Executive Overview:

- ASTEC partnered with Tucson's NWFD to conduct an outdoor simulated mass casualty field exercise involving a 2-vehicle collision with 7 patients. The training exercise received the First Place, 2011 National Award for Innovation in Fire Safety Education and Training from Congressional Institute for Fire Safety, Washington, D.C.

- ASTEC experienced a 34% increase in participant utilization during 2010-11 (as compared with 2009-10) and provided more than 5,720 learner contact hours during 2010-11 (as compared with 4,995 during 2009-10).

- Despite having only 435 square feet of training space, ASTEC has evolved into one of the most multidisciplinary medical simulation centers in the nation, as recognized by industry leaders.

- During 2010-11, nearly a quarter of all participant utilization was conducted within the actual University Medical Center departments (in situ) for an unprecedented 1471 learner contact hours – a total unmatched by any other simulation center in the nation.

- ASTEC continues to be a leader in the delivery of high-fidelity medical simulation, adding 7 new training modules and numerous equipment upgrades to our arsenal of training platforms.

- ASTEC has entered its 5th year of developing computer-assisted surgical training platforms, introducing a new generation of state-of-the-art optical encoders that can measure the position of laparoscopic instruments while procedures are performed on artificial tissue models.

- ASTEC remains #1 in product utilization for Karl Storz Endoscopy-America and continues a 6-year partnership with that corporation, uniting state-of-the-art medical instrumentation with innovative methods of simulation training.

- As a national leader in the development of artificial tissue, ASTEC has manufactured 5 new medical simulation models, including a full size cardiothoracic mannequin, for unlimited practice of high-risk medical procedures.

- ASTEC has been invited to showcase our simulation center at the 3rd Interprofessional Education Conference, Collaborating Across Borders (CAB III), where all components of medical simulation will be presented in an interactive demonstration that invites all attendees to participate.

- ASTEC collaborated with Dr. Robert Poston, chief of the Division of Cardiothoracic Surgery, to secure a $14,000 grant from the University Medical Center to perform interprofessional simulation training involving adverse situations in robotic cardiothoracic surgery.

A simulation exercise that we conducted with Tucson's Northwest Fire Department (NWFD), in collaboration with the Arizona Telemedicine Program, won a prestigious national award (see cover and story inside) bestowed by the Congressional Institute for Fire Safety, which reports to the United States Congress. We were recognized for our massive simulation training exercise designed to help first responders train for major incidents with multiple victims. Carried out entirely in the field, the exercise involved 2 cars in a simulated crash and featured 7 computerized, high-fidelity mannequins. In addition, 3 live video feeds transmitted back to medical students on the University of Arizona campus. For almost all of the students, it was the first time they had witnessed firsthand the famous “golden hour of trauma”—that short interval in which medical rescuers can stabilize severely injured victims and save their lives. Less than 2 weeks later, the very same NWFD unit from our training exercise would be the first responders on the scene after the tragic January 8th shooting of Congresswoman Gabrielle Gifford and 18 others.

ASTEC passed the milestone of providing more than 25,000 learner contact hours since our doors opened. At the urging and with the support of Dr. Kevin Moynahan, the deputy dean for education in our College of Medicine, simulation has now been integrated into all four years of the medical school curriculum.

ASTEC continues to set records for utilization and maintains its edge as the national leader in creating artificial tissues and training modules. With great pride, we continue to demonstrate that a vigorous simulation program can be sustained without ever using any animals or animal tissues. We recently completed a large education research project, involving 120 medical students, that demonstrated new and better ways to train future physicians to perform quicker and safer airway management—a source of critical and often lethal injury to patients when errors occur.

On a regular basis, more than 20 College of Medicine faculty members from 8 departments now participate in ASTEC simulation training. Our use of simulation training within hospital settings has grown by nearly 500% this year.

Dean Goldschmidt has proposed creating a new, larger ASTEC facility for the College of Medicine. We are anxious to attain even greater achievements and pass even more milestones in the years ahead.
ARIZONA SIMULATION TECHNOLOGY AND EDUCATION CENTER

GROWTH

ASTEC opened on August 5, 2005, and has now begun its 6th year of operation. Since 2005, our laboratory has provided a consistently high volume of simulation technology and education services for numerous University of Arizona health sciences departments as well as external first-responder organizations. Overall annual participant utilization has increased by 24% from the academic year 2009-10. We continue to be among the most multidisciplinary medical simulation centers in the nation.

We provide medical simulation training to the full range of Arizona Health Science Center health care providers. This makes up 80% of ASTEC’s simulation training. In an effort to address interprofessional education, 22% of our teaching activities are now provided for multidisciplinary teams as they naturally interact and work within (in situ) the University Medical Center departments of Emergency Medicine, Pediatrics and Surgery. The other 44% of ASTEC’s simulation training is provided to medical flight crews, fire departments, military and federal rescue personnel, community outreach workers and students in pre-collegiate programs.

These training activities amounted to 1,081 training hours for 2010-11. ASTEC increased its utilization rates for all categories of participants during 2010-11, resulting in a cumulative total of 5,720 learner contact hours in a single year, as compared with 4,995 during 2009-10.

Although we have now reached our training capacity in terms of physical space (only 435 square feet for training) and available time, we have exercised every strategy possible to avoid turning away anyone in the Arizona health care community. Through innovations in mobile and simulation interprofessional education, we have been able to expand on the educational mission of the University of Arizona and our College of Medicine, while also providing new training opportunities for others on campus and in the external first-responder community.

This past year, ASTEC achieved remarkable education and training utilization rates—with the same amount of workable space, and the same operational budget since opening in 2005. Given the large increase in demand for our training programs, we added a new medical simulation technician to our staff in August, 2011. We would like to take this opportunity to welcome Lisa Grisham, MS, NNP, to our ASTEC team. Grisham brings valuable clinical experience and insight from her work as a neonatal nurse practitioner. She has taken over many of our in-situ simulations in the neonatal and pediatric intensive care unit at University Medical Center, creating a very realistic simulation experience for the trainees.

More than 80% of our available weekly schedule is devoted directly to medical simulation training. Much of this time is filled by the following College of Medicine programs:
- Emergency Medicine Elective
- Surgery Clerkship
- Internal Medicine Clerkship
- Pediatric Clerkship
- Year 1 & II Societies
- Year III Intersessions
- Year III Transition Block
- Year IV Interprofessional Cardiopulmonary Resuscitation (CPR)
- Cardiopulmonary Resuscitation (CPR) Elective
- Telemedicine and Telehealth
- Emergency Medicine Club
- Surgery Club

Residency participation includes various departments:
- Surgery Residents
- Emergency Medicine Residents
- Internal Medicine Residents
- Family Medicine Residents
- Pediatrics Residents
- Obstetrics and Gynecology (OB/GYN) Residents
- Pulmonary Fellows
- Anesthesia Residents
- Neurosurgery Residents

TEACHING ACTIVITIES

In-hospital programs include the following:
- Emergency Medicine Competency Codes
- In Situ Critical Decision Unit Codes
- In Situ Diamond Children’s Medical Center Pediatric Intensive Care Unit (NICU) Codes
- In Situ Diamond Children’s Medical Center Neonatal Intensive Care Unit (NICU) Codes
- In Situ Diamond Children’s Medical Center Pediatric Step-down Codes
- In Situ Radiology Code Review
- In Situ Cardiopulmonary Resuscitation (CPR) Codes
- In Situ Emergency Medicine Codes
- Radiology Attending Codes
- Undergraduate Health Care Clubs and Groups
- Middle and High School Health Care Programs

ASTEC/NWFD Mobile Unit for outreach and pre-hospital teaching activities
ASTEC continues to be a primary resource for first-responder simulation training:
- Tucson Fire Department Recertification
- Northwest Fire Department (NWFD)
- LifeNet Helicopter Program
- Air Evac Helicopter Program
- Arizona Lifeline Helicopter Program
- United States Air Force Pararescue
- United States Border Patrol
- Pima County SWAT (Special Weapons and Tactics) Team

Other groups include the following:
- University of Arizona Campus Health
- Nurse Practitioner-Acute Care Students
- Physiology Club
- Residency Electives
- American Medical Student Association Premedical Chapter
- Med Cats Pre-Health Club
- International Fellowships
- Bioengineering Research Rotations
- Camp Scrubs
- Telemedicine Fellowship
- Tucson Medical Center Surgery Residents

Faculty and staff proctoring is encouraged for all scheduled training. In the past year, such proctoring was a major component of 900 training hours provided in 404 scheduled training. In the past year, such proctoring was a major component of 900 training hours provided in 404 scheduled training. In the past year, such proctoring was a major component of 900 training hours provided in 404 scheduled training. In the past year, such proctoring was a major component of 900 training hours provided in 404 scheduled training.

In late 2010, ASTEC partnered with Tucson’s NWFD, and the Arizona Telemedicine Program to conduct an innovative, real-time, multiple-victim, high-fidelity in-situ simulation training exercise. ASTEC provided and operated 7 mannequins as victims in a 2-car pileup scenario. High-fidelity patient simulators were used to display a host of medical problems, ranging from broken bones and abdominal trauma to brain injuries—and even an unexpected delivery of a baby! The team of first responders from the NWFD arrived on the scene with no foreknowledge of the large number of victims or the extent of the injuries and medical problems. As part of the event, College of Medicine students on the University of Arizona campus were able to follow the action via telemedicine, thanks to our collaboration with the Arizona Telemedicine Program. Three separate cameras on the scene captured the event from multiple angles to provide a sense of immediacy and to show the efficiency of the response. For almost all of the students, this was the first time they actually saw the unfolding of the “golden hour of trauma”—the vital 60 minutes in which first responders can stabilize severely injured victims and save their lives.

The Medic-Alert Foundation and the Congressional Fire Service Institute recognized NWFD with a national award for Excellence in Fire Service-Based EMS. The award was presented to members of the NWFD in a ceremony on April 7, 2011, in Washington, DC.

ASTEC’s popularity continues to be demonstrated by the enthusiastic and positive data generated from feedback and satisfaction surveys. On standardized, anonymous feedback questionnaires, we have consistently scored in the 95th percentile, clearly considered a favorable educational experience by medical student and resident respondents. In fact, the most consistent comment is that all current users of ASTEC would like more designated time for medical simulation education.

OUTREACH
As part of the College of Medicine’s community outreach effort, ASTEC is making simulation technology available to health care professionals in outlying communities. Beginning in the fall semester of 2011, ASTEC is facilitating a medical simulation internship for members of the Fostering Excellence in Fire Service-Based EMS Program. Two students per semester will become immersed in medical simulation, choose a health care topic of interest, develop a curriculum, and conduct a hands-on training session for all other FACES members. We will also provide internship opportunities for the Tucson Urban League and for the Arizona Assurance Program, which represent underprivileged students interested in a career in medicine.

ASTEC also provides regular Advanced Cardiac Life Support (ACLS) training for students pursuing a medical degree...
in addition, we conducted an intensive 20-hour program for nurse practitioners visiting from tAIWan.

the following is a full list of regular outreach activities conducted by astec:

- neonatal codes in nogales
- neonatal codes in sierra vista
- office of multicultural affairs internship
- arizona assurance program
- tucson urban league
- intensive program for tAIWanese nurse practitioners
- ACLS skills for Mexican medical students
- high school pre-health fellowships
- ACLS skills for Mexican medical students

In the fall semester of 2011, astec launched our undergraduate volunteer program, which seeks to introduce undergraduate students from the University of arizona and Young explorer programs to the clinical aspects of health care. the volunteers learn to prepare and coordinate simulation training from a clinical and procedural perspective, integrating their undergraduate premedical coursework with its clinical applications. the program provides students with an early glimpse into the medical field and helps them decide whether medicine is the right academic investment for them.

Additionally, astec provides independent research opportunities for undergraduate and pre-medical students. in the past year, 4 medical students participated in clinical research as part of their semester-long independent study in astec and 4 residents from the departments of Emergency medicine and Pediatrics conducted research electives in astec. the residents developed new tissue models in our simulated tissue laboratory and applied the models to unique medical cases that were then used to train entire health care teams.

With the University of arizona’s Department of Electrical and Computer engineering (ece), we have been working for the last few years with Wroclaw Medical University and University of Technology (in Poland) to create a sister simulation center. Collaboration has been ongoing in the planning and design of the center, which will be based on the modalities used on a regular basis in astec. in the coming months leading up to the opening of the center, the next venture in this global partnership will be to implement a telemedicine linkage between the University of arizona and Poland.

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In an effort to meet the high training demand from surgery residents and to optimize astec training methods, we have added the Essential Gynecology Procedures and Fundamentals of Laparoscopic Surgery (FLS) Essential Tasks Modules to our simbionix Virtual Reality LAP Mentor™.

astec collaborated with Joseph livinGton, MD, from the University of arizona’s, Department of Neonatology to develop a high-fidelity hydrops fetalis simulator. the simulator was presented at the meeting of the Pediatric Academic Societies and Asian Society for Pediatric Research in Denver, Colorado, April 30-May 3, 2011.

Medical students will now have increased exposure for practicing at all levels of health care; we will also be able to create more realistic medical training opportunities for all current and prospective users.

astec’s full range of medical simulation equipment is listed below:

- 4 adult patient simulators
- 1 birthing simulator
- 1 school-aged mega code simulator
- 1 pediatric simulator
- 2 neonate simulators
- 1 ultrasound simulator
- 1 virtual-reality laparoscopic trainer
- 6 laparoscopic training stations
- full line of Karl storz videoscopes and surgical instrumentation
- 1 neurosurgical microscope
- 20 specialized task trainers (4 New)
- 1 pediatric hydrops fetalis simulator (new)
- 1 cardiothoracic surgery trainer (new)
- 1 suture evaluator (new)
- unlimited supply of simulated tissue models
ARTIFICIAL TISSUE DESIGN

Ongoing is ASTEC’s research to develop and perfect biosynthetic materials for surgical dissection, intravenous therapy, high-risk invasive medical procedures, and microsurgery simulation. In the past year, we have expanded our development of new artificial tissue models by using advanced molding and casting of silicone materials. We now use platinum silicone along with vinyl and gelatins. We have developed several new artificial tissue models for research purposes and regular use in medical simulation training. In addition, we continue to expand our use of medical moulage for standardized patients to increase the realism of the simulation experience.

Further, ASTEC developed a closed cardiovascular system model to simulate treatment for a patient on extracorporeal membrane oxygenation (ECMO) in cardiac arrest.

This is a complete list of artificial tissue models developed by ASTEC since our opening in 2005:

- Adult and pediatric peripheral intravenous access
- Arterial line placement
- Intravenous access
- Umbilical cord access
- Adult and pediatric chest tube
- Adult and pediatric pericardiocentesis
- Tibia compound fracture with arterial bleeding
- Uterus with ectopic pregnancy
- Various wounds for suturing
- Ultrasound-guided line placement
- Bilirubin of common carotid artery
- External carotid to internal carotid bypass
- End-to-side anastomosis
- Bowel anastomosis
- Silicone wound models with pressurized blood perfusion (NEW)

We have created a new line of silicone wound models that have the capability to perfuse pressurized blood. This model produces a very realistic bleeding reaction when the tissue is cut by a scalpel. Other new tissue models that we have created include an adult and pediatric silicone trachea for performing repeated cricothyrotomies in medical simulation training. It features a layer of simulated silicone skin placed over the trachea, making the anatomy realistic.

We have used the silicone trachea model in simulated cases involving tracheal occlusion or malfunction in pediatric patients. In addition, we have created a capillary refill model for use in pediatric cases involving shock, as well as pediatric femoral line trainer to simulate treatment of aspasis in infants.

This is a complete list of artificial tissue models developed by ASTEC since our opening in 2005:

- Adult silicone trachea (NEW)
- Pediatric silicone trachea (NEW)
- Capillary refill model (NEW)
- Closed cardiovascular system model (NEW)

RESEARCH

ASTEC has been involved in a variety of research initiatives this past year.

Computer-Assisted Surgical Trainer (CAST)

ASTEC continued its close partnership with Jerzy Rozenblit, PhD, and his team in the Department of Electrical and Computer Engineering in developing a new generation of the Computer-Assisted Surgical Trainer (CAST). The new CAST system consists of a digital camera and optical encoders (measuring 4 degrees of freedom) attached to laparoscopic instruments that measure the position of the instrument over time while a certain procedure is performed. This system can be used with the full line of Karl Storz laparoscopic instruments.

The hybrid model of camera and encoders is an essential component of this system: it overlays the path history of the instruments as they are used to perform skills involving artificial organs or standardized laparoscopic tasks. This method is intended to help identify erroneous movements made by surgeons. Tracking and reporting information on various performance metrics – such as position and velocity of instruments, total path length of motion, and erratic movements – provide surgeons in training with insight into how to obtain better control, and ultimately better results, during laparoscopic surgery. Haptic response to erroneous movements during the training provides immediate feedback to the trainees.

To support this ongoing project, we recently submitted a National Institutes of Health (NIH) grant proposal entitled "Advances in Patient Safety through Simulation Research."

Critical Airway Study

ASTEC conducted a study (sponsored by Karl Storz Endoscopy) to compare the efficiency of direct versus video-guided laryngoscopy in first-year medical students conducting endotracheal intubation on an airway trainer. We found that the videolaryngoscope (the C-MAC®) allows for significantly faster intubation times in novice trainees. We will present the results at the 12th International Meeting on Simulation in Healthcare (IMSH), San Diego, CA, January 27-February 1, 2002.

Arizona Border Simulation Project

With this 3-year project, ASTEC will work to provide an immersive simulation training program that addresses the dangers of border-specific mass casualties. The project will involve first responders from 36 units comprising medical, law enforcement, and federal agencies from Arizona including all counties along the U.S.-Mexico border. In collaboration with Tucson’s NWF, we will develop in-situ multiple-victim, high-fidelity simulation exercises that will be carried out at designated desert locations over the course of a year. The Arizona Telemedicine Program will broadcast the training exercises live via a telemedicine broadcast.

Practicing Intubation on Airway Management Trainer
network, to units unable to participate at the scene. A blinded evaluation will be carried out to assess the impact of the training program on first-responder performance.

**Cardiothoracic Surgery Robotics: Interprofessional Simulation Training**

ASTEC developed a new cardiothoracic surgery trainer for the purpose of providing interprofessional simulation training for cardiothoracic surgery robotics. The trainer is capable of simulating adverse events in coronary artery bypass graft (CABG) robotic surgery, including excessive bleeding and cardiac fibrillation. It also displays changes in vital signs according to chosen interventions.

Working in collaboration with Dr. Robert Poston, chief of the Division of Cardiothoracic Surgery, we will use our newly developed cardiothoracic surgery trainer to determine the learning curve of trainees in cardiothoracic surgery who are repeatedly exposed to simulation training. Our aim is to train team communication and coordination during emergency situations encountered in cardiothoracic surgery.

**FUTURE INITIATIVES**

ASTEC is working with the College of Medicine to find additional space for a larger, centralized simulation facility to serve our current and future needs. We have outgrown our current physical plant; chronic overcrowding is the rule rather than the exception in our heavily used facility, which currently covers fewer than 500 square feet (453 which are designated for training). A larger ASTEC facility must be established to keep up with the accelerating demand for simulation-based education and training for medical students, residents, and the overall community. Our utilization rates are on par with some of the largest medical simulation centers in the nation, but those centers average 15,000 square feet. Clearly, new sources of revenue must be identified to help develop and sustain a new ASTEC facility (see the donation envelope insert).

We have continued to develop a mobile medical simulation unit that will provide education and training opportunities to community health care providers throughout Pima County and other outlying rural areas. With the help of Tucson’s NWFD, our innovative method of taking simulation on the road will provide a convenient alternative to the traditional center-based method of continuing education.

We will participate in the upcoming 3rd Biennial Collaborating Across Borders Interprofessional Educational Conference in Tucson, AZ. Fully operational on-site demonstrations of how interprofessional education can be taught using simulation training.

**PUBLICATIONS**


Pending:


POSTERS AND ABSTRACTS


