

OSAC RESEARCH NEEDS ASSESSMENT FORM



Title of research need: Comparison of toolmarks on 3D printed components

Describe the need: 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 could/can be used to associate the printed component to its original source.

Keyword(s): 3D printing, toolmarks, additive manufacturing

Submitting subcommittee(s): Firearms & Toolmarks **Date Approved:** October 20, 2023

Background Information:

1. Does this research need address a gap(s) in a current or planned standard? (ex.: Field identification system for on scene opioid detection and confirmation)

This research need does not address a current or planned standard.

2. Are you aware of any ongoing research that may address this research need that has not yet been published (e.g., research presented in conference proceedings, studies that you or a colleague have participated in but have yet to be published)?

Yes.

3. Key bibliographic references relating to this research need: (ex.: Toll, L., Standifer, K. M., Massotte, D., eds. (2019). Current Topics in Opioid Research. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-88963-180-3)

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

4. Review the annual operational/research needs published by the National Institute of Justice (NIJ) at <https://nij.ojp.gov/topics/articles/forensic-science-research-and-development-technology-working-group-operational#latest>? Is your research need identified by NIJ?

No.

5. In what ways would the research results improve current laboratory capabilities?

Research of source of toolmarks created during the 3D printing process has the potential to improve current laboratory capabilities by providing additional foundational data and limitations to be used by firearm and toolmark examiners during their analysis of 3D printed firearms and/or firearm components. Additionally, the research results may impact sections of an existing examiner training program or introduce familiarization areas for previously certified/qualified examiners.

6. In what ways would the research results improve understanding of the scientific basis for the subcommittee(s)?

Recent presentations and publications indicate 3D printing can leave (tool)marks on 3D printed components. Evaluation and characterization of these marks will provide further guidance (e.g. where the marks can be found, the source/cause of the marks, the variance of marks within one instrument as well as between different instruments).

7. In what ways would the research results improve services to the criminal justice system?

Further research into 3D printing will provide consumers of this type of analysis with foundational and educational knowledge regarding 3D printing and resulting toolmark comparisons. Research results would provide comprehensive methodology and limitations for reporting results/observations on 3D printed items.

8. Status assessment (I, II, III, or IV):

II

	Major gap in current knowledge	Minor gap in current knowledge
No or limited current research is being conducted	I	III
Existing current research is being conducted	II	IV

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