

# **OPERATIONS DOCUMENT 410**

## **STANDARD OPERATING PROCEDURES FOR AUTONOMOUS MOBILE ROBOT DEPLOYMENT AND MAINTENANCE**

*Effective Date: January 1, 2024*

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### **1. PURPOSE AND SCOPE**

1. This Operations Document 410 ("Document") establishes the mandatory procedures and protocols for the deployment, operation, and maintenance of Polar Dynamics Robotics, Inc. ("Company") autonomous mobile robots ("AMRs") in temperature-controlled environments ranging from -40 C to +25 C.

2. This Document applies to all Company employees, contractors, and authorized third-party service providers involved in the deployment, operation, or maintenance of Company AMRs.

### **2. DEFINITIONS**

1. "IceNav System" means the Company's proprietary cold-environment navigation and operation platform.

2. "Critical Operating Parameters" means the set of environmental and performance metrics that must be maintained for safe AMR operation.

3. "Deployment Zone" means any customer facility or testing environment where Company AMRs are installed and operated.

### **3. PRE-DEPLOYMENT PROCEDURES**

#### **1. Environmental Assessment**

- a) Conduct full thermal mapping of deployment zone
- b) Document all thermal transition zones
- c) Verify floor surface conditions and friction coefficients
- d) Map RF interference patterns

- e) Document lighting conditions and variations

## 2. Infrastructure Verification

- a) Validate charging station locations and power requirements
- b) Confirm network coverage and redundancy
- c) Verify emergency stop system placement
- d) Document safety barrier locations
- e) Assess ventilation system impact on operations

## 4. DEPLOYMENT PROTOCOLS

### 1. IceNav System Configuration

- a) Upload facility mapping data
- b) Configure thermal zone parameters
- c) Set mission-specific navigation protocols
- d) Establish emergency response patterns
- e) Calibrate sensor arrays for facility conditions

### 2. Safety Systems Validation

- a) Test all emergency stop functions
- b) Verify collision avoidance systems
- c) Validate thermal monitoring systems
- d) Confirm communication failsafes
- e) Document safety compliance metrics

## 5. MAINTENANCE REQUIREMENTS

### 1. Scheduled Maintenance

- a) Weekly sensor calibration checks
- b) Monthly actuator performance testing
- c) Quarterly thermal management system inspection
- d) Semi-annual battery system evaluation
- e) Annual full system certification

## 2. Condition-Based Maintenance

- a) Real-time performance monitoring
- b) Predictive maintenance scheduling
- c) Component wear tracking
- d) Environmental impact assessment
- e) System optimization updates

## **6. OPERATIONAL PARAMETERS**

### 1. The Company's AMRs shall maintain the following operational standards:

- a) Maximum speed: 2.0 meters per second
- b) Minimum operating temperature: -40 C
- c) Maximum payload capacity: 1,500 kg
- d) Battery runtime: 12 hours minimum
- e) Navigation accuracy: 5mm

### 2. Performance Monitoring

- a) Continuous telemetry recording
- b) Real-time performance analytics
- c) Environmental condition logging
- d) Safety incident tracking
- e) Efficiency metrics collection

## **7. COMPLIANCE AND REPORTING**

### 1. All AMR deployments must comply with:

- a) ANSI/RIA R15.08 safety standards
- b) ISO 10218-1:2011 robotics requirements
- c) Company safety protocols
- d) Local regulatory requirements
- e) Customer-specific safety standards

### 2. Required Documentation

- a) Daily operation logs

- b) Maintenance records
- c) Incident reports
- d) Performance analytics
- e) Compliance certifications

## **8. PROPRIETARY INFORMATION**

1. This Document contains confidential and proprietary information of Polar Dynamics Robotics, Inc. and may not be disclosed or reproduced without prior written authorization from the Company's Legal Department.

## **9. DOCUMENT CONTROL**

- 1. This Document shall be reviewed and updated annually or as required by operational changes.
- 2. The Chief Robotics Officer maintains ultimate authority over this Document.

## **APPROVAL AND EXECUTION**

APPROVED AND ADOPTED this 1st day of January, 2024.

POLAR DYNAMICS ROBOTICS, INC.

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