Augmented Reality on the Battlefield

February 2018

GENERAL DYNAMICS
Mission Systems
Contents

The Dual Worlds of Data 2
Bridging the Physical-Digital Gulf 2
Augmented Reality and the Warfighter 3
Augmented Reality as Situational Awareness Support 3
Leveraging Microsoft Product® 3
Reducing Data Clutter and Soldiers' Cognitive Load 4
Augmented Reality Battlefield Benefits 5
Improving the Commercial Product 6
A Mature Technology at an Affordable Price Point 7
Beyond the Battlefield 7
Continuing a Legacy of Innovation 8
Augmented Reality on the Battlefield

The Dual Worlds of Data

Everything today exists in two realities, the physical world and the digital world. From GPS coordinates, to cameras, to sensors, to digital portfolios and social media everything has a place in both worlds. Yet our view of those two worlds is fragmented, controlled by whether we look at a screen or at the world around us, never allowing us to understand both worlds at the same time.

Data processing and visualization technologies have made great strides in transforming data into information for us to use for comfort, efficiency and safety. This information holds enormous value when applied to our interactions. From information on the location of people, the directions we follow, even the current status of objects or events around us. That knowledge overlaid onto the physical world holds great potential for improving our lives and businesses.

Today, digital knowledge is accessed through screens. Monitors of all sizes and shapes – some desktop, some handheld, some wearable, some mounted on objects – display information on flat, two-dimensional interfaces.

And therein lies the problem. Users look away from the three-dimensional real world, navigate to the appropriate screen, view the information, then look up and mentally translate the information onto the world around them. That translation puts a burden on users that leaves them less efficient and less safe.

Bridging the Physical-Digital Gulf

Augmented reality bridges the gap between digital data and the real world. Thanks to recent technological advancements and massive investments, the augmented reality market growth has far outpaced forecasts. These advances have made augmented reality hardware smaller, lighter, and more durable. The software is flexible and more powerful and the products on the market are less expensive than ever before.

The premise of augmented reality’s technology is relatively simple: An augmented reality system begins with a camera-equipped device mounted in a manner that “sees” the same view as a user. Software runs on that device. As the user changes their viewpoint, the camera recognizes the change and the device analyzes the view and subsequently shows appropriate data as an overlay to the real world.

HOW AR WORKS
Technology giants like Microsoft have developed mainstream and affordable products using this technology that come in a huge variety of form factors, from cell phone applications to headsets and glasses to all kinds of ‘mixed reality’ devices.

The applications go far beyond gaming and entertainment usages (think Pokemon Go). Industries of all sorts use augmented reality for training, maintenance and operational planning. For example, Boeing technicians use augmented reality, replacing paper diagrams to aid the repair and maintenance of each plane’s dozens of miles of wiring. Amazon warehouses use object recognition augmented reality technology to rapidly fulfill orders in facilities that average one million square feet. In industrial situations like these, augmented reality supports not only increased efficiency, but worker safety, as well, allowing employees to perform their duties with hands-free for the task at hand and without the distraction of switching their focus from a screen to the real world.

Augmented Reality and the Warfighter

Nowhere is efficiency and safety more paramount than on the battlefield and the maturation and commercial adoption of augmented reality makes this the perfect time to extend its benefits to the U.S. Military. And General Dynamics Mission Systems is the company poised to lead the way.

“This is not an untested technology,” says James Kilbride of General Dynamics Mission Systems, “This is a mature technology that is available right now and we’ve developed the augmented reality solution to help our troops fulfill their missions and come home safe.”

General Dynamics Mission System (GDMS) augmented reality solution addresses those issues most critical to soldier safety and mission success.

Augmented Reality as Situational Awareness Support

Real time situational awareness is the main contributor to mission success and soldier safety. Technology brings an enormous amount of information to warfighters in combat including mission direction, real-time intelligence and surveillance imagery and full motion video. Soldiers rely on this information to inform knowledge of the environment, potential risks and changing mission parameters. Today, warfighters receive all of that data via screens. And, just like civilians using commercial equipment, they must look away from the real world to see that information on the screen. However, unlike civilians, a soldiers’ real world is a battlefield and glancing down at a screen for even a few seconds could be a matter of life and death.

The GDMS augmented reality solution eliminates the screen by overlaying the information previously viewed on a screen on to the actual, physical battlefield. Without ever taking their eyes off of the real world, soldiers can see terrain maps, Red/Blue Force tracking, route indicators and more.

Leveraging Microsoft Hololens®

Building on Microsoft Hololens, GDMS has ruggedized the commercial technology providing a powerful tool for customers looking to use AR in the real world. This platform retains compatibility with the commercial tools, but provides a device that can withstand the rigors of battlefield and industrial use. This new tool ensures that soldiers and workers never take
Augmented Reality on the Battlefield

Their eyes off the world around them, ensuring their safety, while also providing them with the information they need to perform their missions and jobs.

Leveraging this platform, GDMS has created software packages which provide an insight into the power of tactically accessible Augmented Reality, including solutions for Short Range Air Defense (ShoRAD), Target Identification Training, Industrial Maintenance and Mission Planning and Briefing. These solutions highlight the unique value and safety that ruggedized AR brings to the military and industrial space.

This development comes as welcome news to military members at all levels. Frustrated with heavy equipment, more screens and an ever-increasing influx of data, everyone involved is looking for ways to help soldiers make faster, better decisions safely.

Brigadier General Randall McIntire, Commandant, US Army Air Defense Artillery School, responsible for the ShoRAD Mission, stated, “I didn’t believe anybody was doing anything like this. We need this kind of innovation.” The purpose of ShoRAD is to provide situational awareness, targeting cueing, and the ability to coordinate fires (Air Defense and Field Artillery) to the observer/shooter level in Beyond Line of Sight (BLOS) and On The Move (OTM) environments. Augmented reality is at the heart of the ShoRAD mission.

Reducing Data Clutter and Soldiers’ Cognitive Load

An increased cognitive load is one of the greatest threats to situational awareness on the battlefield. A soldier on the battlefield already bears a great cognitive load while executing missions, evaluating the changing environment and making split-second decisions. That load increases when a soldier must mentally sift through an influx of information and determine what is important at that very moment.

GDMS has developed their augmented reality software to avoid this sensory overload situation. The only data displayed is information needed by the soldier at that exact moment. In fact, within one mission, each user might look at the same battlefield and see different displays based on their unique jobs within the group.

This precision information delivery in achieved in two ways:

**Information based on place and space:** The augmented reality software reacts to global position using GPS, therefore delivering mapping and location information which will change as the soldier’s position shifts. Simultaneously, the software can use contextual awareness to display information based on a specific space – such as a vehicle or a building. If a soldier sits in a certain seat in a vehicle, information specific to the job associated with that seat will appear. Similarly, as a warfighter enters a building, data related to that structure will appear in their view.

**Mission and user customization:** Just as with consumer products, users choose applications to run on the hardware based on their unique needs. In the tactical space, these applications are mission specific. Each branch of the military can develop their own apps, using their familiar nomenclature and symbology and then further customize each app to their specific missions. In addition, each individual user customizes their information display based on their personal preferences.

“This is a mature technology that is available right now and we’ve developed the augmented reality solution to help our troops fulfill their missions and come home safe.”
Augmented Reality on the Battlefield

Augmented Reality Battlefield Benefits

Hands Free Data Interaction
Although the technology automatically displays information based on location or space, the user also has the ability to pull in additional information, clear certain pieces of data from their view or rearrange what they are seeing. In a screen-based world, this requires a keyboard or touch screen. With augmented reality, GDMS gives the soldier the ability to control the display with voice recognition, gestures and even facial recognition.

“Over-The-Shoulder” Maintenance and Repairs
Currently, repairs and maintenance on equipment require referral to a two-dimensional printed manual or schematics displayed on a screen. Using augmented reality, the user sees instructions as an overlay onto the actual object in three dimensions, including specific symbology indicating which part to adjust or replace. In addition, remote assistance can provide situation specific information and troubleshooting support to users in the field, including and up to experts looking ‘over the shoulder’ of the soldier in the field. This not only makes the user more efficient, but expands the pool of users who can repair and maintain equipment with a limited amount of training.

Mission Planning
The General Dynamics’ augmented reality solution also provides benefits to command and analysts. Those charged with planning missions – or those charged with providing the intelligence that assists mission planning – can view visualizations created from the integration of data pulled from any sensor, database or source, giving them the ability to organize and plan an operation across teams dispersed in a wide geographic area.

“I didn’t believe anybody was doing anything like this. We need this kind of innovation.”
Training for Reality
Currently, soldiers train in virtual worlds. Augmented reality brings training into the real world, using virtual objects and overlays that mirror what the warfighter will see on an actual battlefield.

Improving the Commercial Product

Hardware:
Despite its commercial success, the Microsoft HoloLens simply is unsuitable for a tactical environment. The glasses are bulky and weighted down with a battery and computing unit. GDMS made several key changes to the look and configuration of that hardware.

First, the over-sized glasses format would be unusable in a tactical environment as they do not fit comfortably while also wearing a helmet. Instead of glasses, a simple flip down visor connects to the rhino mount on a soldier’s helmet. GDMS also decoupled the battery from the hardware. Instead, the battery needed to power the display and the computing functions is attached to a tactical belt, lessening the weight of the visor. The specific battery is based on mission. Shorter missions use smaller, lighter batteries, while longer missions require a larger battery.

The modified hardware has also been ruggedized for a tactical environment. Engineered for every day usage for long periods of time, the visor can withstand heat, cold, dust, dirt, mud and as much as a fifty-caliber glancing blow.

Software:
Microsoft’s software provides the intuitive interface and allows any software written for Windows 10 to run on the platform. Users can bring their own applications or devices and run the platform.

GDMS has developed a suite of specialty applications uniquely suited for tactical environments that run on the Microsoft platform.
In addition, GDMS has further improved the product for military use by hardening the software, including encryption, multi-level security and configuration control all with ability to integrate into the secure tactical networks already in use by soldiers on the battlefield.

**A Mature Technology at an Affordable Price Point**

As with any innovation, there are questions and misconceptions. Augmented reality is no different. It would be a mistake though to dismiss augmented reality as best suited for entertainment and exclusive to a younger audience. Augmented reality is a mature technology thoroughly tested in the commercial sector, allowing GDMS to make their capability available at an affordable price.

As noted, augmented reality’s primary value lies in eliminating the screen as a middleman between necessary battlefield information and the physical battlefield itself. Which is why GDMS has priced this tactical augmented reality solution to be competitive with those screens used for tactical missions.

In addition, the software based interface and app structure contributes to a lower total cost ownership as does the elimination of physical switches, buttons and dials that might need repair and maintenance.

**Beyond the Battlefield**

As adoption of augmented reality grows, GDMS sees opportunity beyond the battlefield.

Industries such as ship building, oil and gas, heavy manufacturing and construction are currently screen-based operations – even in the field. GDMS believes these organizations could increase efficiency and safety by breaking away from screens into a hands-free, data-rich workplace.

The extension of augmented reality to these industries makes sense. Like the U.S. Military, these companies operate in environments where commercial products simply aren’t appropriate.

**AR IN INDUSTRY**

- Oil and Gas
- Heavy Manufacturing
- Ship Building
- Construction
Dangerous environments that include welding, gasses, chemicals and large equipment while requiring a high degree of accuracy could benefit from GDMS’s flip down visor that would easily mount to a hard hat, freeing workers’ hands to the job at hand. Those operations in remote locations with harsh terrains such as deserts, tundras and offshore sites would benefit from GDMS’s ruggedization of the hardware.

**Continuing a Legacy of Innovation**

For more than 60 years, GDMS has delivered innovation to the battlefield in an effort to support the men and women of the U.S. military. The company continually strives to make equipment smaller and lighter and technology more powerful. This latest capability is part of GDMS’s dedication to working side by side with soldiers, understanding their problems and providing effective solutions.

**Contact Information**

James Kilbride, PhD, Business Area Director  
General Dynamics Mission Systems  
443-755-8010  
James.Kilbride@gd-ms.com