Special Notice

Request for Information:
Algorithms and Abstraction for Photonic Processing
DARPA-SN-26-107
August 3, 2026

Defense Advanced Research Projects Agency
Multi X Office
675 North Randolph Street
Arlington, VA 22203-2114

Request for Information (RFI)
Special Notice DARPA-SN-26-107

Algorithms and Abstraction for Photonic Processing
Defense Advanced Research Projects Agency (DARPA)
Multi X Office (MXO)

OVERVIEW:
Posting Date: August 3, 2026
Responses Due: August 20, 2026, at 3:00 p.m. Eastern Time (ET)
Technical POC: Dr. Anna Tauke-Pedretti, MXO Program Manager
E-mail: DARPA-SN-26-107@darpa.mil

RFI DESCRIPTION:
The Defense Advanced Research Projects Agency (DARPA) Multi X Office (MXO) seeks information on first-principles development of algorithms specifically targeting execution on photonic integrated circuits (PICs). DARPA is interested in algorithm-hardware co-design and co-development, specific to state-of-the-art (SOTA) photonics capabilities, that can unlock unprecedented future Department of War (DoW) capabilities.

The goals of this Request for Information (RFI) include, but are not limited to:

- Survey of current SOTA, including most recent academic and industry research
- Discussion on the limitations of the current approaches and exploration of the opportunity space
- Identification of the main technical challenges for photonic-specific algorithm-hardware co-design ("Why are we not doing this already?")
- Identification of relevant figures of merit (FOMs) to evaluate potential application impact
- Preliminary quantitative estimates on anticipated FOM improvement
- Discussion on new capabilities for DoW enabled by this approach

Responses to this RFI will be used to inform future DARPA program research thrusts, goals, and performance targets.

BACKGROUND:
Today, a computational or signal processing workload utilizes algorithms developed and optimized to run on digital (Von Neumann) hardware architecture. Consequently, photonic hardware is designed and built that executes that algorithm as best as possible. However, forcing digital CMOS-optimized algorithms on PICs is an unnatural match and fails to capitalize on the unique wave and non-classical properties of light. As a result, current examples of photonic accelerators demonstrate incremental or no advantage when benchmarked to SOTA digital CMOS. This algorithm/hardware mismatch ultimately limits the potential impact of future photonic systems.

Digital electronics has leveraged multiple levels of abstraction to effectively bridge implementing high-level algorithms on physical hardware. Software languages, compilers, instruction sets, logic synthesis, and physical design tools allow computation to be specified and implemented across multiple levels of abstraction—from code to machine instructions to gates—and a manufacturable layout. This creates a seamless compute stack that is accessible, scalable, and programmable, enabling ever more complex processing. A similar stack could be envisioned for photonics; however, a one-to-one mapping to what is available today in electronics would not be expected due to the differences in the hardware physics. Such a stack is conceptually shown in Figure 1.

DARPA seeks information on the opportunity to rethink and re-develop the computational and signal processing algorithms that maximally leverage the unique strengths of processing with light while simultaneously developing the tools to compile these new algorithms to hardware PIC implementations. These tools would create a photonic compute or signal processing stack incorporating necessary levels of abstraction. The ultimate goal is to develop photonic systems demonstrating orders of magnitude improvement in bandwidth, dynamic range, noise, latency, efficiency, etc.

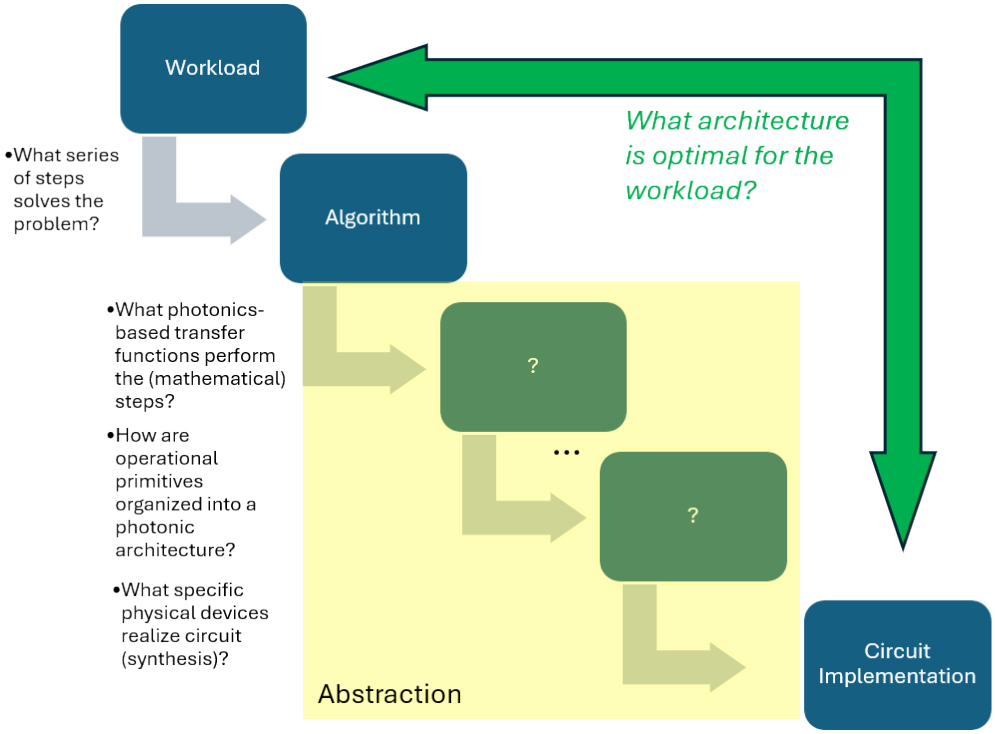

Figure 1. Conceptual photonic compute stack incorporating multiple abstraction levels.

REQUESTED INFORMATION:

DARPA seeks innovative insights to address the technical challenge areas described below. Responses are welcome from all capable sources including, but not limited to, private or public companies, individuals, universities, university-affiliated research centers, not-for-profit research institutions, and U.S. Government-sponsored labs. Responses may address any or all of the following Technical Areas. However, responses addressing multiple Technical Areas should clearly address the linkages and dependencies between them.

Technical Area 1: Algorithms

1. Discuss mathematical, computational or signal processing workloads and the corresponding algorithms to solve such problems specifically leveraging on-chip processing with light. The resulting algorithms should be directly informed and consider current capabilities to manufacture and operate PICs.
2. Describe potential applications that can benefit or be made possible through a chip-scale photonic signal processing or computing capability.

Technical Area 2: Photonic Abstraction Stack

1. Discuss methods and tools for compiling synthesizing, optimizing, and verifying photonic-aware algorithms either directly to application-specific photonic integrated circuit (ASPIC) designs or to

reconfigurable (reprogrammable) photonic fabrics that are compatible with current SOTA photonics manufacturing.

2. Describe abstraction layers that map high-level workloads, algorithms, or application descriptions to photonic hardware that avoid manual device-level implementation details to the user. Such abstractions should enable users to specify desired computation while the software stack manages hardware mapping, device configurations, calibration, control, and readout.
3. Explain how underlying photonic computing and signal processing capabilities can be integrated into existing systems and newly developed systems that take full advantage of photonic modality at all levels of the compute stack.

Technical Area 3: Idea Exploration

1. Describe the key questions that would need to be answered to make a new photonic compute stack viable.
2. Describe a framework for answering these questions including what appropriate expertise would be necessary.
3. Discuss your organizational capabilities and expertise in these areas. Discuss how your organization is uniquely equipped and capable of supporting DARPA in identifying the key challenges and potential solutions in this specific problem space.

SUBMISSION INSTRUCTIONS:

Responses to this RFI should be submitted no later than the due date and time listed in the overview section.

Unclassified responses to this RFI should be submitted to DARPA-SN-26-107@darpa.mil. NO CLASSIFIED INFORMATION SHOULD BE SENT TO DARPA-SN-26-107@darpa.mil.

Classified responses should be coordinated with DARPA prior to submission. Respondents wishing to provide a classified response should send an e-mail to DARPA-SN-26-107@darpa.mil with the subject line "Classified Coordination Requested". Respondents should allow at least three (3) business days for processing requests. NO CLASSIFIED INFORMATION SHOULD BE SENT TO DARPA-SN-26-107@darpa.mil.

To the maximum extent possible, respondents should submit non-proprietary information. If proprietary information is submitted, it must be appropriately and specifically marked. It is the respondent's responsibility to clearly define to the Government what is considered proprietary data. Any proprietary information should be clearly labeled as "Proprietary." DARPA will disclose submission contents only for the purpose of review by DARPA staff, other Government agencies, or DARPA Support Contractors/SETAs.

NOTE: DARPA intends to conduct individual discussions with respondents as necessary to gain a full understanding of the technical and partnership models submitted. DARPA will contact respondents individually via e-mail.

FORMAT INSTRUCTIONS:

Responses to the RFI should be concise. Respondents should submit a single integrated response addressing one or more of the areas described above. DARPA will only review responses submitted as an unprotected Microsoft Word/PowerPoint document or PDF file. Each response must use 11-point font and 1-inch margins on 8.5-inch by 11-inch page size. Responses must adhere to the page limits specified below; however, effective responses that can be provided in fewer pages are encouraged. Any submitted material in excess of these page limits will not be reviewed.

Responses should adhere to the following formatting instructions:

1. Cover page (1 page)
    a. Title
    b. Organization(s)
    c. Respondent's technical and administrative points of contact (names, addresses, phone numbers, and email addresses)
2. Technical areas (4 pages maximum per technical area)
    a. A discussion of the capabilities/challenges addressed (from your perspective)
    b. Theoretical and/or simulation discussion
    c. Development strategy, especially versus requested metrics
    d. Identify current data (if any)
    e. Estimated time to availability and risk assessment (technical and other)
3. References (1 page)
    a. All references to previously published work should be contained within this space.
4. Summary slides (1 summary slide and 1 technical description slide per technical area)
    a. Responses are requested to include slides that summarize the main idea and development strategy. The purpose of these slides is to visually and succinctly indicate the new insights, main objectives, underlying technical mechanisms, fundamental assumptions and limitations, key innovations, expected impact, and/or other unique aspects of the response.

STAY CONNECTED:
Subscribe to DARPA MXO's newsletter for timely updates on research opportunities, upcoming events, ways to work with us, and more.

- MXO will be hosting its next event, MXO's Spark Tank, in Chicago, Illinois, on November 2–4, 2026. For details, visit https://www.darpa.mil/events/2026/spark-tank.

DARPACONNECT:
Entities who have not worked with DARPA before are encouraged to learn more about DARPAConnect, an initiative established to facilitate collaboration between DARPA and potential performers. The DARPAConnect team offers customized support, resources, and guidance on how to prepare your ideas for high-impact conversations with DARPA program managers. Please visit DARPAConnect.us to access a digital hub of online resources, including a curriculum for self-paced learning, personalized support, and in-person and virtual events. In addition to the self-paced online materials, the DARPAConnect team is able to schedule one-on-one conversations to discuss your specific ideas, questions, and paths to DARPA. You can use the contact form at DARPAConnect.us or email the DARPAConnect team directly at darpaconnect@darpa.mil to request assistance.

ADMINISTRATIVE:
This announcement contains all information required to submit a response. No additional forms, kits, or other materials are needed. All administrative and technical questions should be directed to DARPA-SN-26-107@darpa.mil. Please refer to the Special Notice number (DARPA-SN-26-107) in all correspondence.

This RFI is issued solely for information and program planning purposes and does not constitute a formal solicitation for proposals or proposal abstracts; any so sent will be disregarded. In accordance with FAR 15.201(e), responses to this notice are not offers and cannot be accepted by the Government to form a binding contract. Submission of a response is strictly voluntary and is not required to propose to subsequent Announcements (if any) or Solicitations (if any) on this topic. DARPA will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that DARPA is under no obligation to

acknowledge receipt of the information received or provide feedback to respondents with respect to any information submitted under this RFI.