OPERATIONS DOCUMENT 396

STANDARD OPERATING PROCEDURES FOR AUTONOMOUS MOBILE ROBOT DEPLOYMENT AND MAINTENANCE IN TEMPERATURE-CONTROLLED ENVIRONMENTS

EFFECTIVE DATE: January 15, 2024

DOCUMENT VERSION: 3.2

SUPERSEDES: Operations Document 396 v3.1 (July 1, 2023)

CLASSIFICATION: Confidential - Internal Use Only

1. PURPOSE AND SCOPE

1. This Standard Operating Procedure ("SOP") establishes the mandatory operational protocols for the deployment, maintenance, and decommissioning 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 Series X-500 and X-700 AMR units incorporating IceNav(TM) navigation systems and ColdTech(TM) actuators manufactured after March 1, 2023.

2. DEFINITIONS

1. "Cold Chain Environment" means any controlled temperature environment below +5 C.

2. "Critical Operating Parameters" means the set of environmental and operational metrics defined in Appendix A that must be maintained for warranted operation.

3. "IceNav(TM) System" means the Company's proprietary cold-environment navigation and operation system, including all associated software, sensors, and control mechanisms.

4. "Qualified Personnel" means individuals who have completed the Company's Cold Environment Robotics Certification Program (CERCP-2023 or later).

3. PRE-DEPLOYMENT PROCEDURES

1. Environmental Assessment

a) Conduct full thermal mapping of deployment zone

b) Document all transition zones between temperature regions

c) Verify floor surface conditions meet specification SD-271

d) Validate wireless communication coverage throughout operational area

2. System Configuration

a) Upload facility-specific navigation maps

b) Configure thermal compensation parameters

c) Establish emergency shutdown protocols

d) Calibrate cold-environment sensors

4. OPERATIONAL REQUIREMENTS

1. Temperature Monitoring

a) Continuous monitoring of ambient temperature

b) Real-time actuator temperature tracking

c) Thermal gradient analysis at transition points

d) Recording of temperature excursions

2. Performance Parameters

a) Maximum operational speed in sub-zero environments

b) Load capacity adjustments for temperature ranges

c) Battery performance compensation factors

d) Navigation accuracy requirements

5. MAINTENANCE PROTOCOLS

1. Scheduled Maintenance

a) Weekly inspection of thermal management systems

b) Monthly calibration of temperature sensors

c) Quarterly actuator performance validation

d) Semi-annual IceNav(TM) system optimization

2. Emergency Procedures

a) Immediate response protocols for thermal anomalies

b) System recovery procedures after emergency shutdown

c) Backup operation protocols

d) Incident reporting requirements

6. SAFETY AND COMPLIANCE

1. The Company shall maintain compliance with all applicable safety standards, including:

a) ANSI/RIA R15.06-2012

b) ISO 10218-1:2011

c) EN 1525:1997

d) OSHA 29 CFR 1910.178

2. Safety Features

a) Emergency stop systems

b) Collision avoidance protocols

c) Thermal runaway protection

d) Personnel detection systems

7. DOCUMENTATION AND REPORTING

1. Required Documentation

a) Daily operational logs

b) Maintenance records

c) Incident reports

d) Performance metrics

2. Reporting Requirements

a) Monthly performance summaries

b) Quarterly compliance reports

c) Annual safety audits

d) Environmental impact assessments

8. LIABILITY AND INDEMNIFICATION

1. Operation of AMRs in violation of these procedures voids all warranties and service agreements.

2. The Company assumes no liability for damages resulting from:

a) Operation outside specified parameters

b) Modifications by unauthorized personnel

c) Failure to maintain required documentation

d) Non-compliance with maintenance schedules

9. AMENDMENTS AND UPDATES

1. This document may be amended only by authorized Company representatives.

2. All amendments must be documented and communicated to affected personnel within 24 hours.

AUTHORIZATION

APPROVED BY:

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Dr. Elena Frost

Chief Executive Officer

Polar Dynamics Robotics, Inc.

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Dr. James Barrett

Chief Robotics Officer

Polar Dynamics Robotics, Inc.

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