PDR-2023-991 ARCTIC NAVIGATION ACCURACY REPORT

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Polar Dynamics Robotics, Inc.

Technical Documentation - Confidential

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1. EXECUTIVE SUMMARY

This report documents the navigation accuracy testing results for Pola
Robotics' BlueCore(TM) autonomous navigation system operating in e
conditions. Testing was conducted between September 2023 and Dec

the Svalbard Test Facility (STF) in accordance with ISO 18646-2:2019 requirements for mobile robot performance.

2. TEST PARAMETERS

2.1 Environmental Conditions

- Temperature Range: -40 C to -15 C
- Wind Speed: 0-45 km/h
- Visibility: 5-500 meters
- Surface Conditions: Ice, packed snow, mixed terrain

2.2 Equipment Configuration

- Platform: PDR-X300 Arctic Series AMR
- Navigation System: BlueCore(TM) v4.2.1
- Sensor Suite:
- LiDAR: Frost-hardened 360 scanning (16-channel)
- Radar: Dual millimeter-wave units
- Visual: Cold-resistant stereoscopic cameras (4)
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IMU: Temperature-compensated inertial measurement unit

3. METHODOLOGY

3.1 Testing Protocol

Testing was conducted in accordance with PDR-STD-291 (Arctic Nav

Protocol) across 500 autonomous navigation cycles. Each cycle cons

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Point-to-point navigation (25m-500m)

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Obstacle avoidance scenarios

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Dynamic path planning

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Return-to-base procedures

3.2 Data Collection

Navigation accuracy was measured using:

- Real-time kinematic (RTK) GPS reference system
- Optical tracking stations
- Onboard telemetry logging
- Environmental condition monitoring

4. RESULTS

4.1 Position Accuracy

Mean position error: 2.3cm 0.5cm

- Maximum deviation: 4.7cm
- 95th percentile: 3.8cm
- Drift rate: <0.1cm/hour

4.2 Path Following

- Average cross-track error: 3.1cm
- Maximum cross-track error: 7.2cm
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Path completion rate: 99.7%

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Average velocity error: 0.05 m/s

4.3 Environmental Impact Analysis

Temperature correlation:

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-15 C to -25 C: Baseline performance

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-25 C to -35 C: 5% accuracy degradation

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-35 C to -40 C: 12% accuracy degradation

5. PERFORMANCE METRICS

5.1 Navīgation Success Rate

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Complete mission success: 98.4%

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Partial success (requiring minor corrections): 1.3%

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Mission abort rate: 0.3%

5.2 System Reliability

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Mean time between failures (MTBF): 2,180 hours

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System availability: 99.92%

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Recovery time from navigation errors: <2.5 seconds

6. COMPLIANCE VERIFICATION

6.1 Standard Conformance

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ISO 18646-2:2019: Compliant

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EN 1525:1997: Compliant

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ANSI/RIA R15.08-1-2020: Compliant

6.2 Safety Requirements

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Emergency stop function: Verified

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Obstacle detection range: Exceeds requirements by 150%

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Fail-safe behaviors: All test cases passed

7. CONCLUSIONS

The BlueCore(TM) navigation system demonstrates exceptional accu
reliability in arctic conditions, meeting or exceeding all specified perfo
requirements. The system maintains sub-5cm positioning accuracy ac
operational scenarios, with degraded but acceptable performance in e
conditions below -35 C.

8. RECOMMENDATIONS

Implement enhanced temperature compensation algorithms for opera

Upgrade radar filtering for improved performance in heavy snowfall

Deploy additional redundancy systems for extended operations beyon

9. CERTIFICATION

This report accurately represents the testing procedures and results o

during the arctic navigation accuracy assessment of the BlueCore(TM

Certified by:

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Svalbard Test Facility

Date: December 15, 2023

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