



DEPARTMENT OF ENERGY

Notice of Request for Information (RFI) on Autonomous Experimentation Platforms from Material Genome Initiative

AGENCY: Office of Critical and Emerging Technologies, Department of Energy.

ACTION: Request for information (RFI).

SUMMARY: On behalf of the Material Genome Initiative (MGI), the Department of Energy (DOE) seeks public comment on autonomous experimentation platforms to inform implementation of the MGI Challenges and Autonomous Materials Innovation Infrastructure (AMII).

DATES: Responses to the RFI are requested by March 21, 2025.

ADDRESSES: Interested parties may submit comments electronically to info@mg.gov and include “MGI RFI” in the subject line of the email.

FOR FURTHER INFORMATION CONTACT: Further questions may be addressed to Charles Yang through info@mg.gov or (202) 586-6116.

SUPPLEMENTARY INFORMATION:

I. Background

This is an RFI issued by DOE in support of the Material Genome Initiative (MGI) that seeks public input to inform interagency coordination around Autonomous Experimentation (AE) platform research, development, capabilities, and infrastructure. This input will support the efforts of the recently announced MGI Challenges that aim to help unify and promote adoption of the Materials Innovation Infrastructure—through the expansion and integration of capabilities including autonomy, artificial intelligence, and robotics—to realize solutions to challenges of national interest.¹ MGI is a Federal multi-agency initiative for discovering, manufacturing, and

¹ <https://www.mgi.gov/2024-materials-genome-initiative-mgi-challenges>

deploying advanced materials and supporting U.S. institutions in the adoption of methods for accelerating materials development, with over 15 agency participants.

For this RFI, MGI seeks input from stakeholders across the entire materials innovation ecosystem including but not limited to:

- Academic and federally funded research and development centers
- For-profit and non-profit AI developers
- Consortia, public/private partnerships, and industry groups interested in AE
- Scientific equipment manufacturers
- Robotics/automation manufacturers and developers
- Startups and investors
- Scientific workforce and education organizations
- Think tanks and science policy organizations
- And other interested entities

II. Purpose

Autonomous experimentation (AE) is defined in the MGI Workshop Report on Autonomous Materials Innovation Infrastructure² as “the coupling of automated experimentation and in situ or in line analysis of results, with artificial intelligence (AI) to direct experiments in rapid, closed-loops.” The report identifies several technological advances coupled to existing techniques that need to be integrated to realize AE:

(1) Laboratory automation, enabling robots to carry out the autonomous experimental tasks (Including transfer between instruments/experimental stations) prescribed by the decision algorithms.

(2) Automated in-line & in situ sensing, characterization, and analysis capabilities to enable closed-loop autonomous experimentation.

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https://www.mgi.gov/sites/default/files/documents/MGI_Autonomous_Materials_Innovation_Infrastructure_Workshop_Report.pdf.

(3) Improved AI and autonomous experimentation decision methods for materials that enable faster and better R&D.

(4) Improved software for hardware automation, sensing and autonomous experimentation.

MGI announced five challenges to help unify and accelerate adoption of Materials Innovation Infrastructure to build scientific infrastructure to address issues national interest.³ These challenges build off several recent announcements from across the U.S. Government in support of AE systems, including funding for AE for semiconductor materials⁴ from the CHIPS office in NIST, a National Science Foundation (NSF) solicitation for material discovery,⁵ and an ARPA-E funding opportunity for catalyst discovery with AE.⁶ This RFI is not a Notice of Funding Opportunity (NOFO) or Funding Opportunity Announcement (FOA).

This RFI seeks public input on existing research infrastructure as well as opportunities and challenges to leverage autonomous experimentation systems to realize the MGI Challenges. This RFI also seeks input on steps the MGI and the U.S. Government can take to support a broader research and development (R&D) ecosystem for autonomous experimentation systems.

III. Questions

1. MGI Challenges

For any of the following MGI challenges, respondents may provide input on any number or all of the following topics:

- Identify and map existing autonomous experimentation infrastructure suitable to addressing the MGI challenges;
- Describe how autonomous experimentation systems should be designed and integrated to accomplish MGI challenges;

³ <https://www.mgi.gov/2024-materials-genome-initiative-mgi-challenges>.

⁴ <https://www.nist.gov/system/files/documents/2024/10/30/CHIPS%20CARISSMA%20NOFO.pdf>.

⁵ <https://nsf-gov-resources.nsf.gov/files/nsf25508.pdf?VersionId=m260vPkM22sxSgrP2Kawqho5qTCDdHYD>.

⁶ <https://arpa-e.energy.gov/technologies/programs/catalchem-e>.

- Describe promising technical approaches to addressing a particular challenge and how AE systems can be designed to accelerate progress in those approaches
- Describe obstacles to leveraging autonomous experimentation systems specific to a given MGI challenge that will need to be addressed.

Clearly indicate which challenge is being responded to. Further details on the challenges can be found here.⁷ One response may respond to multiple challenges.

(a) MGI Challenge: Point of Care Tissue-Mimetic Materials for Biomedical Devices and Implants

(b) MGI Challenge: Agile Manufacturing of Affordable Multi-Functional Composites

(c) MGI Challenge: Quantum Position, Navigation, and Timing on a Chip

(d) MGI Challenge: High Performance, Low Carbon Cementitious Materials

(e) MGI Challenge: Sustainable Materials Design for Semiconductor Applications

2. Partnerships and Consortium

(a) How should the Material Genome Initiative (MGI) and the U.S. Government more broadly partner with industry, academia, and other stakeholders to realize autonomous experimentation platforms? Are there specific models that should be considered?

(b) What role can a public-private consortium play in supporting the development of autonomous experimentation? How should a consortium be structured and who should be involved?

(c) What are the non-technical barriers to realizing the broad impact of AE that partnerships and consortia can address? For example, standards development, experimental equipment integration, etc.

(d) How can MGI and the U.S. Government more broadly work with the affected communities to support the development of AE systems for science? How can MGI and the U.S. Government work with private industry to support technology transition of innovations developed by the community?

⁷ <https://www.mgi.gov/2024-materials-genome-initiative-mgi-challenges>.

3. Workforce

(a) How can the MGI agencies support the equitable development of an AI-ready scientific workforce, with the skills and knowledge needed to work with, operate, and leverage autonomous experimentation platforms?

(b) How do the workforce skills and knowledge needed to realize autonomous experimentation systems as a new scientific infrastructure overlap with other valuable scientific and engineering discipline needs?

4. Scientific Equipment, Automation, and Software Interfaces

(a) What types of robotic automation hardware and software are most applicable for scientific autonomous experimentation systems?

(b) What are obstacles and challenges to integrating robotic automation with scientific equipment? What role can software Application Programming Interface (API) standards play in developing autonomous experimentation systems? How can MGI and the U.S. Government work with private industry, including equipment manufacturers and autonomy developers, to develop API standards for the industry and accelerate adoption and development of AE systems?

IV. Response Guidelines

Commenters are welcome to comment on any question. RFI responses shall include:

1. RFI title;
2. Name(s), phone number(s), and email address(es) for the principal point(s) of contact;
3. Institution or organization affiliation and postal address; and
4. Clear indication of the specific question(s) to which you are responding.

Responses to this RFI must be submitted electronically to info@mgi.gov with the subject line “MGI RFI” no later than 5 p.m. (ET) on March 21, 2025. Responses must be provided as attachments to an email. It is recommended that attachments with file sizes exceeding 25 MB be compressed (i.e., zipped) to ensure message delivery. Responses must be provided as a Microsoft Word (*.docx) or Adobe Acrobat (*.pdf) attachment to the email and should be no more than 15

pages in length, 12-point font, 1-inch margins. Only electronic responses will be accepted. Only one response per individual or organization will be accepted.

A response to this RFI will not be viewed as a binding commitment to develop or pursue the project or ideas discussed.

Confidential Business Information

Because information received in response to this RFI may be used to structure future programs and/or otherwise be made available to the public, respondents are strongly advised NOT to include any information in their responses that might be considered business sensitive, proprietary, or otherwise confidential.

Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email two well-marked copies: one copy of the document marked “confidential” including all the information believed to be confidential, and one copy of the document marked “non-confidential” with the information believed to be confidential deleted. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. Government is not liable for the disclosure or use of unmarked information and may use or disclose such information for any purpose. If your response contains confidential, proprietary, or privileged information, you must include a cover sheet marked as follows identifying the specific pages containing confidential, proprietary, or privileged information.

Notice of Restriction on Disclosure and Use of Data

Pages [list applicable pages] of this response may contain confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for the purposes described in this RFI. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.

In addition, (1) the header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: “Contains, Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure” and (2) every line and paragraph containing proprietary, privileged, or trade secret information must be clearly marked with [[double brackets]] or highlighting. Submissions containing CBI should be sent to info@mgi.gov.

Signing Authority

This document of the Department of Energy was signed on January 13, 2025, by Helena Fu, Director, Office of Critical and Emerging Technologies, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the Federal Register.

Signed in Washington, DC on January 14, 2025.

Jennifer Hartzell,
Alternate Federal Register Liaison Officer,
U.S. Department of Energy.

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