

DARPA-SN-25-19

Special Notice

Future Program Announcement:

Microsystem Induced CAtalysis (MICA)

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December 9, 2024



Defense Advanced Research Projects Agency

Microsystems Technology Office

675 North Randolph Street

Arlington, VA 22203-2114

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**Microsystem Induced CAtalysis (MICA)
Defense Advanced Research Projects Agency (DARPA)
Microsystems Technology Office (MTO)**

Posting Date: December 9, 2024

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BACKGROUND:

The purpose of this Special Notice (SN) is to provide public notification of additional research areas of interest to the Defense Advanced Research Projects Agency (DARPA) Microsystems Technology Office (MTO), specifically for the contemplated forthcoming Microsystem Induced CAtalysis (MICA) program.

If released, the MICA Broad Agency Announcement (BAA) will be made available at <https://sam.gov/>.

PROGRAM GOALS:

The MICA program will develop advanced concepts for microsystem control of biological function. The program will seek hardware demonstrations of molecular catalysts immobilized to microsystem surfaces and controlled by physical forces generated by the microsystem. Additionally, the program will seek high-accuracy modeling and simulation of such integrated molecular microsystems. While open to a broad range of molecular catalysts, an emphasis is placed on biomolecular catalysts. Through these demonstrations, MICA aims to answer three critical questions: (i) how can microsystems be used to actively control molecules? (ii) what are the different microsystem physics that can be used to drive catalyst function? and (iii) what co-design approaches can be used to integrate the different physics of microsystems and molecules?

The metrics of the program target accurate design, simulation, and fabrication of integrated molecules and microsystems. For design and simulation, the program scope includes physics-based methods that accurately predict dynamic performance of molecules integrated with microsystems. Static predictions of system structure or models that fail to capture relevant time and length scales are excluded from the program scope. For fabrication, the program scope includes methods for accurate placement and immobilization of molecules at microsystem interfaces to facilitate active control of catalyst activity by the microsystem. Control of molecules not attached to the microsystem interface are excluded from the program scope.

A major thrust of the program will be accurate placement and robust attachment of catalytic molecules to microsystems to enable reaction cascades that require multiple catalysts working together to generate products or drive biological function. The program will seek robust-by-design or adaptive interface solutions capable of achieving predictable catalytic performance, with an emphasis on compatibility with standard microelectronics manufacturing and assembly flows.

Catalytic molecules will be unspecified; however, approaches should include molecules whose structure and function can be predicted with high accuracy. The microsystem platform and control physics will also be unspecified; however, approaches should include coupling to a digital logic platform (e.g., FPGA, CMOS). Integrated systems are expected to meet program performance and accuracy metrics while actively controlling a biological system/pathway of the performer's choosing.

FURTHER ENGAGEMENT AND TEAMING:

If the MICA BAA is released, an additional announcement at <https://sam.gov/> will provide details for a Proposers Day.

It is anticipated that solving the technical challenges posed by the MICA program will require a deliberate focus on formation of the proper performer teams. DARPA anticipates two distinct team categories, and it is encourage that prospective proposers explore the formation of teams within each category: (1) Teams with broad expertise in molecular design, microsystem design, and fabrication approaches, all together capable of integrating molecules with microsystems to control molecular function; and (2) Teams with broad expertise in modeling and simulation of both microsystem and molecule performance, capable of developing tools for accurately predicting integrated system performance. Teaming across the two categories is not encouraged. DARPA will not facilitate any teaming arrangements.

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 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 can schedule one-on-one conversations to discuss specific ideas, questions, and paths to DARPA. Use the contact form at DARPAConnect.us or email the DARPAConnect team directly at darpaconnect@darpa.mil to request assistance.

ADMINISTRATIVE:

All administrative and technical questions should be directed to DARPA-SN-25-19@darpa.mil. Please refer to the Special Notice number (DARPA-SN-25-19) in all correspondence.

This Special Notice 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 Special Notice are not offers and cannot be accepted by the Government to form a binding contract. DARPA will not provide reimbursement for costs incurred in responding to this Special Notice. 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 Special Notice.

NO CLASSIFIED INFORMATION SHOULD BE INCLUDED IN ANY RESPONSE TO THIS SPECIAL NOTICE.