

# Running a Military Training Center (C-STARS) at Shock Trauma: Integrating Providers into a Civilian Trauma System

Thomas M. Scalea, MD



AMERICAN COLLEGE OF SURGEONS  
*Inspiring Quality:  
Highest Standards, Better Outcomes*



# C-STARS

- Started with a conversation in a small conference room with Ty Putnam
- It sounded like a good idea
- I had to convince the Dean
- Original concept was only readiness training
- Each iteration has become more sophisticated

# US Air Force

## Center for Sustainment of Trauma & Readiness Skills



# Military-Civilian Trauma Partnerships: *Together improving care on the battlefield and at home*

## Thomas M. Scalea, M.D.

The Honorable Francis X. Kelly Distinguished Professor in  
Trauma

Director, Program in Trauma

University of Maryland School of Medicine

Physician-in-Chief, R Adams Cowley Shock Trauma Center

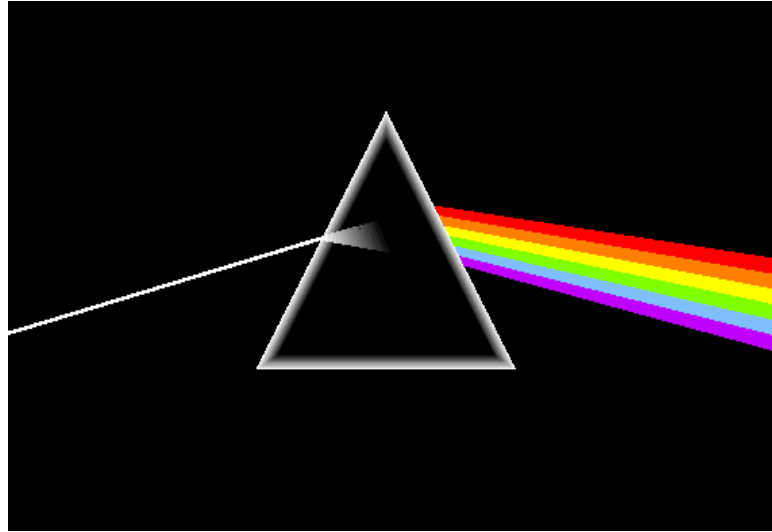
Adjunct Faculty, US Air Force School of Aerospace Medicine



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# The Landstuhl “Prism”



Input: Chaotic, complex compilation of nationalities, diagnoses, medical records and damage control care processes from combat theaters.

Output: Stable patients following a consistent CPG-guided evaluation and with an complete and organized medical record who are evacuated to facilities throughout the world.

# Military/Civilian Interfaces

- It turns out there are far more similarities than there are differences
- Shock is shock. In many ways, it does not matter where or how it occurs
- The principles of trauma care are constant
- We should be able to make this work
- Once one decides the goal, it is just then tactics
- We were lucky because we built on an already strong relationship with the US military

# Unique Military Clinical Experience

There is a golden hour between life and death. If you are critically injured you have less than 60 minutes to survive. You might not die right then; it may be three days or two weeks later -- but something has happened in your body that is irreparable.“

-- R Adams Cowley

# US Army Funded Research

- Dr. Cowley's research of shock initiated with a \$100K grant from the US Army .
- In 1963, US Army Funded Research. Cowley received \$800K to build the Center for the Study of Trauma (2- then 4-bed "death lab").
- After much discussion with the Maryland State Police, the rotary wing med-evac transport occurred in 1969 after the opening of the now five-story, 32-bed Center for the Study of Trauma.
- In 1973, the Governor Marvin Mandel issued an executive order establishing the Center for the Study of Trauma as the Maryland Institute for Emergency Medicine.





# Baltimore C-STARS

- Ten months per year
- 30 participants per month
- 16 years
- Over 5,000 Air Force men and women trained
- When one considers the number of casualties they have treated, I realize the magnitude of effect the program has had is enormous

# C-STARS

- We added Anesthesiologists and CRNA's
- We added Orthopedics
- We had an oral surgeon
- We debated having a military team with the rotators and rejected it
- As the war intensified, deployments became the norm

# C-STARS

- I had great partners
- We imbedded permanent people. They were “permanent”
- They worked for me and the USAF
- Nurses and technicians fit in beautifully
- They worked shifts
- Everyone needs another nurse or scrub tech
- The surgeons were more problematic. Some were not interested. Others thought that they already knew it

# Overview

What does C-STARS Baltimore bring to the AFMS?

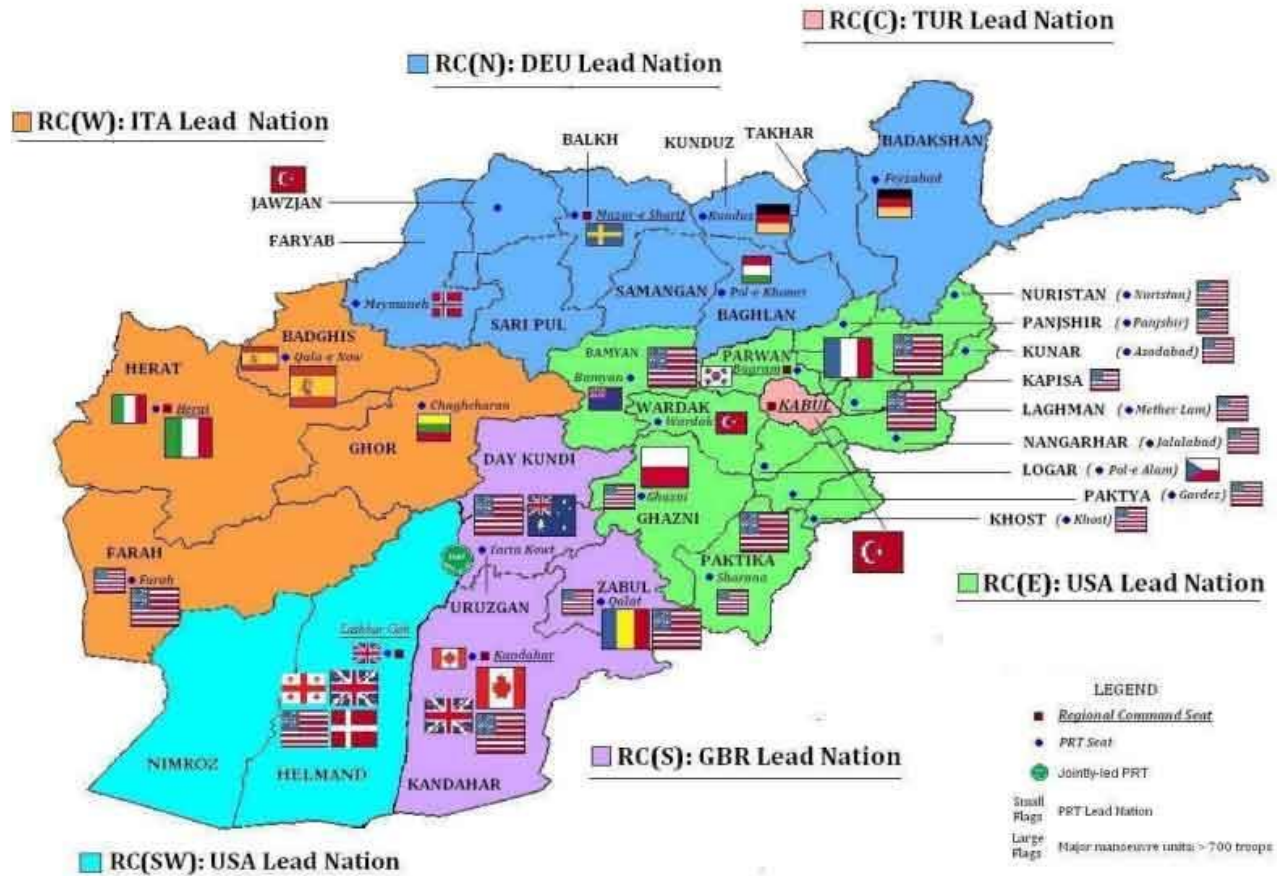
- Pre-deployment trauma training
  - Provider Programs
  - Nursing Program
  - Technician Program
  - AFSOC & IDMT Program
- Deployment ready trauma/critical care assets
- Unique clinical opportunities
- DoD-focused research



# Afghanistan



International Security Assistance Force  
Regional Commands, Major Units, Provincial Reconstruction Teams



# Maryland State Police

## Aviation Division Medevac Zones

### Maryland State Police Aviation Command 11 Helicopters at 7 Locations



# The Evolution of C-STARS

- The ability to make the program mutually beneficial has really kept it alive
- We realized that if we all got smarter, then more military personnel and civilians would live
- The overlap provided great synergism
- It stopped just being about trauma and expanded to a number of innovative approaches to complex disease
- The Air Force won
- Shock Trauma won
- The patients won
- The system won
- Everybody won

# A clinical series of Resuscitative Endovascular Balloon Occlusion of the aorta for trauma: a military-civilian collaboration in hemorrhage control

Patient	1	2	3	4	5	6
Age	62	24	59	25	40	27
Gender	M	M	M	M	M	F
Mechanism of injury	MVC	GSW	GSW	MVC	MCC	ATV collision
Injury Severity Score	28	50	9	25	48	43
Systolic Blood Pressure (SBP) prior to REBOA (mm Hg)	70	70	0	60	70	85
Cardiac arrest prior to REBOA	no	no	yes	no	no	no
SBP after REBOA (mmHg)	135	122	100	110	130	125
Time to occlusion (mins)	5	4	4	6	6	6
Time of occlusion (mins)	12	16	70	60	65	36
Surgery after REBOA	no	yes	yes	yes	yes	yes
Embolization after REBOA	yes	yes	no	no	yes	yes
Complication of REBOA	no	no	no	no	no	no
Outcome	Alive	Alive	Alive	Alive	Brain death	Death (Care withdrawn)



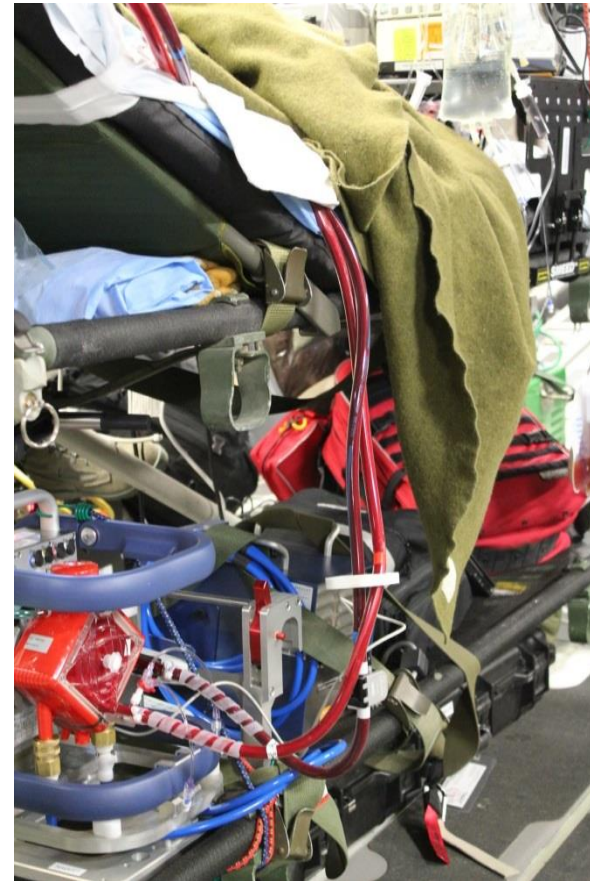
# Patients & Course of Resuscitation

- **4 REBOAs in an austere environment over two months**
  - **Torso gunshot or fragmentation wounds**
  - **Hemoperitoneum**
  - **Class IV shock**
- **Hand-held ultrasound used to guide femoral artery placement of 7Fr sheath**
- **ER-REBOA™ catheter positioning without x-ray**
  - **Zone I (N= 3)**
  - **Zone 3 (N=1)**

# Patient & Course of Resuscitation

- **In all 4 cases REBOA use facilitated:**
  - **Normalization of SBP**
  - **Rapid sequence intubation / anesthesia**
  - **Initiation of whole blood transfusion**
  - **Damage control laparotomy**
  - **Attainment of surgical hemostasis**
  - **Inflation time range: 18-60 minutes**

# Unique Clinical Opportunities





# Extracorporeal Life Support



 U.S. AIR FORCES CENTRAL COMMAND

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## Desperate ECMO treatment used at Bagram to breathe life into NATO ally

By Tech. Sgt. Nicholas Rau, 455th Air Expeditionary Wing Public Affairs / Published February 19, 2016



18 February 2016

PHOTO DETAILS / DOWNLOAD HI-RES 1 of 11

A 455th Expeditionary Medical Group team prepares to load a NATO ally, who required Extracorporeal Membrane Oxygenation team support, onto an aeromedical evacuation transport at Bagram Air Field, Afghanistan, on Feb. 18, 2016. The ECMO team, dispatched from San Antonio Military Medical Center, uses technology that bypasses the lungs and infuses the blood directly with oxygen, while removing the harmful carbon dioxide from the blood stream. The patient was airlifted to Landstuhl Regional Medical Center, Germany, where he will receive 7 to 14 days of additional ECMO treatment. (U.S. Air Force photo by Tech. Sgt. Nicholas Rau)

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**BAGRAM AIR FIELD, Afghanistan** -- A specialized team dispatched from San Antonio Military Medical Center combined efforts with the 455th Expeditionary Medical Group to perform a just-in-time treatment on Feb. 18 in order to save the life of a NATO partner.

142 ECMO  
treatments over the  
past year

# The Need for ECMO

## Wartime Experience



2012;73(6):1448-54

### **Western Trauma Association 2012 Plenary Paper**

Transportable extracorporeal lung support for rescue of severe respiratory failure in combat casualties

Patient	Age (yrs)	Injury	ECLS Device	ECLS Duration (days)	Outcome
1	24	blast injury, bilateral lower limb traumatic amputations	PECLA	12	survived
2	23	blast injury, brain injury	PECLA	8	survived
3	33	blast injury	PECLA	9	died
4	23	blast injury, brain injury	PECLA	8	survived
5	19	gunshot, pneumonectomy	PECLA	18	survived
6	20	motor vehicle collision, spinal cord injury	ECMO	7	survived
7	29	blast injury, brain injury	ECMO	8	survived
8	25	gunshot	ECMO	7	survived
9	22	gunshot, pneumonectomy	ECMO	13	survived
10	21	gunshot	ECMO	6	survived



# Lung Resuscitation Unit

- 2014 (opened 8/4/14)
  - 11 respiratory failure
    - 64% survival to discharge
  - 4 trauma
    - 25% survival to discharge
  - 2 pre lung transplant
    - None transplanted
- 2015
  - 39 respiratory failure
    - 67% survival to discharge
  - 8 Trauma
    - 75% survival to discharge
  - 4 pre lung transplant
    - 50% transplanted
- 2016
  - 63 respiratory failure
    - 84% survival to discharge
  - 10 Trauma
    - 80% survival to discharge
  - 5 pre lung transplant
    - 100% transplanted
- 2017
  - 15 respiratory failure
    - 6 discharged alive
    - 4 died
    - 5 currently on ECMO
  - 4 Trauma
    - 2 died
    - 2 remain in hospital off ECMO
  - 3 pre lung transplant
    - 1 transplanted
    - 2 remain on ECMO





# Critical Care Resuscitation Unit

- 64.5% increase in critical care transfers
- 93.6% increase in critically ill surgical transfers
- 22.6% reduction in lost admissions
- Significant reduction in time to patient arrival
- Accomplished this with a 3.9% increase in total adult ICU bed capacity

MEDICS IN MAYHEM  
Air Force medical  
professionals train in civilian  
trauma unit  
by TSgt Matthew Bates  
29 June 2012



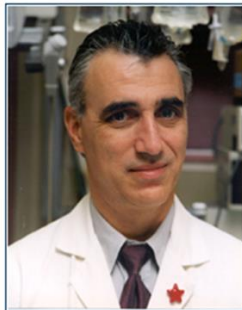
<http://airman.dodlive.mil/2012/06/medics-in-mayhem/>

# Telemedicine-Critical Care

## News & Events

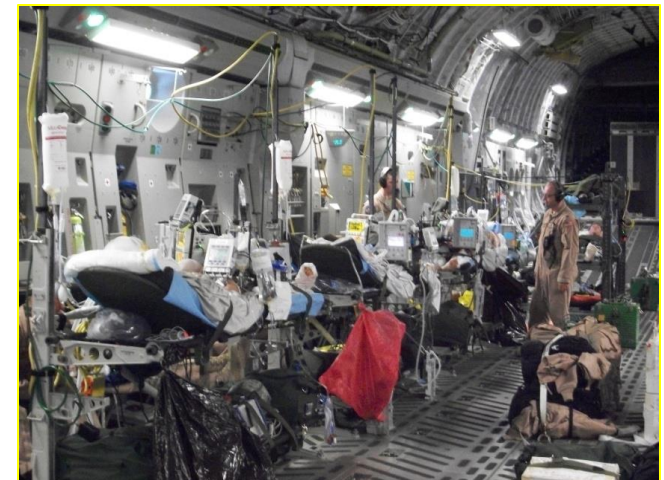
### DR. THOMAS SCALEA APPOINTED SYSTEM CHIEF FOR CRITICAL CARE SERVICES FOR THE UNIVERSITY OF MARYLAND MEDICAL SYSTEM

Friday, January 20, 2012



Thomas Scalea, MD has been appointed to the position of System Chief for Critical Care Services at the University of Maryland Medical System.

Since 1997, Dr. Scalea has served as the Physician-in-Chief at the University of Maryland R Adams Cowley Shock Trauma Center, and is also the Francis X. Kelly Professor of Trauma and director of the Program in Trauma at the University of Maryland School of Medicine. Dr. Scalea has been highly successful in developing a multidisciplinary collaborative group practice at the Shock Trauma Center, linking all of the constituents necessary to provide high quality care and continue to grow the services at the Shock Trauma Center despite significant limitations and resources.



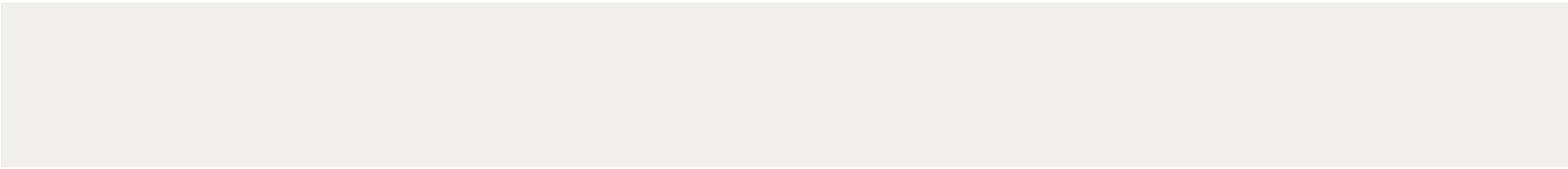
Potential for remote monitoring not only patients in deployed facilities but also casualties en route

# DoD-Funded Research

Principal Investigator(s)	Fin. Award Title	TOTAL
Brenner/Fang	Clinical Study of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) for Severe Pelvic Fracture and Intra-abdominal Hemorrhagic Shock using Continuous Vital Signs	455,776.00
Faden	Hypobaric Exposure Timing after TBI: Targeted Modulation to Improve Outcomes	497,479.00
Faden	Biomarkers and Treatment of Hypobaric-Exacerbated Traumatic Brain Injury	824,999.97
Fiskum	Prolongation of Platelet Storage Time by Protection against Mitochondrial Energy Failure	309,923.00
Fiskum	(Polytrauma) Effects of Hypobaric on Brain Injury and Mortality Following Head Trauma Combined with Hemorrhagic Shock	1,815,000.00
Fiskum	Effect of Hypobaric during Sepsis on Survival, Encephalopathy, and Energy Metabolism	270,999.00
Fiskum	MRI and Neurophysiologic Measurements during Exposure to Hypobaric after Experimental TBI	1,353,543.10
Fiskum/Miller/Fang	Exacerbation of Traumatic Brain Injury by Psychological Stress, Hypobaric and Homocysteinemia	1,342,000.00
Galvagno	Prehospital Testing to Detect Shock and Predict Need for Life-Saving Interventions (LSIs) and Clinical Course	769,343.00
Grissom	Performance of Manual Ventilation by Air Force Medics	125,740.00
Grissom	Evaluation of Handoff outcomes in a multi-site continuum	169,727.00
Hu/Miller	ONPOINT 4 - Validation of Automated Prediction of Blood Product Needs Algorithm Processing Continuous Non-Invasive Vital Signs Streams	280,000.00
Hu/Miller	Developing Reliable Telemedicine Platforms with Unreliable & Limited Communication Bandwidth (Optimal TeleMed)	145,591.00
Hu/Miller	Validation of Prototype Continuous-Real Time Vital Signs Video Analytics Monitoring System "CCATT Viewer"	226,179.00
Hu/Miller	ONPOINT 5 - Validation of Automated Prediction of Blood Products, Critical Care, and Emergency Surgery Using Continuous Prehospital Non-Invasive Vital Signs Streams	290,178.21
Kozar	Effect of Hypobaric after Polytrauma on Gut Function and its Microbiota	257,022.00
Scalea	Physiologic Response to Prolonged Resuscitative Endovascular Balloon Occlusion of the Thoracic Aorta in Swine	717,244.00
Stein/Fang	"Fit to Fly" Biomarkers after TBI	1,038,000.00
Stein/Fang	(Dual ICP) Assessing the Accuracy and the Impact of Standard-Practice Ventricular Drainage on Intracranial Pressure Measurements Following Traumatic Brain Injury	741,791.00
Stein/Hu	Transport Assessment for Critical Traumatic Injuries Calculator (TACTiCal)	499,145.00
Stein/Pasley	The Use of Acupuncture in Potentiating Functional Recovery in Spinal Cord Injury Subjects	1,999,908.00
Chao	Extracellular RNA: Novel Biomarker and Potential Therapeutic Target in Trauma	750,000.00
		14,879,588.28

# Office of Naval Research Grants

Year	Grant Number	Amount
06/01/2010 - 05/31/2012	N00014-10-1-0868	\$3,187,200
07/30/2008 - 03/21/2010	N00014-07-1-0766	\$2,887,350
11/20/2006 - 12/30/2007	N00014-06-1-0298	\$877,677
11/28/2005 - 03/31/2007	N00014-06-1-0188	\$1,011,810
09/30/2004 - 03/31/2006	N00014-04-1-0821	\$1,218,284
11/26/2003 - 12/31/2005	N00014-03-1-0125	\$1,448,000
04/07/2003 - 12/31/2003	N00014-03-1-0611	\$953,310
08/01/2001 - 12/31/2002	N00014-01-1-1014	\$1,447,500
<b>TOTAL:</b>		<b>\$13,031,131</b>



Pre-Injury



Post-Injury



Post-Transplant









# C-STARS

- Tyler Putnum
- William Beninati
- Thomas Grissom
- Sidney Brevard
- David Powers
- Raymond Fang
- Terrence Lonergan
- Joseph DuBose

# Challenges

- The first problem was that we could not bill for services provided by military physicians. We simply changed the law
- Military long term is short term in civilian practice
- Military providers displace civilian providers who may need the work and certainly need the RVU's
- There can be significant differences in the goals of various military providers
- The military reserves the right to change its mind at a moments notice
- Deployments are a certainty. The only question is who and when
- When deployments occur in bunches, the workforce shrinks considerably

# Our Nation's Duty to Our Wounded Heroes



# SUMMARY

- We did it because it was the right thing to do and I love being first
- We continue to do it for the same reasons
- I spoke for Shock Trauma and made an institutional commitment
- That commitment is as strong today as it was in 2001. It is not if, only how
- C-STARS is now a part of our DNA