Field-Purposing Technologies: Placing Forensic Tools into the Hands of Field Practitioners for Timely Intelligence

Kevin Lothridge, M.S., *Chief Executive Officer*[1]; David Epstein, B.S., *Chief Operating Officer*[1]; Jane Smith, B.S., *Instructional Systems Senior Coordinator*[1]; Kirk Grates, *Senior Forensic Specialist – Chemistry*[1]; Garry Ashton, *Contractor*[2]

Abstract

As the military, law enforcement and homeland security communities are called to meet challenges such as narco-terrorism, border incursions and terrorist threats, the need for rapid analysis of forensic evidence becomes paramount. To provide field personnel with the forensic intelligence to conduct investigations and aid missions, agencies are equipping first responders and military service members with portable forensic analysis tools. These technologies allow complex analyses to be conducted outside of the conventional laboratory environment. This capability not only serves to expedite the rapid development of intelligence to lead the investigation, but also promises to dramatically reduce the volume of evidence submitted to already backlogged laboratories.

However, providing practitioners with deployable technologies is only part of the solution. Ensuring practitioners also have the knowledge, skills and support to properly apply these tools to analyze compounds and gather vital forensic data is equally important.

The National Forensic Science Technology Center (NFSTC) has assisted agencies in this effort by assessing the needs of field forensic practitioners, evaluating and disseminating information on available and emerging forensic technologies, developing programs of instruction and providing reachback assistance. Through the Forensic Technologies Center of Excellence (FTCoE), forensic scientists evaluate emerging technologies to determine the performance and applicability of new tools. These evaluation reports provide agencies with impartial data to assist them in selecting the most appropriate technologies for meeting their operational objectives. These efforts hold the potential of producing dramatic gains in public safety.

This combination of technology, quality assurance and support to practitioners at the point of need provides field personnel with the ability to conduct examinations and quickly develop actionable intelligence. In addition, by utilizing proper protocols, practitioners can run tests while maintaining the integrity of the evidence for follow-up laboratory analysis as needed.

Introduction

Not all forensic analyses can be conducted in-situ, but by field-purposing technologies typically found only in laboratories, practices such as identifying explosive compounds, narcotics and hazardous materials can be performed anywhere – from the battlefield to the border. Field-purposing technology puts the ability for timely collection and processing of forensic intelligence in the hands of deployed field personnel to enhance their ability to develop and disseminate actionable intelligence.

Portable, Reliable Forensic Tools in the Field

Military personnel, homeland security agents, police officers and other field practitioners need forensic intelligence-gathering technology that is portable, easy to use and rugged enough to meet the demanding conditions often present in the field. In addition, field personnel require equipment that covers the range of potential evidence they may encounter, including fingerprints, explosive compounds and narcotics, and biological material containing DNA. By deploying our nation's forensic technologies and knowledge into the field, agencies can increase their capability to predict and prevent events rather than react to them.

Bringing technology forward to the point of need allows investigators to expedite decision-making and quickly convey critical information to those who need it.

Deployable Forensic Laboratory
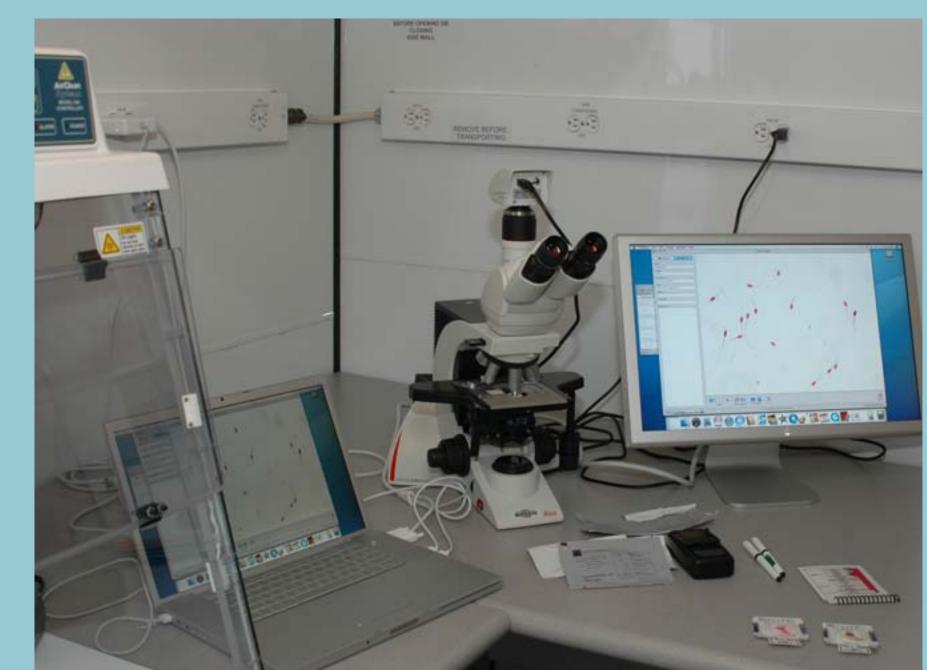### Rapid Response to Urgent International and Domestic Needs

Deployable forensic laboratories are an effective way to provide forensic capabilities in emergency or combat situations. Each expandable module is seated on a standard transport trailer for ease of movement, and once folded out, provides a maximum of 400 square feet of usable laboratory space.

Each shelter is self-supporting and can be used separately or connected to other shelters to expand services. Full set-up of a single laboratory can be accomplished in less than one hour. Each unit features:

- Reachback capability
- Full data sharing
- Dust- and light-resistant enclosure
- Backup generator on board
  - Minimum of 33 hours on a single tank of diesel fuel
  - Remote start and UPS systems eliminate data loss
- Air conditioning and heat
- Access-controlled entryway

Field-Purposing Process

Step 1: Identify Requirements

- NFSTC meets with decision-makers and end-users to identify needs, gaps or deficiencies in available forensic tools and capabilities in the field.
- Requirements emerge from the outcomes of Department of Defense (DoD) Rapid Fielding Directorate (RFD) Joint Capability Technology Demonstrations (JCTD) conferences and events, which seek to identify, demonstrate, and transition the best operational tools and technology solutions for the battlefield.
- The outcomes from the National Law Enforcement and Corrections Technology Center's (NLECTC's) practitioner-based advisory groups help to identify requirements. These groups are convened to help identify criminal justice technology needs and gaps.

Step 2: Identify Potential Technologies

- NFSTC works with representatives from the DoD and the Department of Homeland Security (DHS), NIJ program managers, members of the General Forensics and Biology/DNA Technology Working Groups (TWGs) and other members of the greater forensic service community to identify the need for a performance assessment of an instrument, product or technique for a forensic application.
- TWGs meet twice annually to identify and assess the needs and requirements of the forensic science practitioner community.

Step 3: Test and Evaluate Tools

- NFSTC scientists perform testing and evaluation of currently available forensic technologies to aid decision-makers in selecting the most appropriate tools for their application.
- Evaluations of emerging technologies furnish unbiased information regarding their performance and usability.
- The evaluation process includes:
  - An evaluation plan is designed and submitted for review and approval
  - Evaluation details, results, report and any associated data are submitted for review of technical content and experimental soundness
- All evaluations are available online at the NFSTC website in a standard report format. Some evaluations may be further disseminated through any of the following: a technology transition workshop, a publication, a presentation, a conference poster session or through training sessions with end users.

Step 4: Solicit End-User Feedback

- NFSTC invites end-users to participate in hands-on demonstrations of new technology.
- NFSTC uses panel participants to test the instruments on actual samples and in real scenarios.
- Surveys and questionnaires are completed by end-users and demonstration participants and the gathered feedback is recorded and analyzed.

Step 5: Refine and Adapt Technology

- Through evaluations and feedback from end-users, NFSTC scientists define specific areas for improvement and develop recommendations for implementing those improvements.
- NFSTC reaches out to manufacturers to share ideas for improvements and possible expansions to the range of services the instruments can provide.
- NFSTC helps to adapt existing technology by suggesting to agencies and manufacturers means of repurposing existing instruments and technology for a forensic application.

Step 6: Develop Field-Training Materials

- NFSTC works with stakeholders to analyze the needs of the end-users including the means of applying the technology, environments encountered and the desired outcomes of both training and instrument results.
- NSFTC instructional design experts collaborate with technology subject matter experts and end-users to develop specific training methods and materials, which may include:
  - Online learning modules incorporating integrated self-assessment components
  - Instructor-led courses
  - Scenario-based and/or practical application exercise sessions
  - Blended learning solutions that combine online theoretical learning modules and on-site practical application
  - Scripted videos of hands-on demonstrations, simulations and/or animations
  - Portable job aids featuring equipment details and/or processes
  - Mentoring

Step 7: Support and Reachback

- NFSTC offers ongoing technical and reachback support to end-users through the availability of subject matter experts who provide:
  - Expert support for technical questions
  - Instrument maintenance support
  - Sample analysis assistance
  - Sample preparation guidance for chemical detection and identification technologies
  - Interpretation and data review of colorimetric, IMS, Raman, FTIR and/or GC/MS-based technology
  - Chemical characterization support
  - Report writing and data integration assistance
  - Report and case file review
- NFSTC offers no-cost technology transition assistance to agencies for implementing new forensic technologies. This support includes:
  - User assistance to identify the best methods to apply the technology to their function or need
  - Assistance to agencies in transitioning staff and processes to newly adopted or implemented technology
  - Operational, hands-on demonstrations for end-users with continued adaptation support

Mission Space

The groups that use forensic technology traverse many theaters of operation, but the requirements and the desired outcomes are the same: develop forensic intelligence in order to make decisions that protect the homeland and support the criminal justice system.

Department of Defense	Department of Homeland Security	Department of Justice (Criminal Justice, Domestic)
- Identify friend or foe on the battlefield - Identify and communicate international threats to U.S. security - Prevent terrorist activities through identification and apprehension of suspects - Protect U.S. interests abroad, including those representing the U.S. in official capacities	- Control the flow of undocumented immigrants - Identify potential threats to U.S. security at the borders - Identify and seize illegal or dangerous international cargo at U.S. ports - Identify and prevent international criminals/fugitives from entering the U.S.	- Gather timely crime scene information to support the criminal justice system - Implement predictive policing—using forensic intelligence to prevent crimes - Identify and prevent domestic threats to U.S. security

Soldiers use fingerprint evidence collected from an unexploded IED to identify and apprehend members of a terrorist organization attempting to gain access to the U.S. via illegal border crossing from Mexico.

Border patrol agents intercept a terror suspect attempting to enter the U.S. The agents identify and confiscate an explosive compound being transported by the suspect that could be used against targets inside the country.

Police officers identify and seize narcotics intended for large-scale distribution in the U.S. found in the possession of an individual in the country illegally with alleged ties to an extremist group.

Transitioning Technology from the Lab to the Field

Polychromix microPHAZIR™

The microPHAZIR™ field-portable near-infrared (NIR) spectrometer is used to conduct fast, non-destructive, qualitative or quantitative analysis on solids, powders and other materials used in a variety of industries. The instrument can identify forensically relevant materials such as controlled substances and explosives.

Griffin™ 450 GC/MS

The Griffin™ 450 gas chromatography mass spectrometry (GC/MS) chemical analyzer is used to analyze and identify forensically relevant chemical compounds in the field including narcotics, ignitable liquids and explosives. This device, typically found in the laboratory due to its size and power source, has been optimized and ruggedized for field use.

Ahura Scientific FirstDefender™

This portable, handheld Raman spectrometer is used to rapidly identify unknown solid and liquid chemical substances, including forensically relevant materials such as controlled substances and ignitable liquids. Raman technology measures the inelastic scattering of monochromatic light, usually from a laser in the visible, near-infrared, or near-ultraviolet range.

Smiths Detection HazMatID™ Portable Fourier Transform Infrared (FTIR) System

The HazMatID™ is a small, portable chemical analyzer that uses infrared spectroscopy to identify forensically relevant chemical compounds including narcotics, ignitable liquids, explosives and common household materials. This system allows for non-destructive analysis of samples without the need for specialized sample preparation equipment.

Field-Presumptive Narcotic Screening Tests

These single-use test ampoules use colorimetric technology to screen substances for the presence of classes of narcotics. Each test kit contains a proprietary reagent-granulate (liquid and crystals) and a band of color to indicate a positive result. The tests are optimized for field use and allow law enforcement officers to presumptively test for narcotics including cocaine and crack cocaine, heroin and methamphetamine.

Coherent® TracER™ Laser

The TracER™ is a portable, solid-state argon laser used to detect the presence of fingerprints and trace evidence. The laser uses inherent luminescence or chemical fluorescence to reveal evidence undetectable with the naked eye. The device is lightweight, compact, air-cooled and powered by alternating current or an optional on-board battery for optimal field use.

Impacts and Implications for the Future

- Integrated approach helps those in the field use tools and information expediently and creates a thorough understanding of the benefits and limitations of on-site forensic analysis
- Deployable forensic capabilities expand the available options for gathering actionable intelligence and disseminating it proactively to protect public safety and the homeland
- Evaluated technology can be repurposed to expand the capabilities and long-term value of individual instruments, processes and applications, resulting in cost savings and improved forensic capabilities across the range of users
- Increased integration between technology selection, training, and feedback from end-users boosts the effectiveness and value of the forensic tools deployed in the field
- Integrated evaluation and training for new technology could help standardize equipment selection and education across all deployable groups, saving time and reducing the costs involved with acquiring new equipment
- Technology developed for the battlefield is refined for use by State and local law enforcement, allowing for more confirmative analysis in the field and reducing stress on overburdened crime laboratories
- Field-purposing technology could directly support the growing trend toward prioritizing evidence through the use of confirmative field tests and improved capabilities to analyze discovered materials in-situ
- Field-purposed technology, and the methods used to identify, evaluate, implement and educate, will lead to greater integration between the organizations charged with protecting U.S. citizens at home and abroad, which will support intelligence sharing, predictive policing and stronger national security

References

http://www.ojp.usdoj.gov/nij/

www.NFSTC.org

www.acq.osd.mil/jctd/aboutus.html

www.justnet.org/

Study Contact and Author Affiliations

[1]National Forensic Science Technology Center
7881 114th Avenue N
Largo, FL 33773
(727) 549-6067

www.nfstc.org

[2]Training Team Solutions, Inc.
1340 N. Great Neck Road
Virginia Beach, VA 23454
(757) 803-5557

www.trainingteamsolutions.com