

# SAE 2014 Augmented and Virtual Reality (AR/VR) Technologies Symposium

## Technical Session Schedule

As of 11/24/2014 07:41 pm

Tuesday, November 18

Day One: AR

Session Code: ARVR1

Room I, II, III

Session Time: ALL DAY

Time	Paper No.	Title
8:30 a.m.	ORAL ONLY	<p><b>Keynote: Economic Benefits: Executing Augmented Reality &amp; 4D Within Product Lifecycle</b></p> <p><i>Industrial applications of augmented reality are moving from innovation to scalability. As a key enabler of the 'Industrial Internet', projected productivity gains to the global GDP are expected well in to the trillions over the next decade. Andy Lowery, president of DAQRI and former Chief Engineer for Raytheon's Electronic Warfare Systems, will discuss key industry trends including the developing scalable augmented reality infrastructure, the emergence of tools that let manufacturing and defense businesses integrate AR into their existing workflows, and the next generation of AR-enabled hands-free devices. Studies and pilots have shown incontrovertibly that intuitive AR user interfaces can measurably improve productivity across a variety of industrial applications. Andy will discuss real-world examples of this in action in design, pre-viz, operations, maintenance, training and safety.</i></p> <p>Andy Lowery, Daqri</p>
9:00 a.m.	ORAL ONLY	<p><b>Changing IT Culture Within an Enterprise</b></p> <p><i>Changing IT Culture within an Enterprise : Introducing VR &amp; AR application in an industrial context is a technical challenge, but not only. This presentation will highlight some difficulties and contradictions we can have during deployment of VR &amp; AR applications. From societal impact to cyber security you will have to address a large variety of questions and remarks. It could limit you application perimeter or increase the development time.</i></p> <p>Francois Guillaume, Airbus Group</p>
9:30 a.m.		<b>BREAK</b>

10:00 a.m.	<b>ORAL ONLY</b>	<p><b>Augmented Reality and Advanced Visualization for Manufacturing Cost Reduction</b></p> <p><i>This presentation will discuss current development and pilot implementation activities in Augmented Reality (AR), 3D object recognition and other machine vision and advanced visualization techniques for manufacturing in Boeing. It will address recent technical developments in these areas, in addition to illustrating the business case supporting research investment and how the technology will lead to cost reductions and increased quality in product assembly and integration.</i></p> <p><i>&lt;P&gt;The talk will cover recent core AR technology development including advancements in stability, usability, accuracy, tracking, calibration, scalability and display devices (such as the Oculus Rift and Google Glass), in addition to specific work on multiple Boeing programs. The discussion will include new advanced 3D shape based tracking technology currently being developed, and how this will be integrated with the AR tool.</i></p> <p><i>&lt;P&gt;Finally, the presentation will provide an overview of the business case supporting these technologies, illustrating how their adoption leads to cost reductions. Results of an AR controlled user study conducted in partnership with Iowa State University will be presented, along with an analysis of S&amp;IS data to estimate cost savings in the factory.</i></p>
10:30 a.m.	<b>ORAL ONLY</b>	<p><i>Paul Robert Davies, Boeing</i></p> <p><b>Photorealistic Immersive Visualization: Judging by Appearance is a Good Thing</b></p> <p><i>People draw on their experiences and generalize their beliefs about most everything, forming likes and dislikes from prior encounters. This is true of our interactions with other people, as well as for interactions with products. These experiences form our beliefs regarding what is “right” for our individual perception of quality. These perceptions are often visceral, and can be a strong motivator for or against a purchase of a vehicle.</i></p> <p><i>&lt;P&gt;Visual perception and physical connection to a vehicle are important determinants in the assessment of quality. Though it is mathematically impossible to determine how we see things, we can strive to provide an immersive experience where perception is based on a proper representation of color, illumination, spatial relationships, lights, shadows, movement, etc. If the immersive experience is realistic, the brain associates cues based on prior experience and we can then evaluate a product as a potential customer would in the showroom (or in any environment).</i></p> <p><i>&lt;P&gt;Elizabeth will detail how Ford uses immersive design and engineering to quantify the emotional connection between you and your car. She will review the principles of “judging by appearance”, and how Ford quantifies these judgment calls from an immersive review into data that improves vehicle quality.</i></p>
11:00 a.m.	<b>ORAL ONLY</b>	<p><i>Elizabeth S. Baron, Ford Motor Co.</i></p> <p><b>Uses of AR &amp; VR for Design and Physical Process Reviews</b></p> <p><i>This presentation will cover the technologies used to perform 1:1 scale part design and assembly reviews along with human motion capture for investigating physical processes in an immersive 3D display environment. The basis of this capability uses a Mechdyne technology to re-render the CAD model from Tecnomatix (or Teamcenter, or NX) with no data translation into a large scale immersive display with stereo and user centered perspective viewing. Using the Microsoft Kinect the viewer can also be tethered to the virtual human model and perform physical activities while looking for collision detections or other interferences that may impede the work during manufacturing, assembly, or service.</i></p> <p><i>Kurt M. Hoffmeister, Mechdyne Corporation</i></p>

- 11:30 a.m.**      **ORAL ONLY**      **VR Heavy Duty Application at Caterpillar**  
*Immersive visualization has become an integral part of Caterpillar's global product development process. This talk will discuss how Caterpillar applies immersive visualization to aid product development and will cover lessons learned from the companies 20+ years of experience with the technology.*  
*Galen W. Faidley, Caterpillar Inc.*
- 1:30 p.m.**      **ORAL ONLY**      **Affordable AR/VR: Key to Mid-Tier Supplier Adoption**  
*Cost and function are barriers that prevent mid-tier suppliers from realizing the benefits of advanced visualization technologies. This session will highlight the shifted needs and value proposition for the mid-tier supplier, and it will overview how Rockwell Collins has taken a "Do It Yourself" approach to accomplish flexible and affordable AR, VR, and Interactive Desktop Visualization with broad adoption.*  
*Ryan Wheeler, Rockwell Collins Inc.*
- 2:00 p.m.**      **ORAL ONLY**      **Accessible VR: Implications of Consumer Systems in a Professional World**  
*Virtual Reality systems are quickly hitting the consumer market at a significantly reduced price point. This will have an impact across many industries, including the mobility market. More than just a reduced cost implication, we will examine the benefits the newly accessible technology will have on everyday operations where usage will be at the desk and in the field versus the lab, product design where lower-cost technology does not compromise quality, and hands-on employee training that can be conducted in boundaryless classrooms.*  
*Jason Jerald, NextGen Interactions*
- 2:30 p.m.**      **ORAL ONLY**      **John Deere uses AR/VR Techniques to Drive Productivity and Quality Improvement**  
*Augmented reality has tremendous value in many aspects of life. Applications in a traditional manufacturing facility bring with it opportunities but also unique challenges. We will explore the value which AR can expose and open up to improve productivity and cost controls. The presentation will show how AR technologies can be used for work cell planning and layout, dynamic work instruction presentation to operators, and mistake proofing assistance.*  
*Craig Sutton, Deere & Company*
- 3:00 p.m.**      **BREAK**
- 3:30 p.m.**      **ORAL ONLY**      **Virtual Experience**  
*The presentation will hopefully cover research that JLR are doing with the UK universities to progress the virtual experience, thus enhancing the virtual sign off process. It will cover how this research is bolstering current effective virtual work practices, it will touch on the benefits and justification we use to develop and invest, whilst also highlighting the passion of virtual reality.*  
*Brian Waterfield, Jaguar Land Rover*

- 4:00 p.m. ORAL ONLY** **Augmented Reality Research in Product Development and Manufacturing**
- Augmented reality (AR) is more and more embraced by industry, especially in Europe. Engineering domains such as product development and manufacturing found their use cases and benefits. Despite this success in the recent years and its growing adoption, the use of AR has not reached ubiquity. The talk will introduce several industrial AR projects and applications on which we worked in cooperation with different companies in the time between 2002 and today. The application range covers the domains product design, manual assembly, training & education. The industrial uses cases will be explained and how we addressed them. One challenge we faced when introducing AR to a company is their workforce's reservation; the benefits of AR are often veiled and almost never tangible for people for whom AR is a novel technology. Measures such field test and user studies as well as documentations were proven to be perfect solutions to get those people in touch with the technology, to underpin the benefits of AR, and to convince stakeholders. The talk will summarize those experiences.*
- Rafael Radkowski, Iowa State University*
- 4:30 p.m. ORAL ONLY** **Utilizing VR to Improve Manufacturing Engineering**
- The application of AR/VR techniques is rapidly changing the manufacturing landscape. Costly design mistakes can result in late changes which can be delay delivery and increase program costs. This presentation will provide an overview of how Ford Manufacturing Engineering is leveraging virtual technologies to enhance the manufacturing process. Applications to assembly ergonomics, workstation layout, dimensional control, and assembly feasibility will be discussed. In addition, some current initiatives including digital human model advancement methods and a cloud based `Google Earth` approach to virtual plant navigation will be presented.*
- Marty Smets, Ford Motor Co.*

### Wednesday, November 19

#### Day Two: VR

**Session Code:** ARVR2

**Room I, II, III**

**Session Time:** ALL DAY

Time	Paper No.	Title
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| <b>8:30 a.m.</b> | <b>ORAL ONLY</b> | <b>Keynote: Beyond the Hype-cycle: VR/AR Opportunities and Challenges Ahead</b>   |
|                  |                  | <i>Virtual and augmented reality (VR/AR) technologies have matured into viable problem-solving tools for a wide spectrum of industrial applications. However, despite this modest commercial success, the overall impact of these technologies is just beginning. In fact, the US National Academy of Engineering recently named `Enhanced Virtual Reality` as one of fourteen Grand Challenges of the 21st Century. This presentation describes recent advances in the technologies enabling VR/AR, summarizes the opportunities afforded by them, and outlines some of the open research challenges in VR/AR and other emerging interface technologies.</i> |
|                  |                  | <i>James H. Oliver, Iowa State Univ.</i>  |

9:00 a.m.	<b>ORAL ONLY</b>	<p><b>Using AR for Product Development &amp; Manufacturing process validation at Audi</b></p> <p><i>During development phase of new vehicles prototypes are traditionally assembled manually by operators. Two of the main challenges for workers are to position flexible parts (such as brake tubes, cables and wiring) at exactly the right position and to verify if all parts are present during the assembly. To complete this process, operators are currently using drawings to compare the real prototype with the virtual CAD Data. One issue is that no measurement tools can verify exactly the position of flexible parts within a reasonable time frame. Augmented Reality solutions stand to both accelerate detection of construction and design errors while helping operators to place components or flexible parts at the exact position required. By overlaying the virtual CAD 3-D model on the real prototype with a high accuracy, operators are able to quickly compare the potential points of failure and detect if any components are missing. Furthermore the system allows designers to preview or evaluate design alternatives in real scale while minimizing the production of physical prototypes. The keynote will be focused on AR solutions supporting industrial processes and will be illustrated with a highlight use-case developed for AUDI AG. By employing this solution enterprises are able to save costs and time during prototyping assembly phases, detect construction and design errors in an early stage and reduce the amount of prototypes required in the development phase.</i></p> <p><i>Thomas Jouhanneau, Metaio</i></p>
9:30 a.m.		<p><b>BREAK</b></p>
10:00 a.m.	<b>ORAL ONLY</b>	<p><b>Digitalized Expertise: Acquiring and Transferring Workflow Knowledge Using Augmented Reality</b></p> <p><i>Workflow knowledge comprises both explicit, verbalizable knowledge and implicit knowledge, which is acquired through practice. Learning a complex workflow therefore benefits from training with a permanent corrective. Augmented Reality manuals that display instructive step-by-step information directly into the user's field of view provide an intuitive and provably effective learning environment.</i></p> <p><i>Nils Petersen, DFKI</i></p>
10:30 a.m.	<b>ORAL ONLY</b>	<p><b>Making the Business Case for AR/VR: Lessons learned from Aerospace and Energy</b></p> <p><i>NGRAIN is working on two significant AR/VR project implementations in the aerospace and energy industries. The aerospace industry project is centered on the combined use of 3D AR/VR and visual analytics to address fundamental problems in the manufacturing of large-scale composite aerospace components, while the energy industry project is centered on using AR for field-based performance support and the integration of field operations/maintenance personnel with enterprise logistics and asset management systems.</i></p> <p><i>&lt;P&gt;Similar challenges exist in defining the business case for AR/VR in each application. While focussing on the aerospace application, in this presentation, we will share our lessons learned in making the business case for AR/VR with different stakeholders across the organization. Where appropriate, we will hi-light the business value similarities and differences across industries and organizations. We will also discuss the successes and challenges seen at the current stage of the projects and how they correspond to the initial objectives set for the projects.</i></p> <p><i>Gabe Batstone, NGRAIN</i></p>

11:00 a.m.	<b>ORAL ONLY</b>	<p><b>Workshop: Creation of Augmented Reality Scenarios</b></p> <p><i>Augmented Reality (AR) enriches the user's view by superimposing available digital information in context with the real world in the right place at the right time. These systems usually consist of four different elements: tracking, real images, virtual content and visualization. Tracking is the centerpiece of our technology. The perspective and coordinates of a camera - the so-called 'pose' - are determined optically, with external or internal sensors.</i></p> <p><i>Depending on the use case, a wide range of virtual content is applicable, from simple text or symbols to 3D models that originate from a CAD system. Visualization means that the actual scene and virtual content are aligned correctly regarding perspective, scale and position, while being displayed for the user.</i></p> <p><i>The workshop will focus on the creation of an Augmented Reality scene and will be demonstrated through a live demo, which shows how to create your own AR scenarios. It will also explain the different tracking possibilities and how to choose the most appropriate one. The workshop will also answer questions about tracking, contents and how to optimize the tracking.</i></p>
11:00 a.m.	<b>ORAL ONLY</b>	<p><i>Thomas Jouhanneau, Metaio; Paul Robert Davies, Boeing</i></p> <p><b>Workshop: Location, Location, Location - Working with VR</b></p> <p><i>This hands-on workshop will cover common motion tracking issues faced by Virtual Reality users. An optical motion capture system will be used for demonstration of the following techniques: Camera setup strategies for successful motion capture, Camera focus and calibration, and Rigid body tracking - how to align a rigid body model with the physical object being tracked. The latest Oculus HMD will also be utilized to demonstrate the capabilities of the built-in motion tracking hardware on the Oculus. In addition to the demonstrations, there will be time for discussion of motion tracking issues and sharing of best practices.</i></p> <p><i>Kurt A. Chipperfield, John Deere Dubuque Works; Dan Lincoln, Ford Motor Co.</i></p>
1:30 p.m.	<b>ORAL ONLY</b>	<p><b>Natural Human Interactivity in the World of AR &amp; VR: A Pipe Dream or Reality?</b></p> <p><i>As augmented and virtual reality get traction in enterprises, smart glasses are graduating from a tiny monocular display to a 3D immersive experience, overlaying rich contextual information right where you need it. Now the questions coming into the spotlight are 'What's the optimal interaction model for the enterprise-class workflows powered by the smart glasses? Can we combine hand gestures, voice, eye tracking, head motion, and contextualization to build a more intuitive and natural user interaction?' Augmented interactive reality promises to increase productivity and streamline workflows in ways that hasn't been seen before.</i></p>
2:00 p.m.	<b>ORAL ONLY</b>	<p><i>Soulaiman Itani, Atheer</i></p> <p><b>LED Projection, Manufacturing Applications</b></p> <p><i>Standard paper or electronic forms of work instructions have been used to standardize manual processes since the first days of manufacturing, and are still in wide use today in factories around the world. As augmented reality (AR) technology has continued to advance at a rapid pace, it is opening new doors to drive higher levels of quality, productivity, and training efficiency into worldwide manufacturing processes through its unique ability to place the right information, at the right place, and at the right time.</i></p> <p><i>Paul Ryznar, OPS Solutions LLC</i></p>

2:30 p.m.

**ORAL ONLY**

**Man Wearable AR/VR Systems**

*Discuss and demonstrate the advances in Man Wearable AR/VR systems that have been under development at Lockheed Martin. The trials and successes of designing, prototyping and manufacturing plastic Asymmetric lens for AR displays that provide Wide Field of views using COTS displays. The second display takes advantage of a specially designed Fresnel lens set to create a 170 degree VR display. These display systems designs are focused on Military Training requirements but should not be limited in their use.*

*Richard Boggs, Danielle Holstine, Lockheed Martin Corp.*

3:30 p.m.

**Panel**

**Expert Panel Discussion: Head Mounted Display**

*A panel of 4-6 subject matter experts will be on hand to participate in a moderated discussion focused on the state of head mounted display technologies for augmented and virtual reality applications, and their implementation by end users in industrial use cases.*

*The discussion will be centered on head mounted displays and what is possible in monocular, stereoscopic, and immersive platforms. Additional focus on what is accepted in the industry as value added for the end-user and what criteria to look for in selecting a headset will also be highlighted. The panel will also address technical barriers that currently exist in integration of headsets in production platforms, how technology is addressing the challenges in the field and how these are being overcome, leading to a discussion on the vision of where mounted headsets are maturing in the future.*

*Audience participation is an integral part of the panel discussion, and questions/comments will be solicited by the moderator throughout.*

**Moderators -** Jay S. Seddon, Boeing Company

**Panelists -** Elizabeth S. Baron, Ford Motor Co.; Yuval Boger, Sensics;  
Kurt A. Chipperfield, John Deere Dubuque Works; Jeffrey  
Jacobsen, Kopin Corporation; Richard Moore, The Boeing  
Company;