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# Inertial Navigation System Inspection and Detection of Evolving Roles (INSIDER)

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**Topic Number:** N201-085

**SYSCOM:** Strategic Systems Programs (SSP)

**Program Sponsor:** Strategic Systems Programs-Navgation Branch

## Other Potential Programs:

Naval Air Warfare Center, Office of Naval Research, Naval Sea Systems Command

**Current TRL:** 5

**Projected TRL:** 6 / Q2 2024

## Keywords:

Inertial navigation systems, fault detection, CBM, reliability, navigation

## THE CHALLENGE

Subtle degradations in Inertial Navigation Systems (INS) can result in large navigation errors. Identifying sensor anomalies on existing INS systems is labor intensive and relies on analyst skill, memory, and alertness. Current analysis methods cannot be completed in real time and faults may remain undetected, degrading current and future INS performance and reliability.

## THE INNOVATION

INSIDER uses advanced artificial intelligence/machine learning methods to autonomously detect INS degradations. During Phase II, Boston Fusion will transition INSIDER to shore-side laboratories to augment post-patrol data analysis. Ultimately, INSIDER will transition to operational units to provide real-time anomaly detection and fault analysis.

## THE NAVY BENEFIT

INSIDER will dramatically decrease the person-hours required to identify and assess anomalies. INSIDER will support better Condition Based Maintenance (CBM) through early identification of subtle faults and will lower false detection rates, leading to improved scheduling of corrective maintenance. These improvements will reduce the rate of in-service failures and support decision-making that optimizes maintenance planning and lifecycle management. INSIDER will increase the reliability of inertial navigation and decrease interdependency on other navigational methods.

## THE FUTURE

In FY24, INSIDER will be installed shore-side for post-patrol analysis of INS data. INSIDER's performance on INS post-patrol analysis will inform future research to improve INSIDER sensitivity and accuracy. Further research to incorporate equipment condition sensors will expand the types of detectable faults and enable full CBM+ monitoring. Ultimately, INSIDER will be hardened, tested, and certified for integration into current and future Navy vessels. INSIDER technology is applicable to other INS applications where accurate navigation is required. Potential applications range from military aircraft to autonomous vehicles.

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2023 Navy Gold Coast | Jul 26 – 28, 2023