

Special Technologies Laboratory

The Special Technologies Laboratory (STL) in Santa Barbara, CA, is a satellite office of National Security Technologies (NSTec). The STL staff of about 100 people, including 80 scientists and engineers, supports all major NSTec programs – Stockpile Stewardship, Homeland Security & Defense Applications, and Environmental Management. The STL technical staff is engaged in a broad range of business areas, including communications systems, radar systems, photonics (optics, fiber-optics, lasers), radiation diagnostics, trace detection and remote spectroscopy, and software applications. Projects at STL are generally built around interdisciplinary teams that include strong customer involvement in the planning and execution of the work. Local test facilities are used for small-scale testing of sensors and systems for photonics measurements, radiation detection, chemical/biological/explosive material detection and RF measurements. Large-scale testing is done at the Nevada Test Site (NTS), which offers world-class test and evaluation facilities.

The small-laboratory environment and tight teaming at STL make it an exciting, invigorating place to work. Each summer, starting in 2004, we have been privileged to have at least one DHS student intern, and the experience has been mutually rewarding in each case.

Santa Barbara, California

Santa Barbara is located 90 miles northwest of Los Angeles, and is bordered by the Santa Ynez Mountains and Pacific Ocean. Nick-named the American Riviera, Santa Barbara offers beautiful scenery, and opportunities for outdoor activities including surfing, sailing, ocean kayaking, scuba diving, cycling, hiking and horse-back riding. The Special Technologies Laboratory is located approximately two miles from the University of California at Santa Barbara, home to several nationally-acclaimed research institutes, including the Material Research Laboratory, known as the best in the nation.

For more information about Santa Barbara's offerings see:

<http://www.totalsantabarbara.com/sea.shtml>

National Security Technologies^{LLC}
Summer 2008 Research Opportunities
at Special Technologies Laboratory
Santa Barbara, California

Project Title: Laser Plasma Vapor Detector

Contact: Kevin Kyle, kylekr@nv.doe.gov, 805-681-2283
NSTec Special Technologies Laboratory, Santa Barbara, CA.

Project Sponsor: Site Directed Research and Development (SDRD) (DHS Approval Required)

Project Description: A hand-held chemical vapor sensor for real-time air analysis is being developed. The device will be used primarily at the Nevada Test Site to complement currently available chemical release diagnostic systems, particularly in the area of detecting and identifying low concentrations of fluoro- and chloro-carbons. The unit will also be tested and qualified as an explosives vapor detector. The basis of the unit is the detection of neutral and ionized atomic emission lines from laser-induced plasmas in air.

The intern will explore alternative means of inducing a plasma in air. Of particular interest is research involving piezoelectric ignition sources as a compact replacement for the laser source. Coupling of the piezoelectric firing mechanism to the mechanical motion of the unit's internal air pump is also desired. Tasks for summer 2008 include building a laboratory prototype of the spark source, spectral characterization of the spark and associated plasma, and spectral measurement of target gasses.

Qualifications: A background in physics or chemistry; electronic engineering; spectroscopy; sensor development

Keywords: Explosives detection, chemical detection, vapor analysis, spectroscopy

DHS Research Areas:

Explosives Prevention, Detection, Mitigation and Response

Chemical and Biological Threats and Countermeasures

Project Title: Improved Scintillator Materials

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NSTec Special Technologies Laboratory, Santa Barbara, CA.

Project Sponsor: Site Directed Research and Development (SDRD) (DHS Approval Required)

Project Description: A method is sought to accelerate scintillator decay-time response, without compromising light yield, or alternatively to improve scintillator brightness without compromising time response, in order to advance the state-of-the-art in radiation sensor development. In conjunction with the Department of Chemistry/Institute of Polymers and Organic Solids at the University of California, Santa Barbara (UCSB) we are exploring methods to create faster and brighter scintillator materials. To determine the effect of supplement-addition on chromophore mixtures, radiative lifetimes and quantum yields will be measured, and scintillation strengths compared, using a pulsed X-ray source at STL. To test a material's utility in coincidence counting it will be tested using a Co-60 source or appropriate positron emitter.

Qualifications: A background in physics or chemistry; electronic engineering; spectroscopy; sensor development

Keywords: Explosives detection, chemical detection, vapor analysis, spectroscopy

DHS Research Areas:

Transportation Security

Border Security

Maritime and Port Security

Infrastructure Protection

Emergency Preparedness & Response

Project Title: Miniaturizing Mass Spectrometry

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NSTec Special Technologies Laboratory, Santa Barbara, CA.

Project Sponsor: Site Directed Research and Development (SDRD) (DHS Approval Required)

Project Description: A miniature mass spectrometer for wireless sensor mote networks and handheld deployments represents a major step forward for field analytical chemistry measurements. As a precise and accurate measurement technique with large database collections, mass spectrometry is the gold standard by which all other trace atomic and molecular analysis technologies are compared. A complete miniaturized automated system is being developed that includes sampling, ionization and analytical methodology plus remote data transmission. By summer 2008, benchtop hardware will be available as a prototype for a handheld mass spectrometer system for the detection of a wide range of gas-phase CBE species. Summer activities will include evaluation of the prototype hardware using various chemical and explosives vapors in a chemical release chamber at STL. The project team will also be engaged in improvements to the direct air sampling scheme, optimization of the ionization source and development of data analysis techniques. These developments will lead to further miniaturization in the design of the next-generation hardware.

Qualifications: A background in physics or chemistry; electronic engineering; spectroscopy; sensor development

Keywords: Explosives detection, chemical detection, vapor analysis, spectroscopy

DHS Research Areas:

Explosives Prevention, Detection, Mitigation and Response
Chemical and Biological Threats and Countermeasures

Project Title: Forensic Camera System

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Project Sponsor: DHS, S&T, Innovation Directorate
Stephen Dennis, stephen.dennis@dhs.gov, 202-254-5788

Project Description: This project undertakes the engineering development of a flash-memory-based, miniature forensic camera that can record data for extended periods. The camera will be designed to be reproducible in high-volume production for \$100-200 per unit. The memory requirement is 10 GB, and the memory module is required to survive a short-duration, high-G load.

By summer 2008 the hardware architecture design will be complete, with the following features:

- ARM-based microcontroller
- Micro SD memory module that supports more than one module in an array
- CMOS camera interface
- High-efficiency power supply for long battery life.

The project will be completed during the summer, including the following tasks:

- Development of microcontroller firmware to capture and store low-frame-rate (< 5 fps) video to flash memory
- Development of software configuration program for setting parameters in the camera prior to deployment
- Production support – development of technical manuals, user's manual, assembly manual
- Interface for transferring the project to commercial manufacturing

Qualifications: A background in electronics engineering, including firmware and software programming and experience with technical writing.

Keywords: Incident response, electronics design, software

DHS Research Areas:

Transportation Security
Infrastructure Protection
Emergency Preparedness & Response,
Communications, Operations & Interoperability