SYNCHRONOUS TELEMEDICINE SPECIALTY SUPPORT TO SOF

LTC Shawn Alderman, MD

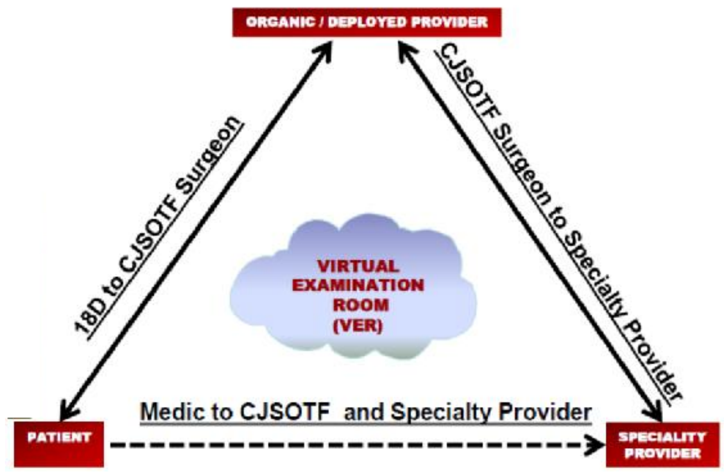
5th SFG(A) ● BACH ● DDEAMC

BACKGROUND

- Environment
- Asset Gaps
- VC3
- BACH / DDEAMC

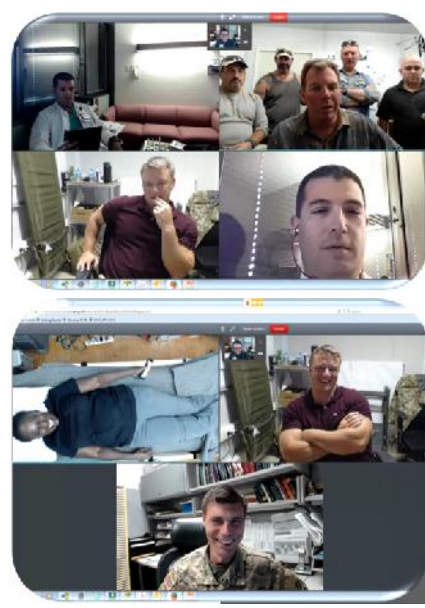
REQUIREMENTS

- Process
  - Simple
  - Responsive Staffing
- Technology
  - Web Based
  - Two-way Video
- Redundancy
  - Synchronous
  - Asynchronous



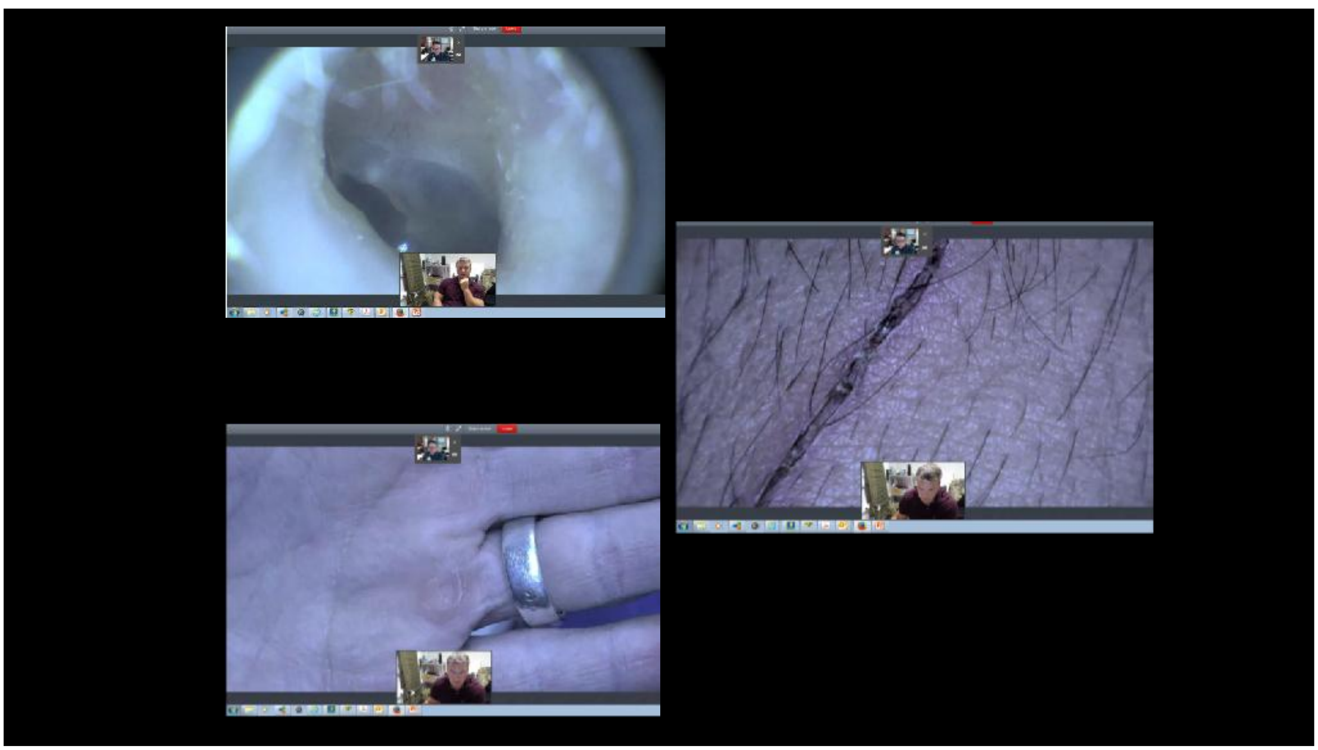
PROCESS

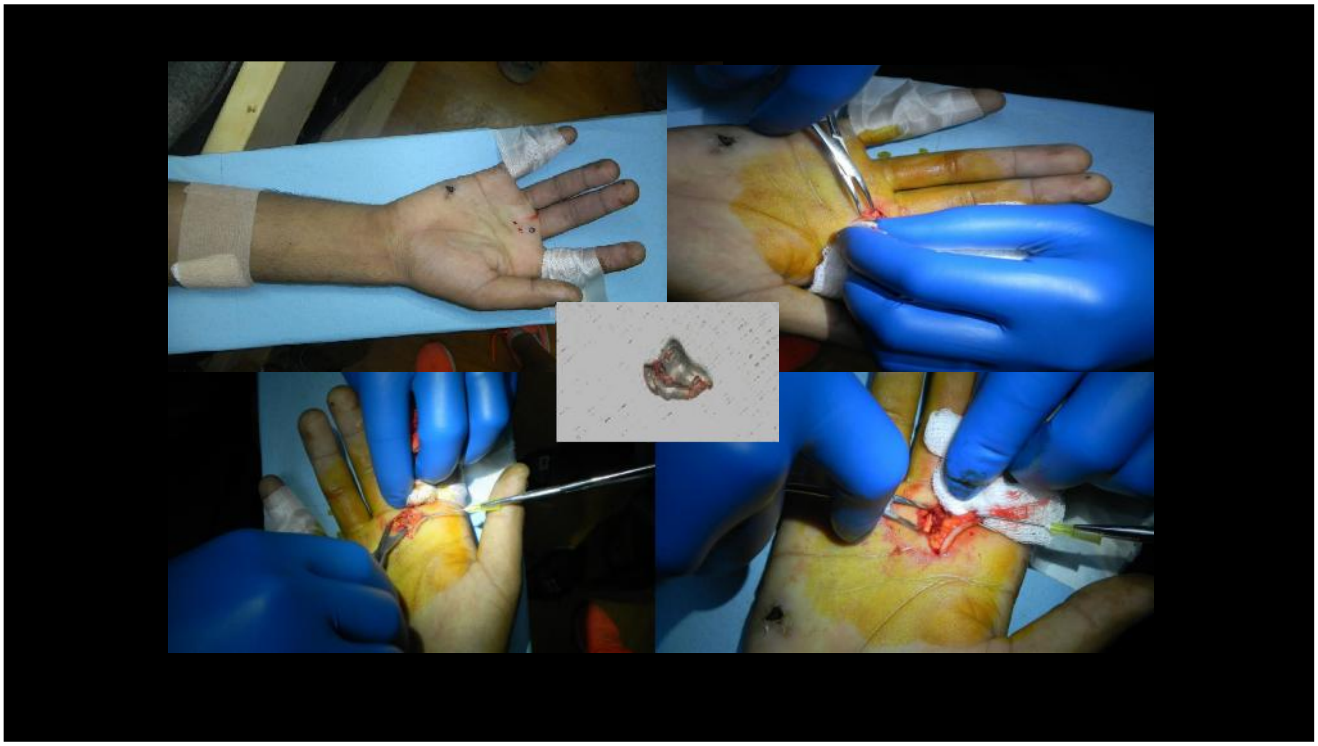
- Specialty Coverage
  - Ortho
  - Gen Surg
  - Critical Care
- Single Phone #
- Script Sheets
- PII and OPSEC



TECHNOLOGY

- Acano
- Global Med
- Cameras
- Connectivity
- Tablets





LESSONS LEARNED

- Technology
  - SDN vs SNAP
  - Network Authorizations
  - Technical Support
- Process
  - No issues
  - Excellent Specialist/MTF Support
- Simple and Redundant

Telemedicine to Reduce Medical Risk in Austere Environments

LTC Jeremy C. Pamplin, MD, FCCM, FACP
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- 24 May 2016

DISCLAIMER

The views expressed are those of the author(s) and do not reflect the official policy or position of the US Army Medical Department, Department of the Army, Department of Defense or the U.S. Government.

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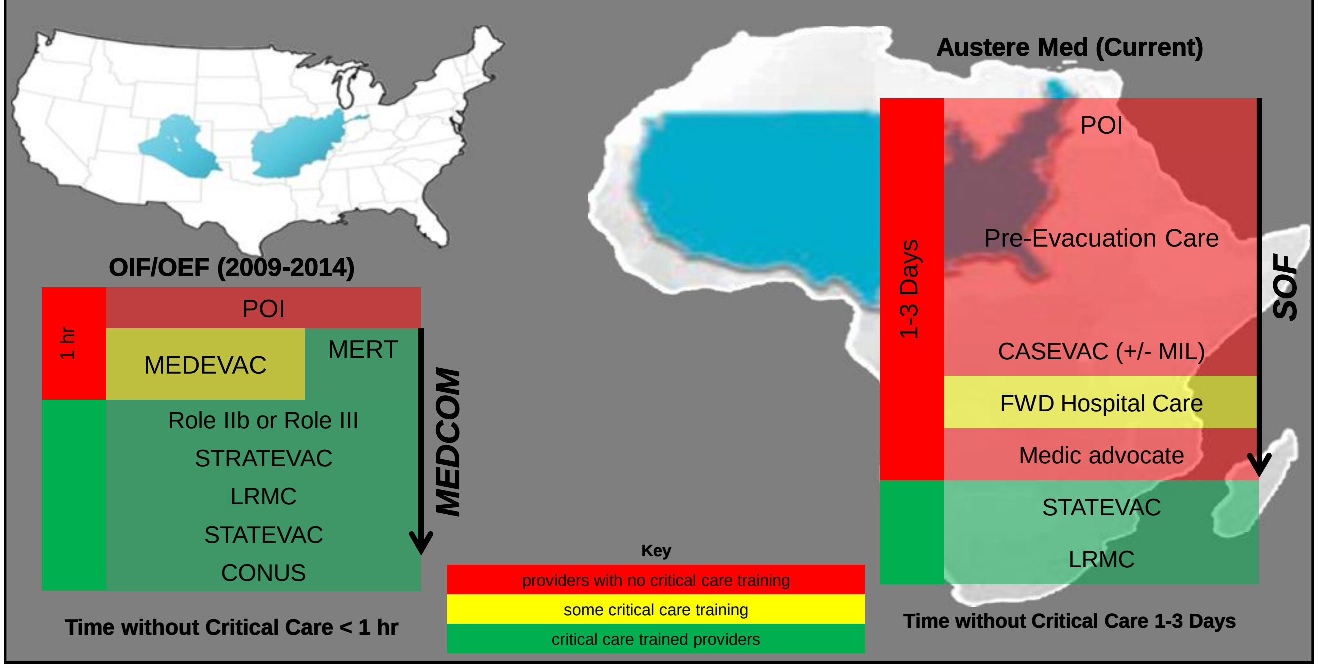
Overview

- Background and rationale for virtual medical support to operational forces
- Definitions
- Current Experience
- Future Directions

The Tyranny of Distance and the Paradox of Time

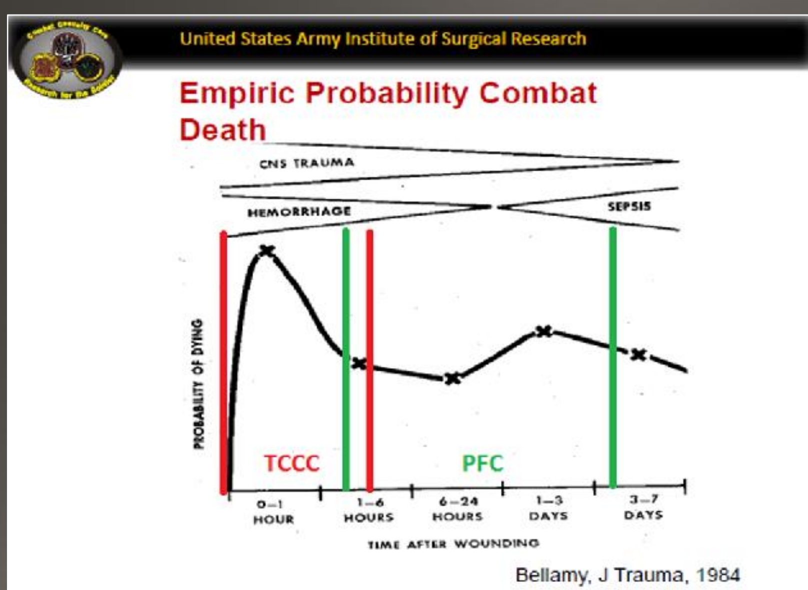


DEFINITION

- *Prolonged Field Care (SOMA WG)*
  - *Field medical care, applied beyond 'doctrinal planning time-lines, by a **Special Operations Combat Medic** or **higher**, in order to decrease patient mortality and morbidity. Utilizes limited resources, and is sustained until the patient arrives at an appropriate level of care.*

> *"Treating a patient that you know should be somewhere else, for longer than you want."*
>
> *– MAJ Doug Powell, MD*
> *USASOC Intensivist*

Medical Problems Differ in PFC



Telemedicine

- Medical support must adapt to the complex, distributed, and dynamic missions at hand

Lilly *Chest* 2016, Lilly *JAMA* 2011
Dellifraine *Telemed Telecare 2008*
Janca *Curr Op in Psych* 2000

Telemedicine

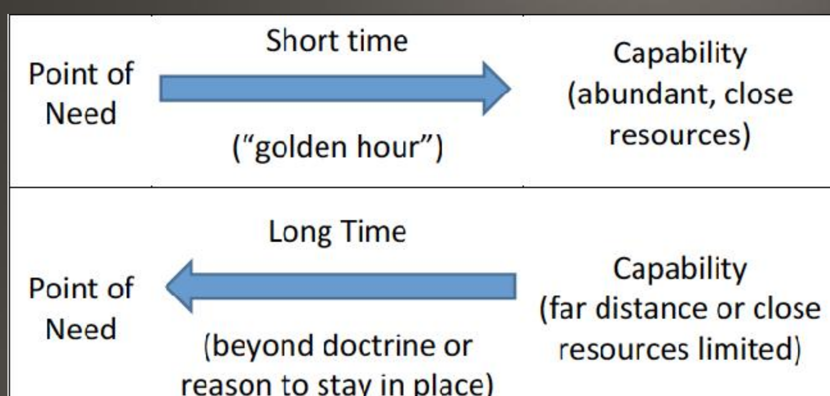


Figure 2. Balance between distance, time, and resource capability. If adequate resources to treat the patient need are close, *transfer the patient*. If the necessary resources are far away, are limited, or there is a particular reason to keep the patient in place, then leverage technology to bring capability to point of need.

Assuming you can!

Pamplin, J. C. (2016, April 12). http://www.himss.org/news/telemedicine-bringing-capability-point-need

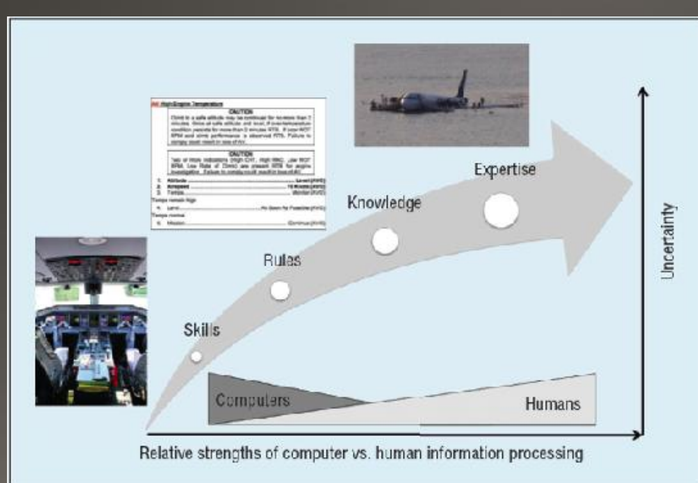
Telemedicine

- Medical support must adapt to the complex, distributed, and dynamic missions at hand
- Telemedicine is NOT plan A
- Plan B?
- Not a panecea: Technology is not "Murphy-proof"
  - Training and back-up systems (i.e. CDSS, protocols, TTPs, etc.) are necessary

Lilly *Chest* 2016, Lilly *JAMA* 2011
Dellifraine *Telemed Telecare 2008*
Janca *Curr Op in Psych* 2000

Man versus Machine or Man + Machine?

Mary (Missy) Cummings, *Duke University and MIT*



Intelligent Systems. 2014.

Definitions

- Local Caregiver
- Consultant/Remote Expert

Conceptual overview of types and frequencies of virtual support

Telemedicine is remote evaluation, diagnosis, treatment, and/or consultation using telecommunications technologies

Communication, Consultation, and Mentoring: Local Caregiver & Remote Expert

= asynchronous communication - unidirectional information flow (i.e. text, e-mail)
= rapid asynchronous communication
= synchronous communication – bidirectional information flow (i.e. voice, video, both)

Continuous Remote Monitoring
(extended unidirectional communication)
&
Continuous remote supervision
(extended synchronous communication)

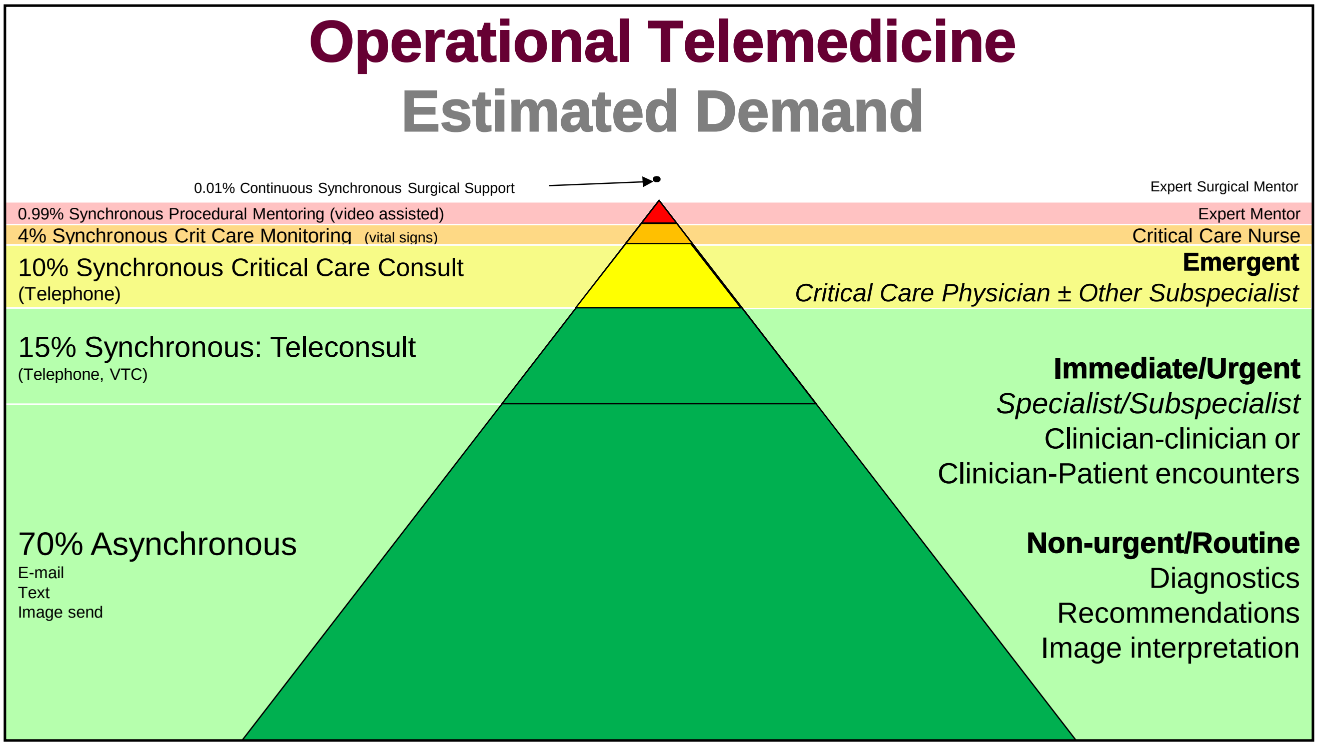
Mission: To provide *immediate* consultation for critically ill/injured patients to clinicians supporting prolonged field care.

Virtual Critical Care Consultation
The VC3 Service

Project Start

- Reviewed all consultations placed to the Teleconsultation Program for FY14 and FY 15 for the potential of clinical deterioration or death that might benefit from critical care consultation.

- Results:
  - 321 consultations
  - 14.6% (47/321) with potential for clinical deterioration and death.
  - Most common subspecialties included
    - neurologic/neurosurgical emergencies, 23% (11),
    - Burns, 21% (10),
    - Toxicology, 19% (9),
    - general surgery 15% (7).
  - Other diagnoses with critical care implications were 21% of consults
    - severe allergic reactions, 6% (3)
    - thyroiditis/Graves disease,11% (5)
    - pulmonary issues, 4% (2)
  - Average reply time: 4 hours 34 minutes
  - Median reply time: 1 hour 6 minutes.



Conclusion

- A potential need exists for more urgent/immediate consultation about critically ill patients in operational environments.

LTC Jeremy Pamplin, jeremy.c.pamplin.mil@mail.mil

VC3 AAMTI Purpose

- To develop a low cost, effective VC3 capability for MTFs without critical care specialists and providers engaged in PFC
  - Demonstrate viability
  - Create/refine SOPs, TTPs, and CPGs to support capability
  - Integrate into treatment protocols of customers
  - Explore technology to augment the capability (i.e. cellphone, COTS VTC, monitors like Tempus Pro)
  - Collect data on the nature of consultation and type of information collected from the end user
  - Provide a model for extension to other specialties and expansion to a wider customer base

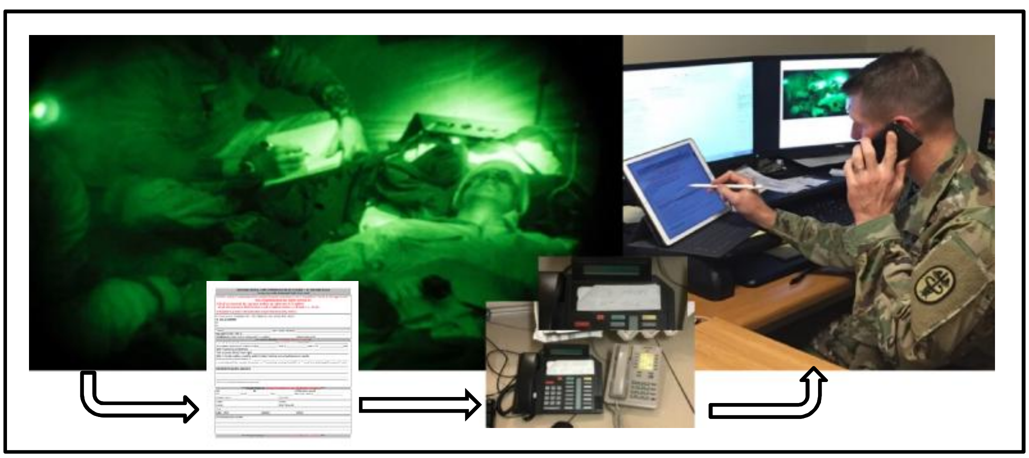


Figure 1. Special Operations Medical Sergeant caring for a simulated critically ill trauma patient during the Mountain Path prolonged field care training exercise. Using the Virtual Critical Care Consultation (VC3) call guide, the medic, if able, first sends images of the casualty, care documentation flow sheets, and available equipment via e-mail to the VC3 distribution list and then calls the VC3 phone number which forwards to the on call VC3 intensivist who provides consultation.

Experience

- > 30 Training Exercises, > 70 "casualties"
  - Averaged 3.6 calls per exercise
  - 6 critical care specialists served as consultants
    - An average of 3.3 recommendations made per call.
    - Case Mix: Burns, Sepsis, TBI, Poly-Trauma, internal hemorrhage
    - All consultants rated the quality of consultations as appropriate
  - 8/60 participants (13% response rate) to survey
    - "No difficulties" in reaching a critical care provider.
    - Consultant Recommendations
      - improved the management plan
      - were appropriate for their level of training
      - were not difficult to implement after ending the call

VC3 Progress

Telemedicine to Reduce Medical Risk in Austere Medical Environments

The Virtual Critical Care Consultation (VC3) Service

Doug Powell, MD; Robert D. McLeroy, MD; Jamie Riesberg, MD; William Vasios, MPAS; Ethan Miles, MD; Jeffrey Dellavolpe, MD; Sean Keenan, MD; Jeremy Pamplin, MD

Journal of Special Operations Medicine Volume 16, Edition 4/Winter 2016

6 real cases over ~12 months

Case of a 5-Year-Old Foreign National Who Sustained Penetrating Abdominal Trauma

Robert D. McLeroy, MD; Jabon L. Ellis, DO; Jason M. Karnopp, NREMT-P, ATP; Jeffrey Dellavolpe, MD; Jennifer Gurney, MD; Sean Keenan, MD; Doug Powell, MD; Jamie Riesberg, MD; Mary Edwards, MD; Renee Matos, MD, MPH; Jeremy Pamplin, MD

Embedded Fragment Removal and Wound Debridement in a Non-US Partner Force Soldier

Robert D. McLeroy, MD; Sloan Spelman; Eric Jacobson, MD; Jennifer Gurney, MD; Sean Keenan, MD; Doug Powell, MD; Jamie Riesberg, MD; Jeremy Pamplin, MD

Lessons Learned/Key components

- **Fundamentals (RP3):**
  1. Recognize the need to call (local caregiver)
     - Clinical question
  2. Prepare to call
     - Flow sheets, scripts, images
     - Send ahead!
  3. Present patient(s)
     - Use script…. On BOTH sides of the call!
  4. Perform with telementoring
     - Know your technology (e-mail, cell phone/land line/SATCOM, VTC)
     - Perform Procedure with Telementoring
- Its not about the tech… its about the people!
  - Technology makes what we do more efficient or reliable by *helping* solve problems
  - Training is imperative…. On both sides!

Key components

- Its not about the tech… its about the people!
  - Technology makes what we do more efficient or reliable
- Telemedical technology solutions for operational forces must be:
  - **Flexible**: capability adapts to the network resources available and can be used in many care scenario
  - **Scalable**: useable for one or many patients
  - **Convenient**: no new kit, user friendly
  - **Reliable**: works every time
  - **Consistent**: same tech on each mission

Gaps/Challenges

- Currently ***three systems*** provide consultation to deployed SOF providers:
  - Army's TSG **E-mail consultation service**
  - The Synchronous Telemedicine Specialty Support to Special Operations Forces (**STS3**)
  - Virtual Critical Care Consultation (**VC3**) Service
- Request made by USASOC surgeon to "provide rules" about which service to engage and when…

AD·VI·S·S·OR

ADvanced VIrtual Support for Special OpeRations

Mission

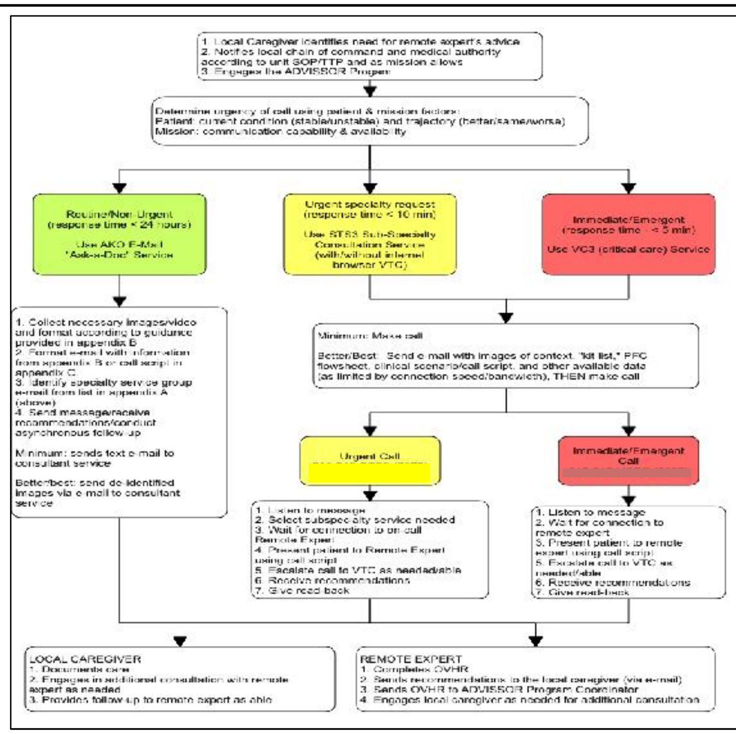
To provide a spectrum of *on demand* medical consultation services in operational settings

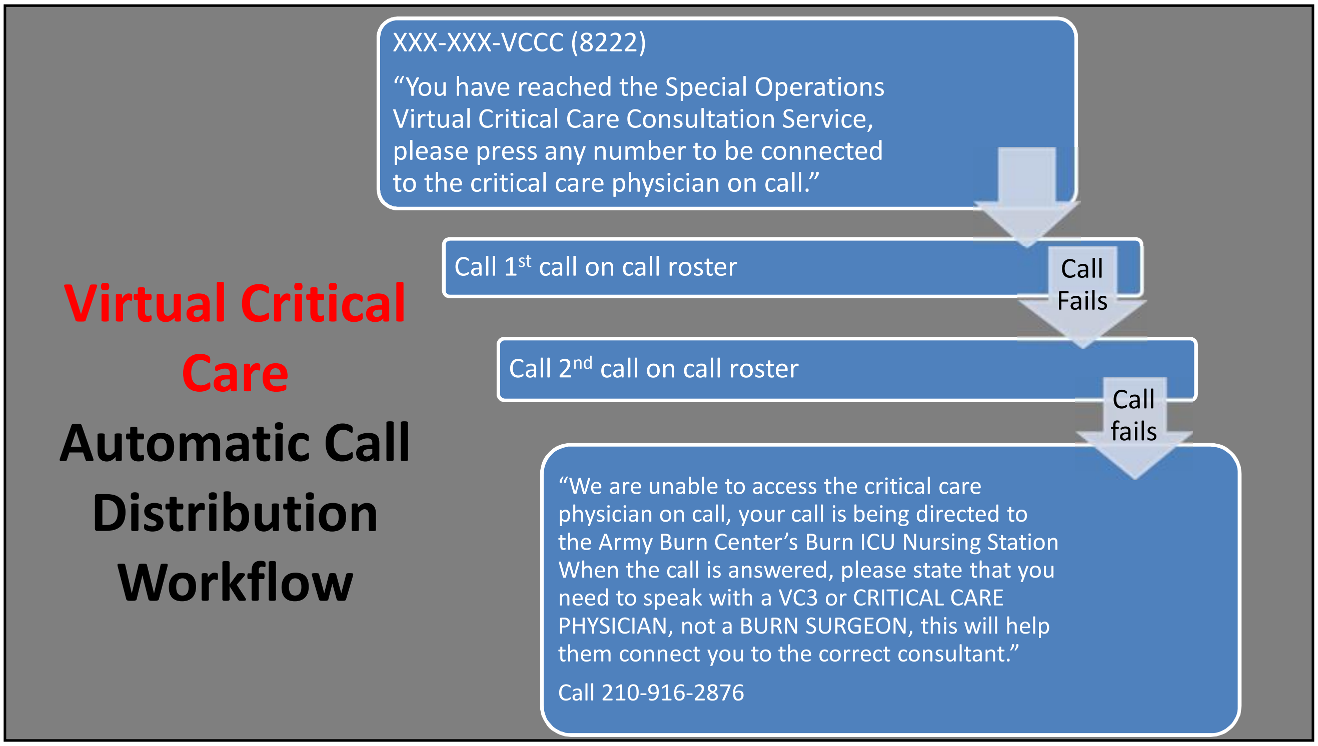
Consult types

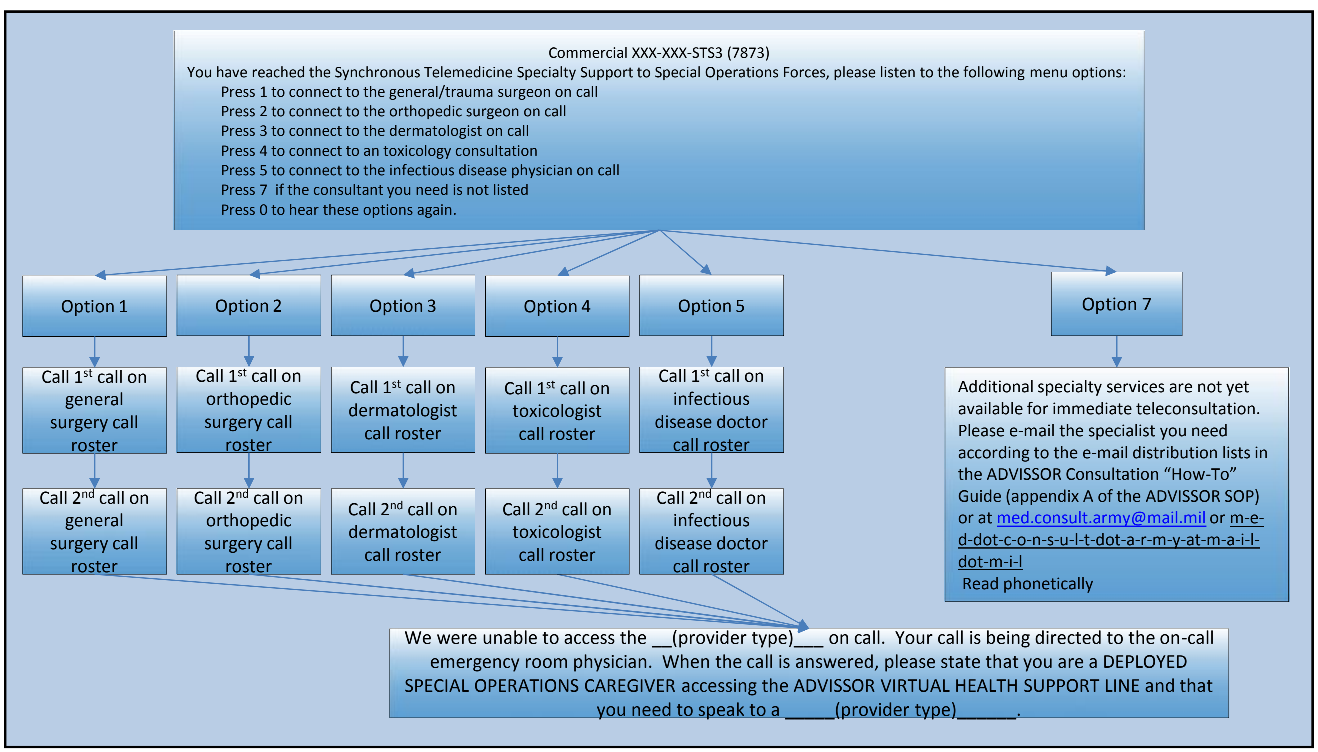
- **Routine**
  - Use the **e-mail teleconsultation system**
  - Consultation within 24 hours (median response ~ 4 hours).
- **Urgent** (phone calls answered immediately 24/7)
  - *Non-critical care sub-specialty consultation,* call **STS3**
- **Emergent** (phone calls answered immediately 24/7)
  - *Consultation for patients with critical illness or injury* call **VC3**

ADVISSOR Workflow

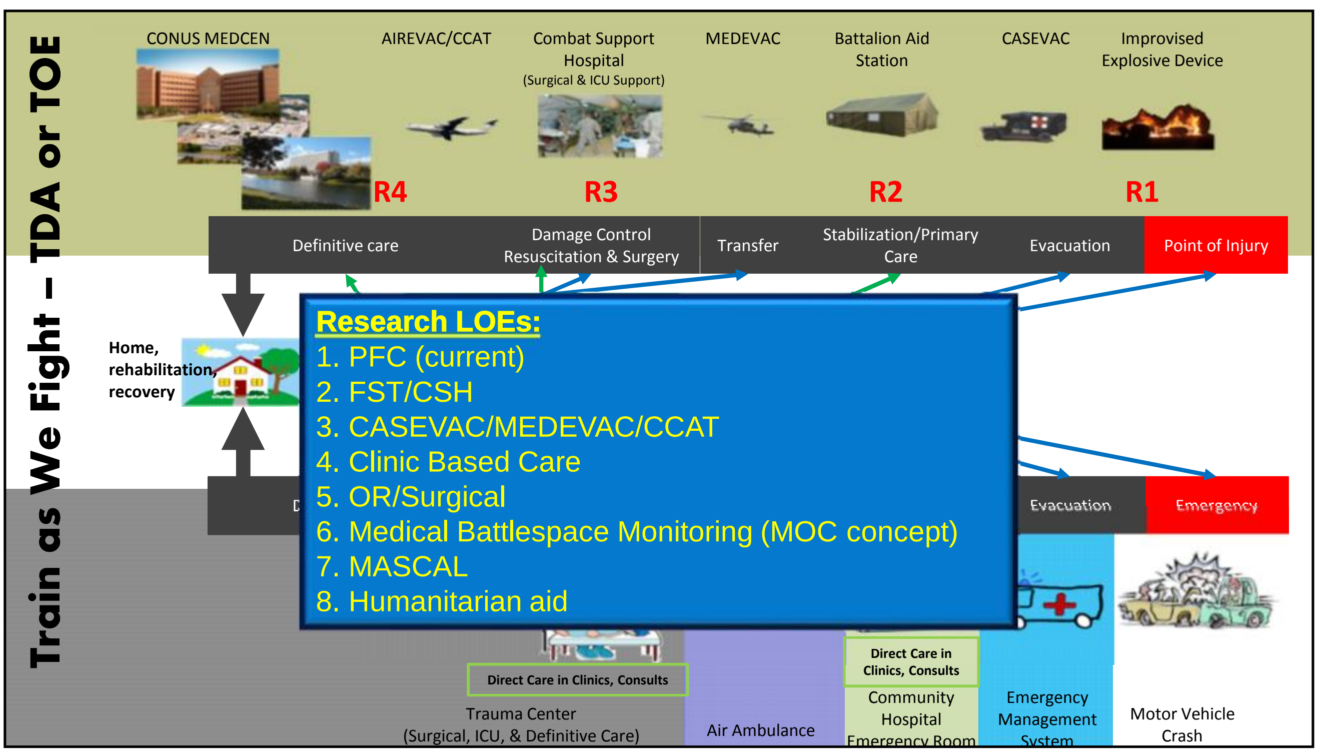
See appendix A of the ADVISSOR SOP




Virtual Critical Care
Automatic Call Distribution Workflow
XXX-XXX-VCCC (8222)
"You have reached the Special Operations Virtual Critical Care Consultation Service, please press any number to be connected to the critical care physician on call."
Call 1st call on call roster
Call Fails
Call 2nd call on call roster
Call fails
"We are unable to access the critical care physician on call, your call is being directed to the Army Burn Center's Burn ICU Nursing Station When the call is answered, please state that you need to speak with a VC3 or CRITICAL CARE PHYSICIAN, not a BURN SURGEON, this will help them connect you to the correct consultant."
Call 210-916-2876


Commercial XXX-XXX-STS3 (7873)
You have reached the Synchronous Telemedicine Specialty Support to Special Operations Forces, please listen to the following menu options:
Press 1 to connect to the general/trauma surgeon on call
Press 2 to connect to the orthopedic surgeon on call
Press 3 to connect to the dermatologist on call
Press 4 to connect to an toxicology consultation
Press 5 to connect to the infectious disease physician on call
Press 7 if the consultant you need is not listed
Press 0 to hear these options again.
Option 1
Option 2
Option 3
Option 4
Option 5
Option 7
Call 1st call on general surgery call roster
Call 1st call on orthopedic surgery call roster
Call 1st call on dermatologist call roster
Call 1st call on toxicologist call roster
Call 1st call on infectious disease doctor call roster
Call 2nd call on general surgery call roster
Call 2nd call on orthopedic surgery call roster
Call 2nd call on dermatologist call roster
Call 2nd call on toxicologist call roster
Call 2nd call on infectious disease doctor call roster
Additional specialty services are not yet available for immediate teleconsultation. Please e-mail the specialist you need according to the e-mail distribution lists in the ADVISSOR Consultation "How-To" Guide (appendix A of the ADVISSOR SOP) or at med.consult.army@mail.mil or m-e-d-dot-c-o-n-s-u-l-t-dot-a-r-m-y-at-m-a-i-l-dot-m-i-l
Read phonetically
We were unable to access the __(provider type)___ on call. Your call is being directed to the on-call emergency room physician. When the call is answered, please state that you are a DEPLOYED SPECIAL OPERATIONS CAREGIVER accessing the ADVISSOR VIRTUAL HEALTH SUPPORT LINE and that you need to speak to a _____(provider type)______.

Research…


Train as We Fight – TDA or TOE
CONUS MEDCEN
AIREVAC/CCAT
Combat Support Hospital
(Surgical & ICU Support)
MEDEVAC
Battalion Aid Station
CASEVAC
Improvised Explosive Device
R4
R3
R2
R1
Definitive care
Damage Control Resuscitation & Surgery
Transfer
Stabilization/Primary Care
Evacuation
Point of Injury
Home, rehabilitation, recovery
Research LOEs:
1. PFC (current)
2. FST/CSH
3. CASEVAC/MEDEVAC/CCAT
4. Clinic Based Care
5. OR/Surgical
6. Medical Battlespace Monitoring (MOC concept)
7. MASCAL
8. Humanitarian aid
Evacuation
Emergency
Direct Care in Clinics, Consults
Direct Care in Clinics, Consults
Trauma Center
(Surgical, ICU, & Definitive Care)
Air Ambulance
Community Hospital
Emergency Management System
Motor Vehicle Crash

ARMY MEDICINE
Serving to Heal…Honored to Serve

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Current Efforts

Short Title	Description	Echelon	Funding Source	Grant Status	Study Status
BURNMAN	Visual Machine Learning to identify Burn Wounds Size	R1	JCP-1, $1.3M	**Funded**	Protocol Development
TRUMAN	The Trauma Medical Assistant – hands free documentation, machine learning & decision support, telementoring	POI-R1	JPC-6, $1.5M/yr x 3	Pre-Proposal	
J-MEDIC3	Program to develop prehospital documentation and telemedicine platform	POI-R1	JPC-1	Pending Decision	
Virtual PFC	Telementoring to Improve Clinical Performance in PFC setting	POI-R1	JPC-6, $1.5M	Funding Recommend	
VC3	Low Cost Virtual Critical Care Consultative Support to Caregivers in Austere locations	POI-R2	AAMTI, $285	**Funded**	Enrolling
ADVISSOR	Low Cost Specialtiy Care Consultative Support to Caregivers in Austere locations	POI-R2	AAMTI, $250K	**Funded**	
Flying TeleICU	UW-MAMC-ISR collaboration to test telemedicine & PCLCs during long range transport of critically ill patients	EVAC	JPC-6, $1.5/yr x 3 yrs	Pre-Proposal	
TeleAware	TeleICU using AWARE COTS Software to improve Process and Outcomes	R3/4	JPC-1, $1M	*Funding Recommend*	

LTC Jeremy Pamplin, MD; jeremy.c.pamplin.mil@mail.mil UNCLASSIFIED/FOUO Slide 40 of 33 27 March 2017

Framework for Telemedical Support in the Operational Environment

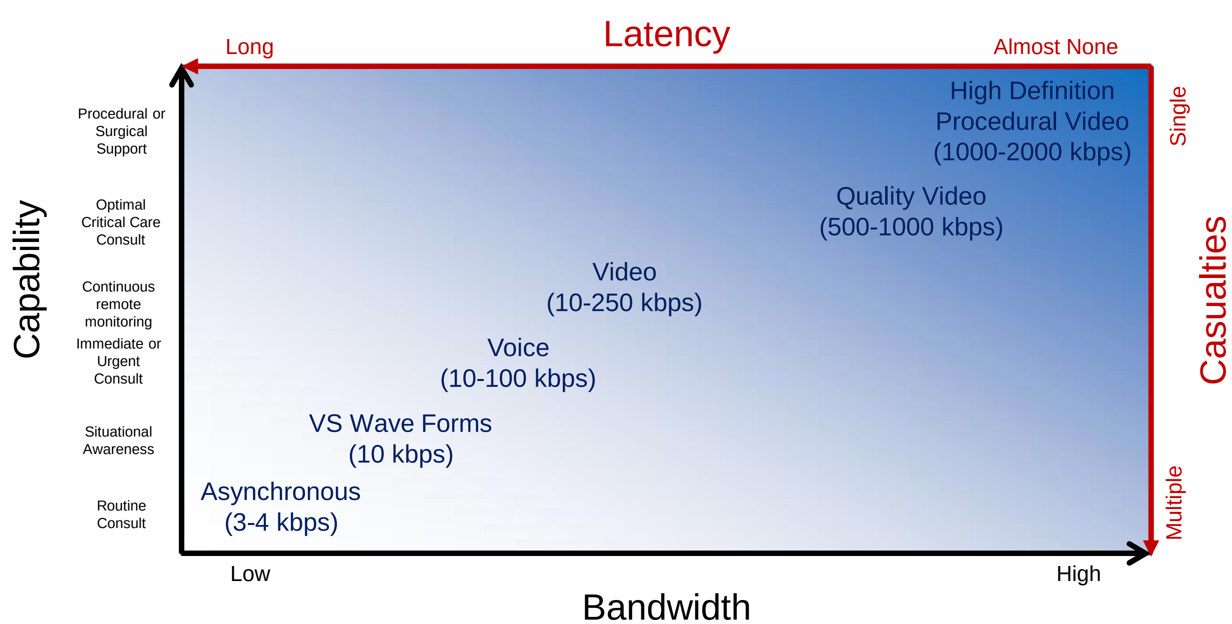
Setting / Capability	Asynchronous	Synchronous		Continuous (Synchronous with no signal loss indefinitely)	
	e-mail Text image send	Voice	VTC, Low DEF Interruptible	Remote Monitoring (vital signs)	VTC, High DEF Uninterrupted
Non-Urgent Provider Consult	X				
Urgent Provider Consult	X	X			
Non-Urgent Patient Encounter	X	X	X		
Optimal Critical Care Consultation	X	X	X		
Remote monitoring	X	X	X	X	
Procedural (surgical) Support/Mentoring				X	X

Practice / Location	Ruck	Truck	House/CSH	Plane
Good (Minimum)	Asynchronous	Asynchronous	Async/Voice	Async/Voice
Better	Synchronous Voice	Synchronous Voice	Cont Monitoring	Synchronous VTC LD
Best	Synchronous VTC LD	Synchronous VTC LD	Cont VTC HD	Cont Monitoring

LTC Jeremy Pamplin, jeremy.c.pamplin.mil@mail.mil

1. Poropatich R. NATO Telehealth standards. February 2012:1-50.

Teleconsultation Support Technologies



ARMY MEDICINE
Serving to Heal…Honored to Serve

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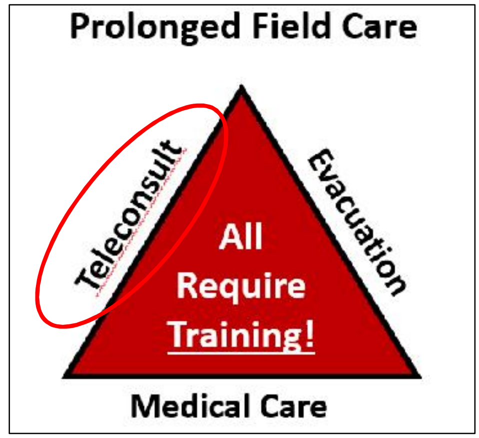
PFC Capabilities

- **Capabilities** combines basic diagnostic and patient treatment skills with medical equipment to define a framework for education and training

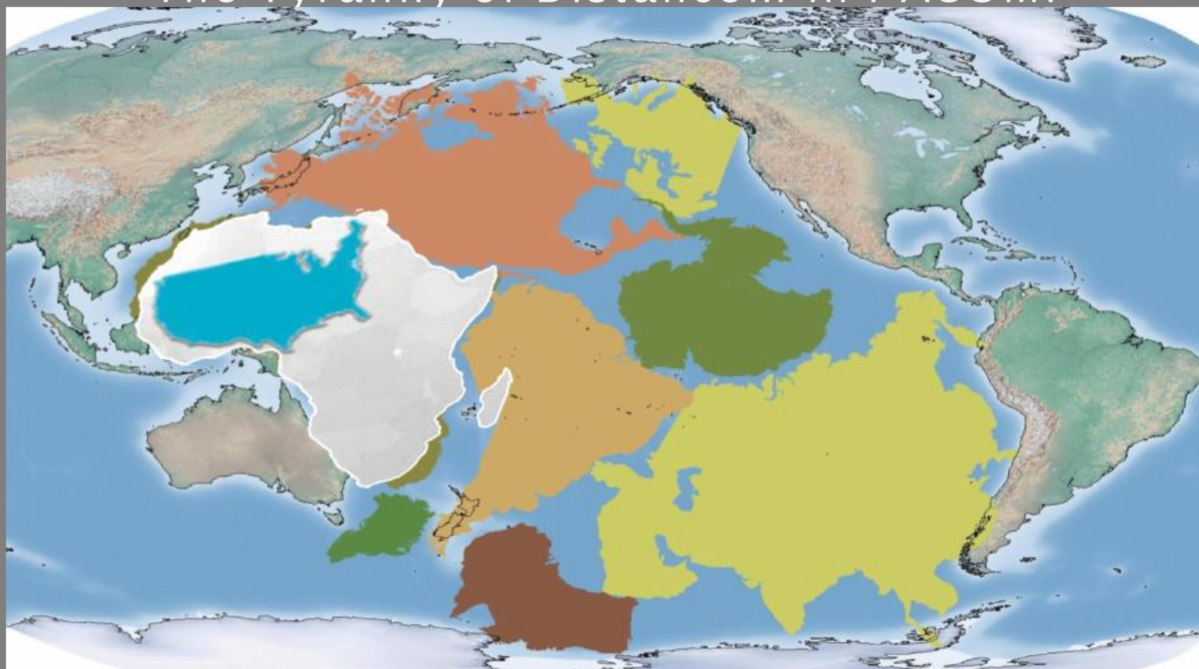
- 10 Capabilities:
  - **Monitor** the patient
  - **Resuscitate** the patient
  - **Ventilate/oxygenate**
  - Maintain an **airway**
  - **Sedation/pain control**
  - **Physical Exam/diagnostic measures**
  - Provide **nursing**/hygiene/comfort measures
  - Perform advanced **surgical interventions**
  - **Telemedicine**
  - Prepare the patient for **flight**



Operational Context of PFC

- ***Common operational PFC planning factors*:**
  - RUCK: Kit medic carries to their farthest point of the mission
  - TRUCK: Conveyance that gets the medic to the farthest point
  - HOUSE: Permanent/semi-permanent structure with all organic team equipment (team house, FST site, hotel room, etc.)
  - PLANE: Any platform that will evacuate patient

The Tyranny of Distance… in PACOM!



DEVELOPMENT OF A CIVILIAN-MILITARY PLATFORM FOR TELEMEDICINE CARE DURING PROLONGED FIELD CARE AND EVACUATION

DoD FY18 DMRDP JPC-6/CCCRP Precision Trauma Care Research Award 16

PI: **Org:** **Award Amount: $4.5M**

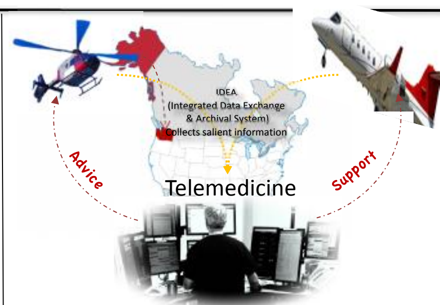
Study/Product Aim(s)

The AirLift Northwest is an optimal platform for testing prolonged field care (PFC) and evacuation (PE) telemedical support. This joint military-civilian platform will:

- Test technologies for physiologic/device related data acquisition and telemedicine to support long range civilian transport of critically ill/injured patients.
- Develop and validate protocols and inflight communication interfaces to ground teams in order to optimize PFC/PE.
- Apply physiologic closed loop controller (PCLC) technologies to patients during transportation using remote supervision supported by telemedicine interfaces.

Approach

Phase 1: Integrate automated data acquisition and telemedical systems into evacuation platforms. Collect data during transports. Extend large animal ischemia-reperfusion model to survival ICU model using same systems plus PCLCs. Phase 2: Adapt inflight protocols/guidelines optimized for lack of telemedical support. Prospective clinical trial. Phase 3: Prospective clinical trial of telemedical support during transportation. Implement PCLCs inflight.



Timeline and Cost

Activities CY	18	19	20
Phase 1	▮		
Phase 2		▮	
Phase 3			▮
Estimated Budget ($K)	**$1.5**	**$1.5**	**$1.5**

Updated: 15 March 2017

Goals/Milestones

CY18 Goals

☐Integrate automated data acquisition and telemedical hardware on extended evacuation platforms
☐Passively collect data and review for consistency, reliability, and accuracy.
☐Extend large animal model to ≧72 hour survival in an animal ICU
☐Test PCLCs into animal ICU

CY19 Goals

☐Adapt military and civilian protocols/guidelines for long range transportation to inflight protocols that would support loss of telemedical support
☐Passively monitor transports with telemedical technology
☐Clinical trial with/without protocols and without telemedical support

CY20 Goals

☐Integrate PCLCs into long range transport
☐Clinical trial of outcomes following long range transport with/without telemedical support and with/without PCLCs

Budget Expenditure to Date

Projected Expenditure: $4,500,000
Actual Expenditure: $0

Trauma Medical Assistant (TRUMAN), A pre-hospital Automated Decision Support System

DoD FY18 DMRDP JPC-6/CCCRP Precision Trauma Care Research Award 16

PI: **Org:** **Award Amount: $4.5M**

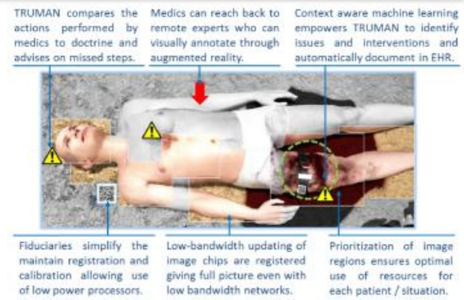
Study/Product Aim(s)

TRUMAN will leverage existing advanced multispectral imaging technology, augmented reality, voice recognition and voice to text capability to design a system that automatically identifies tasks performed by clinicians that will:

- Record and code data to document care in non-ideal environments (SCRIBE);
- Inform decision support algorithms for diagnosis and treatment (HERO);
- Coach caregivers to avoid missteps using remote telementoring (ARTEMIS) and contained machine learning (HERO);
- Seamless integration into the unique clinical work domain of a combat medic in the field (meets SWAP constraints).

Approach

Phase 1: Develop SCRIBE and ARTEMIS independently. Additional field observation of TCCC/PFC during simulation training will be performed to develop a cognitive model and requirements for VIEW. Phase 2 will develop the necessary CDS, including the development of libraries and algorithms. Phase 3 will field test on combat medics with and without TRUMAN using sim scenarios and the performance lab at Madigan Army Medical Center.



Timeline and Cost

Activities CY	18	19	20
Phase 1: Develop SCRIBE & ARTEMIS			
Phase 2: Develop VIEW and HERO			
Phase 3: Filed Test prototype			
Estimated Budget ($K)	**$1.5**	**$1.5**	**$1.5**

Updated: 15 March 2017

Goals/Milestones

CY18 Goals – **Phase 1**: TRUMAN SCRIBE and ARTEMIS design

- ☐Collect motion and audio data and identify critical task steps for automated recognition.
- ☐Validate ARTEMIS using standardized TCCC simulation models
- ☐Field observations for cognitive modeling to identify VIEW requirements

CY19 Goal – **Phase 2:** TRUMAN VIEW and HERO design

- ☐Creation of seamless interface
- ☐Develop ML Algorithms that identify medical tasks based on critical steps and SCRIBE data

CY20 Goal – **Phase 3**: Field testing

- ☐Complete AI-driven medical guidance and backup decision support including finalized ML algorithms
- ☐Field test human performance with/without TRUMAN in limited scenario

Budget Expenditure to Date

Projected Expenditure: $4,500,000

Actual Expenditure: $0

Development of a Simulation Model to Test Technologies that Improve Human Performance During Prolonged Field Care

DM160069

PI: Pamplin, Jeremy LTC, MD, FCCM, FACP **Org:** The Geneva Foundation **Award Amount:** $1.5 million

Study/Product Aim(s)

- Aim 1: Identify a technology platform that supports real-time telemedicine in during PFC.
- Aim 2: Develop simulation training scenarios that test critical decision making during PFC.
- Aim 3: Test subject performance in PFC scenarios after standardized training with and without use of telementoring

Approach

The purpose of this study is to measure clinician performance related to critical care management in prolong field care (PFC). We will create a PFC testing platform, develop and validate simulation scenarios, recruit clinicians to complete "just-in-time" training, and then measure their performance during PFC simulation scenarios with/without telementoring. *We hypothesize that patient care provided to critically ill or injured patients during PFC by clinicians following standardized training will be inferior to patient care provided following standardized training and supported by plus real-time telementoring.*

Figure 1: Example of telemedicine consultation using device to inform military clinician.

Accomplishment: NA

Timeline and Cost

Activities CY	17	18	19
Establish telemedicine platform			
Develop simulation training scenarios			
Pilot test and validate scenarios			
Test subject performance in PFC scenarios			
Data analysis and manuscript writing.			
Estimated Budget ($K)	**$806K**	**$575K**	**$119K**

Updated: 17 August 2016

Goals/Milestones (Example)

CY 17 Goal – Establish technology platform, Pilot test simulations

- ❑ Identify commercial off the shelf product to use as telemedicine device.
- ❑Install telemedicine workstations/hubs at collaborating sites (SAMMC and MAMC)
- ❑Develop simulation straining scenarios
- ❑Identify and write PFC scenarios
- ❑Pilot test and validate scenarios using subject matter experts.

CY 18 Goal – Test subject performance in simulated PFC scenarios.

- ❑Recruit subjects and complete just in time training.
- ❑Test subject performance of critically injured patients using validated testing platform with or without telemedicine consult.

CY 19 Goals – Data analysis and manuscript writing.

- ❑ Statistical analysis.
- ❑Publication (abstracts and manuscripts).

Implementation of the AWARE system to support virtual critical care in a MEDCEN and CSH.

DM167028

PI: LTC Jeremy Pamplin, MD **Org:** Madigan Army Medical Center **Award Amount:** $999K

Study/Product Aim(s)

Using a combination of novel analytics and visualizations of electronic medical data, local workgroup initiated process improvement projects, virtual audits of quality metrics, and daily review of process and outcomes reports by bedside and virtual clinician's, rapidly improve process adherence and patient outcomes in an adult intensive care unit. Demonstrate that this technology and approach to ensuring high quality patient care can be used in a deployed setting.

Approach

We will use the paradigm of structure, process, and outcome standardization and metric monitoring to improve care in the intensive care unit using teleICU technologies that have recently advanced to the point they are ready for supporting clinical medicine in a fixed and deployed facility.

AWARE Unit Level Interface

AWARE Patient Level Interface

Timeline and Cost

Activities CY	16	17	18
Install virtual monitoring capability at Madigan Army Medical Center.			
Develop CPGs, implement virtual critical care service, and measure impact on associated processes and outcomes			
Test capability with 47th CSH during FTX			
Estimated Budget ($K)	**$78.1**	**$660.2**	**$253.9**

Updated: 19 April 2016

Goals/Milestones

CY16 – Installation Phase
- ☐Submit application for Certificate of Networthiness (CON) for IDEA System
- ☐Submit application for CON for AWARE system
- ☐Identify critical care stakeholders to write/rewrite clinical practice guidelines (CPGs) that include process and outcomes measures

CY17 – Complete Installation, Start Operation & Expansion Phases
- ☐Install hardware in ICU rooms and create remote workstation
- ☐Complete CPGs
- ☐Provide remote services and audit quality metrics
- ☐Measure impact of virtual critical care service on process adherence and patient outcomes
- ☐Work with 47th CSH to test virtual support during FTX.

CY18 – Complete Operation Phase and Expansion Phases
- ☐Measure impact of intervention on clinician performance and patient outcomes
- ☐Test virtual presence during FTX

Burn Medical Assistant (BURMAN)

DM167028

PI: LTC Jeremy Pamplin, MD **Org:** US Army Institute for Surgical Research **Award Amount:** $1.3mil

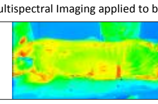
Study/Product Aim(s)

- Enable clinicians to
  - ➢Use non-invasive multispectral imaging systems to capture burn data from imperfectly positioned patients
  - ➢Use advanced machine learning techniques to determine multispectral signatures that characterize burn depth
  - ➢Determine burn size and location from imagery and accurately map the wound to a standard Lund Browder diagram
  - ➢Improve a novice's estimation of burn wound size/depth to within 5% of an experienced clinician's estimation

Approach

We will utilize a combination of multispectral imagers developed by Raytheon Vision Systems and Microsoft Kinect© to capture burn wound images and synthesize these images onto a standard Lund-Browder burn diagram. Machine learning will be used to develop a model to predict wounds based on image data.

Multispectral Imaging applied to burns



Machine Learning to generate automated predictions to guide triage and treatment

Accomplishment: WoundFlow and Burn Navigator previously developed and demonstrated by USAISR, Machine Learning actively applied under the Cooperative Communication System, PIXNET previously developed under DARPA.

Timeline and Cost

Activities CY	16	17
Create de-identified database of enhanced burn wound diagrams		
Expert annotations of enhanced burn wound diagrams		
Create a Machine Learning Model		
Produce a reference design for a mobile platform		
Estimated Budget ($K)	**$604k**	**$518k**

Updated: 24 November 2015

Goals/Milestones (Example)

CY16 Goals – Baseline data collection
- ☐Deliver Raytheon imagers for burn image data capture
- ☐Obtain IRB and IACUC Protocol Approvals
- ☐Start collecting imaging data of burn wounds at the USAISR Burn Center
- ☐Develop enhanced burn wound diagrams for wound estimates

CY17 Goal – Model Burn Wound Predictions
- ☐ Generate burn wound severity data using enhanced diagrams
- ☐ Create machine learning algorithms to predict burn wound severity

CY17 Goal – Design and Test Prototype BURMAN
- ☐ Design mobile imaging system

Comments/Challenges/Issues/Concerns
- All data collection will be performed under an IRB-approved Human Use Protocol