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Final Performance Report

**National Institute of Science, Space, and Security Centers (NISSSC)
University of Colorado Colorado Springs**

Title: (Congressional Interest) Institute for Science, Space and Security (ISSS)

Award No.: FA9550-06-1-0477

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Program Manager: Dr. Robert Herklotz

Jenenne P. Nelson, Principal Investigator
University of Colorado Colorado Springs

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ABSTRACT

This report covers research, educational offerings, and outreach activities between 1 July 2006 and 31 December 2011 in the National Institute of Science, Space, and Security Centers (NISSSC), located at the University of Colorado Colorado Springs (UCCS). The NISSSC is the umbrella Institute for all of the following Centers: The Center for Space Studies (CSS), the Trauma, Health and Hazards Center (THHC), the Center for Homeland Security (CHS), and the Center for STEM Education (CSTEME). Centers were funded by this grant to develop research and education initiatives to address the grant objectives. Highlights from each of the Centers by year are presented over the entire grant period. Additionally, a discussion related to the sustainability of each Center within the Institute is presented.

INTRODUCTION

The events of September 11, 2001 increased our Nation's awareness of the need for information and information systems security. It became quite clear after this event that the United States must develop research and educational infrastructures to address the threats. Thus, the focus of this Air Force Office of Scientific Research (AFOSR) funding and another one (FA-9550-04-1-0239-CONGRESSIONAL INTEREST) helped develop relevant research and educational activities to address this threat. This report covers research, educational offerings, and outreach activities between 2006 and December 31, 2011 in the National Institute of Science, Space, and Security Centers (NISSSC) located on the campus of the University of Colorado Colorado Springs (UCCS), which is the umbrella Institute that manages the current grant and the four distinct Centers: the Center for Space Studies (CSS), the Trauma, Health and Hazards Center (THHC), the Center for Homeland Security (CHS), and the Center for STEM Education (CSTEME). A brief discussion related to the each Center is presented below.

Center for Space Studies (CSS)

The Center for Space Studies (CSS) was created in order to coordinate the University's education and research activities related to space. CSS strives to become a focus of scholars and professionals working together to build and support a center of excellence in space technology and education. CSS capitalizes on strategic partnerships with industry, military, academia and other government agencies supporting space-related programs. Further, CSS is working to lead the development and coordination of programs for the Space Education Consortium to ensure robust national space capabilities through research and enhanced space education.

Trauma, Health and Hazards Center (THHC)

The Trauma, Health and Hazards Center (THHC) mission is to reduce the impact of extreme human events. THHC's mission is accomplished through social science cross-disciplinary scholarship, scientifically informed policy directives, and select educational initiatives across the spectrum of extreme human adversity (i.e., terrorist attacks, natural disasters, mass violence). Further, THHC is uniquely positioned to provide cutting edge research, decision support, and innovation to an array of critical concerns important to both individual and collective adaptation.

Center for Homeland Security (CHS)

The Center for Homeland Security (CHS) is the founding Center in the NISSSC and it has a rich history of collaboration with public and private sector partners to address issues in homeland defense and homeland security. In particular, through its extensive association with United States Northern Command, CHS has built a strong foundation of applied research and graduate educational programs specific to current and future needs in the emerging defense support (i.e., civil authorities). Additionally, CHS works closely with Northern Command to help develop the Homeland Security/Defense Education

Consortium (HSDEC). Collaborating with the HSDEC, the Center has woven an impressive web of interconnected capability with an international group of academic institutions, all with the objective to rapidly expand global capacity in critical areas related to security and defense.

The CHS mission is to provide advanced education, conduct leading-edge basic and applied research, and develop process innovation environments that nourish homeland security and defense discoveries. In support of the mission, the CHS aligns its activities into three interdependent pillars: Education, Research, and Innovation. As public and private sector requirements at the local, state, national and international levels evolve, CHS operates in each of these three broad areas adjusting and transforming to meet the challenge. CHS's national reputation as a service provider in the aforementioned areas accurately reflects the unique nature and the transforming role of Colorado Springs as the nation's Homeland Security and Defense Center of Excellence.

Center for Science, Technology, Engineering & Mathematics Education (CSTEME)

The Center for Science, Technology, Engineering & Mathematics Education ("CSTEME", or also known as the Center for STEM Education), primarily through its Partnership in Innovative Preparation for Educators and Students (PIPES) program funding (AFOSR funding from 2007-2011:FA9550-07-1-0188 and from 2009-2013:FA9550-09-1-0713), seeks to respond to the looming shortage of skilled science, technology, engineering and math workers and the lagging performance of students in science and math through innovative and supportive partnerships with parents, educators and professionals. While working to keep the STEM pipeline full of future students, CSTEME wants to attract a new generation of creative, artistic and innovative students to solve the future problems related to science and math.

Grant Objectives

Below are the grant objectives that guided the focus, activities, and fund expenditures during the grant period.

1. Conduct education and research activities specifically with USNORTHCOM and other related organizations in meeting their priority needs in homeland defense/security.
2. Build on the expertise of UCCS faculty in the area of trauma research as it relates to homeland security through the CU Trauma Center.
3. Expand education and research activities with AFSPC and educational partners around the nation in meeting the needs of the space professional cadre.
4. Institute support to expand and develop new research and funding opportunities in homeland security/defense, trauma research and space education and research.
5. A K-12 effort in math and science curriculum in conjunction with AFSPC to improve teacher instruction in these areas and encourage more students to concentrate on the engineering and scientific fields.

The next section demonstrates specific examples of activities that were engaged in moving the grant objectives forward and building sustainability.

Center Highlights of Activities Reported by Year

Presented below are highlights/accomplishments in each Center by year during the grant years, which advanced the work and objectives of this award:

CENTER FOR SPACE STUDIES SELECTED HIGHLIGHTS

The CSS is responsible for the partnership with AFSPC. The CSS operates under a partnership agreement with AFSPC to promote space education and collaborative research. AFSPC has committed to continued support of the CSS Space Professional education program. CSS also works closely with AFSPC/A9 staff to identify potential research questions of interest to the Command. Below are selected highlights and successes during the performance period of this award.

Successes in 2006-2007

- Initiated, developed, and delivered the Credentialed Space Professional (CSP) Certificate program in the spring of 2007. 20 AFSPC personnel were enrolled in this program. Credits from these courses can be directed toward one of five Master's Programs at UCCS. Continued outreach with Naval Postgraduate School Space Systems personnel around SEC requirements and course development.
- Established cooperative dialog with USAF National Space Security Institute (NSSI).

Successes in 2007-2008

- CSS Director, Dr. Scott Trimboli, assumed Center Director duties on 19 Nov 07 and conducted a review of the existing CSS Charter, met with incumbent NISSSC Center Directors, and previous interim CSS Director to review all related AFOSR documentation.
- Completed CSS Strategic Plan.
- Developed comprehensive CSS overview briefing for presentation to new AFSPC Commander, Gen Kehler.
- CSS Director served as member of invited review panel for USAFA small satellite research program.
- Attended Critical Design Reviews for FalconSat-5 satellite experiment on 11 Dec 07 and 8 May 08.
- Initiated dialogue with USAFA space education leaders to explore collaboration potential between USAFA and UCCS/CSS on small satellite initiatives.
- Met with representatives of USAFA Department of Astronautics on 15 May 08 to formalize partnership with UCCS on FalconSat small satellite program. The Center

proposed that two graduate students in Mechanical Engineering with a space emphasis conduct independent research as part of their special topics course over summer semester.

- 17 students completed the 5-course AFSPC Space Professional Development Certificate program which concluded July 08. Courses developed and enacted included: Systems Engineering Management, Information and Communication Systems, Space and Space Systems, System Lifecycle Management, and Space Policy.
- Negotiated Commitment from AFSPC to fund 2nd cohort of approximately 20 students to begin Space Certificate Program in Jan 09. AFSPC added a UCCS representative to the student selection board. Selection procedures were finalized.
- Attended pilot Space Executive Course developed by Imprimus, Inc. on 3 Dec 07. CSS Director explored the potential roles for the Center to fit in the space professional development program.
- UCCS Chancellor met with AFSPC Commander, Gen Robert Kehler on 3 Jan 08. Discussions addressed continued support for UCCS space education initiatives.
- Received memo from Gen Robert Kehler on 20 Mar 08 affirming AFSPC commitment to supporting UCCS space education initiatives as stated during 3 Jan 08 meeting between Gen Robert Kehler and the UCCS Chancellor.
- Chaired AFSPC/UCCS Steering Committee meetings on 20 Mar 08 and 27 June 08. Discussed integration of Space Certificate courses into UCCS graduate programs and Way Ahead for the Space Education Consortium (SEC). Outlined the evaluation method for the 1st cohort, selection process for 2nd cohort, and sequencing of all courses to follow UCCS semesters. Reached agreement that Gen Robert Kehler and UCCS Chancellor Shockley will serve as Executive Committee to the AFSPC-UCCS Memorandum of Agreement Steering Committee.
- Proposed Space Certificate ‘tracks’ for future offerings to align more closely with different Masters Programs at UCCS; thus, affording graduate students greater flexibility in specialties. AFSPC Space Professional Management Office engaged Air University (AU) Space Chair on recommendation that Air University Fellows Program sponsor students through the Master’s degree with follow-on to National Security Space Institute (NSSI).
- Working in partnership with the Eisenhower Center for Space & Defense Studies and Imprimus, Inc., accomplished initial planning to host a Space Education and Workforce Development Workshop to be held in Colorado Springs – target date Oct 08.
- Met with NASA engineer Stephen Johnson on 31 Mar 08 to discuss leveraging his NASA role into CSS activities – (1) potential new course on Space System Health Management; (2) proposed CSS hosting a future meeting of approximately 50 NASA professionals involved with the Constellation moon project at UCCS.

- Met with Sven Bilen, representative to the Space Education Consortium (SEC) from Penn State University on 24 Apr 08 to discuss the future role of Penn State University in SEC education and research activities.
- Met with representatives of USAFA Department of Astronautics on 12 Feb 08 to discuss partnership with UCCS on FalconSat small satellite program – invited to attend Program Review on 8 May 08.
- Held discussions with TSTI, Inc. regarding their “TeachSpace” program directed toward K-12 educators. Referred this on to Center for STEM Education Director, Dave Kahliqi for consideration.
- Arranged for one UCCS aerospace grad student to attend Northrop Grumman Summer Space Seminar 2008.
- Presented a one-hour presentation on space systems engineering to students enrolled in Northrop Grumman Summer Space Seminar 2008.
- Attended workshop of the Joint Space Academic Group (JSAG) at Maxwell AFB, AL from 1-3 Apr 08. CSS Director participates as an advisor representing the Space Education Consortium (SEC). During the meeting, discussed future of the SEC, recommended establishing a small, focused team of universities for initial program collaboration.
- Attended National Space Symposium in Colorado Springs, CO from 8-10 Apr 08. During symposium, held numerous discussions with representatives of government, industry and academia regarding opportunities for collaborative support of the Center for Space Studies.
- UCCS graduate students under the mentorship of the CSS Director and Dr. Andrew Ketstever (College of EAS) began work 9 Jun 08 on two research initiatives: a) battery box thermal modeling, and b) FalconSat 5 orbital control. Descriptions of these initiatives appear below.
 - Battery Box Thermal Modeling. The prototype battery for FalconSat -5 consists of 66 D-cell NiCad batteries wired in three strings of 22 cells in parallel providing a nominal 28 volt DC system. The layout is designed to provide high heat transfer rates across the batteries and maintain constant temperature from cell to cell. Research task will include detailed coupled electrical and thermal model of the battery box with sufficient fidelity to determine: charging/discharging limits; optimal location of thermocouples; validation of material choice; and other design improvements.
 - FalconSat-5 Orbital Control. FalconSat-5 will incorporate a source of cold gas and electric thruster ions for determining the ability of the WISPERS sensor to detect a perturbed space environment. Maximum cold gas flow rates and maximum power operation of the thruster have the potential to cause changes in the satellite orbit serious enough to degrade pointing accuracies enough so that communications are affected. Research task will include: detailed orbital maneuver and orbit propagation model to determine the absolute and relative sizes of antenna pointing errors that result from propagating the state with and

- without thruster operation; impact of satellite location errors on antenna pointing accuracy, link margin, and expected bit error rate; quantifying impact of disturbance torques on the satellite attitude determination and control system; evaluation of cost/benefit of adding rate sensors.
- On 15 Jul 08, CSS Director, accompanied by Drs. Andrew Ketstever and Steve Tragesser from UCCS met with Dr. Michelle Gaudreault and staff from AFSPC/A9. Purpose of the meeting was to discuss AFSPC research needs and present UCCS/CSS capabilities. Key actions from the meeting were: 1) AFSPC/A9 to coordinate with AFSPC/A1 to explore conducting a call for AFSPC research topics to pass to the CSS; 2) AFSPC/A9 to contact USSTRATCOM and see if they have a list of list of USSTRATCOM science and technology priorities; 3) CSS and AFSPC/A9 to explore the possibility of co-hosting a scientific space technology workshop.

Successes in 2008-2009

- CSS awarded two research sub-grants to UCCS researchers in support of Air Force Space Command.
 - Tethered Satellite Orbit Determination. Sub-Grant PI: Dr. Steve Tragesser, UCCS Department of Mechanical and Aerospace Engineering. The objective of this research is to investigate methods for accurate determination of orbital parameters for space objects connected by tethers. Successful research will enable quick and accurate identification of tethered orbital objects whose observed behavior differ markedly from untethered objects and could be confused with suborbital motion. This study assesses the robustness of the estimation software developed in Tragesser, S. and Faulstich, M. "Tethered Satellite Identification with Mixed Observation Data," *Journal of Spacecraft and Rockets*, Vol. 44, No. 1, 2007, pp. 240-246. All relevant parameters of the tethered system will be varied in order to determine the convergence boundaries of the estimator. These parameters will include: tether length, orbit altitude, pass geometry, pass duration, tether libration, tether vibrations (axial and transverse), drag, and gravity harmonics. Simulated radar observations will be generated using an in-house tether dynamics simulation. The result of this parametric study will be an n-dimensional map of the region of convergence for the current estimation algorithm. This map will provide 1) operational limitations of this software 2) information on which effects should be incorporated into the filter dynamics and 3) a baseline by which future improvements to the filter can be evaluated. Funded amount: \$37,000.
 - Emergency Response Operations for AF Space Command. Sub-Grant PI: Dr. Roger Sambrook, UCCS Department of Psychology. This research would identify key requirements for AF Space Command proposed Incident Management System, and key assets that the Command can provide to local, national and international emergency and disaster management agencies. It would identify technological, organizational and psychological methodologies for investigating incident management decision-making, data fusion and information sharing. It would also address the obstacles faced by incident managers and

suggest potential ways of overcoming them. The high-level goal of the study is to enhance scientific understanding of the incident management process and help AF Space Command to become a more effective user and provider of information during emergencies. Funded amount: \$65,000.

- The CSS Director attended the 22nd Annual PACA-AFRL Briefing for Industry in Albuquerque, NM from 18-20 Aug 08, and gained insight into the funding forecast for upcoming research opportunities sponsored by AFRL (including AFOSR) and NRO. Individual directorates outlined research thrusts and highlighted upcoming BAA, and SBIR/STTR contract opportunities. Representatives from contracting discussed details of the AFRL solicitation process. Engaged in discussions with Deputy Director of the AFRL Space Vehicles Directorate; outlined UCCS capabilities and the role of CSS. Engaged in discussions with representatives of Utah State University Space Dynamics Lab; proposed possible collaboration via Space Education Consortium and involvement in small satellite research.
- AF Space Command has committed to funding a 2nd cohort of AF Space Professionals in the CSS Space Professional Development certificate program. Command staff began developing selection criteria and methodology during Sep2008. AF Space Command completed student selection. At end of 4th Quarter, 17 students were identified and enrolled in this program. CSS developed an alternative “Technical Track” for the program to enable some students to use several certificate courses if they choose to enroll into Masters in Space Studies, a technical Master’s degree offered by the College of Engineering and Applied Sciences at UCCS.
- The CSS Director together with co-investigator Dr. Gregory Plett (UCCS Department of Electrical and Computer Engineering) submitted a Small Business Innovation Research (SBIR) grant proposal with small business PatchPlus, Inc. to investigate employment of mathematical filtering algorithms for Space Situational Awareness (SSA). This work would be sponsored by AF Research Lab (Rome Research Site) and would be performed between Jan – Sep 2009. The Proposal was very highly graded but not funded.
- CSS approved funding for UCCS graduate research supporting US Air Force Academy’s FalconSat V, a small satellite research program.
 - UCCS PI: Dr. Andrew Ketstever, Department of Mechanical and Aerospace Engineering. Project Title: “Advanced Heat Transfer Model for FalconSat V.” Tasks include development of a high fidelity heat transfer model of the FalconSat V satellite and payloads, development of a high fidelity orbital and sun-pointing model for satellite parameters, investigation of the satellite thermal environment in sun and in eclipse, investigation of the effects of a higher power central processing unit (CPU) on FalconSat V, investigation of the effect of high power operation of battery pack on satellite systems, and recommendations to USAFA on thermal control strategies. Funded amount: \$7,000.
- In December 2008, the CSS Director attended a Design Review for FalconSat 5 at the US Air Force Academy.

- On 22 October 2008, the CSS Director participated on a panel for the Rocky Mountain Technology Alliance Space Education Workshop, hosted by Congressman Doug Lamborn in Colorado Springs. Congressman Lamborn emphasized the importance of growing expertise in the sciences related to our most vital missions and industries within the Rocky Mountain region and affirmed his support for STEM education initiatives along the front range.
- On 23 October 2008, the CSS Director convened a meeting of faculty and staff to assess and revise the existing Master of Engineering in Space Operations degree. It was deemed that the program had become highly math intensive and as a result less available to the wider educational demographic characteristic of today's space professionals. The group devised a proposed revision to the program to widen its applicability and refresh and expand its content. The revised program will also dovetail better with the AF Space Command Space Professional Development Certificate program. Currently, CSS is assessing proposals for development of two new courses for the space operations program: 1) space systems health management; and 2) space systems engineering.
- CSS in conjunction with the Eisenhower Center for Space and Defense Studies submitted a proposal to the Coors Foundation requesting \$50,000 to fund a Colorado Space Education and Workforce Development Forum for 2009. This proposal was not awarded funding.
- On 21 January 2009, NISSSC Executive Director, NISSSC Grant Principal Investigator, and CSS Director attended quarterly meeting of the AF Space Command – UCCS Steering Committee in Colorado Springs. CSS Director presented status on new Space Professional Certificate cohort group, which started the program in January 2009. The plan to offer a new technical certificate track and the outline of an updated Master of Engineering in Space Operations academic program was discussed. Also, the Committee discussed the scope of graduate level courses in cyber and information security available to AF and industry professionals from UCCS.
- On 15 January 2009, CSS Director attended a one-day symposium at the USAF Academy on the “One Lightbulb” project, an initiative to develop a demonstration satellite with the goal of collecting and beaming energy from orbit to earth. Conference participants discussed the architectural elements -- technical, logistical, legal, and political -- to design, build, launch, and test a small satellite capable of collecting solar power in low earth orbit and transmitting sufficient power back to Earth to light a single lightbulb. Individual panel sessions addressed the significant capabilities, limitations, and alternatives of space-based solar power generation concepts and worked to identify challenges that must be overcome.
- On 11 March 2009, CSS Director convened a meeting at UCCS of representatives of Charles River Analytics (Boston, MA) and Patchplus Consulting (Colorado Springs) to discuss a joint initiative to submit proposals for R&D to develop enhanced tools for the effective conduct of space situational awareness. Meeting resulted in the subsequent production of three white papers that were submitted by Center faculty.

- The CSS Director, working closely with the UCCS ME Space Operations Program Director, developed a full proposal for the realignment of the UCCS ME Space Operations degree. In order to support the MAE Department's renewed emphasis on student research, the applied ME program in Space Operations was moved under the Office of the Dean of College of Engineering and placed under administration of the Center for Space Studies. The revised program reflects greater application of space technology (versus theory) and includes updated content representing the current state of technology as well as emerging space-related issues (e.g., space policy and space situational awareness). The program was approved by the UCCS Graduate Executive Committee.
- US Air Force Academy awarded an Academic Services and Support contract for UCCS graduate research supporting USAFA FalconSat V, a small satellite research program. UCCS PI: Dr. Andrew Ketsdever, Department of Mechanical and Aerospace Engineering (MAE). Tasks include continued development of a high fidelity heat transfer model of the FalconSat V satellite and payloads. CSS provided bridge funding for this work during the previous quarter in the amount of \$7,000. USAFA follow-on funding amount is also \$7,000.
- In March 2009, CSS funded a third sub-grant in the amount of \$36K to fund graduate research on Terahertz Technology for Multi-Phase Flow Applications. This research has implications for development of advanced micro-propulsion techniques. Work began on this project on 1 July 2009.
- On 24 Apr 09, CSS Director participated in a technical interchange meeting with representatives of the USAF Space Innovation Development Center (SIDC) to discuss a joint white paper with Charles River Analytics and PatchPlus Consulting proposing research and development of new applications for space situational awareness data fusion and visualization.
- On 17 Jun 09, CSS Director participated in a workshop at the USAF National Space Security Institute (NSSI) to review the new curriculum on "Space as a Contested Environment".

Successes in 2009-2010

- CSS funded the fifth sub-grant in the amount of \$8,000 to support a fledgling small satellite research capability at UCCS.
- Submitted SBIR proposal for AF093-BT06 entitled, "Subspace Predictive & Intuitively Dynamic Response Controller Design". Research applies model-based predictive control and principal component analysis to applications involving highly nonlinear trajectory behavior.
- The CSS has been engaged by a major satellite manufacturer regarding the prospect of adopting an on-orbit asset. The satellite's primary mission payload failed rendering it a "write-off" for its customer. Nonetheless, all support systems are functioning normally and the satellite manufacturer would like the satellite to see use in the educational setting. Current discussions are addressing legal and funding issues associated with the potential transfer of this asset. CSS proposes to use the

asset for attitude control and space environment studies and lease time to other interested users.

- The CSS conducted discussions with several industry partners regarding the potential installation of a satellite “command and control” ground station at UCCS. Equipment would support various small satellite programs and provide a venue for education and training.
- CSS Director met with Todd Kaiser, Chief Architect, Command, Control & Communications, Raytheon Corporation to discuss collaborative research opportunities. Specifically, the discussion addressed a CSS initiative to locate a satellite command and control ground station at the campus of UCCS.
- Colorado European Union Center for Excellence (CEUCE), housed at the University of Colorado at Boulder (CU-Boulder), hosted university representatives from three Polish universities to develop exchange and partnerships with the University of Colorado at Colorado Springs. In particular, members of the NISSSC, including the CSS Director, met with representatives of the Silesian University of Technology, Akademia Ekonomiczna (a business school), and the University of Silesia (a school of arts and sciences) in order to develop exchange programs, research partnerships, and mutual inspiration for academic initiatives.
- Formalized UCCS subcontract for United States Air Force Academy (USAFA) Academic and Services Support. Contract currently funding CSS research on small satellite thermal design (FalconSat V) program (UCCS PI: Dr. Andrew Ketsdever). Amount funded: \$7,000.
- CSS Director attended the 2009 Strategic Space Symposium in Omaha, NE. Presentations included perspectives from the DoD, US and Allied governments, industry, and academia. Attended a break-out workshop on Operationally Responsive Space.
- CSS hosted a visit of the Col Bob Gibson, Commander, and Lt Col Michelle Putko, Dean, and other key members of the staff of the National Security Space Institute (NSSI) in Colorado Springs, CO. NISSSC Executive Director, CSS Director, and CHS Director presented perspectives on education and research and led discussions on areas where UCCS and NSSI can cooperate on educational programs.
- CSS hosted a visit of Col Bruce Smith, Director, Future Warfare Center Directorate of Combat Development, US Army Space & Missile Command. Discussed the array of educational programs available through the CSS and proposed initiating a program for SMDC space professionals similar to that underway with AFSPC. Also discussed collaborative research potential and received contacts to directors of SMDC research programs.
- CSS Director, in conjunction with UCCS College of EAS, hosted a visit of Mr. Frank Doerner, Vice President, Aero Structures, Mfg & Support Technology, Boeing Research & Technology, for The Boeing Company. Discussed arrangements by which Boeing and UCCS can build a strategic partnership centered on educational programs and sponsored research.

- SmallSat Simulator Design Team Projects. CSS Director led a three-student senior design team in ENGR 4899 in the design of a small satellite single-axis attitude control demonstrator. The objective of the project was to allow students to gain familiarity with satellite component construction and systems design by building a classroom demonstrator for advanced control system studies. Students completed projects and presented findings during a final design review held at the College of EAS. Total project cost: \$764.
- The Tethered Satellite Orbit Determination study assesses the robustness of the estimation software developed previously by the PI. The algorithm varies the orbit parameters, tether length and end-mass ratios in order to minimize the residuals between the estimate and simulated tracking data. The algorithm identifies the system as tethered if the estimated tether length exceeds a given threshold. Thus far, the research had revealed the existence of multiple local minima in the residual function and suggests more fundamental research must be done on the estimator. Next steps would determine if the algorithms can be adapted for mixed data and whether other estimation techniques (e.g., Kalman Filter) can be effective (PI: Dr. Tragesser).
- Emergency Response Operations Systems Integration (EROSI) was a cooperative research affiliation with the USAFA IITA to develop “first-of-its-kind” knowledge base describing the underlying behavior of emergency management processes Air National Guard. A team of research students investigated: (i) EM system ontology; (ii) current EM software applications; and (iii) cyber-security implications of computer-based EM systems. Dr. Sambrook and his team of student researchers intend to enhance understanding of the fundamental principles underlying emergency response actions to assemble a data dictionary representing the body of knowledge describing incident response. The data set, when completed, would form the basis for comprehensive modeling of the dynamic interactions of incident response, and would ultimately lead to a brand-new paradigm for fashioning best practice incident response operations and software tools (PI: Dr. Roger Sambrook).
- The Terahertz Technology for Multi-Phase Flow Applications accomplishments in 2009 included: (1) Design of high-efficiency interaction circuit for 300 THz oscillator. Dispersion characteristic of the circuit has been analyzed for different electromagnetic modes. The key parameters of the device including circuit dimension, operating magnetic field, beam alpha, Armor radius, guiding center radius, beam voltage, and current, have been determined; and (2) Analysis of an axis encircling, low velocity spread electron gun with high current density: To obtain working gun design, various gun design parameters have been analyzed. High electron beam quality, which is mainly characterized by low velocity spread, and is essential for practical high power terahertz sources. Low velocity spread in the high transverse energy electron beam is critical to efficiency of gyro devices. Velocity spread of less than 5% was incorporated in the current design for a high quality beam. (PIs: Drs. Health Song & Andrew Ketsdever).

- FalconSat V Thermal Modeling Funding was transitioned from CSS to USAFA through their Academic Service & Support contract. Effort to date had met all objectives in support of a launch scheduled for Spring 2010. (PI: Dr. Ketstever).
- Space Professional Development Certificate began its 2nd cohort of AF Space Professionals. The students would complete the 5-course Certificate sequence. Additionally, CSS has formalized a new “Technical Track” to give future students the option to leverage coursework into technical master’s degrees. The new track was made available to the 3rd AFSPC cohort.
- Masters of Engineering in Space Operations. CSS, in conjunction with UCCS College of EAS, rolled out a revised Master of Engineering in Space Operations degree. New courses developed include: (a) space situational awareness, (b) space systems health management, (c) space range management, and (d) space systems engineering.
- CSS Director, together with UCCS College of EAS, hosted a visit of Dr. Jeff Forbes, Chair, Aerospace Engineering Department at the University of Colorado at Boulder (UCB). Explored overlaps and potential synergy between space education and research activities conducted at both institutions. Proposed creating a joint Space Certificate program comprising two courses each from UCCS and UCB.
- CSS Director, together with the UCCS Dean of EAS, visited headquarters of Aerospace Corporation, El Segundo, CA, hosted by Dr. Peggy Hildebrandt. Purpose of the meeting was to learn about one another’s programs and discuss potential programs for collaborative research.
- CSS Director met with Dr. Michelle Gaudrealt, HQ AFSPC/A9, to discuss collaborative education and research opportunities between AFSPC and UCCS/CSS. Dr. Gaudrealt recommended UCCS develop a candidate curriculum from existing courses for a Master’s degree targeting new AFSPC orbital analysts.
- CSS Director presented Space Studies review to the NISSSC Advisory Board during semi-annual meeting. Board member Gen (ret) Howell Estes recommended inclusion of space acquisition topic to CSS educational program.
- CSS Director met with COL Michelle Putko, Dean of the National Security Space Institute (NSSI) in Colorado Springs, CO. Discussions covered areas where UCCS and NSSI can cooperate on educational programs.
- CSS Director met with Mr. Jose Ruiz, Director of Programs, Information Systems, for Northrop Grumman. Discussions centered on cyber-space and the potential for cooperative programs between UCCS and NG.
- Funded UCCS faculty proposal titled: “Enhanced Solar Collection Efficiency in Space Using Microscale Physics”. The research would evaluate the potential for solar power collection efficiency to be enhanced through the use of microscale physics. The intent is to demonstrate that the addition of properly designed microstructures to the surface of a solar collector will result in directional characteristics that improve solar absorption and decrease infrared emittance. Total amount: \$18,000. (PI: Dr. Rebecca Webb, UCCS/EAS/MAE).

- Short Course Series. CSS developed a sequence of special topic short courses on space topics of current interest to the community. Courses developed include: 1) Space Situational Awareness, and 2) Space Architecture and Standards. Courses would be 1-2 days in length and offered either on-campus or at a customer's site. Future courses under consideration included: Space Range Management and Management of Space Technology. All topics would serve as pilots for potential degree course offerings to supplement the curriculum in the Masters in Engineering degree with an emphasis on in Space Operations, tentatively schedule to be offered in fall 2010.

Successes in 2010-2011

- Joined team headed by Analytical Services, Inc. to compete for Systems Engineering Technical Assistance Contract (SETAC) 2010 support to U.S. Army Space and Missile Defense Command / U.S. Army Forces Strategic Command in July 2010.
- STEM Education Workshop: "Near Earth Object". CSS, worked in partnership with the Center for STEM Education ("CSTEME"), supported and participated in an experimental STEM education workshop attended by 19 high school student participants. The workshop scenario was the impending collision of a near earth object, and highlighted the cross-disciplinary application of science, technology and critical thinking to solve the myriad of issues students faced. Key objectives of the workshop were to i) examine innovative approaches to STEM-based learning, and ii) Examine the gender-based differences in adolescents' attitudes towards the STEM disciplines (6-9 Jul 10).
- Initiated the revision of HQ AFSPC – UCCS Memorandum of Understanding (MOU) in anticipation of third signing of this three-year agreement. Key changes to the MOU incorporate specific language addressing UCCS (NISSSC) support of cyber education and research July 2010.
- CSS Director met with Mr. Tracey Tomme, President and CEO of Challenger Learning Center of Colorado Springs and Dr. Billy Crisler, Department of Aeronautics, US Air Force Academy, through a series of meetings, discussed pursuing a collaborative initiative focused on utilizing Challenger's space simulator STEM data and UCCS (8 Jul 10/ 22 Jul 10/26 Aug 10).
- CSS Director met with new UCCS Director of Campus-wide Extended Studies to map out a plan for development and administration of a CSS short course program addressing a variety of space topics. Covered marketing strategy, including inclusion of targeted ad campaigns on Facebook and other uses of social media (8 Jul 10).
- Collaborating with HQ AF Space Command (AFSPC), the third cohort of 20 students was selected and began the next sequence of the Space Professional Certificate program in Aug 2010.
- UCCS College of Engineering & Applied Science (EAS) and Center for Space Studies (CSS) started the newly revised Master of Engineering in Space Operations (ME SpOps) distance learning program in August 2010.

- CSS hosted a campus visit and meeting with Dr. Doug Beason, new Chief Scientist for HQ AF Space Command. Presented an over view of the NISSSC, focusing on activities within CSS and CHS. During afternoon session, details of CSS and EAS research programs were discussed. Special areas of interest included: thin film solar cell work by Dr. Carlos Araujo and micro propulsion research by Dr. Andrew Ketsdever. Discussions also addressed recent initiative to establish a center for cyber education and research to support new HQ AFSPC mission in the cyber area.
- CSS Director joined members of the College of EAS in a meeting with representatives of HQ US Northern Command (USNORTHCOM) Computer & Communications Directorate (J6) to discuss using NISSSC Blade Server equipment to support USNORTHCOM Exercise “24” on 23-23 Sep 2010 (August 2010).
- Dr. Roger Sambrook successfully negotiated a no-cost extension to the USAFA-funded EROSI project (September 2010).
- CSS Director met with Director of HQ AFSPC Studies & Analysis Division (A9) to discuss future educational programs for Air Force Orbital Analysts. Program will offer masters study to AFSPC scholars studying orbital dynamics (October 2010).
- Completed a Memorandum of Agreement with the UCCS College of Engineering & Applied Science on cooperative operations and maintenance of NISSSC blade server equipment for use in advancing cyber research (October 2010).
- CSS formally appointed Dr. Eligar Sadeh as Assistant Research Professor. Dr. Sadeh’s work is in the field of space policy and law. He is currently developing a CSS short course entitled “Astropolitics and the Development of Space”, and would be exploring grant opportunities in the study of space policy and space education workforce issues.
- Dr. Sadeh developed and submitted a proposal to NASA (Proposal 11-11NIAC-0295), Flow Cytometry System for Astrobiology Research to Detect Extant or Extinct Life on Mars.
- CSS administrated the investment of a portion of AFOSR grant equipment funds for the purpose of establishing a Space Environment Simulation Facility at UCCS. The facility will fulfill an important national need for a comprehensive space environment simulation capability and will advance critical space engineering research in areas including rocket exhaust plume chemistry and impact of the space environment on spacecraft materials and subsystems. Further, the funds were used to develop the Chamber for Atmospheric and Orbital Space Simulation (ChAOSS). The key function of the CHAOSS facility is to study the combined effects of environmental elements absent in single element facilities, which simulates ultra-high vacuum, charged particle interactions, extreme ultra-violet radiation, visible solar flux, and thermal cycling. The 2 m long x 1 m diameter vacuum environment is created using a clean pumping system composed of a CTI-20HP cryogenic pump and oil free turbo-molecular pumps, with a total specified pumping capacity of 13,000 l/s. A liquid nitrogen shroud has been designed and fabricated to fit within the vacuum chamber. A liquid nitrogen shroud is used to further remove water molecules and contaminants and reduce the thermal environment to cryogenic

temperatures, creating a unique capability in space simulation. The principal research contact for the new facility is Dr. Andrew Ketsdever, UCCS Department of Mechanical and Aerospace Engineering.

- CSS hosted the annual NASA/JPL/AFRL Advanced Space Propulsion Workshop (ASPW) held this year for the first time at UCCS in Colorado Springs, CO. The event featured 70 rocket propulsion experts from around the world (November 2010).
- CSS Director served on academic committees for the following master's students conducting space-related research:
 - Jake Shonig: "Implementation Strategies for In-Space Propulsion"
 - Curtis Stanley: "Apparent Impacting Trajectories, Identification, and Orbit Determination of Tethered Satellite Systems"
 - Phil Zercher: "Parameter Optimization of the Enhanced Self-Correcting Cell Model for Lithium Ion Cells"
 - Luis Baars: "Dynamics and Control of a Tether Sling on a Rotating Body"
 - Michael Li: "Hysteresis Modeling in Lithium Ion Batteries"
- CSS Director met with Ms. Maggie Stein of US Falcon to discuss UCCS/CSS partnership with US Falcon in pursuit of an award under US Army's new ASTEROID contract. ASTEROID will provide analysis and service support to the US Army on matters of space technology (December 2010).
- CSS Director met with CSS Research Professor Dr. Stephen Johnson to discuss status of on-going NASA work in the area of space system health management. Also discussed an approach to acquiring NASA funding for future research and the development of new educational programs on important space topics technology (December 2010).
- Began construction of National Space Simulation Facility (PI: Dr. Andrew Ketsdever). This facility will provide a comprehensive space environment simulation capability which would advance critical space engineering research in areas including rocket exhaust plume chemistry and impact of the space environment on spacecraft materials and subsystems. The simulator is expected to be operational by Fall 2011. The facility would have the capability to produce high energy ions, electrons, and photons similar to those experienced in Earth orbit along with a diagnostic capability to assess their effects on various media. The interactions of these environments with systems are not fully understood - especially for new materials that might be used on future missions. Experiments conducted in space are extremely expensive and not very flexible; this facility will simulate the harshest environments in a much lower-cost, ground-based facility. The facility will be truly one-of-a-kind in a University environment and will be open to collaborations. The facility will be able to draw in additional research resources. Several proposals are currently being investigated. Partnerships with the AF, USAFA, NASA, DoE, and Colorado State are being investigated. Facility contains:

- Two electron gun sources – low and high energy
- Two ion sources – magnetic filter and microwave (three planned)
- Vacuum ultraviolet light source (Hamamatsu L10366)
- Diagnostic equipment: electrostatic energy analyzer, EXB electrostatic probe, retarding potential analyzer, Langmuir probe
- Cryogenic pump (CTI Cryogenics)
- Cold shroud

The facility features the capability to produce high energy ions, electrons, and photons similar to those experienced in Earth orbit along with a diagnostic capability to assess their effects on various media. Facility simulates the harshest space environments using a cost-effective, ground-based resource. Detailed facility characterization is underway.

- Reached agreement with sysRAND, Inc. to receive fully functional prototype lunar excavator as donation for UCCS space engineering research. Prototype was designed and built under NASA contract in support of ‘return to moon’ program.
- CSS Director attended special meeting of the Colorado Space Coalition (CSC) in Denver, CO. Purpose of meeting was to discuss CSC concept for the formation of a Colorado Aerospace Research Collaborative to enhance coordination and cooperation among Colorado’s aerospace research and engineering institutions (February 2011).
- Received approval of request for CSS Adjoint Research Professor Dr. Cindi Schmitt to serve as Principal Investigator on grant-funded projects.
- CSS Director and CSS Astrodynamics Researcher Dr. Steve Tragesser attended a day-long workshop hosted by HQ AF Space Command to address the need for an orbital object data test bed. The purpose of the workshop was to brainstorm ideas for getting real operational data to researchers and developers (government, universities, & industry) so they can work more easily with government to develop and test new space operations capabilities (May 2011).
- CSS Director met with new Space/Cyber Professional Management point of contact Mr. Dwight Rauhala at HQ AFSPC. Purpose of meeting was to chart a way ahead with regard to the standing MOU between UCCS and AFSPC (June 2011).
- Center-funded research continued on the Guard Emergency Response Operations Systems Integration project (EROSI) (PI: Dr. Roger Sambrook). A collaborative research affiliation was developed with the US Air Force Academy IITA to address the emergency management (EM) system needs of the Air National A team of research students has investigated: (i) EM system ontology; (ii) current EM software applications; and (iii) cyber-security implications of computer-based EM systems. Project received award of \$40K on USAFA-BAA-2009-1. Dr. Sambrook completed data gathering from federal, state, and local agencies on workflow processes and technologies used. Coordinated with Lt Col Nick Volpe at USAFA to discuss

follow-on funding for an emergency management study for the National Guard. Currently negotiating follow-on funding for continuation.

- Center-funded research continued on the “Enhanced Solar Collection Efficiency in Space Using Microscale Physics” project (PI: Dr. Rebecca Webb, UCCS/EAS/MAE). The research evaluates the potential for solar power collection efficiency to be enhanced through the use of microscale physics. The intent is to demonstrate that the addition of properly designed microstructures to the surface of a solar collector will result in directional characteristics that improve solar absorption and decrease infrared emittance. During the research period, solar collection elements with different micro-structured surfaces were compared to smooth surfaced elements. Experimental results showed micro-structured articles had collection efficiencies on the order of 40% greater than those with smooth surfaces. Results have been submitted for publication. Total amount of funding: \$18,000.
- Center-funded research continued on the Terahertz Technology for Multi-Phase Flow Applications project (PIs: Dr. Heather Song & Dr. Andrew Ketsdever) . (i) Design of high-efficiency interaction circuit for 300 THz oscillator. Dispersion characteristic of the circuit has been analyzed for different electromagnetic modes. The key parameters of the device including circuit dimension, operating magnetic field, beam alpha, Larmor radius, guiding center radius, beam voltage, and current, have been determined; (ii) Analysis of an axis encircling, low velocity spread electron gun with high current density: To obtain working gun design, various gun design parameters have been analyzed. High electron beam quality, which is mainly characterized by low velocity spread, is essential for practical high power terahertz sources. Low velocity spread in the high transverse energy electron beam is critical to efficiency of gyrodevices. Velocity spread of less than 5% was incorporated in the current design for a high quality beam. This project was completed at the end of the Spring 2011 semester. The graduate student (2d Lt Anthony O’Shea) participating in the research successfully defended his thesis. The project successfully demonstrated a proof-of-principle experiment and designed a notional instrument for rocket plume diagnostics. Project PI has engaged with representatives at AFRL to gauge interest in continuing to fund certain aspects of the project.
- Center-funded research continued on the Tethered Satellite Orbit Determination project (PI: Dr. Steven Tragesser). Research project completed in Dec 2010. Presented final briefing to AFSPC/A9 on 7 Dec 10. Discussed several avenues for follow-on funding opportunities for this research to include STTR and AFRL BAA.
- New research initiative began titled: Space Systems Health Management/Fault Management. (PI: Dr. Stephen Johnson / NASA). Dr. Johnson, working with Dr. Scott Trimboli, developed a novel conceptual framework for a fault management design methodology for space systems which leverages principals from feedback control theory. The long-term objective of this research is to improve safety, reliability, and availability of NASA systems by development of cost- and schedule-effective representations and tools to analyze on-board and ground-based capabilities to detect and respond to incipient and actual failures. Pursuing NASA and AFRL grant opportunities.

- CSS continued development of a sequence of short courses on space topics of current interest. Courses developed and offered or in development include:
 - Space Situational Awareness
 - Space Architecture and Standards (Fred Slane, Standards Committee chair of the AIAA, course scheduled to debut in June 2012.)
 - Astropolitics & the Development of Space (Eligar Sadeh)
 Future courses in planning include: Space Systems Health Management, Space Range Management and Management of Space Technology.
- Space Professional Development Certificate. AF Space Command 3rd cohort of AF Space Professionals began first course in the 5-course Certificate sequence.
- Master's Program in Orbital Analysts initiated. CSS began working with HQ AFSPC/A9 to develop an on-campus master's degree program for a new AFSPC program designed to educate and employ a new cadre of orbital analysts. Matriculated first two students under new AF Space Command Orbital Analyst program in Spring 2011.
- Conducted a comprehensive study of undergraduate university programs in the U.S. addressing astronautics and space technology. Study findings compiled into survey report and will form the basis of a feasibility investigation for creating a bachelor's program in astronautics at UCCS.
- Sep 11. CSS Director, Dr. Steve Tragesser (MAE), and representatives from Aptima, Inc. and PPC, Inc. met with Col John Shaw, Commander of the 50th Operations Group at Schriever AFB, CO to address issues and offer solutions which enhance the mission capability of the 50th OG. The team surfaced "top four" collaborative project suggestions:
 - Partner with the 50th OG to improve conjunction assessment via proof-of-concept visual conjunction assessment tool utilizing error ellipsoids propagated in time.
 - Enhance anomaly resolution process and space protection.
 - Build a strong UCCS-50th OG partnership centered on developing and offering high quality, targeted educational programs for space professionals.
 - Share with UCCS Center for Space Studies candidate topics for study, analysis and research.
- 3 Oct 11. Attended a meeting of military education leaders and representatives of local universities at Colorado College to discuss participation in Mellon Grant proposal aimed to bridge the gap between military and civilian educational institutions.
- 3 Oct 11. Chancellor Pam Shockley and Mr. Martin Wood visited AFSPC Commander Gen W. Shelton at Peterson AFB, CO. In a follow-up email, Gen Shelton offered the names of key senior leaders interested in contributing to UCCS/CSS endeavors:

- Mr. Jeff Allen – lead for logistics, contracting, and security forces
- BGen David Thompson – lead space and cyber operations officer
- BGen Marty Whelan – requirements lead defining future space and cyber systems
- BG Sam Greaves – financial lead
- BG Ian Dickenson – cyber expert
- Mr. Mike Good – NASA liaison and former astronaut

Gen Shelton also offered two near-term subjects for potential national discussion (possibly NISSC/CSS sponsored):

- “Cyber security for the Nation”
- “America’s Dependency on Space”
- Work by the Center’s Associate Research Professor, Dr. Steven Johnson to date has developed a fundamental taxonomy and theory of System Health Management (SHM), and its operational subset, Fault Management (FM). It defines a set of fundamental principles that define the assumptions of the theory and its relationship to other primary engineering concepts and theories. Potential funding opportunities associated with this work:
 - NASA Manned Spaceflight Center (MSFC) EV43 Consulting/ Jacobs Engineering - secured
 - MSFC Systems Engineering Research – state-based systems engineering and fault management - secured
 - Jet Propulsion Laboratory (JPL) Student Funding – in work
 - JPL Fault Management Proposal – in work
- NASA contracted with Jacobs Engineering, subcontracted to UCCS/CSS, to support Dr. Stephen Johnson (CSS Associate Research Professor) in conducting investigations on space system fault management theory (Sep 2011).

CENTER FOR SPACE STUDIES “Looking Forward”

In 2012, CSS will focus on a small number of well-defined topic areas that will define the future “center of gravity” for CSS.

CSS Focus Areas

- Space System Health Management
- Space Environment Effects
- Cyber Space

Space System Health Management

System Health Management (SHM) is broadly defined as *the capabilities of a system that preserve the system's ability to function as intended*. It consists of capabilities to contain, prevent, detect, diagnose, respond to, and recover from conditions that may interfere with nominal system operations. Further, SHM includes the actions to design, analyze, verify, validate, and operate these system capabilities. SHM is intimately linked to the concept of *dependability*, which refers to *the ability of a system to function as intended*; thus, SHM refers to the capabilities that provide dependability. We define the operational aspect of SHM as Fault Management (FM), which addresses what to do when a system becomes, or is predicted to become unable to function as intended. To use a medical analogy, FM is equivalent to medical treatments once an individual is sick or is predicted to become sick, whereas SHM also includes methods to prevent exposure to disease.

CSS Associate Research Professor Stephen Johnson, Ph.D., has established a solid footing in the domain of SHM, and in particular in *Space SHM*, while working as an affiliated NASA researcher for the past six years. In 2012, Dr. Johnson will bring his expertise into the Center where we hope to build on his previous work to “brand” CSS as a recognized focus of SHM theory and practice.

During the first two quarters of CY 12, Dr. Johnson will be funded ostensibly by NASA to continue his SHM theory development; a portion of his effort will involve work directly with CSS. Dr. Trimboli and Dr. Johnson plan to collaborate to build out an extension of the SHM theory incorporating principles from state-space control theory.

It is anticipated that future SHM work will attract additional funding (from NASA and USAF) to support work conducted at CSS.

Space Environment Effects

The beginning of 2012 saw the *Space Simulation Laboratory* nearing completion. In particular, the facility now comprises the following capabilities:

- Two electron gun sources – low and high energy
- Two ion sources – magnetic filter and microwave (three planned)
- Vacuum ultraviolet light source (Hamamatsu L10366)
- Diagnostic equipment: electrostatic energy analyzer, EXB electrostatic probe, retarding potential analyzer, Langmuir probe
- Cryogenic pump (CTI Cryogenics)
- Cold shroud

In total, the facility features the capability to produce high-energy ions, electrons, and photons similar to those experienced in Earth orbit along with a diagnostic capability to assess their effects on various media. As a result, the laboratory chamber can simulate the harshest space environments using a cost-effective, ground-based resource. Detailed facility characterization is currently underway.

It is expected that as the facility comes on-line this year, it will attract additional research funding from a variety of sources, principally USAF and NASA. In addition, partnerships with the Air Force, US Air Force Academy, NASA, Department of Energy and Colorado State University are being investigated.

The facility design also includes equipment compatible with ongoing battery research being conducted at UCCS (Principle Investigator Gregory Plett, PhD). This equipment is foundational to a future line of research that combines these two areas to examine modeling and control of space-based batteries for advanced satellite applications.

Cyber Space

During 2011, the NISSSC, together with various partners, explored various initiatives centered upon the creation of a *cyber exchange* within the state of Colorado which would serve a variety of functions connected with the detection, diagnosis, and mitigation of future cyber attacks across multiple sectors of regional infrastructure (e.g., financial, energy, communications, etc.)

Recent work within CSS suggests an interesting and important connection between the foundational SHM theory being developed for space systems and the issue of cyber security. In fact, NASA has already connected the two and is beginning explorations to ascertain the role SHM may play in future cyber defense designs.

With that in mind, it seems prudent that CSS similarly explore the potential application of SHM principles to the design of a framework for the cyber exchange concept. If such a connection is viable, this could provide an important third focus for 2012 CSS activity.

TRAUMA, HEALTH, AND HAZARDS CENTER

The Trauma, Health and Hazards Center (THHC) performs research on social science related to terrorism and disaster. This research has focused on issues related to prevention, response and recovery associated with traumatic exposure such as working on disaster warning systems, first responder trauma prevention, and scientist/practitioner collaboration in post-disaster recovery to name a few. The THHC has been active in developing grants, developed and hosted three national conferences for scientists and practitioners on disaster behavioral health, and has published a number of research articles. Below are selected highlights and successes during the performance period of this award.

Successes in 2006-2007

- Began a study with Katrina survivors in the state of Colorado as well as a study with the Bailey, Colorado, community (site of the Platte Canyon High School hostage incident in September 2006) using the THHC “Journey to Trauma Recovery” website program. This project provided initial support for the utility of deploying the website in a community following a community disaster.

- Ongoing Center research activities include: The Warning Project, Weather and Society* Integrated Studies (WAS*IS), Human-Environmental Interaction and the Effect of Waste Tire Removal on Risk for Dengue Fever Infection, An Investigation of Bio-Eco-Social Parameters Contributing to Dengue Outbreaks during Dry Season”, and a new project started analyzing data from Hurricane Katrina to assess growth in post-trauma experiences among survivors.
- Postdoctoral fellow Dr. Roman Cieslak arrived from Warsaw, Poland to assist Dr. Benight in reviewing and updating research projects that were underway.
- Revised the THHC resource manual for local counseling services dealing with trauma, which would be mailed to all counseling agencies in the region as well as agencies making referrals to counseling services.
- Presented research findings on fire department responses to traumatic stress research at the International Society for Traumatic Stress Studies.
- The NSF Warning Project team presented its findings to members of the Denver Metro Area emergency management planning and response team. Completed the NSF Warning Project write-ups for the Environmental Hazards journal and a project write-up suitable for laypersons, which was mailed to approximately 65 study subjects and sent to emergency management officials in Austin, Texas and Denver, CO.
- Dr. Benight participated in the USNORTHCOM Surgeon General Directorate Annual Conference covering disaster response planning and execution. Also Dr. Benight presented his trauma response and recovery research, and described the work of the THHC.
- Negotiated an Intergovernmental Agreement with the Colorado Springs Fire Department for expansion of and ongoing support for the Peer Support program. The THHC will provide supervision, leadership, and training for this program.
- Developed a working partnership with the Colorado Department of Human Services Disaster Mental Health Program Office to jointly convene a national, and most-likely annual, conference in Colorado Springs in August 2007. The conference, Continental Divide Disaster Behavioral Health Conference (www.uccs.edu/codivide), is designed to bridge the gap between the disaster mental health scientific community (including the THHC) and disaster mental health practitioners’ work in the field.

Successes in 2007-2008

- Held the 2007 Continental Divide Disaster Behavioral Health Conference in Colorado Springs, CO August 6-7, 2008. The conference was well attended with 130 attendees and 7 exhibitors.
- Wrote a collaborative grant with Dr. Sheldon Drobot of the University of Colorado – Boulder to the NSF Engineering Directorate’s Infrastructure Management and Hazard Response (IMHR) division entitled “Collaborative Research: Decision-making for driving in hazardous weather conditions.” The THHC portion of this grant is \$79,999 for the two-year project (scheduled to begin July 1, 2008).

- The THHC signed a contract with the city of Colorado Springs to implement the Colorado Springs Fire Department's Peer Support program, and the first training class of 10 firefighters was held in September 2007.
- Dr. Benight attended the first training session to incorporate structural equation modeling, latent growth curve modeling, and hierarchical linear modeling into longitudinal studies of disaster victims and first responders. This project would run from July 2007 through December 2008 with funding from the National Institutes of Health (NIH) Advanced Mentoring Program.
- Dr. Benight was an invited speaker at the National Homeland Defense Foundation inaugural National First Responders Conference, which preceded the Foundation's National Conference.
- Developed a new program proposal for SupportNet, a secondary trauma prevention program designed for the behavioral health team at Ft. Carson. Presented the SupportNet program to officials from Evans Army Hospital at Ft. Carson, to US Senator Ken Salazar staff, and to the Surgeon General Directorate staff at US Northern Command.
- Developed a strategic plan for the Center and presented it at the November NISSSC Board of Advisors meeting.
- Completed most of the "just-in-time" requirements for the TraumTech, Inc., STTR grant through the National Institute of Mental Health. This grant proposal received a score of 171 by the scientific review group and the advisory panel recommended it for funding.
- Completed a grant to the National Science Foundation for a three-year, \$500,000 grant to establish an international research network among physical and social scientists focused on flash flood research. Dr. Eve Grunfest would lead the development of this network and THHC staff and a graduate student in Geography and Environmental Sciences would be chosen to assist with the project. Dr. Grunfest was invited to apply for this funding as part of a small group of scientists working to establish integrated research networks around the country. The network will be called DELUGE (Disasters: Evolving Lessons Using Global Experience); however, it was not funded.
- Dr. Benight met with Dr. Maria Llabre, University of Miami Psychology professor and consultant to Dr. Benight regarding ways to incorporate structural equation modeling, latent growth curve modeling, and hierarchical linear modeling into longitudinal studies of disaster victims and first responders. This project would run from July 2007 through December 2008 with funding from the NIH's Advanced Mentoring Program.
- Dr. Benight attended the Research in Disaster Mental Health (REDMH) meeting in Boston in October. He served as a senior mentor for this program. In addition, Dr. Benight presented at this meeting, and has received the NIH advanced mentoring program grant (as mentioned above).

- Dr. Benight attended the International Society for Traumatic Stress Studies conference in Baltimore, Maryland to present on two panels about web-based interventions for acute trauma and PTSD (regarding the Journey to Trauma Recovery website), and to present on a panel with Dr. Roman Cieslak and Dr. Aleksandra Luszczynska about the relationship between social support and disaster self-efficacy in coping with disaster.
- Received the \$250,000 STTR grant through the National Institute of Mental Health in March. This grant will allow TraumTech, Inc., the company founded to commercialize the THHC technology, to develop the web-based program Journey to Disaster Recovery. Negotiations began between the company, TraumTech, Inc., and UCCS regarding the scientific research the university will complete for this grant.
- Met with CU Technology Transfer Office attorney Kate Tallman to explore possibilities for additional funding for the Center's web based technology. She will be negotiating a technology transfer agreement between the university and TraumTech, Inc., and is helping to determine, which tech transfer grants are the best match to secure grant money for this project.
- Completed the required annual training for 20 peer supporters at Colorado Springs Fire Department and have begun the process of revising the Journey to Trauma Recovery website, and completed the first iteration, for CSFD employees and their families. The website will be available to CSFD employees and their families as a resource for dealing with critical incident stress. The peer support program contract can be renewed up to four additional years, so negotiations for the renewal of the contract for this next year of services to the peer support program is underway.
- Drs. Benight and Pyszczynski began a research project with clients from TESSA, the region's domestic violence prevention center. This research examines the interaction between Terror Management Theory and Social Cognitive Theory on trauma response and recovery among domestic violence victims. This is part of the larger research project the two professors proposed to National Institute of Mental Health (NIMH) for funding in 2007. That research proposal was rejected, in part because they did not have preliminary data to support their theory. The analysis of the results from this project should provide support for their work and lead to additional funding for their joint research.
- Planned and conducted the 2008 Continental Divide Disaster Behavioral Health Conference in Colorado Springs, Colorado July 7-10, 2008. Registration +/- 200 and was a joint effort between the THHC, the Disaster Behavioral Health staff at the Colorado Department of Human Services, and officials from US Northern Command and its partner agencies. The conference featured more than 30 presenters, a skill-building pre-conference workshop day, and a full-day table top exercise regarding behavioral health issues in disaster planning and response for pandemic influenza.
- Through the CU Technology Transfer Office, applied for the Bioscience Discovery Evaluation Grant for TraumTech, Inc., to develop a commercialization plan for Journey to Disaster Recovery. This \$92,000 grant would be awarded in August 2008

to the company and grant funds would be managed through the CU Tech Transfer Office. This grant was funded at \$90,500.

- Completed the first iteration of the Journey to Trauma Recovery website for the Colorado Springs Fire Department. The website will be available to CSFD employees and their families as a resource for dealing with critical incident stress. Renegotiated the annual contract with CSFD to provide another year of services to the peer support program.
- Conducted two trainings on secondary trauma for TESSA, the local domestic violence prevention organization.
- Completed the first printing of the Trauma Resource Directory. This directory provides detailed referral information for individuals who are exposed to trauma. The THHC staff has contacted and verified the credentials and training of the individuals included in the directory. The directory will be handed out to local organizations such as the CSPD, CSFD, Memorial Health System, TESSA, etc. for their clients. The printing of the directory was accomplished through funds collected at a fundraiser several years ago with Old Chicago Restaurant.
- Wrote a grant with the Colorado Division of Mental Health staff for a jail diversion program for Colorado veterans. The THHC faculty/staff would serve as the project evaluation team for this five-year program. If funded, the project would begin in mid-2009 (\$75,000.00 subcontract).
- Began work on the school safety initiative, a joint project with the Center for Homeland Security and researchers from Philosophy and Psychology, will provide instruction to elementary and secondary school administrators, faculty, and staff about evidence-informed practices to improve school safety while caring for the behavioral health needs of students, parents, staff and the community. The focus of this program is to create resilience in the face of a school based tragedy.

Successes in 2008-2009

- Completed negotiations between UCCS and BlueSun, Inc. for the Journey to Disaster Recovery™ website research project funded with an NIMH STTR grant. Research projects began with students at Virginia Tech University who were present during the shootings in May 2007 and with victims of the Weld County tornados of May 2008.
- Ongoing discussion throughout the year regarding the development of an online research network for disaster behavioral health researchers and practitioners to collaborate on research projects. At the time, there were 20 subscribers to the network.
- Began discussions with TESSA (The local Domestic Violence Prevention Center) in October 2008 with a submission of a draft proposal to initiate a peer support program for their staff.
- BlueSun, Inc. (formerly TraumTech, Inc.) received the Colorado Bioscience Discovery Evaluation Grant to develop a commercialization plan for Journey to Disaster Recovery™. This \$90,500 grant is in the award phase now and the work was initiated in July 2009 and concluded in June 2010. The granting agency is the

Colorado Office of Economic Development and International Trade, which contracts with the CU Technology Transfer Office to manage the award.

- Received the U.S. Department of Health and Human Services Substance Abuse Mental Health Services Administration (SAMHSA) Jail Diversion and Trauma Recovery-Priority to Veterans program evaluation grant. The THHC will be the program evaluator for Colorado's five-year program. Colorado is one of only five states to receive this federal grant. Substance Abuse and Mental Health Services Administration is the program sponsor; our contract is with the Colorado Department of Human Services (grantee). Grant amount is \$374,000 for five-year evaluation project.
- Submitted a proposal as a subcontractor to Colorado State University (CSU). The CSU proposal was submitted to the National Science Foundation (NSF) Infrastructure Management & Extreme Events program. The proposal, entitled "Dynamics of hurricane risk perception." was funded at \$40,000 and contract negotiations are underway between UCCS and CSU. It is expected that the award period will begin September 1, 2009 through August 2012. Our subcontract allows Dr. Eve Gruntfest to serve as a consultant on this project to discuss technical aspects of the project design, collaborate on the development and execution of the phone interviews and the analysis of resulting data; and participate as co-author on articles resulting from the project.
- Completed Virginia Tech research focus groups for NIH STTR grant subcontract to UCCS. Weld County tornado research continued and THHC was in contact with officials conducting research post-Hurricane Ike to determine if it is a feasible site for a randomized control trial of the Journey to Disaster Recovery™ website.
- Dr. Eve Gruntfest presented a session sponsored by the Office of Sponsored Programs regarding ways to find funding for sponsored research projects. More than 50 faculty and staff from UCCS attended this program. December 2009.
- Dr. Benight presented results of THHC focused research projects at the 2009 International Society for Traumatic Stress Studies (ISTSS) annual meeting in Chicago November 2008. He presented sessions on the mediating role of coping self-efficacy on posttraumatic distress, the psychological effects on HIV disease progression among AIDS clinic patients affected by Hurricane Katrina. In addition, he supervised UCCS psychology students and faculty presenting posters at the conference regarding the psychometric properties of a self-efficacy scale to be used following trauma (with recent graduate Eddie Waldrep) and predicting PTSD, quality of life and disease progression among cancer and HIV survivors (with visiting faculty member Aleksandra Luszczynska).
- Received a grant from the University of Massachusetts Amherst to conduct social science research regarding emergency managers' responses to new weather technology employed during short fuse weather events that occur this spring and summer in Colorado, Oklahoma, and Massachusetts (e.g., tornados, flash floods, hurricanes). Dr. Eve Gruntfest will manage the grant. She will hire a Professional Research Assistant to help with the work. Grant amount was approximately \$68,000

for the period November 1, 2008 through August 31, 2009. In April 2009, the contract with the CASA was extended for an additional four years due to our excellent performance on the project to date. The additional funding brings the total project award to \$303,000 and the award period is now extended to August 31, 2013. Conducted new research with Drs. Aleksandra Luszczynska and Chip Benight on role of breakdown of anxiety-buffering processes in PTSD among Polish domestic violence victims.

- Completed Windsor study recruitment for website NIMH study.
- Secured sponsors for the 2009 Continental Divide Disaster Behavioral Health Conference. Conference collaborators include the Colorado Medical Society, the State Division of Mental Health and the Hospital Association of America. THHC's 3rd Conference will be held July 30-August 1st, 2009.
- Hired a post-doctoral research associate Dr. Jessica Lambert to assist Dr. Chip Benight build the Center research on trauma.

Successes in 2009-2010

- Began and completed a randomized control trial for students and staff at University of Texas Medical Branch-Galveston suffering traumatic stress symptoms post-Hurricane Ike. This trial is part of the NIMH STTR grant awarded to the Computer Science Department and the THHC.
- Held the 3rd Annual Continental Divide Disaster Behavioral Health Conference July 30-August 1 at the Colorado Springs Marriott. Including guest speakers, 122 people attended the conference.
- Dr. Eve Gruntfest held the 2009 WAS*IS Conference in Boulder, Colorado in August 2009. THHC Professional Research Assistant Ms. Cedar League was among the 30 students selected professional chosen to attend this year.
- Hired Dr. Jeannette Sutton as an adjoint researcher.
- Dr. Eve Gruntfest's grant request to extend the CASA Project with University of Massachusetts-Amherst for an additional four years was approved at \$240,500, which started September 1, 2009.
- Dr. Chip Benight received an expanded peer support program contract with the Colorado Springs Fire Department to provide trauma counseling services in collaboration with the UCCS counseling center to firefighters. The \$25,000 annual contract provided some funding for the THHC (\$3,000 per year).
- Dr. Eve Gruntfest received \$40,000 for three years from the National Science Foundation (NSF) through a subcontract with Colorado State University. This project will assess "Dynamics of Hurricane Risk Perception." The project began October 2009 and will be completed September 2012.
- Dr. Chip Benight submitted a subcontract proposal to the Pacific Disaster Center for assessing psychosocial vulnerability and resilience among the population along the Wasatch Fault in Salt Lake City, Utah. This proposal was \$140,000 for one year, but was not funded.

- Dr. Chip Benight submitted a subcontract proposal to the University of Texas Medical Branch to serve as an evaluation expert on their National Institutes of Health grant entitled: “Hurricane Ike Stress and Coping Analysis.” This was a three-year \$53,959 proposal, but was not funded.
- Dr. Jeannette Sutton submitted a collaborative proposal to NSF along with Florida International University entitled: “Evolving Disaster-Driven Public-Private Sector Social Networks.” This three-year proposal totaled \$205,694, but was not funded.
- Dr. Jeannette Sutton submitted a collaborative proposal to NSF along with University of California-Irvine entitled: “Informal Online Communication in Crises and Disaster Events: Content, Structure, and Dynamics.” This three-year proposal totaled \$351,902 and was funded.
- Dr. Jessica Lambert worked on the following research projects: 1) validating measures and assessing ways of coping with trauma, 2) assisting an online Veteran adjustment study, 3) developing a pilot study on PTSD and intimate relationships that will involve a sample of combat veterans (Preliminary results will be used for a grant application for funding for a larger study), and 4) worked on a cognitive biases study in interpreting physiological symptoms. Also, Dr. Lambert compared a sample of female trauma survivors with a sample of women who have not experienced trauma. Finally, she had established a relationship with director of educational programs at the Pikes Peak Workforce Center that would lead to recruiting participants at the Center.
- Dr. Jessica Lambert attended the grant writing workshop hosted by UCCS. Additionally, she prepared an RO3 application to study couples where one partner is a combat veteran with PTSD. Dr. Lambert also attended an educational offering on statistics using multilevel modeling at the Center for Family Research at the University of Massachusetts, Amherst to build her skills in analysis of longitudinal and dyadic data.
- Ms. Cedar League participated in the 2010 Hazardous Weather Testbed, operated by the National Severe Storms Laboratory at the National Weather Center in Norman, OK. This research emphasized interactions between National Weather Service forecasters and emergency managers during severe weather events. This research is a part of the CASA Grant, “Support for the End User Integration Research Thrust to CASA.”
- Research Assistant Ms. Cedar League began a telephone and internet survey directed to all Oklahoma Emergency Management Directors. The “Emergency Manager Tornado Warning and Technology Survey” is part of the CASA Grant, “Support for the End User Integration Research Thrust to CASA.”
- The 4th Judicial District’s Trauma Court began hearing cases in mid-December, triggering the evaluation process housed at the THHC and headed by Ms. Michelle Slattery. This five year pilot project was in its second year at the time. By this time, eight of the 75 trauma court participants have been selected for treatment services and the evaluation project.

- Dr. Eve Grunfest began a five month appointment as an invited visiting scientist at the Laboratoire d'étude des Transferts en Hydrologie and Environment at Joseph Fourier University in Grenoble, France. Her visit is co-sponsored by the Observatoire des Sciences de l'Univers and the Department of Geography. She would work closely with geographers, meteorologists and hydrologists on flash flood mitigation research with special emphasis on developing ways that integrate social science, hydrology and meteorology.
- Drs. Chip Benight and Jeannette Sutton submitted a proposal to the United States Department of Agriculture Disaster Resilience for Rural Communities program to study community-based social networks as potentially effective tools for disaster response and recovery efforts. This was a \$400,000, three year award that would begin October 1, 2010. This proposal was evaluated very favorably and was ultimately recommended for funding through USDA/NSF.
- Drs. Chip Benight and Tom Pyszczynski resubmitted a \$1.4 million, four year proposal to the National Institute of Mental Health studying the effectiveness of the anxiety buffering system among those who have experienced a traumatic event. This multi-site project involves research collaborators in Poland and Israel and includes active duty military personnel and domestic violence victims among the research subjects. This proposal received a priority score of 22 (18th percentile), but was not funded.
- Dr. Jeannette Sutton submitted a RAPID proposal to NSF to support social network research post-L'Aquila earthquake. This was a one year \$40,000 request, but was not funded.
- Dr. Eve Grunfest, P.I. (with others, UC Irvine as home) submitted to NSF a proposal titled Understanding Impacts of Multi-Scale Precipitation Variability on California's Water Resources through Past and Future Geophysical and Human Dimensions \$549,700 (UCCS Trauma Health and Hazards Center share), but was not funded.
- Dr. Jeannette Sutton resubmitted a collaborative proposal to NSF along with University of California-Irvine researchers entitled "Informal Online Communication in Crises and Disaster Events: Content, Structure, and Dynamics." This three-year proposal totaled \$351,902 and would begin October 1, 2010. It was funded at a \$300,000.
- Dr. Benight submitted a pre-proposal for SupportNet to Telemedicine and Advanced Technology and Research Center (\$2 million).

Successes in 2010-2011

- Dr. Benight submitted to the Veteran's Administration a grant to empower military students as they integrate into the university environment. This \$30,000 grant was awarded in fall of 2010. Dr. Jessica Lambert submitted an IRB application for the studies to be completed in under the UCCS sub-contract for the STTR grant prepared by the UCCS Psychology Department and BlueSun, Inc.

- Dr. Jessica Lambert wrote a research proposal to the National Institute of Mental Health to study couples where one partner is a combat veteran with PTSD; the application was submitted early in Q4. She assisted with development of the \$2.4 million SupportNet proposal, which was also submitted early in Q4. She was assigned as the postdoctoral research on the Disaster Resilience for Rural Communities grant and began learning more about the research work for this project. She was supported 30% appointment on a Veterans Education Programming grant. This grant is a one year grant designed to empower military students as they transition into the university environment, but was not fund.
- Ms. Cedar League, with the CASA project, attended a planning meeting at the University of Delaware in Newark, DE August 25-26, 2010 to discuss future goals and opportunities for CASA's End User Integration Research Thrust. Ms. League also traveled to Norman, OK August 30 - September 1, 2010 to attend the annual Oklahoma Emergency Management Association's meeting. She met with emergency management officials to discuss future collaboration with the CASA project. Also, Ms. League assisted organizing a CASA radar training session for emergency managers at the meeting. Cedar continued deployment of the "Emergency Manager Tornado Warning Survey," an online survey designed for Oklahoma Emergency Managers. One-hundred-thirty-two responses have been collected. All data has been analyzed, and a manuscript was completed during Q4. Cedar plans to submit the manuscript during Q1 of 2011 once final edits from all authors are completed.
- Ms. Michelle Slattery, lead evaluator for the SAMSHA Jail Diversion with Priority to Veterans grant, completed the second year of evaluation services for this program. In addition, she developed and is now administering training evaluations for the PTSD awareness training funded by this grant. The program is referred to locally as the Veteran Trauma Court or VTC, launched in Division 19 of the 4th Judicial District in Colorado Springs on December 17, 2009, in Judge Ronald Crowder's court room. Since the launch, twenty-one individuals have entered the VTC grant and started receiving mental health treatment services. The evaluation team successfully completed their National Site Visit in late August. The VTC evaluation plan and logic model were provided to the site visit team, as were preliminary reports on trauma training workshops, the first year process evaluation, and preliminary results from baseline interviews, target arrest data, initial screens, eligibility determinations, and mental health screens. IRB renewal for the project has been approved. Ms. Mallory Dugger was hired as the part-time Professional Research Assistant for this program in July.
- Dr. Jeannette Sutton received two grants from the NSF that are described below. She made an initial visit to one rural resilience grant field site to introduce the research and to obtain a list of key informants for future interviews. Dr. Sutton traveled to University of California-Irvine (the collaborative research partner for the Twitter grant) to participate in an "All Hands Meeting" during which time the research team discussed data collection methods, research hypotheses, and initial data analysis goals. Mr. Mateusz Greczek has been hired to work on this project as a Graduate Research Assistant.

- Drs. Chip Benight and Jeannette Sutton were awarded funding from the NSF / USDA Disaster Resilience for Rural Communities competition to study perceptions of collective efficacy in two disaster-affected communities. This \$399,998 three year award began September 1, 2010.
- Dr. Jessica Lambert continued work on the Disaster Resilience for Rural Communities grant (a 70 percent appointment), contacting officials for research interviews that will take place in the Lake Arrowhead, CA community in Q1 2011.
- Ms. Cedar League presented a talk entitled, "CASA Alert! How new radar technology supported emergency management decision-making and enhanced communications during the May 10, 2010 Oklahoma tornado outbreak" at the National Severe Weather Workshop held 3-5 March, 2011 in Norman, OK.
- Ms. Cedar League submitted an abstract entitled, "What were they thinking? Using YouTube to observe driver behavior while crossing flooded roads" to the American Meteorological Society (AMS) First Conference on Weather Warnings and Communication which will be held 22-24 June, 2011 in Oklahoma City, OK. The abstract was accepted for presentation as a paper.
- Ms. Cedar League submitted an abstract entitled, "Emergency Managers and Public Warning Systems: The Pros and Cons of Tornado Sirens, SMS and Beyond" to Mountain Lion Research Day at the University of Colorado Colorado Springs. The abstract was accepted and was presented April 1, 2011.
- Ms. Michelle Slattery, lead evaluator for the SAMSHA Jail Diversion with Priority to Veterans (VTC) grant, participated in a one-week Veteran Treatment Court Boot Camp (VTCPI) with the VTC team in Orange County, California and the SAMHSA Project Director's Meeting in Washington, D.C. She and research assistant, Ms. Mallory Dugger, completed data analysis for the VTC Year One Report, the Daily Status Inmate Report Annual Summary, and developed and administered a Client Satisfaction survey. Thirty-five individuals have participated in the VTC to date. Interview completion rates are at 88% for the 6-Month Interview follow-up and 100% for the 1-Year Interview follow-up.
- The Jail Diversion Project evaluation team presented a Poster on the VTC at the UCCS Mountain Lion Research Day, submitted a proposal to the American Evaluation Association, and had a presentation accepted for the Association for Psychological Type International conference this summer. The VTC is currently cooperating with the television program Dateline on a Veteran Trauma Court piece that will follow participants over the next year.
- Ms. Cedar League presented a poster entitled, "Emergency Managers and Public Warning Systems: The Pros and Cons of Tornado Sirens, SMS and Beyond" at Mountain Lion Research Day at the University of Colorado Colorado Springs on 1 April, 2011.
- Drs. Benight, Sutton, and Lambert conducted the first round of interviews for the disaster resilience study in Lake Arrowhead California in January 2011. Disaster Resilient Rural Communities: Drs. Jeannette Sutton, Chip Benight, and Jessica

Lambert conducted research in their second field site in June 2011. This included a tour of the area with a local public official and interviews with 15 key informants. Results from this research were shared at the Natural Hazards Workshop in Broomfield Colorado during the poster session and Sutton presented findings as a panelist for a session on resiliency. Results will also be presented at the Rural Sociological Society annual conference in Boise, ID at the end of July.

- Ms. Cedar League deployed a survey to emergency managers attending the Texas Emergency Management Conference April 26-29, 2011 in San Antonio, TX. The “Tornado Warning and Technology Survey” examines emergency managers about tornado warning procedures and available resources used during severe weather. The survey is an ongoing effort and will continue to be deployed online in 2011.
- Ms. Cedar League traveled to Oklahoma June 22-23 to interview emergency managers regarding operations during recent tornado events in the region.
- Ms. Cedar League traveled to Fort Worth, TX on May 6 to attend CASA business meetings with the National Weather Service, the North Central Texas Council of Governments, and emergency managers from the region.
- Ms. Cedar League and CASA Principal Investigator (PI) Dr. Eve Grunfest traveled to Amherst, MA May 15-18 to attend the National Science Foundation site review for the CASA project.
- Ms. Cedar League traveled to San Antonio, TX April 25-29 to attend the Texas Emergency Management Conference, and deploy the “Emergency Manager Tornado Warning and Technology Survey” to emergency managers attending the conference
- PI Michelle Slattery and Research Assistant Mallory Dugger wrote an addendum to the Veteran Trauma Court (VTC) IRB application to add Active Duty military soldiers to the evaluation of the treatment court. This addition will hopefully increase the number of potential evaluation participants. The VTC evaluation team has been working with the national evaluation team to define, collect, and report services use data for all participants. Locally, the peer program is being revamped and the Mental Health, Services & Support team is working to revise the rewards, sanctions, and phases of participation. The process evaluation for stakeholders will be launched this summer.
- HEROIC Project: PI Jeannette Sutton and Graduate Research Assistant Mr. Matt Grezcek collaborated on a poster with colleagues at UC Irvine on rumoring during extreme events. This was presented during the Political Networks Conference in Ann Arbor, Michigan. A poster will also be presented at the Natural Hazards Workshop in Broomfield Colorado in July.
- Dr. Jeannette Sutton is working with Dr. Rebecca Goolsby at the Office of Naval Research to develop a proposal to conduct a workshop on open source, networked information and communication technologies for humanitarian disaster assistance. This workshop will bring together resources and participants from the military, academia, non-profits, and government both domestic and international.

- Ms. Cedar League, with the CASA project, submitted an abstract entitled, "CASA Alert! How new radar technology supported emergency management decision-making and enhanced communications during the May 10, 2010 Oklahoma tornado outbreak" to the National Severe Weather Workshop (NSWW). The abstract was accepted, and Cedar presented her findings at the NSWW held March 3-5, 2011 in Norman, OK.
- On April 7, 2011, Ms. Cedar League presented a talk entitled, "What were they thinking? Using YouTube to observe driver behavior while crossing flooded roads" at the UCCS Emergency Preparedness Advisory Committee.
- Dr. Jeannette Sutton received funding for the Office of Naval Research conference grant to conduct a workshop on open source, networked information and communication technologies for humanitarian disaster assistance. This is a six-month grant (\$97,500), began January 2011. HADR Tech Workshop: PI Dr. Jeannette Sutton along with Events Coordinator Ms. Mallory Dugger and THHC Associate Director Debbie Sagen coordinated and completed a workshop on Humanitarian Aid and Disaster Relief Technology, funded by the Office of Naval Research. The conference drew 65 participants both domestically and internationally and included representatives from the Department of Defense, United Nations, US military Combatant Commands, academics, nongovernmental agencies, and the private sector. This was the first conference of its kind.
- The SAMHSA National GAINS Center has named the Veteran Trauma Court and the THHC one of a handful of sites to receive its pilot training, "Creating Trauma-Informed Systems of Care," in August 2011 at the THHC. The VTC/THHC application was one of almost 80 received from around the country; the training will be offered to 35 local law enforcement and supportive services professionals on August 16, 2011 in conjunction with the statewide Colorado Jail Diversion project.
- The Colorado Springs Fire Department's Peer Support Program was reorganized internally this quarter (between the University Counseling Center and the THHC). The THHC has assumed all program management requirements and the UCC will provide counseling services only. The THHC will be hiring a part-time clinical manager for this program; this person will be responsible for oversee the program and recruiting additional organizations needing peer support training and/or supervision services in our region.
- Dr. Jessica Lambert submitted a \$150,000, two-year R03 grant to the National Institute of Mental Health for a study on couples where one partner is a combat veteran with PTSD. The grant was not funded.
- Dr. Jeannette Sutton submitted a sub-award to the University of Maryland Department of Homeland Security Center for the Study of Terrorism and Behavior competition. This \$189,500, two-year project that would begin in 2014. The sub-award focuses on how social, behavioral, cultural and economic factors influence the exchange of information between governmental agencies and the general population in the wake of a catastrophe. The grant was not funded.

- Drs. Chip Benight and Jessica Lambert submitted a \$2.087 million grant to the Telemedicine and Technology Research Center of the US Department of the Army's Medical Research and Materiel Command. This three-year project studies secondary trauma among the behavioral health and medical providers at Ft. Carson, CO. This grant was funded June 15, 2011.
- Drs. Tom Pyszczynski and Pelin Kesebir submitted a grant to the US Department of Homeland Security (\$500,000) for a research project to assess the impact of recent events and the likely future impact of possible interventions on Muslims' attitudes toward radical Islam, terrorist violence, and the United States. This was a five-year grant, but it was not funded.
- Ms. Debbie Sagen assisted the CSTEME staff to complete an NSF grant for the Transforming STEM Learning project. This proposal was submitted in March 2011 and a funding decision should be made by mid-July 2011 (it was not funded, but received a very favorable review and will be resubmitted in early 2012).
- Dr. Jeannette Sutton was awarded a \$29,237 RAPID from NSF for continued research on communication post-earthquake in New Zealand. This project "When Online is Off" will investigate the use of information and communication technologies and their effectiveness as a communication mechanism when infrastructure is shut down following a disaster. This research will be done in collaboration with GNS Science and Massey University in Wellington, NZ.
- Ms. Debbie Sagen assisted the CSTEME staff to complete an Office of Naval Research White Paper for a technology-rich STEM initiative aimed at middle school girls; this proposal, i-Create Girls in Technology will be reviewed for determination of compatibility with ONR STEM goals; the CSTEME expects to receive a favorable review by July 31, 2011. If the review is favorable, a full proposal for consideration will be submitted. Sagen also researched ways to approach AFOSR with a continued funding request, and began work on an NSF proposal that was set aside due to pressing CSTEME summer programming issues.
- Ms. Debbie Sagen and PI Michelle Slattery wrote a proposal to provide program management services to the Jail Diversion project for the remaining 2.5 years of the grant in order to improve court coordination and enhance sustainability efforts. This \$122,147 would be paid in addition to the current \$407,000 grant. This proposal was accepted.
- The Veteran Trauma Court grant evaluation team (Michelle Slattery and Nicole Emmons) had been working to consider whether the new Denver Veteran Trauma Court, which begins operations September 1, 2011, should be added as a second evaluation site for their project. The Denver Court site was eventually rejected as a suitable site, and the team is now evaluating the possibility of a new court that is being formed in the 18th Judicial District (Arapahoe/Douglas/Elbert/Lincoln Counties).
- Chip Benight began work on the SupportNet project, coordinating the human subject protocol submission for the SupportNet project to UCCS and to the Human Research Protection Office at Fort Dietrich and negotiating a cooperative agreement with

faculty at the University of Texas at San Antonio who conduct research at Fort Hood on secondary trauma and burnout.

- 2011 University of Colorado Natural Hazards Center Workshop Natural Hazards Workshop, July 9-12. A poster was presented by Dr. Jeannette Sutton and Mr. Matthew Grezcek (a Sociology graduate student and THHC graduate research assistant) and their colleagues at University of California-Irvine. "Informal Online Communication in the Deepwater Horizon Disaster"
- 2011 University of Colorado Natural Hazards Center Workshop Natural Hazards Workshop, July 9-12 - Poster presented by Jeannette Sutton and Charles Benight. "Disaster Resilient Rural Communities: Access to Online Information and Perceptions of Collective Efficacy" 2011 Natural Hazards Workshop, Broomfield, Colorado.
- Rural Sociological Society paper presentation: Drs. Jeannette Sutton, Charles Benight, and Jessica Lambert entitled, "Disaster Resilient Rural Communities: Access to Online Information and Perceptions of Collective Efficacy" was presented at the 74th Annual Meeting of the Rural Sociological Society, July 28-31. Boise, ID.
- The THHC hired Dr. Judith Bock as the part-time clinical manager for the peer support program after their other staff member, Mr. PJ Havice, was offered a temporary position overseas. Dr. Bock is responsible for overseeing the Colorado Springs Fire Department's program and recruiting additional organizations needing peer support training and/or supervision services in our region.
- In August 2011, Dr. Chip Benight conducted a 40 hour peer support counselor training for four new counselors in the Colorado Springs Fire Department's Peer Support program. In addition, he presented to the Regional Fire Chiefs Association on the importance of mental health and spoke about the Colorado Springs Fire Department's Peer Support program.
- Ms. Debbie Sagen and Ms. Michelle Slattery hosted the SAMHSA National GAINS Center training, "Creating Trauma-Informed Systems of Care," on August 16, 2011. Thirty-five law enforcement and supportive service personnel from El Paso County and the Denver Metro Area attended this training at UCCS in the Osborne Center.
- The Veteran Trauma Court grant evaluation team has enrolled 61 soldiers/veterans in the evaluation to date and is on track to achieve its goal of 76 complete sets of Baseline, 6-Month, and 12-Month Interviews. They achieved a 92% follow-up rate on 12-month interviews for the quarter, the highest for their cohort in the grant. There are twenty months remaining on the 5-year grant. The team also conducted an evaluation of VTC Stakeholders in the community this quarter.
- The SupportNet project received IRB approval from UCCS and the U.S. Department of the Army's Human Research Protection Office at Fort Dietrich. The initial survey of behavioral health providers was launched mid-December.

- The Veteran Trauma Court evaluation team compiled and shared Colorado VTC data with the National Association of Drug Court Professionals on the topic of violent offenders for their effort to change legislation that limits veteran treatment court participants to non-violent offenders.
- The city of Colorado Springs has renewed its contract with the THHC to provide supervision and support to the Colorado Springs Fire Department's Peer Support program. This is a \$28,000 annual contract.

TRAUMA, HEALTH, AND HAZARDS CENTER “Looking Forward”

In mid-2006, the THHC joined the NISSSC. Since that time, the THHC has grown from a small organization with a part-time faculty director and a part-time grants specialist to a center with eleven faculty researchers (7.25 FTE), three support staff, and collaborative research efforts underway around the globe. Funding from AFOSR has allowed the THHC to attract new faculty researchers, develop \$4.5 million in new multi-disciplinary research efforts, and \$350,000 in funding designated to help practitioners in preparing for, responding to, and recovering from extreme events.

Our near-term sustainability plan is focused on three growth areas:

- 1) Developing new research proposals based upon current research efforts.
- 2) Creating meaningful educational opportunities for practitioners in the hazards response, emergency management, first responder, and psychological counseling communities.
- 3) Launching initiatives designed to assist returning soldiers, their families and their communities to effectively recover from trauma.

More specifically, we are pursuing opportunities to develop new research efforts in areas such as the use of social media to develop communities that are more resilient post-disaster, the effects of disaster exposure on human health, the magnitude of and possible cultural differences in secondary trauma and burnout symptoms among trauma counselors around the world, and the integration of social science research in meteorology.

Second, we are developing new educational programming for weather scientists interested in learning social science research methods and for counselors interested in pursuing graduate-level coursework in trauma psychology and disaster response, and expect to revive our annual disaster behavioral health conference, which has not been held since 2009 due to the lagging economy.

Finally, we are developing two initiatives for military members and their families. First, we are proposing to create a trauma counseling clinic using the faculty and students at the University; this clinic would diagnose and treat trauma, with a specific emphasis on

combat-related trauma and the clinic would integrate innovative technology approaches to augment care and work to integrated systems with primary health providers. Second, we would expand our efforts to evaluate promising new programs to assist soldiers and their families, like the Veteran Trauma Court that is beginning its third year of operation in our region.

CENTER FOR HOMELAND SECURITY SELECTED HIGHLIGHTS

The Center for Homeland Security (CHS) has an international reputation for homeland security and homeland defense. The CHS has been one of the driving forces to create the Masters of Public Affairs in Homeland Defense degree at the UCCS and other certificate programs. The CHS continues to advance its reputation nationally and internationally as a recognized leader in homeland security (HS) and homeland defense (HD) educational programs. Unlike most funding, the CHS grant objectives were broad and the funds supported a large number of educational programs, research, and outreach activities; therefore, this report highlights its most significant activities.

Successes in 2006-2007

- Delivered a graduate-level homeland security certificate program to USNORTHCOM personnel.
- Developed and launched an undergraduate certificate in homeland security/defense.
- In conjunction with the Graduate School of Public Affairs at the University of Colorado at Denver, developed a business model and curriculum for a Master of Arts in Public Administration with a concentration in Homeland Security/Defense as initiated by USNORTHCOM request.
- Help develop the new graduate certificate program in Disaster Medicine (HLD/HLS case specific) in conjunction with US Northern Command Surgeon General's office and UCCS Beth-El College of Nursing and Health Sciences.
- Completed MOU with National Defense University (NDU) to offer degree programs for NDU certificate students, principally in the UCCS College of Engineering and Applied Sciences, Graduate School of Public Administration, and the College of Business.
- Funded research on Terror Management Theory and Human Factors research to support HLS psychology of terrorism studies.
- Completed MOU with Pacific Disaster Center (PDC), in partnership with the Trauma Health & Hazards Center, for all-hazards research collaboration with PDC in regional disaster management research projects.
- Developed partnership with Harvard Law School's homeland security project to share curricula and research.

- Initiated discussion with Texas A&M, San Diego State University, Eastern Kentucky University, and private sector in emergency management (state/local) programs related to a cooperative intelligence program.

Selected Highlight in 2008-2009

- Completed the full sequence of three courses, and started a second cycle in the new CHS Undergraduate Certificate Program in Homeland Defense and Security.
- Developed first Transatlantic Civil Security Executive course, in conjunction with the George C. Marshall Center.
- Partnered with Business Executives for National Security and Infra-Guard to provide HS training and education assistance to federal and regional agencies supporting the Democratic National Convention (Denver, CO).
- Partnered with Business Executives for National Security to provide education/training and USNORTHCOM-based research perspective on Public-Private Sector “Public Benefit Corporation”.
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- Facilitated international conference on transatlantic civil security for the George C. Marshall School of European Security Studies; developed 4-week Seminars in Trans-Atlantic Civil Security (STACS) for the Marshall Center.
- Established working relationship with Colorado South Central All Hazards Region to support State and regional emergency management training, education and research. Hosted delegation from Singapore Defense Forces to discuss defense support to civil authorities and critical infrastructure protection. On their request, working with USNORTHCOM to develop and deliver an international HS training program.
- Added CHS staff: Associate Directors for Curriculum Development and Government/Private Sector Programs, and Faculty Directors of Information Sciences Research, and Human Factors Research.
- Provided planning and logistics support to multi-agency and jurisdiction emergency management Exercise Entry Point.
- Supported Homeland Security Exercise Evaluation (HSEEP) - compliant weapons of mass destruction (WMD) full-scale exercise for 300+ on the University of Colorado Colorado Springs (UCCS) Campus, city of Colorado Springs, and El Paso County emergency responders; hosted HSEEP-compliant WMD tabletop exercise for 100+ on the UCCS Campus, City of Colorado Springs, and El Paso County emergency responders
- Developed and refined the concept of operations for the city of Colorado Springs (CS) Emergency Operations Plan. CHS continues to work closely with the Colorado Springs City Director of Emergency Management for regular plan updates and community-based (EM) strategy sessions.

- Worked as USNORTHCOM educational lead to expand the Command presence in International Civil Security. Continued collaboration with Carleton University (Ottawa) to establish a joint effort in North American civil security. Developed linkage with Canfield University (UK). Both Canfield and Carleton have Defense Ministry sponsorship and have mature HS and civil security programs.
- Developed Geographic Information Systems (Geo-engineering) track within the Engineering Management Master's Degree program at UCCS. The program designed to include four courses and a two semester project. This program is directed toward Department of Defense (Dodd) personnel seeking to learn more about IGIS (the successor to Gobies – the United States Air Force (USAF) installation management/GIS program).
- Authored Memorandum of Understanding (MOU) for Air Force Space Command (AFSPC) dealing with Geographic Information Systems, Emergency Management and related areas.
- Initiated course development “Psychology and Terrorism”, (a special topics course) to be developed as a Senior Seminar in the Department of Psychology.
- Consulted with United States Air Force Academy (USAFA) in the development and execution of first active shooter scenario; coordinated with Arapahoe County (Aurora, CO) Sheriff's SWAT team in conjunction with mass exercise – building stronger relations with local universities, military community, and law enforcement agencies.
- Pre-proposal submitted to START (University of Maryland Study of Terrorism and Responses to Terrorism): Mitigating the Impact of Fear on Support for Terrorism and Harsh Terrorist Countermeasures in collaboration with Jessica Stern (Kennedy School of Government) and Dalia Moaned (Gallup Center for Islamic Studies).
- CHS continued to fund Human Factors research (Department of Homeland Security Directorate of Science and Technology priority area) in Terror Management Theory. The research is directed by Dr. T. Pyszczynski (CHS Director of Human Factors Research), who is lead an international field study team.
- Attended NATO Conference on Indigenous Terrorism, Budapest, Hungary. Ongoing research collaboration established with Anne Speckhard (US Department of State) to do experiments on root causes of terrorism in Muslim group in Morocco, Europe, and Iraq.
- Conducted an United States Air Force wide analysis on Emergency Management Information Systems needs. Survey approximately 1000 USAF personnel. Data were analyzed to identify key USAF information system requirements for Incident Management. Analysis sent to USAF GeoIntegration Office. This is the first study of its type within the Dodd, and it has an unprecedented sample from the Incident Management community/population.

- Grant Submitted: Political Will Expert Reasoning (POWER) project in collaboration with 21CSI Inc., under STTR OSD07-T002 (Measuring and Mapping Political Will). This is a proposed phase 2 STTR project under the Office of the Secretary of Defense. POWER is an experimental, practical Political Will decision support tool for strategic planning in unstable world regions (not funded).
- Ongoing research efforts by the Director of Human Factors Research, which included meeting with United States Army Psychological Services staff to arrange collaboration on studies on PTSD in returning soldiers initiating data collection on PTSD in soldiers returning from Afghanistan and Iraq, and meeting with British, Dutch, Polish, and German colleagues to set up collaboration on terrorism research.

Selected Highlight in 2009-2010

- Met with British and Dutch colleagues to plan a new international study on the effect of thoughts related to 9/11, Iraq war, 7/7 UK attacks, and one's own death on support for terrorism and military interventions in the Middle East, among American, British, Dutch, Turkish, and Iranian people.
- Continued progress toward an USAF-wide Incident Command/Emergency Operations Management project. White Paper submitted and well-received by Pentagon-level (Air Staff). [The Air Staff agreed to the study. The study was conducted in 2008: An emergency management computer system requirements questionnaire was distributed to almost one thousand emergency response representatives from all MAJCOMS. This is the largest emergency management user requirements study in this field that I am aware of.] The requirements study preliminary White Paper was published on our website.
- Delivered 1st and 2nd iterations of Seminar in Transatlantic Civil Security to the George C. Marshall Center for European Security Studies in Garmisch-Partenkirchen, Germany. The 17-day course included approximately 43 participants from over 20 nations. The course content provided "best practice" information in the areas of Homeland Defense and Defense Support of Civil Authorities. This course is now the most popular and successful academic offering at the Marshall Center.
- Worked with NORAD-USNORTHCOM, the UCCS Beth-El College of Nursing and Health Science and School of Public Affairs, to develop two new homeland security-related certification programs in Intelligence and Disaster Public Health.
- Supported development of \$150K grant proposal to National Science Foundation to conduct workshops on Systems Approach to Security, which was not funded.
- Submitted Grant to the National Science Foundation MINERVA Program: Development, Globalization and Environment: A Systems Approach to Security, Conflict and Cooperation. \$148,722, which was not funded.

- Contract developed with Air Force Space Command via Booz-Allen-Hamilton: Incident Management Evaluation Program. Funding secured (\$30,000); however, the legal agreement between UCCS and the program partners could not be approved, which was not funded.
- In September, 2009, delivered presentation for NORAD-USNORTHCOM Joint Professional Military Education, “Homeland Security: Building Community Resilience.”
- Research presentation delivered at the 7th Biennial Society for the Psychological Study of Social Issues conference discussing the findings/research on the relationship between psychology, socio-economic development, and terrorism.
- Emergency Response Systems needs analysis for the Air National Guard. Meetings between Dr. Sambrook, Mr. Robillard and Mark Barner at USAFA to create partnered research effort between UCCS and US Air Force Academy).
- Conducted a “Capabilities-Based Planning Process Study State of Colorado Key Stakeholder Survey”, on behalf of the Colorado Office of Homeland Security.
- Internal White Paper developed and submitted on research in Homeland Defense & Incident Management. Resulted in \$70k AFOSR sub-award out of the Center for Space Studies) to support Dr. Roger Sambrook’s research. Project funding was to continue pilot study in Emergency Response Operations Systems Integration (EROSI) for Air Force Space Command.
- Completed Senior Seminar: Psychology of Terrorism. Seminar drew on published research, ongoing book research and work for Department of Homeland Security (terrorist profiling) in examining areas such as domestic and international terrorism, terrorist profiling, and red-teaming.
- Completed “Perceptions of Workforce Requirements in Homeland Security and Homeland Defense,” National Homeland Defense Foundation/Career Summit participation survey. Poster presented at UCCS Mountain Lion Research Day.
- Conducted a study on “Colleges & Universities Offering Graduate and Undergraduate Homeland Security Programs; A Comparison with UCCS CHS Programs: Graduate Certificate in Homeland Defense; Undergraduate Certificate in Homeland Security.”
- Developed certificate program review using data collected from 423 students who had completed the CHS homeland security/defense courses since the inception of the certificate program in 2002. Data supported the revised proposal to continue the Certificate in Homeland Security/Defense program with NORAD/NORTHCOM.
- Promoted PILLAR Lecture Series, “Yugoslavia, A Case Study on Why and How America Goes to War”.
- Participated in Ft. Carson Town Hall Meeting, Preparing our Community for 40,000+ New Soldiers & Family Members.

- Co-hosted US-Korean Relations Panel, March 13, 2009 with UCCS College of Education, Daegu English Village.
- Engaged as a founding partner with the Homeland Security and Defense Education Consortium Association to develop national academic standards for homeland security education.
- Engaged with South Central All-Hazards Region, El Paso County Sheriff's Office, and Pikes Peak Community College to co-facilitate a HSEEP compliant table-top exercise, Alpha Point.
- Initiated Joint Homeland Security Studies program between UCCS and University of Zagreb, Croatia (City of Zagreb funding). Conducted three days of meetings with City/University of Zagreb, Croatia officials to structure terms for a partnership with UCCS. In the short-term, UCCS will develop and deliver several courses in homeland security and assist the University of Zagreb in establishing a regional (Eastern Europe) Center of Excellence in Homeland Security. In the long-term, UCCS will assist the University of Zagreb in maturing the Center of Excellence and designing, developing and delivering masters and doctoral degrees in homeland security. Hosted a group of six officials from the City and University of Zagreb, Croatia from August 10 to 15, 2009, as guests of UCCS/NISSSC/CHS. The purpose of the visit was to gain a better understanding of US federal, state and local emergency management processes and procedures, and to finalize plans for partnering with UCCS to provide civil security education in Zagreb, greater Croatia and, eventually, eastern Europe. Short term goal is to develop a 2-year Master's Degree in Civil Security, initially accredited by UZ. The program will consist of 14 courses (6 core courses, 7 electives and 1 thesis). Courses will be delivered by NISSSC/CHS and UZ instructors. Using blended teaching techniques including 3-week compressed onsite instruction and distance learning methods. This project is on hold waiting funding from the University of Zagreb, Croatia.
- Delivered lesson plans for 4-course cyber security program to National Space Security Institute.
- Submitted \$328K Letter of Intent to The Robert Wood Johnson Foundation to develop a definition of "special needs" populations and propose model legislation for nationwide disaster planning. May 2009. There were 235 letters of intent submitted. Unfortunately, our proposal was not selected to submit a full proposal.
- Hired Dr. Pelin Kesebir, post-doctoral research associate, to assist Dr. Tom Pyszczynski in building on the Center's research on terrorism.
- Initiated development of new graduate level certificate course with the School of Public Affairs on "Homeland Security and Homeland Defense under the U.S. Constitution."
- Developed MOU between AFSPC and UCCS for Incident Management & Emergency Response.

Selected Highlight in 2010-2011

- Met with Colorado Director, Homeland Security, Mason Whitney (MG – ret) and department officials to discuss potential research, educational services, and intern program. Discussions resulted in collaboration with CHS.
- Presentation on value of higher education to professional development at the Homeland Security Career Summit in Colorado Springs, CO with over 200 people in attendance.
- Participant in the National Homeland Defense Symposium.
- Met with National Homeland Defense Foundation CEO to discuss 2010 symposium and potential partnering.
- Began discussion with Challenger Learning Center in Colorado Springs to discuss future collaboration with Center for STEM Education (CSTEME), Center for Space Studies (CSS) and Center for Homeland Security (CHS) to develop K-12 STEM programs related to HS/HD areas.
- Participated in community meeting on “Space Journey” at United States Air Force Academy (USAFA). This initiative is a new interactive museum to showcase military space history, products and generate public awareness.
- Keynote speaker at Marshall Center, Garmish, Germany. Comments focused on trends in homeland security education. Also, participated in STACS (Seminar on Trans-Atlantic Civil Security) discussion with students.
- Keynote speaker at the “50 for Colorado” conference. 50 for Colorado is a group of representatives from throughout Colorado taking leadership training sponsored by University of Colorado at Boulder.
- Guest speaker for the Marine War College visit to USNORTHCOM.
- Blade server and lab equipment procured and installed under AFOSR grants FA9550-04-1-0239 and FA9550-06-1-0477 in the new Science and Engineering Building (SENG) to directly support both grants’ objectives to increase UCCS’ research capacity in cyber security, physical security, homeland security, and other areas. Updated and upgraded capabilities and software to enable a path for large public and private cloud (virtualization) infrastructure and increased performance and storage capabilities. The System is used to conduct research in disaster recovery and system restoration which is critical to homeland and cyber security research. Virtualization has allowed us to build a new, multi-purpose datacenter housing multiple environments to attract more research funding, expand classroom services and improve operational capabilities.
- Funded heat exchange system expenditure for SENG physics lab in further support of grant objective to increase research capacity and specifically the work of Drs. Celinski and Camley in the area of physics of high frequency signal processing of electromagnetic waves at specific frequency ranges that are particularly interesting and important as there are a number of possible military and civilian applications to be explored. Additionally, grant monies were used to

purchase the VERTEX 70 Fourier Transform Infrared Spectrometer. This instrument has been used to characterize the IR and FIR spectra of silver and gold colloidal nanoparticles. The colloidal silver and gold nanoparticles have been synthesized in our lab and their IR and FIR spectra were taken by using the VERTEX 70 Fourier Transform Infrared Spectrometer. The FIR spectra of silver and gold nanoparticles have interesting anomalous absorption spectra, which potentially might be used for efficient heat therapy of cancerous cells. In addition, the enhanced FIR absorption of silver and gold nanoparticles may be used for solar cells with enhanced absorption in the FIR wavelength range. Research results of ongoing preliminary investigations will be used to prepare proposals for NFS and NIH grants. NSF has a program specifically devoted for renewable energy sources and NIH has recently announced solicitation for proposals in the nanotechnology field related to biology and medicine.

- Developed and delivered the Near Earth Object (NEO) educational workshop for K-12 students. Workshop focuses on Space, Emergency Management, and Trauma fields applied to STEM areas.
- Started an online undergraduate and graduate Certificate in Disaster Public Health with the first class enrolling 15 students.
- Dr. Roger Sambrook, CHS' Faculty Director of Information Sciences Research received a \$40,000 Grant through USAFA BAA entitled: "An Ontology for USAF Emergency Management", which focuses on building software for command and control of emergency management response. The original Emergency Response Operations Systems Integration (EROSI) (funded within NISSSC/Center for Space Studies) project began conducting research on Air National Guard Emergency Management Software development. The follow on funding from the USAFA is a collaborative effort with USAFA Institute for Information Technology Applications (IITA). This research expands existing collaborations with AFSPC on Emergency Management systems. If this collaboration continues with AFSPC investigating the challenges facing AF wide standardization of emergency management technologies.
- Received a \$67,400 contract from Defense Threat Reduction Agency (DTRA) to host a Disaster Public Health Colloquium in March 2010 held at UCCS.
- Ongoing CHS funded research on individual state and large urban areas targets defining "special needs" populations in their mass evacuation plans. IRB-approved survey completed by 94 senior emergency management personnel from 43 states. Findings from this research will help to develop an unambiguous definition of "special needs" and propose model legislation that will facilitate improvement of intrastate and interstate mass evacuation plans for special needs populations.
- Participated in El Paso County full-scale emergency response exercise.
- Collaborated with UCCS Department of Public Safety to submit a proposal for Emergency Management in Higher Education (EMHE) to the Department of Homeland Security and the Department of Education.

- Met with the President of Croatia at his office in Zagreb, Croatia to discuss Joint Homeland Security Studies program between UCCS and Croatia. President Josipović is interested, in the short-term, in funding UCCS to develop a defense support of civil authorities' course for the Croatian Armed Forces. Initial proposal has been submitted.
- Facilitated the 4th iteration of the Seminar on Trans-Atlantic Civil Security (STACS) at the George C. Marshall Center College of International and Security Studies, Garmish, Germany. Forty-five students from thirty-three countries participated in STACS.
- Began to develop a UCCS freshman level course comprised of a range of homeland security/defense topics. The goal of the course is to develop freshman college skills and encourage engagement in Homeland Security (HS) and Homeland Defense (HD).
- DTRA/Internet Reliability: Revised and submitted \$250K study proposal to examine how the US relies on the "loading of the Internet" during emergencies (pending). (PIs: Drs. Chow, Zhou, and NISSSC).
- Conducted an academic program review of the UCCS homeland security and homeland defense certificate programs and students' perception of its growth as a whole over the course of their study through an evaluation of objectives and outcomes from specific course content; learning outcomes based on the Department of Homeland Security's academic standards list; and self-evaluation of personal skill enhancement, job performance, workforce marketability, and overall educational experience were examined.
- Dr. Pyszczynski and his research associates initiated new research on the impact of the Iranian government's repression of election protestors on support for Political and Militant Islam in various Muslim countries.
- Met with Director of Intelligence for NORAD and USNORTHCOM (N-NC/J2) to build partnership with CHS. CHS will act as N-NC/J2's "one-stop-shop" in academic support for its mission.
- Met with leadership of Homeland Security Defense Education Consortium Alliance (HSDECA) to clarify roles and improve cooperation between UCCS and other universities nationwide in homeland security/homeland defense research, education and outreach.
- Collaborated with EROSI research project team and CSTEME to develop the "Toxic Plume" workshop illustrating the fields of forensics, emergency management, geographic information systems and robotics. One hundred-three students participated in these interactive half-day workshops, which were held at the 2009 National Homeland Defense Foundation Symposium in Colorado Springs, CO.
- Participated in NORTHCOM International Homeland Defense and Civil Support Perspectives Forum, which included discussion of UCCS role in education pillar of ICOE.

- Developed and delivered 4-course Graduate Certificate in Security Intelligence.
- DHS BAA – Partnering with National Defense University and Naval Postgraduate School, submitted \$2.5M Security Education Initiative to Department of Homeland Security, which was not funded.
- Submitted 1-year contract proposal to USNORTHCOM to conduct ten 1-week training workshops in HLD/HLS topics for military and civilian personnel. The workshops are built around the NORAD-USNORTHCOM Commander’s “Focus Areas” and are designed not only to educate and train the USNORTHCOM workforce, but also offer solutions to greatest challenges. [Contract Awarded]
- Teamed with the city of Colorado Springs to conduct survey of its residence measuring disaster preparedness.
- Short courses developed in areas of Cyber Security and Mexico & Boarder Security. Audience would be students, military, and industry personnel (broad interest).
- Built a Video Teleconferencing (VTC) system to develop a robust communication capability and infrastructure to support an interconnected perimeter of networks to be used for cyber network security research, not only for Department of Defense projects but also for the Department of Homeland Security and local and state governments. This capability will be used to coordinate team exercises in terrorist attack response, disaster recovery, and cyber war scenarios for the cyber security and homeland security research and allows us to emulate activities and collect vital information on human system interaction and their responses to such stressful events.
- Funded the creation of a National Space Simulation Facility at the University of Colorado Colorado Springs. This facility will fulfill an important national need for a comprehensive space environment simulation capability and will further critical space engineering research in areas including rocket exhaust plume chemistry, which has several ballistic missile defense applications, and impact of the space environment on spacecraft materials and subsystems, all of which are relevant to Air Force and Missile Defense Agency interests.
- CHS has been part of the senior planning team for a community outreach effort called, “Up In Smoke” – a series of exercises including basic drills and a table-top activity which will culminate into a Full-Scale Exercise to be held on Oct 1, 2011, providing participants with an opportunity to implement and evaluate current Emergency Operations Plans, Mass Care Shelters Plans, as well as other plans, policies, concepts, and capabilities for a response to a large wildfire event that results in mass evacuation requiring the implementation of county mass care and medical surge capabilities.
- CHS Director Kurt Johnson and CHS Operations and Academic Programs Manager Tina Markowski continued participation as a member of the Colorado Springs Community Commemoration Committee which supported several events to mark the tenth anniversary of the 9/11 attacks. CHS, along with the STEM

- Education Center, sponsored a “Never Forget” essay contest for middle and high school students in the Colorado Springs area. Individual winners were recognized at the 9/11/11 commemoration.
- CHS Operations and Academic Programs Manager Tina Markowski participated as the Logistics Chief for the Full-scale Exercise Up in Smoke 2011 supporting Colorado Springs and El Paso County.
 - CHS employed a second-year PhD student as its Senior Researcher for Resiliency and Disaster Preparedness. She is continuing to conduct research into CHS’ concept for a National Preparedness Lab for Resiliency. As part of CHS’ participation in a local full-scale wildfire exercise, she and CHS Operations and Academic Programs Manager, Tina Markowski, developed a survey for area residents, volunteers and local medical and Red Cross staff. The survey is designed to investigate the respondents’ preparedness and resiliency to a disaster or prolonged emergency in the area. The results of the survey will indicate the respondents’ knowledge, familiarity and compliance with FEMA guidance from www.ready.gov and will serve as a pilot study for future research into community resiliency.
 - CHS Director Kurt Johnson was elected a member of the board of the Colorado Springs World Affairs Council (CSWAC), which is a non-partisan organization whose mission is to create and sustain study, discussion, and public participation in international relations. To successfully carry out its mission, the Council conducts monthly programs in which internationally renowned speakers present their views and experience on topics of worldwide importance, and answer members' questions on the subjects. Speakers generally consist of ambassadors, academics, journalists, government officials, and business professionals.
 - CHS successfully conducted the fifth and sixth in a series of six four-day Training Workshops for NORAD & USNORTHCOM covering a range of Homeland Defense and Defense Support of Civil Authorities topics. The fifth workshop, “Aerospace Warning and Control/Missile Defense” was delivered to NORAD and USNORTHCOM Headquarters personnel 19-22 July 2011. The sixth workshop, “Maritime Warning and Control/Arctic” was delivered to NORAD and USNORTHCOM Headquarters personnel 20-23 September 2011.
 - CHS participated as part of a team teaching a Freshman Seminar course entitled “25.” Taking its theme from the television show “24,” this course taught basic Homeland Defense, Homeland Security and Emergency Management via freshman-level terrorism exercises, including structured debate, paper and presentation formats.
 - CHS conducted a two-day seminar “Mexico, Border Security & Drug Cartels” facilitated by the former Director of Intelligence for NORAD and U.S. Northern Command (USNORTHCOM). The seminar explored the current situation in Mexico, the drug cartel threat, and southwest border security. Participants learned about the physical and human terrain in the region, the nature of threats to border security, and discussed policy and technical solutions to these problems. This

- seminar was the first in CHS' development of continuing education unit-based executive seminars in current issues in homeland security and defense. Future topics will include cyber security, terrorist threat financing, and the Arctic & maritime security.
- CHS participated with the UCCS School of Public Affairs in planning a new Concentration in Homeland Security for the Bachelor of Arts in Criminal Justice degree.
 - CHS Director Kurt Johnson and Operations & Academic Programs Manager Tina Markowski participated in developing a committee to propose Ph.D. course development to propose a concentration in Homeland Security under the Public Affairs Ph.D. with CU-Denver School of Public Affairs. CU-Denver SPA agreed to accept the homeland defense and/or the security intelligence certificate courses toward the concentration and begin marketing the Ph.D. program as such.
 - CHS facilitated the 6th iteration of the Seminar on Trans-Atlantic Civil Security (STACS) at the George C. Marshall Center College of International and Security Studies, Garmisch, Germany. July 2011.
 - NISSC and CHS are continuing plans to co-host with the National Homeland Defense Foundation (NHDF) the 6th Annual National Security Innovation Competition (NSIC) in 2012. The purpose of the competition is to stimulate college undergraduate and graduate student interest to address national security problem solving by exposing their university-sponsored projects to a broad audience including industry, academic, and government organizations involved in aerospace, defense, security, and first responder activities.
 - The CHS contract with NORAD and U.S. Northern Command (USNORTHCOM) to provide a series of six four-day Training Workshops for NORAD & USNORTHCOM covering a range of Homeland Defense and Defense Support of Civil Authorities topics was revised twice, first to change the subject matter of the workshops, and second to allow discussions up to the SECRET level in the final two workshops (“Aerospace Warning and Control/Missile Defense” and “Maritime Warning and Control/Arctic”). CHS Director Kurt Johnson and CHS Training Coordinator Steve Peck were granted SECRET access for those workshops.
 - CHS is analyzing the survey results designed to investigate the respondents' preparedness and resiliency to a disaster or prolonged emergency in the Colorado Springs area. The results of the survey will indicate the respondents' knowledge, familiarity and compliance with FEMA guidance (from www.ready.gov) and will serve as a pilot study for future research into community resiliency.
 - CHS Director Kurt Johnson, a member of the board of the Colorado Springs World Affairs Council (CSWAC), participated in sponsoring the “Presidents' Panel on Education and Global Competitiveness” featuring Lt General Mike Gould, Superintendent, US Air Force Academy, Bentley Rayburn, President, Colorado Technical University, Colorado Springs, Dr. Pam Shockley-Zalabak, Chancellor, University of Colorado, Colorado Springs, and Dr. Jill Tiefenthaler,

- President, Colorado College. In early 2011, the World Affairs Councils of America conducted a survey of its 92 councils across the United States, which identified Education in the U.S.: Competing Globally as the leading national security challenge facing the United States.
- CHS established its first-ever Advisory Board in November 2011. The Board is comprised of a broad range of individuals with diverse backgrounds ranging from military to law enforcement to business. CHS will look to the Board for advice and guidance as it plots its future sustainability and growth strategies.
 - CHS successfully concluded the one-year contract to provide a series of 6 four-day Training Workshops for NORAD & USNORTHCOM covering a range of Homeland Defense and Defense Support of Civil Authorities topics. NORAD & USNORTHCOM were extremely pleased with the effort, but the federal budget situation renders uncertain the renewal of this contract
 - CHS Director Kurt Johnson and Executive Director, Strategic Military, Science, Space and Security Initiatives Ed Anderson met with the NORAD & USNORTHCOM Director of Interagency Coordination to discuss possible UCCS-sponsored training workshops for members of the Interagency Directorate. These workshops would be modeled on the successful series of workshops provided through the NORAD & USNORTHCOM Director of Training and Education.
 - CHS Director Kurt Johnson and Executive Director, Strategic Military, Science, Space and Security Initiatives Ed Anderson conducted a series of meetings with the President of the National Homeland Defense Foundation (NHDF) to identify key areas of cooperation and mutual support. UCCS and NHDF are moving toward co-sponsorship in: (1) a new National Conversation Series; (2) establishing an online National Homeland Defense Library; and (3) short courses and executive seminars on various homeland defense and homeland security topics.
 - Dr. John “Jack” Clarke, Director of Studies, Seminar on Transatlantic Civil Security (STACS) at the George C. Marshall European Center for Security Studies (Marshall Center) met with Dr. Pam Shockley-Zalabak, Chancellor, University of Colorado, Colorado Springs on 31 October 2011 to discuss the future relationship between UCCS and the Marshall Center, including continuation of the STACS program.
 - CHS sponsored a brown-bag lecture “Counter-Terrorism Across the Pond: What’s Keeping the United Kingdom Awake at Night” with Mr. Brett Lovegrove, retired Head of Counter Terrorism for the city of London and Metropolitan Police Service on 03 November 2011. Mr. Lovegrove is also a UCCS instructor for the Seminar on Trans-Atlantic Civil Security (STACS) at the George C. Marshall Center College of International and Security Studies, Garmisch, Germany.
 - CHS Director Kurt Johnson, Executive Director, Strategic Military, Science, Space and Security Initiatives Ed Anderson, and University of Colorado Denver Professor Brian Gerber met with Colorado State Officials on 15 December 2011

to identify areas in which UCCS may support Colorado's intent to rewrite its five-year State Homeland Security Strategy.

- CHS Staff and Executive Director, Strategic Military, Science, Space and Security Initiatives Ed Anderson met with UCCS Fort Carson representatives on 29 December 2011 to discuss expanding CHS Homeland Defense and Homeland Security educational offerings at Fort Carson.
- Associate Director Tina Markowski and Training Program Coordinator Steven Peck participated as the Logistics Chief and Logistics Support respectively for the full-scale exercise, Up in Smoke-2011, supporting Colorado Springs and El Paso County on 01 November 2011.
- Training Program Coordinator Steven Peck attended five separate Joint Inter-Agency Coordination Group (JIACG) events at USNORTHCOM.
- Training Program Coordinator Steven Peck attended the Colorado Advisory Council on Military Education (CO- ACME) conference on 14 October 2011.
- Director Kurt Johnson and Training Program Coordinator Steven Peck met with UCCS Public Safety and Student Response Team (SRT) to support and expand the First Aid Survival Techniques (FAST) program.
- CHS Director Kurt Johnson submitted the first draft of a chapter for the American Bar Association (ABA) book, *A Journalist's Guide to National Security Law* entitled *The Use of the Military in the Homeland*. The objective of the book is to provide journalists (and others) with a "scenario-based" set of chapters that they can use as a ready resource to examine important national security law issues.

CENTER FOR HOMELAND SECURITY "Looking Forward"

The Center for Homeland Security (CHS) has developed detailed plans for sustainability in Fiscal Year 2012 and beyond. These plans include a diversified portfolio of federal contracts, research grants, expansion of traditional and non-traditional education programs, and philanthropic donations.

Currently, CHS has several non-AFOSR revenue-generating programs. First, CHS teaches a series of graduate and undergraduate certificate programs. The Center continues, in conjunction with the UCCS School of Public Affairs at UCCS, to teach the Graduate Certificate in Homeland Defense, originally developed under contract, for the North American Aerospace Defense Command (NORAD) and USNORTHCOM. Additionally, CHS currently teaches an Undergraduate Certificate in Homeland Security geared toward enlisted military personnel and emergency responders, and a Graduate Certificate in Security Intelligence conferred by the UCCS School of Public Affairs. Additionally, The CHS teaches the Undergraduate/Graduate Certificates in Disaster Public Health which is delivered by Beth-El College of Nursing and Health Sciences faculty from UCCS. These courses net approximately \$90K per year for CHS.

Using the 4-course homeland defense program as the foundation, CHS developed the Seminar in Transatlantic Civil Security (STACS). Since 2008, CHS has taught and facilitated five separate three and one-half week STACS programs at the George C. Marshall European Center for Security Studies in Garmisch-Partenkirchen, Germany. Approximately 45 mid- to senior-level military and civilian professionals from approximately 32 nations participate in each STACS program. Using lectures, seminars, workshops and exercises, STACS is designed to educate professionals from civil security agencies in Europe, Eurasia and around the world in best practices for ensuring civil security and preventing, preparing for and managing the consequences of domestic and regional crises and disasters. STACS nets approximately \$26K per year for CHS.

Engaging in national and international programs and homeland security exercises has increased the use of the VTC equipment significantly. CHS staff uses the VTC to coordinate team exercises with simulated terrorist attack response, engage in disaster recovery, and contribute to the realism of cyber security and homeland security research. In addition, the VTC equipment is used by CHS and UCCS staff and faculty for other meetings as needed.

Recently CHS, under contract, delivered a series of four-day training workshops to NORAD-USNORTHCOM personnel. Training workshop topics include: (1) The Threat of Terrorism; (2) Interagency Relationships; (3) Mexico, Border Security and Transnational Criminal Organizations; (4) CBRNE Consequence Management; Cybersecurity; (6) Aerospace Warning and Control & Ballistic Missile Defense; and (7) Maritime Warning & the Arctic. The workshops are built around the NORAD-USNORTHCOM Commander's "Focus Areas" and are designed not only to educate and train the USNORTHCOM workforce, but also to offer solutions to greatest challenges. This program nets approximately \$18K per year for CHS.

In the out years, CHS plans to broaden and diversify its revenue-generating programs in order to achieve long-term sustainability. Efforts underway include marketing CHS education and training programs nationally, expanding international education and training programs, expanding non-credit short courses and executive seminars, and growing and maturing research and grant-writing capabilities. CHS' long-term strategy is to be recognized worldwide as a preeminent leader in homeland security education, research and innovation.

Further, expansion of online and onsite CHS graduate and undergraduate certificate programs will include not only increasing enrollment through wider and more effective marketing, but also creation of new certificates such as in the world of cyber security. CHS' goal is to drive to \$150K net per year within five years.

The STACS contract with the George C. Marshall European Center for Security Studies expires in 2012. We believe that the Marshall Center fully intends to continue the STACS program through a new multi-year contract, as it is the most successful and most popular of all of the Marshall Center programs. Due to its superb past performance,

CHS is well-positioned to be awarded the new contract, which is predicted to be a \$100-300K per year multi-year contract. CHS would net approximately \$25K-75K per year.

Similarly, the CHS -NORAD contract, providing a series of training workshops for NORAD and USNORTHCOM personnel, expired in 2011. We understand that NORAD and USNORTHCOM intend to continue the workshop series with a new multi-year contract. Again, due to its superb past performance, CHS is well-positioned to be awarded the new contract, which is predicted to be a \$200K per year multi-year contract. CHS would net approximately \$25K per year.

CHS is a potential subcontractor for the NORAD and USNORTHCOM Technical and Advisory Support Services (TA2S) contract, under which NORAD and USNORTHCOM receive a wide variety of services, including training and education programs. CHS would net \$50-200K under this contract.

Sensing a new trend in homeland security education, and a growing demand from working professionals, CHS plans to move heavily into the world of non-credit short courses and executive seminars. Under a recently conducted pilot project, CHS sponsored a two-day short course "Mexico, Border Security & Drug Cartels" which generated modest net revenue for CHS, but proved the value of such short courses. CHS projects gross revenue of approximately \$50-75K per year as this program builds.

To round out its portfolio, CHS is making significant strides to rebuild its research capabilities and associated grant-generating efforts. As part of this mission CHS is seeking to expand both its research capacity and its community outreach by establishing a National Preparedness Laboratory for Resilience. A resilient community is one that bounces back from a disaster--it bends, but doesn't break. Cultivating resilience is a function of economic development, social capacity, civic and political partnerships, and a strong communication network. CHS aspires to capitalize on the research and intellectual capacity within the NISSC's four centers (Center for Homeland Security, Center for Space Studies, Center for Science, Technology, Engineering and Mathematics Education, and the Trauma, Health and Hazards Center) as well as its relationships and experience within the emergency management and military communities. These resources ideally position CHS for cutting-edge local and national-level research on community resilience.

The first step in this process is to demonstrate the capability for applied research and the need at the local and national level for this research. In fall 2011, CHS participated in a full scale wildfire response exercise in the Colorado Springs area. In partnership with the Office of Emergency Management for Colorado Springs and other area partners, CHS will lend its expertise to the exercise. Concurrent with the exercise, CHS will deploy a survey to area residents, volunteers, and local medical and Red Cross staff. This survey will investigate the respondents' preparedness and resiliency to a disaster or prolonged emergency in the area and it will complement other national, state and local surveys to maximize potential comparisons of the Colorado Springs respondents with other communities. The results of the survey will indicate the

respondents' knowledge, familiarity and compliance with FEMA guidance at www.ready.gov. Similar surveys have indicated that less than 15% of the population is prepared for disasters or emergencies of a prolonged nature. Identifying the information, knowledge and training gaps in our community and first responders is a first step to improving civilian preparedness and resiliency in the wake of a natural or man-made disaster. The fall 2011 exercise and associated research is part of a larger effort to understand community preparedness across the spectrum from individual, to community, to national resiliency.

Recently, CHS added a PhD student to its research staff. The PhD student will lend expertise to the development and expansion of the National Preparedness Laboratory for Resilience. CHS anticipates significant grant funding to support this effort, coming predominantly from the Department of Homeland Security (DHS). Additionally, CHS intends to bring aboard at least two additional Associate Research Professors who will be dedicated to research and grant-writing as part of the larger National Preparedness Laboratory for Resilience effort. Finally, CHS has a four-year \$400K proposal pending with DHS to conduct research as a Center for the Study of Terrorism and Behavior (CSTAB) partner.

The recent addition of the National Space Simulation Facility has significantly increased the University research capacity. This facility is “one of a kind” and it fills an important national need for a comprehensive space environment simulation capability. Additionally, it will further critical space engineering research in areas including rocket exhaust plume chemistry and impact of the space environment on spacecraft materials and subsystems. Current research at UCCS involves the interactions of the space environment with engineering materials and systems. Numerical codes are currently used to predict the performance of materials in the near-Earth space environment. Because of the complexity of providing a facility that can provide simultaneous environments, experimental data in this area is non-existent. Experimental validation of numerical methods is required to assess the accuracy of the physical models incorporated in the numerical codes.

The recent upgrade of the Blade server has significantly increased the research and teaching capabilities for the Engineering and Applied Science faculty and students on the UCCS campus. The Blade server includes a VMware vSphere platform with a 401W n+1 UPS, 24X7 datacenter in six dense rack environments. This equipment not only has expanded research capabilities but it has increased CHS's ability to enhance research collaborations with military and government agencies. The Blade server resides in the newly constructed LEED gold certified Osborne Center on the UCCS campus.

In summary, CHS has a bright future with many opportunities for sustainability. Many of the components for a successful future are in place as a foundation. We plan to build on the CHS foundation and continue to move forward with many of the aforementioned initiatives.

CENTER FOR SCIENCE, TECHNOLOGY, ENGINEERING, & MATHEMATICS EDUCATION (CSTEME)

The primary efforts of the Center for STEM Education (CSTEME) have been related to performing and managing the Partnership in Innovative Preparation for Educators and Students program (PIPES), a sponsored project also funded by the Air Force of Scientific Research (AFOSR) (FA-9550-07-1-0188 and FA-9550-09-1-0713) and its programs, research, and evaluation in applying a systemic and replicable elementary through high school STEM program to ultimately increase the number of students majoring in STEM disciplines. However, all of the CSTEME efforts seek to respond to the looming shortage of skilled science, technology, engineering and math workers and the lagging performance of students in science and math through innovative and supportive partnerships with parents, educators and professionals. Below are selected highlights and successes within CSTEME during the award.

Successes in 2006-2007

- Key faculty and administration team formed to support PIPES, hired full-time Center Director, David Khaliqi, and UCCS Professor, Dr. Gene Abrams, as PIPES Faculty Associate.
- Key networking contacts developed to implement the CSTEME and PIPES programs, and other educational initiatives.
- Provided recommendations to NASA to increase interaction between International Space Station astronauts and K-12 students; conducted panel moderation in support of pursuing careers in STEM disciplines.

Successes in 2007-2008

- Developed Saturday Science partnership with Harrison School District 2. Working on evaluation using framed constructed response questions to demonstrate problem solving and writing improvement.
- Awarded five PIPES mini-grants to local PIPES project teachers to support innovative classroom uses of technology and engineering.
- CSTEME Advisory board established.
- Partnership with D11 STEM magnet school formed, discussed school planning, served on the curriculum committee and the higher education committee.
- Worked with College of Education (COE) to evaluate STEM related programs in the context of culturally relevant teaching and its effect size on student interest and performance in STEM subjects.
- Work on NGA STEM grant with meetings scheduled in 7 cities in the Pikes Peak region; conducting site visits for the Colorado STEM Compact grant through the NGA for the development of an asset map and gap analysis related to STEM education.

- Planned, coordinated, and delivered the first PIPES Science Educator Academy, which served 23 teachers, with a waitlist, from around the state with all content areas staffed.
- Launched the Pipeline Partnership with 4 D11 schools to integrate hands-on science activities in 4th-5th grade classrooms and assist teachers in the development of the programs along with industry volunteers working in classrooms.
- Partnered with the Pre Collegiate Development program (PCD) at UCCS to develop and implement STEM related programming in the PCD programs for both parents and students. This partnership expanded to include more than 300 middle school students in the Pikes Peak region.
- Evaluated student perceptions related to the difficulty and accessibility of science and math opportunities and areas of study.
- Conducted and participated in various discussions and meetings with local principals, superintendents, and curriculum support personnel related to professional development opportunities and projects.
- Corporate funding secured from Boeing and Agilent for teacher stipends and professional development costs.
- Continued to explore best methods of long term sustainability of the CSTEME and how to replicate the PIPES program regionally and nationally.
- Explored grant possibilities to fund a mobile science lab for rural elementary teachers similar in concept to the libraries book mobile. The goals were to develop this into a sustainable, revenue generating enterprise.
- Conducted 3 Saturday Science enrichment events reaching over 150 middle school students.
- Established Pipeline Partnerships with 8 elementary schools serving over 60 students in the Colorado Springs area.
- Initiated a pilot partnership with Otero Junior College and the Santa Fe Trails BOCES to collaborate on a Science/Math resource center to support professional development and material resource support.
- Planned and conducted the first 2 day STEM workshop called “STEM In Real Life” for 7th and 8th graders, reaching 180 middle school students with hands on STEM related activities facilitated by industry and military professionals.
- Began planning of Teacher Circles for math professional development and data collection on the efficacy of problem based inquiry methods on student understanding and perception of math. Sent the math teacher circle team to the American Institute of Mathematics workshop on running teacher circles for math teacher.
- Planning began on the science symposia related to current topics in life science and providing teachers with resources to teach these topics in an inquiry based manner

while gathering data on the effect size that teaching current research has on student perception of a subject.

- Secured the funding and time for Sally Ride to attend the first Sally Ride science festival in September, 2008.
- Evaluated the Pipeline Partnership program in elementary schools.
- Established partnership with Mad Science for future events.
- Conducted evaluation of student perceptions of STEM related subjects through PIPES programs and evaluation of inquiry based methods on student interest in STEM related disciplines.

Successes in 2008-2009

- Completed consolidation of all student perception surveys of PIPES programming.
- Collaborated with Cool Science to develop an elementary grade outreach program by finalizing the outcomes and expectations. Also, expanded the partnership with the UCCS Pre Collegiate Development program to work with 150 students per grade level.
- Pikes Peak Math Teacher Circle and PIPES Science Educator Academy started in June 2009.
- Developed the FLITE model for 9th grade PIPES students, which started in June 2009.
- Begin contacts and planning to implement the PIPES replication program in Pueblo, CO and La Junta, CO.
- Hired a Professional Research Assistant (PRA) for PIPES research. Also hired a graduate student research assistant to collect data.
- Finalized the PIPES research methodology to begin an evaluation study of existing programs by identifying three test school sites and one control school.
- Co-authored STEM proposal submitted for additional PIPES funding to NSF in the FALL of 2009.

Successes in 2009-2010

- Formalized the “parental consent” form to see Institutional Review Board (IRB) approval.
- Formalized the processes to develop a model on securing school district partnerships.
- Continue with instrument development and psychometric for outcome evaluations.
- Expanded the UCCS and NISSSC Fall Science STEM Festival to include Cool Science (a local company), and attracted over 2,000+ participants to the festival.
- Developed and facilitated the “Toxic Plum” scenario in conjunction with the NISSSC’s Center for Homeland Security.

- Expanded the academic year programs, specifically “Mind Quest” and offered it to additional local schools.
- Prepared and submitted Eagle Valley School District Math Science Partnership grant for teacher math circle development. Subcontract award granted.
- Finalized math teacher participant informed consent and surveys for UCCS IRB submission.
- Finalized the science teacher participant informed consent and surveys for UCCS IRB submission.
- Began student data analysis on data collected in spring and fall 2009.
- Expanded STEM high school program offerings and curriculum.
- Administered and collected over 400 student surveys related to program effectiveness and student self-efficacy related to science study.
- Administered and collected over 60 teacher surveys who participated in CSTEME programs.
- Developed and implemented the access and observation of student records to follow student academic progress and testing.
- Developed and implemented, in collaboration with NISSSC’s Center for Homeland Security, the Near Earth Object (NEO) Collision scenario for PIPES high school students. This scenario allows students to explore multiple STEM topics in the context of a scenario around the topic of an imminent collision of an asteroid with earth.
- Developed PIPES College Preparation and Readiness (CPR) program that will allow PIPES students the opportunity to take online courses designed to specifically address and remediate student content deficiencies in pre-calculus and literacy.
- Submitted a proposal to BroadCom to support the FLITE program (funded for \$51K).
- Submitted a second proposal to USAFA for the Mind Quest program (funded for \$60K).

Successes in 2010-2011

- Implemented online survey methodology for teachers.
- Implemented online survey methodology for students.
- Finished 3rd Cohort of PIPES Educator Academy teachers – 18 participants, produced 18 original science units to share with other cohort participants.
- Conducted the psychometric analysis on the Science Attitudes Survey (SAS) created by PIPES.
- Administered 442 Annual Post Surveys to 6th -12th grade PIPES Students , with a 38% response rate

- Transitioned survey administration to an online format.
- Collected demographic, pre-event attitude survey data, and post event survey data on 65 middle school students from rural Colorado.
- Enrolled 366 new PIPES students.
- Enrolled 30 new PIPES educators.
- UCCS IRB approved renewal of PIPES Students and PIPES Teachers research protocols.
- Administered annual post and summer program surveys to PIPES Science and Math Teachers.
- Administered NEW PIPES teacher surveys, observations and interviews.
- UCCS IRB approved protocols for replication site OJC (Otero Junior College). The preliminary results from the site at OJC. Students at this site reported greater interest in science when students attended PIPES STEM events at UCCS. Girls reported significantly greater increases in their motivation for science than did boys.
- Established relationship with 4H southern Colorado region. Provided train the trainer for Robotics curriculum on Saturday Jan 22, 2011. Intent to develop further involvement with 4H student groups around Colorado.
- Established new relationship with a homeschool student group. Provided Robotics training to 6 students on Jan 3, 2011.
- Created new workshop called “The Chemistry of Taste and Smell”, which involves making artificial flavors out of house hold items and creating a fragrance. Presented it to 179 middle and high school student over 4 days.
- Developed new workshop, “Biotechnology”, which involves DNA extraction (self/strawberry) and DNA fingerprinting using electrophoresis. Presented it to 154 middle and high school students over 4 days.
- Facilitated UCCS/EAS involvement in Engineering Symposium at Sand Creek High School.
- The PIPES curriculum from six workshops (Kitchen Chemistry, Rockets, Robotics, Biotech, Crime Science Investigation, and Computer Game Design) was used for a one day middle school STEM camp organized by Otero Junior College in La Junta, CO.
- Middle and high school camp enrollments grew by 38% from previous year.
- Submitted proposal: Transitioning Pre Engineering and PIPES Students Into Engineering Majors and UCCS – NSF, \$900K budget; however, the proposal did not receive funding.
- Submitted proposal: K-12 Immersion Research Project: A Multi-Institutional Collaboration to Increase STEM College Readiness and STEM Workforce Development. – NSF, \$2.9 million; however, the proposal did not receive funding.

- Prepared and submitted proposal: Saturated in Science: Testing the Efficacy of Immersive, Experiential Learning in a Randomized Control Trial – NSF, \$1.86 million. The proposal did not receive funding.
- Prepared and submitted proposal: Project CE21: A Novel Approach to Infusion of Computational Knowledge into Secondary School Curriculum – NSF, \$996K; however, the proposal did not receive funding.
- Prepared and submitted proposal: Office of Naval Research – iCreate: Girls in Computer Science - \$220K. Performance period: Fall, 2011-Summer, 2012. Did not receive funding.
- Enrolled 67 new PIPES students.
- UCCS IRB approved a new partnership replication site with Fountain-Fort Carson School District 8 in which PIPES will be evaluating site-based afterschool STEM programs for middle and high school students
- Prepared PIPES STEM program evaluation reports for Industry and University Partners: (1) FLITE Alternative Energy STEM camp for partnering agency SHaRK (Cornell and California Institute of Technology); (2) STEM in Real Life & FLITE Computer Game Design STEM camps for partnering agency AVITURE; (3) STEM in Real Life 1-day camp at a replication site for partnering University, Otero Junior College, “Out of School Time (OST) STEM Education Workshops for Middle School Students: A Summary of Results by Gender for a Rural Replication Site”; and (4) Jumpstart STEM camp for prospective replication partner, Milton Hershey School.
- Presented research to School Science and Mathematics Association (SSMA) 2011 conference: (1) "Impact of Repeated Exposure to Inquiry-Based STEM Educational Workshops on K-12 Students"-Lisa Decker; and (2) “Influence of Parental Involvement by Gender on Student Outcomes in STEM”.
- Presented research to American Educational Research Association (AERA) 2012 conference: (1) “Implementing Reform-Based Changes in Math Teachers: An Evaluation of a Math Teachers’ Circle Program”-PIPES Research Team; and (2) “Improving Science Teachers’ Self- Efficacy: An Evaluation of an Inquiry-Based Professional Development Academy”-PIPES Research Team.
- Delivered Jumpstart Chocolate Science Investigation (2011) curriculum recipe to the Milton Hersey School in Hersey, PA and Eastern Connecticut State University in Willimantic, CT for replication this next summer (2012).
- STEM workshops offered by CSTEME are 75% complete in conversion to CDIO curriculum format. They also include state standards mapping and costs per student.
- Successfully used the CISCO Telepresence equipment to include our Pikes Peak Math Teachers Circle cohort with math teachers from the Arkansas Valley Math Teacher Circle at Otero Junior College. This is the first step in changing our teacher professional development model to more technology based delivery system.

- New CSTEME blog created and started to help facilitate communications with our STEM community and link us with other STEM communities.
- Conducted the Industry and Education Annual briefing in November 3&4, 2011.
- Worked with local software company, CodeBaby and the Cool Science Organization to develop and produce the MindQuest 3-D Animation workshop for Middle and High school students.
- Partnered with community organizations to grow the Cool Science Festival from 1 day last year to 8 days this year, with over 63 different events hosted around the Pikes Peak region during the week of October 15 – 23, 2011. As part of the festival, CSTEME and UCCS hosted nearly 5,000 community members at UCCS for the Cool Science Festival Carnival Day, involving over 105 different hands-on activities hosted by over 80 different organizations.
- As part of the Cool Science Festival, worked with community leaders to bring 320 middle school girls to UCCS for the Girls STEM event on October 21, 2011. Provided 22 different STEM activities.
- Worked with the Marine Advanced Technology Education (MATE) Center and Underwater connections to design and produce a “Science of Scuba”, “Underwater Robotics” and “Physics of Sports” workshops for 140 Middle school students on December 8th and 9th.
- Presented a Robotics Train-the-trainer session for teachers from the Colorado Springs School on Saturday, December 10th.
- Prepared and submitted proposal to NSF: Saturated in Science, \$1.9M, 10/12 to 9/16, which was not funded.
- Submitted proposal to Daniels Fund: Inquiry Science Certificate, which was not funded.
- CSTEME was awarded \$268,359 from the Anschutz Foundation for the expansion of PIPES workshops in the classrooms of District 8, Fountain/Fort Carson school district and rural school districts in southeastern Colorado. This funding allowed CSTEME to expand STEM programs to 150 additional students from underserved regions. These additional PIPES students will be enrolled in the research model allowing us to understand with greater reliability what is needed to better retain students in STEM areas of study and profession, especially in military and rural contexts.

CENTER FOR STEM EDUCATION “Looking Forward”

CSTEME offers an array of programs for students from regional middle and high schools that provide participants opportunities to explore careers in STEM fields. Over 1,000 students and 100 teachers have been introduced to innovative courses and hands-on workshops that challenge their minds in a creative and energetic atmosphere. Underlying all PIPES activity is a solid evaluation framework aimed at measuring student

interest and retention in STEM subjects through longitudinal tracking of students from 6th through 12th grade and through following teachers who have completed PIPES professional development programs for 3 years. PIPES researchers collect and analyze both qualitative and quantitative data from students, teachers, and parents related to PIPES program effectiveness in stimulating interest in STEM subjects and long-term attraction and retention in STEM careers. Changes in student attitudes, career interest, intention, retention, and academic achievement in STEM subjects are evaluated. The results of this research will provide crucial guidance in developing STEM education programs that effectively and measurably increase student engagement, performance, and retention in STEM subjects from 6th through 12th grades. Longitudinal research of this scale is very rare and is necessary to adequately address the STEM pipeline shortage facing our nation. The outcome will inform other ongoing STEM education research projects and will provide guidance to educational and policy leaders.

CSTEME Model Development

CSTEME has developed national models supporting STEM academic resilience in students, teachers, and parents through STEM explorations and educational research. The core functions of research and curriculum produce three primary areas of center expertise and action (Figure 1):

1. STEM Student Explorations (Student Programs)
2. STEM Teacher Professional Development
3. STEM Educational Resilience Research (Research Contracts)

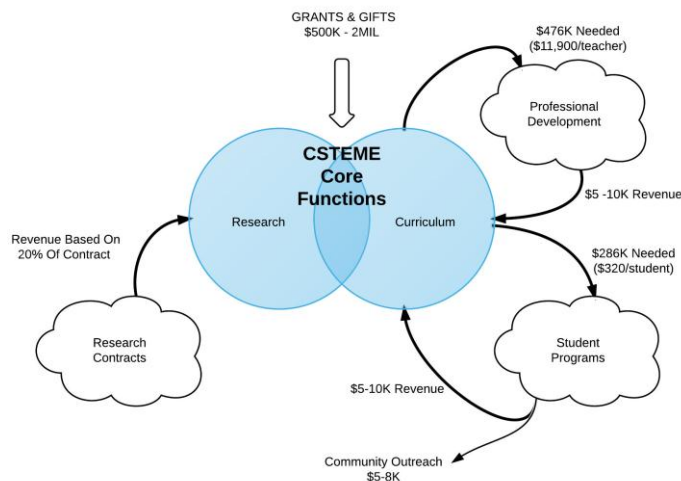


Figure 1

STEM Student Explorations (Student Programs)

The revenue model to support the student programs is based on a subscription, fee for service model in which families will choose from 3 price structures based on the number of student programs they wish to attend. These price structures are:

1. Unlimited: \$560/student. Students may attend all CSTEME programs for 1 calendar year which includes 2 week-long summer camps and a monthly STEM workshop during the school year (6 total).

2. Limited: \$490/student. Students may either attend up to 2 summer camps or the 6 school year workshops.

Market share will include grades 3-10. Based on the current number of students enrolled in the PIPES project (1200), this revenue model will yield between \$588,000 to \$672,000 assuming no student attrition from the current model. Attrition is a reasonable expectation because of the increase in participation fees. Revenue yield based on several attrition models include:

1. 25% student attrition (900 students) – between \$441,000 to \$504,000
2. 50% student attrition (600 students) – between \$294,000 to \$336,000
3. 75% student attrition (300 students) – between \$147,000 to \$168,000

The break-even point to support student programs is \$286,000 meaning the price structure can absorb 50% attrition to cover the costs of the programs.

STEM Teacher Professional Development – The STEM Inquiry Certificate

The revenue model that will sustain the CSTEME professional development programs will be based on a certificate in STEM Inquiry Teaching. The content of the certificate will be delivered using online methods and social media tools. Curriculum will be developed based on the integration of science content, appropriate uses of educational technology, engineering education, and applied mathematics concepts. Participants will enroll for the certificate through the UCCS Campus Wide Extended Studies and Continuing Education Units will be offered for the course work. Corporate underwriting will be sought to support the equipment and supply costs. Participants will pay \$250 tuition for the course. Target enrollments will be 90 participants yielding \$14,700. The teacher professional development courses will require subsidy from various sources to be a viable revenue source for CSTEME. These subsidies will include:

1. \$50,000 for technology and supplies
2. \$80,000 for personnel and overhead

STEM Educational Resilience Research

The initial PIPES work established a rigorous research model that will be used to evaluate other STEM outreach programs on a contract basis. Contracts based on a fee for service model will be developed with organizations inside and outside the UCCS system that engage in STEM outreach but lack the ability and expertise to conduct sophisticated program efficacy research. Contracts will be established that cover the cost of the researcher, graduate students, and publication costs. Additionally, a 20% markup will be included in the contract to cover CSTEME overhead and costs. Projected revenue will initially be small (approximately \$1200 to 1800 per project), but will be developed to scale up to a larger revenue stream of \$5 to 10K per project which will yield a cache of unrestricted funds that will be used to support other CSTEME programs.

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Other Papers and Presentations from the CSS

- White Paper entitled, “Emergency & Incident Management Systems Research” (USAFA-BAA-2009-1). USAFA Contracting subsequently issued CSS a Request for Proposal estimating a \$40K effort.
- Presented “Education & Research at UCCS: Opportunities for Space & Cyber Professionals” to a meeting of the Association of Old Crows at Peterson AFB, CO.
- Participated in the 2010 Air Education and Training Command (AETC) Symposium in San Antonio, TX. CSS Director spoke on a panel entitled, “Educational Implications of Teaching Space as a Contested Environment”. The panel addressed the educational implications of approaching the space domain as an environment in which operations are contested, not only by other space-faring nations, but by the space environment, debris, and overcrowding in orbits and frequency applications.
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- Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report. (February 27, 2007). Dengue Hemorrhagic Fever at the Texas_Tamaulipas Border.
- League, C.E., B. Philips, E.J. Bass and W. Díaz. (2012) Tornado Warning Communication and Emergency Manager Decision-Making. Seventh Symposium on Policy and Socio-Economic Research of the AMS 92nd Annual Meeting in New Orleans, LA.
- Philips, B.J., V. Chandrasekar, F.H. Carr, J. Brotzge, P. Rees, C.E. League, & A. Bajaj (2012). Presented at the AMS 92nd Annual Meeting in New Orleans, LA.
- Philips, B., C. League, J. Brotzge, & E. J. Bass (2012). Emergency Manager Use of High Resolution Radar Data During the May 24, 2011 Oklahoma Tornado Outbreak: A Lesson Socio-Technical System Design. AMS 92nd Annual Meeting, 22-26 January 2012 in New Orleans, LA.
- Slattery, M. Veteran Trauma Court Outcomes & the Role of Domestic Violence. Presentation at the 10th Annual Domestic Violence Summit, 5 October 2011, in Fort Carson, Colorado.
- Slattery, M., Dugger, M. and Williams, L. The Colorado Veteran Trauma Court: Challenges in Evaluating a Jail Diversion and Trauma Recovery – Priority to Veterans Grant. Poster presented at the American Evaluation Association Annual Meeting, 2-5 November 2011, in Anaheim, California.
- Spiro, Emma S., Carter T. Butts, Jeannette Sutton, Matthew Grezcek, Nicole Pierski, & Sean Fitzhugh (2010). "Rumoring During Extreme Events: Deepwater Horizon 2010" Political Networks Conference, Ann Arbor, Michigan.
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Other Papers and Presentations in CHS

- White Paper (2009). USAF Emergency and Incident Management Systems: A Systematic Analysis of Functional Requirements.
- White Paper to AFSPC: Robilard, J., & Sambrook, R. (2008) USAF Emergency and Incident Management Systems: A Systematic Analysis of Functional Requirements.
- White Paper to USAF (2009). Regional Training Facility. Currently being circulated within USAF
- White Paper for AFOSR Faculty Research Fellowship program (1st step of application process).
- White Paper (2009): \$3.3 million Academic Dimension to National Guard State Partnership Program. Interest expressed, but not ready at this time.
- White Paper (2009): \$1.3 million NORAD-USNORTCOM International Center of Excellence (ICOE). In progress.
- White Paper (2009): NORAD-USNORTHCOM Academic Colloquium. Concept approved.
- White Paper (2009). \$250 thousand. Internet Reliability Study. Concept approved.
- White Paper: Pierce, T. (2007). Disruptive Innovation and the Defense Industrial Base
- White Paper: Haefner, J. (2007, February). Innovation in Homeland Defense/Security Education” (HLS Education Summit, Feb 07)
- White Paper: White, R. (2007, February). Game-Informed Learning for Homeland Defense Curricula.

- Presentation: Cain, W.A. (2008). *Homeland Security/Homeland Defense and future Intelligence Courses at UCCS*, Terrorism III Course, Presented at the Governor's Office of Emergency Services, San Diego, CA.
- Presentation: Hughbank, Richard (2008). Bicoastal Counterterrorism Seminar, Panel Presentation at San Diego State University, CA.
- Presentation: Johnson, K. (2009). *Homeland Security Law and Strategy*. Presentation to Seminar on Trans-Atlantic Civil Security (STACS) at the George C. Marshall Center College of International and Security Studies, Garmisch, Germany. Press Club, Washington, D.C., on a chapter he authored, *Legal Issues in the Struggle against Terror* in the edited book entitled: *The Relations between Military and Civilian Authorities within the United States*. Presented at the National Press Club, Washington, D.C.
- Presentation: Keilbach, P. (2008). *International Civil Support*. Presentation at the International Studies Association (ISA) Annual Conference, New York, NY.
- Presentation: Kesebir, P. & Pyszczynski, T. (2010, May). *Disruption in normal anxiety-control mechanisms brought on by trauma exposure*. Paper presented at the annual convention of Association for Psychological Science, Boston, MA.
- Presentation: Kesebir, P. & Pyszczynski, T. (2010, May). *Using priming to assess effects of real world events on political attitudes*. Poster session presented at the annual convention of Association for Psychological Science, Boston, MA.
- Presentation: Kesebir, P., Chiu, C-Y. & Pyszczynski, T. (2010, April). *Perceptions of sacredness help to manage death anxiety*. Talk presented at the annual convention of Rocky Mountain Psychological Association, Denver, CO.
- Presentation: Kuehler, C., Cryer, L., & Sambrook, R. (2010, April). Poster presentation: *Using an emergency management scenario for fostering resilience and encouraging students' interest in STEM fields*. Mountain Lion Research Day, University of Colorado Colorado Springs, Colorado Springs, CO.
- Presentation: Markowski, T. (2010, February). *Homeland Security/Defense Certificate Program Review*. Homeland Security Defense Education Consortium, Washington D.C.
- Presentation: O'Shea, A., Ketsdever, A., Mulcahy, T. & Song, H. (2010). *TeraHertz rayleigh scattering of particles in rocket exhaust plumes*, AIAA paper 2010-4330, 10th Thermophysics and Heat Transfer Conference, Chicago, IL.
- Presentation: Sambrook, R. (2010). *Mental models influencing the efficacy of computer-based emergency management*. Presentation at the Association for Psychological Science Annual Meeting in Boston MA.
- Presentation: Markowski, T. M. & Sambrook, R. (2009). *Perception of Workforce Requirements in Homeland Security and Homeland Defense*, Presentation at the University of Colorado at Colorado Springs, Mountain Lion Research Day, Colorado Springs, CO.

- Presentation: Mulcahy, T, H. Song, O’Shea, A., & Ketsdever, A. (2010). Large orbit electron gun for a high-order harmonic terahertz radiation source. 37th European Physical Society Conference on Plasma Physics, Dublin, Ireland, June 2010.
- Presentation: White, Richard (2008). *Applying Counterinsurgency Doctrine to Cyber Warfare*. Presentation at George Washington University, HSDECA Summit.
- Presentation: CHS Training Program Coordinator Steve Peck participated as a Guest Panelist five times for the Transition Assistance Program (TAP) and Moving Ahead with Purpose (MAP) programs assisting military personnel in their transition from military to civilian life at the U.S. Air Force Academy.
- Presentation: CHS hosted and facilitated a Mil-2-Biz event for Homeland Security Careers. Panelists including Mr. Joseph Ruffini, Mr. Mike Noll, Dr. Scott Trimboli and Steve Peck discussed current trends in Homeland Security education.
- Presentation: CHS Training Program Coordinator Steve Peck supported Center for STEM Education by participating in a week-long science program for middle school children.
- Presentation: CHS Training Program Coordinator Steve Peck supported UCCS Recruiting efforts by participating in a US Air Force Academy Education Fair.
- Presentation: CHS Director Kurt Johnson, Adjunct Instructor Mike Noll, and Strategic Military, Science, Space and Security Initiatives Executive Director Ed Anderson in partnership with UCCS media department participated in taped and aired round-table discussion of “The 9/11 Anniversary: Looking Back & Looking Ahead.”
- Presentation: Trng. Pgm. Coord. Steven Peck participated as a guest panelist for the Transition Assistance Program (TAP), assisting military personnel in their transition from military to civilian life at the US Air Force Academy.
- Presentation: CHS staff attended and hosted a sponsorship table at the Nat’l Homeland Defense Foundation Symposium 31 October – 02 November 2011.
- Presentation: Associate Director, Tina Markowski presented “Writing as a Collaborative Effort” at the School of Public Affairs authors’ panel on November 10, 2011.

Presentations and Poster from CSTEME

Decker, L. (2011). Impact of repeated exposure to inquiry-based STEM educational workshops on K-12 students. Presented at the School Science and Mathematics Association National Convention in Colorado Springs, CO.

- Fitzpatrick, K. (2011). Getting girls to blossom from the STEM up. Presented at Colorado Science Conference in Denver, CO.
- Khaliqi, D. (2011). Students saving the world – Using scenario based learning to deepen student engagement. Presented at the School Science and Mathematics Association National Convention in Colorado Springs, CO.
- Khaliqi, D. (2011). Unleash your inner inventor - Exploring the amazing uses of an Arduino microcontroller. Presented at Colorado Science Conference in Denver, CO.
- Marle, P. (2011). Influence of parental involvement by gender on student outcomes in STEM. Presented at the School Science and Mathematics Association National Convention in Colorado Springs, CO.
- Robotics on the Cheap (2010). Paper presented at the Colorado Science Educators Conference.
- An understanding of the physics and geology concepts and their relationships to stream channel processes (2010). Paper presented at the Geological Society.
- Scenario based learning and its effects on student STEM retention (2010). Paper presented at the International STEM Education Conference.
- Marle, P., Kuehler, C., Decker, L. Khaliqi,, D & Abrams, G. (2010). Meteors, robots, crime scenes and chocolate: How PIPES uses innovation and imagination to grow students from the STEM Up. A poster presented at Mountain Lion Research Day @ UCCS.
- Grassman, D., Marle, P., & Decker, L. (2010). Psychometric properties of the PIPES science outlook survey (SOS). Poster presented at Colorado Springs Undergraduate Research Forum, USAFA, CO.