# U.S. Department of Defense
# Gold Standard Science Implementation Plan

Report to the Office of Science and Technology Policy,
Executive Office of the President of the United States

Office of the Under Secretary of Defense for Research and Engineering

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# Department of Defense Implementation of Gold Standard Science

## I. Summary

The Department of Defense (DoD) is committed to scientific integrity and advancing evidence-based decision-making across the United States' Government, as described in Executive Order (E.O.) 14303. Many of the principles outlined in E.O. 14303 and the White House Office of Science and Technology Policy's (OSTP) Gold Standard Science framework are already embedded in DoD's research policies,[1] culture, and practices. This report outlines how DoD is incorporating the tenets of Gold Standard Science across its scientific enterprise, including efforts in policy updates, training, evaluation, and technology integration. It also identifies areas of opportunity and challenges in ensuring consistent implementation across the Department's diverse and mission-driven research environment. The Department's research efforts include academic performers conducting fundamental research as well as DoD Laboratories and DoD contractors conducting unclassified, controlled unclassified, and classified research.

## II. Alignment with the Tenets of Gold Standard Science

### 1. Reproducibility

DoD promotes reproducibility through policy requirements for data management and research documentation, and by encouraging public access to research findings where feasible. Peer-reviewed journal publications serve as key evidence of research quality. Researchers are required to report publications, technology transfer activities, and—if applicable—retractions. The Department monitors citation rates and publication metrics, recognizing that a large proportion of highly cited publications and few retractions are strong indicators of reproducibility and scientific rigor.

DoD requires any proposal that generates scientific data to have a data management plan. This management plan must describe the data generated through the course of the proposed research that will be shared and preserved and how this will be done. If applicable, the plan must also explain why data sharing or preservation is not possible or scientifically appropriate, or else the plan must explain why the costs of sharing or preservation are incommensurate with the value of doing so. This data management plan is evaluated along with the research proposal, and reviewers are asked to take the strength of the data management plan into account when reviewing a proposal. Public availability of DoD-funded data is also part of DoD Instruction (DoDI) 3200.12, "Scientific and Technical Information Program (STIP)." This approach helps

[1] See, e.g., DoD Instruction (DoDI) 3200.12, "Scientific and Technical Information Program (STIP);" DoDI 3200.20, "Scientific and Engineering Integrity;" DoDI 3210.07, "Research Integrity and Misconduct;" DoDI 3210.1, "Administration and Support of Basic Research by the Department of Defense;" DoDI 3216.02, "Protection of Human Subjects and Adherence to Ethical Standards in DoD-Conducted and -Supported Research;" and, DoD Manual 5000.102, Modeling and Simulation Verification, Validation, and Accreditation for Operational Test and Evaluation and Live Fire Test and Evaluation."

to ensure that raw data and code that contribute to research outcomes are captured to enable replication of a research result.

**2. Transparency**

DoD emphasizes research transparency through existing policies around data management plans and public access. Researchers are required to disclose results and supporting data in alignment with public access mandates, subject to security and classification considerations. Researchers are directed to produce data management plans that contain enough information, including methodologies and analytical tools, to allow outside users to reproduce research results. Publications in scientific journals are required to be submitted to DoD, which helps make clear the connection between DoD funded researchers and the research results. DoDI 3200.12 (enclosure 3, paragraph 3.a.; in accordance with DoDI 3200.20) states "a. In accordance with Reference (af), the DoD will maximize the free flow of scientific and engineering information developed by or for DoD to the public."

It needs to be highlighted that DoD research includes unclassified research, controlled unclassified research, and classified work performed at locations including universities and DoD Laboratories, and by personnel including DoD contractors. The Department considers transparency, and information and national security at an early stage when developing research projects and makes determinations about the availability of research results as early as the project planning stage.

**3. Communication of Error and Uncertainty**

DoD-funded programs include formal expectations for uncertainty characterization and error reporting—particularly in modeling, risk analysis, and system testing domains. For example, DoD Manual 5000.102 (paragraph 3.1.a) states "a. The planning, execution, and reporting of M&S VV&A will be based on the latest advances in science and technology to quantify the uncertainty in the M&S results." Communicating error and uncertainty is essential to the scientific method, and program officers within the Department are trained to seek the degree to which DoD researchers are certain of their results. Without proper uncertainty reporting, progress cannot be made in the disciplines researched by DoD. It is the expectation of the Department that error and uncertainty would be reported in all publications and reports resulting from DoD funded research.

**4. Collaboration and Interdisciplinarity**

The Department actively encourages collaborative and interdisciplinary work through its policies and program design. The Multidisciplinary University Research Initiative (MURI)[2] program is a flagship example, requiring teams of researchers from multiple disciplines to address complex problems which produce collective insights to advance emerging technologies and address the

[2] The MURI program is conducted by the basic research divisions (Army Research Office, Air Force Office of Scientific Research, Office of Naval Research) of the military service departments under the authority of section 4001 of Title 10, U.S. Code (U.S.C.).

Department's unique problem sets. The Defense Established Programs to Stimulate Competitive Research (DEPSCoR) is designed to foster collaboration to strengthen the research infrastructure at institutions of higher education in underutilized States. The Laboratory University Collaboration Initiative (LUCI)[3] program supports collaboration between DoD laboratory scientists and DoD-funded academics, introduces students to the DoD research environment, and facilitates collaborative work that addresses long-term DoD research needs.

In addition, DoD policy and culture encourages program officers to promote interdisciplinary teams during proposal review and award selection. Notably, the Department's research security policies affirm that collaboration—including international collaboration—should not be penalized and is often essential to advancing scientific excellence.

**5. Skepticism of Findings and Assumptions**

DoD's peer review and portfolio management practices foster a culture of critical inquiry and skepticism. Program managers are trained to rigorously evaluate assumptions, encourage replication, and weigh alternative hypotheses. Proposal review processes often include multiple stages of evaluation (i.e., white paper followed by full proposal) to ensure research concepts are robust and evidence based. Findings are typically[4] published for the public, which ensures accuracy and allows for community analysis of the research.

The Department also conducts regular program reviews to present findings to program officers and other experts in the field. DoD funds various approaches for a particular problem to minimize confirmation bias and varies investments across different programmatic approaches.

**6. Falsifiability**

The Department's scientific merit criteria emphasize hypothesis-driven research that is falsifiable and testable. DoD solicitations generally require that DoD-supported projects demonstrate clear research objectives and methods capable of generating confirmatory or contradictory results. This principle is reinforced through award solicitation language and panel review guidelines. For example, the following is language taken from a solicitation for a major DoD research program: "[proposals] should provide sufficient information on the research being proposed (e.g., hypothesis, theories, concepts, approaches, data measurements and analysis, etc.) to allow for an assessment by a technical expert."

Funding opportunities encourage research proposals to articulate clear, testable hypotheses with explicitly defined, measurable criteria for falsification supported by solid experimental designs and statistical methods. DoD prioritizes studies that advance knowledge through thorough testing and allow for rejection of hypotheses based on empirical evidence.

[3] The DEPSCoR and LUCI Programs are operated by the Basic Research Office within the Office of the Under Secretary of Defense for Research and Engineering under the authority of section 4001 of title 10, U.S.C.
[4] Exceptions would be limited to those items prohibited from disclosure by law or regulation. See, for example, https://www.acq.osd.mil/dpap/dars/pgi/docs/National_Security_Decision_Directive_189.pdf

DoD research laboratories provide test and evaluation of DoD technology to ensure technology is safe and ready for the Warfighter. Defense research generates new knowledge by anchoring scientific claims in testable, refutable predictions that promote rigor and prevent the perpetuation of unverified assumptions through systematic testing.

**7. Unbiased Peer Review**

Research awards are made through merit-based competition, a long-standing DoD policy (such as competition for agreements and contracts). Review panels include domain experts screened for conflicts of interest (COI), and program officers are trained in unbiased review practices. Program officers and reviewers are required to report COI and recuse themselves from any proposal reviews for which they are conflicted. Evaluation processes and review criteria are designed to minimize bias, ensure methodological rigor, and uphold scientific standards through objective scrutiny.

DoD's Standards of Conduct Office (as well as acquisition, agreement, contracting, and procurement regulations) provides guidance on conflict of interest; bias, training and educational materials; and resources on how to report bias and COI. The Department remains committed to ensuring fairness and scientific excellence in the evaluation of proposals.

**8. Valuing Negative Results**

The Department recognizes that negative findings are a vital part of the scientific process. DoD encourages publication in public-access journals or data repositories that support transparent documentation and sharing of null findings, recognizing these as meaningful contributions to knowledge generation that counter publication bias and provide valuable insights into ineffective approaches. Negative results guide future research directions and avoid redundant efforts. Program officers are instructed to assess the total scientific value of results regardless of outcome.

Reporting systems such as the Defense Technical Information Center's (DTIC) archive of DoD Grant Awards and DoD Science and Technology Reports[5] both positive and negative results to ensure that all outcomes contribute to cumulative scientific knowledge funded by the Department. DoDI 3200.12 (enclosure 2, paragraph 2.g.(5)) states "(5) The STI contains a summary of work accomplished, which includes negative and positive results and describes…"

**9. Avoiding Conflicts of Interest**

The Department has strong policies in place to prevent both COI and conflicts of commitment, including those involving potential foreign influence. Researchers are required to disclose financial and non-financial interests, and the Department collects and analyzes these disclosures using analytical tools accessing large scientific research databases for data analytics, publication reviews, and research security reviews to inform disclosures, analyze risk factors, and review research networks. Metrics are generated to track the number of proposals declined due to COI

[5] See https://discover.dtic.mil/products-services/

concerns, enabling the Department to monitor the scale and nature of these challenges. The Department is in the final stages of reissuing DoD Instruction 3210.07, "Research Integrity and Misconduct," which will provide further policy updates to the Department's research COI policies.

All DoD program officers receive training on managing scientific portfolios and training on COI identification. Additionally, the Department has partnered with the U.S. National Science Foundation (NSF) to develop researcher-facing training modules that integrate with responsible conduct of research programs. These modules help researchers recognize and appropriately manage potential conflicts.

## III. Evaluation, Metrics, and Technology Integration

### 1. Metrics and Evaluation Mechanisms

DoD is expanding its use of metrics to evaluate adherence to Gold Standard Science, including:

- Number and impact of peer-reviewed publications from DoD-funded research;
- Citation rates and instances of retraction;
- Proportion of interdisciplinary research projects and collaborations; and
- Number of proposals declined due to COI concerns.

These metrics are integrated into DoD's research management infrastructure and inform continuous improvement processes. The Department is exploring the use of automated tools and dashboards to improve tracking and transparency across Components. The Department will continue to examine potential metrics for ensuring that gold standard science continues to be the norm for DoD funded research efforts. In addition, E.O. 14303 section 7 requires that agencies "shall establish internal processes to evaluate alleged violations of the requirements of this order and other applicable agency policies governing the generation, use, interpretation, and communication of scientific information". Furthermore, agencies must designate a senior appointee to administer these processes. The Department designates the Assistant Secretary of Defense for Science and Technology within the Office of the Under Secretary of Defense for Research and Engineering for this oversight function.

### 2. Training and Resources

All DoD program officers complete training designed to support effective portfolio management, including modules on identifying and addressing potential COI. To further support scientific integrity, the Department is evaluating the need for developing new training materials on uncertainty communication, scientific rigor, and gold standard science principles.

In collaboration with NSF, DoD has also developed training resources for researchers. These resources are embedded within existing responsible conduct of research programs and focus on helping investigators recognize, avoid, and appropriately manage COI and commitment.

**3. Leveraging Technology**

DoD is leveraging advanced tools—including AI-enabled platforms—to support the implementation of Gold Standard Science. For example:

- Tools such as DimensionsAI assist in screening disclosures and identifying potential conflicts of interest and conflicts of commitment.
- Data analysis platforms help monitor publication trends, citation rates, and interdisciplinary research outputs.
- Natural language processing is being explored to extract and analyze scientific uncertainty language from research outputs.

These technologies improve both oversight and efficiency, allowing program officers and researchers to focus more time on science and less on compliance.

Automated data harvesting may be improved by using API integrations with research management systems; publication database mining for compliance metrics; citation network analysis for impact assessment; and social network analysis of collaboration patterns. The Department is examining options to improve the evaluation of its research programs using such tools.

**IV. Implementation Challenges**

While DoD has a strong foundation in scientific integrity, implementing gold standard science presents several challenges:

- **Promoting open fundamental research while protecting classified or sensitive work:** Some data and models cannot be publicly released due to information and national security restrictions; these include CUI and classified work. For such work, appropriate venues must be chosen to perform the work and protect the results of the work. The challenge for the Department here is in trying to ensure that appropriate protection or transparency measures are identified during project development and are monitored throughout a research project's lifecycle.
- **Cultural differences across research communities:** Practices vary between university-based basic research and applied or military laboratory work. Ensuring that gold standard science is implemented across these communities will at times require different sets of policies and trainings for tenets such as transparency and collaboration.
- **Administrative burden:** Additional documentation requirements to promote the evaluation of the tenets of Gold Standard Science must be balanced against resource constraints and the need to promote an efficient research environment.

The Department has long been familiar with the challenges surrounding national security research that runs from open to highly classified. The Department has well developed policies to address these challenges and continues to refine these to quickly develop national security technologies to deliver capabilities to the Warfighter.

**V. Conclusion**

DoD remains committed to upholding the principles of Gold Standard Science and is actively updating its policies, systems, and culture to reflect the expectations set forth in E.O. 14303 and the accompanying OSTP guidance. The Department will continue to collaborate with OSTP and other agencies to refine metrics, share lessons learned, and ensure accountability. This report will be published on a DoD website, in accordance with OSTP's guidance.