



## DoD INSTRUCTION 5000.94

# USE OF ROBOTIC SYSTEMS FOR MANUFACTURING AND SUSTAINMENT IN THE DoD

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**Originating Component:** Office of the Under Secretary of Defense for Acquisition and Sustainment

**Effective:** March 28, 2022

**Releasability:** Cleared for public release. Available on the Directives Division Website at <https://www.esd.whs.mil/DD/>.

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**Purpose:** In accordance with the authority in DoD Directives 5135.02, this issuance establishes policy, assigns responsibilities, and provides procedures regarding implementing and using robotic systems and automation within the DoD to manufacture, maintain, and sustain weapons systems.

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## SECTION 1: GENERAL ISSUANCE INFORMATION

### 1.1. APPLICABILITY.

This issuance applies to the OSD, the Military Departments (MILDEPs), the Office of the Chairman of the Joint Chiefs of Staff and the Joint Staff, the Combatant Commands, the Office of Inspector General of the Department of Defense, the Defense Agencies, the DoD Field Activities, and all other organizational entities within the DoD (referred to collectively in this issuance as the “DoD Components”).

### 1.2. POLICY.

The proliferation of robotics used within the manufacturing and sustainment communities continues to expand across the DoD. To coordinate these efforts among and across multiple life-cycle functional domains, it is DoD policy to:

- a. Prioritize using robotic capabilities in sustainment operations when the value proposition for automation results in increased productivity; improved quality, health, and safety; or reduced environmental impact.
- b. Incorporate robotic systems in support of weapon system manufacturing and sustainment throughout the acquisition life cycle for systems.
- c. Educate, train, and, where appropriate, certify the appropriate DoD workforce in robotic systems.
- d. Align manufacturing and sustainment robotic system activities across the DoD to cost-effectively speed up fielding and use.
- e. Ensure that robotic systems use standardized or interoperable systems, where appropriate, to increase cost savings and reduce fielding time and sustainment requirements.
- f. Collaborate and share technical, workforce, software, and operational best practices across the DoD, industry, academia, and other U.S. Government agencies and allies.
- g. Use a systems engineering approach to holistically determine the resourcing for the adoption of robotic capabilities to support robotic system implementation plans, programs, and requirements. Introduce robotic systems based on sound systems security engineering practices to ensure cyber resilience and cyber security considerations are applied throughout the life cycle.
- h. Resource the research and development (R&D) of advanced robotic systems and related technologies to modernize sustainment operations and field new weapons systems.
- i. Establish and maintain a secure and interoperable digital and cyber-physical infrastructure to implement robotic systems.

- j. Build and sustain a robust supply chain to support robotic systems across the defense industrial base.
- k. Ensure that joint planners understand sustainment requirements for robotic systems, including energy requirements.
- l. Acquire and access the intellectual property and data rights necessary to support using and sustaining robotic systems.
- m. Incentivize the private sector to develop sustainment robotic technologies and share these technologies with the DoD.
- n. Identify the cyber survivability risk categorization of robotics' operational systems in production to ensure proper protective measures are taken in designing, implementing, and sustaining robotic systems supporting the operational mission and supply chain.
- o. Establish disposal and reuse strategies or procedures for robotic systems at the end of life cycle.
- p. Developers and operators must comply with the records management requirements of DoD Instruction (DoDI) 5015.02.
- q. Recognize the joint robotics organization for building organic technologies (JROBOT) as the cross-DoD collaboration working group on robotic systems.

## SECTION 2: RESPONSIBILITIES

### 2.1. UNDER SECRETARY OF DEFENSE FOR ACQUISITION AND SUSTAINMENT (USD(A&S)).

The USD(A&S):

- a. Establishes, maintains, and monitors the implementation of policy for the use of robotic systems for manufacturing and sustainment in the DoD.
- b. Promotes integrating requirements for robotic systems into life cycle considerations and as part of the review process at each acquisition milestone.
- c. Establishes a framework and best practices for acquiring robotic systems across the DoD.
- d. Identifies an organizational focal point and lead from within their Component, that participates in JROBOT.
- e. Expands the doctrine, organization, training, materiel, leadership, education, personnel, facilities, and policy process to ensure that robotic systems are considered.
- f. Directs the Defense Acquisition University to provide robotic systems related training for all levels of acquisition certifications.
- g. Directs developing acquisition and sustainment (A&S) requirements to inform R&D activities related to robotic systems for manufacturing and sustainment in the DoD.
- h. Develops and publishes a DoD-wide strategy for robotic systems for A&S operations.
- i. When appropriate, transitions, maintains, and funds R&D for A&S operations.
- j. Informs the joint planning community of sustainment requirements associated with new robotic systems.
- k. Informs research and engineering R&D activities with requirements and need statements from the A&S enterprise.
- l. Promotes establishing and maintaining the cyber-physical infrastructure and risk management framework to support using robotic systems.
- m. Assesses the domestic robotic systems supply chain capability and develops industrial policy and guidance to ensure proper and uninterrupted capacity to support military operations.
- n. Directs the Defense Logistics Agency to oversee and deploy best practices for acquiring and managing common robotic systems and spares.

o. Establishes and monitors acquisition best practices for accessing intellectual property and data rights to support robotic systems sustainment operations.

p. Directs developing requirements and oversees implementing environmental assessments, in accordance with Military Standard MIL-STD-882E to support sustainment operations for robotic systems.

## **2.2. UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING (R&E).**

The Under Secretary of Defense for (R&E):

a. Supports R&D and using robotic systems through organizational policies, guidance, and procedures within the R&E enterprise.

b. Engages with A&S communities to ensure that robotic systems are properly considered and promote robotics configuration management.

c. Coordinates the development of common technical standards for robotic systems and engagement with appropriate standard development organizations.

d. Coordinates developing standardized or interoperable robotic component technical standards and systems for use across the DoD.

e. Identifies an organizational lead and focal point, from within their Component, that participates in JROBOT.

f. Assists the USD(A&S) and the Secretaries of the MILDEPs in developing common technical training methods for robotic systems for manufacturing and sustainment.

g. Coordinates with USD(A&S) on transitioning research, developing, and testing related robotic systems technologies for dual-use sustainment applications.

h. Coordinates and integrates existing R&E priority robotic technology roadmaps (e.g., autonomy community of interest) and MILDEPs' robotic technology roadmaps to satisfy A&S requirements.

i. Maintains and invests in long-term strategic partnerships to develop and advance robotic system technology and workforce development.

j. Supports the USD(A&S) in assessing and establishing a technically capable and resilient robotic systems supply chain.

k. Integrates robotic system considerations into guidance and training. Requires that the applicable workforce is educated, trained, and certified, as appropriate.

### **2.3. UNDER SECRETARY OF DEFENSE FOR PERSONNEL AND READINESS.**

The Under Secretary of Defense for Personnel and Readiness directs requirements development and oversees implementing safety and occupational health assessments, in accordance with Military Standard MIL-STD-882E, to support A&S operations for robotic systems.

### **2.4. SECRETARIES OF THE MILDEPS AND DIRECTORS OF THE DEFENSE AGENCIES.**

The Secretaries of the MILDEPs and the Directors of the Defense Agencies:

- a. Develop and maintain robotic systems and automation policy, guidance, and plans throughout the life cycle for materiel solutions, including using robotic systems to support maintenance and sustainment in a contingency or combat environment.
- b. Conduct inspection and readiness reviews to inform robotic requirements for retooling and new systems, and report the results of these reviews to the USD(A&S).
- c. Conduct return on investment reviews of benefits derived from fielded robotic systems.
- d. Require program managers to conduct a cost-benefit and risk-mitigation analyses to consider and resource robotic technologies.
- e. Direct using best practices for acquisition language, commercial off-the-shelf systems, and components wherever possible.
- f. Direct using common technical standards and specifications with deviations by exception.
- g. Identify an organizational lead and focal point for robotic systems, from within their own Component, who will participate in JROBOT.
- h. Advance and sustain robotic systems by establishing organizational constructs that use accountability and governance to promote implementing and using robotic systems.
- i. Provide resources for the requirements and implementation of robotic systems, including personnel participating in developing common standards and specifications.
- j. Provide guidance and requirements oversight on whether the MILDEP or Defense Agency workforce is properly educated, trained, and certified for robotic systems, in accordance with a common set of requirements to address appropriate classroom and hands-on training.
- k. Support creating common technical training requirements across the DoD in conjunction with the OSD.
- l. Direct connecting R&D activities to support A&S operations using robotic systems and fund transitioning new technologies.

- m. Support developing DoD-wide robotics systems technology road maps and align R&D, test, and evaluation to these road maps and strategies. Leverage strategic partnerships to develop solutions to meet technical requirements as necessary.
- n. Establish and maintain cyber-physical infrastructure and security requirements necessary to deploy robotic systems in the organic industrial base.
- o. Direct, fund, and monitor intellectual property access and data rights necessary to support using robotic systems.
- p. Enable integrating robotic system and automation capabilities into enterprise architecture and supporting business systems and processes.
- q. Comply with applicable U.S. export laws, regulations, and DoD policy, including for international transfers, DoDI 2040.02, and Titles 15, 22, and 50, Code of Federal Regulations, when sharing best practices and related robotic technologies with allies.

## **2.5. CHAIRMAN OF THE JOINT CHIEFS OF STAFF.**

The Chairman of the Joint Chiefs of Staff:

- a. Guides the development of requirements documents and their associated capability requirements necessary to integrate robotic systems and procedures early in the life cycle of weapon systems.
- b. Identifies an organizational lead and focal point from within their Component to participate in JROBOT.
- c. Supports developing robotic systems training appropriate for Combatant Commands' personnel.
- d. Supports using robotics in forward-deployed or mobile maintenance operations.
- e. Coordinates cyber-physical security and infrastructure requirements across the MILDEPs for joint operations.
- f. Works with Service acquisition executives in determining the appropriateness of adding robotic system lines of effort within life cycle sustainment plans tied to joint programs.



## SECTION 3: GUIDANCE AND PROCEDURES

### 3.1. ROBOTIC SYSTEMS IN THE ACQUISITION LIFE CYCLE.

The Office of the USD(A&S), MILDEPs, and Defense Agencies will:

a. Consider robotic systems as part of the acquisition process for the middle-tier and major capability acquisition pathways. In particular, they will consider the impact that robotic systems may have on:

- (1) Weapons systems design.
- (2) Organic industrial base operations, including ongoing modernization efforts.
- (3) Maintaining technological capabilities.

b. Encourage life-cycle cost savings by considering using robotic systems and automation in sustainment and including appropriate language in acquisition contracts.

c. Through their program offices, consider, pursue, and when appropriate, resource designs for both manufacturing and repair solutions that integrate robotic technologies.

d. Collect only the robotic system technical data and acquire the rights in that data, together with associated computer software and software documentation and rights therein, necessary to satisfy defense agency needs in accordance with Subpart 227.71 and 227.72 of the Defense Federal Acquisition Regulation Supplement.

### 3.2. R&E.

The OSD, MILDEPs, and Defense Agencies will:

a. Require that robotic systems and automation processes comply with established configuration, change control, and parts management procedures.

b. Coordinate and use common standards, specifications, and technical approaches. Develop and participate in industry-based standards development organizations for hardware, software, and related technologies for robotic systems.

c. Use commercial off-the-shelf technologies whenever possible.

d. Leverage technology development organizations, such as the Advanced Robotics for Manufacturing Innovation Institute, to support the development, prototype, and transition of new robotic capabilities.

- e. Coordinate research and manufacturing with industry to support and engage the supply chain; use tools such as industry days and technical conferences to engage with the hardware and software industries.
- f. Streamline funding processes to support aligning resources using different contracting mechanisms to advance robotic systems.

### **3.3. ROBOTIC SYSTEMS INTEGRATION INTO THE SUPPLY CHAIN.**

The OSD, MILDEPs and Defense Agencies will:

- a. Collaborate to develop performance metrics to measure and report the effectiveness and resilience of planned, and implemented, integration of robotic systems into programs of record.
- b. Monitor usage, performance, and effectiveness of implementing robotic systems in the supply chain.
- c. Collaborate with each other and industry to:
  - (1) Encourage using robotic systems and automation in supply chain operations.
  - (2) Leverage government, industry, and academia expertise to establish a capable and resilient robotic systems supply chain.
  - (3) Develop and implement cybersecurity processes and standards to integrate robotic systems into the supply chain.

### **3.4. ROBOTIC SYSTEMS INTEGRATION INTO THE ORGANIC INDUSTRIAL BASE.**

The OSD, MILDEPs, Defense Agencies, and Joint Staff will:

- a. Create and staff dedicated robotic system and industrial control teams, where appropriate, and define or expand job roles to cover the skills required.
- b. Establish and use acquired robotic systems best practices and consider creating Defense Federal Acquisition Regulation Supplement and DoD Grant and Agreement Regulations provisions for robotic systems and automation to:
  - (1) Address operator training and technical support for robotic system installation and operations.
  - (2) Include input from affected operators and technicians.
  - (3) Address engineering and technical support to work with the organic industrial base production teams to optimize the automated process.

(4) Use commercial-off-the-shelf technologies whenever possible.

(5) Leverage industry best practices to develop and maintain DoD cybersecurity policy, standards, and guidelines that address robotic systems across the acquisition life cycle.

c. Coordinate with the OSD, MILDEPs, and Defense Agency Senior Information Security Officers to develop and implement standardized cyber-physical security guidance and procedures to authorize robotic systems.

d. Incorporate infrastructure upgrades to support robotics systems, including power and building designs and requirements.

e. Ensure that the digital and cyber infrastructure will support interoperable robotic systems across the A&S and R&E enterprises.

f. As appropriate, resource the development and integration of robotic systems to optimize weapon system sustainment cost.

### **3.5. TECHNICAL DATA MANAGEMENT.**

The OSD, MILDEPs, and Defense Agencies will:

a. Ensure that activities using robotic systems follow laws, regulations, policies, and relevant contract clauses regarding technical data and intellectual property rights in accordance with DoDI 5010.44.

b. Leverage DoD Intellectual Property Cadre resources in accordance with DoDI 5010.44.

c. Use model-based engineering manufacturing tools to advance robotic systems throughout the DoD.

### **3.6. SPECIFICATIONS AND STANDARDS.**

The OSD, MILDEPs, and Defense Agencies will:

a. Use common robotic system specifications and standards as much as possible.

b. Actively collaborate with industry to develop necessary robotic system specifications if they do not exist.

c. When reliance on common robotic system specifications and standards is not feasible, resource the development of military specifications and standards to meet DoD requirements.

d. Ensure applicable DoD cyber security and cyber resilience specifications and standards are met to protect advanced robotic systems.

### **3.7. TRAINING.**

The OSD, MILDEPs, and Defense Agencies will:

- a. Provide training and certification to personnel responsible for robotic systems, including managers, engineers, designers, operators, maintainers, and acquisition professionals.
- b. Develop the robotic systems body of knowledge with industry and align DoD training with stackable, industry-recognized, and nationally portable credentials and certifications.
- c. Create research and education opportunities to advance the state of the art and skill sets of the robotics field to benefit DoD Components.
- d. Develop and carry out workforce development plans to train personnel, including senior leadership, to have a knowledge base for robotic systems operations.
- e. Establish a common skill set, competencies, job requirements and descriptions for robotics-related personnel and occupational series.
- f. Develop and use common workforce development and training requirements, including hands-on and on-the-job training.
- g. Coordinate with key stakeholders and union representation, as appropriate, when developing training to support transitioning to automated processes.

### **3.8. COLLABORATION.**

The OSD, MILDEPs, Defense Agencies, and Joint Staff will:

- a. Collaborate with each other and share best practices for robotic systems through JROBOT and use a common data-management system to share information and best practices.
- b. Develop common robotic systems implementation and outcome metrics and deploy methods to track progress.

### **3.9. POLICY IMPLEMENTATION.**

The OSD, MILDEPs, and Defense Agencies will:

- a. Develop, maintain, and monitor implementation of organizational-level policies, guidance, and procedures necessary to carry out this issuance, identifying roles and responsibilities within the organizational operations down to the depot level.
- b. Develop and issue implementation plans in accordance with this issuance and in coordination with JROBOT within 1 year from the effective date of this issuance.

## GLOSSARY

### G.1. ACRONYMS.

| <b>ACRONYM</b> | <b>MEANING</b>  |
|----------------|---|
| A&S            | acquisition and sustainment                                   |
| DoDI           | DoD instruction   |
| JROBOT         | joint robotics organization for building organic technologies |
| MILDEP         | Military Department   |
| R&D            | research and development                                      |
| R&E            | research and engineering                                      |
| USD(A&S)       | Under Secretary of Defense for Acquisition and Sustainment    |

### G.2. DEFINITIONS.

These terms and their definitions are for the purpose of this issuance.

| <b>TERM</b>                  | <b>DEFINITION</b>   |
|------------------------------|---|
| <b>A&amp;S enterprise</b>    | The people, organizations, facilities, processes, and technology that support DoD A&S operations.   |
| <b>automation</b>            | The creation and application of technology to monitor and control the production and delivery of products and services with no or limited manual tasks or activities.   |
| <b>body of knowledge</b>     | A complete set of concepts, terms, and activities that make up a professional domain as defined by the relevant learned society or professional association.  |
| <b>cyber-physical</b>        | The systems composed of the interacting digital, analog, physical, and human components engineered for function through integrated physics and logic.   |
| <b>intellectual property</b> | A category of intangible personal property and associated legal rights consisting of products of the human intellect, source indicators in the marketplace, or certain other commercial interests. These rights are granted or recognized primarily through patent, copyright, trademark, |

| <b>TERM</b>                    | <b>DEFINITION</b>  |
|--------------------------------|--|
|                                | and trade secret law. Technical data rights, computer software and software documentation, and special works are government contract-designated categories of such property and rights.  |
| <b>model-based engineering</b> | An approach to maintaining a record of authority that is based on digital computer models instead of documents, managed in a data-rich environment beginning in the conceptual design phase, and continuing throughout development and later life cycle phases.  |
| <b>organic industrial base</b> | Composed of resource providers, A&S planners, and manufacturing and maintenance performers belonging to the DoD. Maintenance depots, manufacturing arsenals, and ammunition plants are key components of the organic industrial base.  |
| <b>R&amp;E enterprise</b>      | The people, organizations, facilities, processes, and technology that support DoD R&E development.   |
| <b>robotic system</b>          | A programmable, multifunctional system designed to move material, parts, tools, or devices through variable programmed motions for the performance of various tasks in a manufacturing and/or sustainment environment. A robotic system typically includes a robot — a piece of equipment that has three or more degrees of movement or freedom, a programmable controller, an end tool, and the part or material. |

## REFERENCES

- Code of Federal Regulations, Title 15
- Code of Federal Regulations, Title 22
- Code of Federal Regulations, Title 50
- Defense Federal Acquisition Regulation Supplement, Subpart 227.71, “Rights in Technical Data,” December 28, 2017
- Defense Federal Acquisition Regulation Supplement, Subpart 227.72, “Rights in Computer Software and Computer Software Documentation,” September 23, 2016
- DoD Directive 5135.02, “Under Secretary of Defense for Acquisition and Sustainment (USD(A&S)),” July 15, 2020
- DoD Instruction 2040.02, “International Transfers of Technology, Articles, and Services,” March 27, 2014, as amended
- DoD Instruction 5010.44, “Intellectual Property (IP) Acquisition and Licensing,” October 16, 2019
- DoD Instruction 5015.02, “DoD Records Management Program,” February 24, 2015, as amended
- Military Standard MIL-STD-882E, “Standard Practice System Safety,” May 11, 2012
- National Institute of Standards and Technology Website, “Cyber-Physical Systems,” <https://www.nist.gov/el/cyber-physical-systems>