ELECTRONICS & DEFENSE

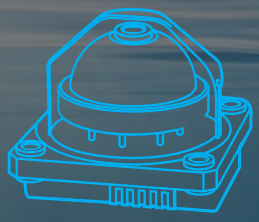
NAVAL NAVIGATION SOLUTIONS



SAFRAN

HRG*: THE COMBAT-PROVEN REFERENCE FOR RESILIENT INERTIAL NAVIGATION

25+ YEARS OF MASTERED HRG TECHNOLOGY



Field-proven HRG for all type of naval platforms





Combat-proven in extreme environments





Long-term guaranteed performance, maintenance-free





Hard-mounted, compact & robust navigation systems

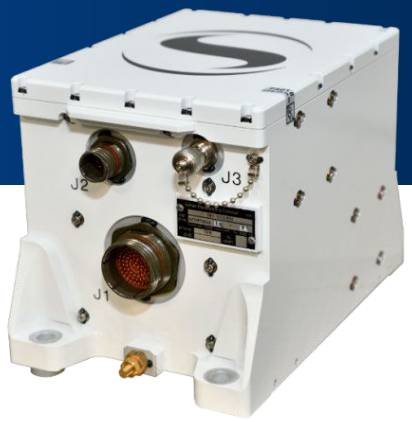


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*Hemispherical resonator gyroscope

GEONYX™ M

Inertial navigation system for amphibious vehicles, USVs and speed boats



GEONYX™ M provides attitudes and heading for systems such as **guns**, **rocket launchers**, **radars** & **observation sights** intended to be used on both **amphibious vehicles, USVs** and **speed boats**, with or without GNSS.

Easily integrated into any type of **vehicle** or **ship**, including amphibious as **primary AHRS/INS system**, GEONYX™ M is specifically designed to withstand **stringent environmental** conditions such as **vibrations**, **shocks**, climate and **radio-environment**. Thanks to the embedded **HRG CRYSTAL™**, **GEONYX™ M** is one the most **reliable INS** on the market.

HRG CRYSTAL™ Technology
Enables highly reliable inertial performance

NAVWAR Capacity
Resilient PNT against spoofing/jamming/meaconing threats

Amphibious Mission Ready
Designed for speed boats and amphibious vehicles

Console-Ready Integration
Fits directly into pilot consoles

ITAR-Free
Exportable solution without regulatory constraints

Shock & Vibration Resistant (MIL-STD)
Built for harsh mobile environments

100,000h Naval MTBF
Delivers strong long-term availability

Stand-Alone Operation
Requires no external navigation sensors







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NEW !

MICROGEONYX™ M

Miniaturized Inertial navigation System



The **MICROGEONYX™ M** is the **most compact INS** for its class of performance. It brings the **battle-proven performance** of the **GEONYX™ M** into a **miniaturized footprint**, specifically engineered for **space-constrained platforms** where **SWaP-C** is a **critical** constraint.

Powered by **HRG CRYSTAL™** technology, this **navigation-grade** system delivers **reliable**, **high-precision** inertial **navigation** and **positioning** in demanding operational environments. Its **optimized design** supports **seamless integration** for **navigation purposes** across **many different naval platforms** and **mission-critical** onboard systems.

Reduced SWaP Architecture
Navigation-grade performance in a compact footprint

NAVWAR Capacity
Resilient PNT against spoofing and jamming threats

GEONYX™ M-Class Performance
High-end inertial capability for constrained platforms

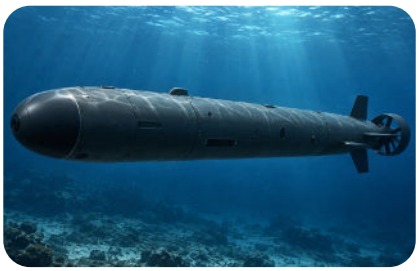
Very High Reliability
More than 100,000 hours MTBF

HRG CRYSTAL™ Technology
Robust and reliable inertial performance

Easy Platform Integration
CMS-ready with modern digital interfaces

Fast & Flexible Alignment
Rapid mission readiness with or without GNSS

Any-Orientation Mounting
Flexible installation in any orientation on naval platforms







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ARGONYX™

Inertial navigation system for surface vessels



Designed for **surface vessels**, from **patrol boats** to **aircraft carriers**, **ARGONYX™** inertial navigation systems provide **accurate attitudes & precise localization** for sensors stabilization & weapons alignment, even in **full GNSS denied environments**.

ARGONYX™ offers the **highest Mean Time Between Failure** (MTBF) of the market. It is indeed **maintenance free** thanks to its disruptive **HRG CRYSTAL™ technology**.

World's Lightest Naval INS
Delivers high performance under 14 kg

HRG CRYSTAL™ Technology
Enables maintenance-free inertial navigation

200,000h MTBF
Provides outstanding long-term reliability

ITAR-Free Design
Exportable solution without regulatory constraints

Full Naval MIL SPEC
Certified for demanding naval operations

Shock & Vibration Resistant
Built for harsh naval environments

Combat System Interface
Connects efficiently with CMS architectures

SIGMA 40 Interchangeability
Easily replaces legacy SIGMA 40 systems







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BLACK-ONYX™

High-performance inertial navigation systems for submarines



Dual-Core Option

BLACK-ONYX™ & **BLACK-ONYX™ Dual Core** inertial navigation system are designed for **all kinds** of **oceanic class submarines**. Thanks to the **HRG CRYSTAL™** inertial technology, these families offer the **highest autonomous** and **stealthiest navigation performance** ever reached in the market.

The **standard BLACK-ONYX™** system delivers advanced autonomous navigation performance tailored for **non-strategic submarines**. For **high-requirement missions**, the **BLACK-ONYX™ Dual Core** family increases these performance parameters to meet the **strict accuracy** specifications of the **most demanding submarine** applications.

HRG Dual Core Technology
Virtually unlimited operational lifetime

Magnetic Stress Immunity
Maintains performance under magnetic constraints

200,000h MTBF
Ensures outstanding long-term reliability

Long-Endurance Accuracy
Sustains accuracy from 1 Nm/4h to <1 Nm/360h

SIGMA 40 XP Interchangeability
Easily replaces legacy submarine INS

Totally Silent
Preserves acoustic stealth during missions

ITAR-Free Design
Supports flexible export and deployment

Integrity and operational efficiency
Accurate attitudes and precise localization for sensors stabilization and weapons employment



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ICONYX™ HP

Tactical Grade Inertial Measurement Unit



The **ICONYX™ HP** IMU, featuring Safran's **HRG CRYSTAL™ technology**, offers **unparalleled navigation performance** in GNSS-denied environments.

Designed for **precision** and **reliability**, ICONYX™ HP integrates **three HRG CRYSTAL™ gyroscopes** and **three closed-loop MEMS accelerometers**, delivering exceptional accuracy in a compact package.

With **best-in-class SWaP** (Size, Weight, and Power) characteristics, ICONYX™ is an ideal choice for **demanding missions** requiring **proven, combat-tested technology**.

Tactical-Grade Precision

High-performance guidance for demanding missions

Combat-Proven HRG

Superior accuracy with proven gyro technology

GNSS-Denied Capability

Reliable operation in contested environments

Compact High-End Design

Top-tier performance in a compact form

Extreme Environment Readiness

Maintains high performance in harsh conditions

Mission-Tailored Range

HP-15, HP-30 and HP-100 tailored to different needs

Fully Controlled Technology

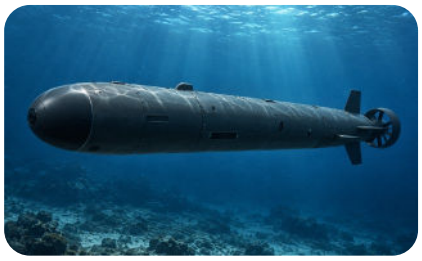
100% in-house design and supply chain

ITAR-Free Design

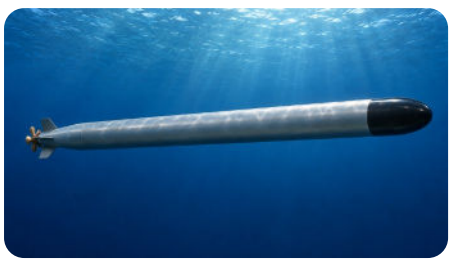
Exportable solution without constraints



Safran proposes an IMU based on **Hemispherical Resonator Gyroscope**, the HRG CRYSTAL™. This **technology** is **combat proven** for **15 years** and is extremely accurate, reliable and can navigate in the most contested GNSS-denied environments.







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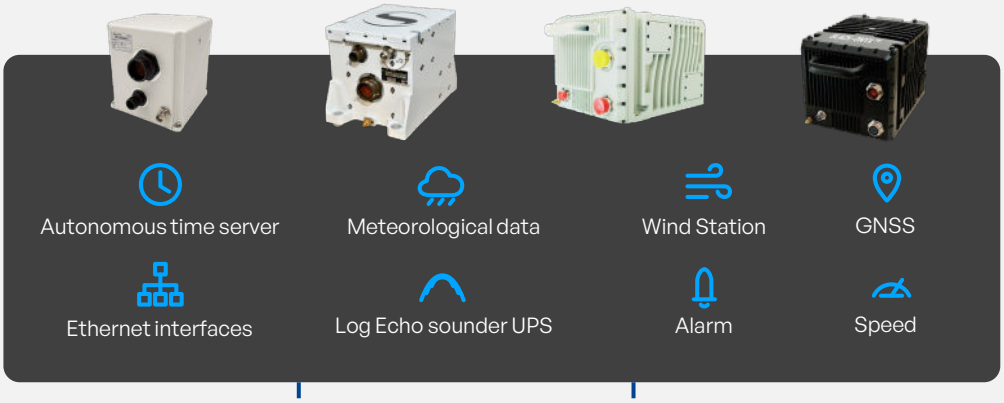
NAVPULSE™

Naval Data Distribution Unit for Surface and Submarine platforms



NAVPULSE™ is a cutting-edge **Navigation Data Distribution Unit** that receives, processes and distributes data from all onboard sensors, delivering highly accurate timing, attitude and navigation information throughout the platform.

Adaptable to **surface vessels and submarines**, NAVPULSE™ ensures resilient operation in **GNSS-denied environments** through advanced **Interference Detection and Mitigation** (IDM) capabilities, with optional **OS hardening** for enhanced cybersecurity.



Sensor data & status acquisition

Data processing
(hybridization, health monitoring, automatic or manual sensor selection, etc.)

Data distribution



Autonomous time server
(time clock generator, time supervision, time stamp management)

User interface
(CDU, navigation system configuration & command, Graphical User Interface)

Bridge

Optronics

Combat Management System

Aircraft Alignment

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OUR NAVAL REFERENCES

40 Navies

equipped with Safran's inertial systems worldwide

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SURFACE INS PORTFOLIO



	GEONYX-M Family		ARGONYX Family		
	MICRO GEONYX-M	**GEONYX-M**	**SP**	**HP**	**XP**
Weight Size Consumption	< 3 kg 120x120x130 mm < 15 W	6.4 kg 245x158x169 mm < 17 W	< 14 kg 253 x 262 x 414 mm < 25 W		
Interfaces	• EMBEDDED GNSS (external GNSS possible) • CANBUS • Ethernet • RS-422		• New user friendly HMI • Optimized interface with CMS • Ethernet, RS-422, NMEA • Flexible interface Library		
Certifications	• Environnement MIL-STD-810G • Electrical I/F MIL-STD-1275 • EMC MIL-STD-461G		• Shock: MIL-STD-810G & MIL-S-901D • Vibration (w/o external dampers): IEC 60945 & MIL-STD-167-1 • Electromagnetic: MIL-STD-461G • Temperature: -10˚C to +55˚C (operation) ; -40˚C to +70˚C (storage) • IMO / WheelMark		
Position*	1Nm/12h		1Nm/4h 1Nm/8h 1Nm/16h	1Nm/24h	1Nm/48h 1Nm/72h
Heading (°seclat RMS)	0.02		0.01		
Roll & Pitch (°RMS)	0.03		0.01		
MTBF	> 100,000 H		> 200,000 H		

*TDRMS

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UNDERWATER INS PORTFOLIO



	BLACK-ONYX Family					
	SP	**HP**	**XP**	**Dual-Core SP**	**Dual-Core HP**	**Dual-Core XP**
Weight Size Consumption	< 18 kg 253 x 262 x 414 mm < 25 W			< 25 kg 253 x 262 x 414 mm < 50 W		
Interfaces	• New user friendly HMI • Optimized interface with CMS • Ethernet, RS-422, NMEA • Flexible interface Library					
Certifications	• Shock: MIL-STD-810G & MIL-S-901D • Vibration (w/o external dampers): IEC 60945 & MIL-STD-167-1 • Electromagnetic: MIL-STD-461G • Temperature: -10˚C to +55˚C (operation) ; -40˚C to +70˚C (storage) • IMO / WheelMark					
Position*	1Nm/4h 1Nm/8h 1Nm/16h	1Nm/24h	1Nm/48h 1Nm/72h	1Nm/96h 1Nm/120h	1Nm/240h	1Nm/360h
Heading (°seclat RMS)	0.01					
Roll & Pitch (°RMS)	0.01					
MTBF	> 200,000 h					

*TDRMS

SAFRAN

OUR SUPPORT SOLUTIONS

Safran Electronics & Defense offers **flexible training programs** and **cost-effective service support** to assist you in your operations.

Thanks to **HRG CRYSTAL™ reliability**, **ARGONYX™**, **BLACK-ONYX™** and **BLACK-ONYX™ Dual Core** families have the **best life-cycle costs** on the market. This allows Safran to propose **innovative support solutions** that will boost your **vessels** and **submarines' availability** rate.

SUPPORT ARCHITECTURE

01 INTEGRATION

Worldwide strategic partnerships with companies that can perform product integration on any platform.

02 TRAINING

- Operating training
- Maintenance training
- Trouble shooting & corrective training

03 WORLDWIDE SUPPORT

- Help desk and hotline
- Local service center
- Field service representative

04 INTEGRATED LOGISTICS SUPPORT

- Customer configuration management
- Engineering change management
- Obsolescence management
- On site technical assistance

05 TRANSFER OF KNOW-HOW

- Co-operation w/ local partners
- Transfer of maintenance
- Offset

06 LOCAL DEVELOPMENT & MANUFACTURING

- Tailored specifications (HMI*, etc.)
- In depth manufacturing



SIGMA 40 RLG

MAINTAINING THE NAVAL INS REFERENCE

As the **world reference** in **naval applications**, **Sigma 40** continues to be **manufactured** and **supported** by Safran. Reflecting Safran's commitment to **flexibility**, interchangeability between **SIGMA 40** and **ARGONYX™** & **BLACK-ONYX™** provides customers with a wide range of options while **facilitating the integration** of the next generation of disruptive Inertial Navigation Systems.

HRG CRYSTAL™ reliability | optimized life-cycle cost | increased vessel & submarine availability

SAFRAN

POWERED BY TRUST

SAFRAN