

# TAILORING CASUALTY CARE TO THE BURGEONING BATTLEFIELD

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U.S. Army Pfc. Shawn Williams, with the 1st Stryker Brigade Combat Team, 25th Infantry Division, gives the thumbs-up sign to soldiers in his unit as he is evacuated after being injured by a roadside bomb, in Kandahar province, Afghanistan.

Imagine a Mobius strip.

That is to say, imagine a rectangular strip of paper, of cloth, of anything, joined together at point A and point B after being twisted a full half-turn. In essence, imagine a long, uneven surface with one continuous side.

Now, imagine a playing field like a Mobius strip –any game, any sport, any team-centric effort– and imagine the rules of that game on that playing field always twisting and turning like a Mobius strip does; a singular concept with a definite starting and ending point but also with stretches of variable, uneven surface in between.

This is life in the Combat Casualty Care Research Program.

We begin with the basics; the warfighter's mission and the warfighter's health - and then we try to bridge the gap between those two points. That's what we do. But then everything changes: things like combat projections, personnel, funding, timelines, and sometimes even the rules themselves change on the way from where we begin to where we eventually find success.

## Leadership into Uncertain Times

And so in keeping with our overall mission of protecting, preserving, and restoring the health and safety of the combat service member, the

staff at the CCCRP now moves into a period where we must begin to harness this era's rapid technological advancements while, at the same time, applying those advancements to what military leadership believes will be a far more unique and unstable battlefield in future conflicts. In short, we must prepare for something we've never seen before.

I believe this mission to be attainable despite the military's own rather alarming projections for future combat scenarios. In a recently released United States Army-Marine Corps white paper entitled, "Multi-Domain Battle: Combined Arms for the 21st Century," the authors paint a wide variety of scenarios for ground combat operations against sophisticated peer enemy threats in the 2025-2040 timeframe. These scenarios include a number of factors, but overall largely preclude the assumption of air superiority – a critical paradigm contributing to the creation of highly asymmetric battlefields in recent conflicts.

Indeed, it is critical to understand why the U.S. military now assumes a lack of air superiority in future conflicts and, further, how this assumption will affect our medical efforts moving forward. Specifically, and again according to the same aforementioned white paper, it is agreed that both current and potential adversaries have for years studied the manner by which the U.S. coordinates air power to enable ground freedom to allow forces the ability to out-manuever

and overmatch. Going further, it is known that highly-advanced potential adversaries are currently developing methods to both counter and degrade U.S. strengths in the air and maritime domains, as well to disrupt U.S. military access to land, space, cyberspace, and the EMS. As such, the combination of these methods is intended to turn long-presumed strengths into weaknesses, potentially greatly diminishing overall U.S. military advantage.

In turn, and as a direct result of these assumptions, the military medical research community must understand and prepare for the ways in which this paradigm shift will impact the pursuit of excellence in our mission. The difficulty in achieving air supremacy, or even localized air superiority, against sophisticated adversaries on the future battlefield will directly require medical efforts to be more proactive and empowered at the point of injury as opposed to efforts that were previously accomplished at a Role 2 medical treatment facility.

Smaller and more ruggedized medical equipment and technologies, including semi-autonomous or autonomous systems, will be needed to potentiate casualty care efforts that can-and-will conceivably stretch for days if required in the aforementioned denied environments. Immediate evacuations will not be available. Adherence to the traditional "Golden Hour" rule of care as currently constructed may not be possible. As such, the concept of bringing life sustaining assets to the point of injury while also supporting delayed evacuation and/or prolonged field care becomes critical from this point forward.

## The Golden Hour: A Ticking Clock

With predicted loss of air superiority becoming a major staple of the projected battlefield of the future, we must again in turn begin the necessary paradigm shift away from the traditional understanding of the "golden hour" standard of combat care and move towards a more mobile application of that concept. Given the likely inability in more urban and denied settings to transport casualties to a damage control facility, we must begin to bring "golden hour" medical assets and intervention capabilities directly to the point of injury.

Of particular interest to me here is the concept, application, and implications of unmanned casualty evacuation. While much work still needs to be done in refining the technical capabilities of both ground and vertical lift platforms, it is here specifically where we can begin the actual and outright harnessing of modern-day technological innovation. Cutting-edge advances in automated systems, airway management, and the establishment of early Extracorporeal Life Support, as well as the continued refinement of damage control resuscitation will be key to success in this field. Further, seeing as how battlefield hemorrhage is responsible for potentially preventable pre-hospital mortality in more than 90% of cases, whole blood transfusion and early wound and extremity management will be of significant importance moving forward in this lane.



Soldiers from the 15th Brigade Support Battalion out of Fort Hood, Texas, provide treatment to the "wounded" during a mass casualty exercise. The training, taking place on Fort Irwin, California, is part of a National Training Center rotation scenario testing their ability to perform under a simulated combat environment. (Photo Credit: G. A. Volb)

Given those facts, it is perhaps in this area more than any other that we can begin to see the need to harness the vast technological advancements and capabilities that I mentioned previously. With regard to technologies directly applicable to this field, there is specific interest within the CCCRP in automated vascular access, which would sharply potentiate the use of more efficient and advanced resuscitation measures. In addition to providing an ideal route for closed loop resuscitation and administration of whole blood, automated vascular access provides access for potential future use of Extra Corporeal Life Support systems and lifesaving medical devices deployed in blood vessels (endovascular) as below.

ECLS systems have the potential to rescue severely injured casualties who go into organ failure as they may have the ability to replace kidney, liver, and lung function. Further, they can be ruggedized and used in the forward environment to supplement the pumping action of the heart also in addition to organ substitute in combat casualties. Early utilization of ECLS near the point of injury could likely increase the probability of survival among severely injured casualties. These technologies also have the potential to greatly reduce the medical footprint required in theater and can ideally be used on the future battlefield in an automated, closed-loop fashion in delayed evacuation and unmanned casualty evacuation scenarios.

Endovascular devices such as (Resuscitative Endovascular Balloon Occlusion of the Aorta) emerged from treating wartime casualties in Iraq and Afghanistan. REBOA is an evolving, effective intervention that stops life threatening, non-compressible torso hemorrhage while preserving blood flow to the heart, brain, and other vital organs and could potentially be deployed in an automated fashion in the future battlefield.

## The Always Fight: Prolonged Field Care

The U.S. Army leadership's recent declaration that prolonged field care is now the number one priority of the Army at-large is a boon to



Medics with the 82nd Airborne Division's 1st Brigade Combat Team, retrieve notionally wounded paratroopers from a Black Hawk medevac helicopter operated by the 101st Airborne Division's 159th Brigade at the Joint Readiness Training Center, Fort Polk, La. (Photo Credit: Sgt. Michael J. MacLeon)

to the current state of military medical readiness, it will clearly be the steps we take now that will ensure that same level of readiness is in place for the 2025-2040 timeframe. In short, the interwar period is a precious commodity, and in the wake of this new declaration, robust support from Army leadership will be required to ensure this period is used with utmost efficiency.

That being said, it is to be expected that the Army's declaration on behalf of prolonged field care will overlap across many of the current portfolios within the CCCRP. The forward application of decision support, automated systems, and even artificial intelligence will be lynchpin concepts moving forward, and will clearly have the support from our entire staff regardless of portfolio division. It is here also where we bring TBI into the fold, as early diagnosis of traumatic brain injury continues to be

the mission of the CCCRP, but also a sizable challenge as well. While all the various and ongoing efforts of this program have contributed

a top priority for both the Army and the larger DoD. With more than 160,000 members of the Army suffering a TBI since 2000 according to the Defense and Veterans Brain Injury Center – a reaffirmation of the importance of prolonged field care requires both the development and delivery of easily-translatable technologies and knowledge products to the warfighter, especially in ground-level combat environments.

## Zero Preventable Deaths: The Constant Goal

This, of course, is our always and constant goal: zero preventable deaths. And much like success in the more clearly-focused area of prolonged field care, success here will depend on re-doubled efforts from staff across the military biomedical research enterprise. Indeed, it seems so simple to say that one wants to provide the infrastructure necessary to prevent combat-related mortality, yet I firmly believe that we can make this reality truly possible if we bring to bear nearly all we do within the JPC family and the wider MRMC family. The multi-domain battlefield will no doubt be the most demanding environment the warfighter has ever faced, and so we must plan and act accordingly.

And yet there always challenges. There are always obstacles.

There is always uneven ground.

Much like traversing the aforementioned Mobius strip, our program must and will employ a combination of short term tactics and long-term strategies designed to build successes that will benefit the warfighter in the current, future, and the continuous fight. These are the places where innovation is needed- along those vast and arduous tracts of shifting ground where teamwork is required to navigate the terrain between point A and point B.


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