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FBI Laboratory 2005 Report



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Quantico, Virginia

The FBI Laboratory 2005 Report
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Dwight E. Adams, Ph.D.

Message from the FBI Laboratory Director

FBI Laboratory personnel routinely respond to bombing incidents, hazardous crime scenes, and other events as requested by the FBI and other duly constituted law enforcement agencies worldwide. In 2005 employees from the FBI Laboratory responded to an unprecedented number of events around the globe. For example, in Thailand, we joined forensic teams from more than 30 countries to help identify the victims of one of the worst natural disasters in history: the tsunami. At home, we responded to a force of nature less powerful than the tsunami but no less daunting—Hurricane Katrina.

Investigations and intelligence gathering are the lifeblood of the FBI, and the FBI Laboratory supports those efforts. FBI Laboratory personnel routinely examine evidence from major cases, as well as other cases you may never read about in the newspaper. Whether the case is big or small, just around the corner or halfway around the world, the FBI Laboratory approaches each one with the same steadfast determination and desire to be the world's foremost forensic laboratory upon which FBI field offices, investigative and intelligence agencies, and the American public can always rely.

Reorganized for Success

It's been said that the only constant is change. At the FBI Laboratory, we are constantly assessing our policies, practices, and performance to ensure that we provide the highest quality service to our constituents. Ongoing evaluation also remains essential for our continued accreditation by the American Society of Crime Laboratory Directors/Laboratory Accreditation Board. Often, and perhaps inevitably, the result of that evaluation is change. FBI Laboratory employees meet those changes with professional and positive attitudes.

In 2005 our commitment to quality led to a restructuring of the Laboratory. The reorganization involved placing the Quality Assurance and Training Unit under the authority of the Deputy Assistant Director of the Forensic Analysis Branch. The Quality Assurance Manager, who heads the unit, now reports directly to the Laboratory Director.

We also reorganized the Latent Print Units and created a program manager to oversee issues relating to *Daubert*, a U.S. Supreme Court ruling that sets forth the criteria for admitting expert testimony in court. I believe that these and other changes we initiated will help the FBI Laboratory achieve and maintain the high standards our constituents expect from us and that we demand from ourselves.



Share Our Accomplishments

As you read this year's report, you'll read the stories of the men and women who dedicate themselves to help the victims of crime and other devastating events. You'll get an inside look at a number of cases, join us in our partnerships, view some of our new technology, discover how we keep the Laboratory running smoothly, learn about our education efforts, and help celebrate our accomplishments, both in the Laboratory and in the community. Indeed, the FBI Laboratory stands as a partner with law enforcement and intelligence agencies, the forensic community, and also with our neighboring community, the people who live and work just outside the borders of our home here in Quantico, Virginia.

Television makes crime scene investigation look glamorous, where cases are often solved in less than an hour. But in reality, the exploitation of forensic evidence requires excellent education and training, a steadfast dedication to quality, and persistence, sometimes leading to years of hard work. The FBI Laboratory is committed to these values so that we can best serve the law enforcement, intelligence, and forensic communities.

Dwight E. Adams, Ph.D.
Director
FBI Laboratory
Quantico, Virginia





Investigation

Conducting forensic analysis to support FBI investigations remains the lifeblood of the FBI Laboratory. This section describes the units whose primary responsibilities involve casework, whether those responsibilities consist of responding to a crime scene or natural disaster to collect evidence, identify victims, or take photographs; examining evidence, reporting the findings, and testifying in court; or producing the exhibits to be used during a trial. This section also details some of the major cases and events Laboratory personnel worked in 2005.

Chemistry Unit

The Chemistry Unit conducts timely, high-quality chemical and metallurgical analyses on evidence; reports findings; provides testimony in court; assists in crime scene investigations; and provides advanced training to law enforcement agencies to support the investigative priorities of the FBI and the law enforcement community.

The Chemistry Unit comprises five subunits that reflect the individual specialties of the personnel assigned to each.

General Chemistry Subunit

The General Chemistry Subunit is responsible for the analysis of unknown powders, liquids, and stains to determine their chemical identities or characteristics. The cases assigned to this subunit usually involve threat letters; dyes and tear gases associated with bank dye packs; drug and pharmaceutical analyses; ink analyses; analysis of petroleum products; and analysis of flammable fluids.

Metallurgy Subunit

The Metallurgy Subunit is responsible for the metallurgical analysis of materials. This is a specialty discipline that few forensic laboratories have available. Therefore, this subunit receives a significant number of cases from other federal agencies as well as state and local contributors. FBI cases submitted to this subunit often involve major bombing investigations.

Paints and Polymers Subunit

The personnel assigned to the Paints and Polymers Subunit analyze evidence for paint, tapes, adhesives, and other polymeric materials. The cases submitted to this subunit usually evolve from hit-and-run homicides, espionage, bombings, and counterterrorism investigations. This subunit also maintains the National Automotive Paint File, which contains entries dating as far back as the 1930s. The Paints and Polymers Subunit also serves as the U.S. repository for the Paint Data Query database. State and local law enforcement agencies investigating hit-and-run homicides rely on both the National Automotive Paint File and the Paint Data Query database.

In 2005 the Paint and Polymers Subunit facilitated two week-long classes at the FBI Academy. Twelve students from local, state, federal, and international law enforcement agencies attended The Forensic Analysis of Tapes in June, and in December, an additional 12 students from state and local law enforcement attended The Forensic Analysis of Paints. Instructors for each class were brought in from academia, industry, instrument manufacturers, and other forensic laboratories to share their expertise with class attendees. Both classes included extensive laboratory exercises designed to reinforce concepts presented during the lectures. During the laboratory exercises, the students had an opportunity to analyze various types of tapes and paints in addition to mock cases.

Toxicology Subunit

The Toxicology Subunit analyzes biological samples and food evidence for the presence of poisons and drugs. In addition to analyzing the numerous case submissions from FBI field office investigations, this subunit provides substantial support to state and local agencies that lack appropriate resources to carry out needed toxicological examinations.

Instrument Operation and Support Subunit

Personnel in the Instrumentation Operation and Support Subunit maintain and repair all of the Chemistry Unit's analytical instrumentation while ensuring that all instruments are fully compliant with quality assurance mandates. Although personnel in this subunit do not work cases, the arduous task of maintaining more than 175 different instruments directly affects the outcome of the work performed by all Chemistry Unit personnel.

Bank Robbery Case

Six men went on trial in May 2005 for their participation in a series of armed, takeover-style bank robberies in the Washington metropolitan area. The Chemistry Unit and other units in the Laboratory processed numerous items of evidence presented at trial, including clothing and currency stained with red dye. The Chemistry Unit examiner who analyzed the evidence linked the stains to the dye packs used by the banks. The Chemistry Unit (as well as the Trace Evidence Unit) also examined duct tape seized from the subjects, while other Laboratory units processed DNA evidence, latent prints, hair and fibers, weapons, and other evidentiary items. The voluminous forensic evidence in the case helped convict the men of numerous federal offenses in addition to bank robbery.

Cryptanalysis and Racketeering Records Unit

The Cryptanalysis and Racketeering Records Unit (CRRU) examines manually encrypted documents in support of all FBI investigative programs. During 2005 CRRU examiners deciphered records and communications from street and prison gangs, violent criminals, drug traffickers, organized crime groups, and domestic terrorist groups.

Carlie Brucia Murder Investigation

On February 1, 2004, Carlie Brucia, age 11, was abducted at a car wash in Sarasota, Florida. The abduction was captured via a video surveillance camera located at the car wash. On February 3, 2004, subsequent to the profiling of the abduction, tips led authorities to Joseph P. Smith. Smith was arrested and initially held on violation of probation charges. During the evening hours of February 5, 2004, the body of Carlie Brucia was found behind a church, located approximately three miles from where she had been abducted. She was found lying face up on the edge of a shrub line, wearing only a red shirt, a bra, and a sock, with bruising around her neck consistent with that of strangulation. The following morning Smith was charged with the kidnapping and subsequent murder of Carlie Brucia.

In August 2005 the FBI's Tampa Field Office requested CRRU assistance in deciphering an encrypted letter written by Joseph Smith to his brother. Smith enciphered the message by replacing letters of the alphabet with a series of one- or two-character combinations of numerals and symbols. To further complicate decryption, he wrote the message from right to left, starting at the bottom of the page and working his way up. Despite these obstacles, CRRU examiners were able to quickly decipher the message, which contained incriminating references to hiding evidence and moving the body.

I WLSH L HAD SOMTHLN JULCYTO SAY OH OK THE BACKPACK AND CLOTHES WENT IN FOUR DIFFERENT DUMPSTERS THAT MONDAY I CAME TO YOUR HOUSE FORADVISE I WENT IT I LEFT IT OUT IN THE OPEN I DRAGED THE BODYTO WHERE STWAS FOUND DESTROY THIS AFTER DECIFERING IT AND SHUT UP

Verbatim translation of Joseph Smith's message to his brother

In all, the Laboratory received more than 100 items for analysis. A DNA Analysis Unit I examiner extracted a full 13-locus male profile from a semen stain found on Carlie Brucia's shirt. The DNA profile from Joseph Smith matched the profile from the evidence, and he was determined to be the source of that DNA.

In November 2005 a CRRU examiner presented the decryption evidence at Smith's trial, and a DNA examiner testified to the DNA evidence. On November 17, 2005, the jury convicted Smith in the abduction and murder of Carlie Brucia.

4/9/05

+5 5+15 ÷3 +2 -4x4-1+1 ÷2 ÷4x4 ÷2+3-5
 ÷5 ÷2-3-5-4 +3-5+1 ÷5-1+2 ÷2 ÷3+11
 x5 +3+1+2-5 ÷4-4x4x5x5-5+2-13+1+2
 -5+3-5 ÷3x5+11-4x5-2-5 ÷3+1-4-5 ÷4
 +1+3-4 ÷2x4-5+5x5 ÷3+1x4+2+15x5+1
 ÷2+1 ÷5-5x2 ÷2+1 ÷2+1x4-5 ÷2-5+2 ÷24
 -4-1+3x5 ÷5-5+25x5 ÷3+35x51x5+1-5x3-1
 -3 ÷21-4x4x5x3+1-1 ÷3+1+2+3-5+1+2x5x35-4
 +1x4-5+3-5 ÷5 ÷5 ÷2-4+35x5 ÷5x4 ÷2+1x4-5
 3+2-5 ÷3+1x5x2-3-4x4-1x1-3-1+5x1-3-1-2-5
 ÷3+1x1x5 ÷3x51-1+2x5+11-3x25 ÷1x4x2
 ÷3+1x3x5+2-41 ÷3x2 ÷3+2x23 ÷2

Enciphered letter written by Smith

Cipher key used to decipher Smith's message

	1	2	3	4	5
—	A	B	C	D	E
÷	J	I	H	G	F
X	K	L	M	N	O
+	T	S	R	Q	P
	Y/Z	X	W	V	U



DNA Analysis Unit I

The DNA Analysis Unit I (DNAUI) provides serological and nuclear DNA testing services in criminal and counterterrorism investigative matters to all federal agencies; U.S. attorneys; military tribunals; and duly constituted state, county, and municipal law enforcement agencies in the United States, its territories, and other countries. The unit also provides expert witness testimony in criminal judicial proceedings on both a national and international level.

DNAUI personnel perform two evidence-processing functions: serology and nuclear DNA analysis. Serology involves screening evidentiary materials for biological stains, such as blood in homicides or other violent crimes and semen in sexual crimes. Nuclear DNA is the genetic blueprint that is unique to every individual, with the exception of identical twins, and is passed on by both mother and father. Nuclear DNA testing can be performed on the stains identified serologically and compared to reference samples obtained from the subject or victim in the case. Nuclear DNA testing also can be performed on samples that are not usually screened serologically, such as envelopes, hats, cigarette butts, and bottles. It can help answer the questions: Who licked this envelope flap? Who was wearing this hat? Who smoked this cigarette? Who drank from this bottle? Because of the extremely high discriminatory power of nuclear DNA analysis, these questions often can be answered with reasonable certainty.

DNAUI also maintains the Federal Convicted Offender (FCO) Program. The FCO Program requires collecting and processing samples from any individual convicted of a federal felony. Once the Laboratory receives the sample, DNA analysis is performed and the subsequent DNA profile is uploaded into the National DNA Database. The FCO Program supplies collection kits and receives samples from more than 500 collection sites across the United States. Since the program's inception in June 2001, more than 100,000 samples have been received. In 2005 alone, the FCO Program received more than 73,000 samples. This increase over subsequent years was due to the Justice for All Act of 2004, which expanded the list of qualifying offenses from sexual assaults and crimes of violence to all felonies. The FCO Program currently receives 7,000 to 8,000 samples every month. In January 2006 Congress passed the DNA Fingerprint Act of 2005, which further expands the list of qualifying federal offenses to include all federal arrestees. This new act will result in an increase of approximately 100,000 samples per year. The FCO Program eventually will use robotics and automation to handle the high production that this legislation requires.

Unit personnel have provided training to more than 3,500 law enforcement and forensic laboratory personnel during more than 20 separate in-services, schools, seminars, working groups, and conferences. The FBI, specifically DNAUI, is responsible for developing and maintaining a DNA audit document for assessing compliance with DNA standards and also provides DNA auditor instruction to all American Society of Crime Laboratory Directors/Laboratory Accreditation Board inspectors, in addition to the forensic DNA community, on how to interpret the DNA standards.

The American Prosecutors Research Institute provides training on DNA technology to state and local prosecutors. The goal of the training is to provide participants with the knowledge and skills necessary to understand, investigate, and present forensic DNA evidence effectively and persuasively in court. DNAUI provides instructors for these classes numerous times throughout the year. The benefits of this program include ensuring that prosecutors receive proper training, establishing communication between forensic examiners and prosecutors, and making pretrial meetings more productive by reducing the training needed during these meetings.

DNAUI has been responsible for developing a memorandum of understanding between the FBI and the District of Columbia to facilitate the staffing and training of qualified

DNA scientists to service a Metropolitan Police Department (MPD) DNA program. Specifically, the unit has developed position descriptions, salary levels, and experience and educational requirements and has assisted in the recruitment, interview, and hiring of technical positions to staff the program. DNAUI also is providing the necessary training, supplies, and quality assurance/quality-control support. Two MPD serologists have completed training, and DNAUI is in the process of training an MPD DNA examiner. The group will ultimately function autonomously within the FBI Laboratory in Quantico until a permanent facility is established by the MPD in the District of Columbia.

Vermont Capital Case

In the early morning hours of November 27, 2000, Terry King, a 53-year-old grandmother, was carjacked and held hostage by Donald Fell and Robert Lee. They had just killed two people and needed a getaway vehicle. Four hours later, Fell and Lee beat King to death as she prayed in a field. After Lee's death in prison, the fate of Fell became a landmark case in the state of Vermont. The state had abolished the death penalty in 1987, making this federal case Vermont's first capital case in more than 40 years. In June 2005 a DNAUI examiner testified that King's DNA was identified on Donald Fell's boots. The jury convicted Fell on all four counts after two hours of deliberation. Jurors unanimously reached a death-penalty verdict.

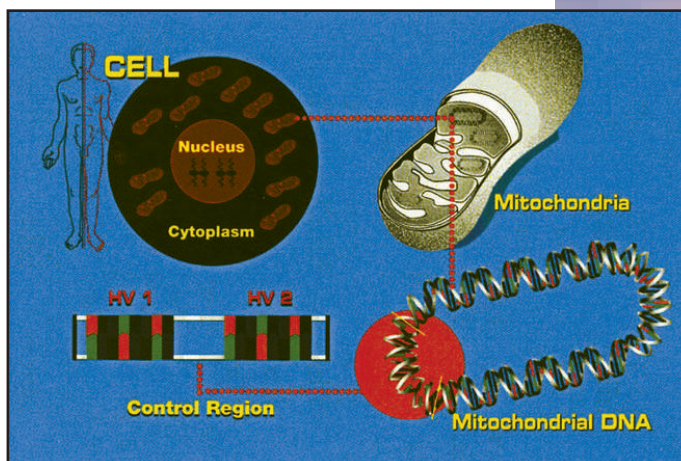
DNA Analysis Unit II

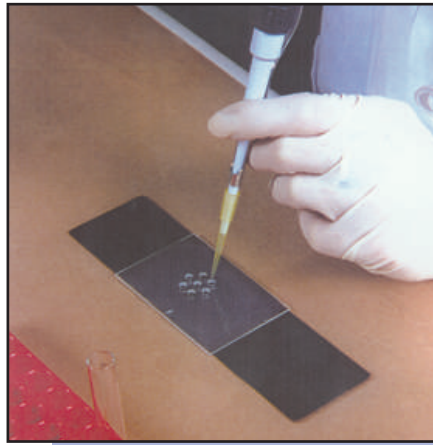
The DNA Analysis Unit II (DNAUII) examines biological items of evidence—such as hair, bones, and teeth—from crime scenes to determine the mitochondrial DNA (mtDNA) sequence. Typically, these items contain low concentrations of degraded DNA, making them unsuitable for nuclear DNA examinations. The high sensitivity of mtDNA analysis allows forensic scientists to obtain information from old items of evidence associated with cold cases and small pieces of evidence containing little biological material.

Additionally, the maternal inheritance of mtDNA allows scientists to compare the mtDNA profile of a set of remains to that of reference samples from such individuals as the mother, brother, sister, or any other maternally related individuals of a missing person. These samples should have the same mtDNA profiles because all maternal relatives inherit the same mtDNA. Because mtDNA is maternally inherited and multiple individuals can have the same mtDNA type, unique identifications are not possible using mtDNA analyses. However, mtDNA analysis is an excellent technique to use for obtaining information in cases where nuclear DNA analysis is not feasible.

In addition to criminal casework, the DNA Analysis Unit II focuses considerable attention on other programs of interest to the forensic DNA community: the National Missing Person DNA Database, the Regional Mitochondrial DNA Laboratory Program, and the Scientific Working Group on DNA Analysis Methods Mitochondrial DNA Population Database.

The unit also provides training to the forensic science community. Each year unit members teach a two-week Forensic Mitochondrial DNA Analysis course, which provides the scientific foundation for human mitochondrial DNA biology and the practices used to





accurately convey the information gained from typing samples. Course participants regularly include national and international members of the forensic community. Topics include heteroplasmy, contamination, quality assurance/quality control, report preparation, statistics, population database, and legal issues. Additionally, the course covers such fields as trace evidence and physical anthropology and their importance to forensic mtDNA analysis. Students conduct extensive literature reviews and moot-court exercises. The course also provides an intense practical experience in the analytical methods used to generate mtDNA profiles by having course participants perform the laboratory procedures. Participants take a sample through extraction, polymerase chain reaction (PCR) amplification, postamplification quantitation, cycle sequencing, and capillary electrophoresis. The students then analyze and interpret the data. Because of the unparalleled expertise of the DNAUII staff, participants receive a comprehensive introduction to forensic mitochondrial DNA analysis.

Shauna Howe

On October 27, 1992, 11-year-old Shauna Howe was abducted while walking home from a Girl Scout Halloween party in Oil City, Pennsylvania. Three days later, searchers found her lifeless body at the bottom of a 30-foot drop from a train trestle. The autopsy revealed that Shauna had been sexually assaulted and that she had been alive when she was thrown from the bridge. Forensic evidence was collected from her body, and the evidence was sent to the Pennsylvania State Police Crime Laboratory and the FBI Laboratory.

Over the next 12 years, several suspects were taken into custody, but in 2004, three main subjects were identified: Eldred Ted Walker, James O'Brien, and Timothy O'Brien. Walker confessed that he and the O'Brien brothers had kidnapped Shauna and brought her to his residence. Walker became a witness for the state and testified that he had heard the child screaming and crying while the O'Brien brothers raped her. He advised that he did not participate in the sexual assault.

The DNA Analysis Unit II processed two questioned hairs in this case: one hair located on Shauna's Girl Scout sash and one hair located on her sock. Mitochondrial DNA sequences from these items matched the mtDNA sequences obtained from the O'Brien brothers. The unit's testimony helped convict the O'Brien brothers in October 2005.

On October 31, 2005, the town of Oil City resumed trick-or-treating for the first time in 13 years.

Explosives Unit

The Explosives Unit (EU) plays an important role in helping the FBI meet its primary mission of preventing terrorist attacks. The unit's main responsibility involves the examination of evidence associated with bombings. Explosives examinations involve identifying the form and function of components used in the construction of incendiary and improvised explosive devices (IEDs). The unit also performs chemical analyses to determine the type of explosive used in devices. This includes analyzing bulk substances as well as the residues left behind after an explosive detonates. Unit members also assist investigators in determining if debris from a fire of suspicious origin indicates the presence of an accelerant.

The unit maintains two resources that help it achieve its mission. The Explosives Reference File contains several thousand standards that help examiners identify the components and manufacturer of explosive and incendiary devices. The Explosives Reference Tools database (EXPeRT) combines the text of FBI Laboratory reports with evidentiary photographs from bombing cases and permits the rapid retrieval of information on any aspect of the forensic examination. The database also contains manufacturer data and open-source literature on the construction and use of explosives and explosive devices. An examiner can search EXPeRT, find similar devices, and identify similarities in components used in the construction of an IED.

Providing field support, investigating bombing crime scenes, searching bomb-making factories and safe houses in which bombs or bomb components may be present, conducting training in bombing crime scene investigations, and providing testimony in court represent other responsibilities of EU personnel.

In 2005 the Explosives Unit provided forensic and/or technical assistance for more than 25 international bombing crime scenes/searches. The unit also provided training to more than 200 federal, state, and local investigators on bombing crime scene investigations. In addition, the EU provided financial support and subject-matter experts in support of the FBI's Large Vehicle Bomb Post-Blast Course. The only one of its kind, this course has provided training for more than 2,500 students, including U.S. military personnel; federal, state, and local investigators; and numerous international law enforcement partners.

Amman Hotel Bombings

On November 9, 2005, three near-simultaneous suicide bomb attacks occurred at the Radisson SAS, Grand Hyatt, and Days Inn hotels in Amman, Jordan. At the Radisson, the bomber infiltrated a wedding reception and detonated an IED just as the bride and groom were arriving. At the Grand Hyatt, the bomber stood in the bar of the hotel lobby and initiated an IED hidden under his leather coat. The attack at the Days Inn took place on the street outside the front lobby, apparently after the bomber had tried and failed to initiate his device inside.

At the request of the Jordanian government, the FBI sent a joint team comprised of Laboratory Division and Washington Field Office (WFO) personnel to support the FBI's legal attaché in Amman. The team, which arrived November 12, included a senior WFO Evidence Response Team leader, along with experts in DNA, explosives chemistry, and IED construction.

FBI team members initially assisted their Jordanian counterparts by reviewing evidence collected from the three bomb scenes. This review revealed that all three devices employed an explosive charge to propel steel balls. Each IED appeared to have two independent fusing systems. One system employed a mechanical-action grenade fuse, whereas the other fusing system had two automotive-type switches connected to an electrical blasting cap.

The bombers carried the IEDs under their coats in vests made from lightweight cloth supported by nylon straps.

On November 12 the Jordanian authorities raided an apartment believed to be the safe house used by the bombers. With the help of the FBI team, the Jordanians collected fingerprints, hairs, and other trace evidence for laboratory analysis. The next day, the Jordanian government announced the arrest of Sadijah Mubarak Atrus al-Rishawi, an Iraqi national. She admitted that she had been a part of the suicide team and had worn an IED into the Radisson along with her husband, who successfully employed his device.

The Jordanian authorities made available for inspection by the FBI team an IED found hidden at the house where al-Rishawi had been taken into custody. This device consisted of a vest constructed from muslin-like cloth and nylon straps. Taped inside the vest were two sheets of metal balls suspended in a clear, caulk-like material. Also found inside the vest were two clear plastic bags containing plastic explosives. This IED also had two fusing systems consistent with the fusing systems recovered from the three bomb scenes.

The FBI Laboratory continues to support the Jordanian authorities in their forensic examinations. DNA evidence found on the al-Rishawi suicide vest may help trace the source of these IEDs back to the bomb maker.



The devastating damage caused by three suicide bombings at the Radisson, Grand Hyatt, and Days Inn hotels in Amman, Jordan

Evidence Response Team Unit

Established in 1992, the Evidence Response Team Unit (ERTU) provides training, crime scene equipment and supplies, and on-scene support to the ERTs in each of the FBI's 56 field offices. There are currently 1,128 ERT members field-wide participating in the ERT program.

The ERTU provides all field offices the following resources:

- An annual budget for crime scene supplies and equipment.
- Mobile command posts and other crime scene vehicles and trailers to use at crime scenes.
- Sophisticated tools that include forensic light sources, laser transit systems, digital cameras, and laptop computer technology.

Other services provided by ERTU include:

- Use of the Underwater Search and Evidence Response Team.
- Basic and advanced forensic training for all field ERT personnel.
- Operational ERT support and consultation to field offices upon request.

The ERT Program is an effective tool that supports FBI priorities to prevent acts of terrorism and investigate acts of terrorism as they occur. ERTs field-wide also support investigations encompassing the FBI's other investigative priorities.



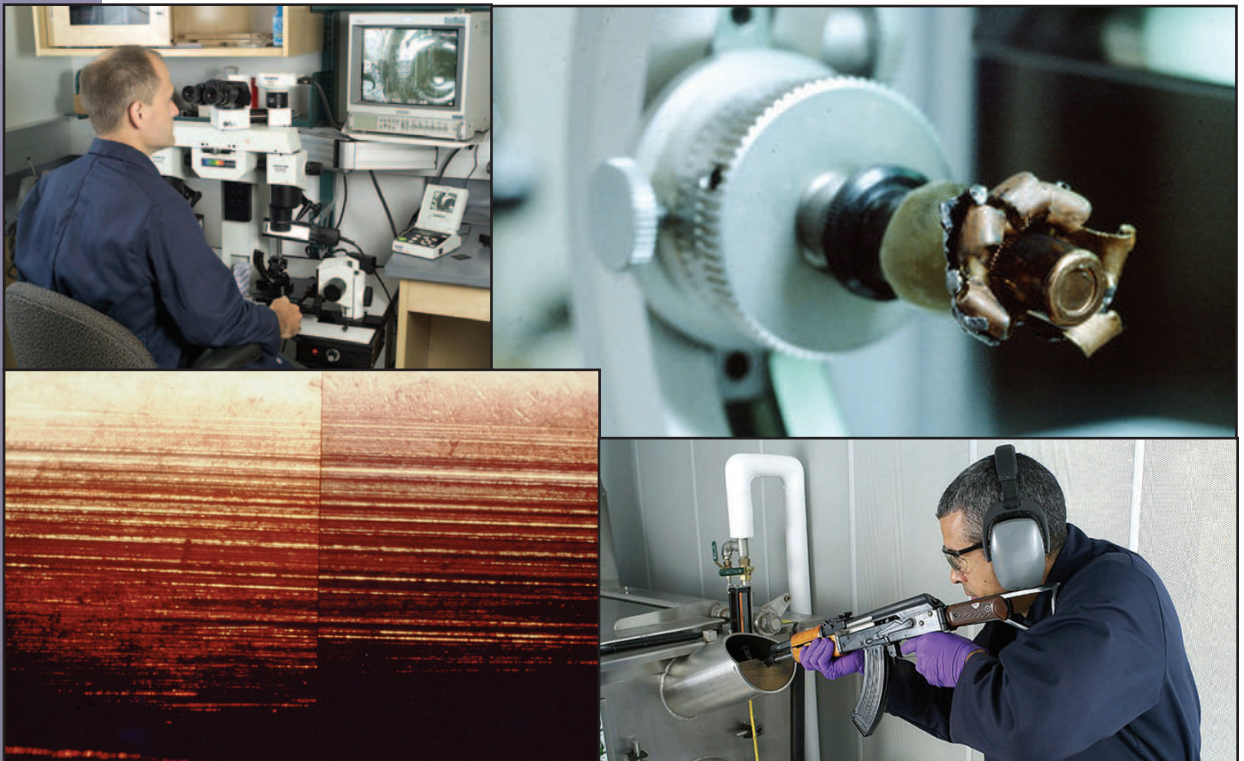
Firearms-Toolmarks Unit

Personnel in the Firearms-Toolmarks Unit (FTU) examine evidence related to firearms, firearm components, ammunition, ammunition components, tools, and toolmarks. Evidence in a typical case may include a number of recovered rifles, pistols, and shotguns; silencers and other muzzle attachments; magazines; holsters; and a variety of fired and unfired cartridges. Lead and other metal fragments, shot wads, shot cups, and bullets removed from bodies at autopsy are also frequently received in firearms-related casework. Evidence submitted in toolmark cases may include screwdrivers, scissors, knives, pliers, wrenches, crowbars, hammers, saws, wire, sections of sheet metal, chains, safety-deposit boxes, human bone or cartilage, plates, locks, doorknobs, bolts, and screens.

Forensic firearms examinations are based on firearms identification, which involves determining whether a bullet, cartridge case, or other ammunition component was fired by a particular firearm. Firearms examiners microscopically compare bullets and ammunition components with each other as well as with any number of firearms to determine whether an association exists between the items submitted as evidence and items whose origins are known. Similarly, forensic toolmark identifications involve determining whether a toolmark was produced by a particular tool. Examiners compare the micro- and macroscopic features of toolmarked items with known and questioned tools that may have produced them.

Other tests and examinations routinely performed by unit personnel include:

- Trigger pull tests.
- Function tests.
- Full-auto conversion tests.
- Accidental discharge tests.
- Shot pattern examinations.
- Gunshot residue examinations.
- Ejection pattern testing.
- Trajectory analysis examinations.
- Silencer testing.
- Serial number restorations.



The unit maintains two reference collections: the Reference Firearms Collection, which contains more than 5,500 handguns and shoulder firearms; and the Standard Ammunition File, a collection of more than 15,000 military and commercial ammunition specimens from both domestic and international manufacturers.

Firearms examiners provide field support in FBI investigative matters and administrative inquiries, assisting with the collection, preservation, and processing of evidence at crime scenes. More frequently, unit field teams provide crime scene trajectory reconstructions and analyses as needed, both in the United States and overseas.

The unit also serves as a liaison with national and international forensic laboratories. Examiners provide extensive training to members of law enforcement agencies and crime scene personnel and investigators. The unit sponsors regular training schools in trajectory analysis, gunshot residue analysis, firearms identification, and the identification of stolen motor vehicles. In 2005 the unit provided training in these areas in Quantico and at other U.S. locations, as well as in Spain and Israel. FTU examiners also traveled to Canada, Italy, and Thailand to provide expert training in serial-number restoration techniques, basic firearm and toolmark identification, and crime scene searches relating to shooting scenes.



Hazardous Materials Response Unit

The Hazardous Materials Response Unit (HMRU) provides rapid scientific and technical assessments of threats involving hazardous chemical, biological, radiological, and nuclear materials, including weapons of mass destruction (WMD). HMRU provides these assessments to FBI field offices, legal attachés, and Headquarters divisions.

The HMRU provides on-site operational and investigative assistance, including scientific and technical support, to FBI investigations involving hazardous materials. HMRU supervises on-site safety oversight at high-hazard crime scenes (e.g., collapsed structures and confined spaces) and supports tactical and hazardous device response operations where hazardous materials may be present.

The HMRU currently supports 27 Hazardous Materials Response Teams (HMRTs) operating in FBI field offices. These teams comprise more than 300 response personnel, predominantly FBI Special Agents, who require response equipment, medical monitoring, and specialized training. The HMRU provides training, certification, and oversight to these HMRTs. In addition, the HMRU assists the FBI's International Training Unit by providing WMD exercises, crime scene training, incident command, and WMD recertification.

In 2005 the HMRU deployed on 75 missions, completed 220 scientific assessments, and provided operational advice via 223 conference calls.

Success for the HMRU program is linked to close and effective working relationships within the FBI, with other government agencies, and in academia. These close working relationships have expanded beyond the national borders of the United States to include representatives of international governments. In 2005, at the request of the Georgian government, the HMRU deployed to the Republic of Georgia on two different occasions to assist on three different investigations. The first investigation involved the deaths of Prime Minister Zurab Zhvania and Deputy Governor Raul Usupov, who were found dead of apparent accidental carbon monoxide poisoning. The second investigation was the attempted assassination of the President of the United States, George W. Bush. The third investigation involved the search and recovery of physical evidence from 14 cars transported to Georgia after being stolen in the United States. HMRU personnel tirelessly responded to and managed hazardous crime scenes involving the collection of hazardous evidence. The effort displayed by HMRU personnel represents a superb example of international law enforcement cooperation and liaison.



The Death of the Prime Minister and the Deputy Governor, Tbilisi, Georgia

In early February 2005 the Republic of Georgia's Prime Minister and Deputy Governor were found dead by apparent carbon monoxide poisoning. Although the deaths appeared to be accidental, immediate public speculation began about possible political assassination, foul play, and the strange circumstances surrounding their deaths. Therefore, the Georgian government requested FBI assistance with its investigation. Given the stature and prominence of the deceased, the request for FBI assistance was of great importance and considered a highly sensitive matter. The Georgian government immediately made it known publicly that the FBI would assist in this investigation, which was heralded by all media outlets and the local international community as an extremely positive step. Less than four days after the incident, a team from HMRU arrived on the scene with an overwhelming amount of pertinent scientific equipment and appropriate scientific and hazardous materials personnel. HMRU personnel re-created the scene and conducted a four-hour test to measure the air quality in the apartment under conditions that approximated as closely as possible those of the morning the bodies were discovered. Nothing was observed during the testing or in the analysis of the test data by the Laboratory Division to contradict the preliminary finding of the Georgian government that the Prime Minister and Deputy Governor died of carbon monoxide poisoning because of a faulty heater.



HMRU personnel about to enter the apartment where the officials' bodies were found

Threat Against the President of the United States, Tbilisi, Georgia

On May 10, 2005, Vladimir Arutinian attempted to attack the President of the United States by throwing a hand grenade in the general vicinity of the President during a public speech in Freedom Square in Tbilisi, Georgia. Subsequent joint investigation by the FBI and the Georgian Ministry of Internal Affairs led to Arutinian's capture on July 20, 2005. In the course of postarrest searches of Arutinian's apartment, investigators discovered that Arutinian had assembled a vast and complex chemistry laboratory in a basement storage area of his apartment building. This laboratory contained vast quantities of unidentified chemical substances, compounds, and acids. The Georgian government immediately requested FBI assistance in the processing and dismantling of this laboratory because it potentially posed a grave danger to the Georgian public. On July 23, 2005, a team of FBI personnel responded from the FBI Laboratory, including HMRU, the Explosives Unit (EU), the Photographic Operations and Imaging Services Unit (POISU), and the Latent Print Units, as well as several members from the FBI's Washington Field Office (WFO) Hazardous

Materials Response Team and Evidence Response Team. During the search process, HMRU and EU provided the scientific and technical oversight to assess and evaluate all of the hazardous and explosive materials, and the WFO HMRT conducted all search tactics based on the continual scientific and technical assessment by HMRU and EU. The four-day search identified many items of evidence, specifically, hazardous chemicals, explosive items, and laboratory equipment. A total of 265 chemical containers were removed, of which 154 samples were taken for potential future forensic analysis by the FBI Laboratory. The contributions of Laboratory Division personnel not only resulted in the recovery of crucial evidence about Arutinian's intentions and activities but also prevented further loss of life or serious injury to Georgian investigators. Without the equipment and personnel the FBI provided, certain chemical substances would have definitely killed or maimed the Georgian team members attempting to recover them.

Meanwhile, back at the FBI Laboratory, DNA Unit I received seven separate evidence submissions. An examiner and several biologists in the unit expedited the submissions and quickly developed a full DNA profile from a piece of cloth that had been wrapped around the grenade Arutinian had thrown. After receiving a reference sample taken from Arutinian, DNAUI was able to definitively link him to the cloth.

In addition, the Firearms-Toolmarks Unit examined component parts of the unexploded grenade. The FTU examiner concentrated on the fact that the grenade failed to detonate and thus carefully examined the primer of the grenade and the depth to which it had been struck. The FTU findings helped the other Laboratory units formulate their final analyses, which identified and helped convict Arutinian.

In January 2006 a Republic of Georgia court sentenced Arutinian to life in prison for his failed assassination attempt.



President Bush addresses a crowd in Tbilisi, Georgia.



Vladimir Arutinian threw this grenade near President Bush during his visit to Tbilisi. Fortunately, it failed to detonate.



Arutinian's basement laboratory



Chemicals found in Arutinian's laboratory

Collision and Derailment of Norfolk Southern Trains Graniteville, South Carolina

In January 2005 a Norfolk Southern freight train collided with a parked train, releasing its load of chlorine and killing nine people. Several hundred residents were hospitalized. The FBI's Columbia Field Office advised that the National Transportation Safety Board (NTSB) had arrived on the scene and had begun its preliminary investigation. The NTSB investigation team requested FBI forensic assistance, in accordance with the recent memorandum of understanding between the NTSB and the FBI. The NTSB specifically requested that the FBI locate the railroad switch involved in the accident. The switch was close to the derailment in a chemically hazardous area. The Columbia Field Office requested that the HMRU deploy to conduct the appropriate search of the switch site. Using Level A personal protection equipment, HMRU personnel entered the scene to provide documentation, specifically of the railroad switch involved in the derailment incident, and to retrieve the railroad switch lock and handle for later forensic analysis.

The NTSB later determined that the accident occurred as a result of human error. A crew working on the parked train failed to return the switch to its proper position, causing the freight train to leave the main track, hit the parked train, and derail, spilling its hazardous load.



◀ **Norfolk Southern
train derailment,
Graniteville,
South Carolina**

**Railroad contractors
stand by while HMRU
personnel document
the scene.**



Investigative and Prosecutive Graphic Unit

In 2005 the Investigative and Prosecutive Graphic Unit (IPGU) provided a wide array of investigative, prosecutorial, and operational support for the FBI. An enhanced support base for counterterrorism, counterintelligence, and criminal matters provided the foundation for the unit's efforts.

Unit personnel produced or enhanced digital imagery for crime scene surveys and reconstructions, the documentation of bombing and shooting scenes, artist composite drawings, facial age progressions, digital photographic manipulations and retouches, facial reconstructions from skeletal remains, and numerous forms of demonstrative evidence.

In the area of crime scene reconstruction, unit personnel traveled to numerous domestic scenes to conduct site surveys and secure digital documentation data. The data they collected enabled them to produce to scale two-dimensional (2-D) and three-dimensional (3-D) scene reconstructions. In conducting these surveys, personnel used both traditional methods and state-of-the-art digital and laser data-collection devices. The Total Station, a laser/digital survey instrument, was used to digitally document several of these scenes. In several other instances, a 3-D, high-resolution laser scanner was used. For one of the larger, more complex scenes, personnel used the Total Station in conjunction with the laser scanner to aid in the collection of the data.

The images below show a photograph of a 3-D laser scanner, one of the scanned "point cloud" data sets, and a completed rendering from the data collected. To create these images, unit personnel scanned the interior of a bank in Ohio where a police officer was shot and killed by a would-be robber.



The image below depicts the point-cloud data set collected from a 3-D laser scanner. The data set represents one of dozens of scans taken throughout this particular neighborhood. It displays specific areas where a violent gang allegedly committed numerous homicides. The result of this effort was a complete to-scale, interactive depiction of multiple crime scene locations. In addition to these scene reconstructions, the final product contained imagery of the individuals suspected of perpetrating these crimes and the ability to visualize spatial relationships between locations and individuals, as well as photographic documentation of the crime scenes.



The IPGU also provided crime scene reconstruction support for crimes that occurred overseas, most notably, in Lebanon and Azerbaijan. In these cases, Evidence Response Team personnel or Explosives Unit examiners collected the data, which was then hand-carried or transmitted electronically to the IPGU. Once received, the information was reviewed, processed, and converted to a 2-D, hard-copy format. The completed images were used by investigators, both domestically and internationally.

Unit personnel prepared artist composite drawings in direct support of FBI, U.S. Department of Defense, and intelligence personnel on the ground in Afghanistan and Iraq. In several cases, IPGU personnel at the Laboratory in Quantico or at FBI Headquarters in Washington, D.C., conducted interviews with witnesses overseas by using video teleconferencing. In this way, the unit can reach out to any location in the world that has similar technology, remotely conduct interviews, and prepare, in real time, high-quality images to support investigations.

One of the areas in which the unit provided the most visible support for the FBI's counterterrorism, counterintelligence, and criminal investigative efforts involved the production of high-quality digital photographic manipulations and retouches. Since the beginning of hostilities in the Middle East, the unit has provided an enormous amount of digital imaging support, with 2005 being perhaps the busiest period for this support. Using information provided by investigators, informants, the military, and other sources, the IPGU prepared retouched and age-enhanced images of some of the most dangerous terrorists in the world. This imagery spanned the globe from Iraq and Afghanistan to Bali to Colombia. Through these efforts, numerous terrorists have been identified and captured.

The IPGU's production of demonstrative evidence for courtroom presentation is as significant as its investigative and operational support efforts. This work is highlighted by the support the unit has provided for the trial and sentencing of Zacarias Moussaoui, the al-Qaeda operative some believe was meant to be the 20th hijacker on September 11.

Since 9/11, IPGU personnel have been working on the production of investigative and prosecutive materials, including items ranging from simple charts and diagrams to complex digitally interactive displays of time-sensitive, multilayered interactions between individuals and organizations. These interactive presentations often include video and audio clips, scanned images of documents and photographs, and typed transcripts of telephone conversations. All of these served as the basis for the government's case against the only person charged in connection with the September 11 terrorist attacks.

In February 2006 the Investigative and Prosecutive Graphic Unit was merged with the Structural Design Unit to create the Special Projects Unit. This merger reflects the similar missions of both units.

Latent Print Operations Unit

The Latent Print Operations Unit (LPOU) consists of six teams of forensic examiners and two programs, Administrative Review and Case Flow Management. The forensic examiners conduct timely, high-quality scientific friction ridge examinations, produce written reports on their findings, present expert testimony relating to these examinations in legal proceedings, and provide training and field support to the national and international law enforcement communities. Personnel in the Administrative Review Program review all examination reports issued by the LPOU, while personnel in the Case Flow Management Program coordinate the assignment of cases to all forensic examiners to ensure the most effective and efficient flow through the LPOU.

Murder of Judge Joan Lefkow's Mother and Husband

On February 28, 2005, U.S. District Court Judge Joan Lefkow returned home to find her mother, Donna Humphrey, and her husband, Michael Lefkow, murdered. The Chicago Police Department processed the initial crime scene, which yielded several items of evidence, including a broken window and a window pane from the point of entry. These items were submitted to the FBI and the Illinois State Police (ISP) laboratories for processing and yielded 12 latent fingerprints of value. The latent fingerprints eliminated four suspects and seven other individuals; however, no identifications were made. Numerous searches of the Integrated Automated Fingerprint Identification System (IAFIS) also produced no identifications.

On March 9, 2005, police officers in Wisconsin performed a traffic stop on a van. As they approached the vehicle, the driver shot and killed himself. In a suicide note found in the van, the driver admitted to killing Humphrey and Lefkow.

At the request of the FBI's Chicago Field Office and the ISP, an LPOU examiner was assigned to process the crime scene and develop any blood evidence for which previous crime scene teams had not been equipped. The LPOU examiner developed blood pattern evidence that was used to corroborate the details set forth in the suspect's suicide note. Known fingerprints obtained from the suspect following his suicide matched a latent fingerprint developed on the inside of the window used to enter the Lefkow home.

Latent Print Support Unit

The Latent Print Support Unit (LPSU) consists of five programs. Staff members working on the IAFIS Program coordinate, test, evaluate, and implement new IAFIS hardware and software from the latent print perspective and conduct liaison with the FBI's Criminal Justice Information Services Division and the criminal justice community on all latent print-related IAFIS issues. The Major Incident Management Program provides a point of contact for the worldwide deployment of the Disaster Squad and other special operations teams.

LPSU staff members assigned to the Standards and Practices Program draft, implement, and maintain the *Latent Print Unit Quality Assurance Manual* and the *Latent Print Operations Manual* and manage the Quality Assurance Program for the LPOU and the LPSU. Technology Development Program employees manage the operation of the Latent Print Digital Imaging System and coordinate, test, evaluate, and implement relevant biometric technology for application in friction ridge analysis. The Training Program staff manages, coordinates, and directs the training programs for both the LPOU and the LPSU. These programs include training for LPU physical scientists, forensic examiners, and new supervisors; in-service training for both FBI employees and law enforcement personnel outside the FBI; continuing education training for LPU employees; latent print training for Indian Country Evidence Task Force and Evidence Response Team personnel; training for new agents at the FBI Academy; and training for law enforcement personnel attending the FBI's National Academy program. These programs maintain the LPOU's ability to conduct or direct high-quality friction ridge examinations in a professional, competent manner and ensure compliance with FBI, Laboratory Division, and American Society of Crime Laboratory Directors/Laboratory Accreditation Board-*International* policies, procedures, and guidelines.

Disaster Squad Deployment: Thailand

As part of the forensic team that responded to Phuket, Thailand, to help identify the approximately 8,000 victims of the tsunami, members of the FBI Laboratory's Disaster Squad traveled in three deployments between February and April of 2005. Working with Disaster Victim Identification Teams from more than 20 countries, the Disaster Squad applied specialized techniques to record friction ridge skin and compare the prints with antemortem exemplars in an attempt to identify the victims. During this time, approximately 1,500 victims were printed. Some of the squad's accomplishments included:

- Introducing a successful method of rehydrating the victims' hands to facilitate the legible recording of postmortem prints. This method is currently being used to reprint victims whose prints were illegible, resulting in additional identifications.
- Providing recording materials superior to the materials previously used.
- Initiating additional printing techniques.
- Devising quality-control measures to administratively document the recording of postmortem prints by more than 20 countries.
- Recognizing the need to resize some of the postmortem prints to enhance Automated Fingerprint Identification System (AFIS) searches. The AFIS database now contains more than 800 antemortem records and more than 3,700 postmortem records. More than 500 victims have been identified using AFIS.



Photographic Operations and Imaging Services Unit

The Photographic Operations and Imaging Services Unit (POISU), commonly referred to as “Photo Operations,” is responsible for coordinating and managing virtually all photographic services for the FBI. These services include conducting operational, investigative, and forensic photography; providing technical assistance; procuring and repairing camera and darkroom equipment; and conducting training in all aspects of photography and image capture. Photo Operations also captures, processes, and produces photographic images using traditional silver-based methods as well as digital imaging technologies. The unit not only manages the FBI Photographic Program but also is responsible for the oversight and management of the Field Photographic Program, encompassing more than 125 full-time and backup photographers in the FBI’s 56 field offices. The unit also provides investigative and forensic photography, imaging, and photographic-processing support for federal, state, local, and international law enforcement investigations.

Photo Operations is divided into three separate subunits with very distinct and specific responsibilities.

The Operations and Training Subunit provides photographic support and services—including forensic, crime scene, and evidentiary photography—directly to the Laboratory, FBI Headquarters divisions, and all FBI field offices. This subunit comprises primarily scientific and technical photographers who deploy to major crime scenes, agent-involved shootings, and other operational or investigative events. Additionally, as its name implies, the subunit provides all photographic training in the FBI. This includes new agents, field photographers, and outside agencies. Instruction includes virtually every aspect of photography and digital imaging.

The Photographic Equipment and Support Subunit has a wide-reaching span of responsibility. Personnel assigned to this subunit design and install photographic camera concealments; procure, disseminate, and repair photographic equipment including digital darkrooms; manage field office equipment transitions and upgrades; and manage all photographic production for the FBI. This subunit annually produces more than 1.5 million photographs ranging in size from 4 by 6 inches to 4 by 8 feet. This subunit also oversees three regional photographic minilabs, which are located in Atlanta, Chicago, and San Francisco.

The Photographic Services Subunit oversees the FBI Headquarters Portrait Studio, the Tactical Site Survey Mission, the Aerial Photography Program, and the Technical Imaging Group. The FBI Headquarters Portrait Studio provides photographic support for special events, anniversaries, retirements, and executive management. Personnel assigned to the Tactical Site Survey Mission work directly with the FBI’s Hostage Rescue Team and Special Weapons and Tactics teams to create virtual walkthroughs of special-event venues or high-risk locations. The Aerial Program provides oblique and direct vertical images of infrastructure, crime scenes, special-event venues, and other areas to use in investigative and tactical planning. Finally, the Technical Imaging Group comprises eight photographers dedicated to supporting the Latent Print Units of the FBI Laboratory. They use essentially every known photographic technique to capture, process, and print high-quality images of latent fingerprints.



Questioned Documents Unit

The Questioned Documents Unit (QDU) provides forensic support to federal, state, and local law enforcement agencies by conducting forensic examinations on evidence collected during investigations. These examinations include handwriting, typewriting, shoe prints, tire treads, alterations, obliterations, rubber stamps, plastic bags, and shredded documents.

The QDU also provides training to federal, state, and local forensic examiners on specialized technical topics in the forensic document, shoe print, and tire tread disciplines and assists law enforcement by providing information and presentations concerning the capabilities of the unit's forensic disciplines in general.

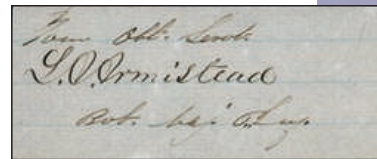
In 2005 personnel in the QDU provided evidence collection training to Indian Country investigators in Belcourt, North Dakota, and Window Rock, Arizona. Photographers and evidence collection personnel in the field also received training on chemical enhancement and photography techniques for shoe and tire impressions. QDU personnel also provided assistance to the FBI's Baltimore and Albuquerque Field Offices. Finally, QDU personnel provided presentations and workshops at numerous professional meetings.

The “Cutting Edge” of Forensic Document Examination

In March 2005 Howard Harner was accused of making more than \$47,000 from the sale of historical documents and signatures stolen from the National Archives Reading Room in Washington, D.C. Harner was arrested after a Civil War researcher recognized one of the signatures he was trying to peddle on eBay. It was suspected that Harner had gone to the National Archives Reading Room, checked out a letter dated June 4, 1861, that had been signed by Confederate Brigadier General Lewis A. Armistead, cut out Armistead's signature, and returned the document to the unsuspecting curator.

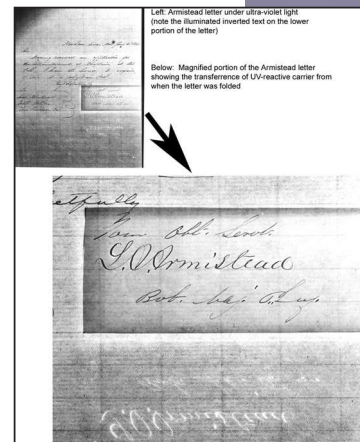
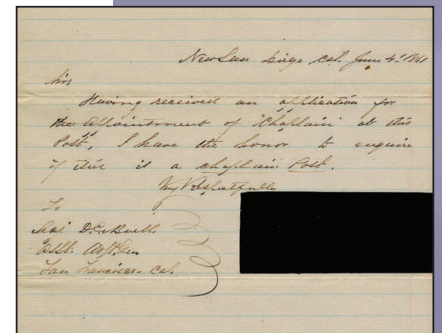
During the investigation, a fragment of paper containing the signature was seized from Harner. The National Archives asked the Questioned Documents Unit to confirm that the cutout Armistead signature did in fact originate from the letter. The task of matching the paper fragment edges of the signature to the letter seemed easy, although Harner had removed many signatures from many documents, and the precisely cut edges of the documents required microscopic evaluation to determine if they had been attached at one time. Some edge characteristics matched; however, the overwhelming proof came when QDU examiners used alternate light sources. Under ultraviolet light, an interesting phenomenon occurred. Just below the cutout area on the letter appeared a glowing, inverted image of General Armistead's signature. The phenomenon is described as luminescence, and in this case, it was caused by the excitation of latent ink properties that had transferred to an area on the letter that had been in contact with the original signature. The two crease marks in the letter indicated that it had been folded in thirds, which explained the upside-down positioning of the glowing Armistead signature. To demonstrate that the luminescing signature on the letter originated from the signature on the paper fragment, the examiner positioned the fragment into the cutout area of the letter and photographed it under ultraviolet light. A transparent print of the letter was made and folded in the same manner as the original letter. The signatures aligned perfectly, and it could be positively determined that the signature seized from Harner did originate from the Archives letter. The signature and letter were returned to the National Archives, and Howard Harner was sentenced to two years in prison and fined \$10,000.

An alternate light source reveals the invisible mirror image of the stolen signature.



Brig. Gen. Lewis A. Armistead's signature cut from the National Archives letter

The Armistead letter with the signature cut out



Structural Design Unit

The mission of the Structural Design Unit (SDU) involves the collection and application of information to create exhibits that visually support the FBI's counterterrorism and counterintelligence programs, all FBI investigations, federal and state prosecutions, and FBI public liaison activities.

Counterterrorism Support

Security models (computer and physical)—The SDU fabricates three-dimensional (3-D) physical scale models of locations where prominent national and international events are scheduled and the potential for a terrorist attack is high. These replicas of terrain and building structures enable law enforcement crisis management and special operations and tactical personnel to develop security strategies.

Crisis response models (computer and physical)—Three-dimensional physical and computer scale models are constructed of areas where terrorist acts or other critical incidents have occurred. These models give tactical response teams a realistic and accurate depiction of building layouts, including entryways, doorways, windows, stairwells, and any interior structural obstructions. Consequently, these scene reconstruction models assist law enforcement with the safe and successful breaching of facilities to extricate hostages and apprehend terrorists.

Prosecutorial Support

Demonstrative evidence (physical scale-model crime scene reconstructions)—When expert or eyewitness testimony includes the interpretation of evidentiary concepts in which questions of line of sight and elevations are fundamental to the prosecution's case, a 3-D physical model can be developed. To ensure that the model accurately illustrates the crime scene and correlated evidence, FBI technicians reconstruct the crime scene from blueprints, photographs, on-site measurements, and expert and eyewitness observations. Developing such demonstrative evidence frequently requires that the SDU technician travel to the crime scene to conduct a site survey to obtain distance and elevation measurements to accurately develop a scale model for trial.

In February 2006 the Structural Design Unit was merged with the Investigative and Prosecutive Graphic Unit to create the Special Projects Unit. This merger reflects the similar missions of both units.

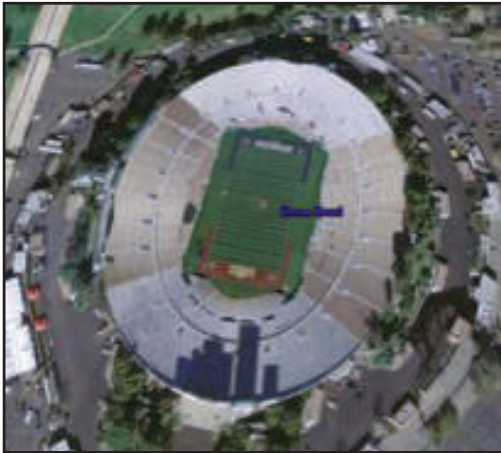


SDU: 3-D Scanning

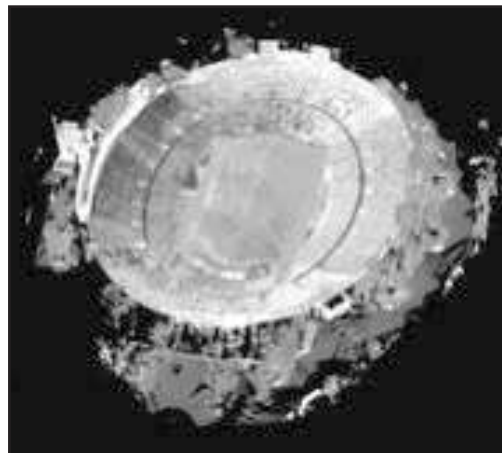
The Structural Design Unit is using 3-D laser scanning for special-event planning and crime scene documentation. The potential applications for 3-D laser-scanning technology are limitless. It can be used for any situation in which an object's actual 3-D shape geometry is unknown, needs to be verified, or needs to be visualized. Although the specific applications are limited only by the imagination, 3-D scanning has proven beneficial in several generalized applications.

The SDU has the capability to laser-scan a wide range of items or parts, regardless of size or complexity. The unit can collect and process millions of points accurately and quickly. Complex items are ideal candidates for laser scanning.

The SDU has purchased two 3-D scanner systems. A large-scale scanner can scan crime scenes as large as bridges, buildings, stadiums, and battleships and as small as vehicles and rooms. The SDU has scanned crime scenes from New York to Israel, while providing services at such major events as Super Bowl XL, the Major League Baseball All-Star Game, the Little League World Series, the Daytona 500, the President's State of the Union address, and the Rose Bowl. The unit's small-scale scanner is used for smaller items, including evidence, toolmarks, bomb devices, and skeletal remains.



Digital photo of the Rose Bowl, aerial view



3-D laser scan of the Rose Bowl, aerial view



Digital photo of the Rose Bowl, front view



3-D laser scan of the Rose Bowl, front view

Additional applications include 3-D crime scene modeling and visualization, deformation surveys, forensic analysis of accidents and crime scenes, bullet trajectories, evidence placement, as-builts and architectural surveys, and reverse engineering. Reverse engineering involves scanning an existing product of unknown geometry to obtain a 3-D representation for purposes of product development and prototyping (e.g., laboratory apparatus, concealments, tactical gear, and covert-operation tools).

Counterintelligence and Counterterrorism Operations

Security Strategic Planning Models

Terrorists are constantly assessing the vulnerabilities of high-value targets, such as prominent national and international events. The planning of an effective security strategy by law enforcement for these potential terrorist targets remains critical. To that end, the SDU can use 3-D laser-scanning technology to collect distance and elevation coordinates. These measurement data are used as a basis for the reconstruction as a 3-D model of a specific venue, to include terrain and building structures. The data provide an accurate likeness to a particular location and can be used to plan security for a special event or operation.

For example, at a large sporting event, 3-D scans would be taken of the entire stadium and surrounding areas and connected together to create one large 3-D model of the needed areas. The data can then be used to analyze and determine possible weak spots in security coverage and to illustrate risk areas, entrance and exit routes, and point-to-point distances. The technology also can provide the user a perspective from any location in the model to determine vantage points and possible trajectories.

Hostage rescue teams and tactical teams also can use these models when planning rescues. Laser-scanning technology can play a vital role in the accurate collection of 3-D measurement data needed to reconstruct a large and complex location so that tactical response teams can breach a facility in the safest way. If potential high-risk sites, special events, or critical national assets are known about in advance, then scans should be conducted and stored for future use.

Geographic information system (GIS) data collection is another major part of what the SDU provides. GIS is a computer software system used to capture, store, analyze, and display spatial information. The SDU collects such data as 3-D scans, global positioning system data, video, photographs, hand measurements, and blueprints and combines them into a GIS package. The GIS provides the ability to visualize on a map the location of important features or items, such as bridges, buildings, roads, rivers, vehicles, water supplies, telecommunication facilities, or people. A GIS not only can display the location of objects, but it also can indicate how these objects interrelate and react to certain stimuli.

Crime Scene Reconstruction Prosecutorial Models

The SDU's 3-D laser-scanning technology allows technicians to accurately collect detailed and precise 3-D measurements of a high-value target before an event occurs. In this way, even if a terrorist attack occurs and destroys buildings, the measurement data that have already been archived can be used to create a 3-D model for the prosecution. This form of demonstrative evidence is a potent tool for the concise and clear explanation of facts by an expert or eyewitness during courtroom testimony.

Trooper David “Rocky” Eales

On September 24, 1999, the Oklahoma State Patrol tactical team and the Drug Enforcement Administration prepared to execute a “no-knock” search warrant drug raid at the residence of Kenneth Barrett in Salisaw, Oklahoma. Barrett, suspected of operating a methamphetamine lab, had told his acquaintances he would kill any officers who tried to arrest him. As the tactical teams entered Barrett's property, Barrett opened fire on the lead vehicle with a high-powered rifle. Trooper David “Rocky” Eales, a passenger in the vehicle, was shot and killed when a round struck him just above the side panel of his bullet-resistant vest.



The U.S. Attorney's Office requested that a team from the FBI document the crime scene and aid witness testimony for trial by constructing a 3-D physical model. Two visual information specialists from the Structural Design Unit traveled to the crime scene and, using several methods, gathered the necessary information. Using the unit's robotic Total Station, they completed a site survey. They also collected digital imagery information and, along with measurements taken by hand and aerial photographs of the scene, generated computer-aided drawings using the unit's AutoCad software.

Next, the visual information specialists began producing the scene model. The AutoCad files were used to create laser-cut acrylic pieces for the house structure. The topography was accurately replicated using drawings generated from the survey data collected. Photographs (both digital and aerial film) were imported into the AutoCad drawings to verify the spatial relationships. The line-of-sight issues involved made accuracy and thoroughness essential.

A 3- by 6-foot terrain model was created. The model contained all of the details necessary to make the depicted scene as lifelike as possible. Grass and trees were included, as was real gravel to simulate the unpaved driveway. Wood lath detail was applied to the structure's exterior. Furniture was replicated and added to the interior. All of this was done to help witnesses recognize and identify various aspects of the scene as an aid to their testimony.

The model proved critical in demonstrating aspects of the scene that could not be visualized by any other method. In fact, at least 40 witnesses referred to the model during their testimony in the lengthy trial.

In November 2005 Kenneth Barrett was convicted on three counts and sentenced to death for the murder of Trooper David Eales.



Trace Evidence Unit

The Trace Evidence Unit (TEU) identifies and compares specific types of trace materials that may be transferred during a crime. Physical contact between two people or between a person and an object may result in the transfer of trace materials. The identification and comparison of these materials often can link a suspect to a victim or a crime scene.

The mission of the TEU is to provide scientific examinations of physical evidence in the areas of hairs, fibers, fabric, cordage, soil, glass, building materials, feathers, wood, gemstones, and physical anthropology; to provide expert testimony relating to these examinations in legal proceedings; to provide training to the law enforcement community; to provide forensic field support in FBI cases; and to develop and implement new technologies to enhance scientific examinations.

In support of the caseworking mission of the Laboratory, in 2005 the TEU completed analysis on approximately 14,000 items of evidence in 2,400 cases. Approximately 1,500 of these items were improvised explosive devices examined for hairs and fibers in support of the Terrorist Explosive Device Analytical Center (TEDAC). When the TEDAC won the Director's Award for Excellence in Outstanding Scientific Advancement, the TEU examiner working these TEDAC cases was included among the award recipients.

To support the mission of training, the TEU sponsored or participated in numerous ventures. Unit members taught one- to two-week courses in hair and fiber examinations and Indian Country crime scene analysis to audiences in Budapest, Hungary; Arizona; Washington; South Dakota; and Quantico. In support of the regional mitochondrial DNA laboratory initiative, TEU members trained nine hair examiners who will work in these four regional laboratories. These laboratories partner with the FBI Laboratory to augment their capacity for mitochondrial DNA analysis in forensic and missing-person cases.



Hurricane Katrina

Evidence Response Team (ERT) personnel were called to action in New Orleans in the aftermath of Hurricane Katrina. The storm caused significant damage to the New Orleans Police Department, including flooding the building used by the department's crime scene investigation and laboratory personnel. Most of the department's crime scene response vehicles had been flooded, taking away the ability to process crime scenes. Furthermore, most of the NOPD crime scene investigators are civilians who had been deemed "nonessential," so they had evacuated the city.

In the days following the hurricane, it became clear that the ERT could assist the NOPD by providing crime scene investigation response capability. Many FBI field office ERTs volunteered to assist, even before the full extent of the need became known. After the situation was evaluated, ERTs from the FBI's Little Rock and Atlanta Field Offices were deployed. After two weeks, they were relieved by ERTs from the Knoxville and Columbia Field Offices.

Some of the damage inflicted in New Orleans by Hurricane Katrina ►



ERT personnel worked 12-hour shifts and teamed with NOPD personnel so that all scenes would be managed by the NOPD with the FBI ERT in a support capacity. In addition to assisting on-scene, FBI ERT personnel conducted many informal training sessions for NOPD personnel on the various ERT equipment on-scene. The FBI also provided some basic crime scene investigation supplies to the NOPD to allow the department to continue working in the absence of the ERTs.

The FBI Laboratory's Disaster Squad also deployed to the Gulf Coast in the wake of Hurricane Katrina. In the two months following Katrina, members of the Disaster Squad worked to obtain identifiable fingerprints from more than 800 victims whose bodies had been severely damaged by the heat and floodwaters. Personnel from the FBI's Criminal Justice Information Services Division's Fly Away Identification Team (FAIT) scanned the fingerprints and searched them against the FBI's database of more than 47 million fingerprints. The prints were also searched against Louisiana's own fingerprint database, which contains some prints not on file with the FBI, and led to several positive identifications. Together with the FAIT, the Louisiana State Police Crime Laboratory, and fingerprint specialists from the Drug Enforcement Administration, the Disaster Squad positively identified 155 bodies. Efforts to identify the remaining victims continue at the Laboratory.

Tsunami Team

On December 26, 2004, an earthquake measuring 9.0 on the Richter scale erupted in the Indian Ocean off the coast of Sumatra. The massive quake created a powerful tsunami that struck a dozen countries in the region, with Indonesia, Sri Lanka, India, and Thailand being the hardest hit. A huge recovery effort ensued, and naturally, the FBI Laboratory took part.

Representatives from 32 nations assembled in Phuket, Thailand, to assist in the massive identification process. FBI personnel responded from the Evidence Response Team Unit (ERTU), the DNA Analysis Unit I, the Latent Print Operations Unit, and several ERTs from FBI field offices in Charlotte, New York, Philadelphia, and Los Angeles. Three separate teams rotated over a 60-day period to assist in DNA, fingerprint, and personal property matters.

Human remains were processed and stored in three separate locations; each was a several-hour vehicle ride from the others. Two of the sites were on temple grounds and contained primitive resources. The remaining site was the most efficient and adequately furnished of the three. There, team members could conduct six simultaneous postmortem examinations in a well-lit and air-conditioned environment. This site also had sufficient electricity to run numerous air-conditioned trailers to store the bodies. Three temporary, state-of-the-art morgues were brought in from Europe for each of the sites.



Latent Print examiners worked at one site to oversee and offer quality control to the latent print process. The examiners introduced the boiling technique for severely decomposed remains. This process greatly increased the Disaster Victim Identification Team's ability to obtain friction ridge detail. The latent examiners also regularly observed operations at the identification section of the command post. In doing so, they identified a problem with the Automated Fingerprint Identification System (AFIS) being used, which dramatically increased the reliability of the AFIS searches.

DNA examiners established the various protocols required for processing both postmortem and antemortem samples. They also established the protocols used for the identification process and developed a method of tracking samples at all three sites using bar-code technology.



Despite the chaos and confusion inherent in a natural disaster, particularly one of this magnitude, the identification process was highly organized. A command post, known as the Information Management Center (IMC), was established in Phuket City and included members of the Thai government, the Royal Thai Police, the Thai Joint Chiefs of Staff,



an executive committee, and several subcommittees. The executive committee governed the entire process. The executive committee included 10 to 15 members, each representing a different country. The IMC

commander sat on the committee, and a chairperson was designated on a rotating basis to oversee the committee. To keep everyone informed, a secretariat recorded the minutes of every executive committee meeting and distributed notes to committee members. Laboratory Division and field ERT personnel served on the executive committee and chaired the scientific subcommittee.

An ERTU team leader or a senior ERT leader was assigned to each of the three rotations. The team leader was responsible for liaison and communication with the Department of State, the FBI's legal attaché in Bangkok, the Laboratory, and the FBI's Strategic Information and Operations Center (SIOC) in Washington, D.C. As a member of both the executive committee and the scientific subcommittee, the team leader attended daily meetings, voicing issues and submitting proposals from the scientific subcommittee to the executive committee. The team leader also provided daily briefings to the Department of State, the Laboratory, and SIOC.

The chair of the scientific subcommittee, which was held by DNA and ERT personnel, scheduled daily committee meetings and ensured that members from each of the disciplines (fingerprint, pathology, DNA, and odontology) attended. The chair maintained minutes from each meeting, distributing them to all members and introducing proposals through the U.S. seat on the executive committee.

The member of the property subcommittee visited each of the three processing sites and worked with local authorities, including the Royal Thai Police and Thai government attorneys. The property subcommittee member identified the methods used to collect, store, and release property in each of the three jurisdictions. The property subcommittee member was further tasked with developing overall protocols to release property to the victims' families. A standardized protocol consistent with Thai law was developed to ease the process for both Thai families and other international government representatives.

Thousands of people lost their lives in the tsunami, which ranks among the world's worst natural disasters. The cooperative efforts of FBI personnel and members of international Disaster Victim Identification Teams helped make the process of identifying the victims—and perhaps the healing process as well—easier.

Collaboration

The complex nature of today's crimes and the global reach of criminals require collaborative efforts from the agencies tasked with protecting their citizens. The Laboratory's partnerships span the globe and encompass not only casework but also disaster response and research efforts. This section highlights the work of Laboratory units whose missions depend on collaboration.

Chemical-Biological Sciences Unit

The mission of the Chemical-Biological Sciences Unit (CBSU) is to develop and maintain the FBI's ability to conduct and direct high-quality forensic examinations of hazardous chemical, biological, and nuclear material and all related evidence. Developing and validating methods to analyze threat agents and establishing a support network of laboratories capable of providing a wide range of analytical capabilities and expertise remain critical to the success of this mission.

CBSU staff members assigned to the unit's Chemistry, Biology, and Nuclear Programs conduct or direct a variety of gene-based and immunological assays that detect and characterize pathogens, as well as analytical methods that identify and characterize toxins, hazardous chemicals, and radiological and nuclear materials. CBSU's research and development efforts focus on validating existing pathogen identification assays, developing and evaluating novel molecular and genetic methods for characterizing biological agents, and identifying trace compounds within evidentiary samples.

To fulfill its mission, CBSU has established partnerships with several federal and private laboratories capable of processing and analyzing hazardous chemical, biological, radiological, and nuclear (CBRN) evidence. These include:

- The Armed Forces Radiobiology Research Institute, Bethesda, Maryland.
- Lawrence Livermore National Laboratory, Livermore, California.
- The Naval Medical Research Center, Silver Spring, Maryland.
- The Savannah River National Laboratory, Aiken, South Carolina.
- The U.S. Army's Edgewood Chemical Biological Forensic Analytical Center, Edgewood, Maryland.
- The U.S. Army Military Research Institute of Infectious Diseases, Fort Detrick, Maryland.
- The U.S. Department of Agriculture, Animal, and Plant Health Inspection Service, Riverdale, Maryland.
- The U.S. Department of Agriculture, Food Safety Inspection Service, Office of Public Health Science, Eastern, Midwestern, and Western Laboratories.
- The U.S. Department of Homeland Security, Washington, D.C.
- The U.S. Department of Homeland Security's National BioForensic Analysis and Countermeasures Center, Frederick, Maryland.

- The U.S. Environmental Protection Agency, National Enforcement Investigations Center, Denver, Colorado.
- The U.S. Food and Drug Administration, Forensic Chemistry Center, Cincinnati, Ohio.

CBSU works with its partner agencies to develop and validate forensic protocols for examining CBRN evidence. Additionally, CBSU is establishing dedicated forensic laboratory facilities at the Savannah River National Laboratory, Lawrence Livermore National Laboratory, and the Edgewood Chemical Biological Forensic Analytical Center to support the forensic analysis of traditional trace and bulky evidence contaminated by CBRN materials.

In coordination with other FBI Laboratory units, CBSU has established the Hazardous Evidence Analysis Team (HEAT). The HEAT consists of experienced FBI Laboratory examiners and technicians trained to analyze CBRN evidence at partner laboratory facilities. The HEAT has more than 60 active members from 14 units.

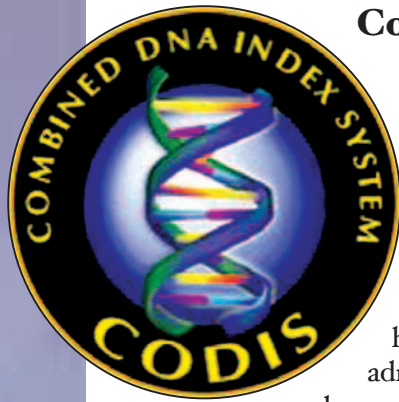
Through leadership of and participation in interagency scientific working groups, CBSU is leading the development of forensic guidelines for examining CBRN materials. CBSU leads the Scientific Working Group on Microbial Genetics and Forensics (SWGMEG) and the Scientific Working Group on the Forensic Analysis of Radiological Materials (SWGFRM). CBSU also participates significantly in the Scientific Working Group on the Forensic Analysis of Chemical Terrorism (SWGFACT).



▲ **Hazardous evidence analysis conducted at the National BioForensic Analysis Center, Fort Detrick, Maryland**



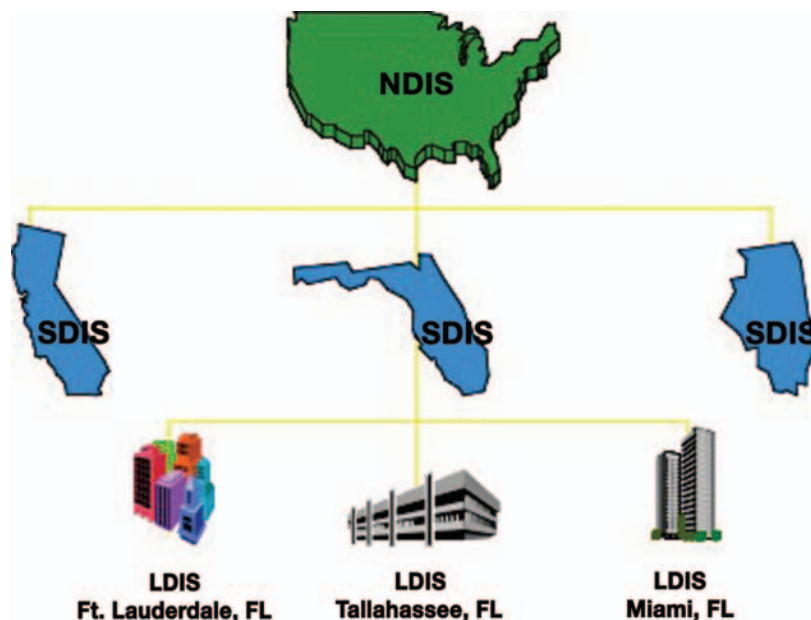
◀ **Anthrax letter**



Combined DNA Index System Unit

The Combined DNA Index System (CODIS) Unit directs and manages the CODIS Program and operates the National DNA Index System (NDIS). The CODIS Program consists of the development, enhancement, and support of software that enables forensic DNA laboratories to store, maintain, and search DNA profiles from crime scenes, offenders, and missing persons. Support of the CODIS software includes training for DNA analysts and help-desk services, as well as a yearly national meeting for all CODIS administrators. The unit also provides CODIS software to international law enforcement laboratories to assist them in establishing a DNA database program. Thirty-nine law enforcement laboratories in 24 countries now have the CODIS software.

CODIS consists of a three-tiered hierarchy of databases: the NDIS, the State DNA Index System (SDIS), and the Local DNA Index System (LDIS). The highest level in the CODIS hierarchy is NDIS, which contains the DNA profiles contributed by participating federal, state, and local forensic DNA laboratories. There are 176 NDIS participating sites consisting of 123 local laboratories and 53 state laboratories, including the FBI Laboratory, the U.S. Army Criminal Investigation Laboratory, and a laboratory in Puerto Rico. The figure below depicts an example of the CODIS hierarchy at the national, state, and local level.



CODIS hierarchy using the state of Florida as an example

The NDIS contains more than 2.9 million profiles of offenders, crime scenes, and missing persons. Operation of NDIS requires determining the eligibility of samples for the National Index in accordance with applicable federal law, developing procedures for laboratories participating in the index, and monitoring the participating laboratories' compliance with federal law. The CODIS Unit also provides administrative management and support for the NDIS Procedures Board and other DNA working groups.

The concept behind CODIS is maintaining a database of a state's convicted offender profiles and using it to solve crimes for which there are no suspects. Recognizing this, as early as the late 1980s, states began to enact laws requiring that offenders convicted of sexual offenses and other violent crimes provide DNA samples. These DNA samples were analyzed and then entered into the state and national DNA databases. All 50 states have

such DNA database laws, and the overwhelming majority of these laws have been expanded to cover all felony offenders in those states.

CODIS uses several indexes to generate investigative leads in crimes where biological evidence is recovered from the crime scene. The Convicted Offender Index contains profiles of individuals convicted of felony offenses and other crimes. The Forensic Index contains DNA profiles developed from crime scene evidence, such as semen stains or blood. There are also three missing-person-related indexes. The Relatives of Missing Persons Index contains DNA samples voluntarily contributed from the relatives of missing persons and is searched against the Unidentified Human Remains Index and the Missing Persons Index.

How exactly does CODIS work? As an example, a sexual assault is committed and evidence is collected from the victim using a sexual assault evidence kit. A DNA profile of the perpetrator is developed from the evidence. If there is no suspect in the case or if the suspect's DNA profile does not match that of the evidence, the laboratory will search the DNA profile against the Convicted Offender Index. If there is a match in the Convicted Offender Index, the laboratory will obtain the identity of the suspected perpetrator. If there is no match in the Convicted Offender Index, the DNA profile is searched in the Forensic Index. A match in the Forensic Index means that the laboratory has linked two or more crimes, and the law enforcement agencies involved in the cases can pool the investigative information obtained in each of the cases.

The chart below depicts the impressive statistics tallied by CODIS through the 2005 calendar year.

CODIS Statistics Through 2005	
Category	Total No. Through December 2005
Investigations aided	30,023
Forensic Index hits	7,005
Offender Index hits	21,314 (18,486 at SDIS and 2,828 at NDIS)

NDIS Statistics Through 2005	
Category	Total Samples Through December 2005
Convicted Offender Index	2,805,572
Forensic Index	125,913
Indicted Persons Index	59
Missing Persons Index	247
Relatives of Missing Persons Index	722
Unidentified Human Remains Index	322

Participants	
Domestic Laboratories	176 state and local laboratories plus NDIS
International Laboratories	39 laboratories in 24 countries
Training	1,061 individuals in more than 217 laboratories have received CODIS training

The CODIS Unit had a number of accomplishments during 2005:

- CODIS provided valuable assistance to law enforcement agencies across the United States in 2005 by aiding 8,545 criminal investigations and generating 1,717 hits in the Forensic Index and 6,933 hits in the Convicted Offender Index.
- Participating federal, state, and local laboratories contributed more than 32,000 forensic DNA profiles and 785,000 offender DNA profiles to the National DNA Index System.
- The unit provided CODIS software or enhancements to international law enforcement agencies in Botswana, Chile, Croatia, Estonia, France, Greece, Norway, and Spain.
- The unit deployed electronic enhancements to the CODIS software to all CODIS laboratories in the United States.
- The National DNA Index System was relocated to the FBI Laboratory in Quantico and a backup site was established.
- In monitoring compliance with federal law, the CODIS Unit processed, reviewed, and closed 96 external quality assurance audits from forensic DNA laboratories participating in the National DNA Index.
- The 11th National CODIS Conference was held November 7–10, 2005, with more than 350 participants, the largest attendance to date.

CODIS Success Story

David and Ann Scoville were honored presenters at the 5th National CODIS Conference held in 1999. Their 28-year-old daughter, Patricia, was found in a shallow grave near Moss Glen Falls in Stowe, Vermont, on October 29, 1991. While riding her bike down a popular hiking trail, Patricia had been attacked, raped, and murdered. Because there were no leads in the case, the Scovilles firmly believed that DNA evidence would be instrumental in solving their daughter's murder. They advocated the passage of DNA database legislation in Congress and state legislatures throughout the Northeast. In 2002 the Scoville's efforts were recognized by the U.S. Department of Justice when they received the Crime Victim Service Award for their work to strengthen state and national DNA databases.

The CODIS Unit was honored to have David and Ann Scoville return as the keynote speakers at the 11th National CODIS Conference in November 2005. This time, the Scovilles reported on a major development: in February 2005, the forensic evidence in their daughter's case was linked to a Vermont convicted offender. A month later, an arrest was made for Patricia's rape and murder. The DNA database system that the Scovilles had believed in and supported all of these years had not let them down.

The National Missing Person DNA Database

In 2000 the Laboratory Division began developing the National Missing Person DNA Database (NMPDD) program to identify missing and unidentified persons using CODIS. The NMPDD contains three indices in which missing- and unidentified-person DNA profiles can be entered: Relatives of Missing Persons, Unidentified Human Remains, and Missing Persons.



The Laboratory performs both mitochondrial DNA (mtDNA) and nuclear DNA (STR) analyses on samples. As the following case illustrates, the NMPDD provides investigators with an opportunity to identify missing and unidentified persons on a national level.

Washington State Missing Person: Russell Warren

Russell Warren traveled to Port Angeles, Washington, on July 3, 1929, to pick up his wife, Blanch, from Lincoln Hospital; to make payments on his 1927 Chevrolet sedan; and to purchase groceries and a washing machine. Russell and Blanch departed Port Angeles, Washington, and were last seen driving west on the Olympic Highway by Lake Crescent in Olympic National Park. They were never seen again. They left behind two young sons. At the time, investigators searched the lake but found nothing. Then, in 2001, the Olympic National Park Dive Team renewed its search of the lake and found debris from a washing machine that was consistent with a brand sold in Port Angeles, Washington, in the late 1920s. On later dives, automobile parts were located. In 2002, a sonar scan was conducted, and a deep-dive team located a 1927 Chevrolet sedan in approximately 165 feet of water. On later dives, photographs and videos



**Russell and
Blanch Warren**



**The Warrens' 1927
Chevrolet sedan**

were taken of the site, and artifacts were removed from the car to confirm the make and model. In 2004, human remains were discovered near the vehicle and were removed for forensic analysis. An anthropologist's report stated that the remains were probably from a Caucasian male. A blood sample was obtained from a daughter of Russell Warren's sister, and the National Park Service sent the evidence to the FBI Laboratory for analysis in March 2005. The mtDNA profile from the unidentified human remains was compared to the mtDNA profile from Russell Warren's niece. The FBI's analysis determined that Russell Warren could not be excluded as the source of the human remains, and the remains were returned to the National Park Service in November 2005. The National Park Service concluded that the remains were those of Russell Warren.

Four Regional mtDNA Laboratories Now Accepting Casework

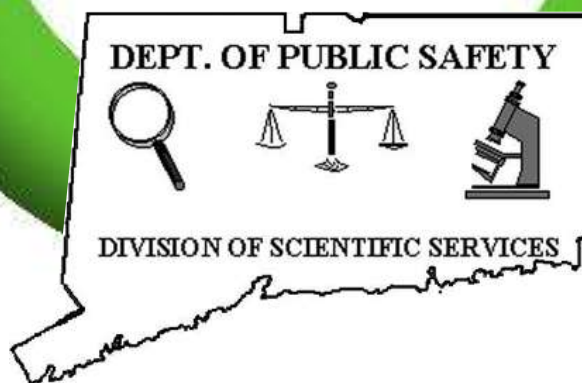
Four regional crime laboratories have partnered with the FBI Laboratory to augment the nation's capacity to perform mtDNA analysis in forensic and missing-person cases. Prior to forming this partnership in 2003, the FBI Laboratory was the only crime laboratory in the country that performed no-cost mtDNA examinations for state and local law enforcement agencies. The increased use of mtDNA analysis will not only provide valuable information for solving violent crime and terrorism cases, but it also will enhance the quantity of profiles in the National Missing Person DNA database. This database will be a valuable resource with the potential to identify missing persons by linking them to DNA profiles of relatives or unidentified human remains.

The following agencies compose the Regional mtDNA Program:

- Arizona Department of Public Safety Central Crime Laboratory, Phoenix, Arizona.
- Connecticut Department of Public Safety Forensic Science Laboratory, Meriden, Connecticut.
- Minnesota Bureau of Criminal Apprehension Forensic Science Laboratory, St. Paul, Minnesota.
- New Jersey State Police Crime Laboratory, Hamilton, New Jersey.



**Four
Regional
mtDNA
Laboratories**



The FBI Laboratory equipped these regional mtDNA laboratories, authorizes casework, and ensures that all laboratory analyses meet FBI quality standards. In addition, the FBI Laboratory funds the salaries of regional laboratory personnel as well as supplies and testimony travel. Since initiating this program, the FBI has provided training at the FBI Laboratory to all of the scientists from each of the regional crime laboratories. The training has encompassed laboratory procedures as well as scientific and legal issues affecting mtDNA analysis and microscopic hair examinations. The regional crime laboratories have renovated their laboratories and performed validation studies for the procedures they will use. Partner laboratories will be responsible for conducting mtDNA and hair analyses, reporting results, and testifying, if necessary. The initial term of the cooperative agreements with these laboratories is three years but may be renewed indefinitely for two-year periods.

The FBI Laboratory remains committed to building long-term partnerships with state and local forensic laboratories to provide critical forensic services and to develop and implement new technologies. The FBI continues to benefit from working with the talented and dedicated employees from these regional crime laboratories as well as from international, national, state, and local laboratories.

Terrorist Explosive Device Analytical Center

In 2004 the U.S. Department of State reported that more than 85 percent of all terrorist attacks against U.S. citizens and interests in the previous five years had involved the use of improvised explosive devices (IEDs). Clearly, a coordinated and systematic approach



to investigating these attacks would stand the best chance of preventing them. The Terrorist Explosive Device Analytical Center (TEDAC) provides such an approach, and as a multiagency center, it adheres closely to the 9/11 Commission's recommendations to reshape the U.S. intelligence program by centralizing and pooling government assets to address this problem.

Prior to the TEDAC initiative, there was no single U.S. government entity responsible for intelligence gathering and exploitation related to terrorist IEDs. Created at the FBI Laboratory in December 2003, the TEDAC represents a unified effort that combines law enforcement, intelligence, and military assets and serves as the single interagency focal point to receive, fully analyze, and store terrorist IEDs of interest to the United States, for the benefit of both the explosives and intelligence communities.

The TEDAC accomplishes its mission by performing a wide array of technical and forensic examinations directed at producing intelligence and other products to be used by the community at large. The TEDAC serves as a major repository center and is maintaining a database of all of the information developed.

Analyzing the evidence and intelligence associated with IEDs involves the work of numerous professionals with varying expertise. From DNA, latent print, and explosives experts to military and intelligence community analysts, the TEDAC brings together every resource available in the FBI Laboratory and the U.S. government to increase our understanding of terrorist methods, to assist in the development of new ways of responding to terrorist attacks, and, most important, to identify those responsible to prevent them from terrorizing again.

Some experts believe that it's only a matter of time before terrorists once again strike the U.S. homeland. The TEDAC is working hard to help prevent this from happening.

Scientific Working Groups

The FBI Laboratory sponsors scientific working groups (SWGs) to improve forensic science practices and build consensus among international, federal, state, and local forensic community partners. Each SWG has a formal structure and functions in accordance with its bylaws. Membership is at the discretion of the chair of the working group. Most SWGs include members from both public and private organizations.

SWGs serve as a common voice for their scientific disciplines. Meetings held at least once a year allow SWG members to come together to discuss issues of concern and reach consensus on documents drafted throughout the year. In that regard, the SWGs create, prepare, and publish standards and guidelines for their constituents in the forensic community. These documents provide crime laboratories a solid basis for operational requirements. Enforcement of the guidelines is left to the appropriate governing agency and each group's internal policies. The documents are published in peer-reviewed scientific journals in the group's discipline. *Forensic Science Communications*, the Laboratory's online scientific journal, publishes SWG standards and guidelines in virtually every quarterly issue.

In 2005 Laboratory-sponsored SWGs held 18 meetings and published several documents in *Forensic Science Communications*. Published works included “Introduction to Forensic Glass Examinations”; “Collection, Handling, and Identification of Glass”; “Initial Examination of Glass”; “Glass Fractures”; “Glass Density Determinations”; “Glass Refractive Index Determination”; “Elemental Analysis of Glass”; “Forensic Hair Examination Guidelines”; “Forensic Fiber Examiner Training Program”; and “Validation Guidelines for Laboratories Performing Forensic Analysis of Chemical Terrorism.”

The FBI Laboratory currently sponsors the following groups:

- Scientific Working Group for Firearms and Toolmarks (SWGGUN).
- Scientific Working Group for Forensic Document Examination (SWGDOC).
- Scientific Working Group for Materials Analysis (SWGMAT).
- Scientific Working Group on Bloodstain Pattern Analysis (SWGSTAIN).
- Scientific Working Group on DNA Analysis Methods (SWGDAM).
- Scientific Working Group on Dog and Orthogonal Detector Guidelines (SWGDOG).
- Scientific Working Group on the Forensic Analysis of Chemical Terrorism (SWGFACT).
- Scientific Working Group on the Forensic Analysis of Radiological Materials (SWGARM).
- Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST).
- Scientific Working Group on Microbial Genetics and Forensics (SWGMGF).
- Scientific Working Group on Shoeprint and Tire Tread Evidence (SWGTTREAD).

Additional SWGs may be sponsored by other FBI divisions or other agencies. For example, the U.S. Drug Enforcement Administration supports the Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG). Whether sponsored by the FBI or another agency, scientific working groups ensure the consistency, credibility, and continued advancement of the forensic sciences.

Innovation

Criminals have become more sophisticated, while crime grows increasingly complex. Research and development lie at the heart of the FBI's ability to function in this environment. By developing new techniques and using emerging technology, the FBI Laboratory helps law enforcement agencies worldwide solve crimes that might otherwise remain unsolved. This section describes the work the Laboratory is doing to enhance its capabilities.

Counterterrorism and Forensic Science Research Unit

The Counterterrorism and Forensic Science Research Unit (CFSRU) researches, develops, and delivers new technologies and methodologies to advance forensic science and combat terrorism. In order to successfully meet the ever-increasing technical complexity posed by the war on terror and the global scope of research and development projects, CFSRU scientists have initiated cooperative studies with scientists at other government agencies such as the U.S. Department of Homeland Security, the Central Intelligence Agency, the Department of Defense, the Centers for Disease Control and Prevention, and the U.S. Department of Energy. For example, the Microbial Rosetta Stone Database, first developed under a contract monitored by CFSRU scientists, has been expanded for use by the U.S. Food and Drug Administration and the U.S. Department of Agriculture in evaluating microbial threats to the nation's food supply. Scientists at CFSRU recently completed a five-year cooperative study with several international crime laboratories under the umbrella of the European Union to develop and test protocols for the use of element and isotope patterns to provide source information on human hair, nail, and bone; adhesive tapes; sugar; steels; and bullet lead used in international crimes, such as terrorism, organized criminal activities, and environmental crimes.

Through the Visiting Scientist and Research Partnership Programs administered by CFSRU, as well as outsourced and internal projects, unit personnel executed more than 100 projects in 2005.

Automation of Nuclear DNA Analysis

Automated liquid-handling workstations have been customized to perform processes for short tandem repeat (STR) genotyping. These processes include extracting DNA from various substrates, setting up real-time polymerase chain reactions (PCRs) for quantification of human DNA, diluting DNA extracts to working concentrations, setting up reactions for amplification of the STR loci, and preparing STR amplification products for analysis using capillary electrophoresis. Six liquid-handling instruments have been installed within the DNA Analysis Unit I, and verification and validation studies are currently under way.

Three-Dimensional Imaging of Toolmarks

An automated method of comparing toolmarks using three-dimensional images obtained by confocal optical microscopy has been developed under external contract and is ready for evaluation by personnel in the Laboratory's Firearms-Toolmarks Unit. A statistical study of the degree of individualization of toolmarks by this technique has been completed.

Noninvasive Latent Fingerprint Development and Chemical Identification of Trace Evidence Within Prints

Spectral imaging is recent technology that uses spectral responses plotted over an area to produce images. With infrared spectroscopy, the Laboratory can produce images in the infrared region using mercury cadmium telluride (MCT) array detectors, similar to the

charge-coupled device detectors used in digital photography. Because chemical information is obtained from the infrared spectra, pictures are produced based on the chemical composition. With the application of reflection analysis, the Laboratory has produced images of latent fingerprints deposited on aluminum, glass, black plastic bags, duct tape (both backing and adhesive), manila envelopes, copy paper, dollar bills, and other materials. Additionally, trace evidence such as explosives, drugs, and fibers has been identified from within the friction ridge deposits. Fingerprint images shown in Figures 1A and 1B were produced as composite images of the deposited materials' major chemical components. The blue ridge patterns are composed predominantly of oils (represented by the peak at $2,929\text{ cm}^{-1}$). The green spots are protein materials from skin particles (measured at $3,240\text{ cm}^{-1}$). The responses plotted as red spots (measured at $3,072\text{ cm}^{-1}$) are a contaminant arising from RDX explosive wedged between the ridges. Complete infrared spectra are shown in Figure 1C, with the colors of the spectra corresponding to the image colors. Information provided by both the fingerprint image and the ability to identify RDX explosive could further link a subject to a crime. This capability demonstrates the power of chemical imaging in forensic analysis. The work has been conducted in collaboration with scientists from the National Institutes of Health, where spectral imaging is being developed to identify medical problems in human subjects. One of the most significant advantages is that these data are obtained noninvasively. Medical subjects and forensic evidence are not altered in any way. CFSRU scientists are developing a portable imaging instrument so that this technology can be brought to the crime scene.

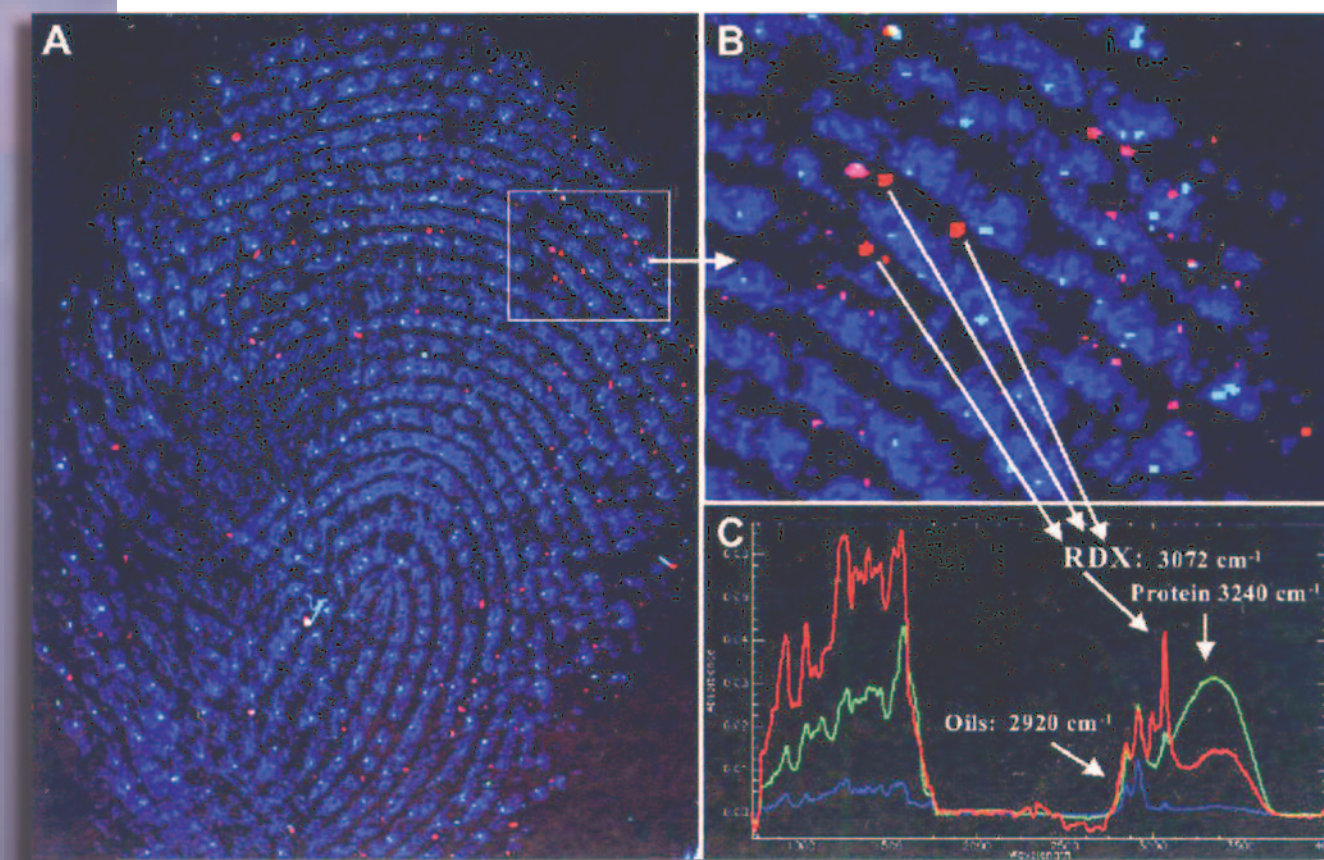


Figure 1A: Full latent fingerprint

Figure 1B: Expanded view of the box in A

Figure 1C: Spectra of the components

Research Partnership Program

The Research Partnership Program, which CFSRU coordinates, is an effort by the FBI Laboratory to improve forensic science through active collaboration with scientists in state and local forensic laboratories. The program funds research and development projects and database building. These projects leverage the experience of state and local forensic examiners for research purposes in disciplines that typically require extensive examiner training and experience to interpret results.

The primary goals of the program are:

- To enhance the development and transfer of new forensic technologies and procedures to caseworking examiners in state and local forensic laboratories by collaborative research and development, testing, and validation studies.
- To facilitate the implementation of protocols defined by scientific working groups.
- To catalyze the development of national forensic databases.

In 2005 CFSRU hosted two Research Partnership workshops:

- **Permanence of Friction Ridge Skin Detail**—Permanence is one of the fundamental principles of the friction ridge discipline that permit identification. Although permanence is supported by the biological sciences, it has yet to be studied empirically by comparing fingerprints over time. Five research partners compared friction ridge detail on prints recorded using ink, photography, and digital imaging.
- **Automotive Carpet Fiber Database**—Automotive carpet fibers are frequently found in abduction and homicide cases when victims were transported in vehicles. The FBI Laboratory's Trace Evidence Unit can determine the make, model, and year of vehicles on the basis of physical-, optical-, and chemical-information searches in the Automotive Carpet Fiber Database. Research partners began reviewing and compiling database elements on automotive carpet fibers. Extensive data-field enhancements were also reflected in the database utility. Contributions from state and local forensic laboratories will permit the database to be updated and maintained for continuing effectiveness as an investigative tool.

A Research Partnership Program update was held on August 16, 2005, in conjunction with the annual Crime Laboratory Development Symposium at the University of Michigan in Ann Arbor. The update featured eight technical presentations by CFSRU personnel covering the biological, chemical, and physical sciences. During the symposium, CFSRU hosted a poster session featuring 36 posters highlighting current research projects.

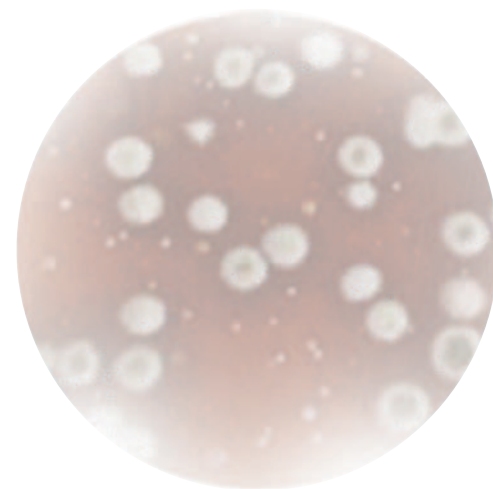
Visiting Scientist Program

The goal of the Visiting Scientist Program is to enhance the research and development capabilities of the CFSRU by providing highly qualified scientists from outside institutions to complement staff scientists and assist in performing duties consistent with the mission and needs of the unit. The Visiting Scientist Program provides a direct connection between the FBI Laboratory and academia. Through the program, university students, postgraduates, and faculty enhance their education by participating in forensic research initiatives using state-of-the-art equipment in the CFSRU laboratories. Participants are afforded unique work experience that offers professional development and increases their research contribution in their chosen field of study within the realm of forensics.

Experienced staff scientists guide the Visiting Scientists' research by serving as mentors. Each Visiting Scientist is assigned one or two projects focused on meeting the needs of the operational units. Program participants may spend from three months to three years working in the laboratories in Quantico. At the end of their tenure, they are required to submit detailed reports or technical papers for publication in peer-reviewed scientific journals. Applications for the Visiting Scientist Program are accepted at <http://www.orau.gov/orise/educ.htm>.

In 2005 program funding allowed the FBI to offer this opportunity to 48 Visiting Scientists representing 37 academic institutions. During 2005, Visiting Scientists were actively involved in 34 research projects, contributed to the publication of 13 manuscripts, and were involved in 63 scientific presentations. In addition, Visiting Scientists participated in 18 specialized scientific training opportunities.

The following represent examples from among the 34 research projects involving contributions from Visiting Scientists in 2005.



Phenotypic Characterization of Microbes of Interest

Working together, biologists and chemists have discovered the potential for using fatty-acid methyl ester (FAME) analysis for the characterization of bacteria of the *Bacillus* group as to their genetic strain and growth conditions. Standardized methods have been established to obtain consistent FAME profiles for each bacterium. These conditions will be used to test which of the many variables that constitute growth conditions affect variations in the bacterial FAME profiles.

Cocaine-N-Oxide Detection in Hair

A method was developed to detect the presence of the endogenous cocaine metabolite cocaine-n-oxide in hair. Preliminary studies show that this metabolite is present in a hair sample from a deceased known cocaine abuser.

Creation of a New FBI Facial Identification Catalog

Following biometric studies on facial features of individuals in the current catalog to validate the selected categories, approximately 40,000 photographs were sorted by ethnicity and traits. Sixteen or more photos were selected for each ethnic group for each facial-feature page. Mock-up catalog introductory pages were created and submitted to the Laboratory's Investigative and Prosecutive Graphic Unit, along with the sorted images for the production of the new catalog. A lecture was recorded on video to document the biometric studies and explain the relevance of the greatly enhanced sections of the new catalog.

Validation of RE/FACE Software

The beta version of this facial reconstruction software program was delivered under contract. Skulls with accompanying photographs of the person when alive, obtained from the University of Tennessee Donated Collection, are being used to test the software. Defects in the software have been corrected, and further enhancements are in progress.



A Visiting Scientist evaluates methods for efficient DNA extraction from bones to assist in the identification of human remains.

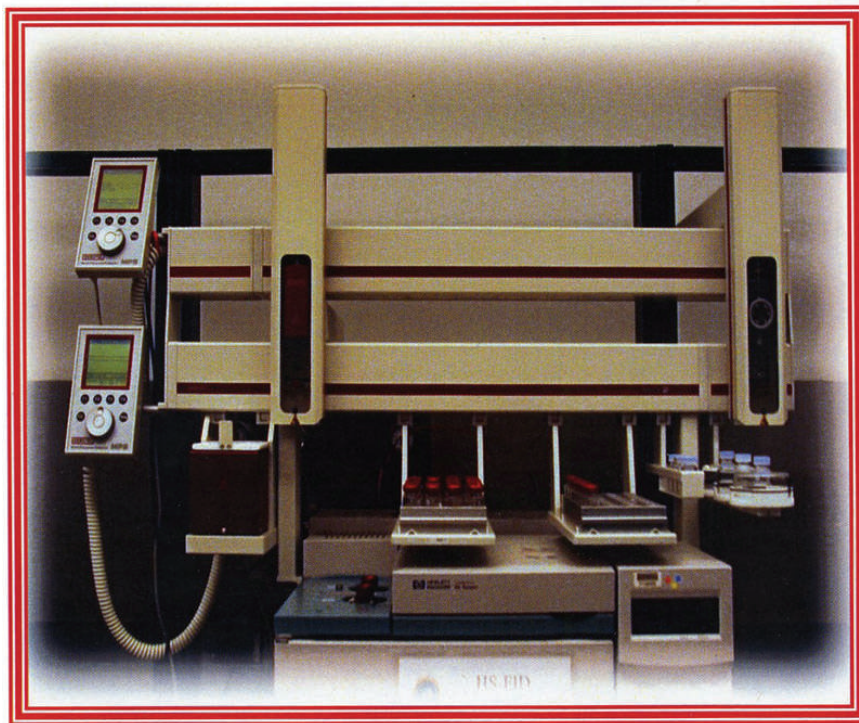


A Visiting Scientist evaluates the use of cathodoluminescence as a means of determining the geographic origin of mineral grains. The resulting information could be used as a point of comparison in forensic examinations involving soil, building materials, and other geologic material.

Laboratory Instrument Automation

In 2005 the Chemistry Unit began acquiring new multipurpose robotic autosamplers that are interfaced with gas chromatograph-mass spectrometers to enhance the speed of analysis and eliminate manual sample preparation. Because sample preparation is very labor-intensive and repetitive, automation of these processes will improve the precision and accuracy of the results while eliminating user errors.

The autosamplers are available in two different configurations: single-rail and dual-rail prep stations. Several accessories can be added to a system to work in unison to complete multistep sample preparation. The dual-rail system is designed to complete more complex experimentation than the single-rail system.



The Chemistry Unit's dual-rail prep station

The dual-rail prep station is fully programmable to perform automated sample preparation and sample introduction into the gas chromatograph-mass spectrometer. One rail of the prep station is an automated liquid-sample handler that performs a wide range of sample-preparation functions, including standard addition, spiking and rinsing, and dilution.

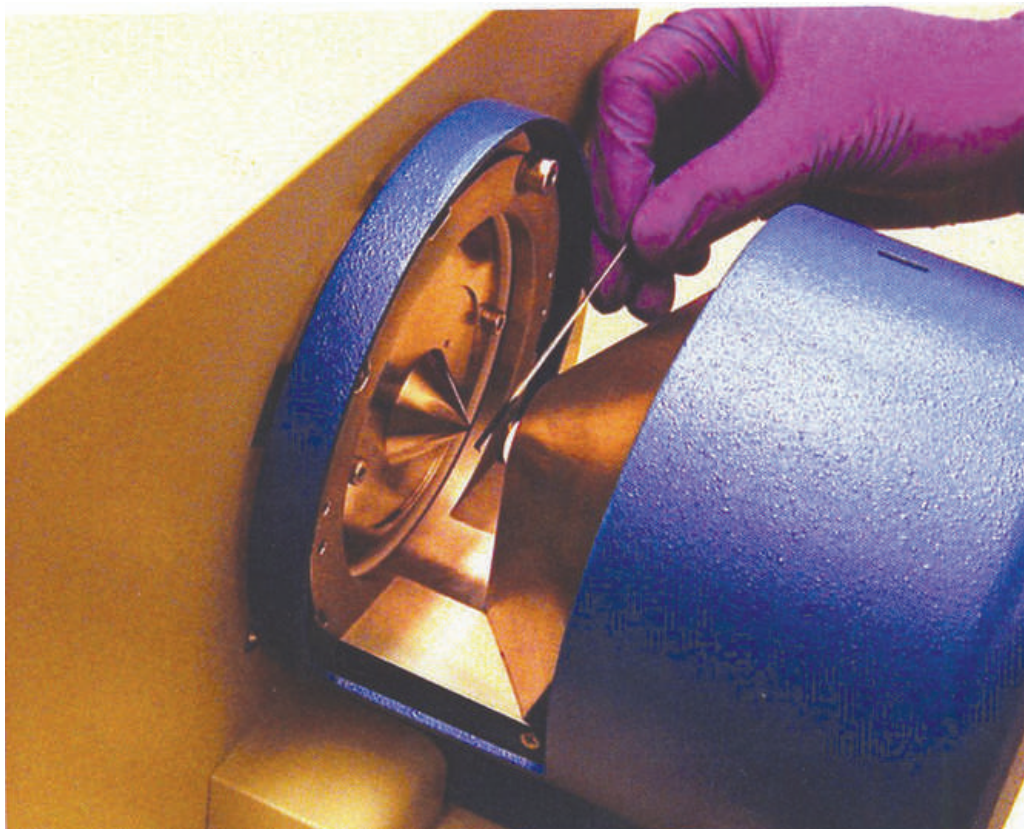
Depending on the selected hardware configuration, the second rail enables many automated sample-introduction options, including headspace sampling, solid-phase microextraction, and standard liquid and large-volume injection.

With the acquisition of two of these systems, the Chemistry Unit quickly recognized results in the validation of the analysis of alcohol in blood and urine. The systems are being used to support the Toxicology and General Chemistry Subunits as well as the Explosives Unit for a variety of analyses, including alcohol in blood and urine, gamma-hydroxybutyrate, cyanide, volatiles, and arson.

Overall, these systems are worthy and necessary acquisitions for a laboratory that wants to stay current with changing technology and improve the quality of the results provided to its clients.

AccuTOF-DART Technology

In May 2005 the Chemistry Unit began using what is considered a breakthrough in mass spectrometer sample introduction: the DART ion source. DART, which stands for “Direct Analysis in Real Time,” is an atmospheric pressure source capable of ionizing liquid, solid, and gas samples in real time. The principle is based on an atmospheric pressure interaction of a sample with long-lived electronic excited-state atoms or molecules and atmospheric gases. The system uses helium or nitrogen to produce metastable atoms or molecules that interact with the analytes.



Sample analysis using the DART source

What does this all mean in terms of forensic chemical analysis? Coupling the DART source to the AccuTOF time-of-flight mass spectrometer lends to the analysis of samples with no preparation or extraction and provides data with accurate mass measurement. A complete analysis can be completed within minutes by simply holding a sample in the open gas stream. A basic DART analysis of a liquid or solid is performed by touching the end of a glass rod to a sample or adding a few microliters of sample solution to the tip of the rod and placing the material in the stream of gas on the DART source.

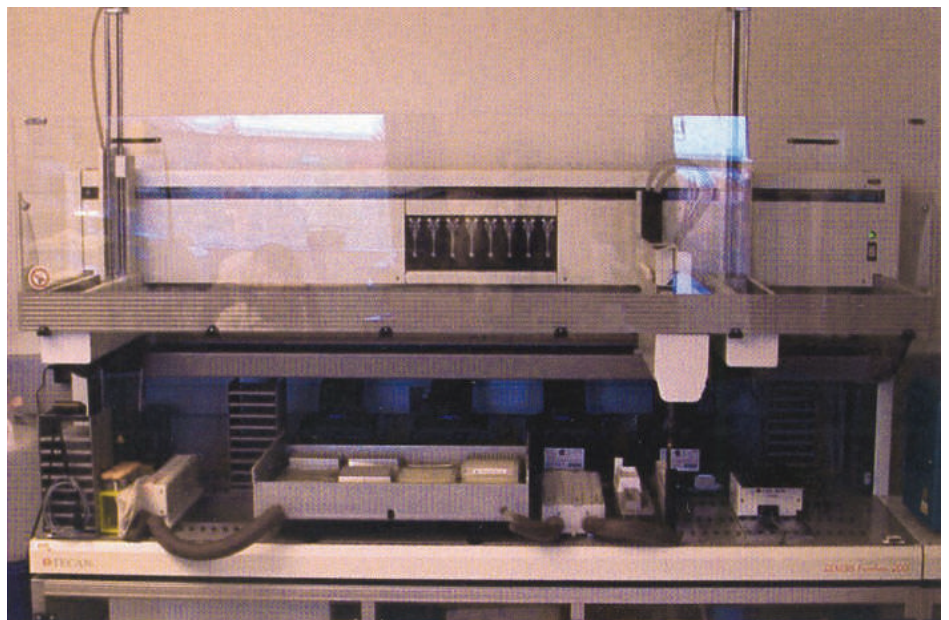
Since acquiring the AccuTOF-DART, the Chemistry Unit has used it to analyze many different types of chemicals and evidentiary materials—including drugs, poisons, sugars, explosives, dyes, and many other commercial products—in matrices ranging from solvents and urine to cereal bowl residue and clothing stains. This technique has been useful for both fast screening and high-end confirmation.

Robotics

DNAUII is validating the use of robotic platforms to automate analysis of the entire control region of mtDNA. The use of a robotic system will greatly decrease the time required to perform mtDNA analysis in the unit. Two Biomek 2000 robotic workstations will perform DNA extraction and preparation for polymerase chain reaction (PCR) amplification. Amplification and mtDNA sequencing will be accomplished on the TECAN Genesis Freedom robot. Validation is expected to be completed in early 2006. The automated analysis of mtDNA will benefit the National Missing Person DNA Database program as well as the SWGDAM mtDNA Population Database by expeditiously processing bloodstains or buccal swabs submitted for entry into the databases.



Biomek 2000 robot



TECAN Genesis Freedom robot

Administration

The combined efforts of every Laboratory Division unit contribute to the Laboratory's success. The units featured in this section provide vital services that help the Laboratory achieve its mission year after year.

Administrative and Security Unit

The Administrative and Security Unit (ASU) provides administrative and security services to the Laboratory Division by coordinating, directing, and facilitating various programs and initiatives in the areas of personnel and staffing matters; physical, personnel, and communications security; and mail services to ensure Division-wide compliance with FBI policies, procedures, and guidelines. The unit also researches, plans, and implements various initiatives as assigned by Division executive management. The ASU completed several major initiatives in 2005.

Division Reorganization

In order to better accomplish its mission and support the FBI's priorities, the Laboratory reorganized, and the ASU was responsible for overseeing the reorganization. Earlier in the year, the Bomb Data Center and Hazardous Device Response Unit had been transferred from the Laboratory's Operational Support Section to the FBI's Critical Incident Response Group. The decision was then made to dissolve the Operational Support Section and reassign its remaining units—the ASU, the Facility Services Unit, the Investigative and Prosecutive Graphic Unit, the Planning and Budget Unit, and the Structural Design Unit—to the Forensic Science Support Section (FSSS). A new addition to the FSSS in 2005 was the IT Coordination Group. Both the FBI and the Laboratory recognize the critical role that technology plays in preventing and solving crimes, and the IT Coordination Group has been tasked with ensuring that the Laboratory uses state-of-the-art technology in all of its operations.

Recognizing the important roles of evidence control and quality assurance, the Laboratory placed the Evidence Control Unit and the Quality Assurance and Training Unit directly under the authority of the Deputy Assistant Director of the Forensic Analysis Branch. The Quality Assurance Manager, who heads the Quality Assurance and Training Unit, now reports directly to the Laboratory Director.

The Terrorist Explosive Device Analytical Center (TEDAC), under the supervision of a Laboratory Section Chief, also reports directly to the Laboratory Director. The TEDAC contributes directly to the FBI's counterterrorism mission by analyzing explosive devices used in terrorist events.

The Laboratory also reorganized the Division's Latent Print Units in 2005 and created a program manager to oversee issues relating to *Daubert*, a U.S. Supreme Court ruling that set forth the criteria for admitting expert testimony. As a result of the Laboratory's reorganization, the ASU handled more than 35 position-classification actions, including the creation, reclassification, and modification of several positions.

Hiring/Staffing

As a part of the Resource Management Allocation Committee (RMAC), the Division's executive management meets monthly to formalize the process of assigning its personnel. During 2005 the RMAC reviewed and recommended more than 55 separate requests to

post positions for Professional Support Staff, converted 3 Supervisory Special Agent Unit Chief positions to Professional Support positions, reassigned approximately 20 personnel and their positions within the Division, reimbursed the 2004 DNA Enhancement (20 positions), and created an additional Senior Scientist position.

Honors Internship Program

The Laboratory hosted 18 interns during the summer of 2005. Each year, outstanding students are recruited from area colleges and universities throughout the United States to work for approximately 10 weeks during the summer. The Honors Internship Program offers students a capsule view of the FBI's operations and provides them with an opportunity to explore the many career opportunities within the FBI. To date, 186 of the honors intern participants have returned to the FBI as full-time employees, 84 in Professional Support positions and 102 as Special Agents. Over the past few years, six interns have returned to work for the Laboratory in Professional Support positions.

New Administrative Classification

In 2004 the FBI's Records Management Division announced the initiation of a new classification system for the management of administrative records. Though it may seem to be a simple task, ASU personnel had an arduous job ahead of them. They had to conduct a thorough review of approximately 630 administrative files as well as the policies and procedures needed to convert to the new classification. By September, ASU personnel had completed their review, written new policies and procedures, and trained key employees throughout the Division on how to use the new system.

Public Key Infrastructure

Vigilant monitoring of Laboratory space and access-control procedures prevents unauthorized entry into FBI space. Public Key Infrastructure (PKI) is an FBI initiative that satisfies the principal security requirements of electronic transactions. Implementation of the PKI system allows the use of encrypted e-mail and electronic signatures and enhances the overall security of sensitive FBI information. To prepare for this initiative, the ASU coordinated the issuance of new badges and PKI registration for approximately 650 Laboratory employees. During the two-week training/registration process, more than 500 employees registered and received new badges. ASU personnel continue to serve as registration authorities and facilitate the issuance of new badges and PKI registration.

Security

The ASU remains responsible for security in the Laboratory. In accordance with the American Society of Crime Laboratory Directors, the Laboratory's security measures are more extensive than any other FBI facility. Therefore, the ASU ensures that policies regarding access and control procedures for the Division are strictly followed and are regularly reviewed and revised as needed.

In June 2005 the Laboratory participated in a 36-hour national exercise involving all federal agencies in the Washington, D.C., capital region. In the scenario, FBI Headquarters (FBIHQ) is destroyed, requiring all FBIHQ divisions to activate their Continuity of Operations Plans at an emergency relocation facility. Although the scenario did not directly impact the Laboratory building or Laboratory personnel, the Division played an essential supporting role in reconstituting FBI operations. As the sequence of events unfolded, the Division's senior leadership provided ad hoc responses and logistical information to FBIHQ's executive management. The exercise tested the Division's ability to respond and communicate during an emergency situation under stressful conditions. The FBI's mission was able to continue

through the successful relocation of its essential functions and with Laboratory Division support.

Evidence Control Unit

The Evidence Control Unit (ECU) is the first stop for all evidence received at the FBI Laboratory. With 10 separate units in the Laboratory examining evidence, the ECU is the focal point for managing the inherent administrative aspects of each piece of evidence. Before transporting the evidence to the Laboratory's examining units, the ECU enters the case information into an automated evidence-control system, inventories each piece of evidence received, and designs an examination plan to direct the path the evidence will take through the Laboratory.



As the central point for the administrative management of evidence, the ECU provides a single point of contact for contributors. Each case is assigned to an ECU physical scientist, who tracks and manages the evidence from receipt to final disposition. The point of contact immediately establishes liaison with the contributor to acknowledge receipt of the evidence and to discuss pertinent case issues. This direct contact allows contributors to check the status of their evidence as well as to receive advice and guidance on packaging, transporting, and storing evidence.

The positive effects of this centralized evidence work flow can be seen in the ECU's successful management of every piece of evidence the FBI Laboratory receives, whether it comes from high-profile major-case incidents or from the myriad pieces of evidence submitted every day to the Laboratory from all over the world.

Facility Services Unit

The Facility Services Unit (FSU) is responsible for facility, health, and safety matters in the Laboratory building and other facilities used by the Laboratory Division.

The Facilities group is made up primarily of maintenance personnel. This group is responsible for maintenance, repair, and alteration of Laboratory Division facilities, as well as oversight of contracts that provide maintenance, repair, or alteration to the facilities. The Facilities group oversees space management in the Laboratory and coordinates with the architectural and engineering firms that provide facility designs and studies for the Laboratory.

The Health Services group facilitates the Health Services Office and fitness center; ensures compliance with federal, state, and local occupational, environmental, nuclear, and transportation regulatory requirements; and oversees food-service operations.

Electronics technicians are responsible for maintenance and modification to the Laboratory's electronic systems. These systems include internal and external local area networks, security systems, internal telephone communications, and video teleconferencing equipment.

Overall, the FSU ensures the efficient and secure operation of the Laboratory's facilities and grounds while advocating an environmentally and occupationally safe establishment.

Planning and Budget Unit

The Planning and Budget Unit (PBU) is responsible for all phases of planning, budgeting, acquisition, project management, auditing, and inventory and supply services for the FBI Laboratory. The core mission of the unit is to deliver these essential services in support of the Laboratory's mission and the FBI's strategic planning efforts. PBU provides Laboratory managers with real-time, online financial and project management information. The unit uses automated tools, templates, and reports to ensure that Laboratory investments are well planned, fully funded, successfully implemented, and appropriately managed. The support the unit provides is a critical link to the success of Laboratory programs and operations.

During 2005 PBU obtained and managed critical funding to enhance Laboratory services. The unit developed the Laboratory's Program Plan, which provides the Laboratory's strategic framework, initiatives, and resources needed to support crime problems and issues facing the FBI. The unit also implemented a centralized, remotely accessed, web-based system to capture, track, and manage Laboratory investments. Project management standards were established to integrate the best practices of investment management and ensure Laboratory project excellence and success.

PBU performs a multitude of tasks that collectively contribute to the mission and success of the Laboratory. In 2005 the unit accomplished the following objectives:

- Developed the Laboratory's Program Plan, Annual Budget Submission, and Spend Plan.
- Implemented project management standards.
- Processed 3,724 financial transactions.
- Managed expenditures totaling \$74 million.



Education

The Laboratory comprises a well-educated cadre of professional staff. Many staff members hold advanced degrees and pursue professional development activities on their own time. At the same time, the Laboratory provides continuing education and professional development opportunities for its employees as well as for members of the forensic community. The Division also remains responsible for proficiency-testing its examiners and maintaining its accreditation with the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB). This section outlines some of the Division's efforts in these areas.

Quality Assurance and Training Unit

The Quality Assurance and Training Unit (QATU) comprises three groups that work together to improve the quality and application of the forensic sciences. Quality Assurance personnel strive to continuously improve the quality system of the FBI Laboratory in order to maintain accreditation by ASCLD/LAB. Training personnel facilitate the delivery of forensic science information and training to law enforcement personnel. Library personnel are responsible for the technical-information needs of the Laboratory. They maintain the Laboratory's reference collection and produce a number of forensic science publications.

Quality Assurance

The QATU supports the caseworking units of the FBI Laboratory by strengthening and expanding the Laboratory's quality system and maintaining the Division's accreditation through ASCLD/LAB. To meet these objectives, Quality Assurance personnel develop and maintain standards for quality assurance practices and general guidelines for standard operating protocols. These standards and guidelines are delineated in the Laboratory's *Quality Assurance Manual*, which the QATU produces. Unit personnel also develop, coordinate, and review quality assurance programs; ensure the calibration and maintenance of instruments and equipment; and administer the proficiency-testing program. In addition, the QATU performs audits to verify that Laboratory personnel are following established quality assurance policies and programs. QATU personnel also coordinate Laboratory activities to maintain accreditation and provide quality assurance training.

Training

QATU personnel administer the Specialized Forensic Science Training program, which offers courses in the forensic sciences to law enforcement personnel. The unit also facilitates meetings of the Laboratory-sponsored scientific working groups. Composed of various members of the forensic community, the working groups meet regularly to establish and improve standards and practices in the forensic science disciplines and to build consensus among law enforcement agencies worldwide. QATU staff members also organize the annual Crime Laboratory Development Symposium for state and local forensic laboratory managers.

Library

The Laboratory Library provides forensic science information to scientists and examiners in the FBI and around the world. The information supports evidentiary examinations, prepares examiners for courtroom testimony, and facilitates research and development to



further forensic science knowledge, techniques, and instrumentation. The Library currently houses more than 8,000 scientific and technical books as well as 400 newspaper and journal subscriptions.

The Library staff also produces several publications that are available to law enforcement personnel. *Forensic Science Communications* is an online, peer-reviewed forensic science journal with an international audience. The *Handbook of Forensic Services* provides guidelines and procedures for collecting, preserving, packaging, and shipping evidence. As its name suggests, the Laboratory's *Processing Guide for Developing Latent Prints* delineates the techniques used to develop latent prints.

Annual Crime Laboratory Development Symposium

In 2005 the FBI Laboratory partnered with the Ross School of Business at the University of Michigan for the 33rd Annual Crime Laboratory Development Symposium, which was held on campus in Ann Arbor, Michigan. The topic for the symposium was Preparing Future Leaders, and a host of distinguished University of Michigan faculty provided a comprehensive four-day program to more than 240 managers and laboratory directors from state, local, and international crime laboratories and law enforcement. Two of the keynote speakers were Dr. James Reilly, a NASA astronaut who spoke about leadership within a diverse community, and Dr. James Reese, who provided insight into individual and personal challenges that law enforcement employees face as a result of their careers. Topics provided to attendees included Leadership and the Road to Value Creation, Change, and Innovation; Managing the Unexpected; The Abundance Framework; Managing in Today's Changing Environment; Understanding Your Work Style and the Impact Upon Your Effectiveness; Engagement: A Tool for Enabling Abundance; Building a Lab of Leaders: The Five Absolutes for High Performance; and The Essence of Positive Organizing.



Dr. James Reilly



Dr. James Reese



The 33rd Annual Crime Laboratory Development Symposium was held at the University of Michigan's Ross School of Business.

Celebration

Employees assigned to the FBI Laboratory work hard. Each year the Laboratory reserves a day for employees to bring their families to work and celebrate their accomplishments and simply spend time together as a family. The FBI Laboratory family also extends to the community. Laboratory employees reach out to the community and engage in projects to help residents lead better lives. This section celebrates the Laboratory's extended family.

All Work and No Play...FBI Laboratory Family Day

In 2005 the Laboratory celebrated its second annual Family Day. This event started in August 2004 as a half-day classic-car display. It included a picnic lunch, musical entertainment by a disc jockey, and a moon bounce for the kids. In 2005 multiple fundraisers and the generous support of Laboratory staff established a budget to allow for the expansion of this event. The fundraisers included a donut sale, a flower sale, and a silent auction.

On Saturday, June 4, 2005, more than 250 people attended the all-day event. The classic-car display, picnic lunch, and moon bounce remained popular but had to vie for attention with many new attractions. A live band called "The Sunday Times" belted out classic-rock tunes, while children got their faces painted and collected stickers for their Junior Forensic Scientist Passports, among other activities. Children and adults alike lined up for photos with McGruff the Crime Dog and various other character cutouts. The athletically inclined



**The Laboratory's
Family Day 2005**

played volleyball and ran three-legged races. The Evidence Response Team provided a live demonstration, while units in the Forensic Analysis Section and Scientific Analysis Section set up full-color displays to highlight each unit's scientific techniques. The second annual FBI Laboratory Division Family Day gave FBI employees, their families, and their colleagues a day to share the unique spirit of pride and teamwork for which the FBI Laboratory family is known.



◀ **Three-legged race**

Two potential scientists inspect the Trace Evidence Unit's display during the Laboratory's second annual Family Day. ▶



◀ **Classic cars on display**



Junior Scientist Program

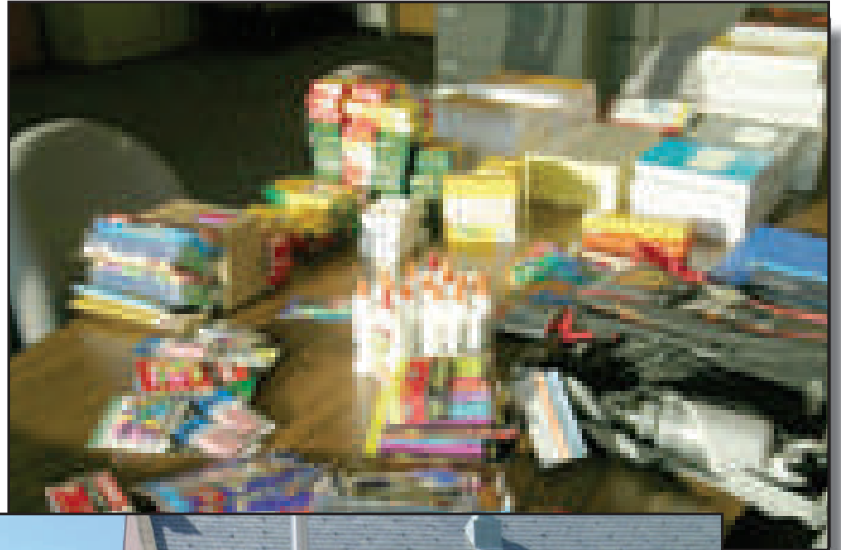
The FBI Laboratory entered into an agreement with Neabsco Elementary School in Dale City, Virginia, to sponsor the Junior Scientist Program. Through this alliance, the FBI Laboratory enhances the educational process and nurtures the development of tomorrow's leaders in science. During the 2004 – 2005 school year, Laboratory personnel provided presentations to the students on a variety of forensic topics. Personnel also served as judges and presented awards to the students during their annual science fair. On June 14, 2005, 104 Neabsco students traveled to the FBI Laboratory for a tour and were awarded FBI Junior Scientist Certificates during a "graduation" ceremony.



Laboratory Director Dwight Adams reaffirms the Laboratory's commitment to support the fifth-grade science program at the school and presents Neabsco's principal with a certificate officially establishing this alliance.

Back-to-School Supply Drive

In August 2005, Laboratory employees participated in a back-to-school supply drive for the children of Stafford County, Virginia. When asked what supplies students needed, the school information officer replied, "We need everything." Laboratory Division employees responded. They generously donated more than 700 pens and crayons, 100 erasers, 200 notebooks, 4,800 sheets of paper, 12 backpacks, and numerous glue sticks, highlighters, scissors, rulers, and folders. The supplies were delivered to the county's schools and distributed among the kids with the greatest need to help them get the school year started off right. Laboratory employees get an "A" for effort!



FORENSIC SCIENCE COMMUNICATIONS

Forensic Science Communications is a peer-reviewed forensic science journal published quarterly on the Internet by FBI Laboratory personnel. The journal is a means of communication between forensic scientists, permitting information of value and interest to be rapidly disseminated among scientists and other interested persons.

Submissions to the journal may include letters to the editor; review, research, or feature manuscripts; book reviews; and technical notes or case reports.

Manuscripts and other information relating to the journal should be sent to:

Managing Editor
Forensic Science Communications
labfsc@ic.fbi.gov

Forensic Science Communications may be viewed online at
<http://www.fbi.gov/hq/lab/fsc/current/index.htm>

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