LOW-TEMPERATURE STRESS TEST RESULTS

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Test Report Number: PDR-LT-2023-142

Date of Testing: November 15-30, 2023

Location: Polar Dynamics Robotics Testing Facility, Minneapolis

Test Supervisor: Dr. Marcus Chen, CTO

Document Classification: Confidential & Proprietary

1. EXECUTIVE SUMMARY

This document presents the comprehensive results of low-temperatur

testing conducted on the BlueCore(TM) Generation 3.5 autonomous r
platform. Testing was performed in accordance with ISO 13849-1:201
requirements and internal Polar Dynamics Robotics testing protocols
PDR-TP-2023-07.

2. TEST SPECIFICATIONS

2.1 Test Units

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Serial Numbers: BC35-2311-001 through BC35-2311-005

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Firmware Version: 3.5.127

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Hardware Configuration: Standard Production Build

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BlueCore (TM) Navigation System Version: 2.3.44

2.2 Environmental Parameters

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Temperature Range: +20 C to -40 C

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Humidity Range: 15% to 85% RH

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Testing Duration: 360 hours continuous operation

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Atmospheric Pressure: 101.3 kPa 1 kPa

3. TEST METHODOLOGY

3.1 Temperature Cycling Protocol

Initial Stabilization: 4 hours at +20 C

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Ramp Down Rate: 2 C per minute

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Hold Times: 8 hours at each test point (-10 C, -20 C, -30 C, -40 C)

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Recovery Period: 6 hours at +20 C between cycles

3.2 Performance Metrics Monitored

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Navigation accuracy (1mm)

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Battery performance and charging cycles

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Motor torque output

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Sensor calibration stability

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Communication system latency

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Emergency stop functionality

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Obstacle detection accuracy

4. TEST RESULTS

4.1 Navigation System Performance

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Maintained 99.97% accuracy at -40 C

- Maximum deviation: 2.3mm at extreme temperatures
- No permanent calibration drift observed
- Successfully completed 1,000 autonomous navigation cycles

4.2 Power Systems

- Battery capacity retention: 94.3% at -40 C
- Charging efficiency: 91.2% at -40 C
- No thermal runaway events observed
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All cells within specified voltage parameters

4.3 Mechanical Systems

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Zero mechanical failures recorded

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Joint flexibility maintained within 98% of room temperature specificatio

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Lubricant viscosity remained within operational parameters

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No structural deformation observed

5. COMPLIANCE VERIFICATION

5.1 Safety Standards

Meets ISO 13849-1:2015 Performance Level 'd'

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Compliant with ANSI/RIA R15.06-2012

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Satisfies EN 61496-1:2013 requirements

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Exceeds internal PDR-SAF-2023-03 standards

5.2 Quality Assurance

All test procedures were witnessed and verified by:

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Internal QA Team Lead: Sarah Martinez

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External Certification Body: T V S D America

Technical Review Board: Dr. James Barrett

6. CONCLUSIONS

The BlueCore(TM) Generation 3.5 platform has demonstrated robust across all test parameters, exceeding design specifications for low-ter operation. All five test units completed the full test protocol without significant degradation in performance or safety systems.

7. LIMITATIONS AND DISCLAIMERS

This test report is provided for internal due diligence purposes only. T results contained herein are specific to the tested units and environme conditions described. Performance in actual deployment conditions m document contains confidential and proprietary information of Polar D

Robotics, Inc. and is protected under applicable intellectual property la

8. CERTIFICATION

The undersigned hereby certify that the test results contained in this r

are accurate and complete to the best of our knowledge.

Approved by:

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Dr. Marcus Chen

Chief Technology Officer

Date: December 15, 2023

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Dr. James Barrett

Chief Robotics Officer

Date: December 15, 2023

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Victoria Wells

Quality Assurance Director

Date: December 15, 2023

9. APPENDICES

Available upon request:

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Raw test data logs

Calibration certificates

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Environmental chamber certification

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Test equipment specifications

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Video documentation

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Sensor data recordings

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