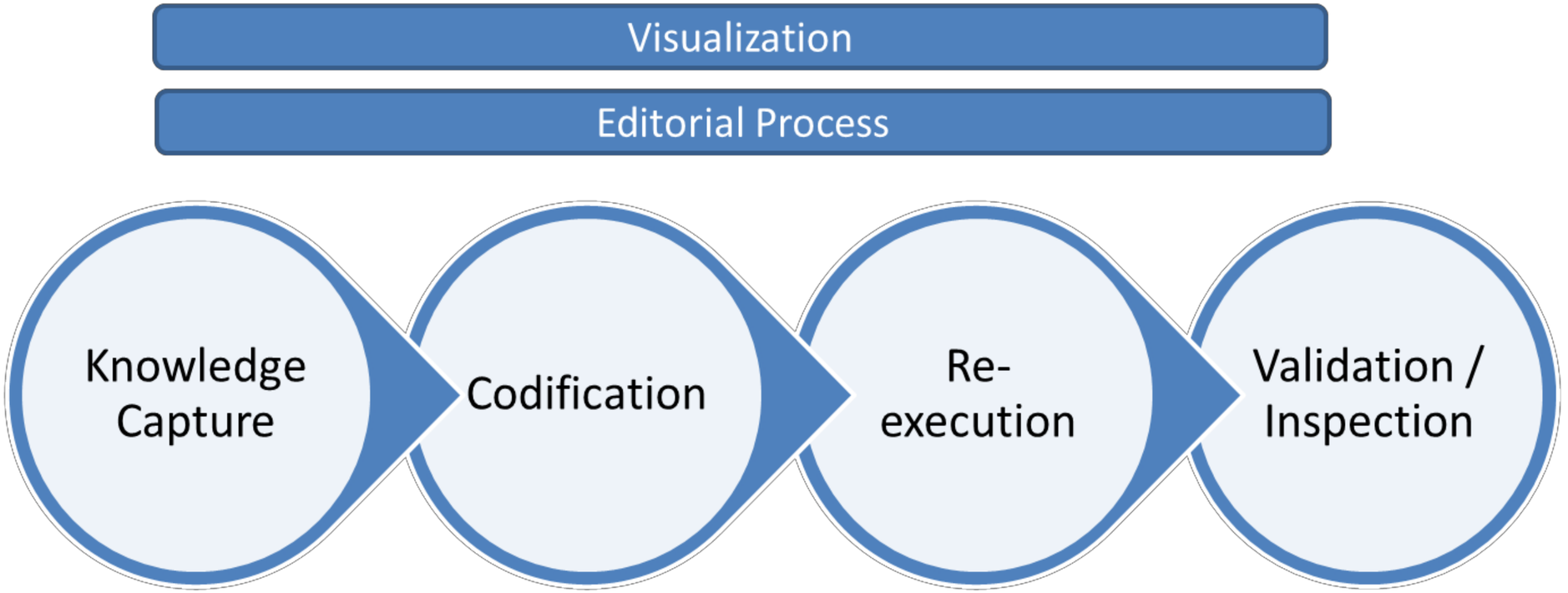
Revolutionize the way knowledge is captured and delivered to front line workers so that EVERYONE IS AN EXPERT

We want to revolutionize the way that tasks are taught, learned, and evolved using human knowledge, computer knowledge and real space. We want people who don't know how to fix engines to fix engines. We want the tribal body of knowledge to grow and evolve naturally without large technology implementation projects. We want to outfit manufacturers of equipment to deliver their manuals in mixed reality.

CORE FUNCTIONS OF MANIFEST

- Field Service Ops, Training and Inspection
- Hands-free Knowledge Capture
- 3D Placement of Task Steps
- Work Order Integration
- Full-cycle Inspection Workflow
- IoT Connectivity & Display
- 3D Map View of Work Progress
- Flexible Integration

MANIFEST: INDUSTRIAL KNOWLEDGE CAPTURE



4

SKILLED EXPERTS CREATE JOB CHECKLISTS

Authors use 3D placement of markers to instruct specifically where, when and how to do complex work tasks. Manifest is powered predominantly through user-generated content stored in a secure cloud for each client.

Here a plant expert new to HoloLens, dons the headset to Author a job as she performs it. Using 3D step markers she builds a job template, complete with video and photo notes, that can be augmented over the panel and equipment to guide any Operator needing to perform the same task.

OPERATORS GET HANDS ON GUIDANCE

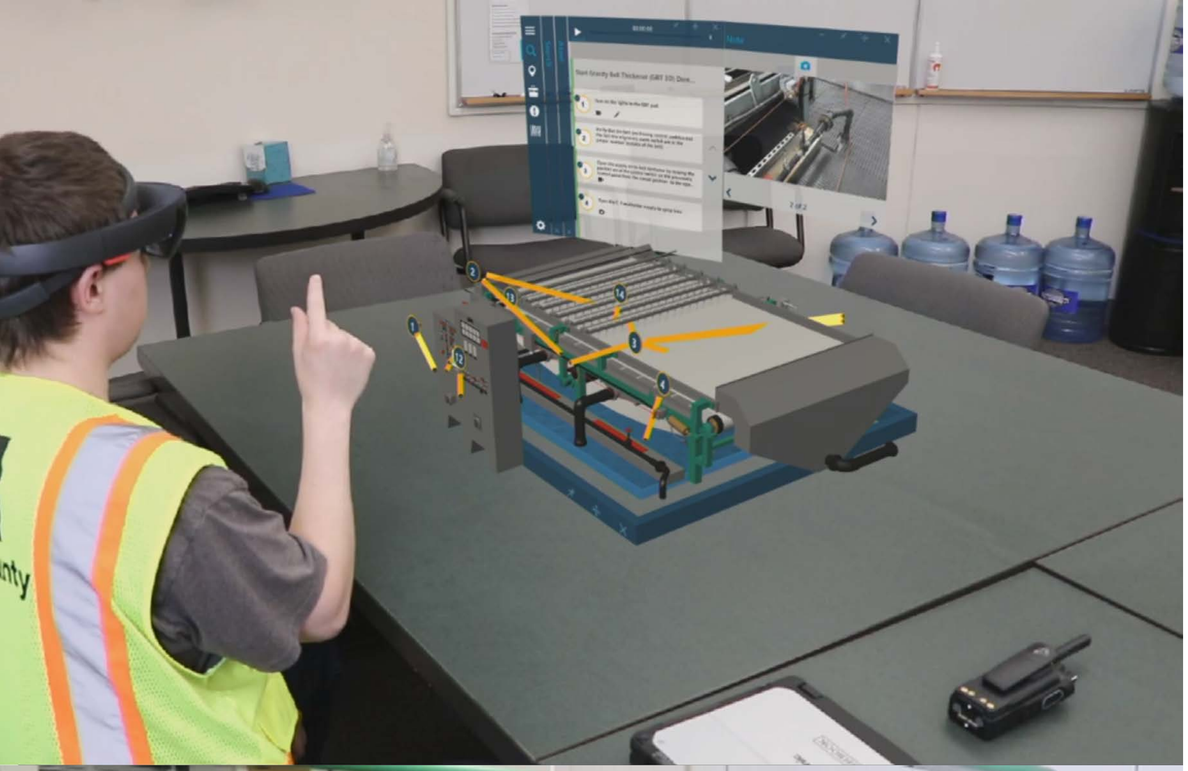
Whether an Operator is still training or just new to a specific task, any expert authored checklist is at their finger tips guiding them through a job as they perform it.

Here a new hire to the plant, follows the previously authored job template in Manifest and completes the same procedure as the expert simply by following the augmented steps and notes.

IOT DATA & ALERTS

Manifest integrates directly with your IoT data displaying meters readings augmented over physical or virtual equipment.

Based on specified meter parameters, alerts are automatically generated empowering on-the-ground Operators to immediately take appropriate action.



DIGITAL TWIN OF ASSETS

Render the digital twin of any asset to remotely author job templates, train, or extend remote assistance to on-the-ground Operators with a representation of the same equipment.

3D model of a gravity belt thickener is rendered at full-scale, or small scale. The user can review steps and content to train or prepare in a safe, controlled environment before going to job site.

EASILY TRANSFER KNOWLEDGE

Whether your experienced workforce is aging out of your industry; or due to the location, cost, or availability of highly skilled resources is limiting your growth – your company needs a quicker and more reliable way to capture, transfer and retain knowledge. Here is how Manifest can help:

SIMPLICITY FOR AUTHOR

Rather than having an expert take additional time to create training materials using traditional methods, Manifest enables them to easily create these as job templates hands-free while performing the task.

EFFICIENCY FOR WORKFORCE

With Manifest, a highly skilled resource can author content making job templates instantly available for any employee to access and perform the same specialized and complex task – regardless of location or skill level.

HANDS ON LEARNING. HANDS FREE.

Manifest enables users to learn by doing with step-by-step guidance augmented directly over the equipment they are working upon.

DEVELOP A SCALABLE KNOWLEDGE BASE

Develop a living knowledge base in a tool that becomes accessible to your entire workforce, making expert knowledge instantly available.

INTEGRATE WITH YOUR SYSTEM OF RECORD

Manifest has a restful API for integrating with existing systems

Cloud Connectivity

All data stored in customer architecture, on site or cloud

Auto-scale as necessary

Compatible with Government Cloud

IoT Integration

Integrate with Azure IoT for seamless MR view of data panels and creation of alerts

Meters can be placed in 3D space over equipment where they are contextually useful

Steps can be controlled and managed based on IoT readings

DFARS COMPLIANT UPGRADE AVAILABLE

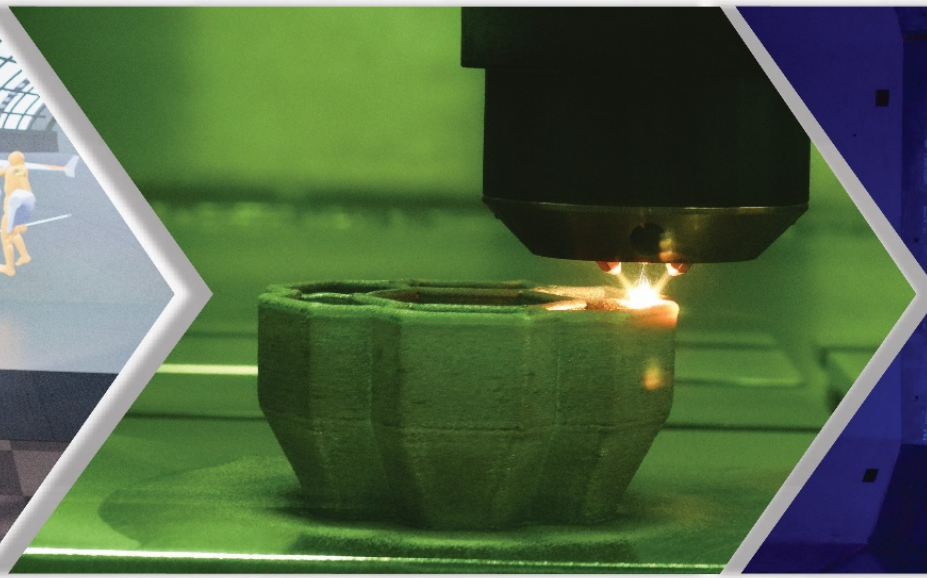
Compliance with Defense Regulations from cloud-backend to HoloLens user

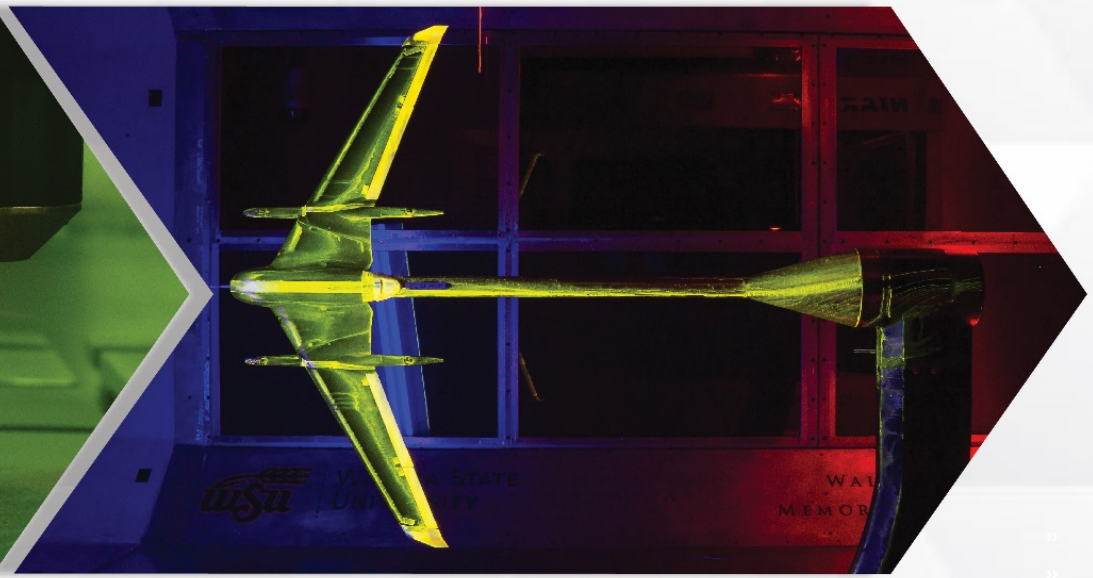
KNOWLEDGE MANAGEMENT

Use Manifest for data capture

Share captured data with other traditional knowledge management systems.

NATIONAL INSTITUTE FOR AVIATION RESEARCH





NIAR Wichita State University
National Institute for Aviation Research

NDIA AR Workshop 2018

Jeff Fisher

NIAR
Wichita State University
National Institute for Aviation Research

Step 1: What is fixed?

Software?

Microsoft
vuforia
blippAR
wikitude
SONY
ARTOOLKIT
kudan
AUGMENTED REALITY
Total Immersion
augumenta
occipital
BOSCH
AURASMA

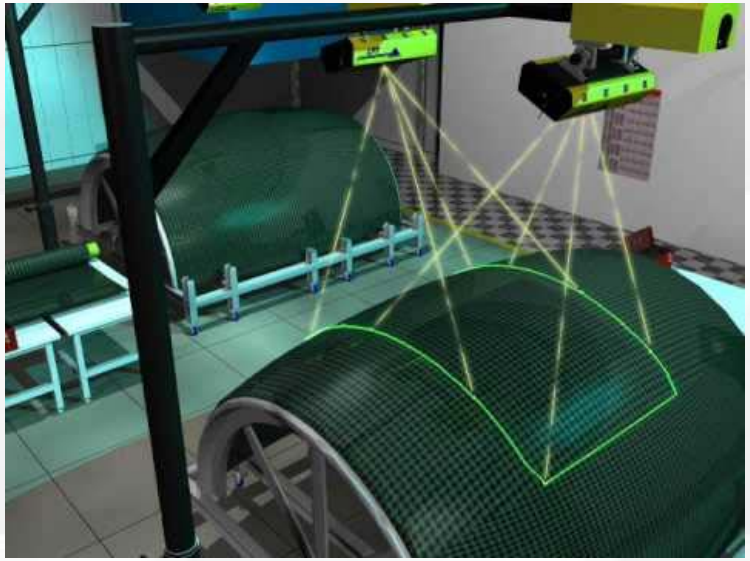
Hardware?

Step 2: What types of devices are available?

Wearables

Tablets

PC/Projector



Step 3: Sample devices

Criteria to evaluate

- Items outside of the normal CPU/GPU/RAM/Storage/Camera Resolution/Screen Resolution requirements:
  - Battery Life (Does it last all shift?)
  - Recharging time
  - Can I permit device's sensor array in the space
  - Can it easily be incorporated into my IT infrastructure?
    - What authentication methods does it directly support?
    - Can IT manage it with current tools?
  - Is the camera location an issue?
  - Does the device operate well in the environment? (Inside/outside/low light/bright light)
  - What type of AR content is being displayed?

NATIONAL INSTITUTE FOR AVIATION RESEARCH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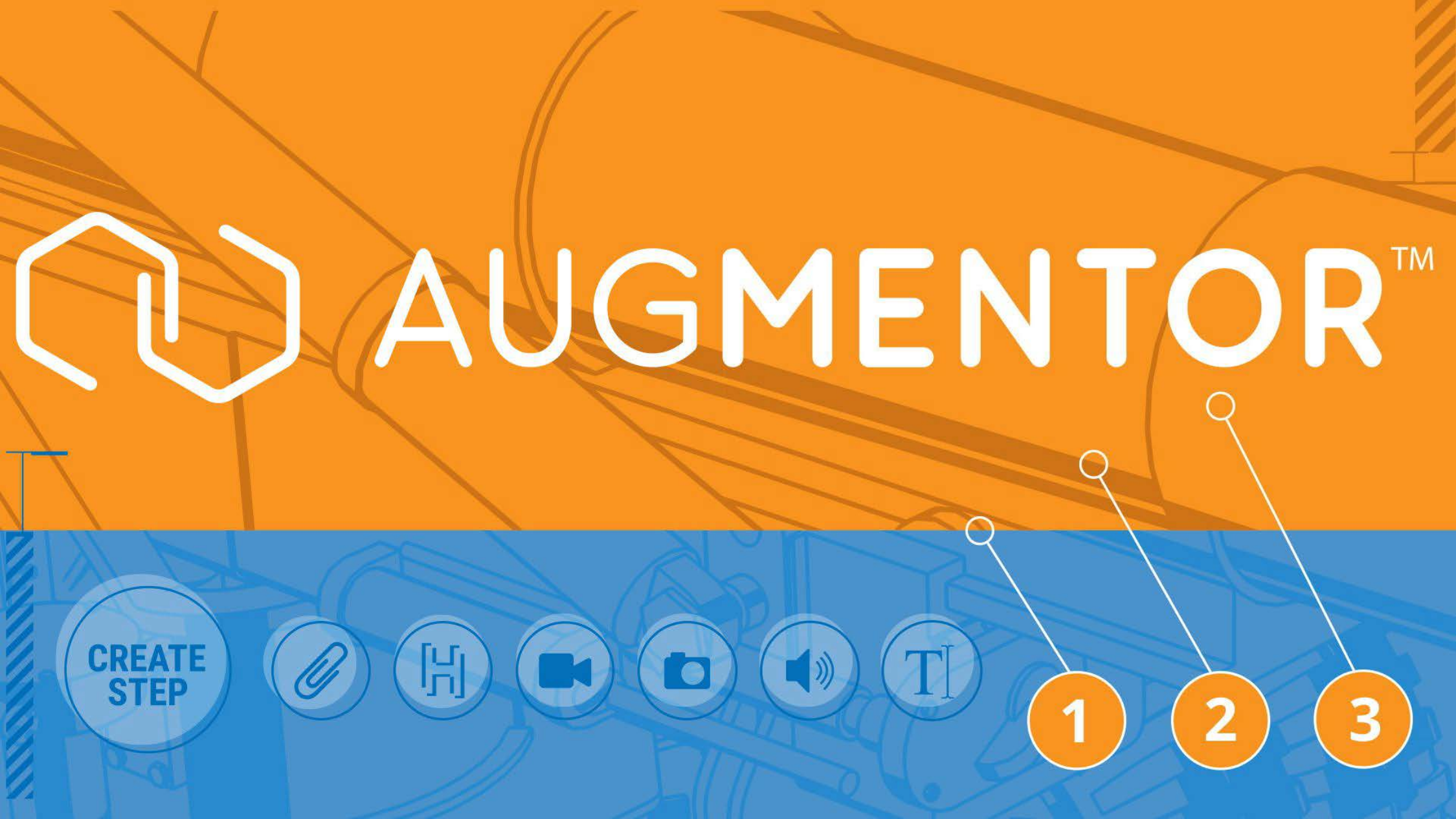
@niar_wsu


AUGMENTOR™
CREATE STEP
1
2
3

MIXED REALITY

Joseph Marina

Oct 4 2018

LMI

ABOUT US

LMI is a consulting firm dedicated to improving the management of government. With more than 1,000 consultants, we design and implement solutions to some of the toughest problems facing government managers in logistics, information technology, and resource allocation.

INSIGHT

Our innovative problem solving provides valuable insights into possible solutions.

OBJECTIVITY

Our independence ensures we operate free from conflicts of interest.

PRACTICAL RESULTS

Our solutions are outcome driven and results oriented.

SHARED PURPOSE

Our shared spirit of public service and deep knowledge of government operations enhance our recommendations.

SIGNIFICANT VALUE

Our net revenue supports our mission, not shareholder return, delivering more value per dollar.

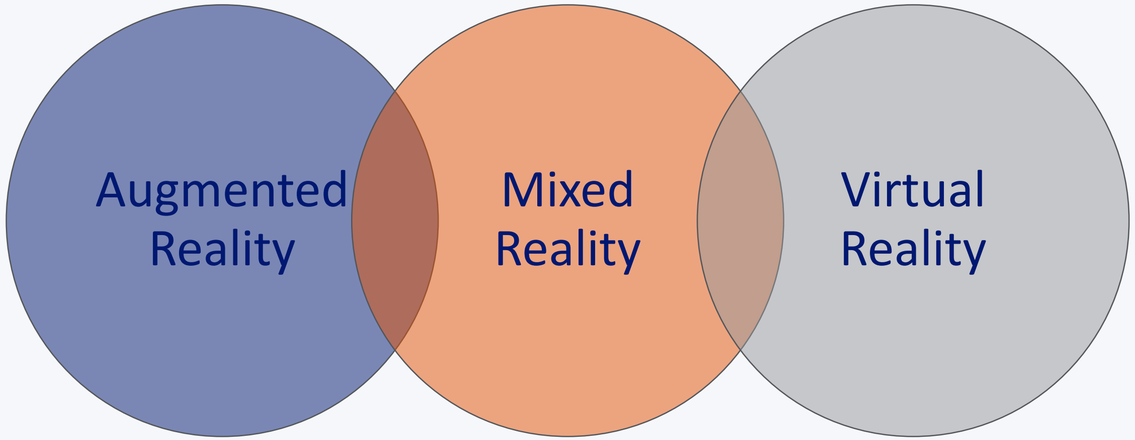
MIXED REALITY AND IMPACT ON DATA

Data Redefined

- The ability to make data interact with its environment is the next step in the evolution of data and data services

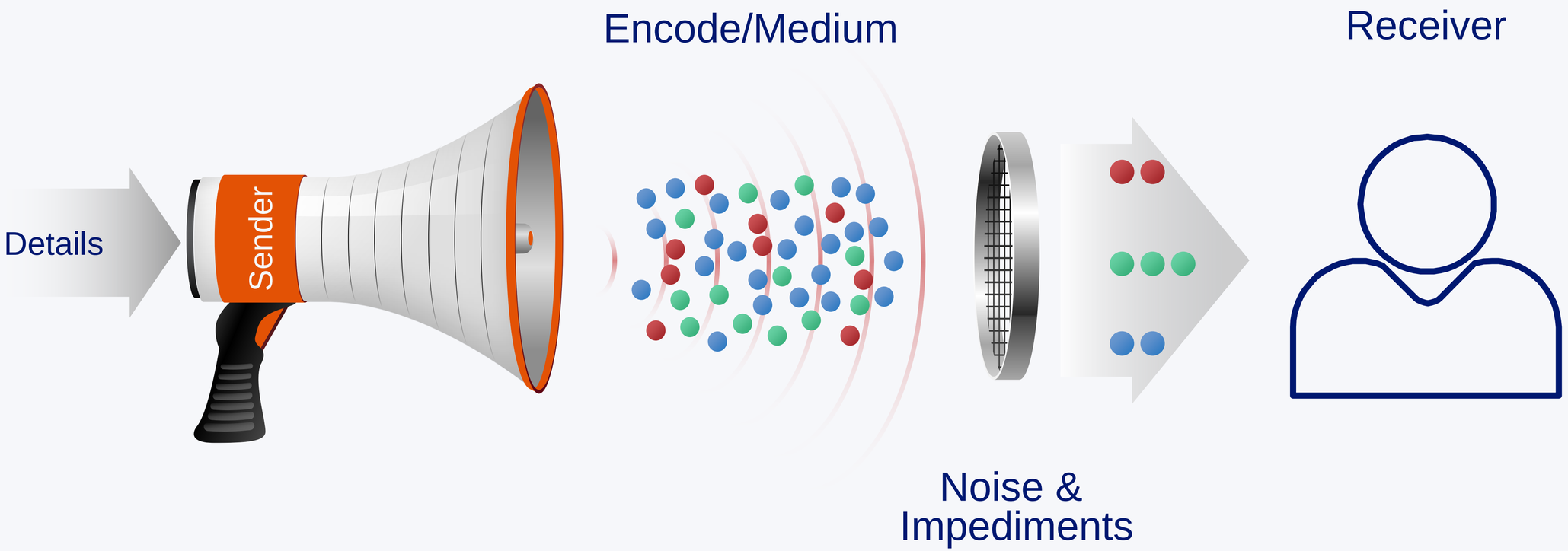
AR vs MR vs VR

- Augmented Reality is an overlay of virtual content onto the real world
- Mixed Reality is a mix of the real world and a virtual world, allowing the virtual world to respond to the real world
- Virtual Reality is an entire virtual world



LMI

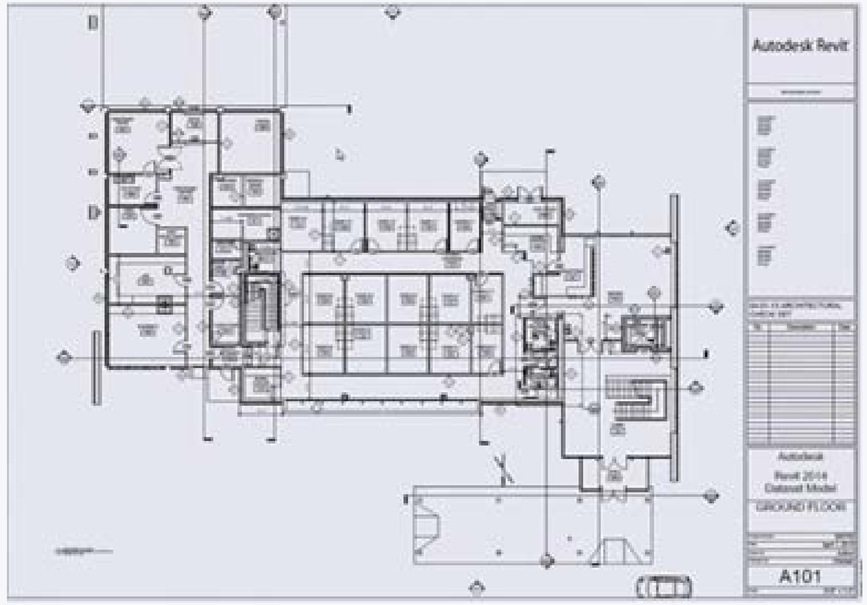
COMMUNICATION



OUR APPLICATIONS

Spatial planning

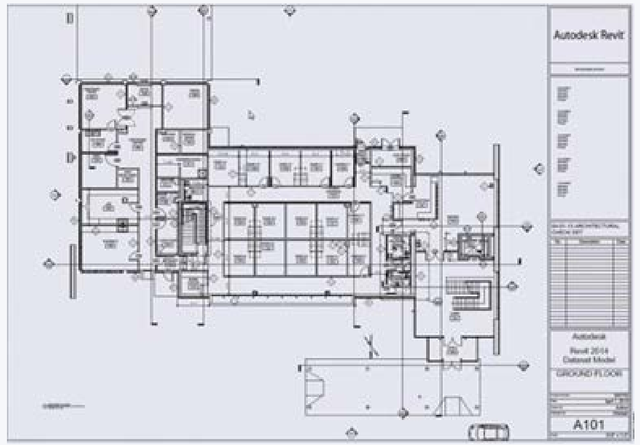
- Communicating spatial plans has challenges:
  - Laborious symbolic
  - No Interaction
  - 2D



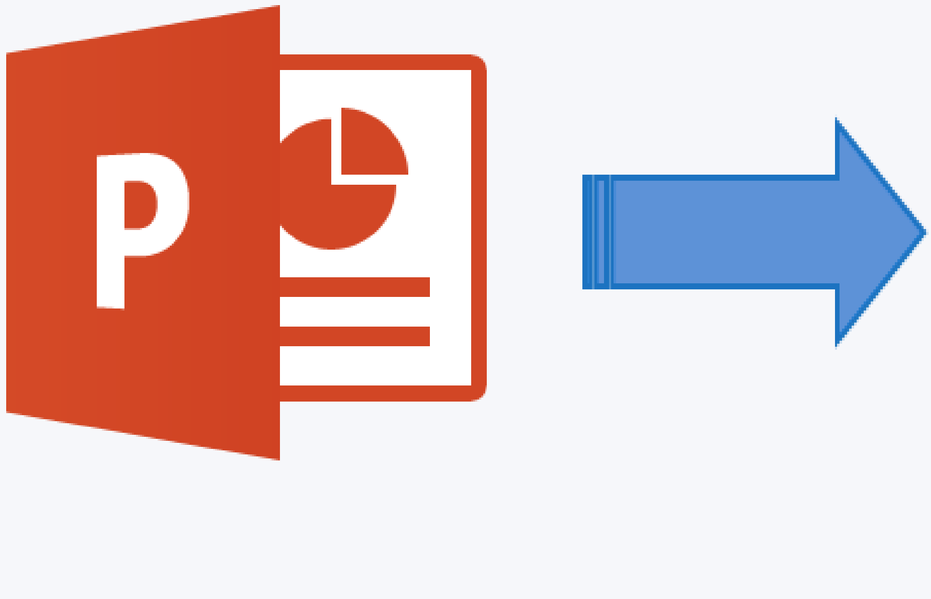
Training and Maintenance

- Communicating physical actions has challenges:
  - Lack of engagement
  - No familiarity with physical interaction
  - Scarcity and cost

SPATIAL DESIGN AND PLANNING



TRAINING AND MAINTENANCE



CONTACT US

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taq
tile


Booz
Allen

CORE FUNCTIONS OF MANIFEST

- Field Service Ops, Training and Inspection
- Hands-free Knowledge Capture
- 3D Placement of Task Steps
- Work Order Integration
- Full-cycle Inspection Workflow
- IoT Connectivity & Display
- 3D Map View of Work Progress
- Flexible Integration

MANIFEST

FOUR USER ROLES

Manifest has four user roles which have independent functions

AUTHOR

SUBJECT MATTER EXPERT

The role for the user that is the knowledge expert and can create checklists and place steps in 3D space

OPERATOR

TECHNICIAN / TRAINEE

Main focus user for Manifest. Follows directions left by Author, accepts jobs from the board, and leaves evidence of what has been done in job history.

INSPECTOR

INTERNAL OR EXTERNAL

The role of the Inspector is to show compliance or non-compliance on a series of Government or Internal regulations.

ADMIN MANAGER

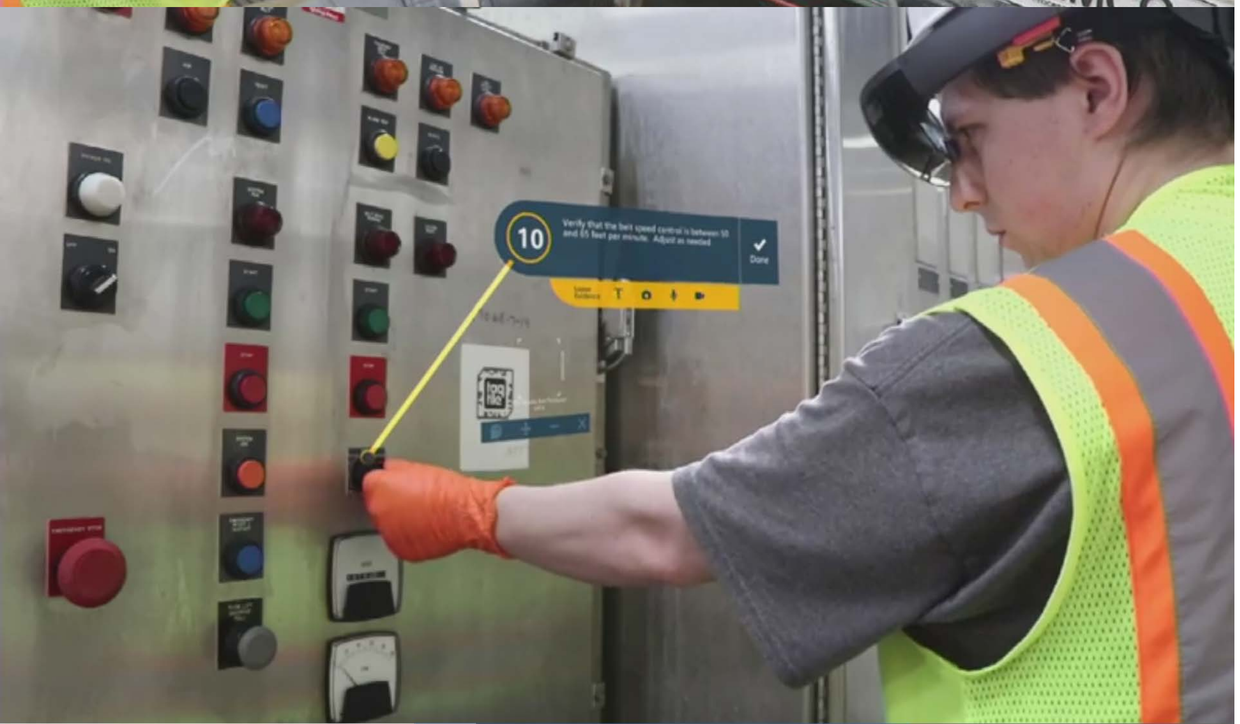
SOLUTION ADMIN

Admins can manage assets, users, and locations in addition to configuring IoT meters & measurements as well as other back-end integrations like work orders, etc.

SKILLED EXPERTS CREATE JOB CHECKLISTS

Authors use 3D placement of markers to instruct specifically where, when and how to do complex work tasks. Manifest is powered predominantly through user-generated content stored in a secure cloud for each client.

Here a plant expert new to HoloLens, dons the headset to Author a job as she performs it. Using 3D step markers she builds a job template, complete with video and photo notes, that can be augmented over the panel and equipment to guide any Operator needing to perform the same task.



OPERATORS GET HANDS ON GUIDANCE

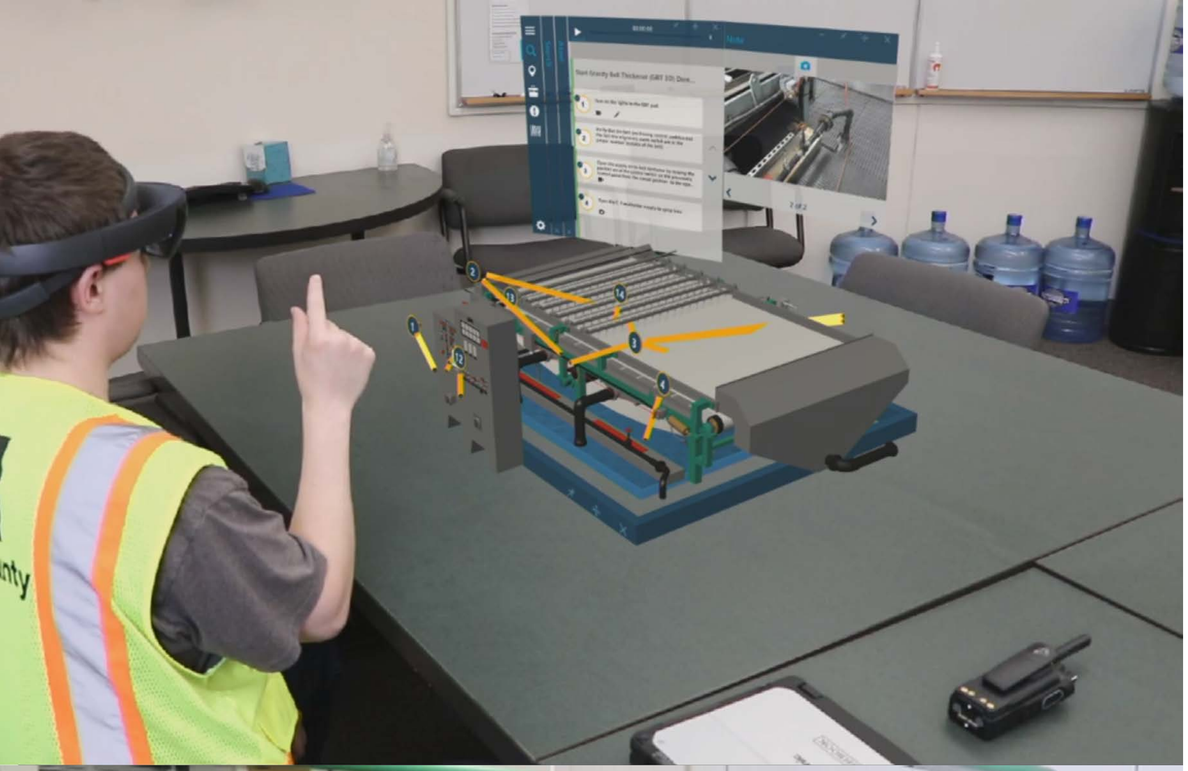
Whether an Operator is still training or just new to a specific task, any expert authored checklist is at their finger tips guiding them through a job as they perform it.

Here a new hire to the plant, follows the previously authored job template in Manifest and completes the same procedure as the expert simply by following the augmented steps and notes.

IOT DATA & ALERTS

Manifest integrates directly with your IoT data displaying meters readings augmented over physical or virtual equipment.

Based on specified meter parameters, alerts are automatically generated empowering on-the-ground Operators to immediately take appropriate action.



DIGITAL TWIN OF ASSETS

Render the digital twin of any asset to remotely author job templates, train, or extend remote assistance to on-the-ground Operators with a representation of the same equipment.

3D model of a gravity belt thickener is rendered at full-scale, or small scale. The user can review steps and content to train or prepare in a safe, controlled environment before going to job site.

EASILY TRANSFER KNOWLEDGE

Whether your experienced workforce is aging out of your industry; or due to the location, cost, or availability of highly skilled resources is limiting your growth – your company needs a quicker and more reliable way to capture, transfer and retain knowledge. Here is how Manifest can help:

SIMPLICITY FOR AUTHOR

Rather than having an expert take additional time to create training materials using traditional methods, Manifest enables them to easily create these as job templates hands-free while performing the task.

EFFICIENCY FOR WORKFORCE

With Manifest, a highly skilled resource can author content making job templates instantly available for any employee to access and perform the same specialized and complex task – regardless of location or skill level.

HANDS ON LEARNING. HANDS FREE.

Manifest enables users to learn by doing with step-by-step guidance augmented directly over the equipment they are working upon.

DEVELOP A SCALABLE KNOWLEDGE BASE

Develop a living knowledge base in a tool that becomes accessible to your entire workforce, making expert knowledge instantly available.

INTEGRATE WITH YOUR SYSTEM OF RECORD

Manifest has a restful API for integrating with existing systems

MICROSOFT AZURE

All data stored in Azure

Auto-scale as necessary

Compatible with Government Cloud

AZURE IoT

Integrate with Azure IoT for seamless MR view of data panels and creation of alerts

Meters can be placed in 3D space over equipment where they are contextually useful

Steps can be controlled and managed based on IoT readings

DFARS COMPLIANT UPGRADE AVAILABLE

Compliance with Defense Regulations from cloud-backend to HoloLens user

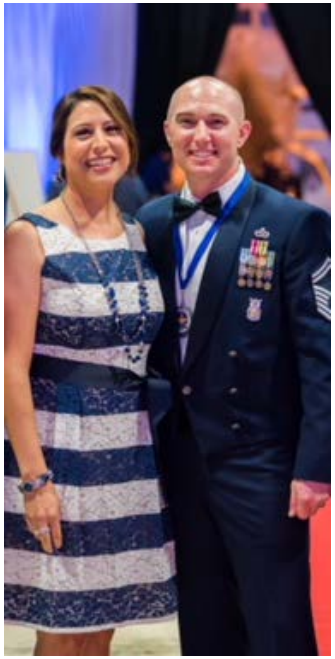
KNOWLEDGE MANAGEMENT

Use Manifest for data capture

Share captured data with other traditional knowledge management systems.

About Me

CISSP® Certified Information Systems Security Professional



CERTIFIED AUTHORIZATION CAP® PROFESSIONAL

INGALLS INFORMATION SECURITY

PROTECT YOUR INFORMATION℠

Risk Management Framework (RMF)

INGALLS INFORMATION SECURITY

PROTECT YOUR INFORMATION℠

Questions?

My Contact Information:

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Risk Management Consultant
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501-515-1026

INGALLS INFORMATION SECURITY

PROTECT YOUR INFORMATION℠

Joint and Coalition Warfighter Experiences in Augmented Reality

Emilie Reitz, Kevin Seavey

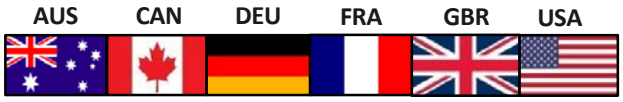
Joint Staff J6, Joint Fires Division

Basic Bold Quest "Who, What and Why"

Major Evolutionary Milestones

- **2001** Conceived and approved (Advanced Concept Technology Demonstration ACTD)
- **2003** First operational demonstration.
- **2011** Transition from Joint Forces Command to Joint Staff management.

Original BQ Coalition (2003)



Current BQ Coalition (2018-2019)

(Plus continuously evolving group of observer nations considering future participation.)

BQ Coalition (2020)
Currently "Under Construction"

What do they do and Why?

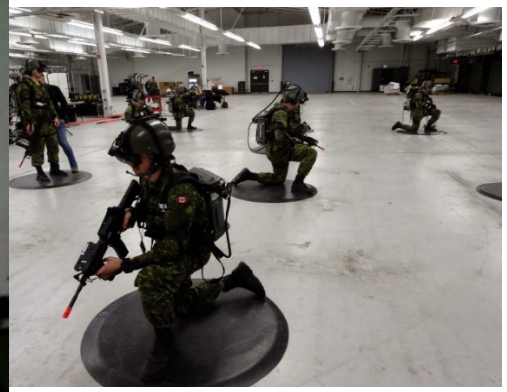
- **Interoperability; sensor-to-shooter kill chain focused.**
- **Coalition network context; Federated Mission Networking (FMN) distributed to sites internationally.**
- **Data collection and analysis derived from scenario/vignettes representative of coalition operations.**
- **Air, Ground, Maritime and Cyber domains.**
- **Live, Virtual and Constructive forces.**
- **Via semi-annual capability demonstrations of varying scale, content, duration and location.**
- **With participants funding own costs; leveraging the collective pool of resources (people and equipment).**

Where is the impact? (So what?)

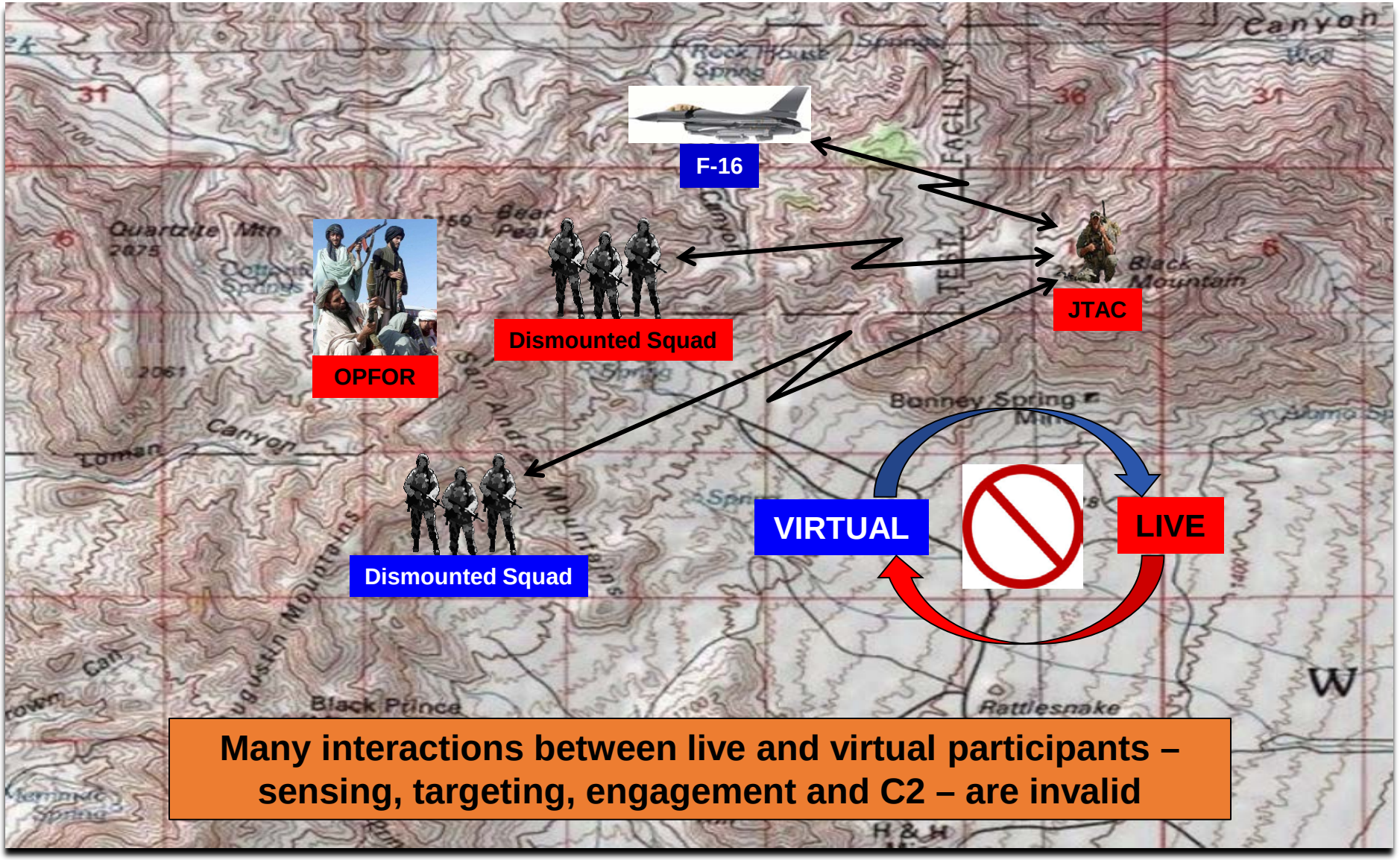
- **Current operational needs (systems test & pre-deployment acceptance checks; tactics, techniques and procedures).**
- **Future requirements and capability development.**
- **Pacing and assessing progress in established Coordinated Implementation processes (e.g. Close Air Support; Fires).**
- **Validation of specific nation/service/program "fixes" in a coalition context.**

Purpose of Bold Quest LVC Environment

- **Provide a venue where Nations, Services and Programs can demonstrate and assess methods to create more capable and interoperable Live, Virtual & Constructive (LVC) environments that support building and maintaining combined joint fires proficiency, to include:**
  - **Assessing and identifying tools, methods and technologies to improve LVC capabilities and interoperability in a joint and coalition environment.**
  - **Determining and assessing the ability of distributed simulators to improve combined joint fires individual and collective performance.**
  - **Demonstrating and assessing new technologies that address current LVC shortfalls, such as Augmented Reality and simulated DACAS capabilities.**
  - **Bringing LVC stakeholders together in a collaborative effort that leads to long term improvements in distributed simulator interoperability.**



Integrated LVC – What is the Issue?



AR – Bridging the Gap in Mixed LVC Training

Fort Benning Feb 2014

Holloman AFB
May 2014

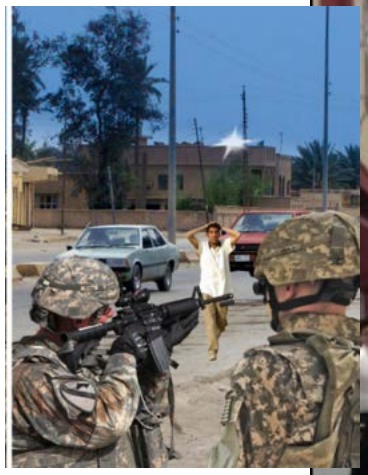
Participant Feedback

1=Not at all Adequate; 2= Generally NOT adequate; 3= Neither adequate nor inadequate; 4= Generally Adequate; 5= Very Adequate

	All simulators (N=18)	AC-130 Scenario (N=5)	Demo 14.1 (N=10)
Was the length (time) of the scenario adequate for the training exercise?	4.32	4.2	3.39
Was the scenario realistic enough for you to feel immersed in the exercise?	4	4	-
Was the scenario complex enough to challenge you?	3.78	3.25	3.48
Were the terrain, landscape, and buildings realistic enough not to cause a distraction to training?	4.17	3.5	-
Were the audio cues distinct enough to replicate patterns of life?	3.72	3.5	3.29
Were the visual cues distinct enough to replicate patterns of life?	4.22	3.75	3.1
Were the visual cues distinct enough to discriminate non-combatants?	3.83	3.75	-
Were the visual cues distinct enough to identify key individuals?	3.67	3.75	4
Were the audio cues distinct enough to identify the location of enemy forces?	3.78	3.75	3.75
Were the visual cues distinct enough to identify the location of enemy forces?	4	4	4
Was the opposing force ratio sufficient enough to evaluate the unit?	4.11	4	-

Conclusions

- **Based on data collected over the two Bold Quest events, AR can close a large interoperability gap in how warfighters in live and virtual environments interact.**
- **AR technology with military applications has rapidly matured.**
  - **Both operational and training environments.**
- **We welcome the opportunity to participate in this forum.**
  - **We are working to bring AR technology to BQ19.1 in May 19.**



PTC BRIEFING:
AUGMENTED REALITY (AR) *FOR*
FEDERAL AEROSPACE AND DEFENSE (FA&D)

David Segal

Director, Business Transformation, FA&D Industry

October 2018

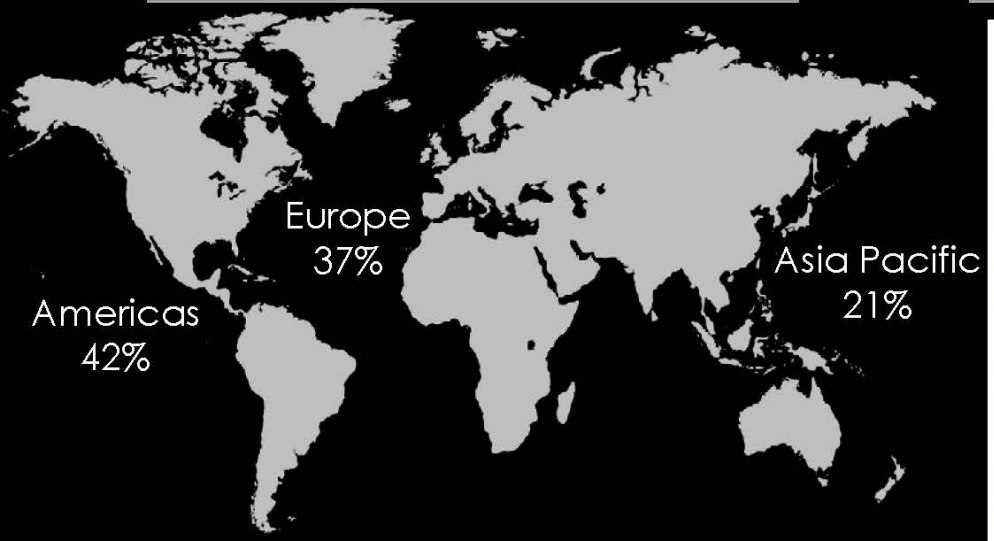
NDIA

Augmented Reality Worksho

The Waterford Reception Center
Washington DC

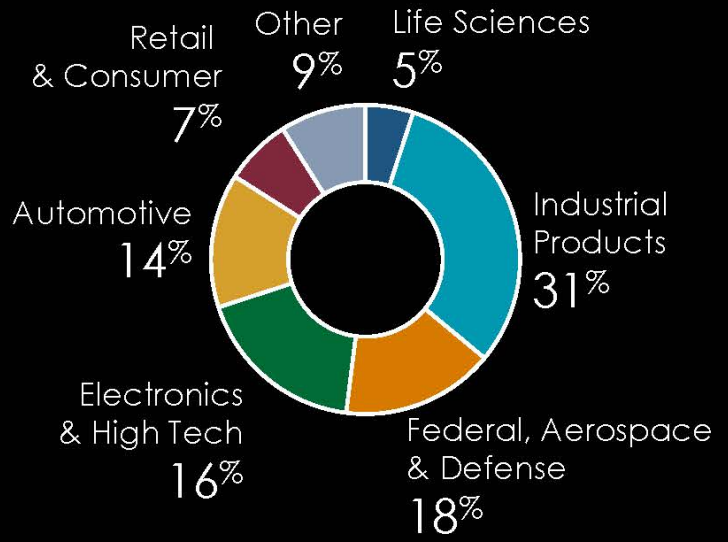
PTC IS A GLOBAL, US SOFTWARE TECHNOLOGY COMPANY

GEOGRAPHIC COVERAGE



NEW HQ: BOSTON SEAPORT

REVENUE BY VERTICAL



BRANDS

ptc

thingworx · creo · vuforia · windchill · kepware · integrity · servigistics

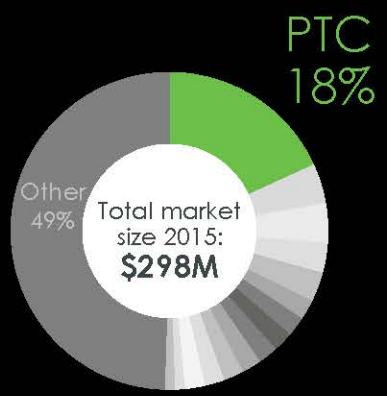
FAST FACTS

$1.17B	$989M	$856M	68%	30,000	750	6,000	1,800
FY17 total revenue	FY17 software revenue	FY17 recurring software revenue	FY17 new software bookings subscription	active customers	partners	employees	universities

PTC: INNOVATION WITH GLOBAL RECOGNITION

CLEAR MARKET LEADER

WITH 18% MARKET SHARE



Source: **IoT Analytics**

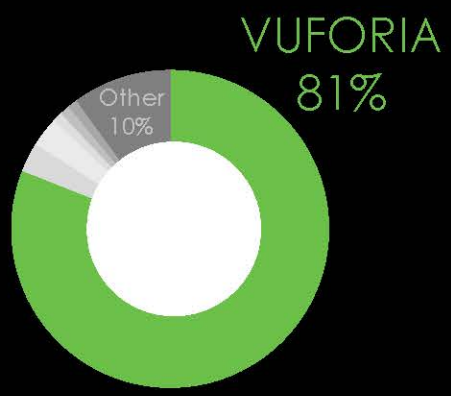
CLEAR MARKET LEADER

FOR IoT TECHNOLOGY PLATFORMS

Source: **BCC Research**

CLEAR MARKET LEADER

IN AUGMENTED REALITY



Source: **Aeon Mobile**

CLEAR MARKET LEADER

IoT PLATFORM MARKET

Source: **Lux Research, Inc.**

CLEAR MARKET LEADER

INDUSTRIE 4.0 IoT VENDOR BENCHMARK 2016

Source: **Experton Market Insight**

Gartner Magic Quadrant for Industrial IoT Platforms May 2018

Forrester Wave™, IOT Software Platforms December 2016

PHYSICAL WORLD

ThingWorx

DIGITAL WORLD

Windchill

FORRESTER

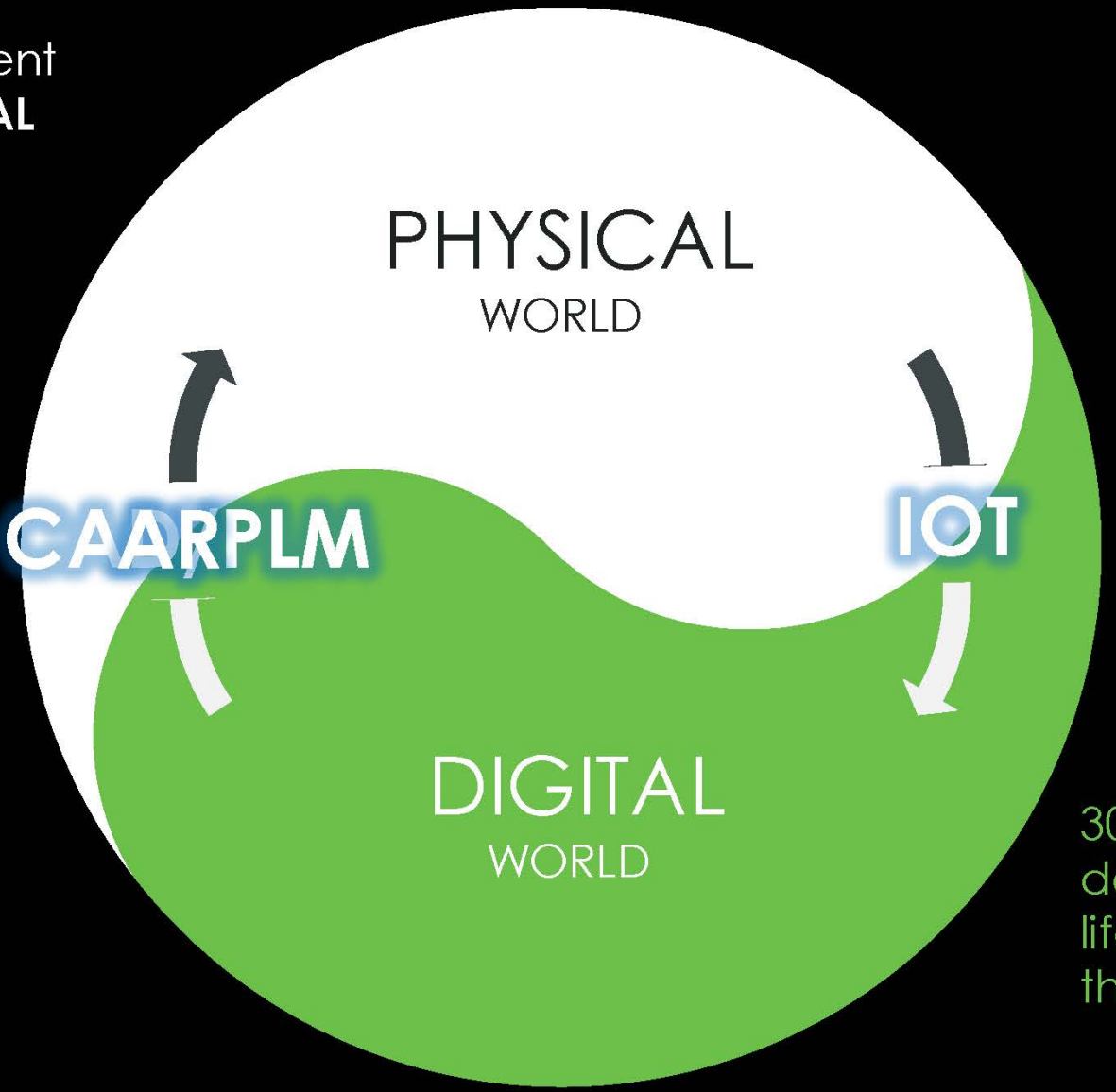
Forrester Wave™, PLM Software November 2017

CONVERGENCE HAS SHAPED OUR **STRATEGY**

ptc

$1B technology investment connects to the **PHYSICAL** world and enables new experiences

SMART CONNETED PRODUCTS



SMART CONNECTED OPERATIONS

30 year heritage in the **DIGITAL** definition, software, and lifecycle management of things

CONVERGENCE HAS SHAPED OUR **IDENTITY**

ptc

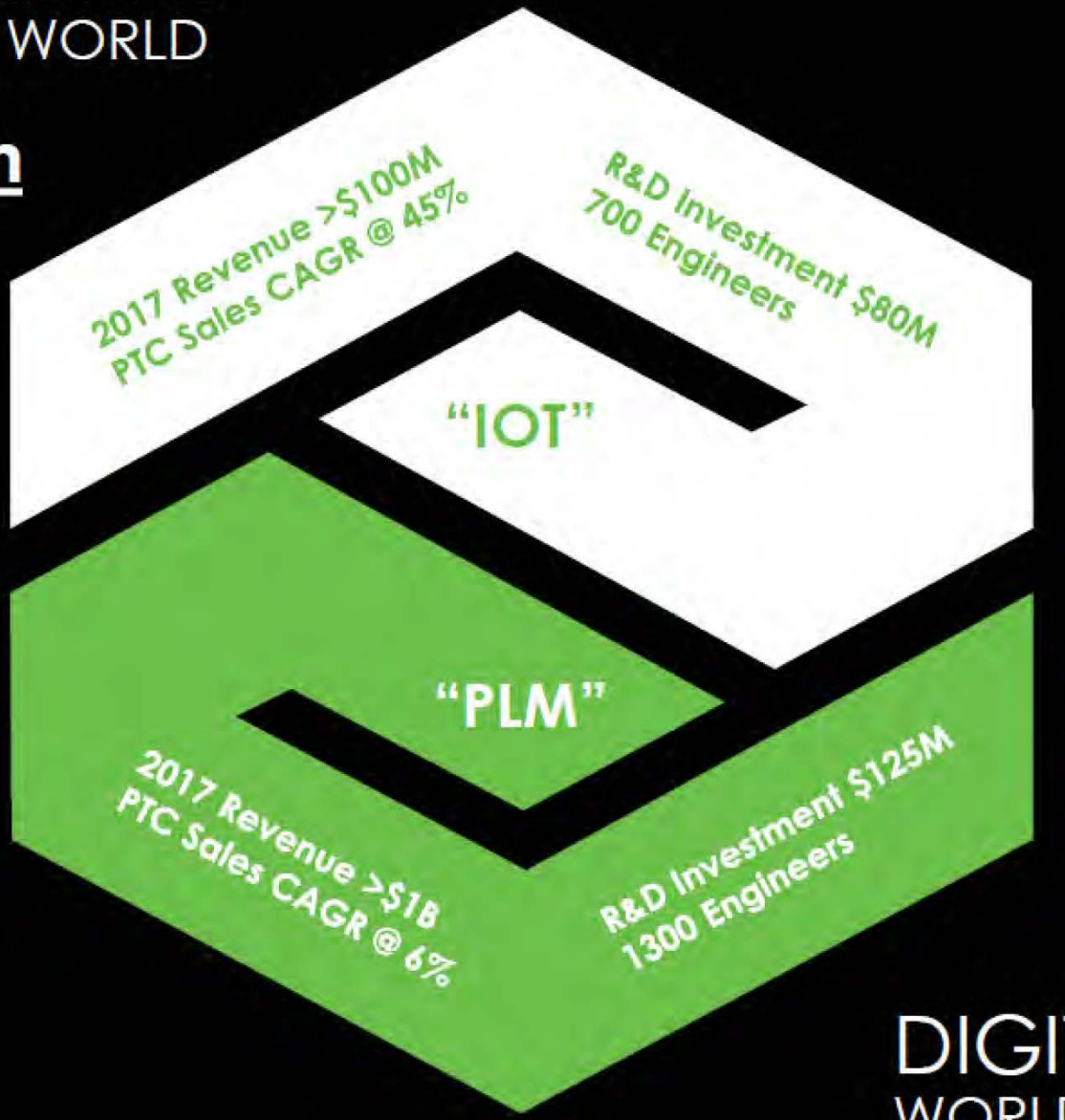
PHYSICAL
WORLD

Innovation Platform

IoT & Analytics | thingworx

AR/VR | vuforia

Industrial Connectivity | kepware



PLM Solutions

CAD | creo

PLM | windchill

ALM | integrity

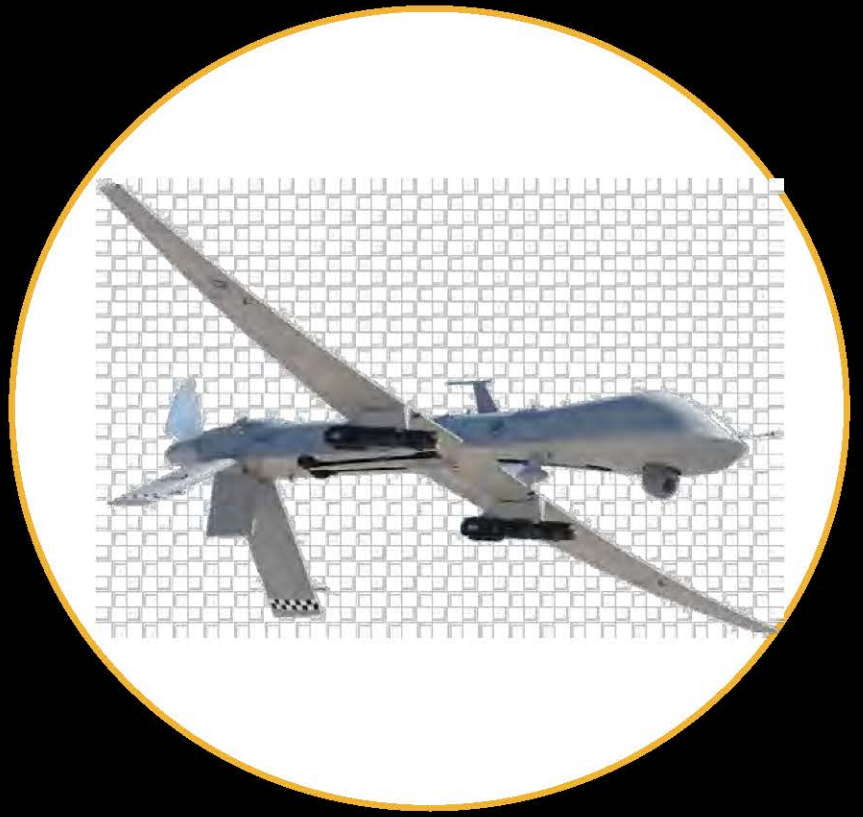
SLM | servigistics

DIGITAL
WORLD

PTC AUGMENTED REALITY (AR) SOLUTION **CAPABILITIES**

VISUALIZE

Enhance the user's **view** of the physical world with the overlay of **real-world** or **hypothetical digital information**



INTERACT

Manipulate digital graphics or extend a product through an **AR interface**

Simulate

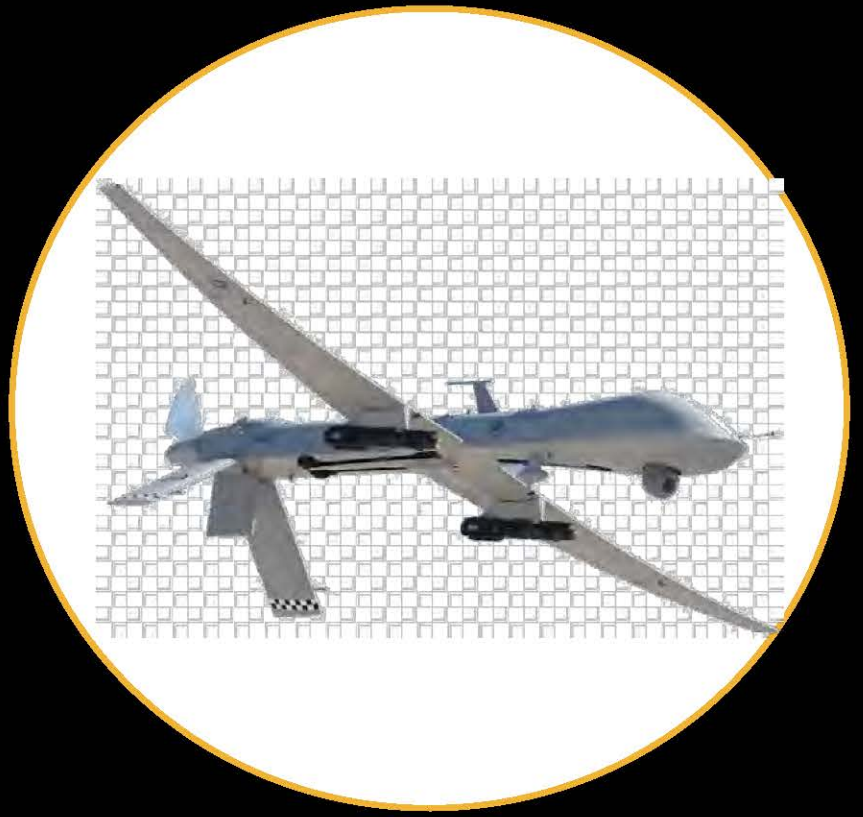
INSTRUCT

Train or guide users on how to perform a task through the overlay of **digital instructions** or **real-time expert guidance**

PTC AUGMENTED REALITY (AR) SOLUTION **USE CASES**

Service and Maintanance Operations

- Depot Scheduled Operations
- Remote (Field) Operations



Manufacturing

AR-guided assembly / disassembly work instructions

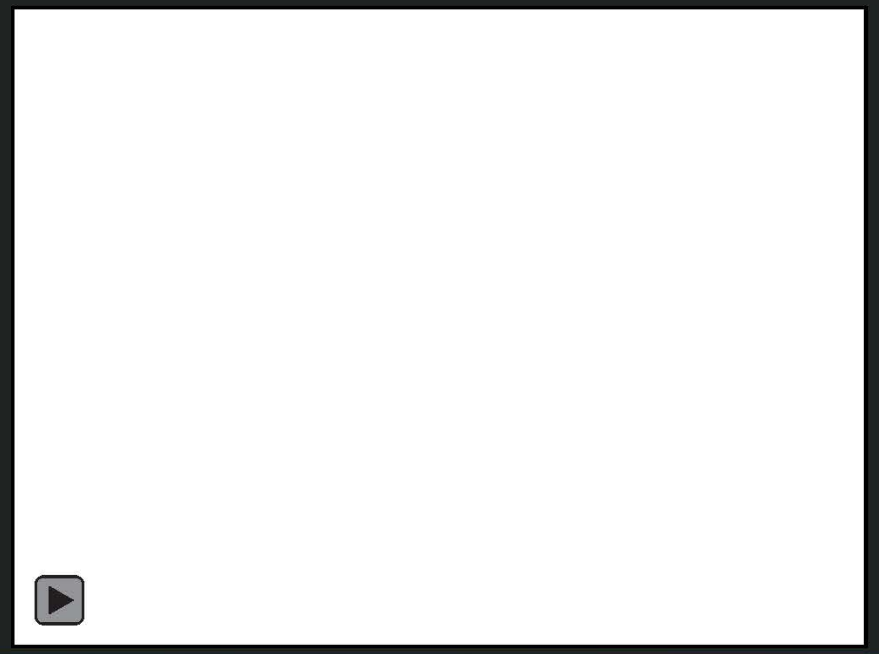
Industrial Workforce Training

AR-guided training and Immersive training
Content creation and scenario development for training

Bleed Air System

CFD Flow Lines

PreFlight Check



TurboFan Engine

DIGITAL INFORMATION IN CONTEXT WITH IOT DATA

APTIMA®
Human-Centered Engineering®

Reconciling the Science and Practice of Extended Reality Training

10/3/18

Ms. Janet Spruill
Vice President, Programs
Aptima, Inc.
Orlando, FL

APTIMA®
Human-Centered Engineering®

We Optimize Human Performance

Apply **Human Centered Engineering** methods and technologies to optimize the performance of humans in technology intensive, mission critical settings.

Performance Assessment Technologies | Improving organizational performance by optimizing individual and team performance

Intelligent Analytic Technologies | Combining data analytics with immersive, naturalistic user experiences to create seamless analyst-machine interfaces

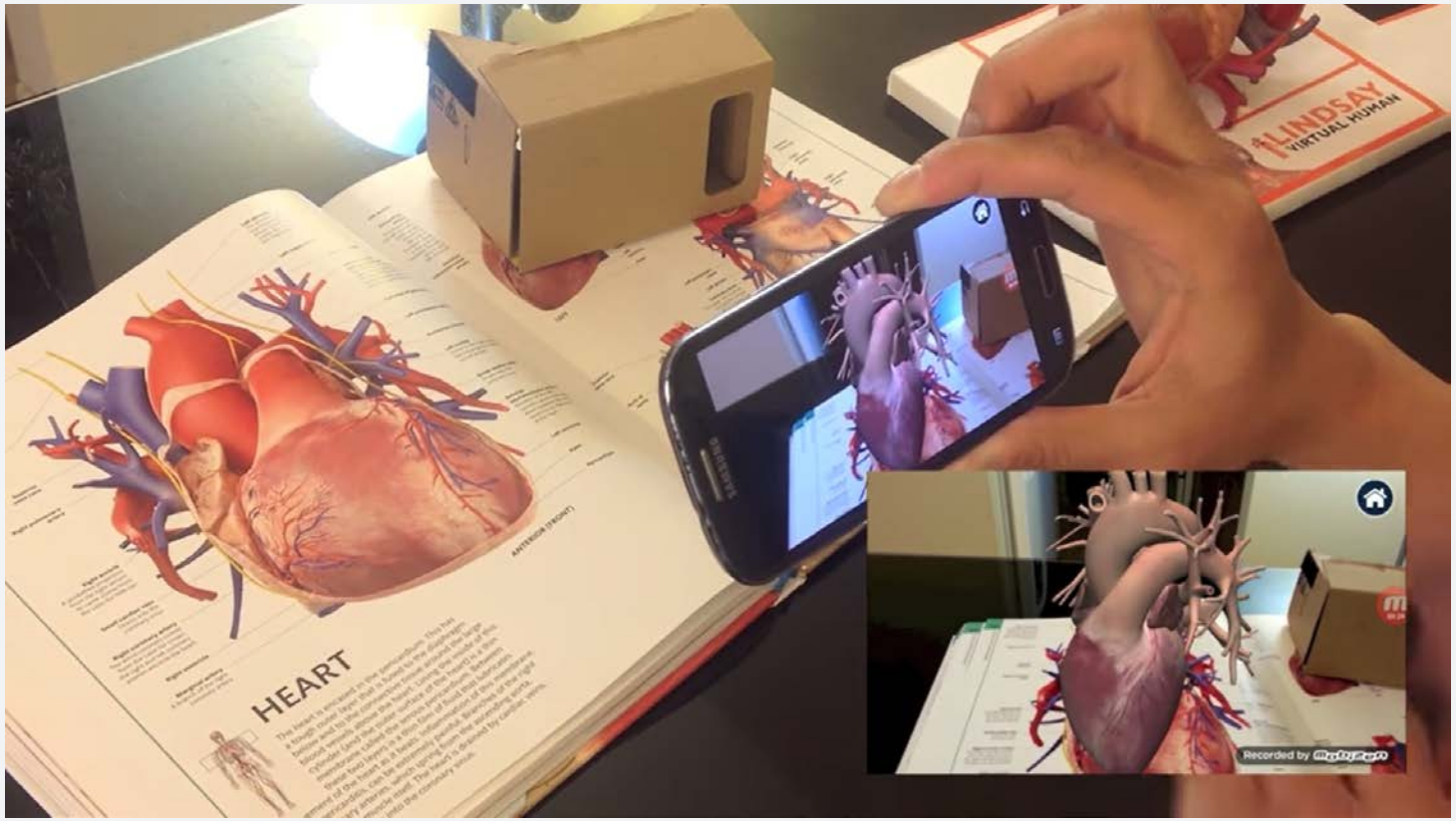
Performance Augmentation Systems | Precisely addressing gaps in performance and forming true human-machine partnerships

Learning and Training Systems | Delivering the right experience at the right time to foster development both within single learning events and over time

APTIMA®
Human-Centered Engineering®

The AR *fit* for Training

A **constructivist** learning environment that allows learners to physically interact with the environment and discover new knowledge on their own.



APTIMA®
Human-Centered Engineering®

The AR *fit* for Training

Realistic models that help the learner to build mental models by “seeing” physical equipment and schematics in 3D.

Learner performance increases when *how-it works knowledge is* provided with *how-to-do-it knowledge.*

The AR *fit* for Training

Sensorimotor feedback allows learners to interact with equipment using their body, especially their hands - critical for maintenance-related tasks.

APTIMA®
Human-Centered Engineering®

The AR *fit* for Training

An **inquiry-based** learning environment that provides freedom and support to think critically through problems without requiring an instructor.

APTIMA®
Human-Centered Engineering®

Why Align with Science of Learning?

- Instructional designers are generally less familiar with the unique affordances and limitations associated with AR technologies.
- A considerable gap exists between the published literature on AR and the larger science of learning community.
- **The inappropriate selection or implementation of augmented reality can hinder learning.**

Use Case – Navy CVN 78 Training

- Selected instructional strategies aligned with objectives for military maintenance training
- Focused efforts on training using XR technologies
- Applied to training for davit operators and maintainers

APTIMA®
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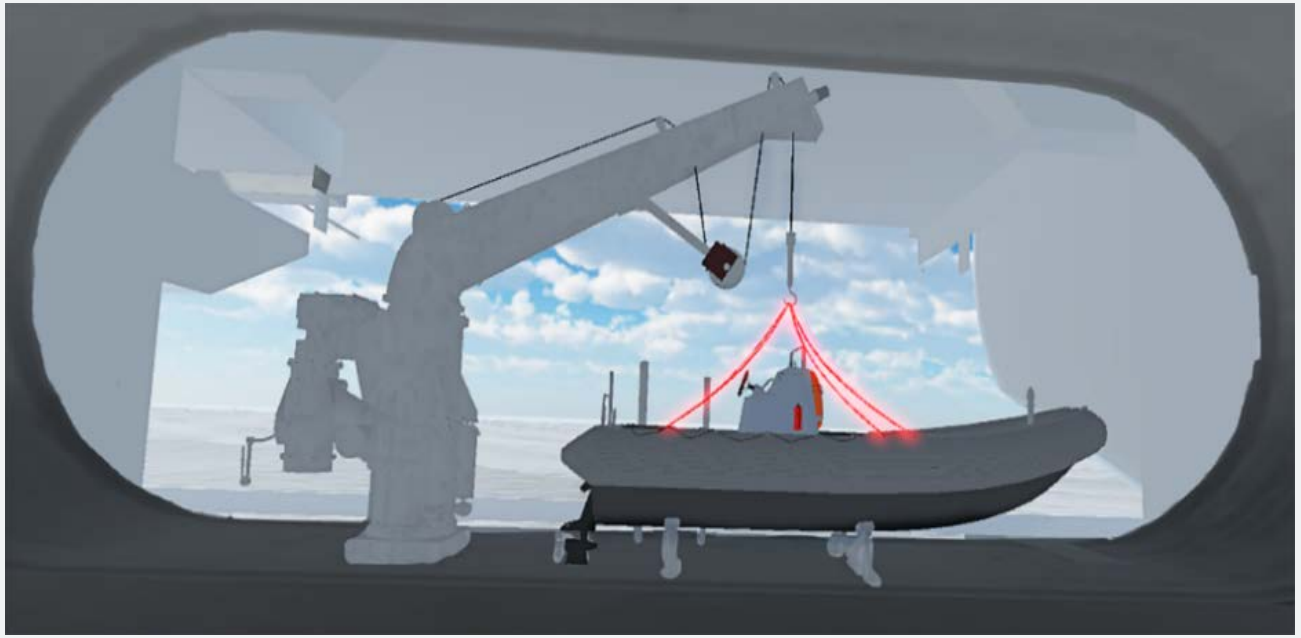
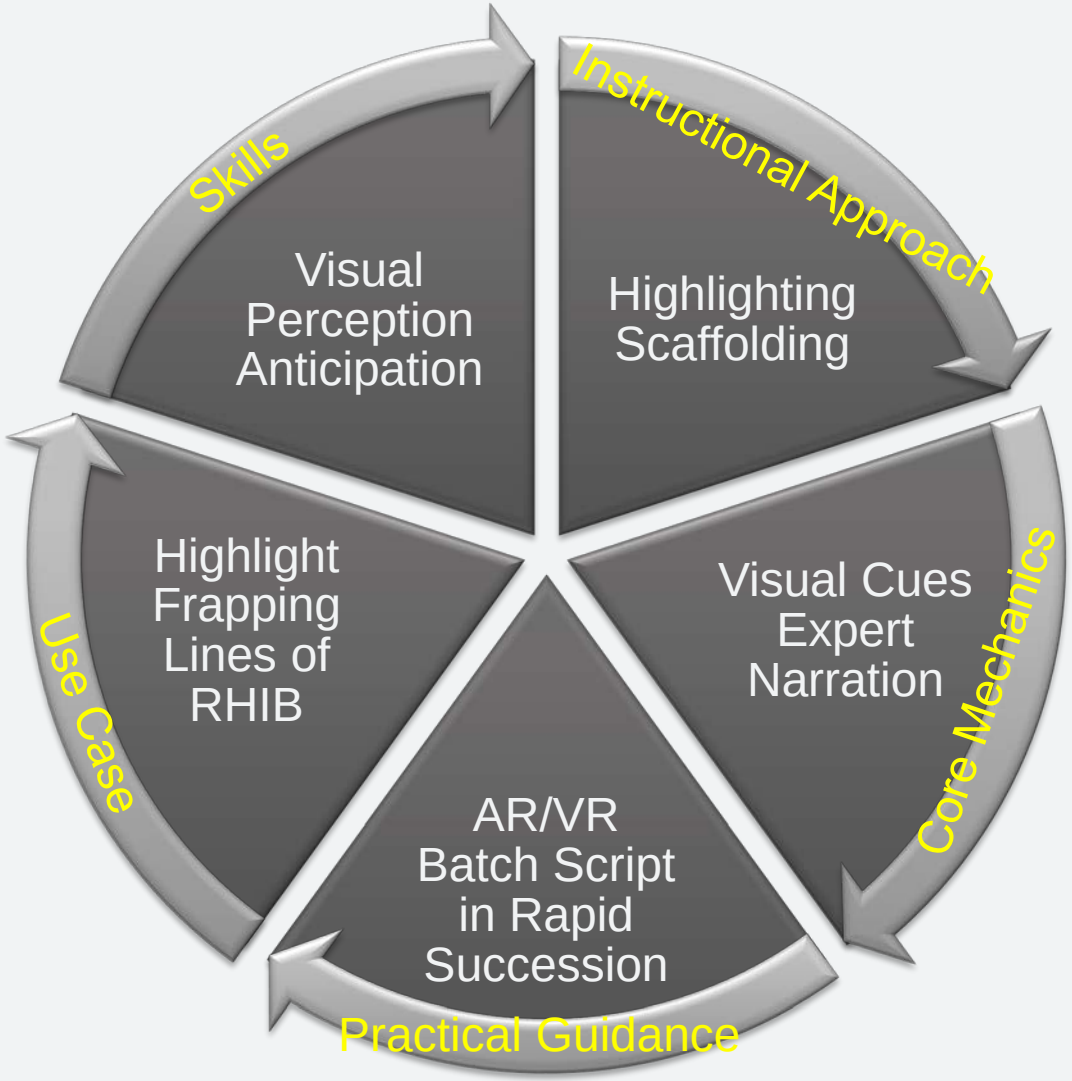
Strategy: Visual Orientation





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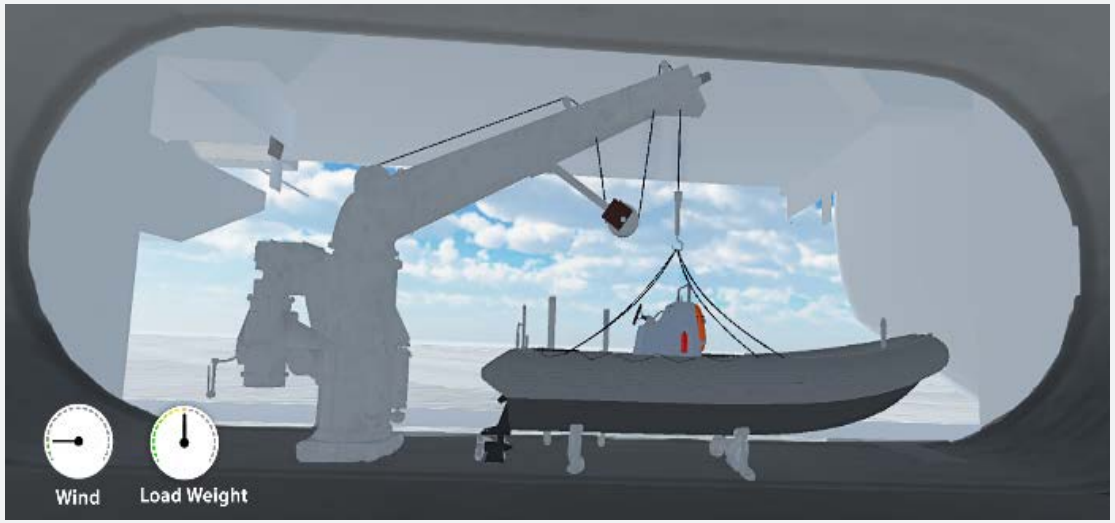
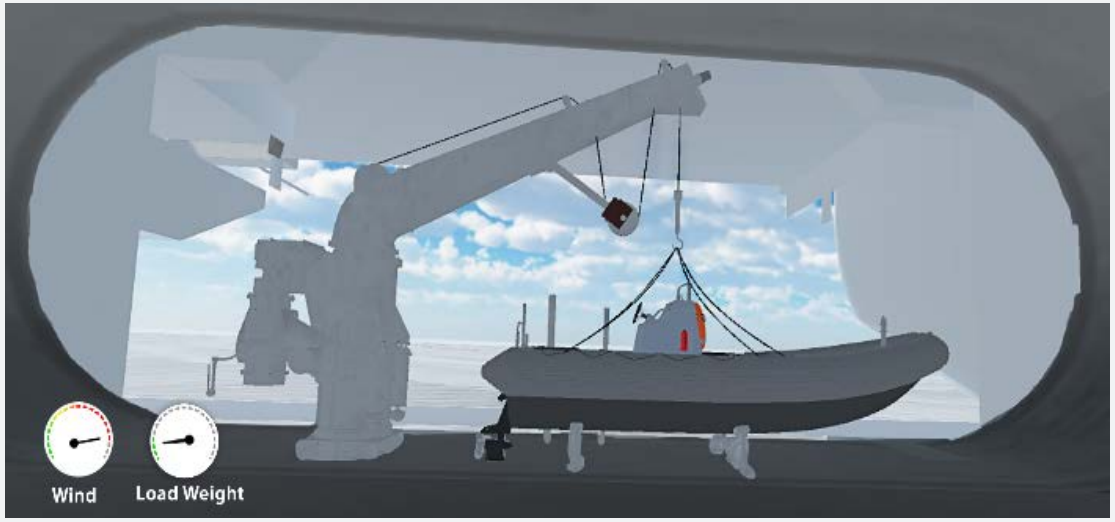
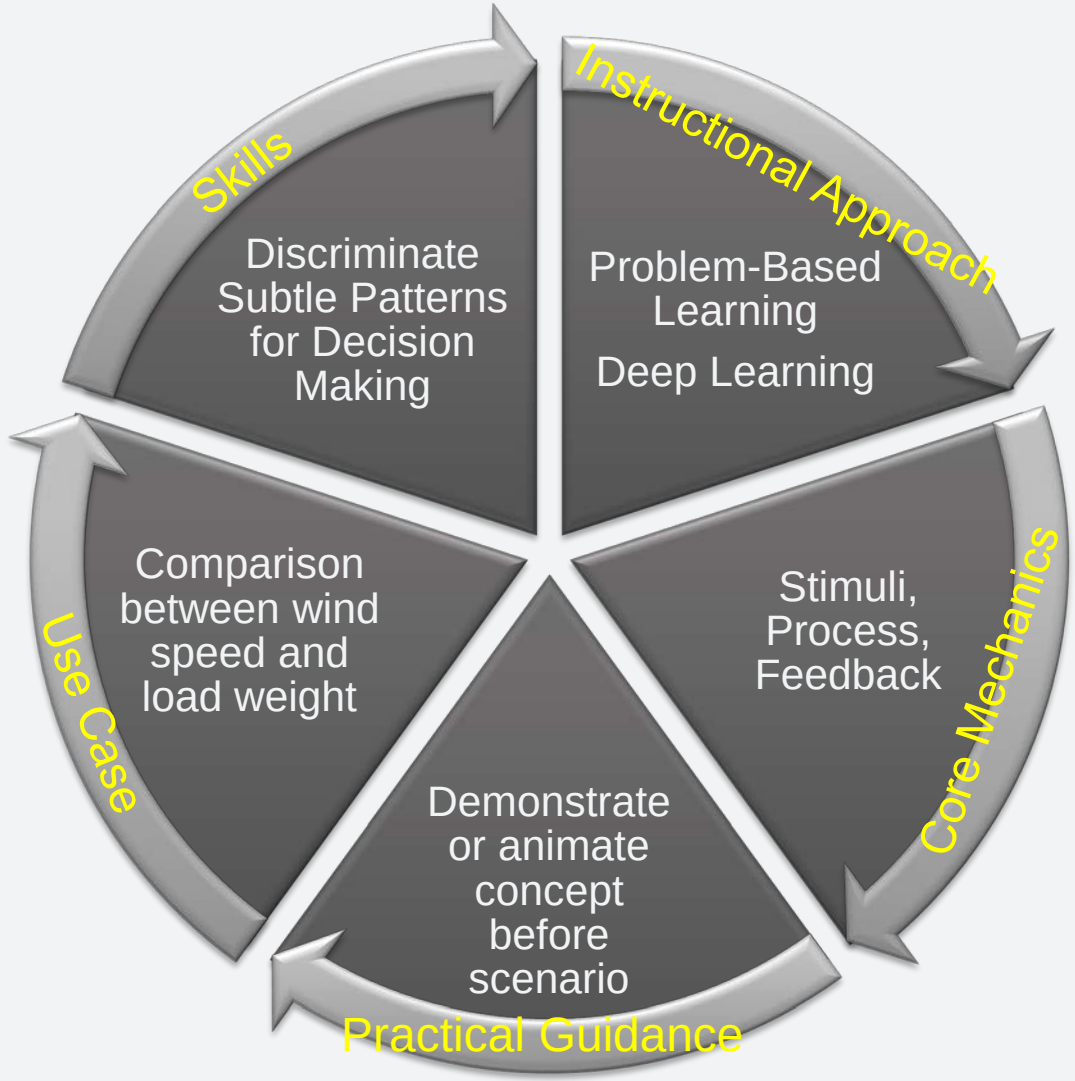
Strategy: Contrasting Cases

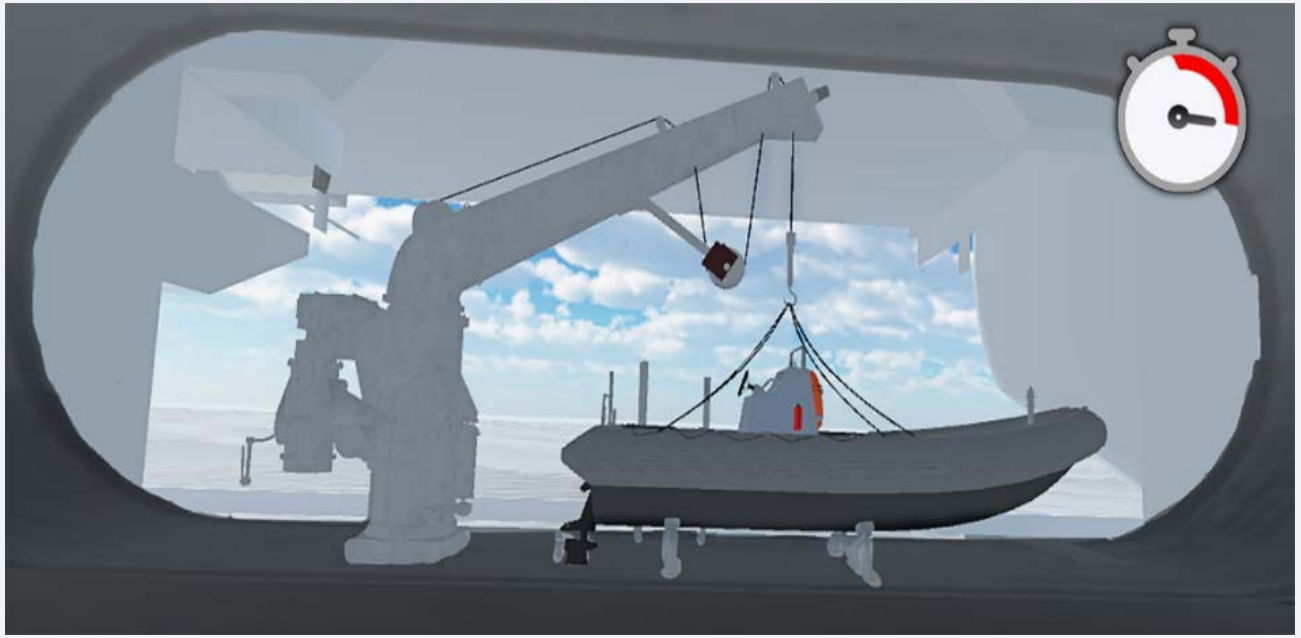






APTIMA®
Human-Centered Engineering®

Strategy: Stress Exposure



APTIMA®
Human-Centered Engineering®

AR Learning Design Pitfalls

1. Distraction – extraneous information, clutter
2. Disruption – flow is impeded with unintended or jarring transitions
3. Seduction – enticing details inadvertently guide a learner in the wrong direction
4. Gratuitous Gamification – gamification elements that inadvertently shift learner motivation away from the training intent

APTIMA®
Human-Centered Engineering®

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Augmented Reality MAINTENANCE AID

ARMA

AVATAR PARTNERS

Simplifying Complex Systems™

About Avatar Partners / Avatar Reality

- **Our Mission**
  - *Avatar Partners develops innovative solutions that Simplify Complex Systems™ to increase the efficiency, safety and effectiveness of equipment, systems, and processes for the Warfighter*
- **Develop Advanced Training Systems and Job Performance Aids**
  - Portable Interactive Electronic Publications
  - Interactive Multimedia Instruction
  - Augmented Reality Maintenance & Decision Aids
  - Additive Manufacturing & 3D Scanning
  - Virtual Reality
  - Holographic Reality

AR Aligns With How Users Learn

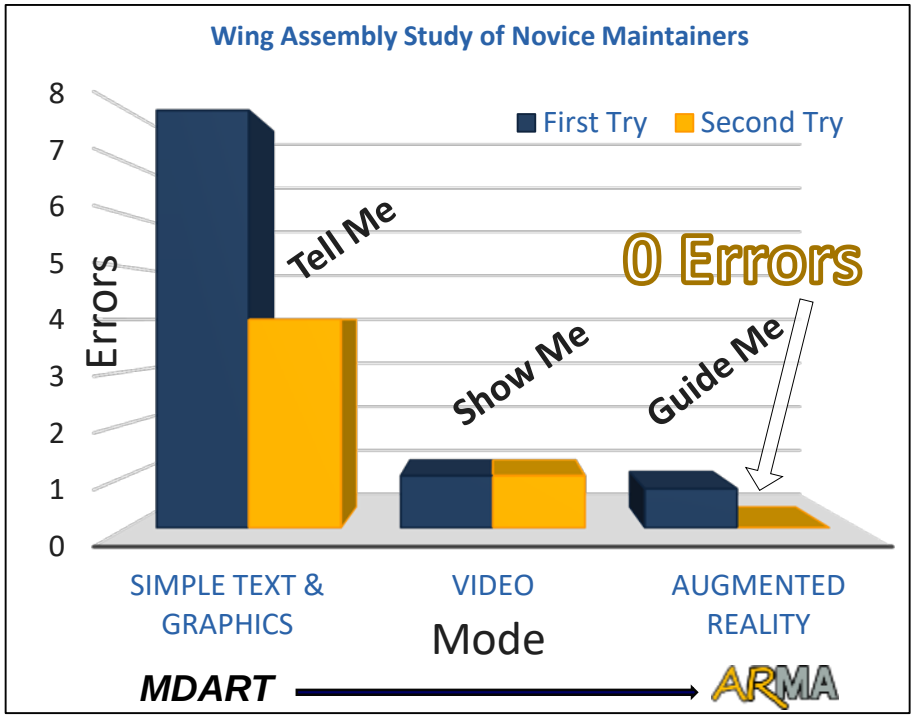
*Early responses indicate ARMA prototype of Aircraft Electrical System troubleshooting task Reduces Time to Troubleshoot from **4 hours to 30 minutes**.*

- Hands-Free Training Tool and Field Performance Aid using Augmented Reality

Benefits

- Improves Unit Readiness
- Increases Warfighter Safety
- Reduces Total Ownership Cost
  - Reduces Time to Complete Task up to 90%
  - Reduces Errors to Zero
  - Reduces Time to Train*
- Improves Quality

Boeing / IOWA State Study



ARMA – Unit Readiness

ARMA is used by operators and maintainers to access and interact with aircraft / ship / vehicle specific information including:

- Maintenance Actions
- Troubleshooting
- Part Information
- Controls and Indicators
- Theory of Operation
- Illustrated Parts Breakdown
- Wiring
- Remote Assistance

ARMA overlays on the actual system or on a scaled down training model through the user's viewing device

ARMA Use Case

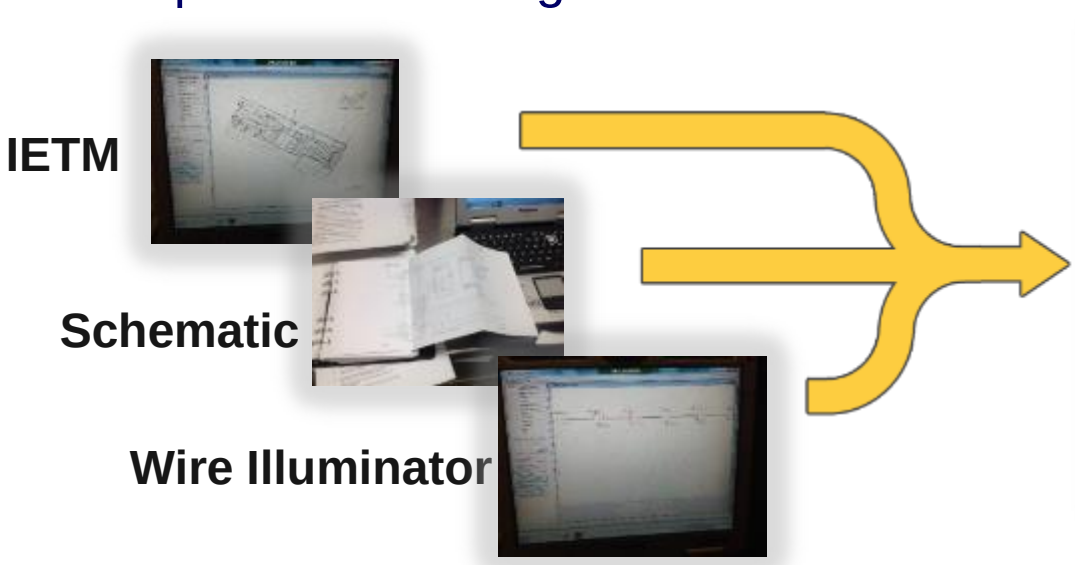
Electrical System Troubleshooting & Repair

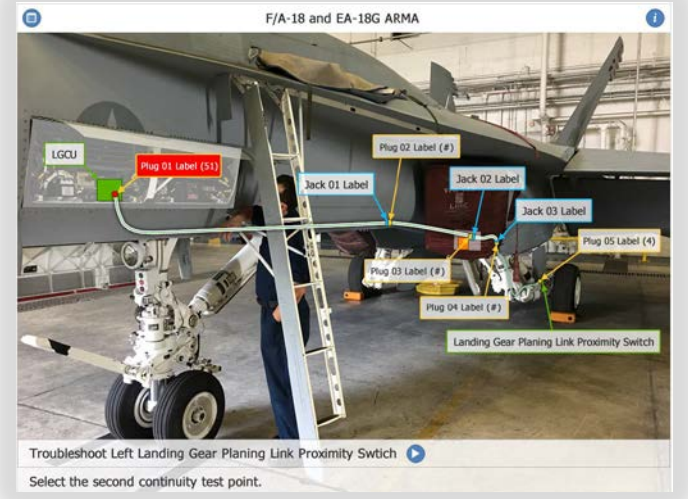
Current Pain Points:

- Task requires 3 non-integrated sources - IETM, Wire Illuminator, Schematic
- Tasks to gain access to test points not identified
- Wire Illuminator visuals cause confusion in wiring orientation
- Lack of visuals showing necessary views of connection points
- Time intensive testing
- Strict time constraints!
- Error prone due to misinterpretation of instructions and 2D illustrations

ARMA Features

- One Stop Shop for all troubleshooting and repair
- Hands-Free Field Performance Aid and Training Tool in One
- Component and wiring visuals displayed as 3D overlays on the aircraft
- Color coded and filterable
- Reference additional required maintenance tasks
- Architected to integrate to Procurement
- Provides Maintenance Task Validation
- Supervisor Viewing in Real-Time

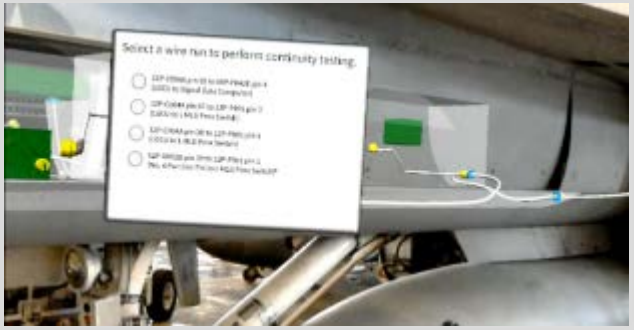


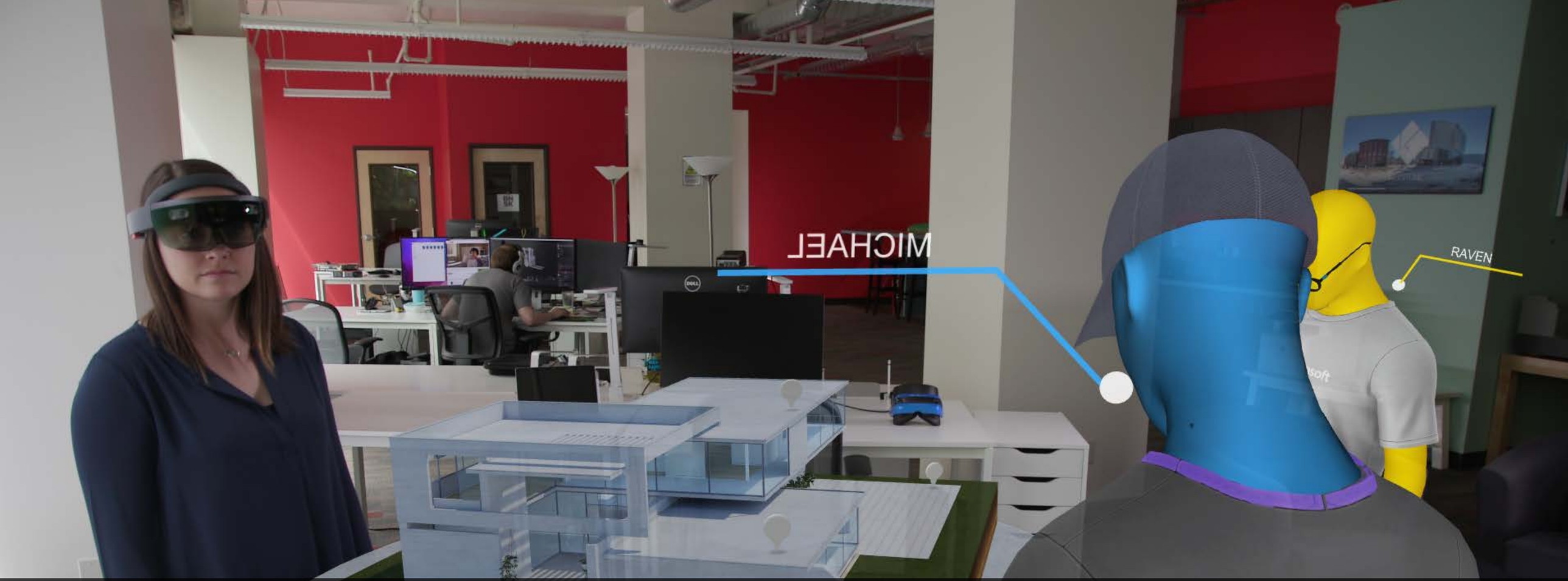


ARMA

ARMA Technology Summary

- **High Fidelity & Precision**
  - Object Tracking - No Marker Required
  - Solution for AR Jitter
- **Open Source / Rapid Updates**
  - S1000D Common Source Database Architecture
  - Modular / Agile Design
- **Disruptive Technology**
  - Driving Commercial Industry to Provide Warfighting Solutions
    - PTC / Vuforia
    - Microsoft





NDIA 2018 AUGMENTED REALITY WORKSHOP

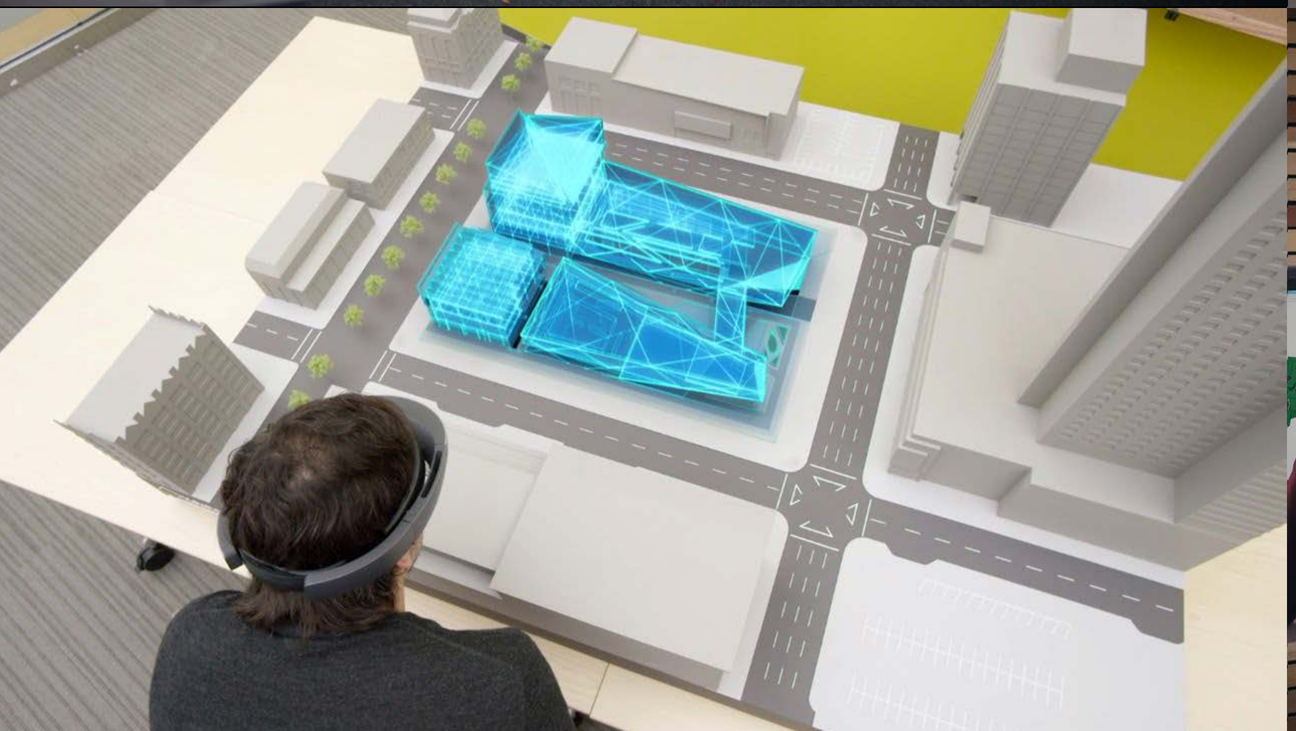
Prism by Object Theory Demo

Raven Zachary, Object Theory

3 October 2018


object theory
We solve enterprise problems with mixed reality.


John

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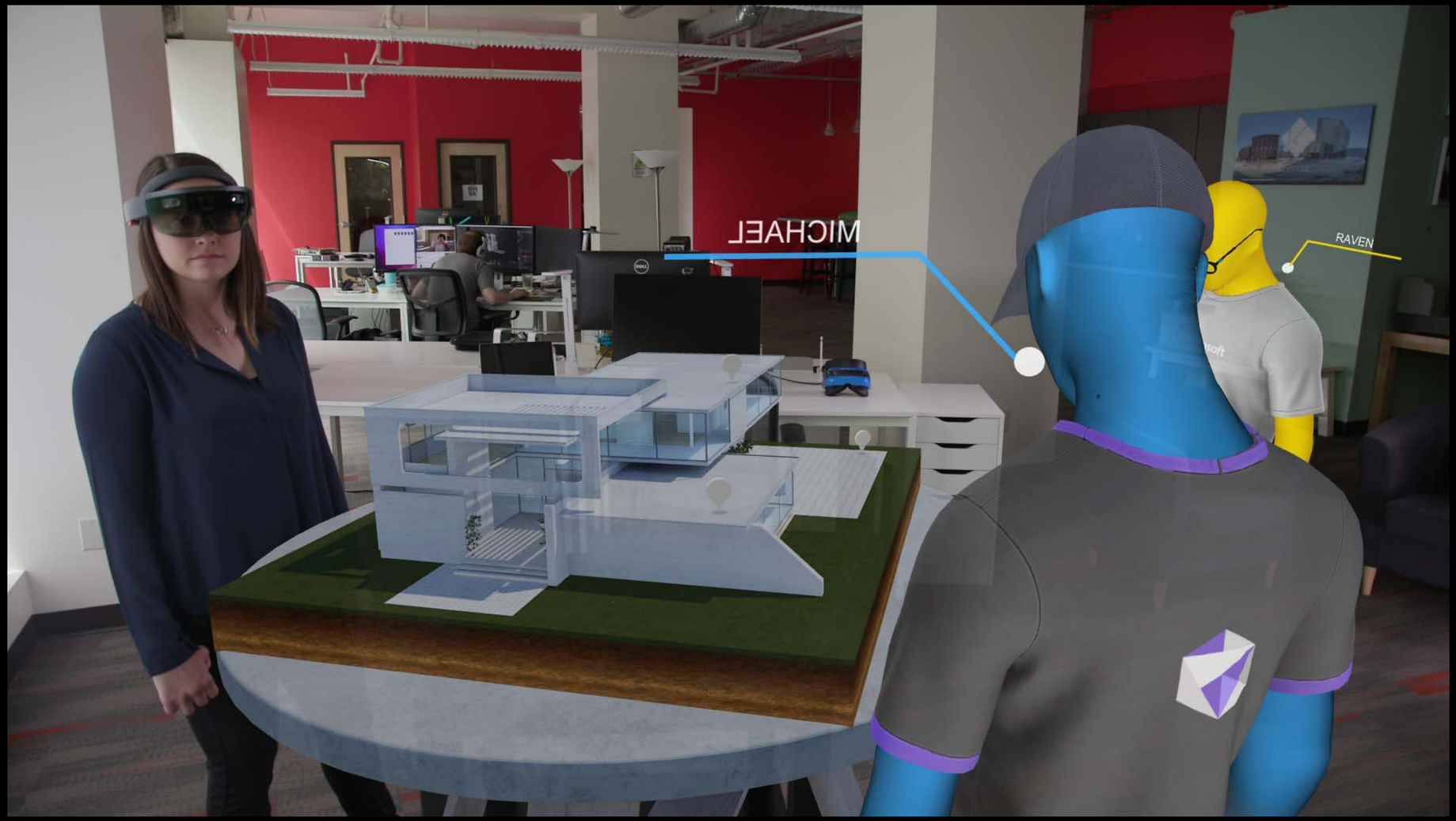
Michael Sagan

object theory



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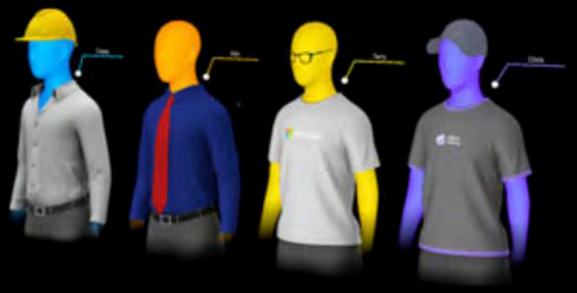
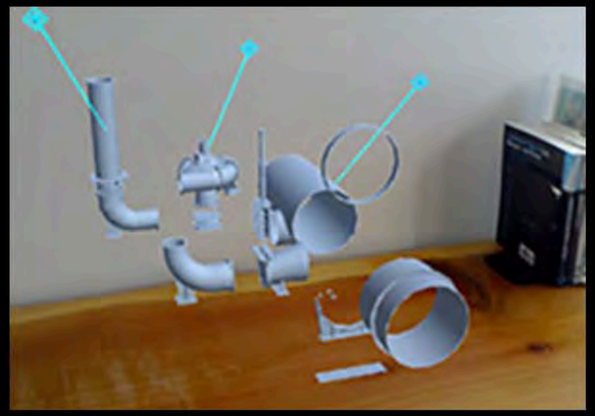
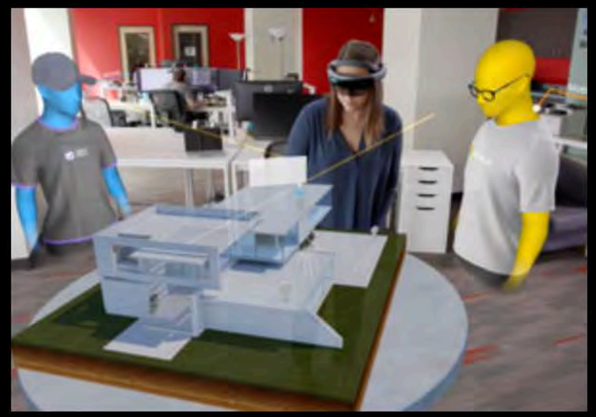


Customized avatars



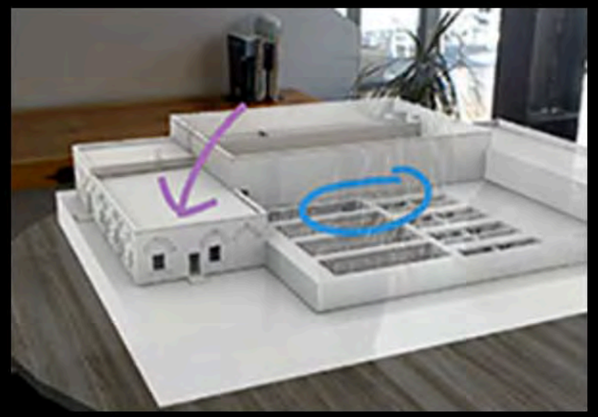
Display of 3D models

Multi-platform



Spatial audio chat

True-scale mode



Annotations

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Remote Collaboration with Mixed Reality

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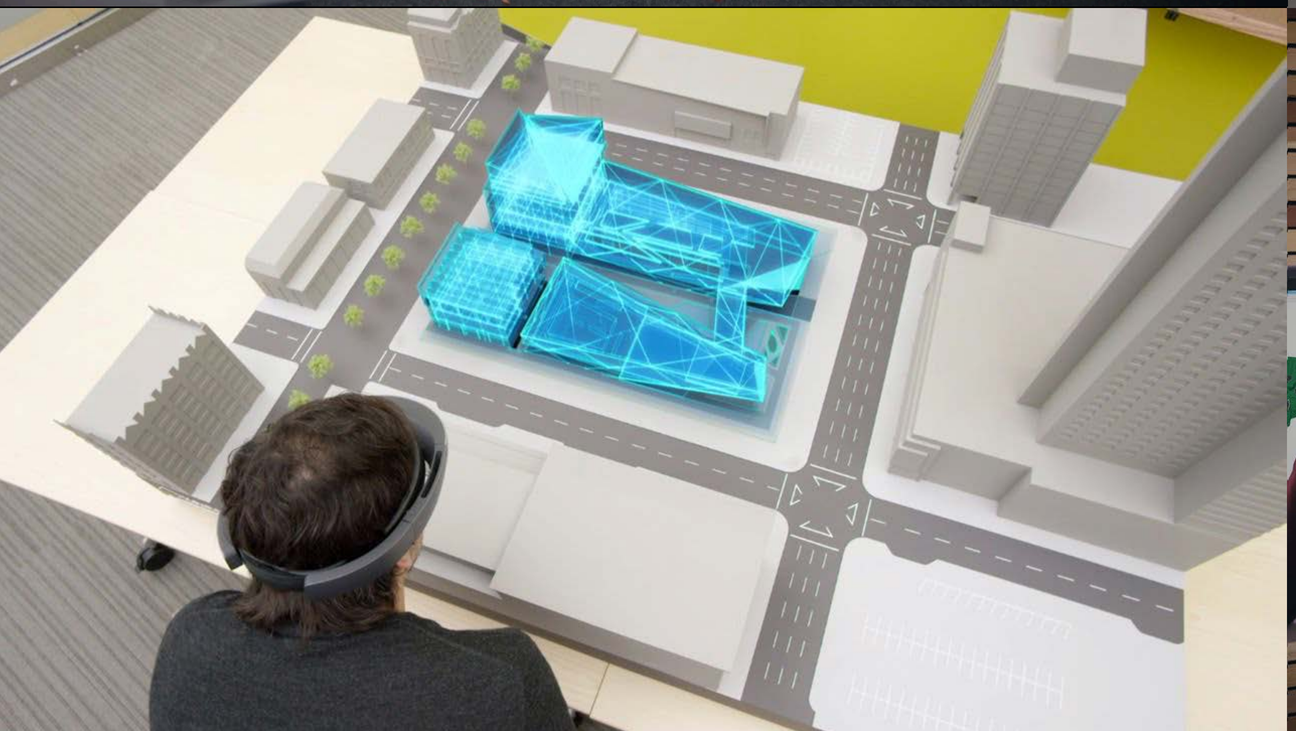


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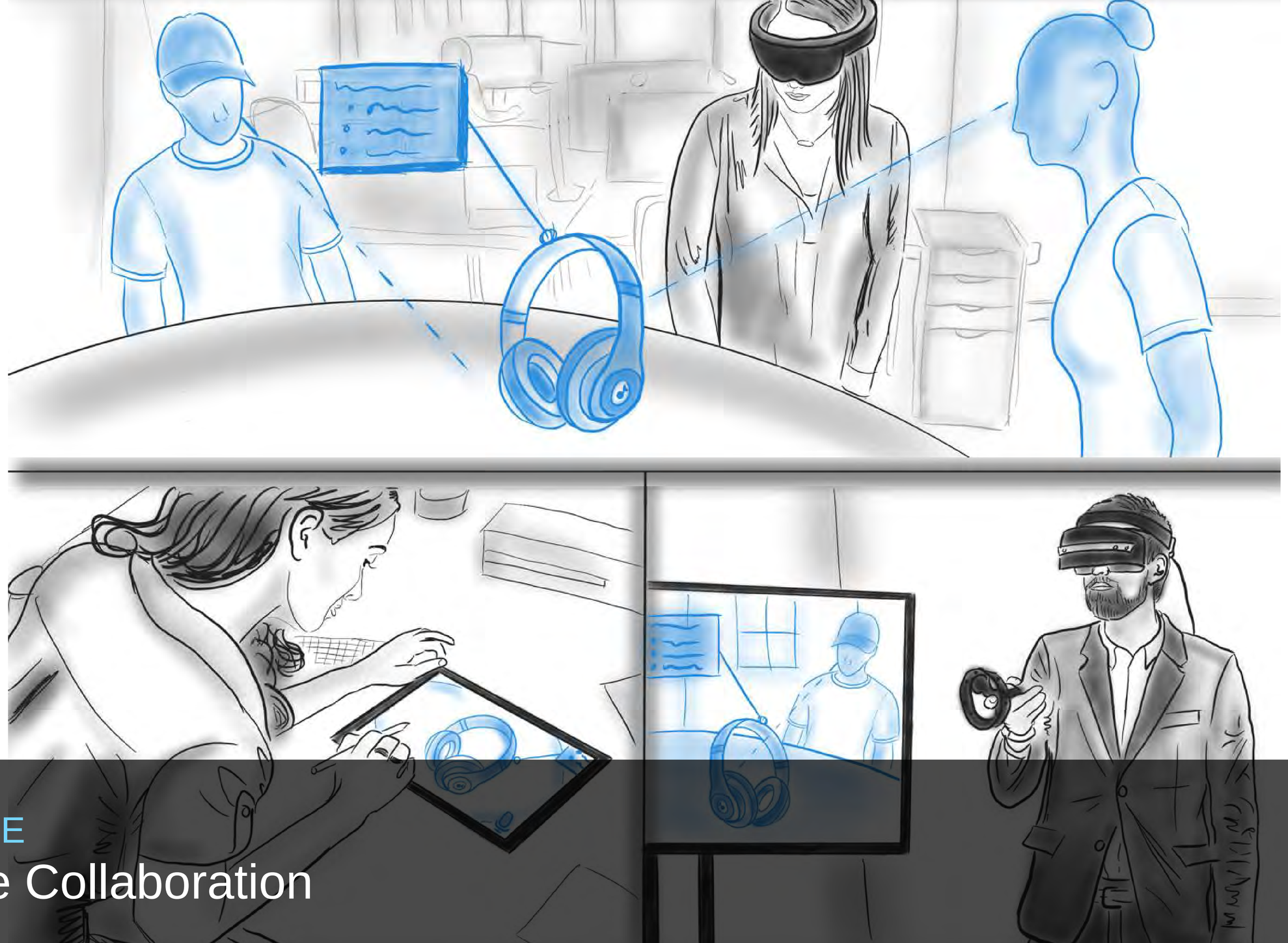
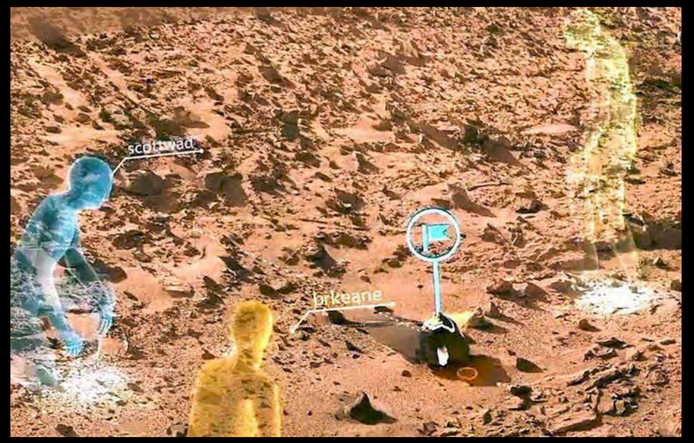


USE CASE

Remote Collaboration

object theory

Shared Experiences in Mixed Reality



Two or more people experiencing the same holographic object(s) and/or environment(s)

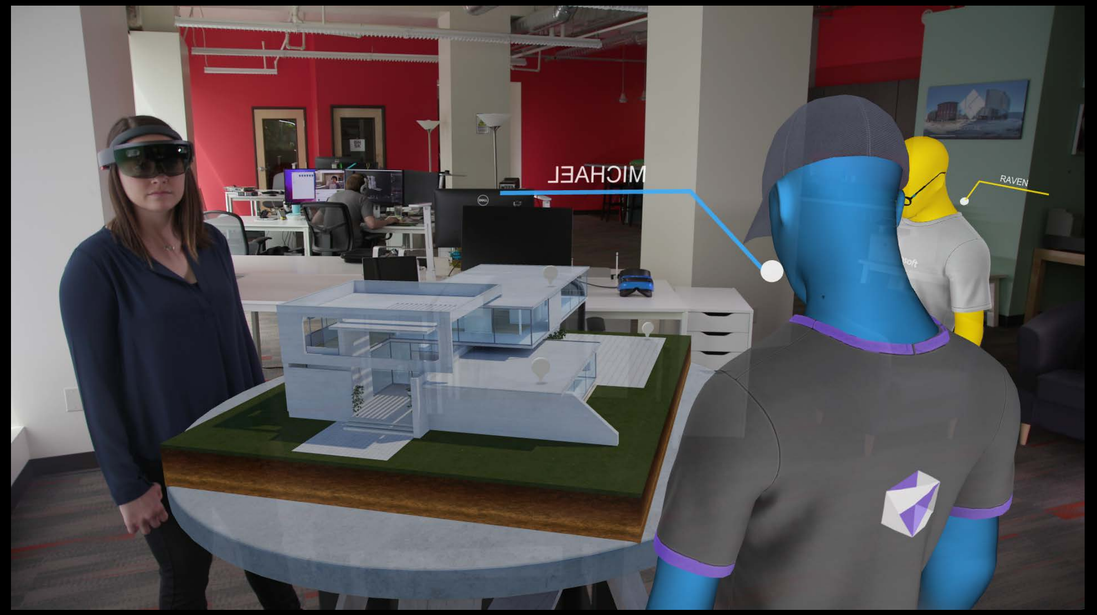
People • Places • Things

object theory

Types of Shared Experiences

Co-located Collaboration

Remote Collaboration



REMOTE COLLABORATION WITH MIXED REALITY

object theory

THE BUSINESS CHALLENGE

When dispersed teams collaborate on 3D problems, it’s difficult to establish an accurate shared context and convey intent with existing 2D tools such as screen sharing, which can result in costly mistakes.

MIXED REALITY SOLUTION

Collaborators feel a sense of presence, plus spatially-relevant annotations and markers can accurately convey intent to establish a more accurate shared context resulting in more informed decisions and fewer mistakes due to miscommunication.

REMOTE COLLABORATION WITH MIXED REALITY

object theory

WHY MIXED REALITY?

- Gaze indicates focus and intent
- 3D Spatial sound provides cues and sense of presence
- Stereoscopic vision improves comprehension
- Spatially-relevant annotations provide critical context
- Ability to see content while conversing/collaborating

REMOTE COLLABORATION WITH MIXED REALITY

object theory

POTENTIAL CHALLENGES

- Geometry complexity
- Outdoor use / safety compliance requirements
- Ubiquitious access to Internet
- Large-group conversations

REMOTE COLLABORATION WITH MIXED REALITY

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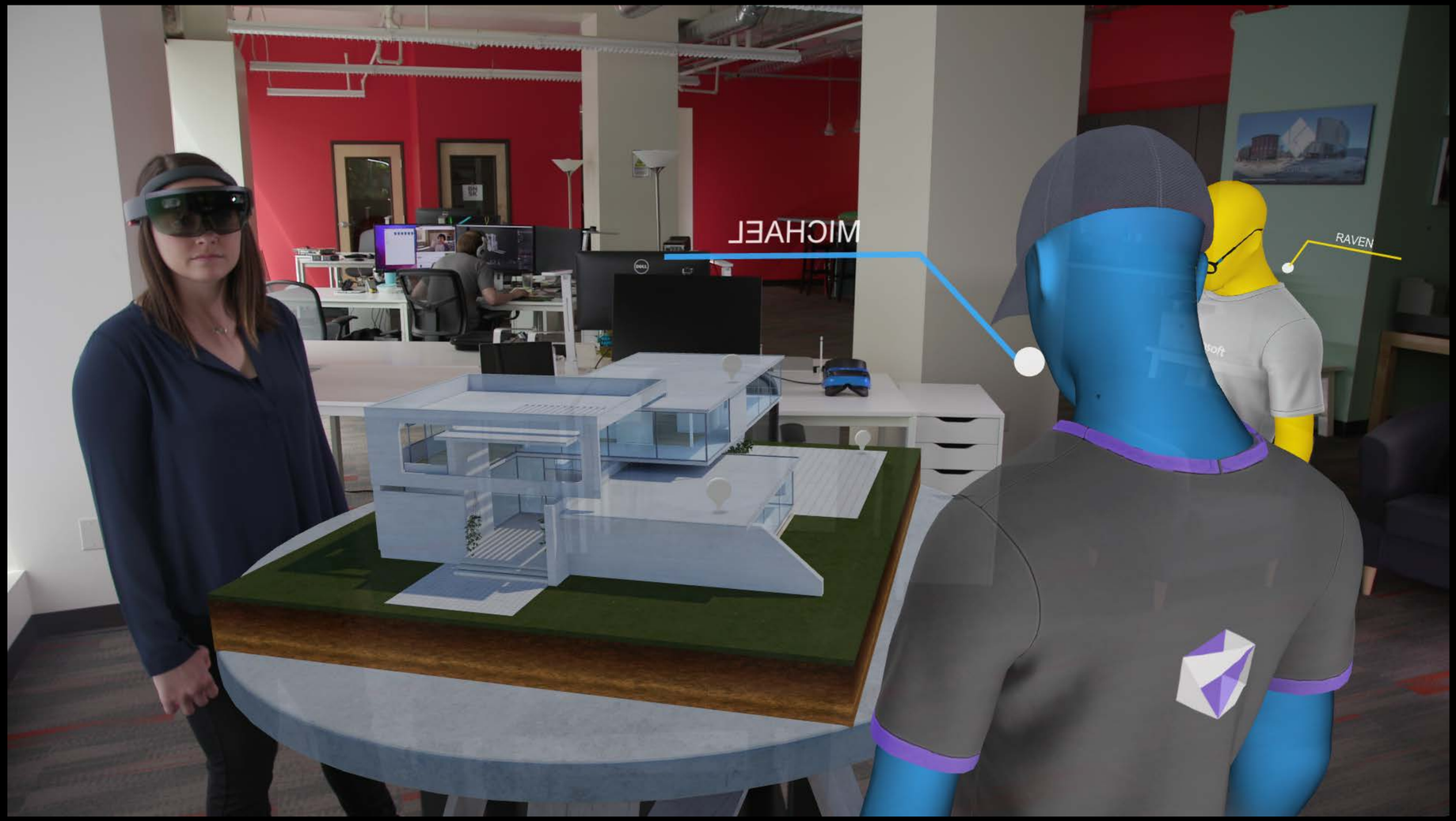
REMOTE COLLABORATION WITH MIXED REALITY

object theory

DESIGN CONSIDERATIONS

- Create presence with avatars
- Provide for human comfort
- Make roles and control clear
- Make intent and focus obvious
- Maintain object consistency
- Create pleasant transitions
- Adapt to, or be consistent across, environments
- Think about levels of persistence

object theory



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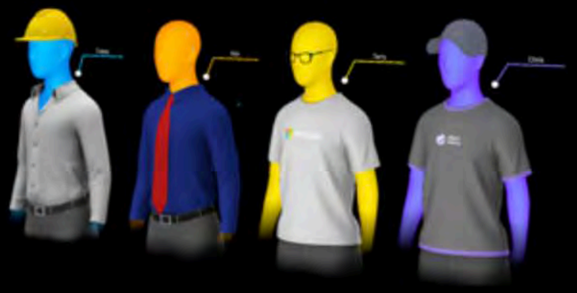

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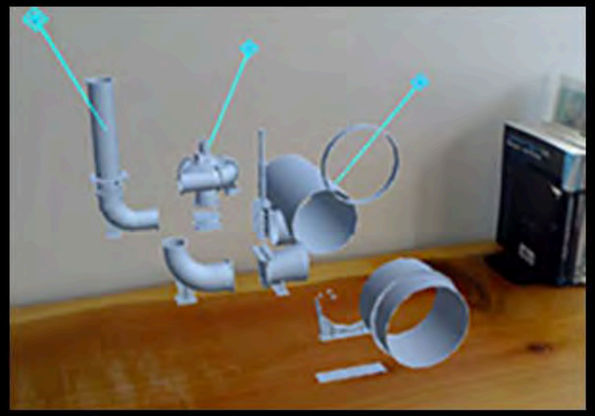

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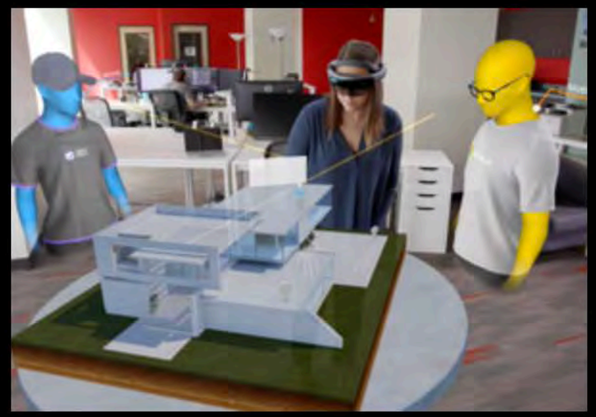

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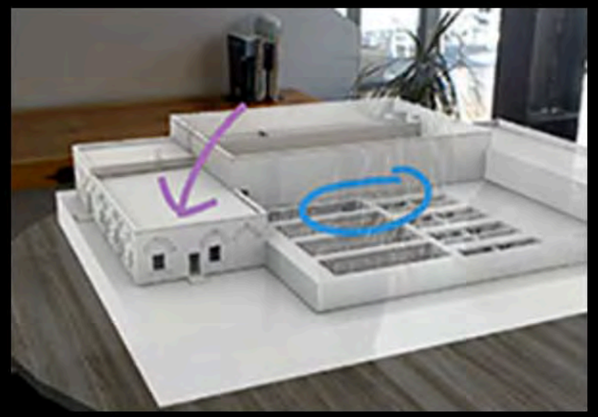

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