

# PDR-2023-001 ARCTIC NAVIGATION SYSTEM PERFORMANCE REPORT

## PDR-2023-001 ARCTIC NAVIGATION SYSTEM

CONFIDENTIAL AND PROPRIETARY

Polar Dynamics Robotics, Inc.

Date: December 15, 2023

### 1. EXECUTIVE SUMMARY

This Performance Report documents the testing and validation results of the Arctic Navigation System (ANS) Version 3.2, integrated with the BlueSky navigation technology platform. Testing was conducted between September 1, 2023, and November 30, 2023.

November 30, 2023, across multiple controlled environment facilities and deployment sites.

## 2. SYSTEM OVERVIEW

1. The Arctic Navigation System (ANS) comprises:

-

Proprietary cold-resistant LIDAR arrays (Model PDR-L420)

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Temperature-hardened inertial measurement units

-

BlueCore(TM) environmental compensation algorithms

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Redundant positioning systems with thermal protection

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Arctic-grade sensor fusion middleware

## 2. Test Configuration:

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Hardware Version: ANS-H.3.2.14

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Software Version: ANS-S.3.2.856

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BlueCore(TM) Integration Build: BC-2023.11.445

## 3. TESTING METHODOLOGY

### 1. Environmental Parameters:

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Temperature Range: +20 C to -40 C

- - 3 -

Humidity: 15% to 95% RH

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Operating Duration: 168 hours continuous

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Thermal Cycling: 50 complete cycles

## 2. Performance Metrics:

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Positioning Accuracy

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Path Planning Reliability

-

Obstacle Detection Rate

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System Response Time

-

Power Consumption Efficiency

-

Error Recovery Performance

## 4. TEST RESULTS

### 1. Positioning Accuracy

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Static Position Accuracy: 2.3cm at -30 C

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Dynamic Position Accuracy: 4.1cm at -30 C

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Drift Rate: 0.15cm/hour at -35 C

## 2. Navigation Performance

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Path Planning Success Rate: 99.7%

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Obstacle Avoidance Success Rate: 99.9%

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Average Route Optimization Time: 127ms

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Navigation Recovery Time: <2 seconds

## 3. System Reliability

-

Mean Time Between Failures (MTBF): 4,380 hours

-

System Availability: 99.95%

- - 6 -

Error Recovery Success Rate: 99.8%

## **5. ENVIRONMENTAL IMPACT ANALYSIS**

### **1. Temperature Effects**

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Operational efficiency maintained down to -38 C

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Thermal management system performance within specifications

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No significant degradation observed in sensor accuracy

### **2. Power Consumption**

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Average Power Draw: 142W at -30 C

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Peak Power Draw: 267W during rapid acceleration

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Standby Power: 28W with active thermal management

## **6. COMPLIANCE VERIFICATION**

### **1. Safety Standards**

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ISO 13849-1:2015 Performance Level D

-

IEC 61508 SIL 2 Certification

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ANSI/RIA R15.06-2012 Compliance



## 2. Environmental Standards

-

IP65 Rating Verified

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MIL-STD-810H Cold Operation Tests

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EN 60068-2-1 Cold Test Compliance

## 7. PERFORMANCE IMPROVEMENTS

### 1. Compared to Previous Version (3.1):

-

18% improvement in positioning accuracy

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23% reduction in power consumption

- - 9 -

35% faster path planning computation

-

42% reduction in error recovery time

## **8. KNOWN LIMITATIONS**

### **1. Operating Constraints:**

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Maximum safe operating temperature: -40 C

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Minimum visibility requirement: 5 meters

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Maximum acceleration: 2.1 m/s

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Battery life reduction of 15% at -35 C

## **9. RECOMMENDATIONS**

### **1. Implementation Guidelines:**

-

Maintain minimum 30-minute warm-up period

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Schedule preventive maintenance every 2,000 hours

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Implement recommended firmware updates within 14 days

-

Follow specified charging protocols for cold environments

## **10. CERTIFICATION**

This report accurately represents the performance characteristics of the Navigation System Version 3.2 as tested under controlled conditions. The data presented is derived from documented test procedures and verified measurements.

Certified by:

/s/ Dr. James Barrett

Dr. James Barrett

Chief Robotics Officer

Polar Dynamics Robotics, Inc.

/s/ Marcus Chen

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Chief Technology Officer

Polar Dynamics Robotics, Inc.

Date: December 15, 2023

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Document ID: PDR-2023-001

Version: 1.0

Classification: CONFIDENTIAL

