

Accelerating Change to Survive

LT COL ROSS F. GRAHAM, USAF

Abstract

Geographic combatant commands (GCC) are the central actors in urgently driving necessary changes to the austere trauma life chain so that trauma survivability in peer combat can be maintained. Similar to how a kill chain consists of the discrete steps of find, fix, track, target, engage, and assess, the austere trauma life chain consists of the discrete steps of triage, rapid intervention, resuscitation, surgery, and evacuation. With the risk of peer war and large-scale combat operations growing swiftly, the pace of standard military change is wholly inadequate, and GCCs must transform mindsets by rapidly prioritizing and enacting life-chain improvements. They can do this by applying a paradigm of evaluating what opportunities are currently available, broadly applicable, cost conscious, and have demonstrated effectiveness (ABCD). This ABCD paradigm can assist in prioritizing potential changes, while promoting a bias toward innovation and action that can urgently improve today's peacetime life chain for tomorrow's peer combat.

Future, peer armed conflict will introduce a new generation of US military service members, medics, and commanders to sustained mass-casualty events.¹ This will severely challenge the trauma survivability life chain of wounded personnel, particularly in austere prehospital environments. Given the optimization for, and habituation to, low-intensity, counterinsurgency conflicts, how can the joint medical force accelerate change to maintain and improve the trauma life chain in a contested, degraded, and operationally limited (CDO) austere environment?² A central piece to this answer is found where the US military can generate requirements and innovate, exercise, and analyze joint operational concepts: the geographic combatant commands (GCC).

¹ Brent Thomas, *Preparing for the Future of Combat Casualty Care*, RAND Report RR-A713-1 (Santa Monica, CA: RAND, 2021), iii; and Todd South et al., "What War With China Could Look Like," *Military Times*, 1 September 2020, <https://www.militarytimes.com/>. A mass casualty event is one in which emergency medical services are overwhelmed by the number and/or severity of casualties.

² Safi Bahcall, *Loonshots: Nurture the Crazy Ideas that Win Wars, Cure Diseases and Transform Industries* (New York: Saint Martin's Press, 2019), 3. For clarity of discussion, instead of using the term *innovation* this article frequently uses the word *change*. This is meant to communicate that while innovation includes both new products and new strategies, the focus of this article is on making positive changes to the life chain. One of the central leadership challenges is guiding and accelerating change via phase transitions between groups of people, as Bahcall aptly explains.

Just as battlefield success requires a tight and durable kill chain, survival from battlefield injury requires a tight and durable life chain. Similar to how a kill chain consists of the discrete steps of find, fix, track, target, engage, and assess, the austere trauma life chain consists of the discrete steps of triage, rapid interventions, resuscitation, surgery, and evacuation.³ Peer war and large-scale combat operations (LSCO) will rapidly degrade and radically disrupt the life chain as currently practiced, increasing the risk to force and mission. The operational environment to which the military has grown accustomed is drastically different than what currently exists today. GCCs are the central actors to challenge paradigms of change and to compel a new mindset for this new environment.

Acknowledging resource constraints, this article proposes to change mindsets through a novel paradigm to prioritize potential changes while promoting a bias toward innovation and action. This paradigm asks if a potential change is available, broadly applicable, cost conscious, and has demonstrated effectiveness (ABCD). While ABCD is a simple set of considerations, military medicine has a relatively short timeline to change for peer war and can find “advantage [in doing] the simple things that work when things change.”⁴ This article evaluates examples of potential medical changes utilizing the ABCD paradigm for prioritizing action to improve the austere trauma life chain, concluding with a brief discussion of other potential areas to apply the ABCD paradigm for life-chain improvement and combat medical support.

Short Time Left to Change

To see the pressing need for change, one must understand significantly divergent trend lines of increasing global tensions versus the historically slow rate of military change. The rise of the People’s Republic of China (PRC) as a peer threat to the United States has quietly grown in the past two decades as the PRC has radically reorganized and professionalized its armed forces, dramatically built up

³ Air Force Doctrine Publication 3-60: *Targeting* (Maxwell AFB, AL: Curtis E. LeMay Center for Doctrine Development and Education, 21 November 2021), 27, <https://www.doctrine.af.mil/>. The discrete steps in the life chain make up the traditional Tactical Combat Casualty Care (TCCC) phases of Care Under Fire, Tactical Field Care, and Tactical Evacuation Care. See *Joint Trauma System, Tactical Combat Casualty Care Guidelines for Medical Personnel*, 15 December 2021, <https://learning-media.allogy.com/>. In the past two decades of counterinsurgency warfare, the life chain has traditionally been thought of as extending from point of injury to the continental United States. However, in peer war, evacuation to the United States will be significantly delayed and, in some cases, may not occur. Some less than catastrophic injuries that previously came back to the United States for management may be managed in-theater during peer war to expedite return to duty. This article assumes that evacuation to hospital-based care is the endpoint for the life chain, regardless of if the hospital is within the continental United States or not.

⁴ Spencer Johnson, *Who Moved My Cheese* (New York: GP Putnam’s Sons, 1998), 18.

its conventional forces, and strengthened its nuclear deterrence.⁵ This has led well-informed observers such as the former Indo-Pacific Command (INDOPACOM) intelligence chief, RADM Michael Studeman, to state that a PRC invasion of Taiwan “is only a matter of time, and not a matter of ‘if.’”⁶ Additionally, the previous INDOPACOM commander, ADM Philip Davidson, stated the PRC threat to Taiwan “is manifest during this decade, in fact in the next six years [2027].”⁷ Other observers have noted that “the conditions currently prevailing in real life in the Indo-Pacific are almost indistinguishable from what might be expected in the early stages of a march to war.”⁸ Additionally, the PRC is not the only source of peer or near-peer threats. For example, just more than a year ago, Russia invaded Ukraine, fomented a refugee humanitarian crisis against Poland, and disrupted the United States’ Colonial Pipeline.⁹ Finally, increased aggression by other autocratic states, such as Iran supporting Houthi rebels launching ballistic missiles and North Korea resuming ballistic missile tests, point toward an increasing risk of open conflict across the world.

In addition to recognizing the accelerating trend of threats, leaders must also realistically address the enormous challenges the military faces in rapidly changing to meet the swiftly evolving threat environment. As an example, the Air Force’s 2020 annual acquisition report showed that when judged by original program timelines, 44 percent of the highest-dollar baselined acquisition programs (Category I) were behind schedule, averaging nearly two years beyond initial projections.¹⁰ As a more poignant example, this author flew a mock-up F-35 simulator at the Paris Airshow

⁵ Phillip C. Saunders et al., eds., *Chairman Xi Remakes the PLA: Assessing Chinese Military Reforms* (Washington, DC: National Defense University, 2019), 262–63; Edmund J. Burke et al., *People’s Liberation Army Operational Concepts*, RAND Report RR-A394-1 (Santa Monica, CA: RAND, 2020); Office of Secretary of Defense, *Military and Security Developments Involving the People’s Republic of China, 2021*, Annual Report to Congress, <https://media.defense.gov/>; and Gerald C. Brown, “Understanding the Risks and Realities of China’s Nuclear Forces,” *Arms Control Today*, June 2021, <https://www.armscontrol.org/>.

⁶ Kimberly Underwood, “China’s Growing Threat to Taiwan and the World,” *Signal*, 13 July 2021, <https://www.afcea.org/>.

⁷ Adela Suliman, “China Could Invade Taiwan in the Next 6 Years, Assume Global Leadership Role, U.S. Admiral Warns,” *NBC News*, 10 March 2021, <https://www.nbcnews.com/>.

⁸ Daniel Davis, “What If China Launched a Surprise Attack on the US Military?,” *19FortyFive* (blog), 5 April 2021, <https://www.19fortyfive.com/>.

⁹ Editorial Board, “Putin’s Belarus Offensive,” *Wall Street Journal*, 11 November 2021, <https://www.wsj.com/>; and Maggie Miller, “Russia Arrests Hacker in Colonial Pipeline Attack, U.S. Says,” *Politico*, 14 January 2022, <https://www.politico.com/>.

¹⁰ *Department of the Air Force Acquisition Biennial Report 2019 + 2020: Building the Digital Force* (Washington, DC: DAF, 2021), 10, <https://www.af.mil/>.

in 2001, but the USAF's F-35A initial operating capability was not until 2016.¹¹ Fifteen years from mock-up to actual fielded capability is most of an Airman's career. In roughly the same amount of time, the PRC built its first aircraft carrier, fielded an operational hypersonic missile system with a fractional orbital bombardment system, and claimed, via man-made island fortifications, the vast majority of the South China Sea.¹² Again, contrast this PRC change mentality and speed with those of the US military as demonstrated by a new pistol request from the Army that included 350 pages of details and two years of testing at a cost of USD 17 million. As then the Chief of Staff of the Army, GEN Mark Milley, dryly commented, "We're not figuring out the next lunar landing. This is a pistol."¹³ The recent departure of the Air and Space Forces' chief software officer over the military's lack of ability to rapidly change further highlights this seemingly futile cultural struggle.¹⁴ The slow pace of change even prompted the Chief of Staff of the Air Force (CSAF), Gen C. Q. Brown, to originally consider titling his vision for the Air Force not "Accelerate Change or Lose" but rather "Accelerate Change or Die."¹⁵

The combination of increasing conflict potential and historically evidenced difficulty in speedily adopting change results in a short timeframe to improve the trauma life chain. Specifically, the advent of hypersonics, widespread cyberwarfare, and other adversary systems specifically designed to counter US strengths drive the urgency to act. As former CSAF Gen Curtis LeMay stressed, US forces must be "ready at the outset of hostilities to fight decisively."¹⁶

This concept also applies to those taking care of the fighters to ensure that "good men [do not] die because of unreadiness."¹⁷ Interestingly, a 2020 article by the Defense Health Agency (DHA), the joint combat support agency responsible for military medicine's readiness platforms, highlighted "7 Ways DHA Ensures a

¹¹ Colin Clark, "Air Force Declares F-35A IOC; Major Milestone for Biggest US Program," *Breaking Defense*, 2 August 2016, <https://breakingdefense.com/>.

¹² James R. Holmes, "The Long, Strange Trip of China's First Aircraft Carrier," *Foreign Policy*, 3 February 2015, <https://foreignpolicy.com/>; Janet Loehrke and George Petras, "Visual Explainer: How China's Hypersonic Missile Compares to Conventional Ballistic Weapons," *USA Today*, 4 November 2021, <https://www.usatoday.com/>; "China Island Tracker," Center for Strategic and International Studies, 24 March 2022, <https://amti.csis.org/>; and Oriana Skylar Mastro, "How China is bending the rules in the South China Sea," *The Interpreter*, 17 February 2021, <https://www.lowryinstitute.org/>.

¹³ Kyle Jahner, "Army Chief: You Want a New Pistol? Send Me to Cabela's With \$17 Million," *Army Times*, 27 March 2016, <https://www.armytimes.com/>.

¹⁴ Thomas Newdick, "Ex-Air Force Tech Boss Eviscerates Pentagon for Already Losing the AI Race against China (Updated)," *The Drive*, 31 October, 2021, <https://www.thedrive.com/>.

¹⁵ Senior Military Leader (lecture, Air War College, Maxwell AFB, AL, Academic Year 2021–22).

¹⁶ Phillip S. Melinger, "How LeMay Transformed Strategic Air Command," *Air & Space Power Journal* 28, no. 2 (March–April 2014), 84, <https://www.airuniversity.af.edu/>.

¹⁷ Melinger, "How LeMay Transformed Strategic Air Command," 84.

Ready Medical Force.”¹⁸ These seven ways included medical care standardization, COVID-19 operations, new technologies, international health surveillance and engagement, Total Force fitness, recruiting and retaining quality professionals, and managing the TRICARE health benefit. However, it notably lacked any mention of the military trauma system and potential changes to support US armed forces in peer war or LSCO. As a senior officer visiting the US Air War College (AWC) remarked in 2022, we “got a hell of a fight coming our way . . . we have got to be ready.”¹⁹ As shown below, the current military medical system is unready for today’s peer operational environment.

Medical Implications of a Radically Different Operational Environment

Since the dynamic of growing threats is closing the window for change, today’s actions must reflect the needs of the near future operational environment. Unfortunately, current senior medics’ formative professional experiences involved perfecting the golden hour for a low-casualty demand signal in a permissive environment.²⁰ This permissive environment allowed minimally impeded transport from initial injury to damage-control surgery (DCS), along with a rapid flow across the battlefield of blood, logistics, and manpower. Additionally, relatively uncontested cyber, space, air, sea, and even land domains not only enabled rapidly responsive patient and asset movement but also permitted frequent and reliable communications and telehealth. Furthermore, a focus on “contingency operations with relative impunity from enemy attacks” fostered a reliance on fixed facilities that rarely experienced combat attrition.²¹ Most profoundly, this environment’s astoundingly low rate of lethality from wounds has generated a perhaps unrealistic expectation of war-fighter survival that is now embedded in the psyche of war fighters, their commanders, the American public, and American leadership.²²

¹⁸ Military Health System Communication Office, “7 Ways DHA Ensures a Ready Medical Force,” *DOD News*, 2 October 2020, <https://www.defense.gov/>; and “Combat Support,” Defense Health Agency, last accessed 29 March 2022, <https://www.health.mil/>.

¹⁹ Senior Military Leader (lecture, Air War College, Maxwell AFB, AL, Academic Year 2021–22).

²⁰ Todd E. Rasmussen et al., “In the ‘Golden Hour’: Combat Casualty Care Research Drives Innovation to Improve Survivability and Reimagine Future Combat Care,” *Army AL&T Magazine*, January–March 2015, <https://mtec-sc.org/>. The *golden hour* refers to the concept of getting a patient to life-sustaining medical interventions and treatment within 60 minutes from initial injury. This medical treatment is often recognized to be advanced resuscitative capability, including damage control surgery.

²¹ Brent Thomas et al., *Project AIR FORCE Modeling Capabilities for Support of Combat Operations in Denied Environments*, RAND Report RR-427-AF (Santa Monica, CA: RAND, 2015), iii.

²² Atul Gawande et al., “Casualties of War—Military Care for the Wounded from Iraq and Afghanistan,” *New England Journal of Medicine* 351, no. 24 (2004), 2471–75. Lethality of war wounds in Iraq and

Contrasted with this highly favorable, resource-rich environment for military medicine, the near future operational environment will be starkly different. Among the most significant differences is the precision-strike threat from cruise and ballistic missiles. Given the speed and range of missile systems, including currently operational hypersonics, missile strikes on US forces could occur with only minutes' notice.²³ While these strikes will likely produce injury patterns similar to improvised explosive device (IED) blasts, the effects of both more blasts and bigger blasts will be a much greater quantity of wounded personnel, including traumatic brain injuries.²⁴ Also, the wreckage of intercepted inbounds may impact nontargeted areas; so, whether targeted or not, fixed medical facilities—both military and civilian—are at risk. Lastly, a lack of passive base defenses renders garrison forces attractive targets and increases the risk of mass casualties.²⁵ In sum, military medicine is not currently organized, trained, and equipped for the casualty demand signal that will result from peer war.

Another major difference in peer war will be the all-domain contested nature of conflict. Operating in fiercely contested domains of air, sea, and land, medics will have significantly limited transport space. Additionally, patient and asset movement will be sporadic and risky. The effects of cyber and space warfare, combined with electromagnetic warfare, will decrease communications' access, volume, and reliability. Due to this degradation, coordination of patient transport, requests for medical logistics or manpower, and reach-back telehealth will be poorly coordinated, intermittent, and unreliable. The culmination of these differences will create, per the Chairman of the Joint Chiefs of Staff, an “extremely austere” environment.²⁶ In peer war, medics will find their previously resource-rich environ-

Afghanistan from 2001–2004 was approximately 10 percent compared to 30 percent in World War II and 24 percent in the Vietnam War. This lethality continued to go down during the course of the wars in Iraq and Afghanistan; see, Jeffrey T. Howard et al., “Use of Combat Casualty Care Data to Assess the US Military Trauma System During the Afghanistan and Iraq Conflicts, 2001-2017,” *Journal of the American Medical Association Surgery* 154, no. 7 (2019), 600–08. “3 key interventions (tourniquets, blood transfusions, and pre-hospital transport within 60 minutes) were associated with 44% of mortality reduction” during the wars in Iraq and Afghanistan.

²³ Eric Heginbotham et al., *Chinese Attacks on Air Bases in Asia: An Assessment of Relative Capabilities, 1996-2017*, RAND Research Brief RR-9858/2-AF (Santa Monica, CA: RAND, 2015), 2, <https://www.rand.org/>. For a rapid and eye-opening understanding of how the PRC missile threat has changed during America's war on terror, view the graphic on page 2 of this report.

²⁴ Thomas, *Preparing For the Future*, 23–24.

²⁵ Stacie L. Pettyjohn, “Spiking the Problem: Developing A Resilient Posture In the Indo-Pacific With Passive Defenses,” *War on the Rocks*, 10 January 2022, <https://warontherocks.com/>.

²⁶ C. Todd Lopez, “Future Warfare Requires ‘Disciplined Disobedience,’ Army Chief Says,” *Army.mil*, 5 May 2017, <https://www.army.mil/>.

ments suddenly quite austere and their prior ability to rapidly move patients to higher levels of care delayed by hours or even days.

One final consideration for change in the operational environment, pertinent to military medicine, is how the military will employ its forces in peer war. The military, including military medicine, has “for 30 years . . . been on a relentless centralization binge” to achieve efficiency, economies of scale, and lower costs.²⁷ However, many US military services are moving toward a leaner, more agile posture that can be employed in a distributed fashion to coalesce synchronized mobile joint fires and actions across domains to generate combat effects.²⁸ This shift from optimization for efficiency to optimization for effectiveness means the medical support to these forces should also become more effective by being more agile, distributed, and mobile, focusing less on efficiency and cost effectiveness. Just as the Cold War era medical force underwent a revolution to become the current optimized medical force for the war on terrorism, so too must today’s medical force quickly undergo revolution to support peer combat.

Who Has the Impetus to Improve and Why They Should Care

While today’s new operational environment demonstrates the need to transform the life chain, who can best provide the impetus to force action? A key driver of successful organizational change is customer demand. In the military, the GCCs—who employ service-provided forces at the point of peer competition and conflict—are best positioned to create change. Organizationally, who better knows where change is most needed and where it will be most effective than those currently maneuvering ground forces, navigating the ships, and flying the jets across the areas of responsibility (AOR)? It is those who are responsible for combat success, the GCCs. A GCC’s ability to set standards and requirements, drive resolutions, and follow up on priorities allows it to force new processes and solutions outside of current ways of doing business.²⁹

Recently, the former staff director of the Senate Armed Services Committee (SASC), Christian Brose, asserted that “You only change minds by actually showing people that there is a better alternative, and the only way that we get a better

²⁷ Senior Military Leader (lecture, Air War College, Maxwell AFB, AL, Academic Year 2021–22).

²⁸ Air Force Doctrine Note 1-21: *Agile Combat Employment* (Maxwell AFB, AL: Curtis E. LeMay Center for Doctrine Development and Education, 1 December 2021), <https://www.doctrine.af.mil/>; “Expeditionary Advanced Base Operations (EABO),” *Marines.mil*, 2 August 2021, <https://www.marines.mil/>; and David H. Berger, *A Concept for Stand-in Forces* (Washington, DC: Department of the Navy, December 2021), <https://www.hqmc.marines.mil/>.

²⁹ David H. Berger and Christian Brose, interview by Andy Milburn and Shawna Sinnott, *Irregular Warfare Podcast*, 12 February 2022, 38:00–40:35 minutes, <https://mwi.usma.edu/>.

alternative is by creating alternative pathways around our system.” He continued, emphasizing that “the only way you are going to get disruption is by working outside and around the system that we have . . . that is how past military transformation, past military revolutions have largely occurred; it has been with visionary leadership, clear definition of operational problems, and rapid iteration of capability development and fielding.” Furthermore, he noted that you “don’t try to overturn the entire apple cart, you start with a handful of things and prove that those use cases work.” Leaders must then “find mechanisms to get . . . game changing ideas and capabilities, these kind of disruptive effects, out into the real world so that people can actually see there is a better solution and it is available to me now.” Lastly, he cautioned that “unless and until we do [this] our system will do what our system does, which [is to say] let’s manage risk, let’s push the timelines out; let’s hang on to the things we have.”³⁰ These sentiments are echoed by senior uniformed leaders, such as one who recently shared at AWC, “Everyone knows we need to get off the X and do it, but it is incredibly difficult to get moving.” GCCs who have the central battlefield stake and can find and demonstrate use cases are crucial to forcing the services to not only “get off the X,” but, in the words of the former Vice Chairman of the Joint Chiefs of Staff, tell the services, “here’s your joint requirement, just go build it, and go fast.”³¹

If GCCs do not drive a revolution in the life chain, they will increase not simply medical risk but also operational risk. As one author has noted, “Ultimately, MS-CODE [Medical Support to Combat Operations in Denied Environments] is not a medical problem. It is a line issue directly related to combat capability and the use of [service], Joint, and Coalition medical capabilities to ensure that the human element within the Military instrument of power remains quantitatively and qualitatively viable for combat operations.”³² As distributed operations concepts take hold, “operators [line personnel] will spend more time thinking about logistical constraints.”³³ A weak life chain is a logistical constraint because human life is what ultimately generates combat power. Unfortunately, the

³⁰ Berger and Christian Brose interview, 38:00–40:35 minutes.

³¹ Senior Military Leader (lecture, Air War College, Maxwell AFB, AL, Academic Year 2021–22). See also, John A. Tirpak, “U.S. Poorly Integrates CCMDs, Hasn’t Figured Out Hybrid, Hyten Says,” *Air Force Magazine*, 10 March 2021, <https://www.airforcemag.com/>.

³² Patrick B. Parsons, “Medical Support for Combat Operations in a Denied Environment (MS-CODE): Considerations for Immediate and Future Operations and Research Across the Strategic, Operational, and Tactical Domains” (research paper, Air War College, 6 April 2017), 25.

³³ Miranda Priebe et al., *Distributed Operations in a Contested Environment, Implications for USAF Force Presentation*, RAND Report RR-2959-AF (Santa Monica, CA: RAND, 2019), xi.

life chain, as currently optimized, increases “the probability of failure in achieving strategic goals at politically acceptable costs.”³⁴

There are multiple risks that accrue from a weak life chain. Fundamentally, a weak life chain obviously decreases troops’ survivability. Beyond this immediate loss of combat power is the loss of future combat power from those who can recover and return to fight. History is replete with examples of the severely injured returning to fight, from a badly burned USS *Arizona* sailor returning to serve on other World War II ships to troops returning to combat in Iraq and Afghanistan after suffering arm or leg amputations.³⁵ Services have invested greatly in developing personnel who are not quickly replaceable, especially in a peer war.

Besides loss of combat power, a weak life chain also drives up the risk that increased US losses will dissuade America from continuing to fight. Interestingly, the influence of war dead on the national will to fight is due to effects on American leaders and not necessarily the American people. Research has shown the US public does not have “an intrinsic, uncritical aversion to U.S. military casualties” but, rather, that “the relationship between public support for military operations vis-à-vis the level of casualties has been a function of national leadership.” The public weighs the “acceptability of casualties against the value of objectives,” but it is leadership that shapes the conversation of value.³⁶ If recent history is any guide, leaders making the decisions to commit forces likely have a much lower tolerance for high casualty counts. As one author has warned, “survival from battlefield injuries is not an indicator of strategic success in the mission. We must be cautious to ensure that successes in military medicine are not viewed as surrogate measures for success on the battlefield.”³⁷ Fewer casualties does not mean the war is being won, and higher casualties does not mean the war is being lost. However, a life chain ill-suited for a peer fight will increase deaths and potentially weaken US leaders’ will to successfully prosecute a war.

A weak life chain also incurs risk by decreasing esprit de corps and driving up personal risk aversion, both of which compromise lethality. It is well known that

³⁴ William E. Rapp, “Civil-Military Relations: The Role of Military Leaders in Strategy Making,” *Parameters* 45, no. 3 (Autumn 2015), 21.

³⁵ Donald Stratton and Ken Gire, *All the Gallant Men: An American Sailor’s Firsthand Account of Pearl Harbor* (New York: Harper Collins Publishers Inc, 2017); and Daniel J. Stinner et al., “Return to Duty Rate of Amputee Soldiers in the Current Conflicts in Afghanistan and Iraq,” *Journal of Trauma* 68, no. 6, (June 2010), 1476–79. Officers and senior noncommissioned officers had return to duty rates of 35 percent and 26 percent, respectively. Overall, the return to duty rate for military members post-amputation has grown from 2 percent in the 1980s to 17 percent during the time from 2001–2006.

³⁶ Richard A. Lacquement Jr., “The Casualty-Aversion Myth,” *Naval War College Review* 57, no. 1 (2004), 45.

³⁷ Matthew D’Angelo, “When the Butcher’s Bill Lies: How Modern Military Medicine Distorts the Costs of War,” *Modern War Institute*, 11 February 2022, <https://mwi.usma.edu/>.

troops perform better with increased lethality when they know they are backstopped by an effective medical system.³⁸ Those responsible for mission success and ordering troops into harm's way have a vested interest in ensuring the life chain is robust and effective to avoid weakened psychological force effectiveness and lethality.

An additional risk to consider is the excess tension created in commanders' minds and organizations by unrealistic or inflexible requests for line resources to care for wounded. The current life chain, with its emphasis on rapid evacuation to enable the golden hour, will create challenging decisions for line commanders due to competing requirements for manpower and transportation assets. These decisions are likely to either dilute the commander's operational focus or create lifelong psychological injury. Transforming the life chain for the new operational environment can diminish these tensions and shape new expectations of care delivery.³⁹

One last potential risk is that a weak life chain may decrease deterrence. Adversaries and partners alike may perceive a lack of change and investment in the supporting structures for peer war as a failure to take threats seriously. Even more ominously, others may see this as indicative of a lower likelihood to respond to aggression. As an example of how investments shift geopolitical dynamics, a recent RAND Corporation study noted that medical "WRM [war reserve matériel] posture can help reassure regional partners of the U.S. commitment to the region."⁴⁰

Having argued that GCCs must drive revolution in the life chain to suit the new operational environment, there are a few key areas this article is not addressing. While improvements today require balancing against more distant threats, the focus of this discussion is on near-term threats manifesting in this decisive decade. Also, this is not a comprehensive life-chain gap analysis but rather a proposal for a paradigm to prioritize actions to improve the life chain now.

How GCC's Can Prioritize Near-Term Actions to Strengthen the Life Chain

While many changes to the life chain are possible, given a highly constrained fiscal situation, GCCs need a framework for prioritizing changes. As mentioned earlier, this proposed paradigm asks if a potential change is ABCD. When considered together these four considerations can drive a bias for action when prioritizing changes.

³⁸ Karen S. Vogt, "Origins of Military Medical Care As An Essential Source of Morale," *Military Medicine* 180, no. 6, (June 2015), 604–06.

³⁹ Tanisha M. Fazal et al, "How Long Can the US Military's Golden Hour Last?," *War on the Rocks*, 8 October 2018, <https://warontherocks.com/>.

⁴⁰ Thomas, *Preparing for the Future of Combat Casualty Care*, 51.

First, given the potentially short timeframe for change in the jarringly different operational environment, current availability of a change is a first-order consideration. New processes already fielded at a unit level have more viability for rapid AOR implementation than those still in a conceptual or design stage. Next, changes that are broadly applicable by being joint and/or multinational capable should rank higher than those that are service or mission specific. Additionally, monetary and training time costs are a continual consideration. Finally, changes that have demonstrably improved links in the life chain deserve consideration for higher priority.

Although simple and brief, the fundamental considerations of what is ABCD can bring clarity and focus to prioritizing life-chain changes. The barrier to improvement is less a lack of ideas but rather prioritizing and transferring improvements to the field expeditiously and widely in a resource constrained environment.⁴¹ Broadly speaking, GCCs can survey the field for innovations to address life-chain challenges posed by the future operational environment, weigh in on evolving capabilities debates via requirements, and frequently iterate these surveys and requirements to guide capabilities to address gaps. The ABCD paradigm is not meant to deterministically drive a decision but rather to aid GCCs in clearly evaluating trade-offs between multiple potential changes, make decisions, and get moving. As an example, this article will now apply the ABCD paradigm to three potential AOR-wide changes that could improve the life chain.

Paradigm Applied, First Example—Shortage of Skilled Hands

One weakness in the life chain is that there are not enough personnel with lifesaving medical training to address the likely overwhelming number of immediate life threats—such as, massive bleeding, collapsed lungs, or compromised airways. As a countermeasure, the Department of Defense (DOD) is transitioning from Self Aid and Buddy Care to Tactical Combat Casualty Care All Service Members (TCCC ASM) training (Tier 1) by approximately 2023. However, in a casualty scenario in the new operational environment, TCCC Combat Lifesaver (CLS) training (Tier 2) is more effective at preserving the life chain. This is because the three major preventable causes of battlefield trauma death are extremity hemorrhage, tension pneumothorax (collapsed lung), and airway compromise.⁴² While Tier 1 training covers the first of these, the skills to address a tension pneumothorax or increased skills to improve an airway are taught at the Tier

⁴¹ Vijay Govindarajan and Chris Trimble, *The Other Side of Innovation: Solving the Execution Challenge* (Boston: Harvard Business Press, 2010).

⁴² Russ S. Kotwal, et al., “Eliminating Preventable Death on the Battlefield,” *Arch Surgery* 146, no. 12 (December 2011), 1351.

2 level, not the Tier 1. Additionally, in the context of the austere trauma life chain, critical skills such as administering initial antibiotics and pain medicine, preventing hypothermia, splinting fractures, as well as extricating, moving, and preparing casualties for evacuation are all skills first taught at the Tier 2 level.⁴³ Applying the ABCD paradigm, the experience and innovation of the 75th Ranger Regiment answers many of the paradigm's considerations and illustrates a way to provide a higher level of initial trauma care in the life chain.

The 75th Ranger First Responder (RFR) program is a line-led program to ensure every Ranger is competent in managing the major preventable causes of trauma death. Originating from then-Colonel Stanley McChrystal's directive to the Ranger Regiment to focus on medical training as one of four priorities, the RFR program has become a "casualty response system that relies on a mastery and immediate application of basic lifesaving skills by all Rangers."⁴⁴ From 2001 to 2010, despite a likely higher casualty severity than other troops in Operation Enduring Freedom and Operation Iraqi Freedom, "the regiment's rates of 10.7% killed in action and 1.7% who died of wounds were significantly lower than the rest of the DoD's rates of 16.4% and 5.8%, respectively." The RFR program increase trained personnel, which led to fewer deaths. In fact, of the regiment's 32 fatalities, only one was potentially survivable in the hospital setting.⁴⁵

The RFR program is proof that the concept of expanding Tier 2 training across a unit is *available*. Next, this change is *broadly applicable* as training materials are easily accessible as joint training. Additionally, if approached in an assignment or vulnerable to deploy phased training timing method, *costs* can be low. Finally, as detailed above, this change has *demonstrated effectiveness* to improve the life chain. Since all four of the ABCD considerations are positive, this change should receive a high priority for AOR-wide action.

To strengthen the first link in the life chain in a similar fashion to the Rangers, a GCC could significantly increase the portion of Tier 2-trained personnel in an AOR. When a GCC evaluates what units may benefit from a higher portion of Tier 2 training, the evaluation could be as simple as a peer competitor's physical missile threat rings or more nuanced using a construct to define a CDO environment such as high personnel density or potential for delayed reinforcement and transport due to topography and distance. In the current peer and near-peer threat

⁴³ Joint Trauma System, "TCCC Skill Sets by Responder Level," *Deployed Medicine*, 22 April 2019, <https://www.deployedmedicine.com/>.

⁴⁴ "Ranger First Responder and the Evolution of Tactical Combat Casualty Care," Fort Benning, 13 May 2020, <https://www.benning.army.mil/>.

⁴⁵ Kotwal, "Eliminating Preventable Death," 1350.

environment, units within minutes of overwhelming missile strikes, such as those in Japan or Germany, would benefit from having a high portion of personnel with the immediate lifesaving intervention skills of Tier 2 training. A member stationed in Japan, minutes from a potential PRC missile strike, currently needs a higher level of initial lifesaving trauma training such as Tier 2 training than, for example, a member stationed in the continental United States who is receiving Tier 1 training.

Regardless of how a GCC defines its particular threshold to increase the portion of Tier 2–trained personnel within units, it can leverage this training requirement on any unit, operational or support, deployed or garrison, that is operating within the potential CDO environment. However, a major limitation of this initial survival improvement is that long-term survival requires effective damage-control resuscitation (DCR) and DCS. This DCR and DCS care falls under subsequent links in the life chain and leads to the next change necessary to evaluate under the ABCD paradigm.

Paradigm Applied, Second Example—Blood Shortage

After initial Tier 2 rapid interventions to address major preventable causes of death, a significant risk to survivability is the inability to adequately perform DCR prior to DCS. Delay of DCS beyond the golden hour, as will often happen in peer war, makes this risk particularly acute. Furthermore, effective DCR frequently requires rapid access to large volumes of blood, and patients need to receive that blood within 36 minutes of injury.⁴⁶ Unfortunately, at the outset of hostilities and in the first weeks of combat, demand for blood will far outstrip available local and regional supplies. Moreover, this blood shortage will be problematic at multiple links in the life chain beyond DCR, including during DCS and evacuation.

Traditionally, blood transfusions have used separate blood product components of red blood cells, plasma, and platelets. Unfortunately, this has major supply- and cold-chain storage challenges that would make significantly boosting blood supplies from US stores infeasible in the first weeks of a peer conflict. Alternatively, whole blood (WB) exists as a viable alternative to component therapy, and current Joint Trauma System (JTS) guidelines recommend WB as the first choice for austere DCR.⁴⁷ Anecdotally, surgeons have called fresh WB the “nectar of the

⁴⁶ Stacy A. Shackelford et al., “Association of Prehospital Blood Product Transfusion During Medical Evacuation of Combat Casualties in Afghanistan With Acute and 30-Day Survival,” *Journal of the American Medical Association* 318, no. 16, (October 2017): 1581–91.

⁴⁷ Christopher Cameron McCoy et al., “Back to the Future: Whole Blood Resuscitation of the Severely Injured Trauma Patient,” *Shock* 56, no. 1S (December 2021): 9–15; and Joint Trauma System, “Whole Blood

gods” as they have noted that trauma patients receiving fresh WB do “much better” than those receiving component therapy.⁴⁸

This WB can be either freshly drawn when needed or pre-drawn and cold-stored. Recognizing this, some units have matured WB programs, such as the Ranger O Low Titer program, the 1st Marine Division’s Valkyrie Program, and US Forces Korea’s Standardized Tactical Universal Donor–Korea program.⁴⁹ In general, these programs screen individuals prior to potential conflict to ensure a safe and reliable blood donor pool for rapid utilization in times of austere crisis. While a unit-based WB program will not completely solve blood shortages, it can help close the gap, especially in austere environments.

Consider the facts through the lens of the ABCD paradigm. This concept is clearly *available* for AOR expansion as there are multiple units with safe and successful indigenously grown WB programs. Next, with relatively low technical and supply barriers to entry, WB programs are *broadly applicable* across the joint and multinational force. Additionally, *cost* and training time are low compared to the future logistical requirements of moving massive amounts of blood in a CDO environment or suffering preventable deaths. Finally, this change has *demonstrated effectiveness* to improve the life chain, particularly in an austere environment. A recent article in the journal *Military Medicine* describes a 33-year-old soldier who survived a severe injury in large part due to use of “a [WB program] . . . in aiding resuscitation” which “provid[ed] smaller, forward-deployed units with blood resupply without the administrative burden of storage, particularly in [a] resource-scarce environment.”⁵⁰ Since all four of the ABCD considerations are positive, this change should receive a high priority for action across an AOR.

When considering implementing a WB program in units across an AOR, a GCC should consider where it would be most needed and most effective. Similar to the previously described TCCC Tier 2 expansion analysis, a GCC could mandate all units under threat of rapidly becoming a CDO environment implement a WB program as guided through their respective force-providing services. Further, with already established programs in multiple services, a GCC could fa-

Transfusion (CPG ID:21),” 15 May 2018, <https://jts.amedd.army.mil/>.

⁴⁸ Stacy Shackelford, interview by Doug Soderdahl and M. Wayne Causey, *WarDocs Podcast*, 21 July 2021, 6:29–6:40 minutes, <https://podcasts.apple.com/>.

⁴⁹ Kaoru H. Song et al., “Ranger O Low Titer (ROLO): Whole Blood Transfusion for Forward Deployed Units,” *Military Medicine*, (10 November 2021); Gidget Fuentes, “‘Valkyrie’ Blood Transfusion System Hopes to Give Marines, Sailors Fighting Chance on the Battlefield,” *US Naval Institute News*, 18 August 2020; and Scott Kuhn, “Walking Blood Bank Can Save Lives on the Battlefield,” *Army.mil*, 5 August 2019, <https://www.army.mil/>.

⁵⁰ Song, “Ranger O Low Titer.”

cilitate component command linkage to these programs to enable rapid adoption to a predefined GCC standard. Additionally, the JTS provides a WB clinical practice guideline that covers the fundamentals of such a program and would be useful in establishing AOR-level guidelines.⁵¹ Once established, regular exercises of unit-level WB programs could ensure currency and familiarity, and the WB drawn could be transfused back into the original donors to train on giving transfusions or potentially donated to partner nations for civilian use. A GCC can lead this endeavor most effectively and efficiently.

Paradigm Applied, Third Example—“Undertrained and Underprepared Austere Surgical Teams”

The third example to illustrate the usefulness of the ABCD paradigm for life-chain improvement are the austere resuscitative and surgical care (ARSC) teams who perform DCS. All three services have used ARSC teams to enable the golden hour in the past two decades, particularly within the special operations community. Recently, the JTS defined ARSC as “advanced medical capability delivered by small teams with limited resources, often beyond traditional timelines of care, [to bridge] gaps in roles of care in order to enable forward military operations and mitigate risk to the force.” With an emphasis on limited resources and longer timelines of care, this definition matches the CDO environment that will dominate medical care in a peer conflict. “Gaps in roles of care” and “limited resources” will not be the anomaly in peer war or exclusively a special operations community challenge; they will be the norm across the force, and as such, “it will be incumbent upon medical, evacuation, and logistics elements to position surgical assets further forward and in greater isolation than in recent theaters.”⁵²

Unfortunately, DCS via ARSC teams is not the traditional and dominant concept of medical operations in the conventional joint medical force. This approach also faces a major tension between team size versus team capabilities.⁵³ As such, there is great heterogeneity in composition and capabilities among ARSC teams. Among the services, there are nearly a dozen different team types with sizes ranging from 3 to 10 personnel, equipment loads ranging between 200 to 7,000 pounds, and

⁵¹ Joint Trauma System, “Whole Blood Transfusion (CPG ID:21).”

⁵² Jay B. Baker et al., “Austere Resuscitative and Surgical Care in Support of Forward Military Operations—Joint Trauma System Position Paper,” *Military Medicine* 186, no. 1–2, (January–February 2021), 14. See also, Brian C. Beldowicz et al., “Death Ignores the Golden Hour, The Argument for Mobile, Farther-Forward Surgery,” *Military Review* (March–April 2020), 47.

⁵³ Joint Trauma System, “Committee on Surgical Combat Casualty Care Position Statement on Single Surgeon Teams,” 1 February 2022, <https://jts.amedd.army.mil/>.

abilities to surgically care for volumes of patients ranging between 2 and 11. Furthermore, across the joint force there have been “ad hoc solutions for manning, training, and equipping austere surgical teams” with “poor standardization and little to no doctrine to guide organization, preparation, and readiness of these teams to deploy into isolated environments with limited supply lines, challenging terrain and environmental conditions, and greater self-reliance to optimize patient survival.”⁵⁴ Although there has been widespread innovation, the medical services have poorly consolidated this capability for a peer fight. Despite this, ARSC teams have performed well, as exemplified by one team that cared for more than 750 patients in an eight-week period, including 19 mass-casualty events.⁵⁵ It is worth noting this capability was sustained in a mature theater with air supremacy and uncontested logistics. However, this level of performance, while serving in a “fast-moving river of trauma,” will likely be the expected norm for many teams in peer war.⁵⁶

Applying the ABCD paradigm to ARSC teams reveals that even while currently fielded, this capability lacks standardization and interoperability and is consequently not a consistent capability. Although ARSC teams are *available* to a GCC, the lack of a joint interoperability standard means this capability cannot easily be interoperable in multinational and joint environments and is thus *not broadly applicable*. Additionally, while making ARSC teams interoperable is a significant investment, multiple ARSC models exist to draw upon for estimating and reducing the *costs* of standards and capability consolidation. Further, although “limited data suggest comparable outcomes for Role 2 surgical teams [versus] Role 3 combat support hospitals,” one study has shown that “undergoing surgical stabilization at a Role 2 [surgical] facility decreased the likelihood of a casualty dying by one-third compared to initial surgical stabilization at a Role 3 [combat support hospital], independent of transport time or injury severity.”⁵⁷ Finally, the chief of the JTS has noted that “we think time [to medical care] is really the biggest factor in survival” and if the choice is “between taking longer and getting the patient to a more robust surgical hospital [or] getting to them with a smaller [surgical] team

⁵⁴ Baker, “Austere Resuscitative and Surgical Care,” 12–13.

⁵⁵ Stephen Losey, “It Sounded Like a Horror Show,” *Air Force Times*, 15 August 2017, <https://www.airforcetimes.com/>.

⁵⁶ Bob Shepard, “A River of Trauma’ Leads to Six Bronze Stars,” *UAB Medicine*, 14 February 2018, <https://www.uab.edu/>.

⁵⁷ Baker, “Austere Resuscitative and Surgical Care,” 14; Brian J. Eastridge et al., “Forward Surgical Teams provide comparable outcomes to combat support hospitals during support and stabilization operations on the battlefield,” *Journal of Trauma* 66 (April 2009), S48–50; Beldowicz, “Death Ignores the Golden Hour,” 42; and Jeffrey T. Howard et al., “Reexamination of a Battlefield Trauma Golden Hour Policy,” *Journal of Trauma Acute Care Surgery* 84, no. 1, (January 2018), 14.

quicker, [the patient is] probably going to have a better survival with the quicker [surgical team intervention].⁵⁸ This data, expert opinion, and previous team example, all point to the *demonstrated effectiveness* of far forward DCS.

After evaluating ARSC with the ABCD paradigm, it is clear that unlike the previous two changes, widespread TCCC Tier 2 and WB programs, ARSC is not broadly applicable across an AOR due to lack of standardization and interoperability. As the JTS has noted, “An ad hoc approach across the services for two decades has resulted in undertrained and underprepared austere surgical teams, which poorly reduces risk and may cause it to increase both for the teams themselves and the combat forces they support.”⁵⁹ However, the requirement for DCS exists and is even more critical in a CDO environment. Active debate exists about what this peer-war DCS capability should be as ARSC teams as currently conceptualized are likely at risk in peer combat.⁶⁰ Therefore, GCCs should set peer-war, operationally based, AOR-level DCS requirements to drive standards, capabilities, and interoperability through the component commands for ARSC team personnel, equipment, and surgical capacity. Additionally, GCCs should ensure these teams have appropriate “basic combat skills of shoot, move, communicate, navigate, and survive” so that they can be lean, distributed units of action in a peer fight with an ability to rapidly aggregate in the event of mass casualties.⁶¹ The GCCs have a key role in forcing this kind of standardization and interoperability.

Finally, as team interoperability and standardization takes form, GCCs can ensure ARSC teams arrive in an AOR already fully trained on multiple employment models and transport mechanisms. These employment models can range from taking inbound patients at a static location for treatment, moving ARSC teams forward emergently and treating at the site of a mass casualty, or even collecting patients and treating them en route away from active hostilities. Also, GCCs could require training for ARSC teams on multiple evacuation platforms—including rail, sea, and air—as appropriate for their AOR and not necessarily their service. By establishing standards for ARSC team capabilities, confirming proper combat training for team survivability, and ensuring greater flexibility in the use of ARSCs, GCCs can spur growth toward a viable, joint, multinational enabled improvement for the surgery link in the life chain.

⁵⁸ Shackelford interview, 2:57–3:14 minutes.

⁵⁹ Baker, “Austere Resuscitative and Surgical Care,” 16.

⁶⁰ Joint Trauma System, “Committee on Surgical Combat Casualty Care Position Statement on Single Surgeon Teams.”

⁶¹ Baker, “Austere Resuscitative and Surgical Care,” 16.

Future Areas to Apply ABCD Paradigm to Prioritize Action

While the three previously discussed potential improvements provide examples of how a GCC can prioritize life-chain changes, GCCs can use the ABCD paradigm to evaluate multiple other possible changes. A few examples of product type and strategy type changes that could be evaluated further for GCC expansion include developing CDO mass-casualty triage pathways; expanding medical care for directed-energy injuries; pursuing self-injectable medications to stop bleeding; formally expanding allied interoperable blood supply; fielding rapid blood and medical resupply capability via drones; dispersing and optimally placing medical WRM for future peer combat; implementing various changes for medical support in a chemical, biological, radiological, and nuclear contested environment; and integrating a roll-on/roll-off mobile biological, chemical, and ballistic protected surgical suite into ARSC teams.⁶² While items may not be ready for immediate expansion, such as the ARSC example discussed earlier, by evaluating current potential changes against AOR requirements, GCCs can drive improvements and requirements that suit the war-fighter's near-term needs. Additionally, the ABCD paradigm can be applied to other medical areas of innovation beyond the trauma life chain, such as how to maximize speed of return to duty in a combat environment, or how to minimize the disturbance to operations from the next major biological threat. While many changes are needed to prepare the United States for the coming peer war, the ABCD paradigm must be utilized to help prioritize near-term actions in a resource constrained environment.

Conclusion

In summary, given the growing nearness of peer conflict and the slow pace of institutional change, it is incumbent upon GCCs to evaluate current potential changes to the life chain and, where appropriate, compel rapid adoption within their AOR. To inform prioritization of changes, GCCs should determine gaps that exist in the life chain's current force structure, capabilities, processes, and equipment and then seek already fielded solutions that are the ABCD paradigm to improve the life chain. Then, as GCCs prioritize changes to the austere trauma life chain, they should leverage their ability to set requirements to rapidly effect these changes across their AOR and shape future research, innovation, and near-

⁶² Bahcall, *Loonshots*, 66. Bahcall convincingly argues that there are two types of breakthroughs, product (a new technology) and strategy (a new way of doing business or new application of a product). See also, Matthew Hanson et al., *Medical Support In A Chemical, Biological, Radiological, and Nuclear Contested Environment*, Fairchild Paper (Maxwell AFB, AL: Air University Press, 2021), <https://www.airuniversity.af.edu/>.

term solutions. There will eventually come a time when resources will be more plentiful, and when that time comes, rapid and aggressive use of the ABCD paradigm to prioritize and drive action will be important.

As a former staff director of the SASC argues, “the issue is not a lack of authority to go faster or to take more risk but that those who must exercise those authorities, bear those risks, and be accountable for the outcomes rarely use the authorities they have.”⁶³ By owning the challenges to the life chain from peer combat, GCCs, which know the scope and nearness of the threat, can accelerate change to optimize force survivability for the “peacetime competition of today and modern conflict of tomorrow.”⁶⁴ With a paradigm to rapidly prioritize action that is as simple as ABCD, GCCs can better heed ADM William “Bull” Halsey’s admonishment to his staff in World War II, “There’s a lot to be done . . . look around, see what it is, and do it.”⁶⁵ ✪

Lt Col Ross Graham, USAF

Lieutenant Colonel (Doctor) Graham is currently serving as the Deputy Chief, Medical Readiness Division, in the Office of the Commander Surgeon, Headquarters, Pacific Air Forces. He received his commission from the US Air Force Academy in 2002 with a Bachelor of Science degree in history and his Doctor of Medicine degree from the Uniformed Services University in 2011. Lieutenant Colonel Graham completed residency training in emergency medicine at the San Antonio Military Medical Center in 2014. He is a prior Air Force instructor pilot with 1,300 flight hours, a current board-certified emergency medicine physician, and has deployed as a chief of medical staff working host-nation care and aeromedical evacuation for active-duty service members and their families. Prior to his current position, Lieutenant Colonel Graham attended Air War College, Air University, Maxwell AFB, Alabama. He has also served as the commander of the 15th Operational Medical Readiness Squadron, Joint Base Pearl Harbor-Hickam, Hawaii. In this position he led 160 personnel providing full-spectrum outpatient active-duty medical and dental care for 5,500 active-duty Airmen across the state of Hawaii, including enroute patient staging services for 200 aeromedical evacuation missions annually. Additionally, he led COVID-19 operations for the 15th Medical Group and was consulted by the Hawaii Military Healthcare System as he authored COVID-19 military operational and clinical guidance utilized across the island of Oahu. He is happily married with five children and currently maintains emergency medicine currency in a community hospital.

⁶³ Christian Brose, *The Kill Chain: Defending American in the Future of High-Tech Warfare* (New York: Hachette Books, 2020), audio book Ch 11, 13:16–13:31 minutes.

⁶⁴ Margaux Hoar et al., “A Better Approach to Organizing Combatant Commands,” *War on the Rocks*, 27 August 2021, <https://warontherocks.com/>.

⁶⁵ William F. Halsey, *Admiral Halsey’s Story* (New York: McGraw-Hill, 1947), 136.

Disclaimer

The views and opinions expressed or implied in JIPA are those of the authors and should not be construed as carrying the official sanction of the Department of Defense, Department of the Air Force, Air Education and Training Command, Air University, or other agencies or departments of the US government or their international equivalents.