A Message from the Executive Director of ASTEC

This past academic year (2009-10) has been one of many firsts and profound accomplishments by the ASTEC team, as you will see in this annual report. Of note, ASTEC achieved the incredible, undreamt-of milestone of providing nearly 5,000 person-training hours in a single year, making our simulation center the most productive in the country—all while serving the greatest breadth of users across the health care spectrum of any simulation center anywhere.

ASTEC is now under the administration of the College of Medicine, in recognition of our institutional role as the provider of simulation training for the entire college. Accordingly, ASTEC has now been incorporated into all 4 years of medical school training; significant new educational and curricular functions have been assigned to us.

In this past year alone, the participation of residents in ASTEC grew by more than 25%. Residency programs at the University of Arizona and beyond face increasing pressure to mandate simulation training as an integral part of graduate medical education.

ASTEC remains the foremost center in the entire United States in the development and use of artificial tissues for simulation training. We added 6 new tissue modules this past year.

Our outreach program to first-response, nursing, and medical staff continues to be one of our primary missions, helping support the development of better health care delivery throughout the state.

In the final analysis, however, what makes ASTEC exceptional is teamwork. We are grateful for the College of Medicine’s resolute support of our concerted efforts to ensure a state-of-the-art educational experience for medical students, residents, and faculty. ASTEC is only as successful as the trainees we serve; their desire to improve themselves through high-fidelity simulation training continues to inspire us.

Thanks for your interest and support. Best wishes to each of you.

Allan J. Hamilton, MD, FACS
Executive Director, ASTEC
Professor of Surgery
ARIZONA SIMULATION TECHNOLOGY AND EDUCATION CENTER

ASTEC opened on August 5, 2005, and has now begun our 6th year of operation. Since 2005, the ASTEC 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 89% from academic year 2007-08, ASTEC is now among the most multidisciplinary medical simulation centers in the nation.

simulation training provided for medical flight crews, fire departments, military and federal rescue, community outreach and pre-collegiate programs all of which amounted to 1,148 training hours for 2009-10. During 2009-10, ASTEC increased our utilization rates for all categories of participants, resulting in a cumulative total of 4,995 person-training hours in a single year, as compared with 2,966 the previous year. Although we have now reached our training capacity in terms of physical space (only 405 square feet for training) and available time, we have exercised every strategy possible to avoid turning away anyone in the Arizona health care community. As a result, we have been able to expand on the educational mission of the University of Arizona and its College of Medicine, while also providing new training opportunities for others on campus and in the external first-responder community.

GROWTH

This past year, ASTEC achieved remarkable, record education and training utilization rates—with the same number of faculty and staff, the same amount of workable space, and the same operational budget since our opening in 2005. With increased support from the University of Arizona and its College of Medicine, we were able to upgrade our equipment. 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 weekly schedule has grown tremendously in the past year, with more than 70% of our available schedule devoted directly to medical simulation training. Much of this time is filled by these College of Medicine programs:

- Emergency Medicine Elective
- Surgery Clerkship
- Internal Medicine Clerkship
- Pediatric Clerkship
- Year I Societies
- Year II Societies
- Year III Interseions
- Year IV Transition Block
- Year I Interprofessional Cardiopulmonary Resuscitation (CPR)
- Telemedicine and Telehealth
- Emergency Medicine Club
- Surgery Club

ASTEC continued to be a primary resource for first-responder simulation training, which has tremendously expanded:
- Tucson Fire Department Recruitment
- Northwest Fire Department
- Lifeline Helicopter Program
- Air Evac Helicopter Program
- Arizona Lifeline Helicopter Program (NEW this past year)
- United States Air Force Pararescuemen (NEW this past year)
- United States Border Patrol – NEW this past year
- Pima County SWAT (Special Weapons and Tactics) Team (NEW this past year)

Faculty and staff proctoring is encouraged for all scheduled training. In the past year, such proctoring was a major component of 64% training hours provided in 278 individual training sessions: an outstanding increase of 107% from the previous academic year. ASTEC continues to encourage all departments to provide an instructor (e.g., an attending, a chief resident, a nurse practitioner)
As part of the College of Medicine’s community outreach effort, ASTEC is making simulation technology available to health care professionals in outlying communities, helping them manage crisis situations involving newborn babies. Led by Josane Paxton, RN, NNP-BC (University Medical Center’s manager of neonatal nurse practitioners), our neonatal patient simulator has increasingly been taken out to health care facilities in various rural areas such as Nogales and Sierra Vista—setting the stage for what will soon evolve into a mobile ASTEC medical simulation unit. In addition, more than 50 individual simulation exercises took place in the past year within the University Medical Center clinical environment (in situ simulation training).

In a partnership with the United States Air Force, ASTEC now provides intensive combat medical simulation for pararescuemen (as part of their extensive training, spanning more than a year, beginning from the moment they enter boot camp). ASTEC has created a simulated environment that encompasses the skills and knowledge that these special troops learn and will utilize on deployment. Leading the primary instruction of all sessions is Josh Appel, MD, who serves as a physician in the United States Air Force and in University Medical Center’s Emergency Medicine Department. Within ASTEC, efforts continue to enhance the fidelity of simulating trauma in the battlefield to the point at which the exercises can be replicated in the desert environment at nearby Davis-Monthan Air Force Base.

During the Siemens Innovations 2010 Conference in Orlando, ASTEC provided 3 days of hands-on medical simulation workshops for more than 500 attendees. A 3-hour peripheral intravenous access workshop featured ASTEC’s customized artificial tissue models, which allow for unlimited practicing of needle insertion and fluid return. In partnership with Medical Education Technologies, Inc., 12 individually scheduled code scenarios were provided throughout 2 days, geared toward contrast reaction situations incorporating the roles of registered nurses and medical technologists; participants thus had an opportunity to step in and experience the roles of other health care professionals that they work alongside each day.

In partnership with the United States Air Force, ASTEC continues to play an integral part in the Department of Surgery’s Intensive Laparoscopic Training Course for general surgery residents. Under the direction of trauma surgeon Rifat Latifi, MD, each resident undergoes 5 hours of simulation training in ASTEC before moving on to 4 days of training in the operating room. First-year through 4th-year residents practice minimally invasive surgery techniques using ASTEC’s artificial tissue models and the latest surgical technology, thanks to grants and equipment donations from industry partners Covidien, Karl Storz Endoscopy-America, and Berchtold. The aim of the course is to provide the highest-quality advanced training in minimally invasive procedures, resulting in fewer surgical errors and faster healing for patients. A newly structured weekly laparoscopic simulated training program is also provided by Marlan Guerrero, MD. These 2 offerings have increased ASTEC’s participant training hours for the general surgery residency program by 547% from the previous year.

In the spring of 2010, ASTEC’s medical simulation facilities—along with our mega code mannequins—were showcased on KVOA’s Kristi’s Kids to demonstrate proper CPR for child drowning victims. Each week, ASTEC conducts

Faculty Instruction during Simulated Neurosurgery

Virtual Reality Laparoscopy Trainer

United States Air Force Pararescuemen

General Surgery Residents

Demonstration of Pediatric Chest Compressions for KVOA’s Kristi’s Kids

ASTEC Training at Siemens Innovations 2010

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so that all simulation training sessions integrate learning objectives with specific clinical environments.

ASTEC has recently secured an educational grant (for the academic year 2010-11) with Karl Storz Endoscopy-America that will help support faculty instruction in both laparoscopic and airway management training.

This type of funding sets an example by combining expert physician instruction with the use of cutting-edge medical instrumentation. As the leading Center of Excellence for Karl Storz Endoscopy-America, ASTEC is proud to further medical simulation training through effective bio-industrial partnerships.

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up to 5 training sessions for Pediatrics caregivers alone, using 3 patient simulators for unlimited practicing of pediatric advanced life support scenarios. Trainees include all levels of health care providers, from novice to advanced, whether in the pre-hospital or the in-hospital setting.

ASTEC’s popularity continues to be demonstrated by the enthusiastic and positive data generated from feedback and satisfaction survey data. On standardized, anonymous feedback questionnaires, ASTEC has consistently scored in the 90th 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.

In an effort to bring more of the realism of the clinical environment into the training room, ASTEC has purchased a Phillips HeartStart monitor. It can be used with our human patient simulators for repeated practicing of cardiac and vital signs monitoring and cardioelectrical therapy, both of which are crucial to lifesaving interventions within the first few moments of a significant cardiac event.

Alongside ASTEC’s new monitor is our recently added ultrasound simulator. Students and health care professionals can practice reading diagnostic ultrasound scans, for both normal and abnormal patient conditions, through feedback imagery from up to 258 unique probe locations. Accompanying modules include focused assessment with sonography in trauma (FAST), echocardiography (echo), gallbladder, abdominal aortic aneurysm (AAA), and renal applications, all of which will soon be incorporated into the College of Medicine’s Year III intersessions curriculum.

Throughout this past year, ASTEC has also added several new individual task training stations for unlimited practicing of both routine and highly advanced medical procedures, including lumbar puncture, femoral line placement, peripheral intravenous line placement, knee aspiration, and shoulder injection training stations.

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
- 1 neonate simulator
- 1 ultrasound simulator
- 1 virtual-reality laparoscopic trainer
- 6 laparoscopic training stations
- Full line of Karl Storz videoscopes and surgical instrumentation
- 1 neurosurgical microscope
- 24 specialized task trainers
- Unlimited supply of simulated tissue models

ASTEC has completed development on several new artificial tissue models for regular use in medical simulation training. For example, a model of a uterus with an ectopic pregnancy was introduced in time to meet the needs of the OB/GYN new internship orientation program, which devoted up to 12 hours to simulation training. We are working with an OB/GYN attending, Heather Reed, MD, to intensify our simulation training program for all 4 years of OB/GYN residents on a weekly basis throughout the year. We have also played an integral part in operating and expanding on the fidelity of running labor and delivery codes with NOELLE, a birthing patient simulator, both within ASTEC and in the OB/GYN Department.

Another example of a new artificial tissue model is our large intestine tissue model, used for practicing bowel anastomosis. This model is now among the advanced components of the weekly general surgery residency simulation program. Residents can experience unlimited practicing of the laparoscopic cutting and suturing.

ASTEC has recently replaced 1 of our 2 obsolete human patient simulators by securing funds to bring aboard a new METIman pre-hospital mannequin, produced by Medical Education Technologies, Inc. (METI), based in Sarasota, Florida. The system is completely wireless and can be operated in locations outside of ASTEC, particularly in the University of Arizona clinical environment, in College of Medicine classrooms, and in the outdoor pre-hospital setting. In addition, through a partnership with the United States Air Force, we have also added a METI iStan to our repertoire of simulators, in order to create the highest-fidelity, most advanced medical training scenarios. Both of these 2 new mannequins are now controlled with METI’s new MUSE interface, enabling greater ease and accuracy for running medical scenarios and for developing a more structured method of debriefing and evaluation.
A new prototype has been developed as a surgical instrument manipulator for ASTEC’s 5th-generation CAST, custom-designed by Dr. Rozenblit and his team in the Department of Electrical and Computer Engineering. This custom-built platform has now increased the accuracy with which we can measure the movement of surgical instruments to about 0.2 mm. It allows mounting of the full line of Karl Storz laparoscopic instrumentation.

A 2nd manipulator is under construction for evaluating bilateral surgical instrumentation. It will be able to accommodate any simulated port placement and any size surgical field. Its initial applications will be to evaluate (1) outcomes for the Fundamentals of Laparoscopy required skill sets and (2) suturing skills of ASTEC participants, from novices to experts. ASTEC is committed to developing robust, inexpensive robotic instrumentation.

ASTEC continues to become more and more involved with the University of Arizona’s Department of Biomedical Engineering. In the past year, we hosted our inaugural graduate research rotation for artificial tissue development. Graduate student Deepa Patel spent 6 weeks working in ASTEC’s artificial tissue laboratory, developing a variety of simulated tissue for medical simulation training, including a model of an anatomic gallbladder (for practicing cholecystectomies) and a model of synthetic tissue wounds with embedded sensors (for tracking suturing accuracy).

RESEARCH

ASTEC has been involved in a variety of research initiatives involving 2 attending physicians, 3 residents, 1 PhD dissertation writer, 2 graduate students, and 2 medical students.

This past year, Jerry Rozenblit, PhD, head of the Department of Electrical and Computer Engineering and codirector of ASTEC, was the only University of Arizona faculty member nominated as a University Distinguished Professor. This signal honor recognizes faculty who have shown a long-term commitment to undergraduate education and have made outstanding contributions at the University of Arizona.

In the past year, Emergency Medicine resident Jeffrey Shefenberger, MD, participated in a medical simulation elective offered by ASTEC. The elective included the use of ultrasound guidance to assist with pericardiocentesis. We developed a unique artificial tissue model with a synthetic chest wall, sternum, and fluid chambers that represent the pericardium and the heart. The model is portable, so can be utilized more readily with an ultrasound machine and as a peripheral training station when running codes on a human patient simulator.

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 added 5 new artificial tissue models, all developed in-house, to better meet the needs of each of the 8 departments utilizing ASTEC on a regular basis.

The following 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 (NEW this past year)
- Umbilical Cord Access
- Adult and Pediatric Chest Tube
- Adult and Pediatric Pericardiocentesis (NEW this past year)
- Tibia Compound Fracture with Arterial Bleeding
- Uterus with Ectopic Pregnancy – NEW this past year
- Various Wounds for Suturing
- Ultrasound-guided Line Placement
- Bifurcation of Common Carotid Artery
- External Carotid to Internal Carotid Bypass – NEW this past year
- End-to-side Anastomosis
- Bowel Anastomosis – NEW this past year

In a partnership with W.L. Gore & Associates, Inc. (representing another successful bio-industrial collaboration), ASTEC has begun research to incorporate Gore-Tex medical materials into new artificial tissue models. The first successful application was an external carotid to internal carotid bypass model featuring Gore-Tex vascular grafts, dura patches, and sutures. This bypass, a technically challenging procedure, is performed under the microscope to permit arterial blood to be bypassed from a vessel in the skull to a major artery feeding the brain. It is useful for patients experiencing symptoms of a potential stroke related to inadequate blood flow through the internal carotid artery. Under the supervision of an attending neurosurgeon, Neurosurgery residents will now be able to repeatedly practice what must be a flawless surgical technique of grafting the vessels.
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 900 square feet (435 of 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, which average 15,000 square feet. Clearly, new sources of revenue must be identified to help develop and sustain a new ASTEC facility (see donation envelope insert).

In conjunction with the University of Arizona’s Office of Outreach and Multicultural Affairs, ASTEC has begun coordinating internship opportunities for the undergraduate health professions group known as F.A.C.E.S. (Fostering Achieving Culture, Equity, and Sensitivity). Undergraduate pre-med minority students will spend a semester in ASTEC experiencing a hands-on approach to all facets of operating a medical simulation center based in a university or hospital. In addition, simulation sessions for minority groups are scheduled throughout each year in ASTEC.

With the help of an educational grant secured from Karl Storz Endoscopy-America, ASTEC will lead an airway management study utilizing that company’s videoendoscope, known as C-MAC. Data will be collected from research participants to further assess the advantages of video capabilities to assist with successful patient intubation.

ASTEC has begun plans 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 the Northwest Fire Department, this innovative method of taking simulation on the road will provide a convenient alternative to the traditional center-based method of continuing education.
ASTEC would like to extend our heartfelt condolences to the family and friends of LifeNet Arizona employees Brenda French, Parker Summons, and Alex Kelley who died while performing their heroic medical emergency first-response duties on July 28, 2010, in a tragic helicopter accident. Through our work with air medical emergency organizations such as LifeNet, we have learned a great deal about how to provide quality pre-hospital simulation training. We are honored to be able to open our doors to work with the members of such a courageous profession.

RECENT PUBLICATIONS


