

AUTOMATED STORAGE RETRIEVAL SYSTEM SAFETY

CERTIFICATE

Certificate Number: PDR-ASRS-2024-0127

Issue Date: January 11, 2024

Expiration Date: January 11, 2025

System Location: Polar Dynamics Robotics Manufacturing Facility

Address: 4200 Arctic Way, Dover, Delaware 19901

1. CERTIFICATION STATEMENT

This Safety Certificate certifies that the Automated Storage Retrieval System ("ASRS") manufactured and operated by Polar Dynamics Robotics, Inc., a Delaware corporation ("PDR" or the "Company"), incorporating the IceNav(TM) AI Navigation Platform and CryoTech(TM) Actuator Systems, has been inspected, tested, and verified to meet or exceed all applicable safety standards and regulatory requirements for autonomous robotic systems operating in temperature-controlled environments.

2. SYSTEM SPECIFICATIONS

1. **System Identification**

- Model: PDR-ASRS-X500
- Serial Number: X500-2024-0089
- Manufacturing Date: December 15, 2023
- Operating Temperature Range: -40 C to +30 C
- Maximum Load Capacity: 1,500 kg

2. **Core Components**

- IceNav(TM) Navigation System Version 4.2
- CryoTech(TM) Actuator Array (Model CT-2023)
- Thermal Management System Series 7
- Emergency Stop Systems (Triple Redundant)
- Safety Light Curtains and Proximity Sensors

3. SAFETY STANDARDS COMPLIANCE

This ASRS has been certified to comply with the following standards:

1. **International Standards**

- ISO 13849-1:2015 Safety of machinery
- IEC 61508:2010 Functional safety
- ISO/TS 15066:2016 Robotics safety requirements
- EN 528:2021 Rail dependent storage and retrieval equipment

2. **National Standards**

- ANSI/RIA R15.06-2012 Industrial Robot Safety
- OSHA 29 CFR 1910.212 General machine guarding requirements
- NFPA 79 Electrical Standard for Industrial Machinery

4. SAFETY FEATURES VERIFICATION

1. **Emergency Systems**

- Emergency stop functionality verified across all operational temperatures
- Fail-safe braking systems tested under maximum load conditions
- Redundant power system cutoffs confirmed operational
- Emergency manual override systems validated

2. **Collision Avoidance**

- Multi-zone safety scanning system verified
- Dynamic path planning algorithms validated
- Object detection accuracy confirmed at all operating temperatures
- Minimum separation distance maintenance verified

3. **Environmental Protection**

- IP65 rating confirmed for all external components
- Condensation management systems verified
- Anti-icing measures tested under extreme conditions
- Thermal cycling endurance validated

5. TESTING METHODOLOGY

1. **Test Protocols**

- 500 hours of continuous operation testing completed
- Full-load testing under varying temperature conditions
- Emergency scenario simulation and response verification
- System recovery testing from power loss events

2. **Performance Metrics**

- Position accuracy: 2mm at all operating temperatures
- Emergency stop response time: <100ms
- Collision avoidance reaction time: <50ms
- System availability: 99.98%

6. CERTIFICATION AUTHORITY

This certification is issued under the authority of:

Dr. James Barrett

Chief Robotics Officer

Polar Dynamics Robotics, Inc.

Professional Engineer License #DE-PE-24578

7. TERMS AND CONDITIONS

1. This certification is valid for one year from the issue date, subject to:

- Regular maintenance as specified in PDR-ASRS-X500 Maintenance Manual
- No unauthorized modifications to the system
- Continuous monitoring and logging of safety parameters
- Quarterly safety audits by qualified personnel

2. This certification becomes void if:

- The system is modified without PDR authorization
- Required maintenance is not performed
- The system is operated outside specified parameters

- Safety-critical components are damaged or compromised

8. LEGAL DISCLAIMER

This certification represents compliance with safety standards as of the issue date. Polar Dynamics Robotics, Inc. assumes no liability for accidents or incidents resulting from improper use, maintenance, or modification of the certified system. All warranties and representations are subject to the terms and conditions set forth in the original purchase agreement and operating manual.

IN WITNESS WHEREOF, this Safety Certificate has been executed by the authorized representative of Polar Dynamics Robotics, Inc.

—

Dr. James Barrett

Chief Robotics Officer

Polar Dynamics Robotics, Inc.

Date: January 11, 2024

[CORPORATE SEAL]