OFFICE OF THE COMMAND SURGEON, AIR COMBAT COMMAND

FELLOWSHIP PAPER

HEALTHCARE INFORMATION TECHNOLOGY (HIT) IN AN ANTI-ACCESS
(A2) AND AREA DENIAL (AD) ENVIRONMENT

By:

Robert J. Orlando, Maj, USAF, MSC, CPHIMS

A Research Report Submitted to HQ ACC/SGX

Joint Base Langley-Eustis, Virginia

March 2014

Disclaimer

The views expressed in this academic research paper are those of the author and do not reflect the official policy or position of the US government or the Department of Defense. In accordance with Air Force Instruction 51-303, it is not copyrighted, but is the property of the United States government.
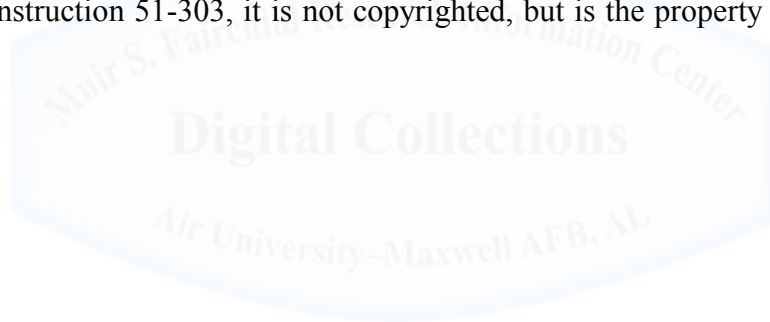
Headquarters Air Combat Command
Office of the Surgeon General
162 Dodd Blvd, Suite 100
Joint Base Langley-Eustis, VA 23430-1995

TABLE OF CONTENTS

ILLUSTRATIONS

Introduction

A ground medical expeditionary support response is needed in an A2/AD environment. Depending on the threat, the U.S. military will operate in new and austere locations. In this paper, we examine HIT and how it acts as a force enabler and mitigates the adversary's A2/AD approach to limit the United States (US) military's power projection. As the Department of Defense (DoD) rebalances the force with more focus on the Asia-Pacific region, this paper identifies the Air-Sea Battle (ASB) concept, US military's primary strategy to A2/AD, and how HIT alleviates challenges associated within an A2/AD setting. Additionally, this paper provides recommendations how the Air Force Medical Service (AFMS) can better utilize HIT in future medical expeditionary responses. A light and lean medical response that utilizes emerging technology, specifically HIT, enhances the AFMS' readiness posture and value to the DoD.

Expeditionary Medical Support (EMEDS)

Col David Johnson (ACC/SGX) explained at the 2013 Global Medical Readiness Symposium, "EMEDS is a rapidly deployable, tailored medical response supporting the full range of medical operations. It is a modular buildup and is light, lean, and life-saving."[1] It is about providing the right level of care on time and on target. The EMEDS deployable force modules are the EMEDS Health Response Team (HRT), EMEDS+10, EMEDS+25, and Air Force Theater Hospital (AFTH). All four have different compositions, populations at risk, care levels, full operating capability timelines, and footprints. The first three EMEDS deployable force modules are illustrated in Figure 1 on the next page.[2] EMEDS provides flexibility for the AFMS to execute its mission in any area of responsibility (AOR). Additionally, lessons learned from humanitarian assistance and disaster relief operations have decreased EMEDS setup times

---

[1] Col David Johnson, "Air Combat Command Expeditionary Medical Operations" (briefing, Global Medical Readiness Symposium, Joint Base Langley-Eustis, VA, 11 September 2013).
[2] Ibid., 15.

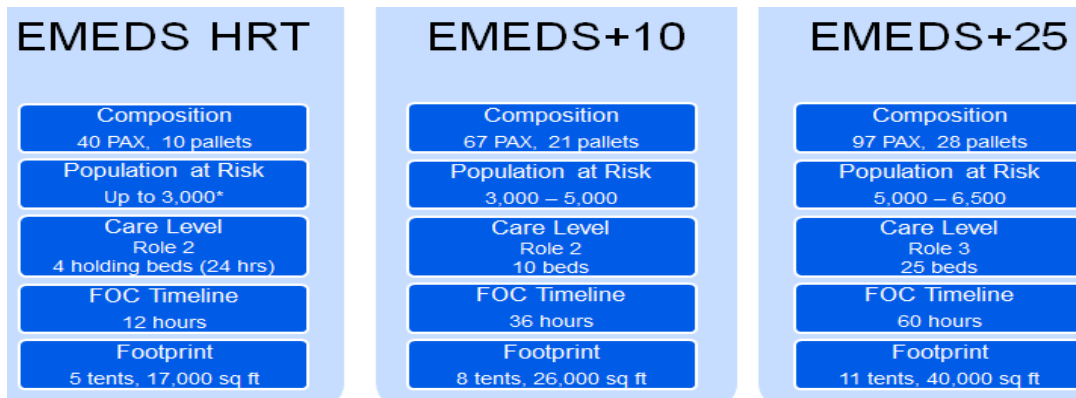| EMEDS HRT	EMEDS+10	EMEDS+25
Composition 40 PAX, 10 pallets	**Composition** 67 PAX, 21 pallets	**Composition** 97 PAX, 28 pallets
Population at Risk Up to 3,000*	**Population at Risk** 3,000 – 5,000	**Population at Risk** 5,000 – 6,500
Care Level Role 2 4 holding beds (24 hrs)	**Care Level** Role 2 10 beds	**Care Level** Role 3 25 beds
FOC Timeline 12 hours	**FOC Timeline** 36 hours	**FOC Timeline** 60 hours
Footprint 5 tents, 17,000 sq ft	**Footprint** 8 tents, 26,000 sq ft	**Footprint** 11 tents, 40,000 sq ft

Figure 1: EMEDS Deployable Force Modules

and improved initial and full operational timelines. An EMEDS unit can be collectively

protected meaning medical operations can continue after a chemical, biological, radiological, or

nuclear (CBRN) incident. According to Mr. Jim O'Connell, "A collectively protected EMEDS

is a critical capability within the Pacific."[3] The emerging way of war, A2/AD, presents medical

operational challenges in the Pacific. A better understanding of A2/AD and how it impacts

medical operations is needed.

Emerging Way of War – Anti-Access (A2) and Area Denial (AD)

The Air Sea Battle Office defines A2/AD in its May 2013 article.

> Action intended to slow deployment of friendly forces into a theater or
> cause forces to operate from distances farther from the locus of conflict
> than they would otherwise prefer. A2 affects movement to a theater.
> Action intended to impede friendly operations within areas where an
> adversary cannot or will not prevent access. AD affects maneuver
> within a theater.[4]

Foreign nations' A2/AD capabilities limit the US military's movement to a theater and maneuver

within a theater. A2/AD presents a major operational challenge, especially in the Western

Pacific region. The notion of a quick combat buildup or operation, and access to the global

---

[3] James O'Connell (HQ ACC/SGXM), interview by author, 11 December 2013.
[4] Air-Sea Battle Office, "Air-Sea Battle, Service Collaboration to Address Anti-Access and Area Denial
Challenges," *Air Force Live*, http://airforcelive.DODlive.mil/2013/06/overview-of-the-air-sea-battle-concept/
(accessed 11 December 2013).

commons is high risk and by no means guaranteed. The adversary will initiate military actions

quickly and without warning. Our bases, forces, and allies are at risk.

A2/AD influences the USAF's expeditionary medical capability. The new USAF reality

in an A2/AD environment is impeded access, very little if any technological dominance,

contested air and cyberspace control, integrated operations, and phase zero operations.[5] There

are options to mitigate the A2/AD challenge in order to maintain freedom of action in the global

commons and project power. These include: (1) ASB concept, (2) pivot to the Pacific, and (3)

phase zero operations. "ASB is about building conceptual alignment, programmatic

collaboration, and institutional commitment in an integrated way across the military Services in

order to develop forces and capabilities that can jointly address A2/AD challenges."[6] ASB

incorporates integrated operations across all five domains (air, land, sea, space, and cyberspace)

in order to create an advantage and mitigate access and denial effects imposed by the adversary.[7]

Furthermore, ASB and phase zero operations are needed as the DoD pivots to the Pacific.

The USAF encounters numerous A2/AD trials as the DoD pivots to the Pacific. The

DoD's joint medical community must have the ability to maneuver into and within a theater. If

there is a medical presence prior to a confrontation, the probability of deterring or withstanding

an initial attack increases. Pacific Air Forces' phase zero medical strategy includes medical

engagement activities that promote regional security, build relationships, and deter aggression.[8]

As the Obama Administration pivots to the Pacific, part of the DoD's strategy involves a force

posture plan that includes troop movement from Okinawa to Australia, and capacity

---

[5] Lt Col Jeffrey Alder, Presentation: The Emerging Way of War: Assessing AFMS Capabilities, 8 August 2013.
[6] Air-Sea Battle Office, "Air-Sea Battle, Service Collaboration to Address Anti-Access and Area Denial Challenges," *Air Force Live*, http://airforcelive.DODlive.mil/2013/06/overview-of-the-air-sea-battle-concept/ (accessed 11 December 2013).
[7] Ibid., I.
[8] Col Michael Hunter, "Rebalancing the Pacific: Shifting Engagement and Readiness" (briefing, Global Medical Readiness Symposium, Joint Base Langley-Eustis, VA, 10 September 2013).

improvement with partner nations such as Singapore, Indonesia, Thailand, Japan, and Australia.[9] The DoD's joint medical community can shape the Western and Southern Pacific regions by performing medical readiness training exercises which focus on providing care and patient movement in austere environments within these two regions. The phase zero medical operations minimize the A2/AD impact by establishing a medical footprint and improving the joint medical community's ability to treat and move patients within these regions. The net effect deters acts of aggression from countries such as China or North Korea.

The time before an adversary commences hostile action presents the best opportunity to manage crisis through shaping and deterrence actions.[10] Sometimes deterrence fails and what is the ramification for patient treatment and movement in an A2/AD environment where the US military does not have hospitals in the immediate area? What about China's long-range precision strike capabilities on US forward operating bases? United States and allied actions would try and enhance air and missile defense of Japan, and extend air superiority over the East China Sea and down the Ryukyu island chain.[11] These actions would take some time and are not guaranteed. Col Hunter stated, "The joint medical community will have to support casualty streams in days rather than hours, multiple patient streams for longer durations under duress, and develop new capabilities, equipment, and teams to address medical care in an A2/AD environment."[12] New medical capabilities, equipment, and teams are needed when a casualty

---

[9] Kiley, Gregory T., and Szechenyi, Nicholas F., *U.S. Force Posture Strategy in the Asia Pacific Region: An Independent Assessment*, Center for Strategic and International Studies, August 2012, http://csis.org/files/publication/120814_FINAL_PACOM_optimized.pdf (accessed 26 February 2014).

[10] Alcazar, Vincent. "Crisis Management and the Anti-Access/Area Denial Problem." *Strategic Studies Quarterly* 6, no. 4 (Winter 2012): 42-70. *International Security & Counter Terrorism Reference Center*, EBSCO*host* (accessed 18 September 2013).

[11] Tol, Jan Von, *Air-Sea Battle: A Point-of-Departure Operational Concept*, Center for Strategic and Budgetary Assessments, 1 April 2010, http://www.csbaonline.org/publications/2010/05/airsea-battle-concept/ (accessed 5 September 2013).

[12] Col Michael Hunter, "Rebalancing the Pacific: Shifting Engagement and Readiness" (briefing, Global Medical Readiness Symposium, Joint Base Langley-Eustis, VA, 10 September 2013).

requires level III hospital care, but receives level II surgical damage control for three days during

en route care because patient movement is intermittent and the lack of a theater hospital in the

AOR. Additionally, all this occurs predominately at 30 thousand feet in the air. This is a

paradigm shift from Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF)

where freedom of maneuver and air superiority were established, and theater hospitals were in

the AOR. The joint medical community must develop concepts of operations and address

medical care in an A2/AD environment that differs vastly from the previous two major conflicts.

Communication and Electromagnetic Spectrums (EMS)

If a commander wants to use HIT in an engagement that differs from OEF and OIF, an understanding of the operational environment is critical. This includes threats, measures, and countermeasures. Two spectrums within the operational environment are the communication spectrum and EMS. The objective of the joint communications system is to support the joint force commander (JFC) in

Figure 2: Global Information Grid Components

command and control (C2) of military operations.[13] This is accomplished by providing the right

information, in the right place, and at the right time. The warfighter gains a clear advantage when

forward operating base information is identified and securely packaged and made available to the

---

[13] Joint Publication 6-0, *Joint Communications System*, 10 June 2010.

warfighter regardless of location. The four joint communications system principles are interoperable, agile, trusted, and shared.[14] These principles enable information superiority which is the degree of dominance in the information environment that permits the conduct of operations without effective opposition on the global information grid (GIG).[15] Before we can understand the communication spectrum, EMS, and threats involved, we need to understand the GIG components.

The GIG supports the JFC throughout the full range of military operations. In order to maintain information superiority, the communication spectrum must be secure as threats evolve between the United States and enemy forces. Figure 2 on the previous page shows the GIG components and means within the communication spectrum.[16] The JFC has to consider both the communication spectrum and EMS when shaping the operational environment. The EMS is a physical medium through which joint forces conduct operations and includes radio frequency (RF) and non-RF portions.[17] EMS supports communications, intelligence, weapons, unmanned aircraft, CBRN, sensor data collection/transmission, free space optics, infrared and laser technologies, and electronic warfare.[18] What are the threats, measures, and countermeasures the United States and enemy forces utilize in the communication and electromagnetic spectrums?

As stated by Mr. Howe (ACC/A6), "Some of the main threats are jamming, interference, eavesdropping, denial of service, spoofing, network intrusions, and other forms of malicious software."[19] The adversary uses these threats as an anti-access and area denial mechanism which reduces the US military's ability to communicate, enter a domain, and maneuver within an area. Conversely, these same threats are also offensive information operations the US military uses

---

[14] Joint Publication 6-0, I-9, *Joint Communications System*, 10 June 2010.
[15] Ibid., I-6.
[16] Joint Publication 6-0, II-2, *Joint Communications System*, 10 June 2010.
[17] Joint Publication 6-01, *Joint Electromagnetic Spectrum Management Operations*, 20 March 2012.
[18] Ibid., I-1.
[19] Jason Howe (ACC/A6), interview by author, 14 November 2013.

against enemy forces. The threats occur in 802.xx wireless, satellite, radio, cellular, or a local area network setting. One way to reduce the impact of A2/AD in the communication spectrum and EMS is the use of a security model that protects data-at-rest and data-in-transit. Furthermore, the security model takes into consideration the growing use of smart devices and those needed in a secure tactical environment that contain five key measures to counter threats: (1) Authentication, (2) Data Protection, (3) Enforce Access Controls, (4) Secure Network Access, and (5) Secure the Platform.[20] These five measures target data-at-rest and data-in-transit.[21] DoD directive 8500.1 and instruction 8500.2 are in place to provide security configuration guidance and act as countermeasures to communication and electromagnetic threats. Countermeasures are vital to operational effectiveness and selecting the correct countermeasures is all the more important due to a small HIT budget.

HIT Budget

"The healthcare information technology budget is approximately $1.5 million per year for sustainment."[22] The AFMS Integrated Logistics Support Plan (ILSP) for the USAF Medical Equipment War Reserve Material (WRM) Information Management/Information Technology (IM/IT) summarizes the logistics support for WRM IM/IT.

> The healthcare IM/IT requirement includes hardware and software as well as communication support such as radios. The ILSP for IM/IT provides the overarching guidance and outlines the logistics support for WRM IM/IT and lifecycle management. WRM IM/IT is any hardware and/or software that is a component of a WRM medical equipment Unit Type Code (UTC). IM/IT equipment includes, but is not limited to rack-mounted or laptop servers, computer peripherals, clients, and IM/IT computer and communication system networking components.[23]

---

[20] Good, "Securing Business Mobility," http://www.jpmobile.com/media/pdf/enterprise/ good_security_whitepaper.pdf (accessed 18 December 2013).
[21] Ibid., 6.
[22] Lewis Rissmiller (HQ ACC/SGXM), interview by author, 7 January 2014.
[23] Air Force Medical Service Integrated Logistics Support Plan for the USAF Medical Equipment War Reserve Material Information Management/Information Technology Version 2.0, December 2011.

The current HIT sustainment budget is minuscule even though theater requirements are robust. Additionally, due to the projected 25,000 Air Force reduction in force over the next five years and $17 trillion national debt, the budget will remain relatively flat in the foreseeable future.[24] Standardizing platforms, modernizing and utilizing easy to build upon technologies, developing a robust HIT acquisition community, and treating HIT as a major weapons system are a few ways to bring value to the DoD during shrinking budget years and doing more with less. An enterprise can improve value with reduced resources by building in a smarter, more efficient, standardized, and flexible way. Our adversaries utilize A2/AD mechanisms such as cyber-attacks, supply chain disruption, or communication inhibition which can prevent US military forces from accessing or maneuvering within an area. They can remove a competitive advantage in a low cost manner as opposed to directly confronting the US. Can current HIT in an expeditionary setting function when the adversary employs A2/AD mechanisms? Before we answer this question, what kind of IM/IT equipment is within an existing expeditionary setting such as an EMEDS? Is the equipment and setup relevant for future engagements?

Current Environment

EMEDS communications equipment includes DoD approved computer systems and radios, and ACC/SG determines the requirements in conjunction with ACC/A6, Theater Medical Information Program (TMIP) Program Management Office, and the Integrated Logistics Support Manager (AFMOA/SGALW).[25] All equipment must be compliant with deployed force information system naming conventions and information assurance requirements.[26] Figure 3 on the next page displays a notional EMEDS network configuration per the Air Force Tactics,

---

[24] Hall, Edward, "United States National Debt Clock," 27 February 2014, http://www.brillig.com/debt_clock/ (accessed 27 February 2014).
[25] Air Force Tactics, Techniques, and Procedures 3-42.71, *Expeditionary Medical Support (EMEDS) and Air Force Theater Hospital (AFTH),* January 2014.
[26] Ibid., 33.

Techniques, and Procedures 3-42.71.[27] There are two main items that stick out when viewing the

IM/IT capability in the current environment. First, EMEDS does not deploy with the data

infrastructure and relies upon the expeditionary combat support and base operating support due

to its limited organic capability.[28] EMEDS relies on the host base's communication unit for

support and its data communication infrastructure. This is displayed in Figure 3 where the red

arrow connects the laptop server to the base communication unit. Additionally, EMEDS

facilities rely upon network control centers for basic core network functions such as network

administration, management, and information assurance.[29] As stated earlier, lessons learned

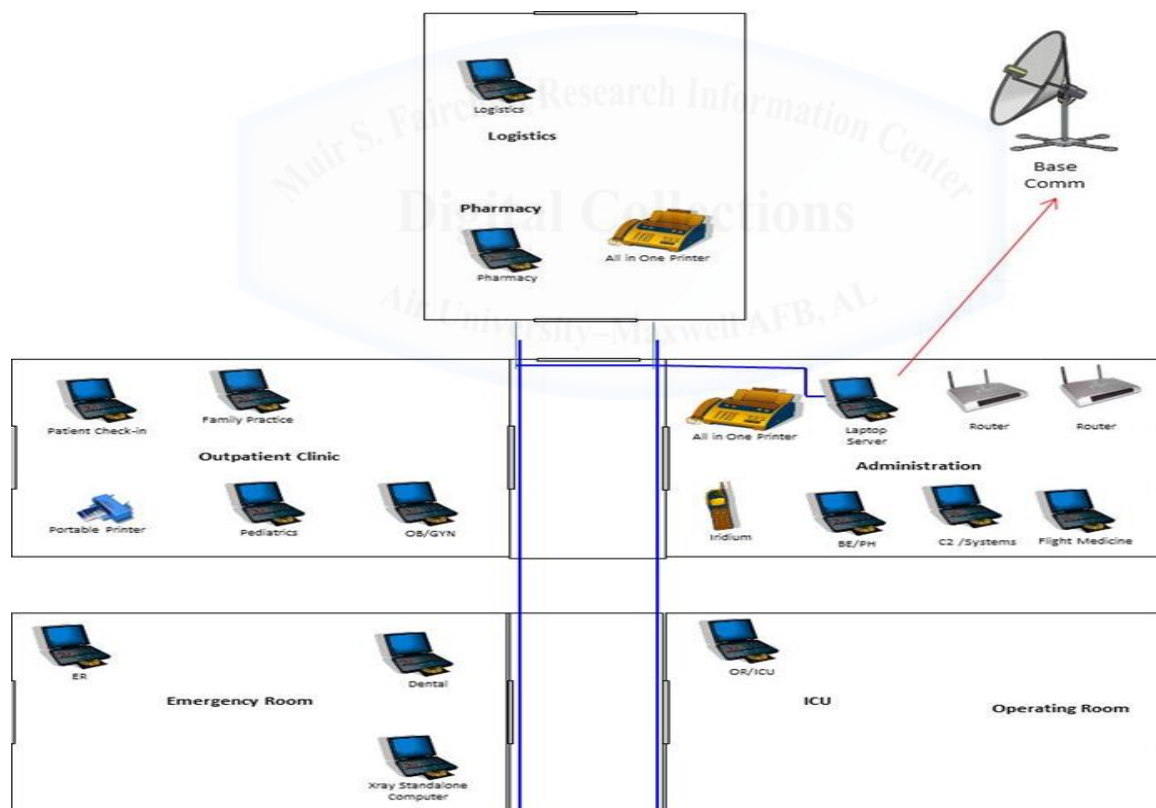from recent humanitarian and disaster relief operations have improved EMEDS setup times and

Figure 3: EMEDS HRT Network Configuration

---

[27] Air Force Tactics, Techniques, and Procedures 3-42.71, *Expeditionary Medical Support (EMEDS) and Air Force Theater Hospital (AFTH),* January 2014.
[28] Ibid., 36.
[29] Air Force Tactics, Techniques, and Procedures 3-42.71, *Expeditionary Medical Support (EMEDS) and Air Force Theater Hospital (AFTH),* 33, January 2014.

9

full operating capability timelines. Is the current EMEDS network configuration the best fit from an IM/IT perspective in an A2/AD environment? The EMEDS model isn't outdated. There are two problems from an IM/IT and operations perspective. First, can an EMEDS meet full operating capability relative to patient demand, injury, and mission requirements with limited organic capability? What is the probability the EMEDS network configuration will operate properly and on time when it relies on another unit? Both of these questions have to be viewed through an A2/AD prism.

The second main point when comparing an EMEDS HRT, EMEDS+10, and EMEDS+25 is the network configuration can be easily scaled-up as the AFMS uses the modular buildup from an EMEDS HRT to EMEDS+25 capability. The network configuration expands as the AFMS transitions from an EMEDS HRT to a larger EMEDS by adding more laptops and printers to emergency medicine, medical ward, dental clinic, critical care, primary care, and preventive medicine. An EMEDS+10 and EMEDS+25 have a server suite compared to a laptop server in an EMEDS HRT configuration. The ability to expand the network provides flexibility as the mission requirements change. However, EMEDS has a limited organic capability and relies on base operating support for data infrastructure and a connection into the GIG. The medical systems UTC (FFSYS) consists of one Medical Service Corps (MSC) officer and two health service managers (4A). The three personnel are part of the 58-bed AFTH. Prior to the AFTH buildup, the MSC or 4A with the most systems expertise will be tasked to act as the facilitator between EMEDS and base support and execute the necessary actions so the EMEDS network functions properly. This takes time and in an A2/AD environment, time, access, and the ability to maneuver will differ from how the AFMS functions today. There are emerging healthcare technologies that would greatly diminish A2/AD effects.

Emerging HIT in the Near to Midterm (1-10 Years)

The emerging trends in the near to midterm are numerous and the technology platforms exist today. Mobile platforms, radio frequency identification (RFID), telemedicine, and a unified theater server platform are four areas where HIT would improve a deployed team's medical capability and efficiency in an A2/AD environment. The trend for mobile computing started several years ago and went mainstream in 2007 when Apple introduced the original iPhone.[30] In 2010, Apple announced the iPad and these two products caused a seismic shift in the technology industry.[31] Mobile computing is here to stay and figure 4 exhibits the trend between personal computers and mobile devices.[32] The same trend could be applied in an expeditionary setting. There are better solutions rather than using laptops in an EMEDS setting. Additionally, an Air and Space Expeditionary Force (AEF) may not have the ability to setup an EMEDS with IM/IT wired components in an A2/AD environment. A small mobile platform computing device with

Worldwide Device Shipments by Segment (Thousands of Units)

Device Type	2012	2013	2014
PC (Desk-Based and Notebook)	341,273	303,100	281,568
Ultramobile	9,787	18,598	39,896
Tablet	120,203	184,431	263,229
Mobile Phone	1,746,177	1,810,304	1,905,030
Total	**2,217,440**	**2,316,433**	**2,489,723**

Source: Gartner (October 2013)

Figure 4: Sales and Forecast

---

[30] Apple, "Apple Reinvents the Phone with iPhone," 9 January 2007, http://www.apple.com/pr/library/2007/01/09Apple-Reinvents-the-Phone-with-iPhone.html (accessed 27 January 2014).

[31] Apple, "Apple Launches iPad," 27 January 2010, http://www.apple.com/pr/library/2010/01/27Apple-Launches-iPad.html (accessed 27 January 2014).

[32] Gartner, "Gartner Says Worldwide PC, Tablet, and Mobile Phone Shipments to Grow 4.5 Percent in 2013 as Lower-Priced Devices Drive Growth," 21 October 2013, http://www.gartner.com/newsroom/id/2610015 (accessed 28 February 2014).

secure medical applications would work wonders in this type of environment. Figure 5 shows

the mobile computing platform desired features according to the Pacific Joint Information

Technology Center.[33]

Desired Features
Device agnostic
Integrates with military electronic health record architecture
Portable/Mobile
Voice recognition
Stores and forwards medical data
Operates in low and no communication environments
Works in harsh environments
Clean and disinfect unit
Secure

Figure 5: Mobile Computing Platform Desired Features

This device needs secure mobile medical applications which meet certain graphical user interface

requirements for ease of use, information assurance and Health Insurance Portability and

Accountability Act (HIPAA) requirements, and the ability to work with theater clinical data

systems from point of injury to definitive care echelons.[34] Incorporating a device with the

aforementioned capabilities would enhance an AEF's medical capability, efficiency, and

flexibility in an A2/AD environment.

RFID is used in several industries. It can track animals, identify products, or cut costs in

order to streamline Walmart's supply chain. How can the AFMS leverage commercially

available technology that identifies and tracks patients in theater? RFID would improve medical

care, minimize time to locate patients and status, reduce administrative errors, and better position

the medical data to eventually end up in the patient's electronic health record. An analysis of

alternatives study was conducted under the direction of the Pacific Joint Information Technology

---

[33] Pacific Joint Information Technology Center, "Mobile Computing/Care En-Route," 1 March 2011.
[34] Ibid., 2.

Center and concluded in September 2012. The key finding was the most effective RFID technology for patient identification and tracking from point of injury to level III care is a patient-mounted Near Field Communication (NFC) tag with encryption, authentication, and a memory size larger than 1.5 kb.[35] Since the current EMEDS network configuration utilizes category five cable and laptops, technology such as RFID provides a better tracking system whether the patient is at the point of injury, EMEDS, airplane, helicopter, or AFTH. A mobile platform computing device such as a secure smartphone or tablet with secure medical applications can work with RFID technology used to track patients. Using HIT which is more flexible, has the ability to operate in austere environments, and isn't associated with base operating support is critical in the emerging way of war.

Since access to certain areas and maneuverability within areas will be reduced, telemedicine is another type of HIT which acts as a force multiplier in an A2/AD setting. Telemedicine uses information technology and telecommunication in order to provide healthcare from a distance other than the point of injury or patient location. The AFMS uses telemedicine for numerous clinical specialties; however, the primary specialty is radiology. The Picture Archiving and Communications System (PACS) program management office at Ft. Detrick oversees all digital radiology equipment and infrastructure. There is a hub and spoke concept that connects radiologists from medical centers to the smaller clinics. Radiologists can retrieve images from five worldwide regional archives when they are reading for a smaller Medical Treatment Facility (MTF) who does not have a radiologist. Additionally, four disaster recoveries are strategically positioned worldwide and act as mirror images of the regional archives so there is a backup in place in case of a natural disaster or real-world contingency. The medical

---

[35] DoD Military Health System, Force Health Protection and Readiness, Pacific Joint Information Technology Center, "Theater Barcode Integration and COTS-based Radio Frequency Identification," 14 September 2012.

Integrated Network Operations Center (INOSC) liaisons act as the focal point for multiple sites to connect to each other so radiologists can read diagnostic images by managing firewall connections. The idea of multiple sites connecting and the ability to retrieve images from Hanscom AFB so the radiologists at Langley AFB can read and provide a clinical assessment on the 24 year old male who had a computed tomography scan is both promising and feasible. How can this concept apply in an EMEDS and A2/AD setting? First, the deployed teleradiology system must work in the full range of military operations, meet digital imaging and communication in medicine (DICOM) and health level seven (HL7) standards, and not be vendor specific meaning it only works with one vendor and not others. Additionally, images and reports must work with the theater medical data store, AHLTA-Mobile, AHLTA-Theater, and TMIP CHCS Cache (TC2).[36] Finally, a deployed teleradiology system which works in a local/wide area network or wireless environment is critical. A portable imaging modality such as digital radiography that meets the AFMS' various standards such as interoperability, transmission security, and environmental flexibility is needed. The ability to capture clinical images in an A2/AD environment where the AFMS may or may not have the ability to setup a medical footprint is vital. If radiologists who are not in the AOR can read clinical images from the AOR, this saves lives and utilizes the full potential HIT can bring to the AFMS and DoD.

One of the most glaring gaps is a next generation suite of medical applications on a server that is both easily deployable and setup in austere environments. HIT can alleviate and ultimately fix this gap with an all-in-one, drop-in-place quick response emergency medical server platform that spans the full range of medical operations. The solution must work in a variety of situations as A2/AD forces the AFMS to plan and execute in a different way. One

---

[36] When AHLTA was deployed, it originally meant Armed Forces Health Longitudinal Technology Application. It is no longer an acronym. Composite Health Care System (CHCS) was the precursor to AHLTA and both are part of the DoD's electronic healthcare record system.

solution is a unified theater server platform (UTSP). A capability release plan for the UTSP

project was prepared for the DoD Military Health System (MHS), Force Health Protection and

Readiness, Pacific Joint Information Technology Center in April 2013 which identified an "all-

in-one" approach. This feasibility study identified a prototype of a unified server computing

platform maximizing the use of commercial off-the-shelf (COTS) components that provides

mobility and a quick medical setup in a number of austere situations.[37] Some of the most

significant requirements are ruggedized, secure, support multiple communication methods

(wired, satellite, 3G/4G), scalable, and able to interface with the theater medical data store.[38]

An all-in-one medical server platform provides flexibility, ease of use, and the necessary

compatibility needed in an A2/AD environment. Additionally, the prototype which is available

from COTS components can use virtualization software such as VMware.[39] Virtualization

means you can run more than one operating system and it supports multiple medical applications

on a single platform. This is like running two operating systems such as Windows 8 and Apple

OS X from one desktop at home. The AFMS utilizes virtualization technology already as it

improves workflow, reduces cost, and provides greater flexibility for a provider or technician.

Emerging HIT in the near to midterm (1-10 years) leads us to the long view. If the AFMS

positions itself today and utilizes emerging HIT in the near to midterm, an AFMS transition to

HIT in the long-term will occur more easily. Although we do not know precisely what type of

HIT will exist 10 to 30 years from now, we do know HIT will be used and we can extrapolate

from there.

---

[37] Department of Defense Military Health System, Force Health Protection and Readiness, Pacific Joint Information Technology Center, "Capability Release 1.0, Release Plan for the UTSP Project," 5 April 2013.
[38] Ibid., 9.
[39] Department of Defense Military Health System, Force Health Protection and Readiness, Pacific Joint Information Technology Center, "Capability Release 1.0, Release Plan for the UTSP Project," 5 April 2013.

HIT in the Long-Term (10-30 Years)

The focus of information technology will shift to intelligent technology.[40] Intelligent technology means machines such as our smartphone or tablet learn just as much from us as we learn from them.[41] Although IBM's Watson isn't living up to the hype just yet, the artificial intelligent (AI) computer system is a precursor for a dynamic shift that will impact every aspect of our lives. Systems learn and devices make decisions. In the future, robotics will influence the paradigm shift from information to intelligent technology. How will healthcare information technology or healthcare intelligent technology look in 10-30 years when unmanned aerial vehicles (UAV) and robots are more cost effective and integrated into the full range of medical operations?

A pilot on the ground can control a UAV with two passengers in it; one technician and one AI healthcare machine (Medical IBM Watson). Once the UAV lands, the technician can provide point of injury care to a wounded Airman. A mobile device can perform a body scan and identify the source of injury. Subsequently, the AI healthcare machine can make an assessment and the necessary course of action would follow thereafter. If the AI healthcare machine lacked the necessary information, the technician and AI healthcare machine would communicate with a physician located in theater or CONUS via the exchange of medical information in a telemedicine format. After the proper diagnosis and treatment, the patient is evacuated in the UAV to the nearest military hospital for final treatment. It sounds far-fetched, but if you look at what technology can do today versus five years ago, combine this with active duty personnel reductions in the DoD, and the blossoming field of robotics, we can take it one step further.

---

[40] Walton, Zach, "Microsoft Thinks the Future of Information Technology Lies in Intelligent Technology," *WebProNews*, http://www.webpronews.com/microsoft-thinks-the-future-of-information-technology-lies-in-intelligent-technology-2013-03 (accessed 13 January 2014).

[41] Ibid., 1.

16

What happens when you take the technician out of the previous scenario? A Pentagon study conducted in 2012 looked at future technology where a wounded troop could be scooped up by an aircraft such as the AirMule displayed in figure 6 or a robot.[42]
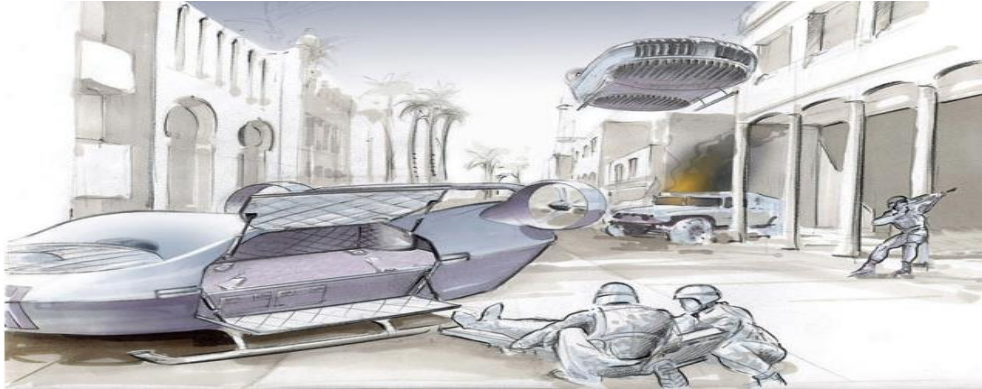

Figure 6: AirMule Illustration

The United States Army Medical Research and Materiel Command Telemedicine and Advanced Technology Research Center performed battlefield extractions using a robot that can carry the size of an adult male in 2007.[43] The UAV can locate the injured Airman and a robot can extract the injured Airman at the point of injury. The 2007 prototype was primitive compared to the

Figure 7: 2013 DARPA Robotics Challenge Winner

---

[42] Weinberger, Sharon, "Wanted: Robots to Evacuate Wounded Soldiers," 25 April 2012, *Popular Mechanics,* http://www.popularmechanics.com/technology/military/robots/wanted-robots-to-evacuate-soldiers-from-future-battlefields-8360171 (accessed 27 February 2014).
[43] Gilbert, Gary and Beebe, Michael, United States Department of Defense, "Research in Robotic Unmanned Systems for Combat Casualty Care," Technical Report ADA526596, NATO/RTO, 2010.

winner of the 2013 Defense Advanced Research Projects Agency (DARPA) Robotics Challenge as displayed in figure 7 on the previous page.[44]

In the future, robots will perform body scans, basic life support, lift and move patients, and communicate with physicians. Once the patient is on the UAV, the robot's scan and assessment automatically uploads into the electronic healthcare architecture system. The robot can communicate with the physician at the nearest military hospital and provide additional care while en route. Three scenarios can ensue from this point. The most likely occurrence is the assessment and patient's status remains the same and the flight back to the nearest military hospital is the best option. A second situation can occur if the robot on the UAV receives a message from C2 and an injured soldier needs life support and medical evacuation. The robot would assess, communicate, and evacuate the soldier. The medical UAVs in the future can carry up to ten passengers. While the robot performs the assessment on the soldier, the previous patient is monitored and watched by a technician located at the nearest military hospital in the AOR through telemedicine. Now the medical UAV transports two patients. While en route to the nearest military hospital, the robot receives a message from the pilot controlling the UAV that they need to fly back to Landstuhl Regional Medical Center since the hospital in theater is under attack and it is unsafe to land there. Both patients' medical information is in Landstuhl's electronic medical system already. Additionally, physicians and technicians are monitoring and providing feedback with the robot on the UAV. HIT will be drastically different in 10-30 years than what it is today. If you combine HIT with drones and robots, the three previous scenarios may come to fruition in some form or fashion. In fact, it is a lot closer than most people realize. The uses of UAVs will expand greatly from how they are used today. As of December 2013,

---

[44] Anthony, Sebastian, "Google Wins DARPA's Robotics Challenge, Wonders If It Was A Good Idea To Turn Down Future Military Contracts," 23 December 2013, *ExtremeTech.com*, http://www.extremetech.com/extreme/173318-google-wins-darpas-robotics-challenge-wonders-if-it-was-a-good-idea-to-turn-down-future-military-contracts (accessed 27 February 2014).

Amazon is testing drone delivery and the Federal Aviation Administration predicts rule changes as early as 2015.[45] Dmitry Grishin from Grishin Robotics said, "There will be robots in agriculture, defense, and medicine. These robots will protect us, cultivate our food, and take care of our health."[46]

Recommendation 1 – Cellular in Expeditionary Settings

You can't put the cart before the horse. New technology is great, but the infrastructure has to be in place. How many times has the AFMS purchased medical equipment only to find out we can't put it on the Air Force network because it is not certified or authorized to go on the AF-GIG? The main reason most consumers of an Android or Apple smartphone or tablet like their device is because they can access what, where, and when they want their information. Cellular service provides this capability. One future capability study involves the use of broadband cellular fourth generation (4G LTE) that supports all combatant commands. The Joint Staff J6 Command, Control, Communications, and Computers (C4) Assessments Division studies and recommends Joint Operational Long Term Evolution Deployable (JOLTED) Tactical Cellular System (TACTICS) capabilities that integrate, assess, and rapidly field COTS solutions.[47] A cellular network owned and operated by warfighters in the AOR provides reach back and flexibility. The ability to use LTE cell nodes on aerial, ground mobile, fixed ground, and maritime platforms provides the warfighter with information from the forward operating base and the GIG regardless of location. This concept has numerous implications such as providing the AFMS the ability to operate in vulnerable areas in the future. Figure 8 exhibits

[45] Gross, Doug, "Amazon's Drone Delivery: How Would It Work," 2 December 2013, *CNN Tech*, http://www.cnn.com/2013/12/02/tech/innovation/amazon-drones-questions/ (accessed 13 January 2014).
[46] Brandon, John, "The Far Future: Tech Trends of 2025," 9 May 2013, *FoxNews.com*, http://www.foxnews.com/tech/2013/05/09/far-future-tech-trends-2025/ (accessed 15 January 2014).
[47] Lt Col Scott Brooks, Presentation: Joint Operational Long Term Evolution Deployable Tactical Cellular System, 4 March 2013.
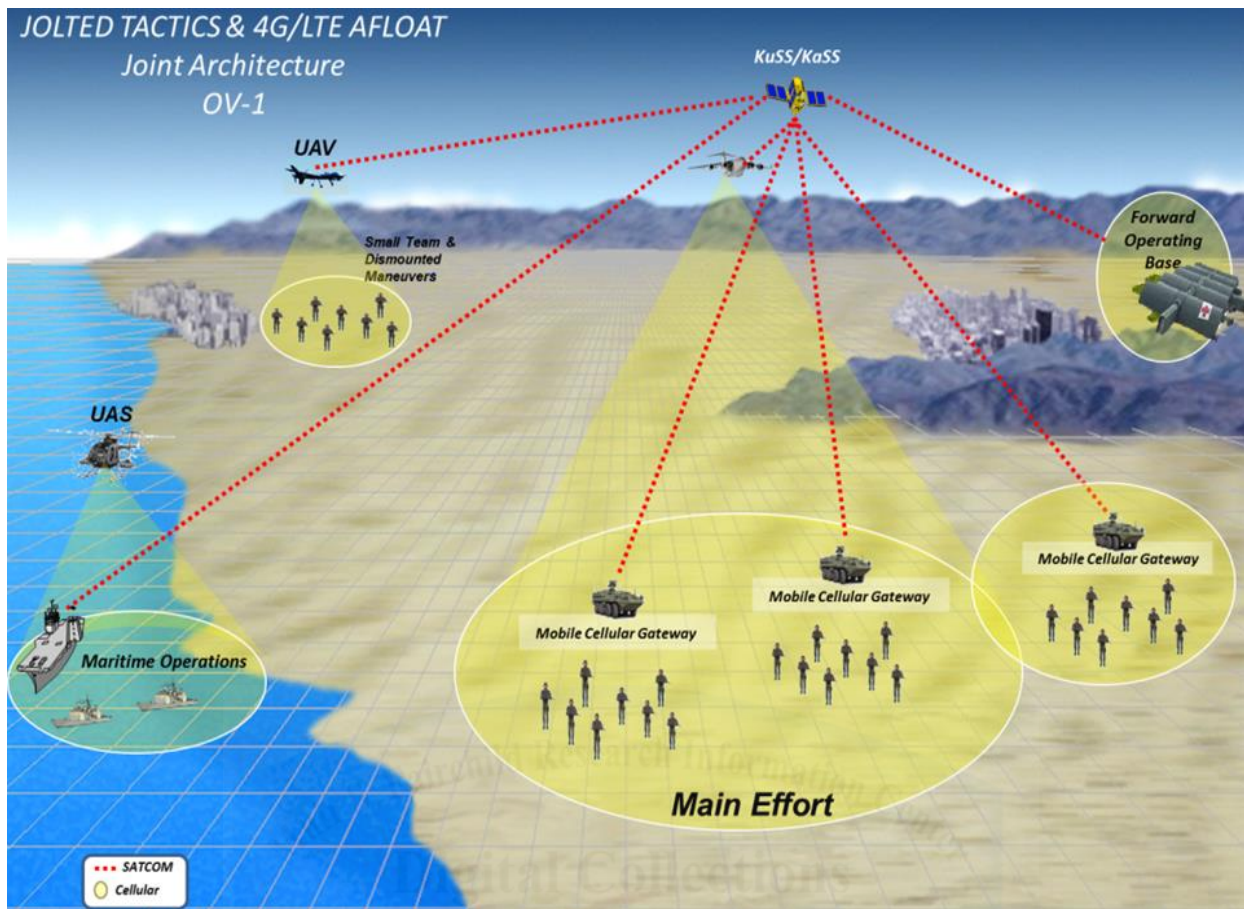
Figure 8: JOLTED TACTICS and 4G LTE Architecture

a notional 4G LTE platform.[48] An aerial platform that provides a cellular network for a

maximum of 100 medics per LTE node with excellent upload (50MB) and download (100MB)

speeds in an austere environment combined with secure mobile handheld devices with medical

applications utilizes cellular broadband, HIT, and acts as a force multiplier.[49]

Recommendation 2 – Treat HIT as a Major Weapon System

Is CHCS and AHLTA the way of the future for electronic healthcare record (EHR)

systems? The answer is a resounding no and no civilian hospital network would have a sunk

cost of $1.3B to design, develop, and implement a system that several years later after

---

[48] Lt Col Scott Brooks, Presentation: Joint Operational Long Term Evolution Deployable Tactical Cellular System, 4 March 2013.
[49] Ibid., 4.

20

implementation was soon outdated.[50] On 21 May 2013, Secretary of Defense Hagel directed the

DoD to pursue a full and open competition for an EHR solution.[51] The main component of this

is a COTS next generation solution that replaces DoD MHS clinical systems including CHCS,

AHLTA, and TMIP. This endeavor falls under the DoD Healthcare Management System

Modernization (DHMSM) program. The DHMSM program will focus on next generation

technology and will deliver standardized business and clinical processes and replaces CHCS,

AHLTA, and TMIP. Acquisitions, Technology, and Logistics (AT&L) assumes direct

responsibility, serves as the milestone decision authority, and follows an acquisition strategy

consistent with procuring major weapon systems.[52]

AT&L should prevent cost overruns that resulted in the previous $1.3B acquisition and

implementation of CHCS.[53] There will be realistic performance and cost expectations. The

acquisition strategy is not bulletproof as seen in the F-35 example; however, following the

acquisition strategy should result in an improved EHR product compared to the existing AFMS

EHR systems. Targeting COTS, next generation technology will provide the flexibility and

ability to modify and customize a platform as future technology capabilities change, and prevent

the acquisition of an AFMS sunk cost. Replacing TMIP with next generation technology will

help the AFMS execute the full range of medical operations in the future with more precision

and efficiency. The DHMSM program covers medical platforms that span the continuum of care

across garrison and theater which includes four roles of care: (1) role one (first responder), (2)

role two (forward resuscitative care), (3) role three (theater hospitalization), and role four

---

[50] United States Government Accountability Office, *Medical ADP Systems: Defense Achieves Worldwide Deployment of Composite Health Care System*, AIMD-96-39, 5 April 1996.
[51] Bonnema, Col Albert H., AFMS Chief Medical Information Officer, Office of the Surgeon General, Memorandum for HQ ACC/SG2, 22 November 2013.
[52] Headquarters Air Force, SG6, Talking Paper on DOD Electronic Health Record Modernization Acquisition, 18 November 2013.
[53] United States Government Accountability Office, *Medical ADP Systems: Defense Achieves Worldwide Deployment of Composite Health Care System*, AIMD-96-39, 5 April 1996.

(definitive care).[54] Subsequently, replacing TMIP with current COTS technology impacts

numerous expeditionary medical capabilities such as triage, sick call, operating rooms, ancillary

services, dental, intensive care units, critical care units, and en route care. HIT is a force enabler

and the AFMS can meet future demands in any environment when they treat HIT modernization

as a major weapon system and meet realistic cost and performance targets.

Recommendation 3 – DoD HIT Modernization

Information technology is central to DoD missions. According to the DoD Chief

Information Officer (CIO), Ms. Teri Takai, the current DoD IT environment contains limited

interoperability, unnecessary costs, cyber security vulnerabilities, and our current IT delivery

process hinders our ability to take advantage of new commercial technology.[55] The three main

pillars of Ms. Takai's IT modernization plan are infrastructure consolidation, streamline

processes, and strengthen the workforce.[56] How can the AFMS align HIT modernization with

DoD IT modernization? One way is to develop a robust HIT acquisition community? The

USAF MSC uses special experience identifiers for those who acquire ample IT experience. An

acquisition track exists within the MSC to develop those individuals with an acquisition

specialty. Radiology technicians who fill PACS administrator jobs are often on controlled tours

and have excellent IT capabilities. Physicians in the Medical Corps have the opportunity to

apply for healthcare informatics fellowships. There are numerous officers and enlisted Airmen

within the AFMS who have superior IT skills. One way to leverage these skill sets and

experiences is to track and use a special experience identifier for those who have IT expertise in

their career field and have these individuals involved in the acquisition process. This cohort

---

[54] Mrs. Valarie Tran, Presentation: DHMSM Increment II Overview, 13 November 2013.
[55] Ms. Takai, Teri, DoD CIO, DoD CIO's 10-Point Plan for IT Modernization, http://dodcio.defense.gov/ (accessed 16 January 2014).
[56] Ibid., 1.

would comprise the HIT acquisition community and a portion would participate in the decision making process during HIT garrison and expeditionary acquisitions.

A second way the DoD can align HIT and IT modernization is by standardizing expeditionary HIT platforms that minimize program unique requirements and ensure a secure cyber environment. Ms. Takai groups IT platform standardization within her infrastructure consolidation category. On the surface it looks like the DoD joint community uses one suite, TMIP-Joint (J), for expeditionary missions. However, when you dig deeper, each service has unique requirements due to land, sea, ground, and air. Moreover, when you factor in access points, record parts (outpatient, inpatient), specialties, connectivity nodes, durability, and miscellaneous issues, it is fairly easy to maximize service program unique requirements rather than minimize them. There is an area of opportunity to standardize the next generation of expeditionary HIT platforms including TMIP-J since per the guidance of Secretary Hagel; DoD Healthcare Management System Modernization has a goal of replacing AHLTA, CHCS, and TMIP with commercial off-the-shelf next generation technology.[57] Figure 9 displays the numerous mission areas TMIP-J medical software influences.[58] TMIP-J spans the continuum
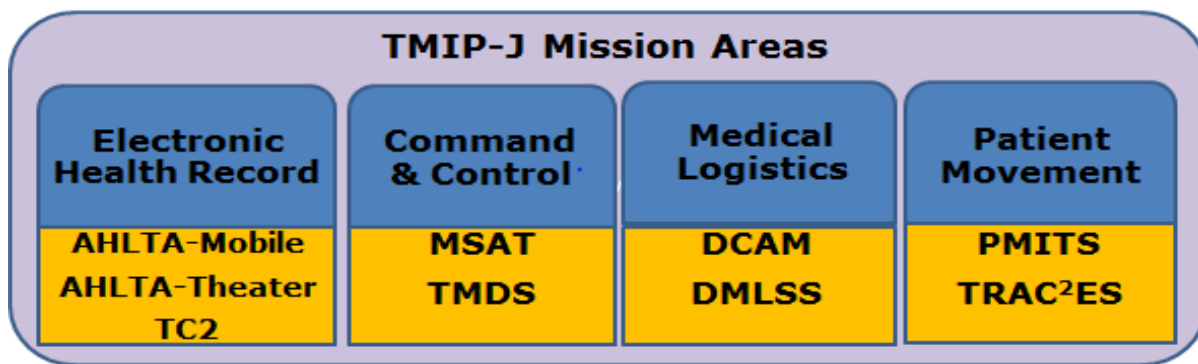

Figure 9: Theater Medical Information Program - Joint

---

[57] Headquarters Air Force, SG6, Talking Paper on DOD Electronic Health Record Modernization Acquisition, 18 November 2013.
[58] Mrs. Valarie Tran, Presentation: DHMSM Increment II Overview, 13 November 2013.

of medical care and standardizing this platform or another one in a way that minimizes service specific unique requirements with next generation technology results in DoD cost savings, improves joint interoperability, and increases mission effectiveness.

Conclusion

In summary, HIT acts as a force enabler and mitigates the adversary's A2/AD tactics. A ground medical expeditionary support response is needed in an A2/AD environment and HIT improves the AFMS' readiness posture. There are several ways HIT can act as a force enabler in an A2/AD environment. Some of the ways include the use of existing technologies such as mobile devices, RFID, telemedicine, and a unified theater server platform. These technologies counter the enemies attempt to deny the US military's freedom of action in the global commons and establish the necessary force posture. As the DoD rebalances the force with more focus on the Asia-Pacific region, three HIT recommendations would alleviate the A2/AD influence in this region: (1) expand cellular use in expeditionary medical settings, (2) procure HIT with an acquisition strategy, and (3) develop a robust HIT acquisition community. All three recommendations maximize HIT's full potential and lessen the A2/AD impact on the US military. This HIT approach moves the pendulum toward an AFMS state that is better positioned for future medical expeditionary responses in an A2/AD setting.

Bibliography

Air Force Medical Service Integrated Logistics Support Plan for the USAF Medical Equipment War Reserve Material Information Management/Information Technology Version 2.0, December 2011.

Air Force Tactics, Techniques, and Procedures 3-42.71, *Expeditionary Medical Support (EMEDS) and Air Force Theater Hospital (AFTH),* January 2014.

Air-Sea Battle Office, "Air-Sea Battle, Service Collaboration to Address Anti-Access and Area Denial Challenges," *Air Force Live*, http://airforcelive.DODlive.mil/2013/06/overview-of-the-air-sea-battle-concept/ (accessed 11 December 2013).

Alcazar, Vincent. "Crisis Management and the Anti-Access/Area Denial Problem." *Strategic Studies Quarterly* 6, no. 4 (Winter2012): 42-70. *International Security & Counter Terrorism Reference Center*, EBSCO*host* (accessed 18 September 2013).

Alder, Lt Col Jeff, Chief, Medical Counter-Chemical, Biological, Radiological, Nuclear Division. "The Emerging Way of War: Assessing AFMS Capabilities," presentation, 8 August 2013.

Anthony, Sebastian, "Google Wins DARPA's Robotics Challenge, Wonders If It Was A Good Idea To Turn Down Future Military Contracts," 23 December 2013, *ExtremeTech.com*, http://www.extremetech.com/extreme/173318-google-wins-darpas-robotics-challenge-wonders-if-it-was-a-good-idea-to-turn-down-future-military-contracts (accessed 27 February 2014).

Apple, "Apple Launches iPad," 27 January 2010, http://www.apple.com/pr/library/2010/01/27Apple-Launches-iPad.html (accessed 27 January 2014).

Apple, "Apple Reinvents the Phone with iPhone," 9 January 2007, http://www.apple.com/pr/library/2007/01/09Apple-Reinvents-the-Phone-with-iPhone.html (accessed 27 January 2014).

Bonnema, Col Albert H., AFMS Chief Medical Information Officer, Office of the Surgeon General, Memorandum for HQ ACC/SG2, 22 November 2013.

Brandon, John, "The Far Future: Tech Trends of 2025," 9 May 2013, *FoxNews.com,* http://www.foxnews.com/tech/2013/05/09/far-future-tech-trends-2025/ (accessed 15 January 2014).

Brooks, Lt Col Scott, Chief, Future Capabilities Assessments, C4AD, J6. "Joint Operational Long Term Evolution Deployable Tactical Cellular System," presentation, 4 March 2013.

Department of Defense Military Health System, Force Health Protection and Readiness, Pacific Joint Information Technology Center, "Capability Release 1.0, Release Plan for the UTSP Project," 5 April 2013.

Gartner, "Gartner Says Worldwide PC, Tablet, and Mobile Phone Shipments to Grow 4.5 Percent in 2013 as Lower-Priced Devices Drive Growth," 21 October 2013, http://www.gartner.com/newsroom/id/2610015 (accessed 28 February 2014).

Gilbert, Gary and Beebe, Michael, United States Department of Defense, "Research in Robotic Unmanned Systems for Combat Casualty Care," Technical Report ADA526596, NATO/RTO, 2010.

Good, "Securing Business Mobility," http://www.jpmobile.com/media/pdf/enterprise/good_security_whitepaper.pdf (accessed 18 December 2013).

Gross, Doug, "Amazon's Drone Delivery: How Would It Work," 2 December 2013, *CNN Tech*, http://www.cnn.com/2013/12/02/tech/innovation/amazon-drones-questions/ (accessed 13 January 2014).

Hall, Edward, "United States National Debt Clock," 27 February 2014, http://www.brillig.com/debt_clock/ (accessed 27 February 2014).

Headquarters Air Force, SG6, Talking Paper on DoD Electronic Health Record Modernization Acquisition, 18 November 2013.

Howe, Jason (ACC/A6), interview by author, 14 November 2013.

Hunter, Col Michael, "Rebalancing the Pacific: Shifting Engagement and Readiness" (briefing, Global Medical Readiness Symposium, Joint Base Langley-Eustis, VA, 10 September 2013).

Johnson, Col David, "Air Combat Command Expeditionary Medical Operations" (briefing, Global Medical Readiness Symposium, Joint Base Langley-Eustis, VA 11 September 2013).

Joint Publication 6-0, *Joint Communications System*, 10 June 2010.

Joint Publication, 6-01, *Joint Electromagnetic Spectrum Management Operations*, 20 March 2012.

Kiley, Gregory T., and Szechenyi, Nicholas F., *U.S. Force Posture Strategy in the Asia Pacific Region: An Independent Assessment*, Center for Strategic and International Studies, August 2012, http://csis.org/files/publication/120814_FINAL_PACOM_optimized.pdf (accessed 26 February 2014).

O'Connell, James (HQ ACC/SGXM), interview by author, 11 December 2013.

Pacific Joint Information Technology Center, "Mobile Computing/Care En-Route," 1 March 2011.

Pacific Joint Information Technology Center, "Theater Barcode Integration and COTS-based Radio Frequency Identification," 14 September 2012.

Rissmiller, Lewis (HQ ACC/SGXM), interview by author, 7 January 2014.

Takai, Teri, DoD CIO, DoD CIO's 10-Point Plan for IT Modernization, http://DoDcio.defense.gov/ (accessed 16 January 2014).

Tol, Jan Von, *Air-Sea Battle: A Point-of-Departure Operational Concept*, Center for Strategic and Budgetary Assessments, http://www.csbaonline.org/publications/2010/05/airsea-battle-concept/ 1 April 2010 (accessed 5 September 2013).

Tran, Valarie, Presentation: DHMSM Increment II Overview, 13 November 2013.

Walton, Zach, "Microsoft Thinks the Future of Information Technology Lies in Intelligent Technology," *WebProNews*, http://www.webpronews.com/microsoft-thinks-the-future-of-information-technology-lies-in-intelligent-technology-2013-03 (accessed 13 January 2014).

Weinberger, Sharon, "Wanted: Robots to Evacuate Wounded Soldiers," 25 April 2012, *Popular Mechanics,* http://www.popularmechanics.com/technology/military/robots/wanted-robots-to-evacuate-soldiers-from-future-battlefields-8360171 (accessed 27 February 2014).