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Federal Forensic Science Research and Development Programs—A 2021 Update

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List of Acronyms and Initialisms

AFMES: U.S. Armed Forces Medical Examiner System

AFMES-AFDIL: U.S. Armed Forces Medical Examiner System—Armed Forces DNA Identification Laboratory

AFOSR: Air Force Office of Scientific Research

ANAB: ANSI-ASQ National Accreditation Board

ANSI: American National Standards Institute

ARO: U.S. Army Research Office

ASQ: American Society for Quality

ATF: Bureau of Alcohol, Tobacco, Firearms and Explosives

BAA: Broad Agency Announcement

BIO: Biological Sciences (NSF directorate)

CARFS: Center for Advanced Research in Forensic Science (NSF/NIJ program)

CBP: U.S. Customs and Border Protection

CFL: Cyber Forensics Laboratory

CIA: Central Intelligence Agency

CISE: Computer and Information Science and Engineering (NSF directorate)

CITeR: Center for Identification Technology Research

DARPA: Defense Advanced Research Projects Agency

DC3: U.S. Department of Defense Cyber Crime Center

DEA: U.S. Drug Enforcement Administration

DFBA: Defense Forensics and Biometrics Agency

DFE: U.S. Department of Defense Forensic Enterprise

DFSC: Defense Forensic Science Center

DHS: U.S. Department of Homeland Security

DHS/S&T: Science and Technology Directorate of the U.S. Department of Homeland Security

DIA: Defense Intelligence Agency

DIU: Defense Innovation Unit

D/MM: Digital and multimedia

DNDO: Domestic Nuclear Detection Office

DOC: U.S. Department of Commerce

DOD: U.S. Department of Defense

DOJ: U.S. Department of Justice

DOS: U.S. Department of State

DTRA: Defense Threat Reduction Agency

EAGER: EArly-concept Grants for Exploratory Research

EHR: Education and Human Resources (NSF directorate)

ENG: Engineering (NSF directorate)

EPA: U.S. Environmental Protection Agency

FBI: Federal Bureau of Investigation

FFRDCs: Federally Funded Research and Development Centers

FLN-TWG: Forensic Laboratory Needs Technology Working Group

FR: Fire Research

FS R&D TWG: Forensic Science and Development Technology Working Group

FSD: Forensic Science Division

FTCoE: NIJ Forensic Technology Center of Excellence

FY: fiscal year

HSE: Homeland Security Enterprise

IARPA: Intelligence Advanced Research Projects Activity

IC: U.S. Intelligence Community

ICE: Immigration and Customs Enforcement

ISO: International Organization for Standardization

IUCRC: Industry/University Cooperative Research Center

IWTSD: Irregular Warfare Technical Support Directorate

MPS: Mathematical and Physical Sciences (NSF directorate)

mtDNA: mitochondrial DNA

NAS: National Academy of Sciences

NBACC: National Biodefense Analysis and Countermeasures Center

NCFS: National Commission on Forensic Science

NEIC: National Enforcement Investigations Center

NGS: next-generation sequencing

NIH: National Institutes of Health

NIJ: National Institute of Justice

NIST: National Institute of Standards and Technology

NRL: Naval Research Laboratory

NSA: National Security Agency

NSF: National Science Foundation

OCS: Office of the Chief Scientist

ODNI: Office of the Director of National Intelligence

OIFS: Office of Investigative and Forensic Sciences

ONR: Office of Naval Research

ORET: Office of Research, Evaluation, and Technology

OSAC: Organization of Scientific Area Committees

R&D: research and development

RDT&E: Research, Development, Test, and Evaluation

RFI: Request for Information

RIF: Rapid Innovation Fund

RRTO: Rapid Reaction Technology Office

S&T: Science and Technology

S&TD: Science and Technology Directorate

SBA: Small Business Administration

SBE: Social, Behavioral and Economic Sciences (NSF directorate)

SBIR: Small Business Innovative Research

SPO: Special Programs Office

SRSE: Special Reconnaissance and Site Exploitation

STR: short tandem repeat

STTR: Small Business Technology Transfer

TMA: Technical Mission Area

TSC: Technical Solutions Component

USG: U.S. Government

USSOCOM: U.S. Special Operations Command

USSS: U.S. Secret Service

WMD: weapons of mass destruction

Overview

In response to the 2009 National Academy of Sciences (NAS) report, *Strengthening Forensic Science in the United States: A Path Forward*, the federal government accelerated its investment in forensic science in recent years. The NAS report advocated for additional coordination and investment by the federal government in research related to the forensic sciences.[1] Federal investments have transformed the ability of forensic laboratories to analyze DNA and other forensic evidence, decreased turnaround times, and increased the capacity for forensic analysis—demonstrating the power of science to address criminal justice challenges. The National Institute of Justice (NIJ) is the primary federal funder of forensic science research across all forensic science disciplines. NIJ awarded over $264,000,000 through nearly 600 grants between 2009 and 2020 for research and development (R&D) projects. Several other federal agencies fund forensic science research relevant to specific disciplines or agency missions; however, despite increased investments, a coordinated, current accounting of forensic science R&D activity across the federal government is still needed.

This landscape report provides a summary of agency interests, funding opportunities, and published research needs to assist interested researchers. 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 to government agencies' websites, reports, and funding opportunities offer the reader easy access to additional information. A previous report was published December 2016, *A Landscape Study of Federal Investment in Forensic Science R&D*.

To begin, the researcher should take the time to understand each agency's mission and interests. Some agencies, such as the National Science Foundation (NSF), are primarily interested in basic research to advance scientific understanding, including topics that support the forensic sciences. Other agencies, such as the U.S. Department of Defense's (DOD's) Defense Forensic Science Center (DFSC), have practical needs that require applied R&D tied to operational requirements. The forensic science–related research topics of interest to each agency are outlined in this report and summarized in a supplemental table. The researcher should examine each agency's websites, linked throughout the report, to find more in-depth information. In addition, it is recommended that researchers attend conferences or agency briefings relevant to their field of focus. Finally, NSF conducts an annual survey of Federal Funds for Research and Development that tracks funding by agency and research obligations that can help researchers understand trends in current funding priorities.[2]

[1] Committee on Identifying the Needs of the Forensic Science Community; Committee on Science, Technology and Law Policy and Global Affairs; Committee on Applied and Theoretical Statistics Division on Engineering and Physical Sciences; National Research Council of the National Academies. (2009). *Strengthening forensic science in the United States: A path forward*. Committee on Identifying the Needs of the Forensic Sciences Community, Washington, DC: National Academies Press.

[2] The annual Survey of Federal Funds for Research and Development is published in on NSF's website and can be accessed at www.nsf.gov/statistics/srvyfedfunds/#tabs-1

U.S. Department of Justice (DOJ)

The U.S. Department of Justice (DOJ) (1) administers forensic laboratories organized within the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF); U.S. Drug Enforcement Administration (DEA); and Federal Bureau of Investigation (FBI) and (2) funds intramural research, development, and evaluation activities at these laboratories—including collaboration with external researchers. DOJ primarily funds extramural research through NIJ. As stated on their website, DOJ has the following priorities related to forensic science[3]:

- Facilitating coordination and collaboration on forensic science within the Department, across the federal government, and with state, local, and tribal entities.
- Increasing the capacity of forensic service providers so that evidence can be processed quickly and investigations can be concluded without delay.
- Improving the reliability of forensic analysis to enable examiners to report results with increased specificity and certainty.

National Institute of Justice (NIJ)

NIJ—which serves as DOJ's research, development, and evaluation agency—is dedicated to improving knowledge and understanding of crime and justice issues through science. NIJ provides objective and independent knowledge and tools to inform the decision making of the criminal and juvenile justice communities to reduce crime and advance justice, particularly at the state and local levels. NIJ uses an R&D process to help ensure that the projects they fund are relevant to the field and produce valid, actionable results. This process includes identification of technology needs, development of a research agenda, implementation of both external and intramural research, provision of post-award assistance, evaluation of research results, and dissemination of research findings. NIJ is composed of the Office of the Director; Office of Investigative and Forensic Sciences; Office of Research, Evaluation, and Technology (ORET); Office of Grants Management; Office of Operations; and Office of Communications.

Office of Investigative and Forensic Sciences (OIFS)

NIJ's Office of Investigative and Forensic Sciences (OIFS) is the federal government's lead agency for forensic science R&D. OIFS's mission is to improve the quality and practice of forensic science through innovative solutions that support R&D, testing and evaluation, technology, and information exchange for the criminal justice community.

OIFS R&D efforts focus on three primary goals[4]:

1. Expand the information that can be extracted from traditional types of forensic evidence and quantify its evidentiary value.
2. Develop reliable and widely applicable tools and technologies that allow faster, cheaper and less labor-intensive identification, collection, preservation and analysis of forensic evidence of all kinds, and reduce existing case backlogs.
3. Strengthen the scientific basis of the forensic science disciplines.

OIFS convenes the Forensic Science Research and Development Technology Working Group (FS R&D TWG), which is a committee of approximately 50 experienced forensic science practitioners from local, state, and federal agencies and laboratories that meets annually to identify, discuss, and prioritize operational needs and

[3] DOJ. (2021, March 15). *Forensic science*. www.justice.gov/olp/forensic-science
[4] NIJ. (2021, March 15). *About NIJ's Office of Investigative and Forensic Sciences.* nij.ojp.gov/about-nij/about-nijs-office-investigative-and-forensic-sciences

requirements. These needs and requirements are published on the NIJ webpage and (1) help inform NIJ's planned and ongoing R&D activities and (2) ensure that future R&D investments meet practitioner-driven needs.

Forensic Technology Center of Excellence (FTCoE)

The NIJ Forensic Technology Center of Excellence (FTCoE) works to advance technology by evaluating emerging technologies applicable to forensic science and delivering support for the transition of technology into practice. Through the FTCoE, NIJ provides technical evaluation, technical assistance, and guidance resources to identify and remove barriers to implementation and acceptance, ensuring that promising technical innovations are put in the hands of forward-thinking practitioners, stakeholders, and policymakers. This report was prepared by the FTCoE, which supports 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 the transition of technologies and other innovations into forensic practice.

Forensic Laboratory Needs Technology Working Group (FLN-TWG)

The Forensic Laboratory Needs Technology Working Group (FLN-TWG) provides objective and independent knowledge, data, information, and expertise to inform NIJ's decision-making process about the forensic technology–related operational and implementation needs of federal, state, local, and tribal practitioners. The FLN-TWG ensures that forensic research is relevant and responsive to law enforcement technology needs and will produce actionable results.

The FLN-TWG assists in (1) identifying technical and applied research needs related to forensic laboratory operations; (2) developing a research agenda that understands the operational requirements and operational readiness of forensic laboratories; (3) identifying the need for new and improved technologies, methods, and practices; (4) disseminating information regarding promising research, technologies, and practices to the field; and (5) helping advance the implementation of relevant research, practices, and technologies into forensic laboratories.

The FLN-TWG assists NIJ in better (1) understanding the technology needs of forensic laboratories and the criminal justice system at large and (2) developing innovative solutions that focus on technical testing and evaluation of technology, technology transition, information exchange, and training and capacity building for the forensic science infrastructure.

FLN-TWG is not a policy-making or advocacy body and will not develop, circulate, or advocate for particular policies. Although FLN-TWG members are welcome to individually work with advocacy organizations to develop and implement policies or positions on particular issues, members should not suggest that the FLN-TWG has a position on any issue or policy. FLN-TWG members can add their participation in this group to their professional résumés but should consult with NIJ before accepting invitations to speak or write publicly about FLN-TWG.

Forensic Science Technology Working Group[5]

NIJ convenes an FS R&D TWG on an annual basis to identify operational needs and requirements to inform NIJ's planned and ongoing forensic science R&D activities and ensure that future R&D investments meet practitioner-driven needs. The requirements are published on NIJ's website.[6] This list provides insight into the practical requirements of crime laboratories—some of which could be addressed by R&D. This working group comprises

[5] NIJ. (2019, December 18). *Forensic Science Research and Development Technology Working Group: Operational requirements.* https://nij.ojp.gov/topics/articles/forensic-science-research-and-development-technology-working-group-operational

[6] *Ibid.*

practitioners who represent the fields of forensic biology and DNA, trace evidence, seized drugs, toxicology, crime scene examination, forensic pathology, forensic anthropology, and impression and pattern evidence.

Office of Research, Evaluation, and Technology (ORET)

ORET is an agency within NIJ that focuses on the improvement of criminal and juvenile justice systems by supporting research, development, and evaluation, with a focus on investigating the following[7]:

- Causes and correlates of crime and violence,
- Methods of crime prevention and control, and
- Criminal justice system responses to crime and violence.

Funding Opportunities

From 2009 to 2020, NIJ provided over $264 million in forensic science R&D funds, covering all aspects of forensic practice. In 2020, NIJ funded 35 research grants with a median funding level of $221,000 per year and a median period of performance of 2 years. Additionally, between 2014 and 2020, NIJ has awarded over $7.7 million for 29 grants for research and evaluation projects that support the testing and interpretations performed by publicly funded forensic laboratories. Because of the size and diversity of its research portfolio, NIJ should be the first place to look for researchers whose interests may be related to forensic science. Current and forthcoming NIJ funding opportunities are also listed on NIJ's website, in addition to prior-year funding opportunities and award listings.[8] Researchers should also review the needs and operational requirements identified by the FS R&D TWG. NIJ has developed Strategic Research Plans to guide the research community. Notable research solicitations include the following:

- "Research and Development in Forensic Science for Criminal Justice Purposes." This funding opportunity represents the large majority of NIJ's funding in forensic science. The solicitation funds basic scientific research, R&D 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. States, units of local government, nonprofit and for-profit organizations and institutions of higher education, qualified individuals, and federal agencies are eligible to apply.
- "Research and Evaluation for the Testing and Interpretation of Physical Evidence in Publicly Funded Forensic Laboratories." This opportunity aims to fund projects that direct the findings of research and evaluation toward the determination of the most efficient, accurate, reliable, and cost-effective methods for the identification, analysis, and interpretation of physical evidence for criminal justice purposes. The goals of this solicitation are to (1) identify and inform the forensic community of best practices through the evaluation of existing laboratory protocols and (2) have a direct and immediate impact on laboratory efficiency and assist in making laboratory policy decisions. States, units of local government, federally recognized tribal governments, nonprofit organizations, institutions of higher education, certain individuals, and federal agencies are eligible to apply. Applicants must be, or be partnered with, publicly funded forensic science laboratories. To help connect researchers with

[7] NIJ. (2019, July 30). *About the NIJ Office of Research, Evaluation, and Technology*. https://nij.ojp.gov/about-nij/about-the-nij-office-research-evaluation-and-technology

[8] NIJ forensic science awards for each solicitation and fiscal year can also be found by using the NIJ Expired Funding search page.

forensic laboratories, NIJ maintains a list of labs that have expressed an interest in partnering with researchers.

- Various funding opportunities under ORET include a forensic science nexus in support of its mission. These programs include research grant programs, such as "Research and Evaluation in Safety, Health, and Wellness in the Criminal Justice System"; "Research and Evaluation on the Administration of Justice"; "Research on the Abuse, Neglect, and Exploitation of Elderly Individuals"; and "Research and Evaluation on Drugs and Crime." NIJ's drugs and crime research informs crime reduction through research projects related to epidemiology, prevention, and intervention; drug markets; market disruption; and forensics—including (1) projects to identify and assess methods, technologies, and strategies for drug recognition and detection and (2) support of medicolegal death investigation.
- NIJ also offers fellowship programs to support the development of researchers tackling issues of crime and justice. NIJ's Graduate Research Fellowship program supports doctoral students from across all science and engineering fields whose dissertation research is relevant to crime or criminal justice. The Research Assistantship Program brings graduate students to work at NIJ for term appointments. The Visiting Fellows Program brings established researchers into residency at NIJ.

Federal Bureau of Investigation (FBI)

The FBI houses a distinguished forensics laboratory that manages many critical programs of national importance, including the Combined DNA Index System. Although the FBI continues to conduct research using internal staff, the agency no longer funds an extensive extramural research program. However, the agency has funded key cooperative research efforts in recent years and does offer a robust visiting scientist program to fund postdoctoral students to conduct research at the laboratory. Federal law enforcement agencies—such as ATF and DEA—may not have funds to support extramural research; however, all federal laboratories have an interest in R&D—especially as it relates to internal operational needs. For example, IWTSD/Technical Support Working Group's forensics subgroups often fund applied research in response to needs identified by federal agencies.

Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF)

ATF has forensic laboratories in California, Maryland, and Georgia; these laboratories are responsible for providing the accurate and authoritative scientific information that ATF needs to reduce violent crime and protect the public. Forensic laboratories examine fire debris, explosives, latent fingerprints, firearms/toolmarks, DNA/forensic biology, questioned documents, tobacco, and trace evidence. One of ATF's most prominent research programs is conducted at the ATF Fire Research Laboratory, which conducts research on fire scene reconstruction, flashover studies, validation of fire pattern analysis indicators, impact of accelerants on fire growth and spread, ignition studies, and electrical fire cause analysis.

U.S. Drug Enforcement Administration (DEA)

The mission of DEA's Office of Forensic Sciences is to (1) provide quality scientific, technical, and administrative support to the law enforcement and intelligence communities and the criminal justice system at large and (2) assist with the enforcement of U.S. controlled substance laws and regulations. Forensic laboratories support DEA and other law enforcement agencies with analysis of suspected seized drugs and related substances; crime scene investigation; latent fingerprint identification and photographic development; analysis and evaluation of digital (i.e., computer) evidence; development, monitoring, and processing of hazardous waste cleanups at clandestine laboratory investigations and disposals; and expert witness testimony. The DEA Special Testing and Research Laboratory supports DEA's investigations by developing methods, analyzing seized narcotics, and tracing the origin

of those narcotics. Recognizing the expanding role of technology, DEA established the Computer Forensics Program in 1994. This program processes digital evidence from laptop and desktop computers, storage media, and other devices; provides on-site duplication support when evidence cannot be removed from a business; and provides expert witness testimony.

National Science Foundation (NSF)

NSF supports basic research in science and engineering and has an annual budget of $8.1 billion. NSF is interested in receiving proposals for existing programs in any Foundation directorate addressing fundamental research questions that might also advance activities related to research education in forensic sciences. NSF supports research and education across multiple fields of science and engineering through the following directorates:

- Biological Sciences (BIO)
- Computer and Information Science and Engineering (CISE)
- Education and Human Resources
- Engineering (ENG)
- Environmental Research and Education
- Geosciences
- Mathematical and Physical Sciences (MPS)
- Office of Integrative Activities
- Office of International Science and Engineering
- Social, Behavioral and Economic Sciences (SBE)

NSF issued a Dear Colleague letter outlining its interests and programs in forensic science to help guide researchers wishing to submit a proposal relevant to the Foundation. In that letter, NSF states that the Foundation would be particularly interested in proposals that engage forensic scientists and experts to collaborate with basic science researchers. As presented in that letter, topics can include 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 Division of Biological Infrastructure's Infrastructure Capacity for Biology Core Program releases two solicitations, Infrastructure Capacity for Biology, and Infrastructure Innovation for Biological Research.
- 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 Science, Technology, Engineering, and Mathematics discipline.

In addition, NSF convenes workshops and policymaker briefings that are relevant to the forensic sciences. NSF's Division of Behavioral and Cognitive Sciences in the SBE Directorate recently announced its Cognitive Neuroscience Program, which seeks proposals that address the neural etiology of human cognitive behavior.

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

Since 2017, NSF has funded 736 proposals in forensic science, including the following:

- 73 awards totaling $100 million from EHR for undergraduate and graduate training
- 127 awards totaling $21 million from CISE
- 116 awards totaling $16 million from MPS
- 134 awards totaling $14 million from ENG
- 108 awards totaling $10 million from SBE
- $6 million from BIO

The funded projects have focused on topic areas related to cyber security, cyberattacks, cognitive science, nuclear physics, data science, trace elements, microbial communities, cell cultures, and species trees and have supported both undergraduate research and faculty mentors. In March 2019, NSF issued a Dear Colleague Letter inviting proposals to the Operations Engineering program to conduct fundamental, multidisciplinary research that advances the scientific knowledge and understanding of illicit supply networks' operational methods to discover, disrupt, and disable such networks.

In addition to the standard proposal mechanisms, NSF also funds other proposal types, including the following:

- Rapid Response Research
- EArly-concept Grants for Exploratory Research (EAGER)
- Research Advanced by Interdisciplinary Science and Engineering
- Grant Opportunities for Academic Liaison with Industry
- Ideas Lab
- Facilitation Awards for Scientists and Engineers with Disabilities

Additional Funding Opportunities

NSF and NIJ collaboration led to the establishment of an NSF-NIJ Industry/University Cooperative Research Center (IUCRC) in forensic science—the Center for Advanced Research in Forensic Science (CARFS)—with sites at Florida International University, the University of South Alabama, Texas A&M University, and Boston University; there are also more than over 20 industry members. CARFS aims to develop, implement, and commercialize tools that benefit the national forensic science research enterprise. Research programs include forensic chemistry, digital forensics/data analytics, forensic molecular biology, behavioral sciences, forensic anthropology, and forensic microbiology—with the possibility of future expansion to include other forensic disciplines. By leveraging industry and academic partnerships, this program supports cutting-edge fundamental research that can drive innovation to address challenges in forensic science. CARFS leverages their Industrial Advisory Board to provide guidance about the directions of projects at the forefront of forensic science.

The Center for Identification Technology Research (CITeR) is another NSF IUCRC. Their mission is to work in partnership with government and industry stakeholders to advance the state-of-the-art human identification capabilities through coordinated university research. CITeR includes sites at several universities—including Clarkson University, the University at Buffalo, the University of Arizona, and West Virginia University—and has approximately 20 industry members.

NSF also maintains the master government list of federally funded R&D centers (FFRDCs). The FFRDCs are a special classification of research institutions owned by the federal government but operated by contractors—including industrial firms, nonprofit organizations, and universities. These FFRDCs provide the federal government with R&D capabilities that the federal government or industry alone cannot provide. FFRDCs provide R&D capabilities in a broad range of areas—including energy, astronomy, cybersecurity, and health. There are currently 42 FFRDCs that are sponsored by 12 federal agencies and are categorized into one of three types of centers:

1. R&D laboratories (26 FFRDCs),
2. Study and analysis centers (10 FFRDCs), or
3. System engineering and integration centers (6 FFRDCs).

Although none of the FFRDCs focus solely on forensic research, several conduct research that contributes to the advancement of forensic science, investigation and certification of death, and modernization of courts.

U.S. Department of Commerce (DOC)

The U.S. Department of Commerce (DOC) "promotes job creation and economic growth by ensuring fair and reciprocal trade, providing the data necessary to support commerce and constitutional democracy, and fostering innovation by setting standards and conducting foundational research and development."

National Institute of Standards and Technology (NIST)

DOC's National Institute of Standards and Technology (NIST) promotes U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. NIST's key mission elements are as follows:

- **Measurement Science**: Creating the experimental and theoretical tools—methods, metrics, instruments, and data—that enable innovation.
- **Standards**: Disseminating *measurement standards* and providing technical expertise to further develop *documentary standards* that enable comparison, ensure interoperability, and support commerce.
- **Technology**: Driving innovation through knowledge dissemination, technology transfer, and public-private partnerships that bridge the gap between discovery and the marketplace.

The Special Programs Office (SPO) plans and manages high-profile programs that span the mission and expertise of multiple NIST laboratories to address critical national needs. SPO works with and forges partnerships among government, private industry, academia, and professional organizations to provide world-class leadership in advanced measurement science, science-based standards, and data-driven technology innovations. SPO actively fosters communication and collaboration between NIST and external stakeholder communities, as well as agile collaboration across organizational boundaries at NIST. SPO manages NIST's Forensic Science Program with a focus on research, standards, and foundation studies.

- The **Forensic Science Research Program** oversees research conducted by NIST scientists across multiple NIST laboratories in seven disciplinary focus areas: biometrics, digital evidence, drugs and toxins, firearms and toolmarks, forensic genetics, statistics, and trace analysis. SPO is currently planning to expand its research portfolio to include several new cross-disciplinary focus areas—including forensic science algorithms, data, quality assurance, and training for the legal community. NIST also publishes reports on topics such as human factors (improving practice through a systems approach) for fingerprints and handwriting examinations, and DNA analysis. In addition, NIST publishes process maps for a number of forensic science disciplines—such as latent print, handwriting, firearms, DNA analyses, seized drugs, footwear/tire treads, and fire/arson debris.
- The **Forensic Science Standards Program** strengthens the nation's use of forensic science by facilitating the development and promoting the use of high-quality, technically sound standards through the Organization of Scientific Area Committees (OSAC). OSAC drafts and evaluates forensic science standards via a transparent, consensus-based process that allows for participation (1) by all stakeholders within OSAC and (2) through OSAC's engagement with standards development organizations. These standards define minimum requirements, best practices, standard protocols, and other guidance to help ensure that the results of forensic analysis are reliable and reproducible. OSAC also reviews standards and posts high-quality ones to the OSAC Registry. Standards posted in this registry are considered technically sound, and laboratories are encouraged to consider adopting these standards. Recent additions to the registry cover DNA mixture interpretation, digital evidence examination, and wildlife forensics; hundreds more are in the pipeline. In addition to considering participation in OSAC subcommittees, researchers should review the OSAC R&D Needs. These needs inform NIST's research funding priorities and the work of other agencies.
- The **Forensic Science Scientific Foundation Reviews Program** identifies, documents, and assesses foundational knowledge in forensic science methods and practices. SPO is preparing Scientific Foundation Review reports for various forensic science disciplines—including DNA mixture analysis interpretation, bitemarks, firearms, and digital evidence.

NIST supports its forensic science stakeholders by producing guidelines and manuals, reference data and tools, reference materials and tools, and documentary standards. The NIST forensics team also convenes a large number of working groups and implements other activities that are important to forensic research and practice.

- NIST hosts subject matter conferences and workshops on its work in the forensic arena, including Forensics@NIST, which is held every 2 years at the NIST campus and is also accessible online.
- NIST typically convenes meetings and conferences about various topics of interest to the forensic science community in alternating years, between Forensics@NIST events. (For a complete list, see NIST's Forensic Science Conferences and Events page.) Topics at these events have included research innovation to implementation, evidence management, crime laboratory quality infrastructure, error management, quantifying weight of forensic evidence, synthetic opioids and the overdose epidemic, improvement of technology and measurement in trace forensic science, and the forensic analysis of human DNA.

In 2015, NIST established a **Forensic Science Center of Excellence** called the Center for Statistics and Applications in Forensic Evidence (CSAFE). CSAFE—which focuses on pattern and digital evidence—has sites at Iowa State University; Carnegie Mellon University; the University of California, Irvine; the University of Virginia; Duke University; and West Virginia University. CSAFE seeks to improve the statistical foundation for pattern evidence disciplines—such as fingerprint, firearm and toolmark, footwear, blood pattern, and handwriting analyses—and computer, video, audio, and other digital evidence analyses. CSAFE also has two cross-cutting research groups that focus on (1) education and training and (2) implementation and practice.

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 Grant Program offers grants or cooperative agreements to fund research efforts related to laboratory programs sponsored by NIST in 12 funding areas. Within this funding opportunity, the SPO Grant Program: Forensic Science Program funds projects with forensic-related topics, such as new material standards, computer and digital forensics, impression and pattern evidence, trace analysis, and more. Other programs—such as the Material Measurement Laboratory program, Fire Research (FR) program, and Information Technology Laboratory program—and the Standards Coordination Office also support projects with forensics-related interests.

Informing Research Needs

The FS R&D TWG is a committee of approximately 50 experienced forensic science practitioners from local, state, and federal agencies and laboratories. Through this TWG, NIJ reaches out to the forensic science practitioner community to identify, discuss, and prioritize operational needs and requirements. These needs and requirements help inform NIJ's planned and ongoing R&D activities and ensure that future R&D investments meet practitioner-driven needs.

Housed at NIJ and supported by NIJ's FTCoE, the FLN-TWG is the product of department-sponsored listening sessions held with forensic science practitioners and stakeholders. FLN-TWG includes laboratory directors from across the country—representing large and small urban and rural facilities. Representatives from independent laboratories and laboratories organized by law enforcement agencies are included, as well as leaders in the field of forensic science research. The working group provides objective and independent knowledge and expertise, ensuring that forensic technology research and implementation are relevant and responsive to the forensic science community's laboratory operations needs.

DOJ Needs Assessment of Forensic Laboratories and Medical Examiner/Coroner Offices: DOJ coordinated with NIJ to conduct a needs assessment of forensic laboratories. This assessment (1) examined the workload, backlog, personnel, and equipment needs of public crime laboratories and medical examiner and coroner offices and (2) provided an overview of academic forensic science resources and needs. DOJ operationalized the needs assessment by holding a series of listening sessions with stakeholders from fall 2017 to early 2018 and conducting special topic listening sessions to address topics—including violent crime, the opioid epidemic, digital and multimedia forensics, and system-based approaches to efficiency and capacity. In addition to the listening sessions, DOJ reviewed data collected through various instruments and ongoing research projects. DOJ submitted the needs assessment report to Congress in 2019 with key findings that identified challenges associated with the needs as well as promising practices to address the needs.

NIST: OSAC coordinates the development of standards and guidelines for the forensic science community to improve the quality and consistency of work in the forensic science community. In addition to considering whether to become involved in the committees, researchers should review the OSAC R&D needs. These needs inform NIST's research funding priorities and the work of other agencies.

Although OSAC does not allocate funds for research, their 22 discipline-specific subcommittees influence research priorities. OSAC informs the forensic science community about research needs identified during OSAC's standards development activities; these needs are published on NIST's website. The National Commission on Forensic Science (NCFS) subcommittee about scientific inquiry and research examined existing foundational research and recommended research priorities for technological investments that can improve the quality and timeliness of forensic analyses. NCFS's archives are still available on DOJ's website.

DOJ/NIST: NCFS was a federal advisory committee that—in partnership with NIJ—convened from 2013–2017 to enhance the practice and improve the reliability of forensic science. The commission included federal, state, and local forensic science service providers; research scientists and academics; law enforcement officials; prosecutors, defense attorneys, and judges; and other stakeholders from across the country. NCFS adopted 43 work products, including 20 Recommendations documents and 23 Views documents.

U.S. Department of Defense (DOD)

DOD is the largest government agency in the United States. It has a budget of $716 billion, employs 2.87 million staff, and receives nearly 40% of all federal R&D appropriations. R&D plays a key role in maintaining the exceptional technological capabilities of the armed forces. DOD's Research, Development, Test, and Evaluation (RDT&E) funding includes appropriations for the Army, Navy, Air Force, a DOD-wide RDT&E account, and the Office of the Director of Operational Test and Evaluation. Investment in the DOD RDT&E programs has grown 36% since fiscal year (FY) 2016 to $96 billion in 2019, and the budget request for FY 2020 includes a 10% increase in the RDT&E budget, to approximately $109 billion.

DOD RDT&E funding is separated into seven categories: basic research, applied research, advanced technology development, advanced component development and prototypes, systems development and demonstration,

RDT&E management support, and operational system development.[9] The first three of these categories—basic research, applied research, and advanced technology development—are supported by DOD's Science & Technology (S&T) funding. The DOD S&T enterprise funds R&D of technology solutions to address the challenges encountered by Warfighters (members or the armed forces who are deployed to an area of conflict) facing an increasingly diverse set of threats in complex and ever-changing environments. The FY 2020 budget request for S&T is $14.1 billion.[10] Forensic-related scientific research has a strong presence within DOD and its subsidiaries, whose interests include digital evidence and cyber forensics, chemical and biological detection, nuclear forensics, event representation, and genetics. The Guide for Defense Basic Research Funding provides a thorough overview of all DOD-funded basic research programs.

The DOD Forensic Enterprise (DFE) was established by directive 5205.15E, issued in April 2011. All activities of the DFE are coordinated by the Forensic Executive Committee. **Exhibit 1** lists the DOD Executive Agents and the forensic science area(s) for which they are responsible.

Exhibit 1. DOD Executive Agents and Areas of Responsibility

DOD Executive Agent	Responsibilities
Under Secretary of Defense for Research and Engineering	Primary responsibility for directive 5205.15E and the DFE
Secretary of the Army	Forensic disciplines related to DNA (except those related to forensic medicine), serology, firearms and toolmarks, latent prints, questioned documents, forensic chemistry, and trace materials
Secretary of the Air Force	Digital and multimedia (D/MM) forensics for those forensic disciplines relating to computer and electronic device forensics, audio forensics, image analysis, and video analysis
Director, Defense Intelligence Agency (DIA)	Intelligence activities and programs related to forensics

U.S. Armed Forces Medical Examiner System (AFMES)

The U.S. Armed Forces Medical Examiner System (AFMES) is the DOD leader in providing medical–legal services and emerging technologies essential for the readiness, sustainability, and survivability of their service members. AFMES is responsible for determining the cause and manner of death for all active-duty members who die within federal jurisdiction and for identifying the decedent. Comprehensive forensic investigative services offered by AFMES include forensic pathology, DNA forensics, forensic toxicology, and medical mortality surveillance.

The AFMES DNA operations unit consists of the U.S. Armed Forces DNA Identification Laboratory (AFMES-AFDIL), which is accredited by the American National Standards Institute (ANSI)-American Society for Quality (ASQ) National Accreditation Board (ANAB) to the International Organization for Standardization (ISO)/International Electrotechnical Commission-17025 forensic testing and FBI Quality Assurance standard. AFMES-AFDIL supports AFMES by conducting DNA testing on human remains for medicolegal death investigations through use of autosomal short tandem repeat (STR) and Y-STR testing and mitochondrial DNA (mtDNA) sequencing. The Past Accounting Operations section provides DNA testing and reporting services to the Defense Prisoner of War/Missing

[9] These data were pulled from the Congressional Research Service report on the DOD RDT&E Appropriations Structure, which was updated on June 25, 2018, and is accessible at https://fas.org/sgp/crs/natsec/R44711.pdf. Detailed descriptions of the types of activities supported under the seven budget activity categories can also be found in this document.

[10] These data were extracted from the DOD FY 2020 budget request, which is available at the following link: https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2020/fy2020_Budget_Request_Overview_Book.pdf

in Action Accounting Agency to aid in the identification of human remains recovered under past conflict accounting efforts. In 2016, AFMES-AFDIL began using next-generation sequencing (NGS) in reference databasing and the identification of remains from past and current conflicts and developed an NGS mtDNA sequencing protocol for sequencing DNA from chemically treated and highly degraded samples to identify remains recovered from the Korean punchbowl, Vietnam, and World War II.[11] The U.S. Armed Forces Repository of Specimen Samples for the Identification of Remains maintains a DNA reference specimen database and collects DNA from all active duty and reserve service members to assist in the identification of human remains retrieved by DOD. AFMES-AFDIL also has a research section called the Emerging Technology Section, which is responsible for assisting with the development of new technologies to fill gaps in current testing methods, optimize commercially available testing kits that are fit for use with typical AFMES-AFDIL samples, and generate new DNA databases for statical calculation as needed. The Emerging Technology Section also aims to improve efficiency for the personnel accounting mission and assists in the development, planning, organization, and execution of original research and validation projects to advance forensic DNA analysis.

Defense Forensic Science Center (DFSC)

The Defense Forensic Science Center conducts comprehensive forensic operations in support of criminal investigations and conducts expeditionary forensic and biometric operations in support of Army and DOD efforts to increase military readiness, protect the force and defend the Nation.

Within DFSC, the Office of the Chief Scientist (OCS), is responsible for all the RDT&E activities. The mission of OCS is to increase the Army's readiness by executing an innovative RDT&E program that strengthens current and develops future forensic and biometric capabilities. To accomplish this important mission, the OCS Portfolio comprises programs such as the Internal Research Program, the External Research Program, the External Partnership Program, and the Educational Outreach Program. OCS has established procedures to identify customer requirements, gaps, and needs that lead to forensic RDT&E projects in the areas of: Crime Scene Investigation, DNA/Serology, Drug Chemistry, Trace Evidence, Latent Prints, Digital Evidence, Questioned Documents, Firearms and Toolmarks.

- **Internal Research Program**—OCS Research Scientists are responsible for designing and conducting research projects at DFSC. This work is performed within three dedicated research laboratories: the Next-Generation Sequencing Laboratory, the DNA/Serology Laboratory, and the Chemistry Laboratory. Research projects include participation from DFSC stakeholders to ensure that the research project will meet the need of the customer and transition into forensic operations.
- **External Research Program**—OCS Project Managers provide technical and programmatic support for external research projects. This support ranges from expert technical input to collaborative laboratory evaluations of prototypes, instruments, and new methods by OCS Research Scientists. OCS collaborates on external research projects that align with DFSC goals.
- **External Research Partnership Program**—Strategic partnerships with DOD and non-DOD agencies to support the development of new and improved forensic capabilities through the identification of shared research priorities. OCS works closely with dozens of interagency, academic, private industry, and international partners in a way that brings transparency to related research, minimizes redundancy, and leverages similarity while allowing its scientists to stay abreast of forensic technology advancements.
- **Educational Outreach Program**—Cultivates a scholarly environment at DFSC through educational partnerships with universities and experience-building student internships; this program allows students

[11] AFMES. (2018, August 22). *AFMES DOD DNA Operations Fact Sheet*. Available at https://health.mil/Military-Health-Topics/Combat-Support/Armed-Forces-Medical-Examiner-System

to work on cutting-edge forensic RDT&E projects with OCS Research Scientists, providing scientific and professional mentorship. The students participate in developing research plans, conducting experiments, analyzing and interpreting data, preparing notes and reports, presenting, and networking. Through internships at DFSC, students discover how interesting and rewarding work at the laboratory is and they learn more about scientific career opportunities with DFSC, the U.S. Army, and the DOD.

U.S. Army Research Office (ARO)

The U.S. Army Research Office (ARO) was founded in 1951 and is based in Research Triangle Park, NC. The ARO has more than 100 scientists, engineers, and support staff who manage the Army's extramural research program. The ARO competitively selects and funds basic research proposals from educational institutions, nonprofit organizations, and private industry to increase fundamental knowledge and understanding in the chemical, life, physical, engineering, materials, mechanical, computing, information, network, mathematical, earth, and social sciences related to long-term national security needs. The ARO also funds forensic-related research projects. Current research areas of interest include 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 to engineer portable and secure devices for use in the field.

Defense Forensics and Biometrics Agency (DFBA)

DFBA resides within the U.S. Army's Office of the Provost Marshal General and executes the mission to coordinate, consolidate, and lead the DOD's biometric and forensic efforts. DFBA seeks to "Deny the Enemy Anonymity!" by supporting activities that assist in identifying individuals for the military and organizations that protect national interests. DFBA facilitates the exchange of identity information to strategic partners through the development and execution of sharing agreements. At the same time, the agency ensures that individuals who provide their data have their privacy and civil liberties protected in accordance with law and policy. DFBA also coordinates S&T and RDT&E programs and efforts to guide the development and transition of technologies that enhance forensic or biometrics-enabled capabilities. Through close collaboration with organizations that span the government, industry, and academia, DFBA provides strategic and monetary support to R&D initiatives to advance forensic and biometric knowledge, procedures, and capabilities. This ensures a unified approach while aiming to fund applied research proposals that create deliverables beyond technical reports—including techniques, databases, protocols, and device prototypes.

Irregular Warfare Technical Support Directorate (IWTSD)

The Irregular Warfare Technical Support Directorate (IWTSD) (formerly known as the Combating Terrorism Technical Support Office) is a DOD agency that funds applied R&D relevant to a broad array of interagency and international partners who work in thwarting terrorism. IWTSD's mission is to identify and develop capabilities to combat terrorism and irregular adversaries. The agency interacts with DOD components and interagency partners through rapid R&D, advanced studies and technical innovation, and the provision of support to U.S. military operations.

IWTSD maintains several Technical Support Working Groups, including the Forensic Exploitation and Identity Operations subgroup that funds specific requirements detailed in its annual Broad Agency Announcement (BAA). This subgroup focuses on developing and improving credibility assessments, crime scene responses, criminalistics, D/MM forensics, and forensic exploitation. Examples of recently funded projects include the following:

- **Symbols, Weapons, and Extensible Search Target**: This project aims to develop an automated detection/classification tool that exploits, triages, and retrieves images of symbols, weapons, and user-designated objects.
- **Improved Latent Fingerprint Quality Metrics**: The objective of this project is to improve processes and software for determining latent print quality and suitability for comparisons and database entry.
- **Alternative Light Source Enhancement System**: This project aims to provide an advanced, broad spectrum, and tunable continuous light source for the identification of all types of forensic evidence.
- **Separation of Complex DNA Mixtures**: This project is developing a procedure that separates samples with as many as eight sources of DNA and within a relatively rapid turnaround.

The agency also examines other proposals without specified requirements if they may be of interest to subgroup members, which include many federal law enforcement agencies and DOD representatives.

U.S. Special Operations Command

The U.S. Special Operations Command (USSOCOM) 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. USSOCOM SRSE is a program executive office that is responsible for everything from overseeing applied research to equipping special operations forces to support the collection and exploitation capabilities of the USSOCOM warfighter for advanced surveillance, reconnaissance, and intelligence gathering. USSOCOM also funds research and the development of new technologies through their Science and Technology Directorate (S&TD). SRSE and S&TD fund a wide range of applied R&D relating to USSOCOM's program requirements and capabilities. Their BAA 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 (DTRA)

The Defense Threat Reduction Agency (DTRA) is a DOD Combat Support Agency tasked with countering threats to the United States from weapons of mass destruction (WMD)—including chemical, biological, radiological, and nuclear weapons 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 U.S. Department of Homeland Security's (DHS's) Countering Weapons of Mass Destruction Office. 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 are listed in the DTRA BAA.

Defense Advanced Research Projects Agency (DARPA)

DARPA is an organization within DOD that funds innovative research to implement transformational technologies benefiting national security. DARPA ranks among the largest sources of research funding in the federal government. Although DARPA's 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.

DOD Research Offices

The DOD's Research Offices include the ARO, the Office of Naval Research (ONR), and the Air Force Office of Scientific Research (AFOSR). Through multiple funding programs, these offices support a variety of S&T funding opportunities in disciplines closely aligned with their interests:

- The Naval Research Enterprise includes the ONR, ONR-Global, the Naval Research Laboratory (NRL), and ONR Global and office of special projects (PMR-51). The Naval R&D Framework identifies key issues and priorities to inform the allocation of funding and investment portfolios. The three components of the Framework are Align, Allocate, and Accelerate and include research efforts from "discovery to deployment."[12] The Naval Research Enterprise Framework outlines priorities that include augmenting the warfighter, integrating and distributing forces, increasing operational endurance, sensing and sense-making, and achieving scalable lethality. ONR research covers a broad range of science and engineering disciplines and includes wide variety of technology areas.
- The Chemistry Division of the NRL employees 300 individuals who conduct basic and applied R&D to address critical Navy needs and advance the frontiers of physical, chemical, biological, and materials science, as well as nanoscience. NRL research cuts across many areas, including vapor signatures, isotopic fingerprinting, canine training, sensor development, tissue dissection, and Independent Verification and Validation.
- As part of DOD'S University Research Initiative, the Service Research Offices administer the Defense University Research Instrumentation Program. This program provides accredited U.S. universities with funding for instrumentation to advance research areas that are of interest to 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 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 BAA solicits proposals in forensic-related topics, such as "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 3-year period of performance.
- ARO, ONR, and AFOSR each circulate their own BAAs for funding opportunities.

Defense Innovation Unit (DIU)

The Defense Innovation Unit (DIU), created in 2015, is an initiative meant to accelerate DOD's adoption of new technologies from nontraditional contracting sources, such as early-stage startups. DIU uses the Defense Innovation Marketplace as a central repository for DOD S&T acquisition resources and funding information. Technologies chosen by DIU receive non-dilutive funding in the form of Other Transaction Agreements and benefit from direct feedback on prototypes from DOD users, customers, and experts. In FY 2020, the Pentagon requested $164 million

[12] Summary information was obtained from https://www.onr.navy.mil/en/our-research/naval-research-framework. The three components of this Framework—Align, Allocate and Accelerate—are intended to guide conversations and R&D efforts to align early research, development, and demonstration to priority technology requirements; allocate investments for higher payoff in lethality, integration, and interoperability; and accelerate capability adoption to match the pace of technology innovation.

for DIU, a significant increase from the FY 2019 budget of $40 million for DIU funding efforts.[13] Although the research topics vary by solicitation, areas of forensic-related interest include data analysis and cybersecurity.

Rapid Reaction Technology Office (RRTO)

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 nontraditional sources of innovation to develop prototypes for high-impact technologies aligned with DOD interests. RRTO invests in biometrics and forensics technologies that improve current solutions (e.g., through cost reduction or functionality improvement) and in technologies 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 DOD to support forensic and biometric efforts. RRTO holds solutions meetings annually to release needs statements and interact with potential commercial partners.

Additional Funding Opportunities

The Rapid Innovation Fund (RIF), established in 2011 as part of the National Defense Authorization Act, supports efforts targeting small businesses with innovations that address specific defense interests. The program funds mature prototypes for technologies (i.e., those reaching a Technology Readiness Level of around 5–6 [**Exhibit 2**]) that meet pressing DOD needs; up to $3 million will be distributed over a 2-year period to develop, test, evaluate, and integrate these technologies. These innovations must support a specific DOD component requirement as outlined in the BAA. Some of these components solicit forensic-related technologies; for example, 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, NGS platforms, single-nucleotide polymorphism deconvolution methodologies, and the detection of organic components of gunpowder.

[13] American Institute of Physics. (2019, March 28). FY20 budget request: DOD science and technology. *FYI: Science policy news from AIP*. www.aip.org/fyi/2019/fy20-budget-request-dod-science-and-technology

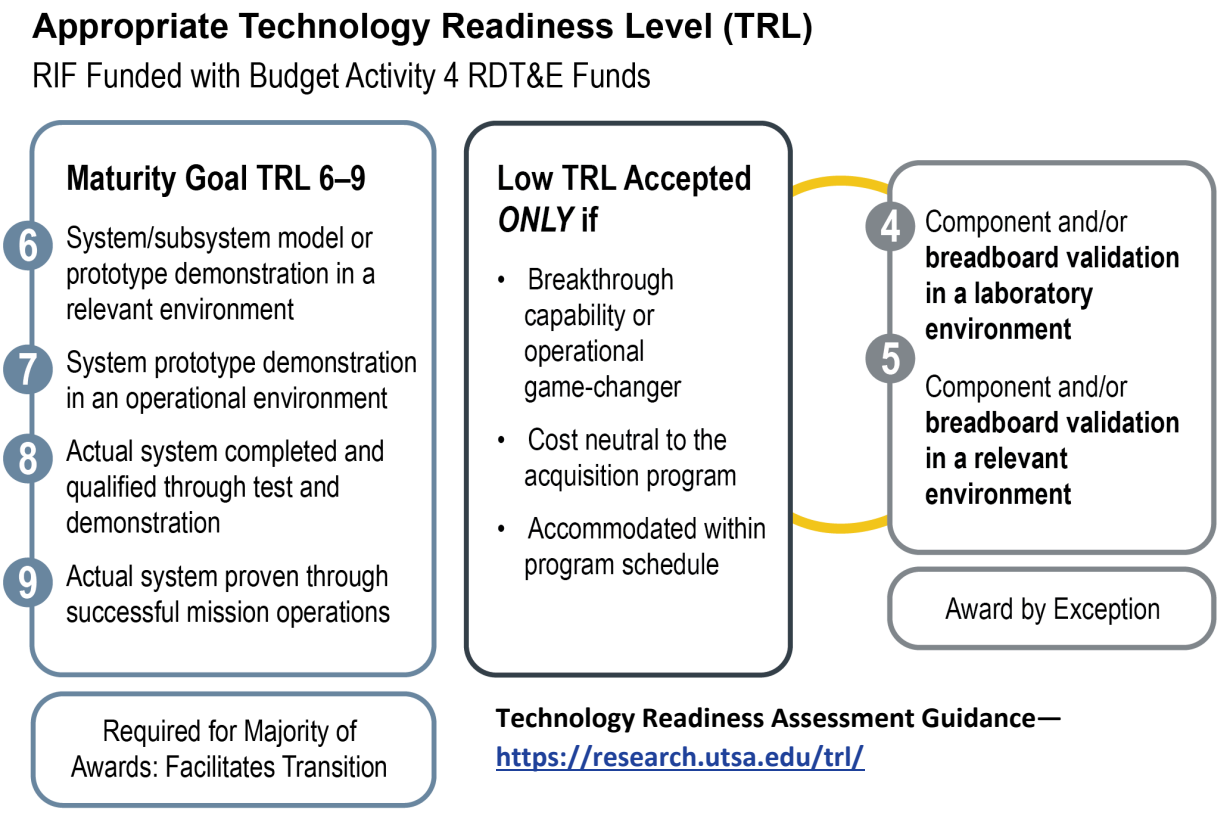

Exhibit 2. RIF Technology Readiness Level Guidance

U.S. Air Force

DOD Cyber Crime Center (DC3)

The DOD Cyber Crime Center (DC3) is designated as a federal cyber center and a DOD center of excellence. DC3 is one of seven federal cyber centers that operate under the executive agency of the Secretary of the Air Force. Their mission is to deliver superior D/MM forensic services, cyber technical training, vulnerability sharing, technical solutions development, and cyber analysis within the following DOD mission areas: cybersecurity and critical infrastructure protection, law enforcement and counterintelligence, document and media exploitation, and counterterrorism. Specialized D/MM forensics have been developed in support of mobile device unlocking/recovery/decryption, damaged media and submerged devices, video and audio recording enhancement, network intrusions, malware/reverse engineering, and aircraft mishap data recovery.

The Technical Solutions Component (TSC) is the RDT&E component of DC3. TSC identifies new technologies and validates commercial-off-the-shelf, government-off-the-shelf, and DC3-developed tools to support investigations, the cyber intelligence community, and law enforcement agencies. TSC also maintains a Counterintelligence Tool Repository, which is a repository of classified and unclassified tools that support digital forensics and counterintelligence needs. Most tools are made available through the repository portal, and executable files can be downloaded by authorized personnel. When a downloadable executable cannot be provided, authorized personnel

will be advised on how to obtain the tool from the hosting agency. TSC also maintains a list of tools and validations for use by authorized personnel.

DC3's Cyber Forensics Laboratory (CFL) performs D/MM forensic examinations, device repair, data extraction, and expert testimony for DOD. CFL also provides robust intrusion and malware analysis capability that supports other DC3 lines of business and activities. CFL is accredited under ISO 17025 by the American Society of Crime Laboratory Directors/Laboratory Accreditation.

U.S. Department of Homeland Security (DHS)

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 DNDO. In addition, the Forensic Services Division of the U.S. Secret Service (USSS), Immigration and Customs Enforcement (ICE), and the Cybersecurity and Infrastructure Security Agency—formerly known as the National Protection and Programs Directorate—work closely with DOD, DOJ, state and local governments, international law enforcement, and the private sector in the area of forensic science for cybersecurity.

Science and Technology Directorate (DHS/S&T)

DHS/S&T—an organization created in 2003—is focused on the prevention, disruption, and prosecution of terrorism and achievement of other national security goals through the rapid development of technological solutions. DHS/S&T's FY 2020 budget was $582 million. S&T conducts outcome-oriented RDT&E activities that are customer-focused for DHS components and the Homeland Security Enterprise (HSE). S&T's university programs provide the HSE with research to address high-priority, DHS-related issues at U.S. colleges and universities. S&T also manages two FFRDCs: (1) Homeland Security Systems Engineering and Development Institute and (2) Homeland Security Operational Analysis Center. These FFRDCs are a funding vehicle for contracting special R&D within the federal government. S&T also operates and maintains facilities that support DHS through the development, maintenance, and utilization of a coordinated network of DHS laboratories and Department of Energy national laboratories. Through this network of laboratories, the HSE is able to leverage advanced scientific expertise to inform policy, improve operations, and advance research in support of homeland security.

Cyber Forensics Working Group

Within DHS/S&T, the Cyber Forensics Working Group is tasked with project requirements development, capability gap identification, and technology development for cyber forensics. Working with representatives from federal, state, and local law enforcement agencies, DHS is currently implementing three cyber forensic efforts:

- 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.
- The Cybersecurity Forensics Support for Law Enforcement effort develops solutions useful for the investigation of criminal and terrorist activity.

National Biodefense Analysis and Countermeasures Center (NBACC)

The National Biodefense Analysis and Countermeasures Center (NBACC) at Fort Detrick (Frederick, Maryland) defends our nation against biological threats by supporting preparedness planning, emerging threat analyses, 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 of suspected biothreat samples. NBACC laboratory facilities are at biosafety levels 2, 3, and 4—allowing NBACC to perform R&D on pathogens for which no vaccine or treatment currently exists. NBACC collaborates with the DOD and National Institutes of Health (NIH) to conduct research to address gaps and needs in biodefense and to characterize and analyze pathogens that could pose a threat to the HSE, including research on COVID-19. NBACC also provides support to the FBI in cases involving biothreats and has supported more than 100 federal law enforcement cases.

Chemical Forensics Program

The DHS Chemical Forensics Program 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 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:

1. Determining the attributes of Chemical Threat Agents
2. Identification of chemical attribution "signatures"
3. Development of sampling tools and techniques
4. Development of analytical techniques

Digital Forensics Program

The goal of the Digital Forensics Program is to develop, assess, and integrate innovative technologies to support federal, state, and local partners to provide agents with an operational edge (e.g., workload reduction, automation, lead generation). Example projects have been funded in the technology areas of unconstrained facial recognition, source camera identification, and speech and language triage.

- Integration of U.S. Government (USG)-owned algorithms with detection, clustering, recognition, and verification capabilities into operational forensic & imagery analytics platforms used by federal, state, local, and international law enforcement agencies.
- Development of disruptive technology to match samples of digital imagery taken with the same camera.
- Pilot of a rapid prototype triage tool to detect the presence of speech and identify spoken language.
- Some examples of the DHS investigative analytic tools include DOBSON Speech and Language triage tool, C-HORUS unconstrained facial recognition and SCID source camera identification.

U.S. Customs and Border Protection (CBP)

The forensic and scientific arm of U.S. Customs and Border Protection (CBP)—Laboratories and Scientific Services—provides forensic and scientific testing in the areas of trade enforcement, WMD, intellectual property rights, and narcotics enforcement. Their mission is as follows[14]:

- To provide scientific/forensic support, including on-site support, to CBP officers and other government agencies with regard to the investigation and interdiction of WMD.
- To produce timely and effective laboratory reports and crime scene documentation supporting Customs trade compliance and law enforcement missions.
- To provide timely and effective scientific/forensic support to CBP officers and the trade community (i.e., training, targeting, health and safety).
- To provide scientific/forensic support to other federal agencies, standards writing organizations, foreign governments and international organizations to promote international trade compliance and more effective international efforts to counter the movement of WMD.

Additional Funding Opportunities

DHS S&T supports other funding opportunities for forensics-related research. For example, the Directorate circulates "Long-Range" BAAs, which are standing, open invitations to fund R&D projects in support of the operational environment of DHS. There are currently three forensics-related long-range research funding opportunities within DHS/S&T. 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.

U.S. Secret Service (USSS)

As one of the oldest federal law enforcement agencies in the country, USSS is responsible for fighting global crime through protective and investigative endeavors. Using innovative technologies, advanced countermeasures, and a highly skilled and motivated workforce, USSS provides physical protection to the nation's highest elected leaders. USSS also utilizes multidisciplinary forensics experts, investigative experts, and intelligence analysts to secure the nation's cyber, banking, and financial infrastructure.

USSS is supported by 11 offices. The mission of its Forensic Services Division (FSD), a division of the Office of Investigators, is to provide timely and accurate forensic examinations of latent print and questioned document evidence, to assist with training and consultation, and to meet visual communications requirements in support of the mission of USSS. FSD's capabilities are provided by the three branches it is composed of, as follows:

Questioned Document Branch

- Forensic Information System for Handwriting
- Anonymous Letter Integrated Query
- Thermal Ribbon Analysis Platform
- Writing, Inkjet and Toner Analysis

[14] CBP. (2017, February 28). *Customer service standards*. www.cbp.gov/about/labs-scientific-svcs/customer-svc

- Document Dating

Fingerprint Operations Branch

- Cyanoacrylate ester fuming, dye stains, 1,2-indanedione-zinc enhancement, physical developer, vacuum metal deposition
- Light amplification by stimulated emission of radiation, reflected ultraviolet imaging
- Database Searches: Northern Virginia Regional Information System, Next Generation Identification, Office of Biometric Identity Management, Interpol

Quality Assurance & Scientific Services Branch

- Manage and maintain the various quality assurance programs within FSD
  - Proficiency testing
  - Analytical quality control
  - Quality audits
- Support operational and research needs within FSD
  - Optimization of processes
  - Instrument validation
- Technical and operational support to headquarters and field offices for evidence collection and evolving casework

U.S. Intelligence Community (IC)

The U.S. Intelligence Community (IC) is composed of 16 separate federal agencies tasked with the collection and production of foreign and domestic intelligence and headed by the Office of the Director of National Intelligence (ODNI). The overall U.S. Intelligence budget for FY 2019 was over $81.7 billion, which includes $60.2 billion for the National Intelligence Program and $21.5 billion for the Military Intelligence Program.[15] Several components of IC, especially the larger agencies, such as the Central Intelligence Agency (CIA), the National Security Agency (NSA), and DIA, as well as specific research arms, such as the Intelligence Advanced Research Projects Activity (IARPA—research arm of ODNI) 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 are detailed in the following sections.

Intelligence Advanced Research Projects Activity (IARPA)

IARPA is the R&D arm of ODNI. Analogous to DOD'S DARPA, IARPA invests in high-risk, high-payoff research programs to address the difficult challenges faced by the agencies and disciplines within IC. Research topics of interest to IARPA include multimedia forensics, scalable discovery methods for pattern and data identification, and processes for analyzing and processing large amounts of data.

[15] DOD. (2016, February 9). *Department of Defense (DoD) releases fiscal year 2017 President's budget proposal.* www.defense.gov/News/News-Releases/News-Release-View/Article/652687/department-of-defense-dod-releases-fiscal-year-2017-presidents-budget-proposal

- IARPA's Requests for Information (RFIs) 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 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 BAAs 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 BAA to solicit proposals.

Central Intelligence Agency's (CIA's) In-Q-Tel

In-Q-Tel is the not-for-profit, independent, strategic venture capital arm of the 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 with companies recognized as global leaders in digital forensics software, particularly in the recovery of evidence from computers, smartphones, and tablets.

Defense Intelligence Agency (DIA)

DIA specializes in defense and military intelligence, including the military intentions and capabilities of foreign governments and non-state actors, such as terrorists. In fulfilling this role, DIA launched an initiative to establish a worldwide forensic intelligence capability that would include chemical, biological, radiological, and nuclear defense laboratories worldwide, including in 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 between $500 million and $600 million over a 10-year period. DIA circulates BAAs for white papers that align with DIA research topics. Current forensic-related research areas include development of new analysis technologies, enhancement of counterintelligence and security, intelligence collections, forensic technology advancement for documents and digital media, and data analysis.

National Security Agency (NSA)

NSA is responsible for all Signals Intelligence—including global monitoring, the collection and processing of information to exploit foreign intelligence, and the provision of support for U.S. counterintelligence operations. In addition, the NSA Director is the head of the U.S. Cyber Command, which is responsible for USG 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. The NSA research program focuses on the following four goals:

1. Develop the means to dominate the global computing and communications network.

2. Cope with the overload of information in our environment and turn that overload into a strategic advantage.

3. Provide the means for ubiquitous, secure collaboration within our government and through interactions with various partners.

4. Create the means for penetrating targets that threaten our nation.

Small Business Administration (SBA)

The Small Business Administration (SBA) is a USG 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 R&D funding for small companies that collaborate with research institutions to develop technologies. Both programs fund two phases of the three-stage process of growing a business: Phase I, which is focused on determining technical and commercial feasibility, and Phase II, which is 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 are described in the following sections.

U.S. Department of Defense (DOD)

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 DOD subsidiaries participate in this program, including the USSOCOM. Current BAAs are posted on the Defense SBIR/STTR Innovation Portal.

National Science Foundation (NSF)

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 R&D funding for small companies that collaborate with university researchers to develop technologies aligned with NSF interests.

National Institute of Standards and Technology (NIST)

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 announcement for the SBIR program listed cybersecurity as a research priority.

U.S. Department of Homeland Security (DHS)

S&T and DNDO participate in SBA's SBIR program. The S&T SBIR program provides up to $850,000 of funding to small early-stage companies with technologies that align with DHS interests. Similar to the R&D programs of the DHS S&T, the SBIR topics generally address the needs of the nine DHS operational units that include the Coast Guard, Transportation Security Administration, Customs and Border Protection, Federal Emergency Management Agency, Citizenship and Immigrations Services, ICE, USSS, Cybersecurity and Infrastructure Security, and the Federal Law Enforcement Training Center. DNDO's SBIR program also provides up to $850,000 of funding for companies with technologies relevant to nuclear research. This funding could be used to support research in specific nuclear forensics technical mission areas (TMAs)—such as pre- and post-detonation material, signatures, and analysis methods.

U.S. Environmental Protection Agency (EPA)

National Enforcement Investigations Center (NEIC)

As an accredited environmental center for the U.S. Environmental Protection Agency (EPA), the National Enforcement Investigations Center (NEIC) has a unique role in supporting complex criminal and civil enforcement investigations and conducting applied R&D to maintain sufficient scientific tools and applications for enforcement programs. NEIC produces unbiased forensic evidence that enables appropriate, defensible enforcement outcomes and specializes in enforcement (e.g., evidence management; science-based results engaging experts, including statisticians, geochemists, and toxicologists). NEIC also makes courtroom-trained staff available for expert testimony and consultation, provides a broad selection of instrumentation to help analyze chemical unknowns and interactions, ensures laboratory-field synergy, and provides statistical support for sampling strategies. The laboratory employs scientists and engineers who are trained to develop innovative field and laboratory tools to identify pollutants and are prepared to handle the rigors of the legal process, including the need to serve as expert witnesses in the courtroom.

Other Agencies and Sources

The aforementioned federal agencies explicitly support forensic research efforts and 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 are described in more detail in the following sections.

National Institutes of Health (NIH)

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

U.S. Department of State (DOS)

DOS works to develop a peaceful and progressive world by managing foreign policy issues for the nation. The Bureau of Democracy, Human Rights, and Labor, which seeks to promote and protect human rights around the world, lies within the DOS. This agency circulates Notices of Funding Opportunities to solicit the use of forensic anthropology techniques to address human rights violations.

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, often hold annual meetings to showcase cutting-edge technology and encourage discussion, which can lead to funding opportunities, although the organizations do not fund research directly. National professional forensics organizations and their meeting schedules are listed in **Exhibit 3**.

Exhibit 3. Professional Forensics Association Meeting Schedules

Professional Organization	Meeting Schedule
American Academy of Forensic Sciences	Annual—Winter
American Society of Crime Laboratory Directors	Annual—Spring
Association of State Criminal Investigative Agencies	Annual—Fall/Winter
Society of Forensic Toxicologists	Annual—Fall
American Society of Trace Evidence Examiners	Annual—Fall/Winter
Association of Firearm and Toolmark Examiners	Annual—Summer
American Society of Questioned Document Examiners	Annual—Summer/Fall
National Association of Medical Examiners	Annual—Fall
International Association of Chiefs of Police	Annual—Fall
International Association of Coroners and Medical Examiners	Annual—Summer
International Association for Identification	Annual—Summer/Fall
International Association of Forensic Nurses	Annual—Fall
Clandestine Laboratory Investigating Chemists Association	Annual—Fall
Major Cities Chiefs Association	Annual—Spring/Summer
The International Association of Forensic Toxicologists	Annual—Fall

Summary

Researchers should begin by reviewing the 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 beta.SAM.gov (formerly Federal Business Opportunities). 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 in transitioning 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 can review past and current NIJ-funded forensic science R&D projects at NIJ.gov and on the FTCoE website, which also provides a large number of archived webinars on scientific topics of interest. Additionally, research that is ready for beta testing or evaluation of implementation into a field or laboratory application can be funded under the Research and Evaluation for the Testing and Interpretation of Physical Evidence in Publicly Funded Forensic Laboratories solicitation.

Funding Summary Table

Although this list is not exhaustive, it does include important forensic research–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 beta.SAM.gov (formerly Federal Business Opportunities) website.

	Federal Agency	Forensics-Related Research Topics	Funding Opportunities
NIJ	Agency-wide	Forensic biology/DNA, seized drugs, 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 Funding Opportunities
NSF	Agency-wide	Decision making in forensic settings, analytical chemistry, genomics and proteomics, bioinformatics, digital evidence, vertical integration of forensic science conceptual approaches, forensic anthropology, biological sciences	Current NSF Funding Opportunities
NIST	Agency-wide	Materials standards, digital evidence and computer forensics, impression and pattern evidence, trace evidence, and FR	Current NIST Notices of Funding Opportunities
DOD	DFSC	DNA, serology, trace evidence, latent prints, firearms and toolmarks, digital evidence, drug chemistry, forensic documents, genetics, device miniaturization and ruggedization, site exploitation	DFSC Program (BAA)
DHS	DFBA	DNA, serology, trace evidence, latent prints, firearms and toolmarks, digital evidence, drug chemistry, forensic documents, genetics, device miniaturization and ruggedization, site exploitation	**DFBA Forensics**
	IWTSD	Video and audio forensic analysis, rapid data extraction, evidence collection and preservation, trace evidence (especially from homemade explosives), field methods for rapid and low-cost DNA analysis, advanced identification technologies, forensic exploitation	Current IWTSD BAAs
	USSOCOM: Special Operations Forces Acquisition, Technology & Logistics	Document exploitation, electronic media exploitation (computers, cell phones), trace evidence, detection of hidden rooms	Current SOF AT&L BAAs
	DTRA	Nuclear forensics, post-detonation forensics, trace evidence	Current DTRA BAAs
	DARPA	Digital evidence and media forensics	Current Opportunities
	DOD Research Offices (Army, Navy, Air Force)	Latent print identification and matching, biometrics and multimodal matching capabilities, analytical and computational models, cybersecurity, analytical chemistry	ARO BAAs
			ONR BAAs
			AFOSR BAAs

	Federal Agency	Forensics-Related Research Topics	Funding Opportunities
DHS (continued)	DIU Experimental	Varies: specific DOD-related topics per fiscal year and common themes, such as cybersecurity and data analysis	Commercial Solutions Opening Solicitations
	RRTO	Data analysis, automated/remote systems, non-compliant collections, standoff collections, personnel accounting, counter-counter forensic technologies	Links to contacts and more information
	RIF	Novel forensic instruments and processes, DNA collection and identification, chemical sample collection, NGS tools, analytical chemistry, trace evidence, rapid body fluid screening, cybersecurity, digital evidence, automation	Current RIF BAAs
	S&T	Cybersecurity, digital evidence, analytical chemistry, biological threat analysis, latent print identification, biological detection technologies and protocols	Current BAAs
	DNDO	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 (TMAs)	Nuclear Forensics Research Award
IC	IARPA	Genetics, bioinformatics, identification techniques, cybersecurity, media forensics, pattern identification and analysis, data collection methods	Current RFIs Current BAAs
	In-Q-Tel	Cybersecurity, digital evidence biotechnology including DNA sequencing technologies, data analytics (Portfolio)	Instructions for business plan submittal
	DIA	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 DIA BAAs
SBA	DOD	Varies: Research topics vary by year but can include identification intelligence, cybersecurity, data analytics, analytical chemistry, and data collection methods	SBIR/STTR programs

	Federal Agency	Forensics-Related Research Topics	Funding Opportunities
SBA (continued)	NSF	Varies: Research topics vary by year but can include computational biology, bioinformatics, and development of instrumentation for chemical detection or characterization	SBIR/STTR programs
	NIST	Varies: Research topics vary by year but can include cybersecurity, analytical chemistry, computer and digital forensics, impression and pattern evidence, trace analysis, and FR	SBIR program
	DHS	Varies: Research topics vary by year but can include cybersecurity, digital evidence, analytical chemistry, biological threat analysis, latent print identification, and biological detection technologies and protocols	S&T 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 (TMAs)	DNDO SBIR program
Other Agencies	NIH	Genomics, proteomics, bioinformatics, data analysis	Current opportunities
	DOS	Forensic anthropology and DNA sample analysis	Current BAAs
General	Grants.gov	All-encompassing	Current Opportunities
	Federal Business Opportunities	All-encompassing	Current Opportunities

The National Institute of Justice and its Forensic Technology Center of Excellence

NIJ is the research, development and evaluation agency of the U.S. Department of Justice. NIJ is dedicated to improving knowledge and understanding of crime and justice issues through science. NIJ provides objective and independent knowledge and tools to inform the decision-making of the criminal and juvenile justice communities to reduce crime and advance justice, particularly at the state and local levels.

The NIJ Office of Investigative and Forensic Sciences (OIFS) is the federal government's lead agency for forensic science R&D. OIFS' mission is to improve the quality and practice of forensic science through innovative solutions that support R&D, testing and evaluation, technology, information exchange, and the development of resources to support technical assistance, technology transition, and adoption of new technologies for the criminal justice community.

RTI International and its academic and community based-consortium of partnerships, including its Forensic Science Education Programs Accreditation Commission partners, work to meet all tasks and objectives put forward under the NIJ Forensic Technology Center of Excellence (FTCoE) Cooperative Agreement (award number 2016-MU-BX-K110). These efforts include determining technology needs; developing technology program plans to address those needs; developing solutions; demonstrating, testing, evaluating, and adopting potential solutions into practice; developing and updating technology guidelines; and building capacity and conducting outreach. RTI is a global research institute dedicated to improving the human condition by turning knowledge into practice. With a staff of nearly 5,000 providing research and technical services to governments and businesses in more than 75 countries, RTI brings a global perspective. The 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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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. Any perceived value judgments may be based on the merits of device features and developer services as they apply to and benefit the law enforcement and forensic communities. The information provided herein is intended to provide a snapshot of current alternate light source developers and a high-level summary of available devices; it is not intended as an exhaustive product summary. Features or capabilities of additional instruments or developers identified outside of this landscape may be compared with these instrument features and service offerings to aid in the information-gathering or decision-making processes. Experts, stakeholders, and practitioners offered insight related to the use of alternate light sources for law enforcement agencies.