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Key Points/Objectives:

- Administered by the National Institute of Standards and Technology (NIST)
- OSAC was created in 2014 to address a lack of discipline-specific forensic science standards.
- OSAC members and affiliates work in forensic laboratories and other institutions around the country and have expertise in 22 forensic disciplines, scientific research, measurement science, statistics, law, and policy.
- OSAC:
  - Drafts proposed standards and sends them to standards developing organizations (SDOs), which further develop and publish them;
  - Evaluates and approves standards for the OSAC Registry; and,
  - Promotes the use of OSAC endorsed standards throughout the forensic science community.

ORGANIZATION OF SCIENTIFIC AREA COMMITTEES (OSAC) FOR FORENSIC SCIENCE

Author and Co-author Contact Information
John Paul Jones II
NIST 100 Bureau Drive, MS 6020, Gaithersburg, MD 20899
john.jones@nist.gov
ORCID: 0000-0002-3258-0770
Co-Author(s) Name
Allison Getz
NIST 100 Bureau Drive, MS 6020, Gaithersburg, MD 20899
allison.getz@nist.gov
ORCID: 0000-0002-0648-9463
Co-Author(s) Name
Donna Sirk
NIST 100 Bureau Drive, MS 6020, Gaithersburg, MD 20899
donna.sirk@nist.gov
ORCID: 0000-0002-9844-6670

Abstract
The National Institute of Standards and Technology (NIST) established the Organization of Scientific Area Committees (OSAC) for Forensic Science in 2014 to address a lack of discipline-specific forensic science standards. OSAC's mission is to strengthen the nation's use of forensic science by facilitating the development of technically sound standards and guidelines and encourage their use throughout the forensic science community. OSAC's 800-plus members and affiliates work in forensic laboratories and other institutions around the country and have expertise in 22 forensic disciplines, as well as scientific research, measurement science, statistics, law, and policy. OSAC drafts and evaluates forensic science standards via a transparent, consensus-based process that allows for participation by all stakeholders.

Glossary

- Forensic Science Standards Board (FSSB): OSAC's governing board. The FSSB consists of the chair from each Scientific Area Committee, seven representatives from forensic professional organizations, four members-at-large including researchers and a legal representative, and one NIST representative (Ex-Officio Member).
- OSAC Registry: A repository of high-quality, technically sound published and proposed standards for forensic science.
- Scientific Area Committees (SACs): OSAC units that provide direction and oversee the work performed by the discipline-specific subcommittees. SACs consist of a chair and vice chair and the chairs from each subcommittee in that SAC.
- Standard: Document that has been prepared by a standards developing organization (SDO) and includes best practice recommendations, classifications, codes, guides, methods/test methods, practices, specifications, or vocabulary/terminology. The elements required in a standard will differ by the type of standard and by the SDO.
- Standards Developing Organization (SDO): An organization focused on developing, publishing, or disseminating technical standards using a consensus-based standards development process.
- Subcommittees (SCs): OSAC units that work to identify existing technically sound forensic science standards, draft new standards, and facilitate their development through the SDO process. Subcommittees focus on specific forensic science disciplines and consist of both OSAC voting members and affiliates that collaborate to achieve their objectives.

EXECUTIVE SUMMARY/INTRODUCTION

The Organization of Scientific Area Committees (OSAC) for Forensic Science strengthens the nation's use of forensic science by facilitating the development and promoting the use of high-quality, technically sound standards which define minimum requirements, best practices, standard protocols, and other guidance documents. These standards help to ensure confidence in the accuracy, reliability, and reproducibility of laboratory results and positively increase the impact of admissibility and expert testimony in courts of law.

OSAC is administered by the National Institute of Standards and Technology (NIST) (https://www.nist.gov/), a non-regulatory agency of the U.S. Department of Commerce (https://www.doc.gov/). 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. Through OSAC, NIST provides a mechanism to coordinate and facilitate the development of forensic science standards in the United States.

NIST established OSAC in 2014 (in collaboration with the U.S. Department of Justice (DOJ) (https://www.justice.gov/) to address a lack of discipline-specific forensic science standards. OSAC's mission is to strengthen the nation's use of forensic science by facilitating the development of technically sound standards, expanding the OSAC Registry with standards that have completed a technical assessment, and promoting the adoption of those standards by OSAC's stakeholders and the forensic science community.

U.S. STANDARDS SYSTEM

The U.S. Government's role in the development and use of standards and conformity assessment is guided by the National Technology Transfer and Advancement Act (1995), Office of Management and Budget (OMB) Circular A-119: Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities (2016), NIST Organic Act [Updated with America COMPETES Act] (2016), and other federal laws, regulations, and international agreements.

The NIST Organic Act authorizes NIST to cooperate with other departments and agencies of the federal government, industry, state and local governments, governments of other nations and international organizations, and private organizations in establishing standard practices, codes, specifications, and voluntary consensus standards. Additionally, Guidance on Federal Conformity Assessment (15 CFR Part 287) outlines Federal agencies' responsibilities for using conformity assessment to meet these requirements in an efficient and cost-effective manner.

Guided by these policies, NIST supports the development of voluntary consensus standards in private sector standard developing organizations (SDOs) wherever possible and coordinates with federal, state, and local agencies to foster a greater reliance on voluntary consensus standards.

NEED FOR FORENSIC SCIENCE STANDARDS/OSAC

National Research Council Report

In February 2009, the National Research Council (NRC) published *Strengthening Forensic Science in the United States: A Path Forward* (NRC, 2009). This report assessed the state of forensic science and made recommendations for strengthening the field. One of these recommendations was for the development and widespread adoption of uniform and enforceable standards and best practices in forensic science. The NRC acknowledged the work of Scientific Working Groups (SWGs) that were in operation at the time noting the following:

> "The SWGs generate voluntary guidelines and protocols, which carry no force of law. Nonetheless, the SWGs have been a source of improved standards for the forensic science disciplines and represent the results of a profession that is working to strengthen its professional services with only limited resources." (NRC, 2009).

While the original efforts of the SWGs served as a laudable attempt at improving the state of practice in the forensic science community, they largely worked independently of each other and lacked uniformity in their governance and structure. Executing a nationwide campaign to encourage the adoption of technically sound standards and best practices would require a more centralized effort to truly address the NRC's recommendation.

Subcommittee on Forensic Science (SoFS)

In July 2009, the White House's Office of Science and Technology Policy (OSTP) (www.whitehouse.gov/ostp/) coordinated the establishment of the Subcommittee on Forensic Science (SoFS) to primarily address the forensic science challenges raised in the NRC report (Butler, J.M., 2015). The SoFS operated until December 2012, and during that time formed several Interagency Working Groups (IWGs) to develop recommendations for improvements. One of these groups was the Standards, Practices, and Protocols Interagency Working Group (SPP IWG) that was tasked with investigating the complex issues associated with forensic science standards and the infrastructure that supported standards development. As part of its review, the SPP IWG looked at the existing 21 SWGs that operated independently of each other. At that time, SWGs existed to determine best practices and develop guidance documents within a particular area of forensic science. The SPP IWG realized that if the SWGs could receive unified support and operate in a standardized structure, they might become more effective. As a result, in 2010, the SPP IWG developed the concept of the SWG Program Management Office (PMO) (NSTC, 2010) that NIST could manage. The SWG PMO idea was refined over the years based on lessons learned from studying the SWGs and reviewing NIST's past successes with convening stakeholder groups.

In February 2013, NIST and the U.S. Department of Justice (DOJ) (https://www.justice.gov/) announced their collaboration in launching the National Commission on Forensic Science (NCFS) (www.justice.gov/archives/ncfs) and Guidance Groups (later renamed OSAC) in an effort to strengthen and enhance the practice of forensic science (NIST, 2013). Under this arrangement, the DOJ and NIST would serve as co-chairs for the NCFS, and NIST as the administrator for OSAC. On September 27, 2013, NIST published a Notice of Inquiry (NOI) entitled *"Possible Models for the Administration and Support of Discipline-Specific Guidance Groups for Forensic Science"* (NIST, 2013) in the Federal Register to seek feedback from interested stakeholders on the following four topic areas:

- Structure of the Guidance Groups
- Impact of Guidance Groups
- Representation in the Guidance Groups
- Scope of the Guidance Groups.

The feedback received in response to the NOI, along with NIST's internal planning team's research, enabled NIST to announce the official creation of OSAC on February 4, 2014 at the inaugural NCFS meeting (NIST, 2014). Over the next year, members of the Forensic Science Standards Board, three resource committees, five scientific area committees, and the initial 24 subcommittees were added to complete the launch. In August 2015, DOJ and NIST updated their Memorandum of Understanding to continue collaborating on OSAC and NCFS (DOJ and NIST, 2015).

Forensic Science Landscape

Standardization within the forensic science and affected stakeholder communities is challenging considering the diversity of occupations and opinions and the specific role each group plays. The following government agencies have an interest in forensic science and serve the U.S. criminal justice system:

- 409 federal/state/local crime laboratories (Bureau of Justice Statistics, 2014);
- 18,000+ law enforcement agencies (Bureau of Justice Statistics, 2011);
- 2,000+ medical examiner/coroner offices (Bureau of Justice Statistics, 2007);
- 2,300+ prosecutor offices (Bureau of Justice Statistics, 2011);

- 1,000+ public defender offices (Bureau of Justice Statistics, 2007).

The U.S. does not have a central regulator for forensic science. Since most forensic science analysis occurs in state and local crime laboratories that operate under individual state or local regulations, the federal government plays a limited role in the overall direction of forensic policy and practice. Without having a single forensic science owner or regulatory body, establishing and implementing nationwide standards becomes a challenge.

OSAC engages with various stakeholders to support the development and implementation of technically sound standards. Many of these stakeholders are directly involved in the production of standards or are impacted by the change in forensic science practice because of standards. A list of stakeholders and agencies that OSAC collaborates with includes:

- Academic institutions;
- Federal, state, and local government agencies;
- Forensic science service providers;
- International and national standards development organizations (SDOs);
- National Institute of Standards and Technology (NIST);
- Non-government organizations (NGOs);
- Private-sector manufacturers and service vendors supplying forensic service providers;
- Professional organizations (forensic science and others);
- The public;
- Quality system providers (e.g., accrediting and certifying bodies);
- Representatives of the criminal justice system (e.g., judges, attorneys);
- U.S. Department of Justice (DOJ).

Interests of the forensic science community, the stakeholders impacted by them, and the efforts of OSAC are wide-ranging and diverse. A key attribute of OSAC is the ability to enable these stakeholder groups to work together to improve the practice of forensic science in the U.S. Having an opportunity to hear stakeholder voices and leveraging strong scientific support during the standards development process helps to ensure OSAC work products will have a positive impact on the criminal justice community. NIST was selected as the home of OSAC because its standards expertise and its strong forensic science research foundation to support standardization efforts.

NIST FORENSIC SCIENCE PROGRAM OVERVIEW

NIST currently leverages appropriated funds to support three key focus areas to increase the quality of forensic science in the U.S.:

RESEARCH: NIST's Forensic Science Research Program supports the development of science-based standards and measurement methods, as well as tools and assessments to underpin reliable, accurate, interoperable, and validated forensic analysis (https://www.nist.gov/topics/forensic-science). This robust intramural research program focuses on seven areas (digital and identification evidence, biometrics, drugs and toxins, firearms and associated toolmarks, forensic genetics, statistics, and trace evidence). The program also includes research on human factors and process mapping of forensic science disciplines and results in the production of guidelines, manuals, reference data, reference materials, and tools.

FOUNDATIONS: NIST's Forensic Science Foundational Studies Program (https://www.nist.gov/topics/forensic-science/interdisciplinary-topics/scientific-foundation-reviews identifies, documents, and assesses foundational knowledge in forensic science methods and practices. The program's current efforts focus on DNA mixture interpretation, firearm examination, digital evidence, and bitemark analysis.

STANDARDS: NIST's Forensic Science Standards Program accelerates the development and adoption of high-quality, technically sound forensic science standards by administering OSAC (https://www.nist.gov/topics/organization-scientific-area-committees-forensic-science). OSAC-approved standards define minimum requirements, best practices, and standard protocols that help ensure that the results of forensic analysis are reliable and reproducible. NIST has ensured the significant involvement of the forensic science community in the process of standards development.

PARTNERS: NIST also sponsors extramural research through its Center for Statistics and Applications in Forensic Science (CSAFE) (https://www.nist.gov/coe/forensic-science-center-excellence) to improve the statistical foundation of pattern and digital evidence and to educate and train forensic practitioners, legal professionals, and other stakeholders on how to use, interpret, and communicate improved forensic methods. CSAFE, a NIST Center of Excellence, includes Iowa State University; University of California, Irvine; Carnegie Mellon University; Duke University; West Virginia University; and University of Virginia as partners.

EARLY OSAC: MISSION, STRUCTURE, AND MEMBERSHIP

Figure 1: Early OSAC Logo

OSAC was established and first introduced at a meeting of the NCFS on February 4, 2014 in Washington, D.C. OSAC's mission is to strengthen the nation's use of forensic science by facilitating and promoting the development and use of technically sound standards (Figure 1).

OSAC's early organizational aims were to:

- Populate the *OSAC Registry of Approved Standards* and the *OSAC Registry of Approved Guidelines (which were later consolidated into a single OSAC Registry);*
- Develop a framework for organizational practices (i.e., *Forensic Science Code of Practice);*
- Compile and update a forensic science catalogue of standards and related documents.
- Maintain Priority Action Plan documents on OSAC strategic objectives and associated goals and intended actions;
- Promote and improve the communication, dissemination, and use of forensic science standards, accreditation, and personnel competencies;
- Encourage forensic science service providers in the U.S. to implement guidelines and standards (e.g., ISO/IEC 17025) for quality and competency;
- Provide insight on each forensic science discipline's research and measurement standard needs;
- Enlist stakeholder involvement from a broad community to provide public comment on OSAC outputs.

OSAC's early organizational structure comprised (Figure 2):

- Forensic Science Standards Board (FSSB): OSAC's governing board.

- Three Resource Committees (RCs): Human Factors Committee (HFC), Legal Resource Committee (LRC) and Quality Infrastructure Committee (QIC).
  - The HFC was composed of up to 10 psychologists, quality systems managers, and usability experts who provided guidance on the influence of systems design on human performance and on ways to mitigate errors in complex tasks.
  - The LRC was composed of 10 judges, lawyers, and legal experts who provided guidance on legal ramifications of forensic standards under development and input on presentation of forensic results to the legal system.
  - The QIC was composed of up to 15 standards experts, quality systems managers, and accreditation and certification specialists who were responsible for writing and updating OSAC's *Forensic Science Code of Practice*.
- Five Scientific Area Committees (SACs): Biology/DNA, Chemistry/Instrumental Analysis, Crime Scene/Death Investigation, Digital/Multimedia, Physics/Pattern Interpretation.
  - The SACs consisted of up to 15 members, which included the subcommittee chairs, researchers, measurement scientists, and practitioners.
- Twenty-five subcommittees (SCs)
  - The SCs consisted of up to 20 practitioners, researchers, scientists, and research and development partners.
  - OSAC's twenty-fifth SC, Crime Scene Investigation, was added in December 2015.
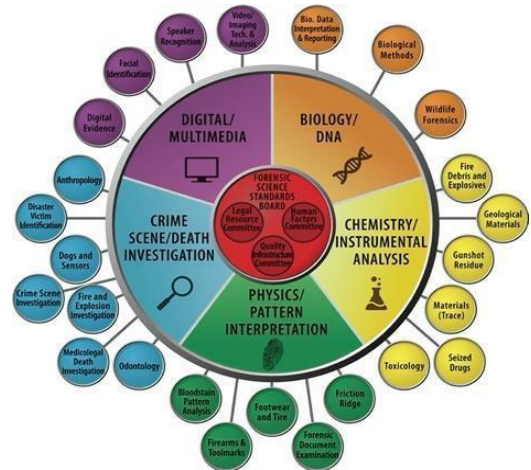

Figure 2: Early OSAC Organizational Chart

Members for OSAC's FSSB, RCs, and SACs were initially selected by the NIST-DOJ leadership/membership committee. Subcommittee members were then selected by the FSSB and SAC officers, after being reviewed by the NIST-DOJ committee. NIST scientists also participated in the FSSB, SAC, and SCs as researchers and standards experts, when needed. The original OSAC membership process was as follows:

- Applicant recruitment began in April 2014 and closed in May 2014;
- The FSSB was appointed in July 2014 and the first meeting was held in July 2014;
- Membership recommendations for the RCs and SACs were collected from July to August 2014;
- SC appointments were completed in October 2014 with NIST-DOJ review;
- The first in-person meeting of the OSAC members took place in January 2015 in Norman, OK (Figure 3).
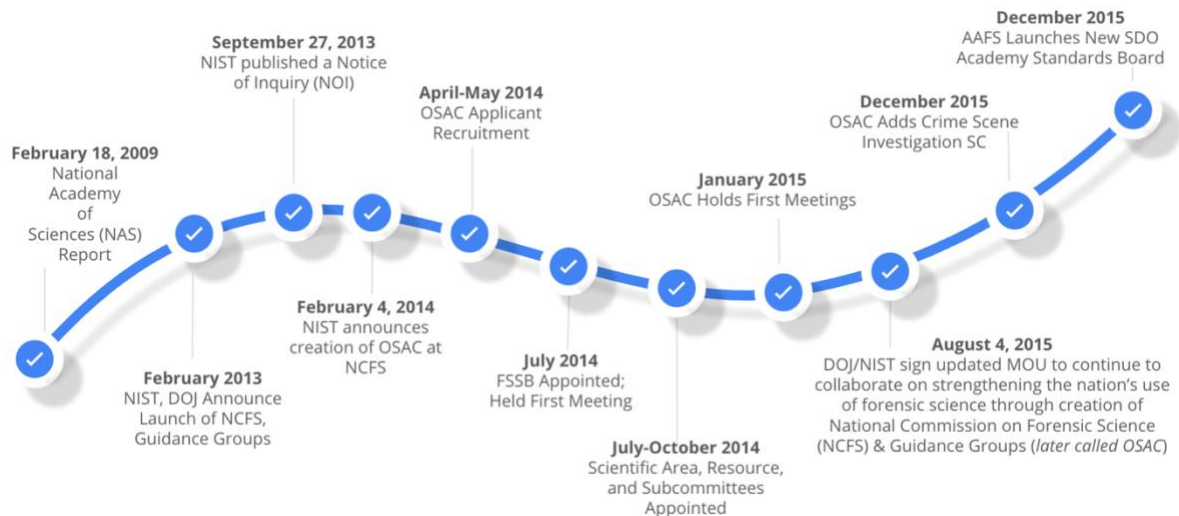
Figure 3: OSAC Origins Timeline

CURRENT OSAC: MISSION, STRUCTURE, MEMBERSHIP, AND FUNDING

In August 2017, NIST staff and OSAC leadership began to examine ways to improve the efficiency and effectiveness of the organization, and NIST issued a *Request for Information on the Development of the Organization of Scientific Area Committees (OSAC) for Forensic Science 2.0* (NIST, 2017)). Between the latter part of 2017 and into the fall of 2018, NIST held numerous stakeholder meetings to develop and finalize a reorganization plan for OSAC leadership's consideration. Throughout 2019 and 2020, NIST and OSAC leadership revised OSAC's organizational priorities and finalized the plans to restructure the organization.

On October 1, 2020, NIST officially launched the changes to OSAC's structure and processes with the goal of enabling OSAC to make high-quality, technically sound standards available to forensic service providers more quickly. OSAC's mission has remained constant through this evolution, while allowing it to pivot its organizational priorities (Figure 4).

Figure 4: OSAC Evolution Timeline

Timeline:
- **August 2017** — NIST Issues RFI on Reorganization
- **Fall 2017 - Spring 2018** — NIST Team Develops Reorganization Plans
- **Summer 2018** — NIST Held Numerous Stakeholder Meetings on Reorganization
- **September 2018** — Presented Reorganization to OSAC Leadership, V1
- **Fall 2018 - March 2020** — FSSB Revises OSAC Organizational Priorities
- **June 2019** — Presented Revised Reorganization to OSAC Leadership, V2
- **October 2020** — Launch Reorganization, V2

OSAC's organizational (figure 5) aims have evolved to:

Figure 5: OSAC Logo

- Facilitate the development of standards and evaluate standards for placement on the OSAC Registry;
- Promote the use of standards on the OSAC Registry in the forensic science community by accreditation and certification bodies and the legal system;
- Provide insight on each forensic science discipline's research and development needs;
- Enlist a broad community of interested individuals and institutions in these efforts;
- Establish and maintain working relationships with pertinent organizations.

On August 1, 2021, OSAC's organizational structure consists of:

- Forensic Science Standards Board
- Four FSSB Resource Task Groups: Human Factors Task Group (HFTG), Legal Task Group (LTG), Quality Task Group (QTG), and Statistics Task Group (STG). These task groups provide guidance and submit comments on standards, technical publications, and other OSAC and FSSB documents related to their content areas. OSAC subcommittees have a representative from each of these Task Groups to provide guidance to the subcommittee during their deliberations.
  - HFTG members have expertise in psychology, cognitive science, or a related social science discipline, or knowledge of social science literature on human judgment, decision making, observer effects, communication, or cognitive bias.
  - LTG members have expertise in litigating, judging, legal counselling, teaching, or writing about forensic evidence in the legal system.
  - QTG members have expertise in quality assurance/quality control including quality management techniques such as lean six sigma, root cause analysis, quality audits, or risk management.

- o The STG is composed of at least one member from each OSAC subcommittee that provides a statistician's perspective for the subcommittee. STG members have expertise in applying statistics in the physical sciences or other types of experimental science.
- Seven SACs (Figure 6): Biology, Chemistry: Seized Drugs & Toxicology, Chemistry: Trace Evidence, Digital/Multimedia, Medicine, Physics/Pattern Interpretation, and Scene Examination.
  - o The SACs are composed of the chairs from each applicable SC, along with two additional SAC officers.
- Twenty-two subcommittees (Figure 6):
  - o The SCs are made up of human factors, legal, and quality assurance representatives, practitioners, R&D partners, researchers and scientists, and statisticians.
  - o The twenty-second SC, Forensic Nursing, was announced and began membership selections in the summer of 2021.
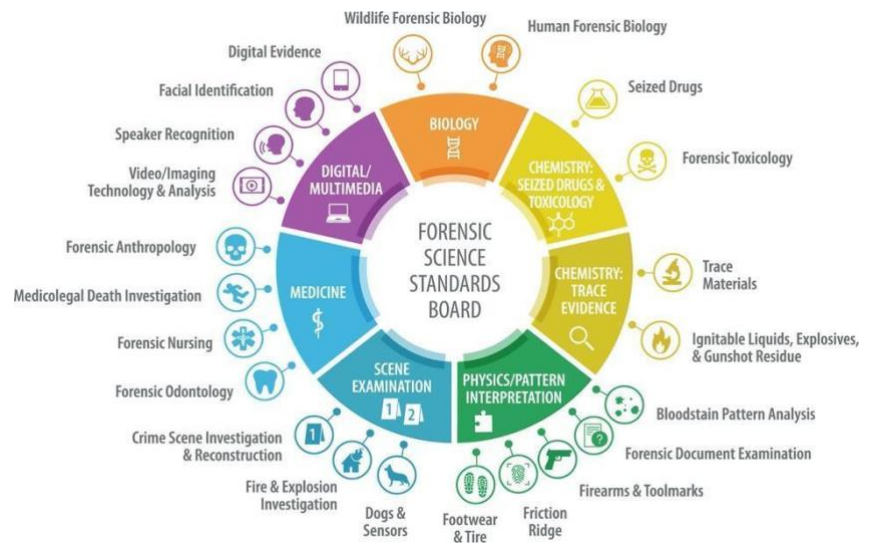

Figure 6: OSAC's Current Organizational Chart

As of August 2021, OSAC consists of approximately 470 active members and 325 active affiliates, and has over 3,000 interested individuals in its applicant pool. OSAC accepts membership applications on a continuous basis, and its appointed members and affiliates are selected based on their education, training, experience, expertise, and qualifications. OSAC benefits tremendously from this diverse group of volunteers.

To ensure the OSAC accomplishes its mission, aims, and organizational priorities, all applicants agree to adhere to a Code of Responsibility. OSAC members and affiliates follow organizational core principles such as balance, consensus, harmonization, openness, promoting a free exchange of information about OSAC, and avoiding any conflicts of interest.

OSAC receives congressionally appropriated funds annually to support its operations.

The forensic science community has benefitted from OSAC's standardization efforts including the availability of more science-based standards, professionalization of the standards development practices in forensic science, encouragement of inter-disciplinary collaboration, and the facilitation of conversations with all stakeholders. While the primary audience for consensus-based standards is forensic practitioners, the broader audience now includes the organizations and individuals who comprise the criminal justice system.

OSAC'S ROLE

OSAC was created to address a lack of discipline-specific forensic science standards. OSAC fills this gap by drafting proposed standards and sending them to a standards developing organization (SDO), which further develops and publishes them.

OSAC also reviews standards developed by the SDOs and posts high-quality ones on the OSAC Registry. Inclusion on this registry indicates that a standard is technically sound and that forensic science organizations should consider implementing them. OSAC is administered by NIST, which is a non-regulatory federal agency. Therefore, OSAC encourages voluntary standards implementation as it does not have authority to enforce the use and adoption of the standards on the OSAC Registry.

It should be emphasized that OSAC facilitates the development of standards and does not publish them. There are multiple SDOs (e.g., American Society of Testing Materials (ASTM), National Fire Protection Association (NFPA), American Dental Assocation (ADA)) that receive draft standards from OSAC to route through their consensus processes and publish as formal standards. After OSAC's launch, the American Academy of Forensic Science (AAFS) (www.aafs.org) responded to the need for additional SDOs in the forensic science community by establishing the AAFS Standards Board (ASB) (www.asbstandardsboard.org) in 2015.

OSAC REGISTRY

The OSAC Registry (Figure 7) is a repository of high-quality, technically sound published and proposed standards for forensic science. These written documents define minimum requirements, best practices, standard protocols, and other guidance to help ensure that the results of forensic analysis are valid, reliable, and reproducible.

Figure 7: OSAC Registry Banner Bar

The OSAC Registry contains two types of standards:
- **Published standards.** These are fully developed standards that have been published by an SDO.
- **OSAC Proposed Standards.** These are new or revised standards that have been drafted by OSAC and sent to an SDO to be further developed and published. An OSAC Proposed Standard may be revised during the SDO development process, and once available, the SDO published standard will replace the OSAC Proposed Standard on the Registry.

All the standards on the OSAC Registry have passed a rigorous technical and quality review by OSAC members, including forensic science practitioners, research scientists, statisticians, and legal experts. OSAC encourages the forensic science community to implement these published and proposed standards. Technical reviews consist of evaluating standards to determine whether they properly address topics such as validation, measurement uncertainty, human factors, quality assurance, terminology, clear method descriptions and limitations, and reporting results.

The number of standards on the Registry continues to grow (Figure 78. The complete list of Registry standards is available on the OSAC website (www.nist.gov/osac/osac-registry). To help stakeholders better see what standards became effective on the Registry each year, "annualized" versions of the Registry are also available on the website. As of July 2021, there are 59 publised and OSAC proposed standards on the OSAC Registry.
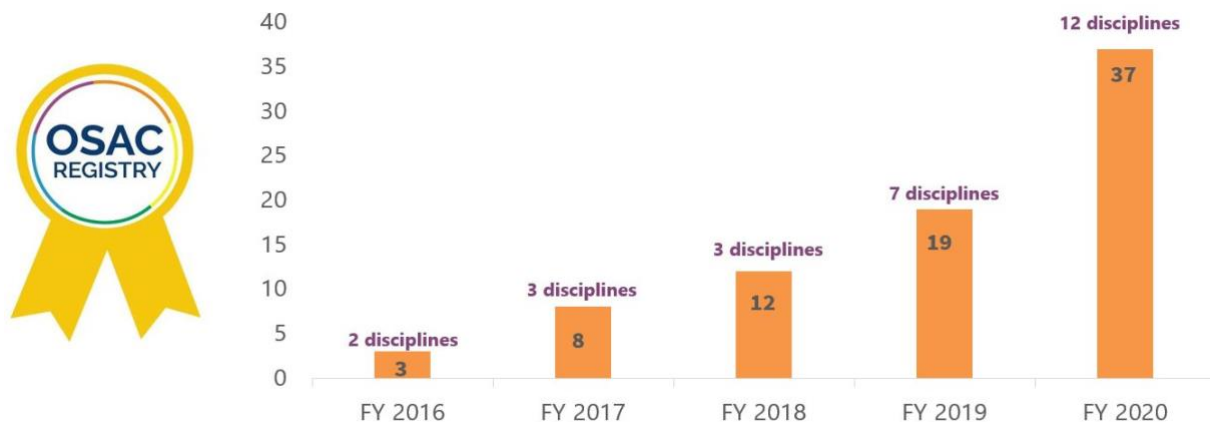
Figure 8: OSAC Registry Annualized Growth. This image reflects the cumulative number of standards on the OSAC Registry at the end of each fiscal year (ending September 30), along with the number of forensic science disciplines represented on the Registry.

OSAC REGISTRY APPROVAL PROCESS

To ensure the highest-quality standards are available for the forensic science community, OSAC evaluates published and proposed standards using two internal processes:

- **Registry Approval Process for OSAC Proposed Standards** is used to review OSAC-drafted standards (i.e., OSAC Proposed Standards) for technical quality and placement on the Registry before they are sent to an SDO for further development and publication. This process became effective October 1, 2020 and applies to documents that were not submitted to an SDO prior to September 30, 2020.
- **Registry Approval Process for Published Standards** is used to review existing SDO-published standards for technical quality and placement on the Registry. This process became effective February 1, 2020.

OSAC REGISTRY APPROVAL PROCESS FOR OSAC PROPOSED STANDARDS

This process starts when there is a need to draft a new forensic science standard or revise an existing one. After a standard has been drafted or revised, a Scientific and Technical Review Panel (STRP), if applicable, will review it according to set criteria and provide the panel's feedback to the drafting subcommittee as initial comments for consideration.

Stakeholders from the forensic science community are also invited to submit additional comments on the standard during a 30-day open comment period. After the open comment period closes, the subcommittee will review and adjudicate any comments that were received. OSAC shares any public comments from the open comment period and the STRP's final report.

The FSSB also has an opportunity to review a standard before it is added to the Registry. If the FSSB does not oppose placing it on the OSAC Registry, the standard will be listed as an OSAC Proposed Standard and then sent to an SDO for further development and publication. OSAC encourages the forensic science community to implement proposed standards in anticipation of their being published as formal standards.

After the standard has been published by an SDO, the subcommittee can approve the addition of the SDO published standard to the Registry. The FSSB will have one final opportunity to review it, and if the FSSB does not oppose the addition, the SDO-published standard will replace the OSAC Proposed Standard on the Registry (Figure 9).
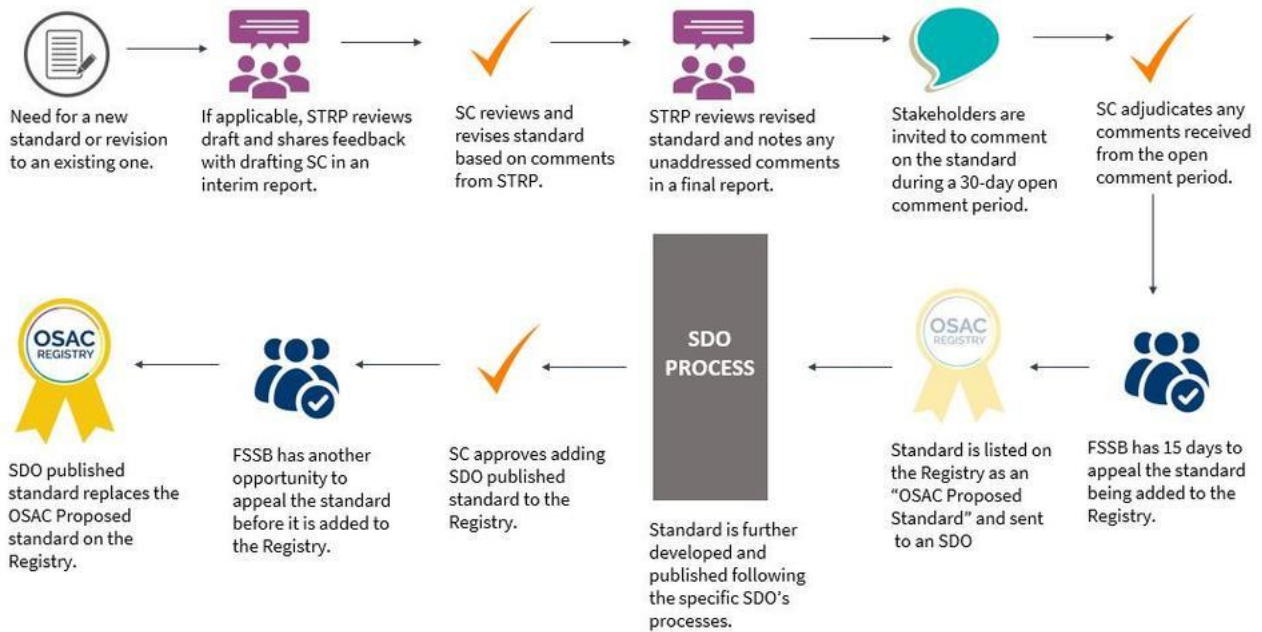

Need for a new standard or revision to an existing one.

If applicable, STRP reviews draft and shares feedback with drafting SC in an interim report.

SC reviews and revises standard based on comments from STRP.

STRP reviews revised standard and notes any unaddressed comments in a final report.

Stakeholders are invited to comment on the standard during a 30-day open comment period.

SC adjudicates any comments received from the open comment period.

SDO published standard replaces the OSAC Proposed standard on the Registry.

FSSB has another opportunity to appeal the standard before it is added to the Registry.

SC approves adding SDO published standard to the Registry.

SDO PROCESS

Standard is further developed and published following the specific SDO's processes.

Standard is listed on the Registry as an "OSAC Proposed Standard" and sent to an SDO

FSSB has 15 days to appeal the standard being added to the Registry.

Figure 9: OSAC Registry Approval Process for OSAC Proposed Standards

OSAC REGISTRY APPROVAL PROCESS FOR PUBLISHED STANDARDS

This process is used to review existing SDO-published standards for technical quality and placement on the Registry. The technical review of the standard occurs after it has been published, instead of before, as in the Registry approval process for OSAC Proposed Standards.

If a subcommittee approves moving an SDO published standard through the Registry approval process, it will first be evaluated by forensic science practitioners, academic researchers, statisticians, and legal representatives on the subcommittee. Technical reviews consist of evaluating standards to determine whether they properly address topics such as validation, measurement uncertainty, human factors, quality assurance, terminology, clear method descriptions and limitations, and reporting results.

Once this assessment is complete and the standard is determined to be technically sound, OSAC will open a comment period to solicit feedback from forensic science stakeholders on whether it should be included on the Registry as a published standard. After the comment period closes, the subcommittee will address any feedback received from the community. Next, the FSSB will review the standard and the adjudicated comments and vote to approve the standard for placement on the Registry. Finally, the standard is listed on the Registry and any public comments received from the open comment period are shared (Figure 10).

Figure 10: OSAC Registry Approval Process for Published Standards

Scientific and Technical Review Panels (STRPs)

In October 2020, OSAC established Scientific and Technical Review Panels (STRPs) to provide an independent technical review of drafted standards going through the OSAC Registry approval process. STRPs are made up of forensic science practitioners, discipline-specific subject matter experts, researchers, statisticians, and human factors, legal, and quality experts. OSAC subcommittees, scientific area committees, the FSSB, and NIST staff recommend individuals to serve on an STRP, for a finite period to complete their technical review of a given standard. During the review, STRP members evaluate topics such as human factors, method description, quality assurance, reporting results, scientific merit, and terminology.

Forensic science standards are expected to not only inform scientists and technicians but also to inform other participants in the criminal justice system about how results have been reached and to build trust and confidence in the integrity of those findings. Consequently, STRPs are created to have the range of expertise to consider (1) how well a standard meets the needs of the forensic science, law enforcement, and legal communities, and (2) to recommend improvements to the standards under review.

Standards being proposed for the OSAC Registry, that cover the following topics, will undergo a technical review from an STRP:

- **Method development, practices, and procedures**: Method development produces a method that answers a specific question or yields a result relevant to the answer. Once a method has been developed, validation is required to ensure it is fit for purpose.
- **Method validation**: Methods must be evaluated to determine whether they work as intended and are fit for purpose. The specific process of evaluation will vary depending on the nature and purpose of the method, but the evaluation must establish how accurate the method is under the established conditions.
- **Quality assurance**: Methods must include quality assurance procedures to ensure that sufficiently similar results will be obtained when the methodology is properly followed by different users in different facilities.
- **Reporting and testimony**: These standards specify language to be used in written reports and testimony and should strive for language that will be understood as intended by law enforcement personnel, lawyers, judges, and jurors.

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The goal is for a comprehensive STRP review and recommendations to strengthen and enhance the standard.

OSAC REGISTRY IMPLEMENTATION

To improve consistency within and across forensic science disciplines, ensure confidence in the accuracy, reliability, and reproducibility of laboratory results, and positively increase the impact of admissibility and expert testimony in courts of law, OSAC encourages stakeholders in the forensic science and criminal justice communities to implement the standards on the OSAC Registry into their everyday practice.

In August 2018, the FSSB prepared an *OSAC Registry Implementation Plan* (OSAC, 2020) that describes various pathways OSAC might pursue to promote and encourage stakeholders to implement the standards on the OSAC Registry. Additionally, it describes strategies and tools within these pathways that OSAC and the FSSB might leverage to encourage support from forensic service providers, associations, the criminal justice system, academia, and federal, state, and local agencies. The plan establishes a compendium of options for moving the Registry standards into use by our nation's forensic science service providers and beyond. The *OSAC Registry Implementation: A How-to Guide,* developed by OSAC's Quality Task Group's Working Group on OSAC Registry Implementation (OSAC, 2020), provides further suggestions to forensic service providers on how to evaluate and demonstrate successful incorporation of applicable standards on the OSAC Registry.

CURRENT IMPLEMENTATION EFFORTS

- **Self-implementation:** Forensic service providers (FSPs) can choose to voluntarily adopt OSAC Registry standards, partially or in their entirety. This is currently the quickest and most direct way for implementation to occur. FSPs are the primary benefactors of the OSAC Registry as these standards are developed through a consensus-based process and determined to be technically sound by forensic practitioners, academic researchers, measurement scientists, and statisticians. FSPs can evaluate these standards and then determine if implementation in possible.
- **Forensic Science Professional Associations (FSPAs**): Numerous FSPAs exist that cover the breadth of forensic science disciplines. Most forensic scientists belong to at least one professional association. These associations have a wide range of influence including core mission statements, defined ethical policies, educational programs, standards boards, and certification programs. Professional organizations could promote the shared value of OSAC Registry standards and encourage FSPs to integrate these standards into their quality documents and standard operating procedures.
- **Legal Community:** The legal community has extensive influence related to the requirements of science admitted into court proceedings. The impact includes admissibility of forensic procedures and analyst testimony in not only criminal but also in civil legal actions. Appellate rulings can have a wide-reaching effect at the state and national levels. Attorneys and judges may demand that forensic service providers incorporate OSAC Registry standards into their management systems. The spotlight on forensic sciences, as they are presented in courts of law, will continue to bring a demand for more stringent scientific applications and validation from the legal community.
- **Education Programs:** Post-secondary education and research bodies look to the forensic science community to help provide content for the curriculum they teach to their students and researchers. Many new forensic scientists who attend these colleges or universities will be introduced to the scientific procedures they will use during their careers. It is important, therefore, to provide a solid foundation of scientific procedures. The future application of technically sound practices, protocols and procedures can be influenced by introducing and emphasizing the importance of standards to these collegiate forensic science practitioner candidates.
- **Accreditation Bodies:** Approximately 88% of publicly funded forensic laboratories are now accredited (Bureau of Justice Statistics, 2014), and some judicial systems require accreditation of forensic laboratories that offer testimony. Accreditation can help forensic service providers demonstrate that they have implemented the standards on the OSAC Registry.
- **Certification Bodies:** Assurance of reliable and accurate forensic analysis requires confidence in both the analytical procedures and the competence of the person performing them. Certification promotes consumer and public confidence in the capabilities and competence of the people who provide specialized services by evaluating their knowledge, skills, and abilities through written and practical testing. Adoption of OSAC Registry standards by certification bodies can provide consistency in analytical processes and provide a common foundation for certification examinations.

- **Funding Bodies**: Financial resources are a concern for stakeholders. The National Institute of Justice (NIJ) and Bureau of Justice Assistance (BJA) are the primary providers of external grants to the state and local forensic science community. These grants generally support research and development, capacity enhancement, backlog reduction, cold case analysis, training, and quality improvement. NIJ's and BJA's grant offerings can be leveraged as a funding incentive for state and local forensic science laboratories to adopt standards listed on the OSAC Registry by giving preference to laboratories using them or including funding to help achieve implementation.
- **State Forensic Science Commissions/Regulatory Authorities**: State forensic science commissions advance forensic efforts by providing oversight, making recommendations, and coordinating resources to improve the practice of forensic science in their jurisdiction. Many of these activities align with the mission of the OSAC. Although the mandates, scope, and authority of each commission varies widely, some have investigative authority, oversee accreditation, certification or licensing standards, rulemaking authority, or fiscal oversight. More importantly, some state commissions have developed systems to engage forensic laboratories with other stakeholders such as attorneys and academic researchers. State commissions could be a valuable resource for outreach and future implementation efforts.

OSAC REGISTRY: EARLY IMPLEMENTERS

The Georgia Bureau of Investigation - Division of Forensic Sciences (dofs-gbi.georgia.gov/) made the decision to embark on the implementation journey in January 2017 and celebrated its three-year anniversary as the first forensic laboratory to implement the standards on the OSAC Registry.

The Houston Forensic Science Center (HFSC) (www.houstonforensicscience.org/) has adopted standards recommended by OSAC in its continuous effort to improve forensic science results for Houston and impact the broader forensic science community.

The Seized Drugs section of the Kentucky State Police (KSP) Forensic Laboratories (kentuckystatepolice.org/forensic-laboratory-system/) has committed to implementing all seized drugs-related OSAC Registry standards and has created a process to evaluate and consider incorporating new Registry standards each year.

In November 2019, the Texas Forensic Science Commission (www.txcourts.gov/fsc/) recommended that all crime laboratories accredited to perform forensic analysis in the State of Texas voluntarily adopt the standards listed on the OSAC Registry (OSAC, 2019). The Texas Forensic Science Commission, a national leader in forensic oversight and reform, is the first regulatory body in the United States to recommend implementation of standards on the OSAC Registry.
Seven professional forensic science organizations, all represented on OSAC's Forensic Science Standards Board, have also released statements declaring their support for the development and implementation of forensic standards.

- **The American Academy of Forensic Sciences (AAFS)** (www.aafs.org) is a multidisciplinary professional organization that provides leadership to advance science and its application to the legal system. AAFS founded the AAFS Standards Board (ASB), the first ANSI-accredited SDO dedicated to the forensic sciences. As noted in a statement from the AAFS Board of Directors, AAFS supports the work of OSAC as it plays a critical role in ASB's and other SDOs' standards development efforts.
- **The American Society of Crime Laboratory Directors (ASCLD)** (www.ascld.org) is a non-profit professional society of crime laboratory directors and forensic science managers dedicated to providing excellence in forensic science through leadership and innovation. ASCLD supports policies that further the ongoing development of standards with significant forensic practitioner involvement and leadership. In its 2020-2021 National Outreach Priorities and Agenda, ASCLD noted its support of OSAC and encourages forensic science service providers to evaluate and implement the standards on the Registry whenever possible.
- **The Association of Firearm and Tool Mark Examiners (AFTE)** (www.afte.org) is the international professional organization for practitioners of firearms and/or toolmark identification and has been dedicated to the exchange of information, methods, and best practices, and the furtherance of research since its creation in 1969. The AFTE Board of Directors supports the OSAC mission and encourages its members to stay informed and engaged in OSAC activities.
- **The Association of Forensic Quality Assurance Managers (AFQAM**) (www.afqam.org) is a professional organization whose mission is to promote standardized practices and professionalism in quality assurance management for the forensic science community. As an organization based in quality, AFQAM encourages forensic science service providers to evaluate and implement the standards on the OSAC Registry whenever possible, as reflected in its position statement.
- **The International Association for Identification (IAI)** (www.theiai.org) is the oldest and largest forensic association in the world. It represents a diverse, knowledgeable, and experienced membership to educate, share, critique, and publish methods, techniques, and research in the physical forensic science disciplines. IAI encourages its members to become involved in standards development and supports OSAC and the implementation of standards on the OSAC Registry.
- **The National Association of Medical Examiners (NAME)** (www.thename.org) is a professional organization for medical examiners, forensic pathologists, and medicolegal affiliates and administrators. NAME endorses the development and adoption of strong standards for excellent practice in all areas of forensic science as noted in its policy statement.
- **The Society of Forensic Toxicologists (SOFT)** (www.soft-tox.org) is an organization composed of practicing forensic toxicologists and those interested in the discipline for the purpose of promoting and developing forensic toxicology. The SOFT Board of Directors has written a statement of support for the OSAC Registry and encourages forensic toxicology laboratories to evaluate and implement the standards whenever possible.

REGISTRY IMPLEMENTATION SURVEY

To understand how forensic science organizations are using standards on the Registry, the challenges around standards implementation, and what support is needed to improve it, OSAC has instituted an annual Registry Implementation Survey. The first survey was launched in June 2021 and provides an assessment of the 46 standards that were added to the Registry through March 2021 (https://www.nist.gov/osac/osac-registry-implementation-survey). The Registry Implementation Survey will be conducted annually to track implementation progress.

OTHER WORK PRODUCTS

During the process of creating and finalizing documentary standards, OSAC may also develop other supplementary work products. The following work products support standards development or implementation and may complement the suite of documents OSAC generates.

LEXICON: The OSAC Forensic Science Lexicon (lexicon.forensicosac.org/) was created to help bring consistency and understanding to the way terms are used by the various forensic science disciplines (Figure 11).

Figure 11. OSAC Lexicon Banner

The Lexicon aims to be the primary resource for terminology and is referenced when OSAC drafts and edits forensic science standards and other OSAC work products. This terminology tool began with 4,000 forensic science terms and definitions and is continuously updated as terms are revised or removed, and new ones are added.

The terms and definitions in the OSAC Lexicon come from published literature, including documentary standards, specialized dictionaries, SWG documents, books, journal articles, and technical reports. When a suitable definition is not found in any of these sources, OSAC generates a new or modifies an existing definition. Gradually terms are evaluated and harmonized by OSAC to a single definition. This process results in an OSAC Preferred Term.

An OSAC Preferred Term and its definition are approved by the FSSB. There are 26 OSAC Preferred Terms as of July 2021; these are made available to the public via the OSAC website.

PROCESS MAPS: OSAC has created process maps to help guide the standards development process. In addition to supporting document development, the process maps generated by OSAC provide illustrations of the step-by-step actions, decisions, input, outputs, and results of a specific process for some forensic science disciplines (https://www.nist.gov/osac/osac-work-products).

OSAC has developed and published process maps for:

- Biology/DNA
- Firearms analysis
- Friction ridge
- Speaker recognition.

Future process maps will be created for:

- Crime scene investigation/reconstruction
- Fire and explosion investigation
- Footwear and tire impressions
- Seized drugs
- Video/imaging technology analysis
- Wildlife forensic biology.

RESEARCH AND DEVELOPMENT (R&D) NEEDS: Forensic science standards are created to help address a certain need within a specific discipline. As a standard is being drafted, other needs and ideas may be uncovered that lead to future research and development activities.

OSAC documents and publicly shares with the forensic science community any research and development (R&D) needs that are identified during the standards development process. These needs may benefit a wide range of stakeholders. For example, R&D needs can help inform NIST researchers and NIST's Forensic Science Center of Excellence, also known as the Center for Statistics and Applications in Forensic Science (CSAFE), of valuable projects to consider as they perform research to advance the practice of forensic science. They can also serve as useful input for the National Institute of Justice (NIJ) when making decisions about funding opportunities for research, development, and evaluation projects that support the forensic science community. Additionally, universities that sponsor forensic science programs with research components can leverage these needs for undergraduate and graduate student research projects that will provide a tangible benefit for the field. As of July 2021, OSAC has published over 140 R&D needs (https://www.nist.gov/osac/osac-research-and-development-needs).

BASELINE DOCUMENTS: OSAC units provide discipline-specific documents which may contain information to help forensic scientists, judges, lawyers, researchers, and other readers better understand the nature, scope, and foundations of the individual disciplines as currently practiced. While the identification of these documents does not represent an endorsement by OSAC or NIST, OSAC may make them available to stakeholders for the benefit of the forensic science disciplines.

TECHNICAL GUIDANCE DOCUMENTS: OSAC Technical Guidance Documents are OSAC produced and published documents that support the development or implementation of a standard. These documents are not standards and will not go through the consensus process at an SDO. The OSAC Technical Guidance Documents provide a way to share information that was gathered during the standards analysis and development process but will not be part of a standard. As of July 2021, OSAC has published five OSAC Technical Guidance Documents (https://www.nist.gov/osac/osac-technical-guidance-documents).

OSAC Technical Guidance Documents address one of the following topics and are made available to the public for free use:

- Conceptual structure or framework related to development or implementation of standards;
- Standards needs and gaps in specific forensic science disciplines;
- Lessons learned and recommendations for the development and implementation of standards;
- Guidance for the implementation of standards.

CONCLUSION

Since its creation in 2014, OSAC has strengthened the forensic science community by facilitating the development of technically sound standards, professionalizing the standards development practices in forensic science, encouraging interdisciplinary collaboration, and coordinating conversations with stakeholders. As of July 2021, OSAC's 800-plus volunteer members and affiliates have elevated 59 published and OSAC proposed standards to the OSAC Registry, drafted over 120 SDO-published forensic science standards, with hundreds more under development. OSAC encourages stakeholders in the forensic science community to implement the SDO-published and OSAC Proposed standards on the OSAC Registry to improve consistency within and across forensic science disciplines, ensure confidence in the accuracy, reliability, and reproducibility of laboratory results, and positively increase the admissibility and the impact of expert testimony in courts of law.

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17. President's Council of Advisors on Science and Technology (PCAST), 2016. Report to the President - Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods. Executive Office of the President.

RELEVANT WEBSITES

1. American Academy of Forensic Sciences (AAFS) (https://www.aafs.org/)

2. American Dental Association (ADA) (https://www.ada.org/en)
3. American Society of Crime Laboratory Directors (ASCLD) (https://www.ascld.org/)
4. ASTM International (https://www.astm.org/)
5. Association of Firearm and Tool Mark Examiners (AFTE) (https://afte.org/)
6. Association of Forensic Quality Assurance Managers (AFQAM) (https://www.afqam.org/wp15/)
7. Georgia Bureau of Investigation - Division of Forensic Sciences (https://dofs-gbi.georgia.gov/)
8. Houston Forensic Science Center (HFSC) (https://www.houstonforensicscience.org/
9. International Association for Identification (IAI) (https://www.theiai.org/)
10. Kentucky State Police (KSP) Forensic Laboratories (https://kentuckystatepolice.org/forensic-laboratory-system/)
11. National Association of Medical Examiners (NAME) (https://www.thename.org/)
12. National Commission On Forensic Science (https://www.justice.gov/archives/ncfs)
13. National Institute of Justice (https://nij.ojp.gov)
14. National Institute of Standards and Technology (NIST) (http://www.nist.gov)
15. National Fire Protection Association (NFPA) (https://www.nfpa.org/)
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18. NIST's Center for Statistics and Applications in Forensic Science (CSAFE) (https://forensicstats.org/)
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25. OSAC Registry (https://www.nist.gov/osac/osac-registry)
26. OSAC Research and Development Needs (https://www.nist.gov/osac/osac-research-and-development-needs)
27. OSAC Technical Guidance Documents (https://www.nist.gov/osac/osac-technical-guidance-documents)
28. Society of Forensic Toxicologists (SOFT) (https://www.soft-tox.org/)
29. National Science and Technology Council Committee on Science Subcommittee on Forensic Science (https://www.ojp.gov/pdffiles1/NIJ/251422.pdf)
30. Texas Forensic Science Commission (http://www.txcourts.gov/fsc/)
31. U.S. Department of Commerce (https://www.doc.gov/)
32. U.S. Department of Justice (https://www.justice.gov/)

33. [White House's Office of Science and Technology Policy (OSTP)](http://www.whitehouse.gov/ostp/)
(http://www.whitehouse.gov/ostp/)

FIGURES