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14. ABSTRACT
Technological advances will soon make possible capabilities once only considered in the realm of science fiction. The primary benefit of connecting small units to such a system would be the rapid ability to share information both up and down the entirety of the command chain. An overall plan for implementation will require an intuitive design component that takes into account social problems from an emerging digitally interconnected world, such as cognitive overload and digital distraction. It will require comprehensive integration into existing training, both at schoolhouses and operational units, to allow the targeted users to gain and maintain proficiency with the system without placing the training burden on one single entity. The complexity of the system and the tools it provides will require small units to create digitally capable command and control cells, so that no one individual becomes overwhelmed by the information. The final component of the plan for implementation is a service level recommitment to decentralized command and control to ensure technology decreases the burden on the small unit leader.

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Avoiding Digital Distraction: Fielding an Effective Future Small Unit Digitally Interoperable System

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THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT

On 19 September 2014 a Company Landing Team (CLT) from a Marine Expeditionary Unit conducted on short notice a Noncombatant Evacuation Operation (NEO) in a rapidly deteriorating country thousands of miles from a U.S. military base. A Radio Frequency Identification (RF ID) system tracked each Marine on the mission, automatically manifesting them on the aircraft for both pickup and extraction. During the long flight to the objective, small unit leaders down to the squad leader level received updates on the overall situation, imagery of the target area, enemy movement, and changes in the plan from tablets wirelessly integrated to a digital network within and between the aircraft. As they approached the target area, the small unit leaders again used the tablets to raise their situational awareness, viewing the landing zone by accessing video provided by the aircraft's Direction Infrared Countermeasure (DIRCM) system. Once on the ground, the small unit leaders were able to continue to receive and send digital information to the command element thousands of miles away via the wireless network provided by the aircraft overhead, thus ensuring situational awareness up and down the chain and facilitating command and control (C2).

The operation described above, while not a real world mission, was an experiment called TALON REACH conducted by the Marines of the Infantry Officers Course and Marine Aviation Weapons and Tactics Squadron One (MATWS-1) to test the effectiveness of a small unit digital interoperable system on battlefield decision making and C2.[1] While only in the experimental stage at this time, rapid advances in technology will make such a system with even more powerful tools a very real possibility in the decades to come. The purpose of this paper is to explore the potential benefits of a small unit digital interoperable system, the issues associated with its design, and to provide recommendations for how to field it across the service to ensure its effectiveness. The capabilities described in the exercise above and the even more powerful ones on the drawing board will no doubt provide an increased level of effectiveness for small

units on the battlefield. However, one cannot just turn over these powerful tools to their targeted users with the expectation that they will immediately be effective.[2] *To field an effective small unit digitally interoperable system will require an intuitive design specifically tailored for the future small unit leader, comprehensive integration into existing training programs, the creation of small unit command and control cells, and a service level recommitment to decentralized command.*

Background

The Ground Combat Element (GCE) is the last element of the Marine Air Ground Task Force (MAGTF) to digitally integrate a significant portion of its forces. The Air Combat Element (ACE), due to the nature of its mission and its platforms, is the most digitally advanced MAGTF element with true digital interaction between both aircraft and ground controllers. The Command Element (CE) has within the last decade linked all operational headquarters elements down to company level combat operation centers, facilitating a common operating picture for commanders at multiple levels. The Logistics Combat Element (LCE), while not much more advanced than the GCE, does have digital tracking systems for both convoys and certain end items. The GCE has failed thus far to develop a workable system to digitally link a foot mobile unit to an information system while "outside the wire" despite numerous attempts over the last two decades by the defense industry.

Technical improvements in the last five years have brought a renewed effort to digitally link the small foot mobile units of the GCE. As noted above, the Marine Corps' TALON REACH exercises at the Infantry Officers Course have been experimenting with small unit digital interoperability since March of 2013.[3] The U.S. Army has been experimenting with small unit and individual digital interoperability since the 1990's Land Warrior program. In

2010, the Nett Warrior became the latest project to evolve from that program.[4] In each case, technological advances in the computing, telecommunication, and defense industries have enabled these and other programs to move forward at a more rapid pace. The capabilities, which are now closer to reality, are ambitious, impressive, and right out of science fiction. They include:

- Automated position reporting and tracking for every Marine or soldier on the battle field;
- Individual health monitoring and reporting with automatic MEDEVAC request based on sensors that can detect trauma;
- Accessing or submitting up to the second intelligence reports anywhere on the battlefield;
- Full motion video from aircraft pods and UAVs overhead, ground based sensors, individual point of view cameras, or on site video conferencing;
- Digital fire support requests simultaneously sent to both approving and supporting agencies to speed up the kill chain;
- Weapons with integrated ballistic computing to improve accuracy and networked to position reporting system to prevent friendly fire;[5]
- All of these capabilities linked to a single interface device, such as a tablet or hands free Heads-Up-Display (HUD) similar to the ones used by aircraft pilots.

These are just a few of the capabilities the industry is experimenting with that theoretically would give U.S. forces a marked advantage over its potential enemies. The primary benefit of connecting small units, and even individual Marines, to such a system would be the rapid ability to share information both up and down the entirety of the command chain. Whether the fast paced tempo of conventional maneuver warfare or the deliberate and collaborative nature of counterinsurgency, the ability to out cycle one's enemies in the decision-making process is extremely important. Digitally connecting the entire force would speed up the information flow not only about the enemy but also on factors such as the local population, terrain, weather, and

most importantly friendly troop disposition. By automating many of the time-consuming friendly reporting requirements such as location, health, and supply status, more focus can be put on the operationally relevant information needed to make effective decisions. With this understanding of the benefits of such a system, the question must shift to how does one effectively implement it once it's ready? Every good system should start with a solid design, and this one is no different.

Intuitive Design

An intuitive design with an interface specifically tailored to the modern military small unit leader is the first, and arguably the most important, component in the effective implementation of a digitally interoperable system. If designed correctly with an eye on the end user, it will lessen the severity and impact of the other three components for effective implementation. In this case the targeted user is a young adult, age 19-25, with a varied educational background. Enlisted squad leaders will most likely not have an extensive level of higher education where commissioned platoon commanders will. One element both will have in common is extensive exposure to digitally interconnected devices. Kids today as young as elementary school ages are now connecting to social networks through devices and game consoles to send and receive information. While this might make this generation the ideal end user, the design of the system must account for two human factors currently having an effect on the digitally interconnected world, cognitive overload and digital distraction.

The cognitive load is the amount of mental effort being used in the working memory. When the amount of information presented exceeds the mental capacity of the individual, cognitive overload occurs and results in an overall reduction in mental effectiveness.[6] Another important factor related to cognitive overload is how the brain prioritizes the types of information it receives. To someone who has grown up in a digitally dominated modern

environment there is the danger that the brain will mistakenly prioritize a digital threat (a report of enemy activity) over sensory warnings (sight, smell, or hearing). The opposite of this issue has also proven to be true. Attempts to field a wearable HUD for ground forces have produced mixed results as the wearers tended to remove the device during simulated combat situations because they felt it impaired their ability to assess the physical environment around them.[7] Yet, successive generations raised on an interface such as Google Glass or simulated combat experienced through a video game console might be more receptive and capable of using such a tool. Cognitive overload leads to reduced capacity multitasking and contributes to the second factor, digital distraction.

Digital distraction or "social cocooning" is a recent phenomenon in which individuals become sucked into their digital devices and are oblivious to the world around them. Dave Coplin, the Chief Envisioning Officer for Microsoft UK and author of a number of books on the effect of technology on society, states, "We have a natural tendency to snack on information, which is turning us into a 'head down' generation of workers, with our faces constantly buried in technology".[8] The best example of this is the rise in pedestrian related traffic accidents since the introduction of the "smart phone" in 2007. In 2013 an Ohio State University study found that pedestrian injuries related to cell phone use in 100 select emergency rooms nationwide doubled from 2005 to 2010.[9] The study considers these numbers to be very conservative since the injured pedestrians are unlikely to concede fault by admitting their distraction at the time of the accident. What was the age group most likely to be injured? 16-25 year-olds, which is the same demographic as a squad leader or platoon commander. IOC staff members have observed this phenomenon during the TALON REACH exercises and have had to remind tablet users to also remain aware of the world around them.[10]

If it is a threat on city streets, it is reasonable to believe it will become an increased threat on future battlefields or conflict zones. The small unit leader must balance the vast amount of information through the digital system that is competing for his attention with the more dangerous physical environment on the battlefield. With a generation of overloaded and digitally distracted users as the target operators, digital interoperability on the battlefield will face significant challenges if not properly mitigated. Reduced mental effectiveness will have an obvious important effect on battlefield decision making, so with this in mind, how much information is too much? How does one place effective limits on a combat information system when cognitive loads vary by individual? The diametric solutions to this problem are to either limit the information to a level usable to the vast majority of potential users under current mental intelligence standards or raise the standards to ensure most users can use a more complete system. While raising the intelligence requirements for service in infantry units could solve some of these issues, the cascading effects it would have on recruiting and manpower would be more sweeping for the service as a whole. This is an idea worth pursuing but is outside the scope of this paper, which focuses on solutions based on current intelligence standards and manning practices.

The workable solution is somewhere in the middle of the two extremes and must start with a system design and user interface that takes these human factors into account. The design needs to be intuitive and based on operational requirements. The function of the system, the presentation of the information, and the ability to communicate over the system should be as instinctive as possible. The design should also seek to free the user from as many of the cognitive tasks as possible through automation, thus easing the cognitive load on the individual. Additionally, the system needs to be scalable to operational requirements and not driven by what is technologically possible. Just because the system is capable of providing the user a number of

features does not mean they all are needed and useful. Unnecessary features that need to be monitored by the user will only contribute to cognitive overload. Fortunately these are the same goals for commercial digitally interconnected systems, such as smart phones and tablets. Utilizing commercial devices and application-to-task based software provides three primary benefits. First, it is much more cost effective to procure and then tailor these systems than it is to fund a program to design and build them from scratch. The collective innovations borne from the competitive commercial market outweigh and outpace military design and procurement. This cost saving factor will ensure that the development and implementation of the system will remain palatable during the current period of fiscal restraint without having to settle for less than state of the art technology. Second, as an operational requirement is identified, an application such as a Fire Support, MEDEVAC, or resupply "app" can be developed for the task instead of designing an entirely new system. Third, these are the same commercial products and software the targeted operators have used for years in their personal lives. This will ease the cognitive burden on the individual as well as on the service that is responsible for its implementation and training.

Integrated Training

The second factor in the effective implementation of a digitally interoperable system is a plan for comprehensive integration of the digital system into all facets and levels of training. The more complex the system, the more robust the required training will need to be if it's going to be effective. Training programs, whether in a schoolhouse or operational unit, have become over tasked as it is with a variety of training requirements. In many units, training has become a zero-sum game where if something new is added, something must then be subtracted from the schedule or curriculum. A complex system requiring a significant investment in both time and

personnel for initial system specific training is not practical with current and projected operational tempos either in the initial training pipeline or at rotational deploying units. Part of the solution to this is the intuitive design discussed above. A system based on commercially popular devices and software utilizing an existing intuitive design will ease these upfront, system specific training requirements. Commercially procured system will facilitate integration into the already tight training requirements by incorporating the system into already existing training.

An intuitive design will only solve part of the cognitive overload and digital distraction problems; the other part requires training. The more integrated into existing training programs the system is, the more users with insufficient intellect will be able to decrease their cognitive load and focus on more operationally relevant information. Additionally, the command chain will become accustomed with the automated reporting aspects of the system. This will allow a more comprehensive use of the available tools the system provides. To accomplish this, all levels of infantry training must incorporate the system. Initial training should expose the Marines to the system on a rudimentary basis (Boot Camp and Officer Candidate School). As they transition to the School of Infantry (SOI) and The Basic School (TBS)/IOC they will continue their exposure to the system as they learn to execute individual and collective training tasks. Once in the fleet, young Marines will observe the systems used by their leaders. As they demonstrate an ability to lead, they attend NCO Professional Military Education (PME) courses like the Marine Corps' Corporals, Sergeants, or Infantry Squad Leaders Courses, where they exercise with the full features of the system. Finally, skilled in the system at many levels, they can maintain and gain additional proficiency during the training associated with operational workups or exercises. Commanders, particularly battalion and company commanders will also need a specifically tailored training package so that they will understand the limits and capabilities of the system, how best to incorporate the system into their existing C2 structure, and

how to effectively incorporate it into training. By integrating the system at all levels and types of infantry training, the entire burden does not fall squarely on the unit or a schoolhouse.

A key element to ensure the successful integration into training will have to be a robust and responsive customer support. Whether the customer support is a civilian company obligated as part of the contracting process, created from within the service, or a combination of both, there need to be subject matter experts to assist schoolhouses and units with initial integration and product troubleshooting. Without this support, trouble shooting technical problems with the system could very quickly consume a training event. This will result in either not meeting training goals, or discarding the system for the sake of other training objectives. Training enlisted communications Marines on the operation and troubleshooting of the system as part of their initial MOS training is also important. It will provide a technical expert to the operating units and ease the customer support burden overall. There are typically three or more communications Marines assigned to an infantry company. These Marines would be the first line of support for on the spot troubleshooting, while at the same time forming the nucleus of the next component for the systems implementation, a small unit C2 element.

Small Unit Command and Control Cell

The third component in the effective implementation of a digitally interoperable system is in the creation of small unit command and control cells. The creation of a small team within a squad or platoon to help facilitate C2 within the unit and to its higher is not a new idea. Squad leaders and Platoon commanders routinely will pull together a few members of the squad, such as a radio operator and the Corpsman, to assist them with their duties and provide them an element of security. However, the addition of a digitally linked information system to the unit makes creating one more of a necessity. Even with the benefits of automated reporting, a robust system

with all the capabilities discussed at the beginning of this paper would likely overwhelm all but a select few small unit leaders; however, if that leader had an additional Marine or two also linked in to assist him, collectively the group could better apply the full capabilities of the system. Here is an example of what a squad sized, digital C2 cell would look like:

1. An Assistant Squad Leader: Typically the assistant squad leader is one of the senior team leaders and next in line should the squad leader go down. In this case, just as the name implies, he would assist the squad leader with a division of labor of his now expanded responsibilities, but not necessarily be the second in command. He could track individual Marine location and status, monitor airborne video feeds over watching the squad's movement or a target location, or sort through intelligence updates. All of these would be difficult for a squad leader to do himself while at the same time directing the squad on the ground. Under such a system, it's not even necessary to collocate the assistant squad leader with the rest of the squad. In certain situations it may be more beneficial to the squad leader to have an assistant in a secure location, such as a forward operating base, where he could better monitor the tools of the digital system. In doing so he would provide a different perspective on the mission and be in a better position to directly communicate with higher or supporting agencies.
2. A Radio Operator: An infantry Marine who has demonstrated a talent with technology. Trained and overseen by the platoon communications Marine, he would monitor the squad's network connection and both radio and digital communications (Voice and Text).
3. Security: This should be another infantry Marine, but the manning level of the squad might require someone like an unengaged squad corpsman. Either way, there needs to be a member of the cell unencumbered by the digital system and has his "head up" monitoring the physical environment protecting the cell.

A platoon-sized cell composed under similar lines could include attachments, such as an intelligence analyst from the Company Level Intel Cell (CLIC). Briefly returning to the issue of design, a tailored and scalable information system adjustable to the requirements of the user would help facilitate the operation of the cell. Just as in current mobile operating systems, a settings menu that will allow the user to control the type of information displayed on the screen will provide needed flexibility. Different user configurations based on the division of labor established by the squad leader would allow flexibility for the manageable distribution of information within the cell. It would also help to prevent any one individual from reaching cognitive overload.

While an adjustment to the Table of Organization for a platoon and squad to facilitate the manning of these cells would be ideal, it is also unlikely to occur without sweeping manpower changes. This makes the manning of these cells subject to the personnel traditionally available to the unit. Thus, to facilitate its creation, it may be necessary to designate one of the three fire teams in an infantry squad for this task as a collateral duty. Certifying one fire team as "Digitally Capable" will provide a C2 cell for the squad composed of an infantry radio operator, a team leader to be the assistant squad leader, and two infantrymen to provide security when the situation requires the squad to be digitally "linked in".[11] A quick reconstitution of the fire team for its primary function as a fire and maneuver element is then possible when the situation warrants the full fighting capacity of the squad. Although the creation of a digitally capable C2 cell at the small unit goes a long way to ensure the effective implementation of these powerful tools by reducing cognitive overload, an overall decentralized C2 system will also be important.

Decentralized Command and Control

> First and foremost, in order to generate the tempo of operations we desire and to best cope with the uncertainty, disorder, and fluidity of combat, command and control must be decentralized.
> ...War is a human enterprise and no amount of technology can reduce the human dimension, our philosophy of command must be based on human characteristics rather than on equipment or procedures. [12]
>
> MCDP-1

A service level recommitment to decentralized command and control is the final component required to field an effective small unit digitally interoperable system. A potential pitfall of this system is that it enables multiple levels of command to reach down to the small unit leader in search of information and to give direction. Such actions tend to overreach when they bypass multiple command levels on the way down to platoon and squad size units. The additional requirements placed on the small unit leader in this situation could push him closer to cognitive overload as well as stifle initiative. Such a system requires discipline at both ends of the spectrum. Small unit leaders must make sure they are not allowing themselves to become distracted by the digital world at the expense of the physical world around them. In the spirit of mission type orders, higher-level leaders must resist the temptation to micromanage their junior leaders even with a digitally interoperable system that makes it easy to do so.

The Marine Corps has traditionally prided itself on its decentralized philosophy and the initiative it generates in its leaders. As the quote above from MCDP-1 states, decentralized command and control is a principle "first and foremost" in the Marine Corps' maneuver warfare doctrine. From time to time, particularly as technological advances pose a threat to its philosophy and principles, the service needs to be reminded of what's more important. In this case, the purpose of implementing this system is to increase situational awareness and ease the reporting burden on small unit leaders, not increase it. Upon the wide scale implementation of

the system, the service leadership must reemphasize its commitment to its decentralized command and control philosophy. The 36th Commandant of the Marine Corps, General Dunford, provided an excellent example of this recommitment in January 2015 when upon assuming command, he published his planning guidance in which he stated on the first page his commitment to decentralized command and mission tactics.[13] The publishing of white letters and holding discussions at senior level PME schools and the Commander's Courses upon the fielding of this system will go a long way toward fulfill this requirement.

Summary

Technological advances will soon make possible capabilities once only considered in the realm of science fiction. A few of the potential benefits are individual location tracking and health monitoring; video imagery available on the battlefield from a variety of sources; up to the second intelligence updates and fragmentary orders; and all sourced to wearable interface that will blend of the physical world with the digital world for the small unit leader in combat. However, the Marine Corps cannot simply hand a squad leader a tablet with these powerful and demanding tools and expect good things to happen. It will require an overall plan for implementation with an intuitive design component that takes into account social problems from an emerging digitally interconnected world, such as cognitive overload and digital distraction. It will require comprehensive integration into existing training, both at schoolhouses and operational units, to allow the targeted users to gain and maintain proficiency with the system without placing the training burden on one single entity. The complexity of the system and the tools it provides will require small units to create digitally capable command and control cells, so that no one individual becomes overwhelmed by the information. Additionally the collective effects of the group will allow the unit to use the system to its full capabilities. The final component of the

plan for implementation is a service level recommitment to decentralized command and control to ensure technology decreases the burden on the small unit leader instead of increasing it. Any plan that fails to implement these components runs the risk of being discarded in frustration by the targeted users. This would forfeit not only the money and time invested in fielding the system but more importantly the capabilities that could give its forces an incredible advantage over its adversaries.

Notes

[1] George Flynn III, *IOC CLT TALON REACH IV AAR*. (Quantico, VA: Infantry Officers Course, 2014): 1-38.

[2] Bradley Meyer. *Re: Your SAW Future War Paper Outline and Problem Statement* [Personal email]. (Quantico, VA: 18 November 2014): 2.

[3] Flynn, *IOC CLT TALON REACH IV AAR*, 3.

[4] "Science & Technology." WWW.ARMY.MIL, http://www.army.mil/news/sciencetechnology/ [accessed November 2, 2014].

[5] Tracking Point, Inc., http://tracking-point.com/products/shotglass [accessed December 26, 2014].

[6] International Cognitive Load Theory Association (ICLTA). "What CLT is.", http://www.iclta.net/P1About2.aspx. [accessed December 26, 2014]

[7] National Research Council. *Tactical Display for Soldiers: Human Factors Considerations*. (Washington, DC: The National Academies Press, 1997), 66-80.

[8] Rodger Trapp. "How Organizations can Free their Employees from Digital Distraction." www.forbes.com, http://www.forbes.com/sites/rogertrapp/2014/05/20/how-organizations-can-free-employees-from-digital-distraction/ [accessed November 2, 2014].

[9] Jack L. Nasar and Derek Troyer. "Pedestrian Injuries due to Mobile Phone use in Public Places." *Accident Analysis & Prevention* 57, no. 0 (8, 2013): 91-95.

[10] Shelby Lasater. Personal Interview. Infantry Officers Course, Quantico, VA: October 24, 2014.

[11] Bradley Meyer. Personal Interview. (Quantico, VA: 9 February 2015).

[12] *Warfighting*. MCDP. Vol. 1. (Washington, D.C.: U.S. Marine Corps, 1997), 77-78.

[13] Joseph Dunford. *U.S. Marine Corps 36th Commandant's Planning Guidance 2015*. (Washington, D.C.: U.S. Marine Corps, 2015), 2-3.

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