

NATO Human Factors Study

HFM RTG 419



Engineered,
designed + built
in Canada.



HSB operators routinely face high, rapid-onset impacts (3-25+ g) causing fatigue, musculoskeletal injury, and possible TBIs.

The NATO Study standardizes collection of acceleration (HSB & operator) data to link impact characteristics with reported pain and identify harmful exposures.

Objectives to Establish

- 1 Incidence of impact induced injuries and cognitive symptoms among operators
- 2 Levels and characteristics of human impact-exposure at-sea
- 3 What levels and characteristics of impacts are sustainable vs injurious
- 4 Relevant recommendations for exposure during training and operations
- 5 Smart signal solutions for real-time operator guidance

NATO HUMAN FACTORS STUDY

NATO's HFM RTG-419 advances research on High Speed Boat operators' impact exposure and brain injury to improve safety and readiness in high-speed maritime operations.



NO INTERNET REQUIRED
NO CLOUD REQUIRED



Engineered,
designed + built
in Canada.

Prior to founding Barnacle, Brandon Wright, P.Eng, developed remote monitoring and surveillance equipment for the CIA, US Air Force, and Homeland Security.

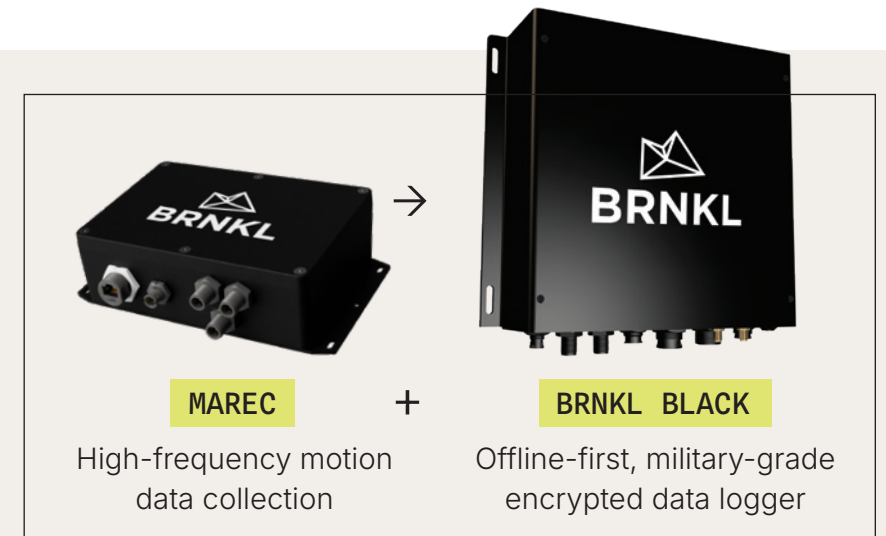
BARNACLE SYSTEMS INC.

Barnacle builds products that protect vessels and operators around the globe.

Barnacle delivers dual-use hardware and software solutions to militaries and government operators, setting the standard for safe, intelligent, mission-ready fleets.

NATO Study Package

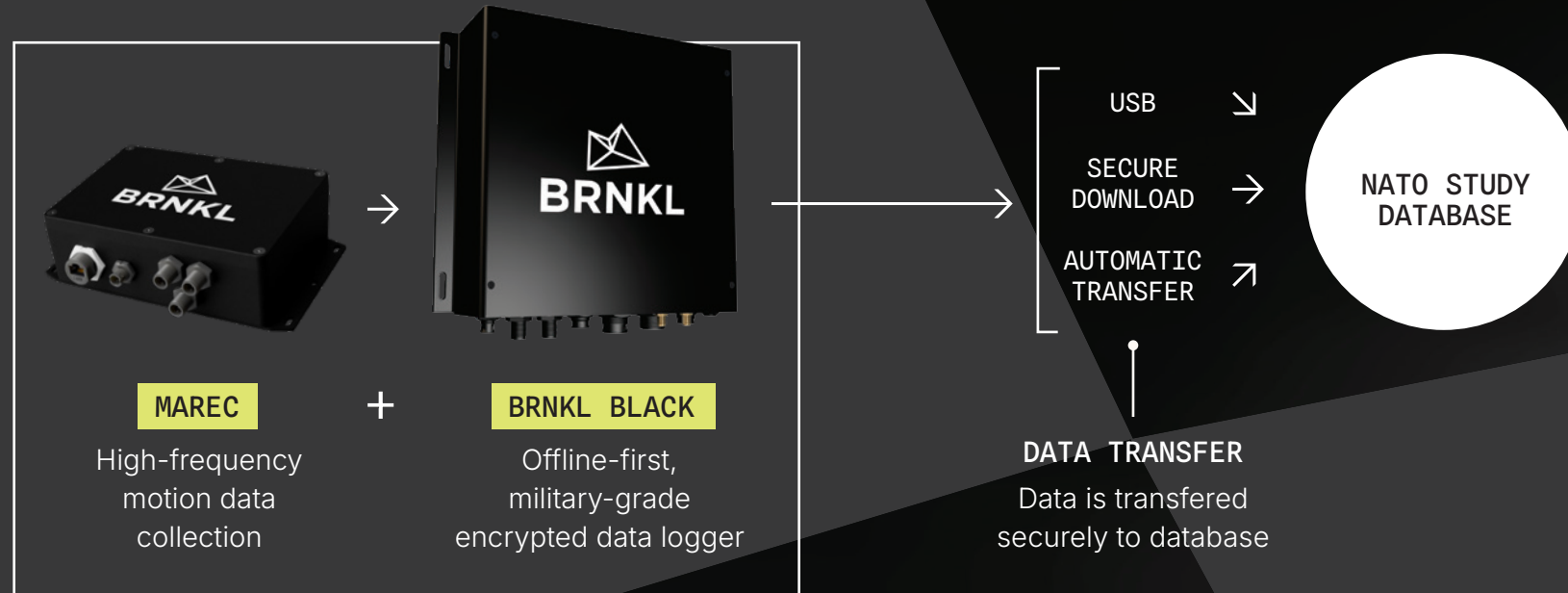
Our BRNKL Black + MAREC systems (NATO Study Package) are specified as the only approved hardware products in the NATO human factors program (HFM RTG 419).



NATO HFM RTG-419

The NATO Study Package

MAREC, paired with BRNKL Black, is the specified device for NATO HFM RTG-419, supporting standardized human factors measurement for high-speed craft and maritime operations.



The NATO Study Package is available in two applications:

FIXED INSTALL:



PORTABLE:



Learn more about HFM RTG-419, the BRNKL NATO package, and how to join the study.

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INSIDE THE BRNKL NATO STUDY PACKAGE

MAREC

High-Frequency Motion Data



MAREC supports standardized human factors measurement for high-speed craft and maritime operations. Paired with BRNKL Black, it logs a complete record of operator and vessel impact data.

MAREC captures high-resolution motion data using connected 3-axis accelerometers, enabling:



Whole Body Vibration (WBV) measurement



Shock and impact analysis



High-frequency motion capture

Acceleration data is collected from hulls, seats, and human bodies and transmitted to BRNKL Black, where it is fused with vessel data and GPS to create a single, time-synchronized mission record.

Multiple MAREC devices can be added to the network to expand sensor coverage and scale data collection across operators, seating positions, or the entire vessel.



Technical specifications

GENERAL

Dimensions	198mm x 119mm x 61mm
Weight	2.136 lbs
Temperature	-40C to +75C
Power Consumption	160mA @ 12VDC

CONNECTIONS

Accelerometer Inputs (3-Axis)	3 wired
Ethernet Port	1 wired
Power	1 wired (10-30V DC)

ACCELEROMETER SPECIFICATIONS

Dimensions	35mm x 35mm x 15mm
Mounting	Flange
Sample Rate	7 - 3,800 Hz
Accelerometer Range	+/- 19g

INCLUDED ACCESSORIES

3 Accelerometers with cables, power cable, installation guide



INSIDE THE BRNKL NATO STUDY PACKAGE

BRNKL Black

The "Black Box for Boats"



BRNKL Black is a mission critical black box for boats, delivering **offline-first intelligence** with military-grade encryption. In addition to its Nato Study data logging capabilities, it is engineered for predictive maintenance, human-factors monitoring, video recording, automated trip reporting, and synchronized mission playback — all in one secure solution.



DATA LOGGING



HUMAN FACTORS MONITORING



VIDEO RECORDING



PREDICTIVE MAINTENANCE



TRIP REPORTS



SYNCHRONIZED MISSION PLAYBACK

Technical specifications available at brnkl.io/brnkl-black/

Serving **navies, special forces, police, fire, and coast guards** around the globe, BRNKL Black secures vessels, protects operators, and optimizes maintenance for safe, intelligent, mission-ready fleets.



NO INTERNET REQUIRED
NO CLOUD REQUIRED



NATO STUDY PACKAGE: RECOMMENDED

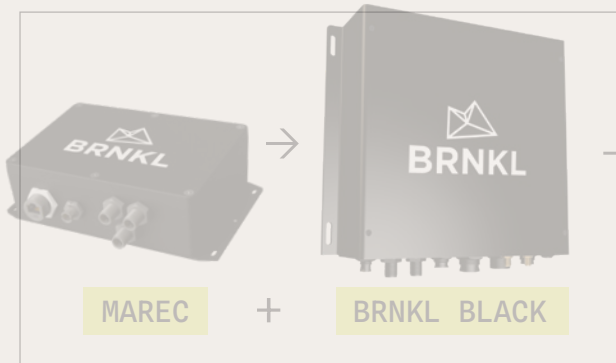
BRNKL Fleet

Safer missions. Longer equipment life.

BRNKL Fleet is an **optional** platform that ingests and contextualizes data from MAREC and BRNKL Black.



NATO Study Package



Data Analysis



Readiness + Maintenance

INCREASE FLEET READINESS:

- See what's mission-ready now, what's at risk, and where to focus.

REDUCE UNPLANNED DOWNTIME

- Use AI-driven, condition-based maintenance powered by real data.

OPERATE SECURELY IN ANY ENVIRONMENT

- Deploy offline on-premise or scale securely in the cloud.

Vibration + Impact Analysis

MAP IMPACT HOTSPOTS

- Identify high-impact areas, refine procedures, and reduce hull stress.

TRACK HULL, CREW, AND EQUIPMENT EXPOSURE

- Track impact and vibration exposure over time to monitor trends.

PREVENT DAMAGE FROM BECOMING DOWNTIME

- Detect early equipment impact and vibration patterns to prevent failures.



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