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6. AUTHOR(S) William E. Ayen				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) University of Colorado at Colorado Springs 1420 Austin Bluffs Parkway P.O. Box 7150 Colorado Springs, CO 80933-7150			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Air Force Office of Scientific Research Suite 325, Room 3112 875 Randolph Street Arlington, VA 22203-1768 <i>Dr Robert Herklotz</i>			10. SPONSORING / MONITORING AGENCY REPORT NUMBER AFRL-SR-AR-TR-06-0443	
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13. ABSTRACT (Maximum 200 Words) The grant was instrumental in establishing the Network Information and Space Security Center (NISSC) at the University of Colorado at Colorado Springs. NISSC has supported the U.S. Northern Command (USNORTHCOM) since it was established by providing research and academic programs that aid the command in meeting mission requirements. Over 40 faculty and over many graduate student research project were supported. This lead to theses, dissertations, funded research proposals, and multiple publications. The NISSC and several of the campus faculty have continued with research projects initially supported by this grant. The most significant results have been in the areas of cybersecurity, terrorist psychology, biology, and trauma psychology. A graduate certificate in homeland defense has been completed by over 200 USNORTHCOM personnel as well as many others from the local community and across the nation.				
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Objectives

Extracted from proposal:

The funds from this grant will be used to significantly increase the research capacity of the university in information assurance and homeland defense. UCCS has already initiated research and academic program efforts tied closely to USSPACECOM (now USSTRATCOM) and USNORTHCOM needs. The funds requested will assist the university in meeting stated needs of military and government organizations in homeland security and homeland defense by increasing the capacity of the NISSC. Funding for faculty grants, graduate students, equipment, and the support necessary to carryout research, projects, and education initiatives needed to meet critical national priorities is requested.

Specifically, the grant will enable the university to directly support USNORTHCOM in accomplishing its mission as well as to satisfy broader objectives related to homeland security and homeland defense, particularly related to cybersecurity, for not only the Department of Defense but also the Department of Homeland Security and local and state governments. The three general areas where advancement will occur are:

- A. Research in areas directly related to mission needs.
- B. Working in concert with industry partners, the university will leverage its resources to perform projects related to ongoing research efforts or to address identified issues or problems, both technical and non-technical, identified by USNORTHCOM and related organizations.
- C. Transition research results to the development of curriculum and training modules for military, government, and industry personnel in the area of homeland security and homeland defense.

Accomplishments

The Network Information and Security Center (NISSC) at the University of Colorado at Colorado Springs supported the U.S. Northern Command and its homeland defense mission since its inception. The significant accomplishments include:

1. UCCS faculty were funded through 47 "seed grants". These grants were awarded to faculty at UCCS for homeland security research. The grants were used for summer stipends for faculty, for undergraduate and graduate student research assistantships, and for supplies, equipment, and travel. These grants developed a strong research base that has been used by many faculty to build strong research programs in homeland security research in general and USNORTHCOM research in particular.
2. The establishment of the Homeland Security/Defense Education Consortium (HS/DEC). Working with the staff at USNORTHCOM and faculty from the University of Denver and the Naval Postgraduate School, this consortium of higher education institutions (now numbering over 175) supports the homeland defense

mission. The consortium provides civilian universities education and training modules related to USNORTHCOM and provides opportunities for university faculty and graduate students to conduct research on problems specifically identified by USNORTHCOM.

3. NISSC co-facilitated Research Symposiums in 2003, 2004, and 2005 at USNORTHCOM that resulted in generating over 100 research questions from the USNORTHCOM staff that were researched by faculty and students at HS/DEC member institutions. These research questions were the basis for the UCCS "seed grants". Results have been returned to USNORTHCOM and published in research journals.
4. NISSC developed a 4-course, graduate certificate program in homeland security and homeland defense for USNORTHCOM. Over 200 USNORTHCOM personnel have enrolled in this program. The courses have been used to complete requirements in both the Masters of Public Administration and Masters of Business Administration degrees at UCCS. A masters degree in homeland security and a doctoral degree in homeland security will be offered in 2007 as a direct result of this activity.
5. Significant partnerships with industry and government have been established. Included are a partnership agreement with Northrop Grumman/TASC, a subcontract with Booz Allen Hamilton (AFRL sponsored contract), and a Partnership Intermediary Agreement with AFRL at Kirtland AFB, NM.
6. A Memorandum of Understanding with Air Force Space Command establishing UCCS as the designated higher education representative to establish and manage a consortium of higher education institutions to provide research and academic program support to the Command was signed in 2004. The Space Education Consortium has twelve members and actively supports the needs of AFSPC.

Personnel Supported

Faculty

Name	Discipline/Non-UCCS Institution
Augusteijn, Marijke	Computer Science
Badel, Dashan	Computer Science
Benight, Charles	Psychology
Berry-Lowe, Sandy	Biology
Boult, Terrance	Computer Science
Camley, Robert	Physics
Carlson, Robert	Mathematics
Celinski, Zbigniew	Physics
Chow, C. Edward	Computer Science
Christensen, Thomas	Physics
Cios, Krys	U Colorado Denver
Coolidge, Fred	Psychology
Czaplewski, Andrew	Business
Ferber, Abby	Sociology

Gill, Ronald	U Colorado Health Science Center
Gorder, Peter	Mechanical and Aerospace Engineering
Grabowski, Marek	Physics
Hatahet, Zafer	U Texas Health Science Center - Tyler
Kalkur, T.S.	Electrical and Computer Engineering
Kalita, Jugal	Computer Science
Martz, W. Benjamin	Business
Mattoon, James	Biology
Meadows, Rick	Biology
Melamede, Robert	Biology
Milliman, John	Business
Newell, Karen	Biology
Olkowski, Dorothea	Philosophy
Olson, Eric	Business
Pyati, Radha	Chemistry
Pyszczynski, Thomas	Psychology
Roney, Jason	Mechanical and Aerospace Engineering
Saunders, L. Ken	Mechanical and Aerospace Engineering
Schoffstall, Allen	Chemistry
Segal, Dan	Psychology
Semwal, S.K.	Computer Science
Wang, Charlie	Electrical and Computer Engineering
Weiss, David	Chemistry
Wickert, Mark	Electrical and Computer Engineering
Zhang, Yu	Mathematics
Zhou, Xiaobo	Computer Science
Ziemer, Rodger	Electrical and Computer Engineering

Post-Docs

Name	Department
Hayden, Mary	Psychology

Graduate Students

Name
Bulusu, Nirmala
Cai, Yu
Carroll, Dustin
Chandrashekhara, Kaushal
Deshmukh, Ankur
Dinan, Thomas
Ferraro, Patricia
Fong, Paul j.

Hans, Reena
Kgodava, Ganesh
Kuanr, Bijoy
Kosuri, Syama
Markowski, Tina
O'Riley, Alisa
Sampayan, David
Selvam, Priyadarshini
Sampayan, David
Vincent, Merlin
Watson, Frank
Wilkinson, David
Williams, G.A.
Williams, Tom
Yu, Cai
Zheng, Gang

Publications

C. Edward Chow, Paul J. Fong, and Ganesh Godavari, "An Exercise in Constructing Secure Mobile Ad hoc Network (SMANET)," *Proceedings of 18th ANIA 2004 Conference*, Fukuoka, Japan, March 2004.

Bijoy Karanr, Z. Celinski, and R.E. Camley, "Tunable High-Frequency Band-Stop Magnetic Filters", *Applied Physics Letters*, Vol. 83, No. 19, November 2003, pp3969 – 3971.

B. Kuanr, R.E. Camley, and Z. Celinski, "Effect of Shape Anisotropy on Stop-Band Response of Fe and Permalloy Based Tunable Microstrip Filters", *IEEE Transactions on Magnetism*, Volume: 40, Issue: 4, July 2004, pp:2841 – 2843.

Bijoy K. Kuanr, D. L. Marvin, T. M. Christensen, R. E. Camley and Z. Celinski. "High-Frequency Magnetic Microstrip Band-Pass Filters", submitted to *Applied Physics Letters* 2005.

A. Mahmud, T.S. Kalkur and N. Cramer, "An Active Phase Shifter using Tunable Ferroelectric Capacitor", *Integrated Ferroelectrics*, vol.66, pp. 153-160, 2004.

John Milliman, John Grosskopf, Ozzie Paez, and William Ayen, "Responding to New Security and Environmental Threats: An Integrated Security, Environment, Health, and safety (SHE&S) Management System Approach", *Environmental Quality Management*, Summer 2004.

John Milliman, John Grosskopf, Ozzie Paez, and William Ayen, "Pilot Project Results for Integrated Security Management System," *Disaster Prevention and Management*, Vol.14, No. 1, 2005, pp 20-31.

T. Pyszczyński. (2004). What are we so afraid of? Terror management theory and the psychology of terrorism. *Social Research*, 71, 827-848.

David Wilkinson, C. Edward Chow, and Yu Cai, "Enhanced Secure Dynamic DNS Update with Indirect Route," Proceedings of Fifth IEEE Systems, Man and Cybernetics Information Assurance Workshop 10-11, June 2004, pp. 335-341.

G. Zheng, T.E. Boulton, C.-J. Wang, "Projective Invariant Hand Geometry: An overview", to appear Biometric Symposium, Sept. 2005.

Xiaobo Zhou, Jianbin Wei, and Cheng-Zhong Xu, "Processing Rate Allocation for Proportional Slowdown Differentiation on Internet Servers", In *Proc. of 18th Int'l Parallel and Distributed Processing Symposium (IPDPS)*, IEEE Computer Society, Santa Fe, Apr 2004.

Xiaobo Zhou, Yu Cai, Ganesh K. Godavari, C. Edward Chow, "An adaptive process allocation strategy for proportional responsiveness differentiation on Web servers", *Proc. of 2nd International Conference on Web Services (ICWS)*, IEEE Computer Society, San Diego, July 6-9, 2004.

R. Ziemer, M. Wickert, and T. Williams, "A comparison between UWB and DSSS for Use in a Multiple Access secure Wireless sensor network," *IEEE Conf. on Ultra Wideband Sys. and Tech.*, Reston VA, November 2003., pp. 36-47.

R. E. Ziemer and M. A. Wickert, "Average Synchronization Time in DSSS Sensor Array Networks," *IEEE Radio & Wireless Conference*, Atlanta, September 2004.

Interactions/Transitions

a. Participation/presentations at meetings, conferences, seminars

William Ayen, "Secure Intelligence and Information Transfer to First and Second Tier Responders: Technology / Doctrine / Policy", E-Gov Conference, Washington, D.C., December 2003.

William Ayen, Organizing Committee, Homeland Defense Symposium, Colorado Springs, CO, October 2003.

T.E. Boulton, "Personal Identification by Cross Ratios of Finger Features", presented at IAPR workshop on Biometrics Challenges from Theory to Practice, Cambridge UK August. 2004.

C. Edward Chow, Yu Cai, David Wilkinson and Ganesh Godavari, "Secure Collective Defense System," GLOBECOM 2004, Volume 4, 29 Nov.-3 Dec. 2004.

M. Hayden, M., E. Zielinski-Gutierrez, M. Fonseca-Ford, E. Navarro, L. Nava, and S. Waterman. National West Nile Virus Conference. "Knowledge, Attitudes, and Practices Concerning West Nile Virus on the California/Baja California Border." San Jose, CA. February 8-9, 2005.

M. Hayden, E. Zielinski-Gutierrez, M. Fonseca-Ford, E. Navarro, I. Nava, and S. Waterman. National West Nile Virus Conference. "Knowledge, Attitudes, and Practices Concerning West Nile Virus on the California/Baja California Border." San Jose, CA. February 8-9, 2005.

Kristopher J. McKee, Angela K. Cook†, Justin A. Russak, Allen M. Schoffstall and David J. Weiss. "Rapid determination of a methylphosphonic acid nerve agent degradation product by capillary electrophoresis with UV detection" Poster presented at Pittcon (The Pittsburgh Conference on Analytical Chemistry), Orlando, FL, March 2005.

John Milliman, John Grosskopf, and Ozzie Paez, "An Integrated Approach to security and Environmental Management: Results and Key Learnings From an Industry Project", National Homeland Security Conference, Orlando, FL, February, 2004.

John F. Milliman, J. Grosskopf and O. Paez. "Application of ISO-Based Integrated Security and Environmental, Health, & Safety (SEH&S) Management System." International Conference on ISO 9000, Orlando, FL., February, 2005.

T. Pyszczynski. *What are we so afraid of? Terror management theory and the psychology of terrorism.* Invited address, presented at New School for Social Research, Conference on Fear, Terrorism, and Politics. New York, NY, February 2003.

Allen M. Schoffstall, Justin A. Russak, Michael J. Slogic, Christopher R. Anderton, Carrie Dean, David J. Weiss. "Synthesis of methylphosphonic derivatives", Poster presented in the Organic Division at the spring national ACS meeting in Anaheim CA, March 2004.

D. L. Segal, A. Czaplewski, E.M. Olson, & A. O'Riley. "Initial evaluation of the Homeland Security Advisory System". Paper presented at the 112th annual meeting, American Psychological Association, Honolulu, Hawaii, July, 2004.

J. Weiss, Christopher R. Anderton, Carrie Dean, Justin A. Russak, Michael J. Slogic, and Allen M. Schoffstall. "Determination of nerve agent degradation product derivatives using micellar electrokinetic chromatography," David Poster presented at spring national ACS meeting in Anaheim CA, March 2004.

David Wilkinson, C. Edward Chow, and Yu Cai, "Enhanced Secure Dynamic DNS Update with Indirect Route," Fifth IEEE Systems, Man and Cybernetics Information Assurance Workshop 10-11, June 2004.

G. Zheng C.J. Wang and T.E.Boult, "Personal Identification by Cross Ratios of Finger Features", IAPR workshop on Biometrics Challenges from Theory to Practice, August. 2004

Theses

Implementation and Performance Analysis of the Protected Extensible Authentication Protocol, Nirmala Bulusu, December 2003.

Secure Collaborative Web Browsing and Chat Through Standard Web Pages, Patricia Ferraro, November, 2004.

Multiple Path Connection using Connection Relay Servers, Syama Kosuri, May, 2005.

ESI Extensions for Web-Based Collaboration, Merlin Vincent, April, 2004

Enhance TCP Performance with Multiple Path Routing, Frank Watson, March, 2005.

Enhanced Secure DNS: A Defense Against DDOS Attacks, David Boyd Wilkinson, March 2004.

Dissertations

On Proxy Server based Multipath Connection, Yu Cai, May 2005, Edward Chow, Advisor.

Techniques for supporting proxy server-based multipath connection (PSMC) studied: design and implementation, enhanced TCP/IP protocol developed, proxy server selection algorithms developed, and resource allocation schemes proposed.

Projective Invariant Hand Geometry, Gang Zheng, Ph.D. Dissertation, March 2005.
G. Zheng is now on the faculty at Gannon University

Novel concept of non-contact non-intrusive projective invariant hand geometry developed and analyzed. Original projective and permutation invariants are introduced.

New discoveries, inventions, or patent disclosures

Patent Application: Biochemical Process for the Separation of Toxic Substances, Including Heavy Metals Contained in Integrated Circuit Boards, Karen Newell.

Patent Disclosure: Continuous Monitoring of Airborne Bacterial Spores in an Enclosed Environment, James Mattoon and Zbigniew Celinski.

Honors/awards

NISSC was awarded the 2003 Community Enhancement Award by the Greater Colorado Springs Economic Development Corporation