OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need:	Toolmarks on 3D printed components
Keywords:	3D printing, toolmarks, firearms examination, additive manufacturing

R&D Need Rank: Low, Medium, High	High	**SAC Approved Date:**	9/3/2025

Submitting subcommittee(s): Firearms & Toolmarks

Research Need Summary:

The purpose of these research needs is to build a stronger scientific foundation for forensic science standards. The information provided herein will help to evaluate and strengthen existing standards, and/or fill any standards related gaps. In the space below, please provide a brief narrative of the need to be addressed. This should include:

- The identity of any specific standards that would be affected/improved/evaluated
- A discussion on gaps that exist within the standards or standards related gaps that need to be filled
- How this work would fill those gaps
- An overview of any current or past research efforts that may be relevant to this effort
- A discussion regarding how this research might improve current laboratory capabilities and/or forensic services within the criminal justice system
- Any relevant references

With the invention of and increasing prevalence of 3D printing hardware, 3D printed components may be encountered in forensic casework. Some 3D printed components have microscopic features (i.e., toolmarks) that may be used to associate the printed component with its original source. Recent presentations and publications indicate that 3D printing can leave (tool)marks on 3D printed components. Evaluation and characterization of these marks will provide further guidance for casework (e.g., where the marks can be found, the source/cause of the marks, the variance of marks within one 3D printer, as well as between different 3D printers).

References (not intended to be a comprehensive list on this topic):

- Aronson A, Elyashiv A, Cohen Y, Wiesner S. A novel method for linking between a 3D printer and printed objects using toolmark comparison techniques. J Forensic Sci. 2021;66:2405–2412.
- Steven Pavlovich, Kirk Garrison, An exploratory study of topographical signatures within 3D fused deposition modelling using Polylactic Acid (PLA) filament, Forensic Science International, 349, 2023.
- Aurélie Szwed, Stefan Schaufelbühl, Alain Gallusser, Denis Werner, Olivier Delémont, Was a 3D-printed firearm discharged? Study of traces produced by the use of six fully 3D-printed firearms, Forensic Science International, 348, 2023.
- Li SY, Turner J, Golightly S, Zelbst P, Yu J. Potential impacts of 3D modeling and 3D printing in firearm toolmark examinations. J Forensic Sci. 2021;66:2201–2207.
- Mohammed A. Al Shamsi, "3D Printed Firearms Comparison", AFTE Journal 2019, Volume 51, Number 4 (Fall), Page 242 thru 245

This research need has been identified by one or more subcommittees of OSAC and is being provided as an informational resource to the community.