The U.S. Air Force Medical Modeling & Simulation Training Program (AFMMAST): Medical Training for the Twenty-first Century

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AFMMAST Mission

To develop and use advanced blended learning technologies and methodologies to improve education and training for all medical personnel, healthcare teams and patients; to improve patient outcomes
AFMMAST Program

- Integrate M&S technology into all education, training, currency platforms
- Create simulation program network and enterprise IT infrastructure
- Develop a technology-enabled Advanced Bended Learning (ABL) platform
- Strategic Plan, CONOPS and execution timeline for target areas:
  - Currency & Competency, Sustainment training for all Corps
    - Physician, Nurse, Medical Technician and Allied Health
  - Hospital Care
  - Combat Casualty Care, Critical Care Air Transport
  - Graduate Medical Education, Nurse, Allied Health
  - Patient Safety & Team Training
  - Disaster, Homeland Security, Pandemic Response
  - Medical Errors, Healthcare Cost Reduction

Battlefield Trauma, Critical Care Air Transport, In Garrison Care, Patient Safety, Humanitarian Missions, CBRN, Disaster, Homeland Defense and Pandemic Response
Why Simulation and Advanced Blended Learning Tools?

- Potential disruptive and cost-saving concept
- Must produce better outcomes with fewer dollars and people
- It must be executed with:
  - Strategy based upon Doctrine
  - Capabilities-driven, competency-based, performance tracking, ROI
  - CONOPS driven by mission and operations
  - Leverage technology without sacrificing standards
  - Application of technology that meets requirements
  - Backed by science and validation research
  - Include Force Development policies and align with processes and policies
  - Delivered through innovative and sound resourcing/programmatics
Preventable medical errors among the leading causes of death in the United States

November 1999
INSTITUTE OF MEDICINE
Shaping the Future for Health
TO ERR IS HUMAN:
BUILDING A SAFER HEALTH SYSTEM
Recommendation 8.1:
“Patient safety programs should...establish interdisciplinary team training programs for providers that incorporate proven methods of team training, such as simulation.”

March 2001
INSTITUTE OF MEDICINE
Shaping the Future for Health
CROSSING THE QUALITY CHASM:
A NEW HEALTH SYSTEM FOR THE 21ST CENTURY
“The nation’s health care delivery system has fallen far short in its ability to translate knowledge into practice and to apply new technology safely and appropriately”
One Decade Later...

- 13.5% Medicare inpatients >1 unexpected adverse event
  - 1.6M harmed per year
  - 180,000 fatalities per year
- 44% “clearly or likely preventable”
  - 707,000 harmed per year
  - 79,000 fatalities per year
- Added FY09 annual expense of $4.4B
- Estimate did not include follow-up care after discharge
- Opportunities to improve individual and team education and training (skills and processes)

Over $4 billion added to U.S. Medicare health care cost
Conventional Training Limitations

- Core curricula and E&T materials not standardized
- Quality variable and inconsistent internally and externally
  - Patient and surgical case load vary, staff experience and availability
- Lack true validation of skill acquisition and performance
  - Metrics not tracked or archived enterprise wide
- Surrogates for quality health care and “competency“ flawed
  - Board exam, # cases, errors, complication rate, malpractice, chart rev
- Retraining - no formal program
  - “Reset” post deployment
- No enterprise IT architecture or interoperability
  - Multiple information sources, servers, databases, passwords
  - Difficult to access, local server only, unknown, no digital apps
Simulation Training Limitations

- Lack uniform use of standardized and validated tools and technologies
- Quality variable
- Instructor knowledge of subject matter and simulation ops
- Not formally integrated into all curricula
- High student-instructor ratio
  - Limits individual instruction and number of didactic sessions
- Low throughput due to setup/breakdown, space availability
- Inconsistent debrief (format, verbal vs taped)
- Performance metrics not defined, measured or tracked
- No ROI
- Inadequate for surgery, invasive procedures, live tissue
Joint En Route Care System – A Case for Standardized Joint Simulation Training

Greater Demand for Blended LVCG and Mobile Learning Tools

- Combat Medic and Tactical Combat Casualty Care
- Joint Operations and Mission Rehearsal
- Disaster Response and Pandemics
- Peacetime Operations

INTRA-THEATER

INTER-THEATER

US Medical Center

Overseas Medical Center Aeromed Staging Facility (ASF)

First Responder Care

Battlefield CASEVAC

Battalion Aid Station

MobileASF Secure Airfield

EMEDS

Combat Support Hosp AF Theater Hosp

Theater Hospital Care

Definitive Care

Army, Marines, AF, Multinational

Army, Marines, AF, Navy, Multinational
**Trauma Surgery** - A Case for Standardized Joint Simulation Training

<table>
<thead>
<tr>
<th>Level 1 US Trauma Center</th>
<th>332 EMDG/AFTH Balad, Iraq</th>
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</thead>
<tbody>
<tr>
<td>~2000-7500 admissions/year</td>
<td>~8000 admissions/year</td>
</tr>
<tr>
<td>&lt;30% penetrating trauma</td>
<td>&gt;90% penetrating trauma</td>
</tr>
<tr>
<td>High velocity GSW – rare</td>
<td>High velocity GSW – rule</td>
</tr>
<tr>
<td>Blast injury – rare</td>
<td>Blast injury – very common</td>
</tr>
<tr>
<td>&lt;10% trauma patients need surgery</td>
<td>&gt;80% trauma pts need surgery</td>
</tr>
<tr>
<td>1 surgeon performs 1 operation</td>
<td>Multiple procedures and surgeons</td>
</tr>
<tr>
<td>Multiple casualty event – rare</td>
<td>Mass casualty event – common</td>
</tr>
<tr>
<td>Trauma – nominal workload</td>
<td>Trauma – majority of workload</td>
</tr>
</tbody>
</table>

*Balad, Iraq May 2007

*Combat trauma injuries are unique and must be managed differently. Must combine hands-on training with simulation to achieve and maintain competency*

* May 2007
On-The-Job-Training?....... Not An Option
Initial Status of U. S. Air Force Medical Simulation Training

- Isolated initiative within each medical facility
  - No overarching Strategic Plan, Doctrine or CONOPS
  - Departments worked independently within and between facilities
  - No procurement strategy (end of year funding)

- Total asset visibility unknown

- Lack simulation operators to run and maintain equipment

- Simulators are underutilized or used inadequately

- Lack of standardized and validated curriculum

- Training not linked to outcomes

- $26M in simulation equipment with No Strategic Plan, Doctrine or CONOPS

Maximum capability not achieved
AFMMAST Program and Tiered Structure

- **AFMMAST Central Program Office (CPO) – Established in Sept 2007**
  - Oversees and supports all MM&S training activities throughout the AFMS

- **Tiered Site Structure:**
  - Tier 1: Med Cen/large Hosp - AFMMAST contractor staff; medical trng requires simulation
  - Tier 2: Med Hospital/Clinic – Military/Gov civilian staff; medical trng requires simulation
  - Tier 3: Do not conduct routine medical simulation training (out source to nearby facility)

- **Mentoring:**
  - Tier 1 sites designated as mentors to support specific Tier 2 and 3 sites
  - Mentoring sites also work as a team to address questions from all sites (no silos!)
  - Joint/Sister Service Sites: CPO maintains a robust relationship to promote standardization, continuity, and research across the U.S. Department of Defense
Initial Task Analysis and Simulation Mapping

Medical Readiness Skills That Can be Trained With Simulation (Mannequins, Task Trainers, Virtual Reality or Gaming)

Adaptive “learner centric” environment incorporating performance feedback and metrics
The Call for Innovation in Medical Simulation and Information Technology

- Simulation is integral to multidisciplinary medical and trauma training platforms
- The complexity of knowledge, technical proficiency, communication and teamwork has outpaced the capacity of the traditional healthcare system and the capability of conventional medical E&T programs
- Advances in our ability to treat disease and to develop leading-edge technology progress at an exponential pace but there has been little organized application to the efficiency and effectiveness of care delivery
- Combined with an enormous influx of technologically savvy health and allied health professionals make it essential that hospitals implement new technology that mirrors these complexities
- Medical and trauma training programs must employ innovative simulation tools that are strategically incorporated into standard curricula
The Future Airman
Today’s Cyber Teenager = Tomorrow’s Medical Professional

Digital Native

With permission: Gen Irv Lessel HQ AETC A5/8/9
Why Advanced Blended Learning?

- Learning strategy that integrates multiple different instructional modalities
  - Live, Virtual, Constructive, Gaming, Mobile Learning, Synthetic Tissue
- Designed for specific learning outcomes (requirements)
- Adaptive, initiative and learner-centric
- Credible, rigorous and relevant
- Address the future mission and operational environment
  - Political, Military, Socioeconomic, Informational, Infrastructure, Physical Environment
- Continuum of learning from accession to retirement
  - Meet training requirements of the organization, tactical units and
- Foster critical thinking and problem solving, teamwork and collaboration
- Cultural, national and multinational competencies
- Full spectrum capable learner: Tactical and Technical competence
- Rapidly incorporate lessons learned
Advanced Blended Learning by Environment – U.S. Army TRADOC

Training by environment – ARFORGEN TRADOC
Budget cuts driving organizations to look for efficiencies
- Training is a multi-million dollar expense; looking to M&S to leverage
- Use of M&S reduces infrastructure, travel and personnel needed for training

Modeling, simulation and gaming effective learning tools

Greater acceptance by Federal and commercial health organizations, and professional societies

Focus on task analysis, implementation, outcomes and ROI

Goal: Improve medical education and training for medical personnel, healthcare teams and patients-------- to improve treatment outcomes
AFMMAST Advanced Blended Learning “Cloud” Architecture

Overarching Strategy for Enterprise Technology Service Delivery and Advanced Blended Learning Ecosystem
AFMMAST Technology

- **AFMMAST Portal**
  - Centralize all global simulation center best practices, provide medical gaming, CME, simulation updates, communities of practice

- **Web-Based Education & Training System (WBETS)**
  - Share best practices and critique training videos through a web-based host
AFMMAST Technology

- **Virtual Medical Center**
  - Medical staff, healthcare teams and patients can communicate and collaborate
  - Access to thousands of online learning tools, journals, communities of practice, patient education tools and media such as videos, presentations, documents
  - Telemedicine and group appts for patient care, eConsults, training classes and 24/7 access to an avatar based Virtual Medical Advisor (VMA)
  - Physician-physician consultations, international Grand Rounds
  - Cybrary with links to textbooks, journals
  - Gaming for repetitive cognitive skills trng prior to sim center “Capstone Event”
**AFMMAST Portal**

- Single resource for simulation centers and medical staff seeking up to date medical information, simulation and educational tools
  - Tier 1 simulation center web pages
  - CPO functions (research, curriculum, operations, logistics)

- **Additional outreach**
  - Consolidated links to high quality websites via a medical cybrary (virtual library)
  - Centralized hosting of medical gaming, WBETS, other medical simulation projects

- Dedicated site maintenance staff employed by CPO

- Public facing site for patients and caregivers
STAT! - A serious game for trauma training

GAME PREVIEWS
Virtual Training Videos

STAT! Trauma Team Training
The life or death of a Warfighter wounded in combat often depends on the care he receives within the "golden hour" immediately following injury. Multiple casualty, multi-trauma incidents require emergency medical teams, working within extreme time constraints, to make rapid and accurate decisions regarding medical assessments and procedures, and to prioritize their time and resources among the life-threatening conditions. Learning to perform effectively in such an environment requires considerable practice in making critical decisions "Sooner Than Already There" (STAT). However, there are few opportunities for trauma teams to practice these skills prior to deployment.

COMING SOON
Mobile Training Applications targeting mobile platforms such as the iPad and other tablet devices.

First Responder Medical Card Game
Card Games have been successfully used in the past for training purposes. Examples include the WWII Airplane Spotter Deck and Iraqi Most Wanted Decks. These cards have not only helped to train, but have also helped to increase awareness with identification. Two first responder card decks, that are now available as mobile apps, assist first responders as an additional training aid. The Combat Medic and Combat Lifesaver (CLS) Card Games provide a portable and inexpensive avenue for first responders (i.e. Combat Lifesavers and Combat Medics) to continue to reinforce training skills for medical emergencies without the presence of instructors.
The USAF Virtual Medical Center provides Air Force personnel and their families direct access to medical care and resources anytime, anywhere in a virtual environment.

TRICARE beneficiaries and Air Force medical professionals can access healthcare information and wellness resources, schedule an eConsult, and get answers to frequently asked questions via a Virtual Medical Advisor.

Virtual Medical Advisor
Consult the Virtual Medical Advisor 24/7 for frequently asked medical questions.

Medical Clinics
Medical information, speak with a specialist, ask the Virtual Medical Advisor, or take a class specific to your medical interests.

Providers: Provide medical assistance, hold a group information sharing session or browse medical journals in your field of expertise.

eConsult
Patients: Schedule an eConsult with a medical provider or join in a private chat with a provider or another patient.

Providers: Schedule an eConsult with a patient or join in a private chat with a patient or another provider.

Cybrary
Patients: Browse wellness information on variety of medical topics.

Providers: Browse medical journals.
The AFMMAST Online Cybrary is the central location for online learning. Here you will find eJournals, eBooks, research material, podcasts and much more. The Cybrary provides Air Force medical personnel with the ability to learn content anytime, anywhere.
New Technology Development

- Natural Disaster Response Gaming Simulation
- Trauma Simulation Training - Center for Sustainment of Trauma and Readiness Skills (CSTARS) Baltimore/UMMC
- Special Operations Forces Simulation Training – PJ/Combat Control Team
- Medical Gaming +/- haptics - virtual surgery/invasive procedures
- Virtual Environments - Hospital/EMEDS/CCATT
- Synthetic Tissue to augment/replace live tissue – 1st in DoD
- Medical Technician Gaming Simulations
- Tri Service Medical Simulation Training Validation Research for skills and to analyze adequacy of simulation tools
Synthetic Tissue Training
**Immersive Live Training: Wide Area Virtual Environment (WAVE)**

- **Wide Area Virtual Environment (WAVE)**
  - Smaller version on permanent loan to U.S. Air Force from Uniformed Services University of the Health Sciences, Bethesda, Maryland
Virtual Haptic Task Trainers

- Damage Control Neurosurgery and Cricothyroidotomy task trainers with haptics
  - First responders, combat medics, and emergency room Physicians
- Trained USAF personnel in Iraq and Afghanistan

Intracranial Hemorrhage Perforator Demo

Intracranial Hemorrhage Drill Bit Demo
Future

- Standardize U.S. Military Simulation Education & Training
  - TCCC curriculum, gaming simulations with task trainers/haptics, Mannequins with synthetic tissue and organs (surgery)
- Build the U.S. Military Medical Cloud..... Federal, National, Multinational?
- Joint Medical Training Platforms and Exercises – virtual, WBETS
- Joint Validation Research and Multicenter Studies
- Joint Technology Development - Leveraging economies of scale
- Telemedicine, mobile applications and devices for first responders, trauma management, civilian healthcare (chronic and complex disease, rural/remote)
Future

- Virtual deployed hospitals and forward operating bases
- Gaming Simulations for repetitive practice – recovery from “worst case scenario”
  - Pre deployment training
  - Hospital and medical equipment familiarization
  - Operational rehearsals for mass casualty, triage, staging and patient throughput, etc
  - Patient management scenarios - trauma/burns, use CPG’s from Joint Theatre Trauma System (JTTS)
Central Program Office - 2013

- Assets $65M, FTEs 52, 87 sites worldwide
- Assistant Sec Def for Health Affairs – “The DoD Center of Excellence” for Medical Simulation
- Model Program For Department of Defense and Department of Veterans Affairs
- Lead Service, Federal MM&S Trng Consortium
- Lead Service, DoD Joint Technology Development and Research (TATRC)
AFMMAST Program Strategic Overview

Theme: CENTER DEVELOPMENT  
Phase: 1. Simulation Centers

Doctrine
- Service
- Joint integration for training/war games

Organization
- Primary Location/Med Facility
- Consolidation
- Integrated training sites

Training
- Standard Service Curriculum
- Local Training Network
- Service Simulation Network IT Cloud Infrastructure
- Standard Joint Curricula and POIs

Materiel
- Materiel Solutions
- Materiel Solutions
- Innovation Solutions
- Economies of Scale for Joint Technology Development

Leadership
- Service
- Joint

Personnel
- Service

Facilities
- Tier 1 Sites
- Distributed Simulation Network
- Joint Simulation Centers: NCR/SAMMC
- Tier 2 & Tier 3 Sites

Service Synergy

Joint Integration

2. AFMS Distributed Simulation Network
3. Educate/Train Med War Games
Questions?