Battlefield care of combat casualties is not a new phenomenon. In the early 1800s, France established a system of care on the battlefield that included evacuating wounded soldiers from the conflict area to the rear of the battlefield by using litter bearers.¹ ² The concept of battlefield evacuation of casualties was later expanded by Dr Jonathan Letterman during the American Civil War. It is Dr Letterman’s work with the War Department during the Civil War that resulted in a network of aid stations and hospitals capable of treating casualties in a tiered system from the front lines to a fixed facility in the rear of the battlefield.¹ These medical assets were in place on the battlefield during the Civil War; however, physicians were present only at the rear of the battle area. It was not until the start of World War I in 1914 that practitioners realized that the lack of surgical capability on the battlefield had an adverse
effect on the survival rates of casualties. This information prompted a number of surgeons to begin to advocate for the development of small, mobile military hospitals that could move closer to the front lines, hospitals that would be capable of providing emergent medical and surgical care directly behind the lines of combat. The Mobile Army Surgical Hospital (MASH) was developed in response to this need. After the unsatisfactory experiences with the design of the MASH in Grenada and the First Gulf War (1990-1991), the Army recognized the need for a smaller, more mobile battlefield medical unit.

The Army Forward Surgical Team: Mission, Equipment, and Personnel

The mission of the Army forward surgical team (FST) is to provide rapidly deployable, urgent surgical capability (resuscitation and surgery) as close to the fighting as possible in order to save the lives of casualties so severely injured that they would not survive transport to the next higher level of care—the combat support hospital, located farther back in the battle area. Once deployed into the theater of operations, the FST is ideally set up within 3 to 5 km of the combat units it supports. Recent conflicts have precluded this ideal, partly because of the constraints of mountainous terrain and nontraditional (also known as nonlinear) battle tactics.

The FST is highly mobile and operates in interconnected tent shelters that in total provide anywhere from 900 to 1000 square feet of functional space. This space serves the team’s housing needs and also includes the emergency, operating, and recovery rooms (Figure 1). The teams’ 6 high-mobility multipurpose wheeled vehicles and generators supply the power needed to run all the equipment and heating/cooling systems within the shelters. Each FST is equipped to set up a functioning medical facility with 2 advanced trauma life support litters, 2 operating rooms tables, and 4 postoperative ventilator-equipped litters within, at most, 90 minutes. The term litter is used as opposed to “bed” because the term bed implies an inpatient capability—an FST only holds patients for transport and does not have a bed capacity in the traditional sense.

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The FST is designed and equipped to perform surgery on as many as 30 wounded in a 72-hour period before requiring resupply. The initial supplies to immediately resuscitate and operate on critically wounded casualties are included in the FST equipment. Altogether this equipment includes the necessary sterile surgical instruments, anesthesia equipment, medications, drapes, and gowns designed to meet the basic surgical needs of the team. FSTs also have some other basic equipment, such as a hand-held blood analyzer, a small ultrasound machine, portable heart rate/blood pressure/pulse oximeter monitors, transport ventilators, and an oxygen concentrator.

The FST makeup is a multifunctional mix of 20 highly trained personnel: 10 officers, including 3 general surgeons and 1 orthopedic surgeon; 2 certified registered nurse anesthetists (CRNAs); 1 operating room nurse, 1 emergency room nurse, and 1 intensive care nurse; and an executive/operations officer. The remaining 10 personnel are a mix of enlisted operating room technicians, licensed practical nurses, and combat medics. Surgical services provided by the FST are focused on damage control (lifesaving) surgery. In other words, the intent is surgical intervention to control massive hemorrhage and casualty stabilization in an attempt to reduce battlefield mortality.

Trauma Training and the US Army Trauma Training Center

The 13 years of armed conflict in which the US Army and Army Medical personnel have been engaged has ultimately resulted in tremendous changes in the military trauma system and the surgical management of battlefield casualties. This battlefield knowledge has contributed extensively to what we now know about treating the war wounded and polytrauma patients. Tactical Combat Casualty Care and more than 40 clinical practice guidelines were developed and revised. The Army Medical Department’s Center and School is one of the major Army organizations responsible for collecting and disseminating this information, and it is tasked with educating and training all US Army medical personnel. The school facilitates training of the Army FST at the US Army Trauma Training Center (ATTC) in Miami, Florida. The FST and trauma training conducted at ATTC are also the result of a partnership between the US Army, the University of Miami, and Jackson Memorial Hospital/Ryder Trauma Center.

The University of Miami and Jackson Memorial Hospital/Ryder Trauma Center (Figure 2) partnership was chosen over numerous other program applicants because of the overall number of trauma patients treated there (Ryder Trauma Center performs 3500 major trauma resuscitations each year against a background of 10000 significant traumas in Miami-Dade County) with a high percentage (approximately 30%) of cases that involve penetrating trauma. The resultant partnership between University of Miami/Jackson Memorial Hospital and the ATTC has been a model for civilian/military partnership that has endured the test of time, change, and the ongoing overseas conflicts.

Although prototype FSTs were functioning in the late 1980s, the first official 20-person FST was not fielded until March 1997. When Operation Enduring Freedom began on October 7, 2001, in response to the attacks of September 11th, FSTs were, for the most part, untested in combat. Personnel assigned had very little combat trauma training or experience, and few lessons had been learned from previous conflicts. As Operation Enduring
Freedom began to take shape and Operation Iraqi Freedom evolved, FSTs were being sent farther and farther forward into the combat zone to provide lifesaving damage-control surgery to men and women suffering horrific wounds in combat. Consistent data collection from the battlefield began through the Joint Theater Trauma System in 2004, and it soon became evident through analysis of injury patterns and severity of injury that the FST members needed consistent, evidence-based training and needed to be fully integrated as a team. The personnel on these FSTs required not only trauma training, but also highly specialized training that focused on a proven teamwork model.

**Team STEPPS**

The Team STEPPS initiative is a Department of Defense patient safety program developed in collaboration with the Agency for Healthcare Research and Quality (AHRQ). This evidence-based, teamwork training system is designed to improve the quality and safety of patient care. Team STEPPS forms the foundation of training at the ATTC. The 5 key principles of Team STEPPS are team structure, leadership, situation monitoring, mutual support, and communication. Team structure outlines the composition of the team and defines the leadership of the team. The leadership principle provides structure for the team leader and members, the construct within which the team actions are coordinated, information shared, and resources provided. Situation monitoring is the process of constantly assessing the situation in order to gain understanding and support the team function. Conversely, mutual support is the ability to understand the team members’ responsibilities, while anticipating and supporting their needs. Finally, communication is the clear and accurate exchange of information among the team members. For the trauma team, this communication process is managed through a system of “call outs” and “check backs.”

**The Army Trauma Training Center**

The mission of the ATTC is to provide a comprehensive training venue designed to enhance the resuscitative (Advanced Trauma Life Support–based), perioperative (damage control surgery), and critical care (postoperative/intensive care unit) capabilities of the FST and its soldiers within the context of the evidence-based Team STEPPS framework. The ATTC emphasizes the care of trauma patients and addresses strategies to translate the trauma care provided here in a fully outfitted, technologically advanced level I trauma center to the mission and capabilities of the FSTs when deployed.

The training staff of the ATTC is made up of 10 specialized and hand-selected officers and enlisted personnel from the Army Medical Department. All are subject matter experts within their military occupational skill or area of concentration and in operational resuscitation and surgery. The training staff closely mirrors the staff of the FST, with 2 surgeons (a trauma/general surgeon who is the center director and an orthopedic surgeon), an executive officer, a CRNA, and 4 registered nurses. The 4 registered nurses include a clinical nurse officer in charge (supervisor)/clinical instructor who is an experienced intensive care unit or emergency room registered nurse, an intensive care nurse, an emergency department nurse, and an operating room nurse. Two enlisted personnel round out the team, a licensed practical nurse and a combat medic. All of these positions are filled by full time, active duty US Army personnel whose mission is to train the FST members who rotate through the ATTC.

In the past few years, new technology has been integrated into the program. The iPod Touch (Apple Inc) is used to present lecture and demonstration videos, which allows soldiers to view the training in an updated and more relaxed format. The video lectures have been developed by the Department of Defense in close partnership with the University of Miami’s Lehman Injury Center. These lectures are tailored to provide information regarding current trends in trauma treatment and management.

**Training**

The comprehensive training is provided in 3 phases: didactic and simulation training, clinical rotations, and the Capstone Exercise (Figure 3).

**Phase I.** Phase I is 5 days of didactic and simulation training that takes place in a number of venues. Classroom instruction is provided, followed by skill station training as the FST members rotate through the technologically advanced simulation laboratory training using the Sim-Man 3G trauma(Laerdal Medical) and TraumaMan
Simulab Corporation patient simulators, along with numerous other skill stations designed to target knowledge deficits and highlight specific Tactical Combat Casualty Care topics and clinical practice guidelines developed for the care of combat casualties. Hands-on learning is incorporated by having the providers attend the Advanced Surgical Skills for Exposure in Trauma course and the Combat Extremity Surgery Course while the FST members not attending these courses participate in a clinical orientation to the respective work areas in the trauma center, such as the trauma resuscitation unit, the co-located observation area, and the trauma operating rooms.

The process that is applied to trauma casualty care is a 5-person team approach that uses a team surgeon as the team leader, a CRNA, a registered nurse or licensed practical nurse, and 2 medics or 1 licensed practical nurse and a medic (Figure 4) depending upon the overall makeup of the rotating FST. This 5-person team uses Abbreviations: ABG, arterial blood gas analysis; FAST, focused assessment with sonography for trauma; GCS, Glasgow Coma Scale; IV, intravenous.

![Figure 3](http://example.com/figure3.png) Three phases of training at US Army Trauma Training Center.

![Figure 4](http://example.com/figure4.png) Five-person trauma team approach taught at US Army Trauma Training Center.
Instructors at the training center are full-time, active duty US Army soldiers who are subject matter experts in their field.

Instructors work 12-hour shifts, days and nights alongside the faculty from the ATTC and the Ryder Trauma Center, learning and practicing the teamwork and trauma principles. On average, the teams care for 40 to 60 trauma patients during this time, allowing adequate opportunity to implement and adjust in the treatment of critically injured trauma patients. The principles of TeamSTEPPS are practiced, as is the implementation of the trauma team roles. As team members get familiar with their initial assigned roles, they are challenged to move into another, more challenging team role. The team nurse is expected to take over and perform as team leader, the licensed practical nurse as team nurse, and so forth.

Operating room nurses and technicians are also brought into the trauma resuscitation unit in order to learn and function in the 5-person team role, as they too are an important part of the FST and the reality is that not all patients seen in the FST will require operative intervention. The 20-person makeup of the FST is such that all team members must be flexible and adaptable.

Phase III. Training culminates with the Capstone Exercise, during which trainees assume control of the trauma resuscitation unit, observation area, and trauma operating room at Ryder Trauma Center for a set period of continuous operations. For this time frame, the FST members manage all patients who arrive at the trauma resuscitation unit through initial resuscitation and on to the observation unit and disposition. This process affords the FST team members the opportunity to test their work-rest cycles and train for a patient flow situation that exceeds the team’s capability, which may occur while they are deployed. Patient flow varies, as it does in any urban trauma setting, but during some of the busier rotations, teams have cared for more than 20 trauma patients during Capstone rotation. More than 20 may not sound like a large number of patients, but the team composition is such that at any given time, half of the 20-person team may be on the rest portion of their cycle, and team members have to be woken up in order to care for an influx of patients. This closely resembles a real mass casualty situation such as one that they could encounter while deployed. Ultimately, this is the final opportunity for the FST members to practice and implement all they have learned during the preceding 12 days of training and is most likely the last full-scale opportunity they will have to “train as they will fight” before they deploy.
Conclusion

As lessons learned have been brought back and integrated into training and the demands of the Army have required adaptation, the ATTC has remained flexible and responsive in order to meet the needs of the FST members rotating through this training. This civilian/military partnership has resulted in exceptional team-focused trauma training and a Center of Excellence within the Department of Defense. To date, more than 2000 soldiers have been trained at the ATTC—more than 112 FSTs have rotated through for training before deployment.

As the war in Afghanistan winds down and the uncertainty of peace descends upon the Armed Forces, it is unclear when and where the next conflict will arise. But what remains certain is the need to retain and train the lessons learned in the past decade, and to train medical personnel so that they are ready and capable for the next military medical mission. CCN

Acknowledgments
The opinions or assertions contained in this presentation are the private views of the authors and are not to be construed as official or reflecting the view of the US Department of the Army, Navy, or Air Force or the US Department of Defense.

Financial Disclosures
None reported.

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