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Portable Displays and Controls for Vehicle and Dismounted Operations

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ABSTRACT

The concept of handheld control systems with modular and/or integrated display provides the flexibility of operator use that supports the needs of today's warfighters. A human machine interface control system that easily integrates with vehicle systems through common architecture and can transition to support dismounted operations provides warfighters with functional mobility they do not have today.

With Size, Weight and Power along with reliability, maintainability and availability driving the needs of most platforms for both upgrade and development, moving to convertible (mounted to handheld) and transferrable control systems supports these needs as well as the need for the warfighter to maintain continuous control and command connectivity in uncertain mission conditions.

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INTRODUCTION

The uncertainty inherent in today's battlefield is generating the need for both increased information and greater actionable decision making capability at the tactical edge. As a result of the trend toward decentralization and the progress toward net-centric warfare, warfighters require computing and control solutions that are reliable, intuitive to use, easily implemented on multiple platforms and provide application flexibility. Platforms that require weapon and/or payload control, and more recently capability for managing control and interface with unmanned systems, require human machine interface controls for a variety of activities including camera and/or sensor control, tracking, targeting and fire control. Vehicles with turrets or remote weapon stations (RWS) typically have vehicle mounted Commander and/or Gunner style controls for operator control with a separate display to support force protection by providing situational awareness while the warfighter is safely protected within a vehicle such as MRAP. Although, these control systems provide the required reliability and redundancy necessary for use in theater, they do place limitations on operators as they can only be used at specific stations/locations within the vehicle which limits warfighter versatility which is a key tenet of Army Modernization. [1] Once the Gunner or Commander moves from his vehicle post, both connectivity and weapon control are lost.

Space within vehicles is increasingly limited and soldiers are being required to operate control systems and use displays that may be placed simply wherever there is space with little to no regard for operator accessibility, usability and fatigue; see Figure 1.

Fitting more – more equipment, more controls, more displays and more analytical power – in a vehicle is

becoming the norm as data, situational awareness, convoy and soldier networking and integration of subsystem platforms including UGVs, UAVs, and unattended sensors, are increasingly integrated into both vehicle and warfighter platforms. With more data comes the need for increased processing and analytic capability and with more payload content comes the need for more versatile and flexible control systems, including simultaneous control of multiple payloads by a single operator. Traditional, stationary control systems and displays do not support these demands and do not provide the capability to maintain complete versatility in support of net-centric operations at the tactical edge.

The mission complexities resulting from urban and unconventional warfare are forcing decentralization which is driving the need for net-centric operations and current technology development. At the same time, these needs will ultimately drive down to the need for mission critical C4ISR along with the control of vehicle subsystems to remain with the soldier at all times. This translates to the need for total warfighter mobility. The mission critical control and display systems not only need to be mobile, but soldier portable without adding significant weight and additional burden to the dismounted soldier.

To meet the developing need to increase the functionality and effectiveness of the warfighter regardless of where he may need to be located on a mission, there are innovative, technologies that can be based on common architecture(s) and will enable the warfighters' ability to enhance force protection, battlespace awareness and dismounted operations via a level of mobility and versatility that does not exist today. The concept is new, however it is a logical progression to repackage control systems such that they are multi-modal in nature to support versatility of mission critical operations while maintaining the human interface to provide seamless transition for the warfighter as he moves locations both within a vehicle and outside of it.

MISSION NEEDS FOR DISMOUNTED CONTROL TO ADDRESS UNCONVENTIONAL WARFARE

There is significant current focus on the need for decentralization within US armed forces in order to meet the needs of engaging in conflict laced with uncertainties. Much of the focus today has been on developing net-centric connectivity and communications systems that will provide the shared situational awareness at the strategic, operational and tactical levels for better synchronization, greater speed of command and increased lethality, survivability and responsiveness [Implementation of Net-Centric Warfare]. New vehicle platforms, including GCV, are requiring network connectivity for these reasons and are also requiring integration with unmanned air and ground systems for increased ISR and force protection. With the focus on net-centric operations and mission networking at the platform level, including the soldier as a platform, what has been missing is the link between the networked platform to the soldier and back to Mission Command. Soldier as a sensor is a sound concept as every soldier is a source of situation awareness and ISR, however with decentralization, every soldier is also potentially a mission commander with the responsibility to take both immediate and appropriate action for mission success.

Decentralization is pushing decision making authority to lower levels of command which ultimately requires greater capability and functionality at the soldier level. A warfighter deployed on any mission ultimately needs to maintain the flexibility required by today's battlespace and will also therefore need to maintain connectivity with and control of all mission critical assets regardless of what the mission demands of him. If the majority of mission C4ISR capability and network connectivity resides within a vehicle platform, as soon as the soldier moves from a vehicle post or dismounts the vehicle, a level of capability and connectivity is lost. If the vehicle or unmanned asset controlled from within the vehicle is weaponized, a level of force protection is also lost.

With increasing demand to integrate the control of unmanned systems with vehicle platforms, it becomes even more imperative that the soldier maintains the capability for connectivity with all mission critical vehicle systems regardless of where the mission requires the warfighter, Commander or Gunner to be in these times of unpredictable warfare. What is known is that in order to demonstrate force superiority and to win engagements, US warfighters will be required to demonstrate versatility and flexibility during conflict. As a result, all of the functionality that the soldier uses during a given mission whether for ISR, C4, control of unmanned assets, control of vehicle systems – including platform weapon systems – should, ultimately and ideally, move with the warfighter.

Whether the warfighter needs to move about within a vehicle or given platform or the mission demands dismounted operations, the soldier should be able to maintain connectivity and control over all mission critical C4ISR and platform functionality along with any added functionality required specifically for the soldier on foot. Given this logical need and the progression of both decentralization and net-centric operations, all systems and functionality that a soldier needs to access on a vehicle platform that is integrated into net centric operations, will need to be transferrable to the soldier on foot.

PORTABLE COMMAND AND CONTROL

Traditional stationary control systems are just now starting to be evaluated for mobile control systems as the Army, Special Operations in particular, are looking to support the mobility and versatility required to succeed in modern conflict. Form factors that are handheld and support greater switch and control configuration consolidate and concentrate increased functionality directly into the hands of the warfighter. Today, solutions with increased functionality and configurability, especially when paired with touch screens, provide greater levels of control in a compact form factor. With the addition of high resolution, backlit and sunlight readable LCDs, these hand held controllers typically take the form of a game- or tablet-style controller and provide both access to ISR as well as operator feedback, Typical application is for the control of unmanned air or ground vehicles, however, these control systems can offer greater capability when fully integrated into mission requirements and vehicle platforms in support of net-centric operations and decentralization.

As concepts of net-centric operations are fielded, the warfighter is being inundated with systems and data while also being asked to provide operator control functionality. As these systems multiply in support of the increased need for data and net centric connectivity during mission operations, the warfighter is becoming overloaded both physically and cognitively. While there has been research completed on how data is being processed such that the warfighter can synthesize it into the next timely and appropriate action, very little research has been accomplished with regard to the ideal configurations and modes of human machine interface(s) that will deliver necessary C4ISR functionality to the warfighter, and in turn, also provide the necessary controls for him to take appropriate and timely action through vehicle systems and mission capabilities. Whether warfighter action involves the control of multiple unmanned assets, vehicle based weapon systems or any other mission critical system, the soldier needs to operate in response to the immediate conditions with which he may be faced – which may include his need to move from the traditional Gunners or Commanders seat in a vehicle platform.

The challenge lies in concentrating mission critical functionality in a handheld, lightweight wireless solution that can either be platform mounted and then dismounted or to which platform functionality could be transferred as required by the mission providing the warfighter with full mission control and the flexibility of full mobility.

Such control systems are available today and are currently providing portable functionality for payload and weapon control. Controllers typically referred to as “game-style” controllers concentrate significant functionality in a small, portable form factor that is lightweight and can be highly ruggedized as shown in Figure 2. Though first introduced as a control system with concentrated and versatile switch and joystick configurations, the addition of LCDs, whether integrated or modular, added ISR capability, reception of video for situation awareness and non-line of sight operation capability.

Figure 2: Freedom of Movement Control Unit with and without modular LCD. (Ultra Electronics, Wallingford, CT)

While these game style controls provide reliable single asset control, they have the capability to evolve into control systems that provide larger LCD form factors with touch screen capability. Adjusting the form factor to a tablet, maintaining the HMI and adding processor capability makes the control a multi-functional control system capable of true portable command and control inclusive of secure communications and data links. Tablets have typically been used for document management and as a transceiver. With the enhancement of integrated HMI and secured network compatibility, the tablet matures into a portable command and control that provides the answer to the need for man-portable C4ISR connectivity with capability for payload/weapon control and the control of unmanned systems of any kind. Figure 3.

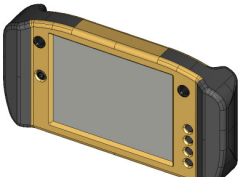

Figure 3: Tablet solution with integrated HMI for system command and control. (Ultra Electronics, Wallingford, CT)

By addressing the need for reductions in size, weight and power while also increasing processing and control capability, including simultaneous control of multiple payloads and/or unmanned assets, the concept of the fully

networked, operationally ready warfighter in a successfully decentralized command structure can be realized.

REFERENCES

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