



KEYPOINT
INTELLIGENCE

| *InfoTrends*

SERVICE AREAS:

Digital Photography Trends
Connected Imaging Trends
Business Development Strategies

ANALYSIS

AUGMENTED REALITY GAINS MOMENTUM

JULY 2018





Document

Introduction	3
Key Findings	3
Augmented World Expo	4
PTC.....	5
Meta.....	5
Lumus	6
Epson Moverio	6
Kopin Golden-i Infinity	7
Qualcomm.....	8
Osterhout Design Group (ODG).....	8
PTC LiveWorx 2018 Technology Conference	9
Impact of AR and VR Technologies on Business	10
Leveraging HoloLens Mixed Reality in the Enterprise	10
The Current and Future State of AR Eyewear for the Enterprise.....	11
AR and the Future of the Enterprise.....	11
InfoTrends' Opinion.....	12
About the Authors	13

Figures

Figure 1: AugmentedReality.org CEO and Co-Founder Ori Inbar	4
Figure 2: Meta 2 AR Headset	5
Figure 3: Lumus OE50 Optical Engine	6
Figure 4:Epson AR Flight Simulator for DJI Drones.....	6
Figure 5: Golden-i Infinity Display	7
Figure 6: ODG SAVED HUD Oxygen Mask	8
Figure 7: Xtropolis Exhibit Hall at LiveWorx 2018	9
Figure 8: PTC/Microsoft HoloLens Manufacturing Training Solution for BAE Systems	10



Introduction

Augmented Reality (AR) is generally defined as the addition of digital content to a user's view of the real world around them. That additional content may be text, graphics, video, or some combination of all three and is either overlaid on or displayed adjacent to the user's view of his or her surroundings. Its presence at that time and in that place augments or enhances the user's experience, making it more valuable (i.e., useful, productive, or entertaining) than it would otherwise be.

In most cases, AR involves the use of one or more cameras that can shoot photos or video and serve various other purposes, such as bar code reader, motion detector for gesture control, or detecting the scene that is to be augmented so that the additional content can be placed in a position where it will be most useful. This makes AR an important trend for the imaging industry, and one that we are spending more time researching for our clients. To that end, we recently attended two important AR industry events. This report will cover some of the devices, services, and applications that we feel are worthy of highlighting.

Key Findings

- ◆ The term XR is gaining traction as an umbrella term that includes augmented reality (AR), virtual reality (VR), and mixed reality (MR).
- ◆ The outlook for enterprise AR applications is very good, with vendors reporting that many customers are moving beyond testing and pilot programs to larger rollouts.
- ◆ AR is being used in a wide range of industries including retail, airlines, real estate, automotive, architecture, banking/financial, health/medical, mining, oil and gas, as well as manufacturing.
- ◆ AR for consumers is still in its early stages and exists mostly on mobile devices rather than in headsets.



Augmented World Expo

The ninth annual Augmented World Expo (AWE) USA was held May 30-June 1, 2018 in Santa Clara, California. Show organizers were expecting nearly 6,000 attendees and more than 400 journalists. Conference sessions featured over 400 speakers on six stages, while some 250 vendors showed their latest products, services, and applications in about 100,000 square feet of exhibit space.

Billed as the “World’s #1 AR+VR Conference and Expo,” AWE 2018 was about more than just Augmented Reality. Many speakers and exhibitors were using the term xR, conjuring up memories of high school algebra, where the expression took on different meaning depending on the value of x. In this context, x can equal A, V, or M, and xR is an umbrella term that describes Augmented Reality, Virtual Reality, and Mixed Reality.

AugmentedReality.org CEO and Co-Founder Ori Inbar kicked off the event with a keynote address designed to rebut negative stories about the adoption of AR and VR and to pump up the audience, and it was a resounding success. Alluding to two mathematical novels, he noted that we (the industry) are “still in Flatland, but we can see Spaceland,” meaning that despite all the advances so far, there is a vast future ahead.

Figure 1: AugmentedReality.org CEO and Co-Founder Ori Inbar



Source: *Augmented World Expo*

Following are some highlights from meetings and exhibits at AWE 2018.



PTC

In a conversation with Mike Campbell, PTC's EVP Augmented Reality Products, he said that he "couldn't be more upbeat" about the AR market and that PTC's Vuforia business could double from 2018 to 2019. Campbell said that the AR market is, "moving on [from testing and pilot projects] to scale," and that about 10,000 industrial companies are engaged with PTC to leverage AR for various purposes. He considers head-worn devices to be a "headwind," and says that the ideal headset is not yet available. He said the device would be rugged, bright, and comfortable, with a wide field-of-view, and while several vendors are doing one [or two] of those things, no one is doing it all. As a result, about 85% of AR applications are using phones or tablets, many with accessories such as swing-arm mounts or overhead cameras. While Campbell's comments were primarily about the industrial/enterprise market, where PTC is well-established as a technology provider, he said that much of Vuforia technology is already in consumer-facing applications such as gaming, entertainment, and shopping.

Meta

The Meta 2 3D holographic headset capitalizes on a user's instinct to grab things that are displayed in front of them, providing an interactive AR environment in which one or more users can interact with objects and with each other. The company cites use cases in sales and marketing, design review, and training in automotive, aerospace, health care, architecture and education markets.

Company representatives said that computer assisted design (CAD) is a leading source of content for Meta applications, including support for 3D standard glTF. Earlier this year, a partnership with Solidworks was announced that allows users of that 3D design software to easily view their work in Meta's immersive environment.

Figure 2: Meta 2 AR Headset



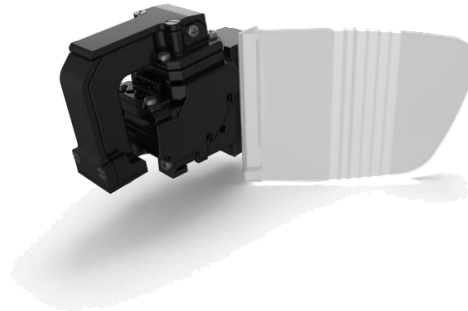
Source: Meta



Lumus

Lumus is an Israeli optics company that makes transparent displays. Its investors include Alibaba, HTC, and Quanta Computer. Although most of its R&D is focused on the consumer market, one of its customers is Thales Group, a French company that supplies helmets to the US military. At AWE, the company showed samples of its latest display technology that can be integrated into eyeglass lenses for AR and other applications.

Figure 3: Lumus OE50 Optical Engine

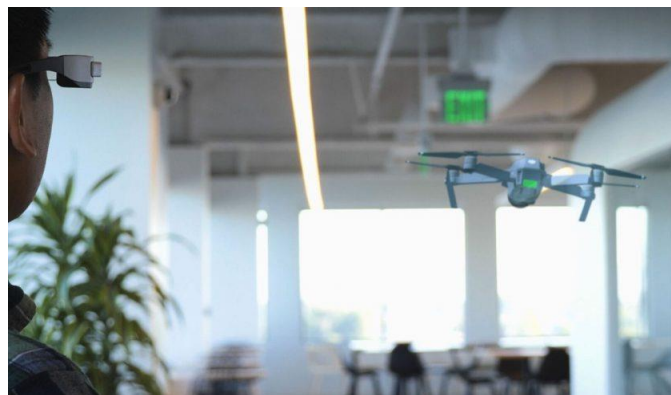


Source: Lumus

Epson Moverio

Epson, a consistent exhibitor at a variety of industry events, showed its Moverio AR glasses. According to company representatives, top applications are in remote assistance, remote training, and drones (leveraging its strong partnership with drone vendor DJI Global). Epson's AR flight simulator for DJI drones, which employs a hologram of a DJI Mavic Pro, is an ideal solution to demonstrate at trade shows, where flying actual drones is generally prohibited outside a caged enclosure. Moverio is also making inroads in the education market, particularly in higher education and STEM (science, technology, engineering, and math) classes.

Figure 4: Epson AR Flight Simulator for DJI Drones



Source: Epson



Kopin Golden-i Infinity

Kopin, a leading micro-display manufacturer, introduced Golden-i Infinity, a small, rugged, smart screen that functions as an external display for Android or Windows 10 devices. It clips onto most eyeglass frames, safety glasses, or hardhats and can be positioned in front of the user's left or right eye, providing hands-free access to information such as instructions, maps, or data. It connects to the host device with a standard USB-C cable, through which it also draws power. Its built-in microphone and camera provide voice and gesture control for connected device applications.

Elegantly simple, with no built-in operating system or computing capabilities. Golden-i Infinity has zero impact on a corporate IT infrastructure and cannot be hacked. That, along with its \$899 MSRP, should make it easy and affordable for testing AR application concepts. Availability is planned for Q3 2018.

Figure 5: Golden-i Infinity Display



Source: Kopin



Qualcomm

Chip-maker Qualcomm Technologies announced the Snapdragon XR1, positioned as the world's first dedicated Extended Reality (XR) platform. The XR1 platform has been optimized for AR experiences with Artificial Intelligence (AI) capabilities as well as improved interactivity, power consumption, and thermal efficiency. In the announcement, the company noted that the XR1 will provide a more immersive user experience, with features such as native voice processing, 3D audio, motion tracking, and head tracking.

Qualcomm also announced that Meta, VIVE, Vuzix, and Pico are already developing products using the XR1 platform. In its own announcement of a development partnership with Qualcomm, Vuzix said that its next generation of AR smart glasses, based on the XR1, would be available in 2019.

Osterhout Design Group (ODG)

ODG demonstrated SAVED (Smoke Assured Vision Enhanced Display), a heads-up display (HUD) integrated with an oxygen mask to assist pilots in an emergency landing if the cockpit is filled with smoke. ODG's smart glasses technology lets the pilot see critical instrument displays and images from exterior cameras while preserving the view of the surrounding environment. The SAVED prototype was developed with FedEx Express, but will be marketed to civil and commercial aircraft manufacturers and military organizations around the world.

Figure 6: ODG SAVED HUD Oxygen Mask

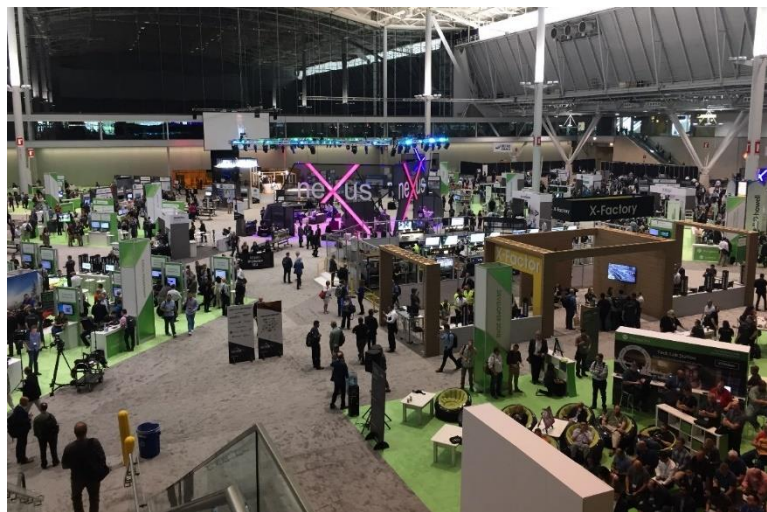




PTC LiveWorx 2018 Technology Conference

Based in the Boston area, PTC is a leading vendor in technology for design, manufacturing, operation and support. Its capabilities range from Computer-Aided Design (CAD) and Product Lifecycle Management to the Internet of Things (IoT) and Augmented Reality (AR). Each year, PTC invites customers, partners, investors, media, and analysts to its LiveWorx Technology Conference & Marketplace, a three-day event jam-packed with educational sessions, training, information, and exhibits. LiveWorx 2018 was held June 18-20 in Boston and was expected to draw some 6,000 attendees. It featured more than 200 breakout sessions and more than 100 exhibitors.

Figure 7: Xtropolis Exhibit Hall at LiveWorx 2018



One of the biggest topics of discussion at LiveWorx was the June 12th announcement of a \$1 billion equity investment in PTC by Rockwell Automation. The resulting partnership will leverage PTC's ThingWorx IoT, Kepware industrial connectivity, and Vuforia augmented reality platforms with Rockwell Automation's FactoryTalk MES, FactoryTalk Analytics, and Industrial Automation platforms to provide integrated smart factory solutions for increased productivity, heightened plant efficiency, reduced operational risk, and better system interoperability.

In a PTC management Q&A session for analysts and media, executives said that PTC's AR business is currently about \$20 million and is growing at about 100% per year. In a move to promote AR to the next level, PTC is aligning all AR activities into a new business unit under the Vuforia brand name.

Following are some highlights from selected breakout sessions at LiveWorx 2018.



Impact of AR and VR Technologies on Business

This LiveWorx session was led by Mike Festa, head of online retailer Wayfair's research and development team (and President of the Boston Chapter of the [VR/AR Association](#)). He described applications in a wide range of industries including retail, airlines, real estate, automotive, architecture, banking/financial, health/medical, mining, oil & gas, and manufacturing. According to Festa, one of the biggest barriers for AR is the lack of suitable content. He gave examples of how some retailers are addressing that need:

- ◆ In 2017, Williams-Sonoma spent \$112 million to acquire AR imaging company [Outward](#) to produce 3D models for use in AR applications
- ◆ Wayfair carries some 10 million products and is adding another 130,000 per week. To keep up, the company has started Wayfair 3D University to train people to create suitable AR content

Leveraging Hololens Mixed Reality in the Enterprise

This session featured Ryan Orwoll of PTC and Mark Day of Microsoft, who discussed how the Microsoft Hololens Mixed Reality headset is being used in various business applications. They explained how some applications (e.g., high voltage train lines, architecture) have started in VR and moved to AR or MR, and that having a single code set that can move between all xR environments would be ideal. (They suggested that [Unity](#) might be that code platform.) Echoing Festa from Wayfair, they said that the lack of content is still a big problem. Orwoll explained how PTC's Vuforia Studio can be used to author and publish MR experiences and features several built-in tools for Hololens.

To illustrate another example of Hololens in action, they talked about a manufacturing and training project at BAE Systems for the assembly of batteries for green energy buses. BAE was looking for a way to protect itself from the "Silver Tsunami," the mass exodus of experienced workers (and their acquired knowledge) as they reach retirement age.

Figure 8: PTC/Microsoft Hololens Manufacturing Training Solution for BAE Systems



Source: Microsoft/YouTube



The Current and Future State of AR Eyewear for the Enterprise

This panel discussion featured Andy Lowery (RealWear), Paul Boris (Vuzix), John Werner (Meta), Neena Kamath (Microsoft), and Mike Campbell (PTC). Following are some highlights from their comments:

- ◆ AR is the next wave of how we interact with technology
- ◆ AR allows us to interact with IoT, Big Data, robots
- ◆ Three converging factors will impact AR: Moore's Law, 5G, and content
- ◆ A "voice joystick" is coming, that will allow us to interact with all this stuff
- ◆ We retain only 10-30% of what we read, but 80% of what is presented digitally
- ◆ We all want to get away from holding a "rectangle" (smartphone) to do AR

AR and the Future of the Enterprise

In this session, business technology consultant and writer Shel Israel discussed several benefits of AR and VR in enterprise applications, including efficiency, safety, customer satisfaction, employee loyalty, competitive edge, and profits. Among his supporting examples:

- ◆ A warehouse order-picking application developed by PWC Consulting for DHL and Ricoh that resulted in near zero errors and 25% lower costs
- ◆ A United Parcel Service driver education application, resulting in more efficient driving. (Each 1 mpg savings per truck saves the company \$50 million per year)
- ◆ A VR presentation used by the NBA Golden State Warriors in 2016 to recruit free agent player Kevin Durant, featuring pitches from Warrior players (and Steph Curry's Mom), virtual tours of the Warrior facilities and San Francisco area, and more. (It worked – Durant signed with the Warriors and the team has since won two consecutive NBA championships!)
- ◆ A recruit screening tool to expose trainee applicants to the dangerous and unpleasant working conditions on an oil rig, discouraging those who would not last before going to the expense of hiring and training them
- ◆ Virtual tours of Mars, hosted by astronaut Buzz Aldrin, to recruit people interested in space travel



opinion

InfoTrends' Opinion

AR has already changed the way that many companies operate and will someday change the way that consumers go about their daily lives. A common theme at AWE and LiveWorx is that for many companies, enterprise AR has clearly moved past testing and into the implementation phase. As one vendor put it, "Adoption is NOW; scale is the question." For those still on the fence, entry-level devices such as the Golden-i Infinity may help them to take the next step.

The primary platform for AR among consumers is mobile devices rather than headsets. This will continue until challenges such as size, weight, fashion, and cost are addressed. It is also critical that the industry gets privacy right—for users as well as those around them—before asking people to wear sensor-laden devices as part of their daily lives.



authors

About the Authors



Alan Bullock
Associate Director
+ 1 781-616-2117



Alan Bullock is Associate Director of the InfoTrends Connected Imaging Trends service. He focuses on online photo services, social networking sites, as well as connected consumer electronics devices and services that enable consumers to access as well as share their photos and other digital content.

[Comments or Questions?](#)

This material is prepared specifically for clients of Keypoint Intelligence. The opinions expressed represent our interpretation and analysis of information generally available to the public or released by responsible individuals in the subject companies. We believe that the sources of information on which our material is based are reliable and we have applied our best professional judgment to the data obtained.