Homeland Defense & Security Information Analysis Center

# HDIAC TECHNICAL INQUIRY (TI) RESPONSE REPORT

## Knowledge and Skills for Medics Working in Austere Environments

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The Homeland Defense & Security Information Analysis Center (HDIAC) was asked to provide resources and trainings available for medics to perform in austere environments and conduct prolonged care. Military medical professionals must often provide prolonged care in austere environments that have a lack of resources and pose logistical challenges and potential dangers. Therefore, it is important for military medical personnel working in these environments to acquire skills outside the range of their normal needs.

HDIAC utilized its active technical inquiry services to gain information based on this topic from its database consisting of subject matter experts. This report gives a list of tools and resources to prepare medics working in austere environments for the greatest success. Each tool is listed in alphabetical order and categorized by resources, learning platforms and certificates, and simulators.

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# About

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## TI Research

A chief service of the DoDIAC is free technical inquiry (TI) research limited to four research hours per inquiry. This TI response report summarizes the research findings of one such inquiry. Given the limited duration of the research effort, this report is not intended to be a deep, comprehensive analysis but rather a curated compilation of relevant information to give the reader/inquirer a "head start" or direction for continued research.

# Abstract

The Homeland Defense & Security Information Analysis Center (HDIAC) was asked to provide resources and trainings available for medics to perform in austere environments and conduct prolonged care. Military medical professionals must often provide prolonged care in austere environments that have a lack of resources and pose logistical challenges and potential dangers. Therefore, it is important for military medical personnel working in these environments to acquire skills outside the range of their normal needs.

HDIAC utilized its active technical inquiry services to gain information based on this topic from its database consisting of subject matter experts. This report gives a list of tools and resources to prepare medics working in austere environments for the greatest success. Each tool is listed in alphabetical order and categorized by resources, learning platforms and certificates, and simulators.

# Contents

# 1.0 TI Request

## 1.1 Inquiry

What information is available regarding resources and training for medics to perform in austere environments and conduct prolonged care?

## 1.2 Description

The Homeland Defense & Security Information Analysis Center was asked to provide available training and simulations that discuss the required knowledge and skills for a medic to properly perform in an austere environment and conduct prolonged care at the point of need. Specifically, the inquirer wants to know what knowledge and skills maximize return-to-duty rates; overcome contested logistics; and allow a medic team to optimize ground, sea, and air evacuation.

# 2.0 TI Response

U.S. military medical personnel often work in austere environments to provide healthcare in remote, dangerous, or low-resource settings. Austere/remote environments can be [1]:

> …defined by any or all of the following limitations:
>
> - Caregiver Knowledge, Skill, Ability, or Expertise. An example is a junior physician with no experience or training in performing escharotomies, who is caring for a casualty with circumferential thermal injuries to the lower extremities.
> - Quantity, Quality, or Availability of Equipment, Supplies, or Medications. An example is having only one ventilator, a ventilator with limited functionality, or no ventilator at all.
> - Number of Caregivers or Assistants. An inadequate number of caregivers might not provide enough hands or enough time to complete all necessary tasks to optimally help patients.
> - Time. An example is the [need] to quickly treat a casualty while knowing that additional casualties are en route to the healthcare facility or the need to evacuate the casualty (or the healthcare team) within a short time period.

Medics working in austere environments may need to "triage patients because of resource limitations and the use of telemedicine to obtain essential subspecialty advice or procedural guidance when evacuation is delayed" [1]. Due to the lack of resources, logistical challenges, and potential dangers, it is important for military medical personnel working in these environments to acquire skills outside the range of their normal needs.

This report provides a list of tools and resources to prepare medics working in austere environments for the greatest success. Each tool is listed in alphabetical order and categorized by resources, learning platforms and certificates, and simulators.

## 2.1 Resources

This section discusses available resources for medics in austere environments. Summaries are provided for:

- Concepteers Teleconsole v.2 Security Gateway
- Joint Trauma System (JTS)
- QuantaSpec

### 2.1.1 Concepteers Teleconsole v.2 Security Gateway

The Concepteers Teleconsole v.2 Security Gateway was built for medical personnel at the point of need in an austere environment. It is already capable of allowing real-time access to surgical operating environments in the field by telemedicine. It also has a remote-control robotics apparatus to perform surgeries and provide critical visual imagery for direct patient care and is currently deployed in 200 locations in theater of battle worldwide [2].

### 2.1.2 JTS

The mission of the JTS "is to improve trauma readiness and outcomes through evidence-driven performance improvement" [3]. The JTS has many roles within the medical community and has evolved to become a world-renowned authority regarding the care of casualties during war. Military and civilian trauma experts have developed guidelines that are, whenever possible, evidence based on actual process and outcome measures captured in the U.S. Department of Defense's (DoD's) Trauma Registry and from data derived from their experience [3].

Within the JTS, there are several programs relating to austere and forward-deployed environments. Some examples include:

- Clinical Practice Guidelines (CPGs): CPGs "are the backbone of the JTS Performance Improvement program for combatant command trauma systems" [4]. The JTS CPGs are used by both military and civilian healthcare providers worldwide. "The CPGs are compiled from DoD Trauma Registry data, health data abstracted from patient records, and after-action reports. The data are analyzed and distilled into guidelines to remove medical practice variations and save lives."
- Deployed Medicine: See Section 2.2.2.
- Emergency War Surgery Course (EWSC): See Section 2.2.3.

### 2.1.3 QuantaSpec

QuantaSpec is a software platform that has conducted research for the U.S. Army on the automated reagentless diagnosis of infections using infrared hyperspectral imagery. QuantaSpec has developed technology to miniaturize hyperspectral imagers and use hyperspectral images to detect and identify pathogens in human blood. Past research has been conducted on the diagnosis of malaria and bacterial and fungal pathogens [5].

## 2.2 Learning Platforms and Certificates

This section discusses available learning platforms and certificates for medics in austere environments. Summaries are provided for:

- Austere Emergency Care (AEC)
- Deployed Medicine
- EWSC
- Fundamentals of Critical Care Medicine in the Austere Environment
- Prolonged Field Care (PFC) Collective
- Tactical Trauma Reaction and Evacuation Crossover Course (TTREX)
- Wilderness Paramedic Certification (WPC)

### 2.2.1 AEC

AEC is a four-day course designed for medical professionals working in austere/remote environments. The course is based on PFC concepts created by U.S. Special Forces medics for medics who might be treating critical casualties for extended periods of time [6].

### 2.2.2 Deployed Medicine

Deployed Medicine is a mobile learning "platform used by the Defense Health Agency [DHA] to trial new innovative learning models aimed at improving readiness and performance of deployed

military medical personnel" [7]. It currently serves as the "one stop shop" for combat casualty care instruction, including tactical combat casualty care (TCCC), K9 care, and prolonged care. It is available through its website [7] or iPhone and Android stores. Currently, the JTS is the tenant/content validator; it could be easily expanded to be inclusive of additional content modules as needed [8].

### 2.2.3 EWSC

The EWSC is designed for surgeons and other deploying providers to help "guarantee every injured service member or person on the battlefield is afforded maximal opportunity at survival and to optimize functional outcome" [9]. The course material is updated periodically to deliver the most relevant information for each specialty role in combat casualty care. The EWSC has two parts.

Part 1 is a teaching curriculum meant for anyone working in the combat casualty care space and focuses on delivering combat casualty care in accordance with the JTS CPGs.

Part 2 is [9]:

> …a specialty specific module for each combat casualty care team member.
>
> - General Surgery and those who deploy as such, as well as surgical technicians (i.e., scrub [technicians])—[Advanced Surgical Skills for Exposure in Trauma Plus] ASSET+
> - Orthopedic Surgeons and Surgical Technicians—[Combat Orthopedic Trauma Surgery Course] COTS+
> - Operational Medical Officers and those who deploy as such (i.e., internal medicine, [pediatrics], family practice)—Critical Skills for Expeditionary Medicine
> - Head and Neck—Under development by Triservice, multispecialty (plastic surgery/[ear, nose, and throat] ENT/[oral and maxillofacial surgery] OMFS) group run out of Uniformed Services University of the Health Science (USU)
> - Anesthesia—Under development at USU
> - Emergency Medicine—Under development at USU
> - Emergency Medicine and Critical Care Nursing—Under development by DHA Nursing Readiness Workgroup

### 2.2.4 Fundamentals of Critical Care Medicine in the Austere Environment

The Fundamentals of Critical Care Support (FCCS) course is commonly taught to U.S. military clinicians before deployment and in civilian settings where clinicians are challenged by limited medical resources. Clinicians would benefit from an understanding of critical care fundamentals that they can apply in austere and operational environments [1].

The course was developed in collaboration with the Society of Critical Care Medicine Uniformed Services Section, who recognized that the traditional FCCS course was already taught in multiple military, graduate, medical education programs but needed to better match the principles of the course to military deployment realities in underdeveloped nations, especially when opportunities arose to help caregivers in these countries develop their healthcare infrastructure. Consequently, this course was designed with two goals in mind: (1) education about critical care fundamentals to caregivers in resource-limited environments and (2) education to caregivers deploying to those locations [1].

Much of the new content and understanding of best practices for care in resource-limited settings was identified by reviewing the guidelines published by the U.S. Military's JTS. The FCCS also uses resources from the Centers for Disease Control and Prevention, the World Health Organization, and the Sphere Project and often from the experiences of the 46 military and civilian subject matter experts who authored *Fundamental Critical Care Support: Resource Limited* [1].

The course takes place over two days and has moved toward a more interactive format with case discussions; integrated skill stations; and short, reinforcing didactics. The course uses the minimum-better-best concept to emphasize the importance of using the best level of care in a resource-limited setting [1].

### 2.2.5 PFC Collective

The PFC Collective is an online website [10] that offers a wide variety of tools and expertise for medics working in the most challenging environments. The PFC Collective, formally known as the PFC Working Group, was created by medics for medics in 2014. "The mission of the [PFC] Collective is to educate, inform, and advocate for the training of austere emergency medical responders at all levels of training." Since its creation, it has become the leader in "bringing relevant digital content to special operations medic around the world."

The PFC website focuses on promoting best practices, sharing knowledge, and fostering connections among healthcare providers who work in these challenging environments. It offers a podcast and YouTube channel, which features experts and practitioners in the field to share lessons learned and educate and inform the niche community. Additionally, the PFC website has [10]:

> …hosted the official landing page for the U.S. DoD Advanced Virtual Support for Operational Forces (ADVISOR) Telemedical Consult Service managed by the Telemedicine and Advanced Technology Research Center (TATRC), which is part of the U.S. Army Medical Research and Development Command at Fort Detrick, MD.

The members of PFC have also helped develop the JTS CPGs.

### 2.2.6 TTREX

TTREX is a training program established by Army and Air Force personnel from Brooke Army Medical Center's Department of Emergency medicine. The TTREX training program is an 8-hr-long course that takes place at the Torch Training Site on Joint Base San Antionio-Lackland. It was [11]:

> …developed to familiarize military and civilian personnel with critical trauma skills relevant to both the hospital and the austere environment and to maintain mission readiness [by incorporating] battlefield trauma simulations, evacuation procedures, and trauma care in a Role 2 environment.

### 2.2.7 WPC

WPC is offered to healthcare professionals to validate their advanced medical skills in remote settings, with a focus on prolonged field care [12]. The certificate is for candidates that "hold a current unrestricted paramedic, registered nurse, or physician assistant license in the state or country of practice or [for] a medical director/physician working on a wilderness medical team" [13]. It is composed of a 2.5-hr examination offered by the International Board of Specialty Certifications.

## 2.3 Simulators

This section discusses available simulators for medics in austere environments. Summaries are provided for:

- Augmented Reality (AR) for Lifesaving Trauma Care
- Lateral Canthotomy and Cantholysis (LCC) Training System
- Tactical Combat Casualty Care Simulator (TC3Sim)

### 2.3.1 AR for Lifesaving Trauma Care

Researchers at the Johns Hopkins Applied Physics Laboratory (APL) in Laurel, MD, are developing an AR headset for military health professionals to use while in a combat setting. The headset will use [14]:

> …a statistical shape atlas—a detailed map of variations in human anatomy—to predict the likely location of internal organs based on external body landmarks. This predictive modeling is aided by AR technology, allowing medics to view an overlay of the patient's internal anatomy directly on the body.

This project will be a useful tool for military medical professionals to be able to provide prolonged care in austere environments where the nearest hospitals are miles away.

The Johns Hopkins APL team has [14]:

> …also developed a prototype heads-up display system for ultrasound recordings—complete with voice-activated commands—all within an AR environment. Integrating point-of-care ultrasound enables an eFAST (extended focused assessment with sonography for trauma) exam, which is a tool used to noninvasively, quickly, and accurately diagnose internal bleeding or lung collapse due to blast or trauma. Incorporating an AR headset into the ultrasound allows for step-by-step visual guidance of the exam.

The heads-up display system will allow medics who are not formally trained to perform an eFAST exam to be guided through the process so they can diagnose internal bleeding or a collapsed lung and perform triage [14].

### 2.3.2 LCC Training System

An LCC is a crucial vision-saving surgical procedure to relieve orbital compartmental syndrome, where pressure builds up behind the eye, potentially causing blindness. "Over the past 15 years of conflict, eye injuries have held at a steady rate of 5–10% of combat trauma, mostly attributed to the enemy's use of improvised explosive devices" [15]. The ability to perform an LCC in a timely manner, ideally within 90–120 min, and in an austere environment without the specialized surgical equipment is crucial in providing the best probability to save a patient's vision.

To help train military medical professionals in this procedure, the LCC Training System was developed under the DHA Small Business Innovation Research program [16]:

> The LCC training system is a realistic, simulation-based medical manikin. [It] has single-use replaceable eye inserts that simulate the pressure of a proptotic eye, relevant anatomical landmarks of the eye and orbit, tendon strumming, and tendon cutting. Once the procedure is done correctly, the pressure behind the eye is relieved.

This allows students to rehearse the procedure until they feel comfortable enough to proficiently perform it.

### 2.3.3 TC3Sim

TC3Sim is a virtual-reality and AR simulator designed to train military personnel in TCCC. It has been developed by Engineering & Computer Simulations, a recognized leader in military medical training who has continued to invest in developing technologies over the past 20 years. It provides realistic combat scenarios that end at evacuation. "TC3Sim is a serious game that focuses on training the critical skills for triage and treatment of trauma injuries and the top preventable causes of death on the battlefield" [17]. It is available on the TC3Sim website [18] and can be installed by mobile application stores but requires a .mil email address for registration [17].

## 3.0 Conclusions

Military medical personnel working in austere environments with a lack of resources, logistical challenges, and potential dangers need to acquire skills outside the range of their normal needs. Although this list is not exhaustive, the provided resources, learning platforms and certificates,

and simulators should provide helpful tools for military medical personnel working in austere environments and help them adapt to challenging situations, improving their overall effectiveness.

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# Biography

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