Forensic Technology Center of Excellence

Federal Investment in Forensic Science Research and Development

Landscape Study

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Information provided herein is intended to be objective and is based on data collected during primary and secondary research efforts available at the time this report was written. The information provided herein is intended to provide an overview and guide; it is not intended as an exhaustive summary.

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The Forensic Technology Center of Excellence (FTCoE)

The FTCoE is a collaboration of RTI International and the following academic institutions, which are accredited by the Forensic Science Education Programs Accreditation Commission (FEPAC): Duquesne University, Virginia Commonwealth University, and the University of North Texas Health Science Center. In addition to supporting NIJ's research and development (R&D) programs, the FTCoE provides testing, evaluation and technology assistance to forensic laboratories and practitioners in the criminal justice community. NIJ supports the FTCoE to transition forensic science and technology to practice (award number 2011-DN-BX-K564).

FTCoE is led by RTI, a global research institute dedicated to improving the human condition by turning knowledge into practice. With a staff of more than 4,700 providing research and technical services to governments and businesses in more than 58 countries, RTI brings a global perspective. FTCoE builds on RTI's expertise in forensic science, innovation, technology application, economics, data analytics, statistics, program evaluation, public health and information science.

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OVERVIEW

Federal government involvement in forensic science improvement has accelerated in recent years. Federal investments have transformed DNA capacity and demonstrated the power of scientific advances to address criminal justice challenges. In its 2009 report, *Strengthening Forensic Science in the United States: A Path Forward*, the National Academy of Sciences (NAS) advocated for additional coordination and investment by the federal government in scientific research related to the forensic sciences.[1]

The National Institute of Justice, the primary provider of forensic science research funding, devotes more resources to the topic than in 2009. Despite the increased dedication of investments in forensic science research by organizations, many researchers lack the information to find funding opportunities.

This landscape report provides a summary of agency interests, funding opportunities, and published research needs on an organized and interactive platform in order to assist the interested researcher. This compilation lists government agencies and sub-agencies that offer funding opportunities for forensic science researchers, as well as sub-agencies and organizations that offer support for the forensic science research community. Much of the information provided on agency websites has been incorporated into this report verbatim. Hyperlinks of government agencies websites, reports, and funding opportunities offer the reader easy access to additional information.

To begin, the researcher should take the time to understand each agency's mission and interests. Some agencies, like the National Science Foundation (NSF), are primarily interested in basic research to advance scientific understanding, but are interested in topics that relate to forensic science needs. Other funding agencies, like the Department of Defense (DoD)'s Defense Forensic Science Center (DFSC), have practical needs that require applied research and development be tied to operational requirements. In addition, most agencies will only have an interest in a subset of forensic topics. For example, the Department of Homeland Security (DHS) may be very interested in issues related to explosives and Weapons of Mass Destruction (WMD), but not as focused on pattern or impression evidence problems. Forensic-related research topics of interest to each agency are outlined in the report and summarized in a supplemental table. The researcher should examine each agency's web page links to find more in-depth information. In addition, it is recommended that researchers attend conferences or agency briefings relevant to their field of focus.

[1] Strengthening Forensic Science in the United States: A Path Forward Committee on Identifying the Needs of the Forensic Sciences Community, National Research Council, ISBN: 0-309-13131-6, 352 pages, 6 x 9, (2009)

NATIONAL INSTITUTE OF JUSTICE

As stated on its website, the National Institute of Justice (NIJ), which serves as the research, development and evaluation agency of the U.S. Department of Justice, is dedicated to improving knowledge and understanding of crime and justice issues through science. The NIJ provides objective and independent knowledge and tools to inform the decision-making of the criminal justice community to reduce crime and advance justice, particularly at the state and local levels.

Office of Investigative and Forensic Sciences

NIJ's Office of Investigative and Forensic Sciences is the federal government's lead agency for forensic science research and development as well as for the administration of programs that facilitate training, improve laboratory efficiency and reduce backlogs. OIFS' mission is to improve the quality and practice of forensic science through innovative solutions that support research and development, testing and evaluation, technology, information exchange, and the development of training resources for the criminal justice community.

In September 2015, the National Research Council (NRC) released "*Support for Forensic Science Research: Improving the Scientific Role of the National Institute of Justice.*" The Committee noted that NIJ has a unique and critical role among the diverse federal agencies working to positively impact the progress of forensic science because, unlike other agencies, NIJ has a mission focus on forensic science research and development. The Committee found that the efforts of NIJ have: (1) restored authority that is appropriate for a science agency and addressed some previous concerns about NIJ's independence; and (2) contributed to the building of a research infrastructure necessary to develop and sustain research that advances forensic science methods.

OIFS supports basic and applied research for multiple purposes, which are defined on the Forensic Sciences webpage, including the intent to:

- Direct the findings of basic scientific research in broader scientific fields applicable to forensic science.
- Apply forensic science research to the development of highly discriminating, accurate, reliable, cost-effective, rapid methods for the identification, analysis and interpretation of physical evidence.
- Expand the scientific basis of forensic methods.
- Produce useful materials, devices, systems or methods that have the potential for forensic application.
- Increase the body of knowledge to guide and inform forensic science policy and practice.

Office of Research and Evaluation

The Office of Research and Evaluation (ORE) is an agency within the NIJ that coordinates and conducts research efforts to prevent and reduce crime and violence and promote justice through social and behavioral research. Since 2004, the ORE has collaborated with the OIFS to understand the impact of NIJ funding and subsequent implementation of new forensic technologies and methods in the community. The ORE and OIFS circulate solicitations that focus not only on developing novel and advanced technologies for the forensics community, but on understanding the experiences of the users and impact on criminal justice.

Office of Science and Technology

The Office of Science and Technology (OST), also located within NIJ, is the federal government's lead agency for work in criminal justice technology. OST's mission is to improve criminal justice policy and practice through the application of technology and technology-related knowledge. To accomplish this, OST undertakes research, development, testing and evaluation projects; develops equipment performance testing standards; manages equipment conformity assessment activities; and informs federal policy as it relates to the application of technology applied to criminal justice purposes.
OST accomplishes this work with a staff of skilled scientists and engineers through a program incorporating elements of both extramural and intramural research. Extramural research activities are implemented primarily through grants, agreements and contracts with other federal research agencies, academic institutions and other relevant organizations.

Forensic Technology Center of Excellence

This report was prepared by the Forensic Technology Center of Excellence (FTCoE), supported by NIJ's forensic science program to advance the transition of new scientific knowledge and tools into practice in the crime laboratory. Researchers are encouraged to contact the FTCoE for guidance concerning transition of technologies and other innovations into forensic practice.

Forensic Science Technology Working Group

The NIJ convenes a Forensic Science Technology Working Group on an annual basis to provide needs and requirements to inform NIJ's planned and ongoing research and development activities, and ensure that future research and development investments meet practitioner-driven needs. The requirements are published on the NIJ website. This list provides insight into practical requirements of crime laboratories that could be addressed by applied research and development, although it is not a comprehensive examination of basic research needs.

Funding Opportunities

Since the 2009 NAS report, NIJ has provided over $129 million in forensic science research funds, covering all aspects of forensic practice. Funded projects are available on NIJ's website and are summarized in an annual report. When reviewing NIJ's funding, it is important to distinguish between their extensive support to crime laboratories in the form of assistance grants (Coverdell and DNA Capacity Enhancement and Backlog Reduction Program) and the research program. Because of the size and diversity of its research portfolio, NIJ should be the first place to look for a scientist whose interests may be related to forensic science. NIJ funding opportunities are listed on the NIJ website. Notable research solicitations include:

- The annual solicitation, "Research and Development in Forensic Science for Criminal Justice Purposes," represents the large majority of NIJ's funding in the area. As stated in a recent Dear Colleague letter, the forthcoming solicitation covers basic scientific research, research and development in broader scientific fields applicable to forensic science, and ongoing forensic science research toward the development of highly-discriminating, accurate, reliable, cost-effective, and rapid methods for the identification, analysis, and interpretation of physical

evidence for criminal justice purposes. The solicitation does not cover social science issues, such as the evaluation of innovations in practice, or digital evidence examination, which is managed separately.

- NIJ is currently soliciting proposals for, "Research and Evaluation for the Testing and Interpretation of Physical Evidence in Publicly Funded Forensic Laboratories," to direct the findings of research and evaluation toward the identification of the most efficient, accurate, reliable, and cost-effective methods for the identification, analysis, and interpretation of physical evidence for criminal justice purposes.
- NIJ's OIFS and ORE also have a solicitation for "Research and Evaluation on Drugs and Crime" seeking applications to examine the feasibility, impact, and cost-efficiency of tools, protocols, and policies that support criminal justice agencies in addressing drug trafficking, markets and use, and the effects of drug legalization and decriminalization on law enforcement.
- In 2016, through NIJ's OST, over $2 million in digital evidence research projects were funded primarily through the solicitation, "Developing Improved Means to Collect Digital Evidence."

NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) supports basic research in science and engineering, with an annual budget of $7.5 billion. The NSF is interested in receiving proposals to existing programs in any directorate across the Foundation that address fundamental research questions which might simultaneously advance activities related to research education in forensic sciences. NSF has issued a Dear Colleague letter that outlines its interests and programs in this area that can guide the researcher who wishes to submit a proposal relevant to forensic science to the Foundation. In that letter NSF states that the Foundation would be particularly interested in proposals that engage forensic scientists and experts in a collaborative fashion with basic science researchers. Topics might include, but are by no means limited to, the following:

- The effect of cognitive bias on judgment and decision making within a forensic setting.
- Discovery of new principles and approaches for remote and field-based chemical measurement and imaging, with enhanced reliability, resolution, and speed.
- Acquisition of shared-use major instrumentation for researchers engaged in fundamental studies, including forensics-relevant research.
- Conception and demonstration of improved methods for interpreting hyper-dimensional spectroscopic data, including images.
- New approaches to acquiring, storing, accessing, and interpreting large datasets, including biological data (as in genomics and proteomics). For example, the NSF circulates a broad agency announcement titled "Advances in Biological Informatics" that seeks development of informatics tools that improve biological research workflows and integration between field and laboratory. A similar announcement, "Collections in Biological Research" seeks proposals that strive to improve infrastructure of biological collections, such as DNA databases.
- Pathways linking genotype to phenotype.
- Factors influencing how jurors understand forensic evidence.
- Generalizable algorithms and techniques for extracting legally binding evidence from computing systems.
- Development of methods to determine provenance of forensic samples (e.g. sediments, human remains), including applications of geospatial analysis or measurement.

- Design, implementation, and evaluation of the vertical integration of a forensic science conceptual approach throughout the sequence of courses within a traditional STEM discipline.

In addition, NSF has convened working groups in cognitive science and instrumentation. And the NSF's Division of Behavioral and Cognitive Sciences in the Directorate for Social, Behavioral, and Economic Sciences recently announced its Cognitive Neuroscience Program, which seeks proposals that address the neural etiology of human cognitive behavior.

The Biological Anthropology Program has released a solicitation, "Doctoral Dissertation Research Improvement Grants", seeking proposals for methods to better understand human biology and etiology, including forensic anthropology.

Additional Funding Opportunities

The NSF and the NIJ signed a Memorandum of Understanding (MOU) that outlines a framework for cooperation and collaboration in the social, behavioral, and forensic sciences. The MOU has led to the establishment of NSF Industry/University Cooperative Research Consortia (I/U CRC) in forensic science.

NATIONAL INSTITUTE FOR STANDARDS AND TECHNOLOGY

The National Institute for Standards and Technology (NIST) promotes technical innovation through advancement of measurement science and development of standards. NIST acts as a leading forensic science federal agency, as NIST scientists work across many forensic science disciplines and the NIST forensics team convenes a large number of working groups and other activities that are important to forensic research and practice. NIST hosts subject-matter conferences on its work, including Forensics@NIST, which is held every two years at the NIST campus and is also accessible online; as well as the NIST International Symposium on Forensic Science Error Management held every two years alternating with Forensics@NIST. Today, the role of NIST in forensic science involves policy, science, and practice. Agencies that fund or support forensic science by identifying topics of research needs include:

Forensic Science Center of Excellence

Focused on pattern and digital evidence, the Forensic Science Center of Excellence (FSCoE) was established in 2015 at Iowa State University to improve the statistical foundation for fingerprint, firearm, and other pattern evidence analyses, in addition to computer, video, audio and other digital evidence analyses.

Additional Funding Opportunities

NIST offers a variety of funding opportunities in areas applicable to forensic science, such as ballistics, digital/computer, DNA, toxicology, and pattern and trace evidence. For example, the Measurement Science and Engineering (MSE) Grant Program offers up to $500,000 of grants or cooperative agreements for funding to support research efforts related to a laboratory program sponsored by NIST. Within this funding opportunity, the Special Programs Office Grant Program: Forensic Science Program (FSP) funds projects with forensic-related topics, such as creating new material standards, computer and digital forensics, impression and pattern evidence, trace analysis, and more. Other programs, such as

KEY FORENSIC SCIENCE PANELS

The National Commission on Forensic Science (NFCS) is a federal advisory committee in partnership with NIJ that sets forensics policy. The NCFS, consisting of stakeholders from academia, law enforcement, forensic science service providers, and legal counsel, aim to improve quality of forensic science and federal coordination for implementation.

The Organization of Scientific Area Committees (OSAC) coordinates development of standards and guidelines for the forensic science community to improve quality and consistency of work in the forensic science community. In addition to potential involvement in the committees themselves, researchers should review the OSAC Research and Development Needs. These needs inform NIST's research funding priorities and the work of other agencies.

While the NCFS and OSAC do not allocate funds for research, these entities do influence research priorities. OSAC informs the forensic science community of research needs that are uncovered during the OSAC's standards development activities (https://www.nist.gov/topics/forensic-science/osac-research-development-needs). The NCFS subcommittee on "Scientific Inquiry and Research" examines existing foundational research and recommends research priorities for technological investments that can improve the quality and timeliness of forensic analyses (https://www.justice.gov/ncfs/scientific-inquiry-and-research.)

the Material Measurement Laboratory (MML) program, Fire Research (FR) program, and Information Technology Laboratory (ITL) program also support projects with forensics-related interests.

DEPARTMENT OF DEFENSE

The Department of Defense (DoD) is the largest government agency in the United States, with a budget of $419.3 billion and over three million employees. Research and development play a key role in maintaining the exceptional technological capabilities of the armed forces, and the agency is expected to invest around $71.8 billion in FY 2017 to support science and technology innovation.[2] Forensic-related scientific research has a strong presence within the DoD and its subsidiaries, whose interests include digital evidence and cyber forensics, chemical and biological detection, nuclear forensics, event representation, genetics, and more.

U.S. Army Criminal Investigation Command

The U.S. Army Criminal Investigation Command, commonly referred to as CID, was originally organized as a major command of the U.S. Army to provide investigative services to all levels of the Army. CID's Mission statement explains: As the U.S. Army's primary criminal investigative organization and the DoD's premier investigative organization, CID is responsible for conducting criminal investigations in which the Army may be a party of interest. CID utilizes modern investigative techniques, equipment, and systems to investigate criminal activity and identify the facts of a situation; the end goal is to create a logical summary of investigative data which is then presented to the responsible command, or United States attorney, as appropriate. The CID includes both the Defense Forensic Science Center (DFSC) and the U.S. Army Criminal Investigation Laboratory (USACIL).

[2] Retrieved from: http://www.defense.gov/News/News-Releases/News-Release-View/Article/652687/department-of-defense-dod-releases-fiscal-year-2017-presidents-budget-proposal

Defense Forensic Science Center

On November 13, 2013 the CID redesignated USACIL to the Defense Forensic Science Center (DFSC). The DFSC is the primary forensic center for the DoD. Its mission is to provide forensic support, specialized training and research capabilities to the Army and other DoD entities worldwide. As the only full service forensic laboratory in the DoD, the DFSC provides worldwide forensic science support across all military services, DoD components, and other federal departments and agencies. Located within the DFSC is the USACIL, which provides forensic laboratory services to all DoD investigative agencies as well as other federal law enforcement agencies. USACIL's forensic disciplines include DNA, Serology, Trace Evidence, Latent Prints, Firearms & Toolmarks, Digital Evidence, Drug Chemistry and Forensic Documents. In addition to USACIL, the DFSC includes the Office of the Chief Scientist (OCS), the Forensic Exploitation Directorate (FXD) and the Office of Quality Initiatives and Training (OQIT). According to data presented by DFSC to NIJ, in FY 2015 the DFSC allocated $328,000 to internal forensic R&D and $10.8 million to external projects.[3]

As stated on the DFSC website, the OCS manages and conducts research, development, testing and evaluation (RDT&E) efforts related to forensics in order to meet current and future warfighter and law enforcement requirements. It collaborates closely with dozens of interagency, academic, private industry, and international partners in a way that brings transparency to related research minimizing redundancy and leveraging similarity while allowing its scientists to stay abreast of forensic technology advancements. DFSC OCS also provides support for DoD acquisition organizations and subject matter expertise to other DoD and United States Government (USG) agencies with a vested interest in forensics and biometrics.

Of the RDT&E projects managed by OCS, a majority involve external research, with $9.23 million of funding devoted to projects with external research and $1.42 million for projects with internal research. OCS staff also perform research internally with assistance from Educational Outreach Program research associates, and function in a subject matter expert role to support external research projects managed by other DoD agencies. Currently, the largest investment of research funding is made in areas of DNA/serology.

The DFSC, in conjunction with the U.S. Army Research Office, supports the Defense Forensics Science Center Program, which funds forensic-related research projects. Current research areas of interest include the areas of digital evidence and computer forensics, signal processing and visual comparison of patterned and impression forensic materials, site exploitation and material recognition, miniaturization and ruggedization of equipment for use in the field, genetics, biology, and analytical chemistry. The program is seeking proposals that aim to develop new and improved technological capabilities for forensic tools in both laboratory and field settings, as well as proposals that engineer portable and secure devices for use in the field.

[3] Retrieved from: https://www.nap.edu/read/21772/chapter/4

Defense Forensics and Biometrics Agency

The Defense Forensics and Biometrics Agency (DFBA), whose mission is to deny the enemy anonymity, leads efforts to identifying unknown and known individuals for the military and organizations that protect national interests. The agency works closely with the DFSC and the Biometrics Identity Management Activity (BIMA). With the U.S. Army Research Office, the DFBA runs the DoD Forensic and Biometric Research and Development Program, which actively seeks research proposals that advance forensic and biometric knowledge, methods, or devices. The program seeks to fund applied research proposals that create deliverables beyond a technical report, including techniques, databases, protocols, and device prototypes.

Combatting Terrorism Technical Support Office

The Combatting Terrorism Technical Support Office (CTTSO), also known as the Technical Support Working Group (TSWG), is a DoD agency that funds applied research and development relevant across a broad array of interagency and international partners who work in thwarting terrorism. The CTTSO's mission statement is to identify and develop capabilities to combat terrorism and irregular adversaries. The agency interacts with DoD components and interagency partners through rapid research and development, advanced studies and technical innovation, and provision of support to U.S. military operations. The CTTSO maintains a forensic science subgroup that funds specific requirements detailed in its annual broad agency announcement. The agency also examines other proposals without specified requirements if they may be of interest to subgroup members, which includes many federal law enforcement agencies as well as DoD representatives. Other subgroups, such as the Training Technology Development subgroup, may have interest in closely-related requirements as well.

Special Operations Command

The Special Operations Command (SOCOM) Special Reconnaissance and Site Exploitation (SRSE) office manages special operations work that relates to the application of forensic science techniques. Site exploitation is analogous to crime scene investigation, except that site exploitation relates to military operations that seek to collect intelligence or evidence in a conflict environment. SOCOM SRSE is a program executive office that is responsible for everything from applied research to equipping special operations forces in this area. SRSE funds a wide range of applied research and development relating to its program requirements. Their broad agency announcement solicits proposals relating to capabilities to exploit personnel, documents, electronic data, and material on a sensitive site for the collection of unique, measurable biometric signatures.

Defense Threat Reduction Agency

The Defense Threat Reduction Agency (DTRA) is a DoD Combat Support Agency tasked with countering threats to our nation from WMD's, including chemical, biological, radiological, nuclear, and high explosives. Officially established in 1998, DTRA focuses primarily on threat reduction, threat control, combat support, and technology development. As such, DTRA manages a research portfolio to assist in the development of tools and capabilities, including support of nuclear post-detonation forensics capabilities. Funding is usually derived from partnerships with other federal agencies, especially the U.S. National Laboratories and the Department of Homeland Security's Domestic Nuclear Detection Office (DNDO). Specific forensic science projects involve basic science for protection of life and life-sustaining resources and networks, including investigations that support nuclear forensic science. Examples of

specific current research projects listed in a DTRA broad agency announcement include "Plasma Chemistry for Nuclear Forensics" and "Prompt Diagnostic Signatures of Nuclear Detonations for Forensics," each of which will average about $100,000.

DoD Research Offices

The Research Offices for the DoD include the Army Research Office (ARO), the Office of Naval Research (ONR), and the Air Force Office of Scientific Research (AFOSR). Through multiple funding programs, the offices support a variety of science and technology funding opportunities in disciplines closely aligned with their interests.

- As part of the DoD's University Research Initiative, the Service Research Offices administer the Defense University Research Instrumentation Program (DURIP). This program provides accredited U.S. universities funding for instrumentation that helps advance research areas of interest to the DoD. These awards provide between $50,000 and $1.5 million of funding to enhance existing or develop new research capabilities through the purchase of laboratory equipment.
- The Multidisciplinary University Research Initiative Program (MURI) is a funding source for high risk research that attempts to understand or achieve something that has never been done before. Each DoD research office offers funding for specific research topics in areas that encourage multidisciplinary collaboration. This year's broad agency announcement solicits proposals in forensic-related topics like "Cyber Deception through Active Leverage of Adversaries' Cognition Process," "Characterization of Information Content in Data for Multimodal Analysis," and "Event Representation and Episodic Memory." The program provides annual funding of $1.25-$1.5 million for a three-year period of performance.
- The ARO, ONR, and AFOSR each circulate their own broad agency announcements for funding opportunities.

Defense Innovation Unit Experimental

The Defense Innovation Unit Experimental (DIUx), created in 2015, is an initiative meant to accelerate the adoption of new technologies into the DoD from nontraditional contracting sources, such as early stage startups. The DIUx uses a Commercial Solutions Opening (CSO) tool to post solution briefs in current technological areas of interest. Technologies chosen by the DIUx receive non-dilutive funding in the form of Other Transaction Agreements (OTAs), and benefit from direct feedback on prototypes from DoD users, customers, and experts. According to the FY 2017 President's Budget Proposal, the DoD has budgeted $45 million for DIUx funding efforts.[4] While the research topics vary by the solicitations, areas of forensic-related interest include data analysis and cybersecurity.

[4] Retrieved from: http://www.defense.gov/News/News-Releases/News-Release-View/Article/652687/department-of-defense-dod-releases-fiscal-year-2017-presidents-budget-proposal

Rapid Reaction Technology Office

The Rapid Reaction Technology Office (RRTO) is an agency under the Deputy Assistant Secretary of Defense, Emerging Capability & Prototyping, under the Assistant Secretary of Defense for Research and Engineering. The office leverages non-traditional sources of innovation to develop prototypes for high-impact technologies aligning with DoD interests. The RRTO invests in biometrics and forensics technologies that improve current solutions (through cost reductions, functionality improvements, and more) or those that are novel and transformational. Research focus areas for forensic research include data analysis, automated/remote systems, non-compliant collections, standoff collection, personnel accounting, and counter-counter forensic technologies. The office provides its own funding, and solicits joint funding from agencies within the DoD to support forensic and biometric efforts.

Additional Funding Opportunities

The Rapid Innovation Fund (RIF), established in 2011 as part of the National Defense Authorization Act (NDAA), supports efforts for small businesses with innovations that address specific defense interests. The program funds mature prototypes for technologies (those reaching a Technology Readiness Level of around 5-6) that meet pressing DoD needs; up to $3 million will be distributed over a two-year period to develop, test, evaluate, and integrate the technology. These innovations must support a specific DoD component requirement as outlined in the broad agency announcement. Some of these components solicit forensic-related technologies: for example, the DFSC has released three different components requesting proposals for innovations that develop enhanced or new capabilities for forensic instruments and processes, including DNA and chemical sample collection techniques, next-generation sequencing platforms, SNP deconvolution methodologies and detection of organic components of gunpowder.

DEPARTMENT OF HOMELAND SECURITY

The Department of Homeland Security (DHS) safeguards the nation from threats and hazards. The role of forensic science in homeland security to support intelligence and other operations, including cybersecurity and nuclear forensics, is carried out within the Science and Technology Directorate (DHS/S&T) and the Domestic Nuclear Detection Office (DNDO). In addition, the Forensic Services Division of the US Secret Service (USSS), Immigration and Customs Enforcement (ICE), and the National Protection and Programs Directorate (NPPD) work closely with the DoD, the DOJ, state and local governments, international law enforcement and the private sector in the area of forensic science for cybersecurity.

Science and Technology Directorate

The Science and Technology Directorate of the DHS (DHS/S&T), an organization created in 2003, is focused on the prevention, disruption and prosecution of terrorism and other national security goals through rapid development of technological solutions. The S&T Directorate, with a proposed FY 2017 budget of $785 million, supports forensics efforts in the following ways:

Cyber Forensics Working Group

Within DHS/S&T, the Cyber Forensics Working Group (CFWG) is tasked with the development of project requirements, capability gaps, and technology development for cyber forensics. Working with representatives from federal, state and local law enforcement agencies, DHS currently has two cyber forensic efforts, as outlined on their webpage:

- The Cyber Forensics Tool Testing effort provides funding for the Cyber Forensics Tool Testing Program at NIST.
- The Vehicle and Infotainment System Forensics effort includes research to forensically acquire data from information and entertainment systems found in vehicles seized during law enforcement investigations.

National Biodefense Analysis and Countermeasures Center

The National Biodefense Analysis and Countermeasures Center (NBACC), located in Fort Detrick, MD, defends our nation against biological threats by supporting planning, emerging threat analysis and bioforensic analyses. This facility was established after the anthrax attacks in 2001. It coordinates with other national laboratories and provides the FBI with bioforensic testing on suspected biothreat samples.

Chemical Forensics Program

The DHS Chemical Forensics Program (Chem FP) is increasing the nation's preparedness for potential criminal and terrorist chemical threats by providing new chemical sample collection and forensic analysis techniques. The mission of this program is to develop a national technical chemical forensics capability for the collection, preservation and forensic analysis of Chemical Threat Agents and associated evidence in support of counterterrorism and criminal investigations. Research activities focus on four areas:

- Determining the attributes of Chemical Threat Agents.
- Identification of chemical attribution "signatures."
- Development of sampling tools and techniques.
- Development of analytical techniques.

Additional Funding Opportunities

The S&T Directorate supports other funding opportunities for forensics-related research. For example, the Directorate circulates "Long Range" broad agency announcements, which are standing open invitations to fund research and development projects in support of the operational environment of the DHS. There are currently three forensics-related "Long Range" research funding opportunities within DHS/S&T. The DHS provides funding for research topics such as forensics analysis tools, forensic data analytics for cybersecurity, and cloud computing security, including forensic analysis to preserve digital evidence.

Domestic Nuclear Detection Office

The Domestic Nuclear Detection Office (DNDO) was established to help ensure that the nation never experiences nuclear terrorism. Nuclear forensics can be directed on suspected nuclear materials or devices, discovered in the aftermath of an explosion, in order to determine their character and origin. The DNDO circulates a broad agency announcement for the Nuclear Forensics Research Award, which promotes development of collaborative teams in universities to conduct advanced research in the nuclear forensic sciences. The award provides up to $250,000 of funding for two years to support research in specific nuclear forensics technical mission areas (TMAs), including pre- and post-detonation material, signatures, and analysis methods. The award provides tuition and a stipend to support graduate students pursuing Ph.D. level research, as well as stipends for undergraduate students conducting research.

U.S. INTELLIGENCE COMMUNITY

The U.S. Intelligence Community (IC), which is comprised of 16 separate federal agencies tasked with the collection and production of foreign and domestic intelligence, is headed by the Director of National Intelligence (DNI). The overall U.S. Intelligence budget requested for FY 2017 is over $70 billion, which includes $53.5 billion for the National Intelligence Program (NIP) and $16.8 billion for the Military Intelligence Program (MIP).[5] Several components of the IC, especially the larger agencies such as the Central Intelligence Agency (CIA), the National Security Agency (NSA), and the Defense Intelligence Agency (DIA) as well as specific research arms such as the Intelligence Advanced Research Projects Activity (IARPA – research arm of the Office of the DNI) and In-Q-Tel (venture capital arm of the CIA) are involved in forensic science research, conducting and supporting research primarily in the areas of computer/digital forensics, and nuclear forensics. Although research spending by category is classified information, millions of dollars are being allocated to forensic science. Example efforts include:

Intelligence Advanced Research Projects Activity

The Intelligence Advanced Research Projects Activity (IARPA) is the research and development arm of the Office of the Director of National Intelligence (ODNI). Analogous to the DoD's Defense Research Projects Agency (DARPA), IARPA invests in high-risk, high payoff research programs to address the difficult challenges of the agencies and disciplines within the UIC. Research topics of interest to IARPA include forensics of multimedia, scalable discovery methods for pattern and data identification, and processes for analyzing and processing large amounts of data.

- IARPA's Requests for Information (RFI) seek expertise in a specific area to help understand the landscape of a specific technology. A current RFI, the DNAtoFace project, includes the exploitation of forensics on multimedia and/or social network data, and an effort to use genetic information to predict facial structure phenotype. This project would investigate using genetic DNA phenotyping to assist in identifying a person by providing a possible face structure of the unknown person.
- IARPA releases broad agency announcements for various research programs that have intelligence applications. A current solicitation, "Functional Genomic and Computational Assessment of Threats," seeks researchers capable of developing a rapid, more accurate DNA sequence screening tool to mitigate biological threats. In addition, IARPA releases an agency-wide research broad agency announcement to solicit proposals.

Central Intelligence Agency's In-Q-Tel

In-Q-Tel is the not-for-profit, independent, strategic venture capital arm of the Central Intelligence Agency (CIA) and invests in various innovative technology companies in support of the CIA and other Intelligence agencies. In-Q-Tel has a number of partnerships in the forensic science area, including companies recognized as global leaders in digital forensics software, particularly in the recovery of evidence from computers, smartphones and tablets.

[5] Retrieved from: http://www.defense.gov/News/News-Releases/News-Release-View/Article/652687/department-of-defense-dod-releases-fiscal-year-2017-presidents-budget-proposal

Defense Intelligence Agency

The Defense Intelligence Agency (DIA) specializes in defense and military intelligence, including the military intentions and capabilities of foreign governments and non-state actors including terrorists. In fulfilling this role, DIA has launched an initiative to establish a worldwide forensic intelligence capability that would include chemical, biological, radiological and nuclear defense laboratories, located world-wide, including combat zones. Funding for this initiative, which will include the areas of post-blast analyses, forensics of identity intelligence, latent print examination, and biometric collection techniques, is expected to total from $500 million to $600 million over a ten-year period. The DIA circulates broad agency announcements for white papers that align with DIA research topics. Current forensic-related research areas include development of new analysis technologies, enhancing counterintelligence and security, intelligence collections, forensic technology advancement for documents and digital media, and data analysis.

National Security Agency

The National Security Agency (NSA) is responsible for all signals intelligence (SIGINT), involving global monitoring, and collection and processing of information to exploit foreign intelligence as well as supporting US counterintelligence operations. In addition, the NSA Director is the head of the United States Cyber Command, responsible for US government cyberspace operations and the defense of U.S. military networks. As such, digital forensic tools and techniques are critical in its operations and have become a high priority for NSA and its Cyber Command.

SMALL BUSINESS ADMINISTRATION

The Small Business Administration (SBA) is a U.S. government agency created in 1953 to support Americans in starting and growing a small business through financial aid and counsel. Eleven government agencies participate in the SBA's Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) programs. The SBIR program provides funding to small early-stage companies with technologies that have commercial and societal impact. The STTR program provides funding for early-stage research and development funding for small companies that collaborate with research institutions to develop technologies. Both programs fund two phases of the three stage process of developing a business: Phase I, focused on determining technical and commercial feasibility, and Phase II, focused on prototyping. Projects that progress to the Phase III stage, commercialization, obtain funding from private sources or government agencies. Each government agency participating in the SBIR/STTR programs chooses proposals that align with their interests and capabilities. Examples of government agencies with SBIR/STTR programs that have forensic-related interests include:

Department of Defense

The DoD manages the largest subdivision of the SBIR/STTR programs. The SBIR program provides up to $1.15 million of funding to small early-stage companies with technologies that align with DoD interests. Multiple subsidiaries of the DoD participate in this program, including the SOCOM, who posted a solicitation for a forensic analysis tool capable of processing large amounts of data for defensive cyber operation in the upcoming 2017 SBIR broad agency announcement. The STTR program provides up to $850,000 of early-stage research and development funding.

National Science Foundation

The NSF SBIR program provides up to $975,000 of funding to small early-stage companies with technologies that have commercial and societal impact. The STTR program provides up to $975,000 of early-stage research and development funding for small companies that collaborate with university researchers to develop technologies aligned with NSF interests. Research topics for this grant applicable to forensics in FY 2016 include computational biology and bioinformatics (under the Biological Technologies theme) as well as development of instrumentation for chemical detection or characterization (under the Advanced Materials and Instrumentation theme).

National Institute of Standards and Technology

The NIST SBIR program provides up to $400,000 of funding to small early-stage companies with technologies that align with NIST values. The most recent federal funding opportunity (FFO) announcement for the SBIR program listed cybersecurity as a research priority.

Department of Homeland Security

The S&T Directorate and the DNDO participate in the SBA's SBIR Program. The S&T Directorate SBIR program provides up to $850,000 of funding to small early-stage companies with technologies that align with DHS interests. The recently released S&T Directorate research topics include "Video Analytics for Homeland Security Missions," which seeks innovative methods to identify specific activities in forensic video analysis or real-time monitoring. The DNDO SBIR program also provides up to $850,000 of funding for companies with technologies aligned to nuclear research. This could include research in specific nuclear forensics technical mission areas (TMAs), such as pre- and post-detonation material, signatures, and analysis methods.

OTHER AGENCIES AND SOURCES

The aforementioned federal agencies explicitly support forensic research efforts as well as research on underlying scientific principles for direct forensics-related purposes. However, additional funding opportunities exist for forensic research used for alternative purposes. In addition, several foundations and private sources provide funding for forensic research. These include:

Federal Bureau of Investigation

The Federal Bureau of Investigation (FBI) houses a distinguished forensics laboratory that manages many critical programs of national importance, including the Combined DNA Index System (CODIS). Although the FBI continues to conduct research using internal staff, the agency no longer funds an extensive extramural research program. The agency has funded key, cooperative research efforts in recent years. Federal law enforcement agencies, such as the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) and Drug Enforcement Administration (DEA), do not have funds to support extramural research, although all of the federal laboratories have an interest in research and development, especially as it relates to internal operational needs. For example, CTTSO/TSWG's forensics subgroup will often fund applied research in response to needs identified by federal laboratories.

Defense Advanced Research Projects Agency

The Defense Advanced Research Projects Agency (DARPA) is an organization within the DoD that funds innovative research to implement transformational technologies benefiting national security. It ranks among the largest sources of research funding in the federal government. While their investments have made a major impact on forensic science, such as digital evidence and media forensics, these efforts are focused on research needs outside of forensic practice.

National Institutes of Health

The National Institutes of Health (NIH) is a federal agency dedicated to improve human health and quality of life through scientific research. While NIH investments have impacted forensic science, especially in the areas of genomics and bioinformatics, these funding sources support research focused on healthcare advancements, such as better diagnostic technologies.

U.S. Department of State

The U.S. Department of State (DOS) works to develop a peaceful and progressive world, managing foreign policy issues for the nation. Within the DOS lies the Bureau of Democracy, Human Rights, and Labor (DRL), which seeks to promote and protect human rights around the world. This agency circulates Notices of Funding Opportunities (NOFOs) soliciting the use of forensic anthropology techniques to address human rights violations. The DRL is currently circulating two NOFOs, "Forensic Assistance to Address Legacies of Gross Human Rights Violations," and "Transitional Justice Processes including Bolstering Accountability for Gross Human Rights Violations," which seek to empower marginalized populations through forensic tools such as analysis of DNA samples and anthropological techniques.

Foundations/Private Funding

In addition, some foundations support research related to criminal justice needs. These include:

- The Arnold Foundation has supported forensic research and other initiatives the way evidence is collected in the field, analyzed in labs, and used in criminal proceedings.
- The Forensic Sciences Foundation promotes forensics research and education to resolve pressing social and legal issues. The nonprofit organization provides the Lucas and Acorn grants, which are small research grants ($1,000-$5,000) to support problem-oriented forensics research. The Jan S. Bashinski Grant is a small grant that provides financial assistance for graduate students completing research towards a Criminalistics or Forensic Sciences degree.
- The W.M. Keck Foundation funds high-impact science, engineering, and medical research that addresses significant challenges in society. The foundation provides between $500,000 and $5 million of grant money to support research proposals from universities and research institutes, and prioritizes projects that are high-risk and able to develop into methodologies or instruments.
- The Koch Foundation, which funds research with the potential to create a lasting societal impact, supports criminal justice and policing reform efforts. The foundation seeks to fund projects that *"promote human dignity, reduce costs, enhance public safety, and make victims whole again."*
- The American Academy of Forensic Sciences (AAFS) Humanitarian and Human Rights Resource Center supports AAFS members applying their forensic work to humanitarian efforts.

- The Ford Foundation, which aims to address worldwide inequality issues, funds efforts to promote gender, racial, and ethnic justice. The foundation recently awarded a grant to the Argentine Group of Forensic Anthropologists to support their mission to identify remains of missing migrants in the Latin America region.

Professional Forensics Organizations

Professional forensics organizations are avenues for researchers to collaborate and improve upon forensic research practices. These organizations, which can be regional, national, or international groups, often hold annual meetings to showcase cutting edge technology and encourage discussion, which can lead to funding opportunities despite not funding research directly. National professional forensics organizations and their meeting schedules are listed in the following table:

Professional Organization	Meeting Schedule
American Academy of Forensic Sciences	Annual - Winter
American Society of Crime Laboratory Directors	Annual - Spring
Society of Forensic Toxicologists	Annual - Fall
American Society of Trace Evidence Examiners	Annual – Fall/Winter
Association of Firearm and Tool Mark Examiners	Annual - Summer
American Society of Questioned Document Examiners	Annual – Summer/Fall
National Association of Medical Examiners	Annual - Fall
International Association for Identification	Annual- Summer/Fall
International Association of Forensic Nurses	Annual- Fall

SUMMARY

Researchers should begin by reviewing the research needs documents published by NIJ, NIST and other agencies to determine the alignment of their work with specific problems in forensic practice. Additional forensics-related funding opportunities from the agencies mentioned above, as well as agencies not listed, can be found on grants.gov and the Federal Business Opportunities site. The scope of relevant issues is quite broad, and actual practice is often quite different from expectations, so a relationship with a local forensic laboratory can also provide needed perspective. The FTCoE supports NIJ to transition technologies into practice, and the center is always interested in reviewing the state of research projects to determine if support for transition would be beneficial. Researchers and practitioners may review past and current projects on the FTCoE website, which also provides a large number of archived webinars on scientific topics of interest.

FUNDING SUMMARY TABLE

While this list is non-exhaustive, it is a guide that lists important forensics-related funding opportunities in key federal agencies, along with links to current lists of funding opportunities for each agency. Opportunities for federal agencies that do not provide a list of active funding opportunities can be found on grants.gov or the Federal Business Opportunities website.

Federal Agency		Forensics-Related Research Topics	Funding Opportunities
National Institute of Justice	Agency-wide	Forensic biology/DNA, controlled substances, forensic toxicology, forensic anthropology and odontology, forensic pathology and medicolegal death investigation, impression and pattern evidence, trace evidence, crime scene analysis, latent prints, questioned documents	Current NIJ BAAs
National Science Foundation	Agency-wide	Decision making in forensic setting, analytical chemistry, genomics and proteomics, bioinformatics, digital evidence, vertical integration of forensic science conceptual approaches, forensic anthropology, biological sciences	Current NSF BAAs
National Institute for Standards and Technology	Agency-Wide	Materials standards, digital evidence and computer forensics, impression and pattern evidence, trace evidence, fire research	Current NIST BAAs

Department of Defense	Defense Forensic Science Center	DNA, serology, trace evidence, latent prints, firearms and toolmarks, digital evidence, drug chemistry, forensic documents, genetics, device miniaturization and ruggedization, site exploitation	Defense Forensic Science Center Program (BAA)
	Defense Forensics and Biometrics Agency	Digital evidence and computer forensics, signal processing, analytical chemistry, molecular biology, forensic pathology, equipment miniaturization and ruggedization, site exploitation	Current U. S. Army BAAs
	Combatting Terrorism Technical Support Office	Video and audio forensic analysis, rapid data extraction, evidence collection and preservation, trace evidence (especially of homemade explosives), field methods of rapid and low-cost DNA analysis, advanced identification technologies, forensic exploitation	Current CTTSO BAAs
	Special Operations Command: Special Reconnaissance, Surveillance, and Exploitation	Document exploitation, electronic media exploitation (computers, cell phones), trace evidence, detection of hidden rooms	Current SRSE BAAs
	Defense Threat Reduction Agency	Nuclear forensics, post-detonation forensics, trace evidence	Current DTRA BAAs
	DoD Research Offices (Army, Navy, Air Force)	Latent identification and matching, biometrics and multimodal matching capabilities, analytical and computational models, cybersecurity, analytical chemistry	Army Research Office BAAs Office of Naval Research BAAs Air Force Office of Scientific Research BAAs
	Defense Innovation Unit Experimental	Varies: specific DoD-related topics per fiscal year, but common themes such as cybersecurity, data analysis	Commercial Solutions Opening Solicitations
	Rapid Reaction Technology Office	Data analysis, automated/remote systems, non-compliant collections, standoff collections, personnel accounting, counter-counter forensic technologies	Links to contacts and more information
	Rapid Innovation Fund	Novel forensic instruments and processes, DNA collection and identification, chemical sample collection, next-generation sequencing tools, analytical chemistry, trace evidence, rapid	Current RIF BAAs

		body fluid screening, cybersecurity, digital evidence, automation	
Department of Homeland Security	Science & Technology Directorate	Cybersecurity, digital evidence, analytical chemistry, biological threat analysis, latent identification, biological detection technologies and protocols	Current broad agency announcements
	Domestic Nuclear Detection Office	Nuclear forensics, including pre-detonation material and device signatures, pre-detonation analysis methods/tools, post-detonation material collection and analysis, post-detonation prompt signal analysis (Technical Mission Areas)	Nuclear Forensics Research Award
U.S. Intelligence Community	Intelligence Advanced Projects Agency	Genetics, bioinformatics, identification techniques, cybersecurity, media forensics, pattern identification and analysis, data collection methods	Current requests for information Current broad agency announcements
	In-Q-Tel	Cybersecurity, digital evidence biotechnology including DNA sequencing technologies, data analytics (Focus Areas)	Instructions for business plan submittal
	Defense Intelligence Agency	Post-blast analyses, identity intelligence, latent print examination, biometric collection techniques, analysis technologies, counterintelligence and cybersecurity, intelligence collections, digital evidence, data analysis (Research Areas)	Current BAAs for Defense Intelligence Agency
Small Business Administration	Department of Defense	Varies: Research topics vary by year, but could include identification intelligence, cybersecurity, data analytics, analytical chemistry, data collection methods	SBIR/STTR Program
	National Science Foundation	Varies: Research topics vary by year, but could include computational biology, bioinformatics, development of instrumentation for chemical detection or characterization	SBIR/STTR Program
	National Institute for Standards and Technology	Varies: Research topics vary by year, but could include cybersecurity, analytical chemistry, computer and digital forensics, impression and pattern evidence, trace analysis, fire research	SBIR Program

	Department of Homeland Security	Varies: Research topics vary by year, but could include cybersecurity, digital evidence, analytical chemistry, biological threat analysis, latent identification, biological detection technologies and protocols	S&T Directorate SBIR Program
		Nuclear forensics, including pre-detonation material and device signatures, pre-detonation analysis methods/tools, post-detonation material collection and analysis, post-detonation prompt signal analysis (Technical Mission Areas)	DNDO SBIR Program
Other Agencies	Defense Advanced Research Projects Agency	Digital evidence and media forensics	Current opportunities
	National Institutes of Health	Genomics, proteomics, bioinformatics, data analysis	Current opportunities
	U.S. Department of State	Forensic anthropology and DNA sample analysis	Current broad agency announcements
Foundations	Arnold Foundation	All-encompassing forensic science initiative, with focus on best practices	Current opportunities
	Forensic Sciences Foundation	All-encompassing	Lucas Grants
			Acorn Grants
			Jan S. Bashinski Grant
	W.M. Keck Foundation	High-risk science and engineering projects that can develop into methodologies or instruments	Link to grant programs
	Koch Foundation	Criminal justice, policing reform, public safety	Requests for proposals
	AAFS Humanitarian and Human Rights Resource Center	Any forensic work applied to humanitarian efforts	Proposal submission information
	Ford Foundation	Projects promoting gender, racial, and ethnic justice (Focus Areas)	Grants database
General (all federal agencies)	Federal Business Opportunities	All-encompassing	Current opportunities
	Grants.gov	All-encompassing	Current opportunities

LIST OF ACRONYMS

AFOSR: Air Force Office of Scientific Research
ARO: Army Research Office
ATF: Bureau of Alcohol, Tobacco, Firearms and Explosives
BAA: Broad Agency Announcement
BIMA: Biometrics Identity Management Activity
CFWG: Cyber Forensics Working Group
Chem FP: Chemical Forensics Program
CIA: Central Intelligence Agency
CID: U.S. Army Criminal Investigation Command
CODIS: Combined DNA Index System
CSO: Commercial Solutions Opening
CTTSO: Combatting Terrorism Technical Support Office
DARPA: Defense Research Projects Agency
DEA: Drug Enforcement Administration
DFBA: Defense Forensics and Biometrics Agency
DFSC: Defense Forensic Science Center
DHS: Department of Homeland Security
DHS/S&T: Science and Technology Directorate of the DHS
DIA: Defense Intelligence Agency
DIUx: Defense Innovation Unit Experimental
DNDO: Domestic Nuclear Detection Office
DNI: Director of National Intelligence
DoD: Department of Defense
DOJ: Department of Justice
DOS: U.S. Department of State
DRL: Bureau of Democracy, Human Rights, and Labor
DTRA: Defense Threat Reduction Agency
DURIP: Defense University Research Instrumentation Program
FBI: Federal Bureau of Investigation
FEPAC: Forensic Science Education Programs Accreditation Commission
FFO: Federal Funding Opportunity
FR: Fire Research
FSCoE: Forensic Science Center of Excellence
FSP: Forensic Science Program
FTCoE: Forensic Technology Center of Excellence
FXD: Forensic Exploitation Directorate
I/U CRC: Industry/University Cooperative Research Consortia
IARPA: Intelligence Advanced Research Projects Activity
IC: U.S. Intelligence Community
ICE: Immigration and Customs Enforcement
ITL: Information Technology Laboratory
MML: Material Measurement Laboratory
MOU: Memorandum of Understanding
MSE: Measurement Science and Engineering
MURI: Multidisciplinary University Research Initiative Program
NBACC: National Biodefense Analysis and Countermeasures Center
NBS: National Bureau of Standards
NDAA: National Defense Authorization Act
NFCS: National Commission on Forensic Science
NIH: National Institutes of Health
NIJ: National Institute of Justice
NIST: National Institute for Standards and Technology
NOFOs: Notices of Funding Opportunities
NPPD: the National Protection and Programs Directorate
NSA: National Security Agency
NSF: National Science Foundation
OCS: Office of the Chief Scientist
OIFS: Office of Investigative and Forensic Sciences
ONR: Office of Naval Research
OQIT: Office of Quality Initiatives and Training
OSAC: Organization of Scientific Area Committees
OTAs: Other Transaction Agreements
R&D: Research and Development
RDT&E: Research, Development, Testing and Evaluation
RFI: Requests for Information
RIF: Rapid Innovation Fund
RRTO: Rapid Reaction Technology Office
SBA: Small Business Administration
SBIR: Small Business Innovative Research
SIGINT: Signals Intelligence
SOCOM: Special Operations Command
SRSE: Special Reconnaissance and Site Exploitation
STTR: Small Business Technology Transfer
TMAs: Technical Mission Areas
TSWG: Technical Support Working Group
USG: United States Government
USSS: US Secret Service
WMD: Weapons of Mass Destruction