Proof of Concept: Change Detection Analysis in Island Areas of the South China Sea

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NEW SPACE INTELLIGENCE

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Takeaways

- Confirmed new land reclamation and facility construction on the southwestern part of Barque Canada Reef in the South China Sea, and successfully identified vessels potentially involved in these activities.
- Conducted an integrated analysis of land reclamation and facility construction status on islands using optical satellite data[1] and AIS (Automatic Identification System)[2] data.
- Based on the results of this PoC, further development of the service will continue.

1. Background and Positioning

1.1 Background of the PoC

In a world increasingly characterized by uncertainty and opacity, intelligence—information that supports decision-making based on objective evidence—is indispensable. Demand for intelligence derived from geospatial data, including satellite observations, continues to grow. Since 2024, Mitsubishi Research Institute, Inc. (MRI) and New Space Intelligence Inc. (NSI) have been jointly developing intelligence services utilizing satellite and related data for both domestic and international applications, combining their respective strengths. As part of this initiative, they have been conducting a Proof of Concept (PoC) focused on change detection analysis in island areas of the South China Sea.

1.2 Positioning of the PoC

The objective of this PoC is to verify the business feasibility of providing future change detection analysis services in island areas, which are of strategic importance to Japan. Under this objective, the PoC involved the collection and analysis of recent and past optical satellite data, real-time and archived AIS data, and up-to-date media reports, to assess ongoing changes in island regions of the South China Sea.

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[1] Optical satellite data with spatial resolutions of 10 meters and 0.3 meters was used.
[2] AIS (Automatic Identification System) data were provided by Kpler.

1.3 Reasons for Selecting the Analysis Area

In this PoC, island areas in the South China Sea were selected as the target region for change detection analysis. The South China Sea is a vital sea lane of communication (SLOC) for Japan, and changes occurring in its island areas could affect Japan's national security, economy, and other sectors. Consequently, both the public and private sectors maintain a high level of interest in developments within this region. Additionally, the South China Sea is a contested area where territorial claims over islands remain disputed among coastal states. For this reason, Southeast Asian countries and other littoral states are also closely monitoring developments in the region.

2. PoC Methodology

2.1 Selection of Target Islands

Among the islands in the South China Sea, four islands currently under active development by coastal states were selected as the targets for analysis, as shown in Table 1. Specifically, these are Sabina Shoal and Second Thomas Shoal, where territorial disputes between China and the Philippines are ongoing, and Barque Canada Reef and Pearson Reef, where Vietnam has been engaged in land reclamation and facility construction.

Table 1 Target Islands in the South China Sea Selected for Analysis

Island Name	Island Status
Sabina Shoal	Tensions have escalated since a collision occurred in 2024 between Chinese and Philippine coast guard vessels
Second Thomas Shoal	Since 2021, China and the Philippines have been in dispute over territorial claims, and in 2024, a Philippine vessel was damaged after being rammed by a Chinese vessel
Barque Canada Reef	Since 2024, Vietnam has been carrying out land reclamation and runway construction
Pearson Reef	Since 2024, Vietnam has been conducting land reclamation and runway construction on the western end of the reef.

2.2 Data Collection and Analysis

2.2.1 Change Detection of Land Reclamation and Facility Construction Using Satellite Data

Using satellite data from January 2024 to August 2025, changes on the

four selected islands in the South China Sea were detected and confirmed. Specifically, initial change detection was conducted using low-resolution optical satellite data (spatial resolution: 10 m) to identify areas exhibiting significant alterations in and around the islands. Subsequently, where changes were detected, the findings were verified and detailed using high-resolution optical satellite data (spatial resolution: 0.3 m).

2.2.2 Analysis of Vessels Involved in Land Reclamation and Facility Construction Using AIS Data

To identify vessels potentially involved in land reclamation and facility construction activities, AIS data for vessels approaching the four target islands during the period from January 2024 to August 2025 were analyzed. Specifically, the analysis focused on information contained in the AIS data, such as vessel type, flag state, and navigational tracks, in order to determine whether any vessels potentially involved with the China–Philippines territorial disputes or the land reclamation and construction activities by Vietnam were present or not.

2.2.3 Automated Collection of Media Reports Related to Island Changes Using "RoboRisa"[3]

To rapidly identify areas of analytical interest and to automatically collect media articles that contribute to a detailed understanding of changes detected through satellite data, the AI-driven web information collection service, "RoboRisa" was utilized[4]. Specifically, using "RoboRisa", news reports published by selected web media[5] sources between April and August 2025 were automatically collected, translated into Japanese, summarized, and compiled into a database in near real time (Figure 1). Subsequently, the system' s semantic search function (Figure 2) was used to confirm whether any reports existed concerning observed changes in

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[3] An AI service for 'automated information gathering and reporting' developed by Mitsubishi Research Institute. It utilizes AI/ChatGPT technology to automate information collection from the web and summarize the collected results, contributing to operational efficiency and improved research quality.

[4] Since December 2024, Mitsubishi Research Institute has been offering an AI risk monitoring service via "RoboRisa", which implements Key Risk Indicator (KRI) detection as an advanced feature. This service is provided as part of an 'intelligence platform' equipped with data collection and AI-driven analysis capabilities.

[5] Refers to official government and private media sources of the countries concerned with the South China Sea (China, the Philippines, and Vietnam).

the South China Sea, including the four target islands analyzed in this PoC.



Figure 1: Example of "RoboRisa" Service Interface



Figure 2: Example of Semantic Search Function

3. PoC Results

3.1 Overview

In this Proof of Concept (PoC), recent and past satellite data, along with real-time and archived AIS (Automatic Identification System) data, were collected and analyzed in an integrated manner. As a result, new land reclamation and facility construction were confirmed on the southwestern part of Barque Canada Reef in the South China Sea (Figure 3), and vessels potentially involved in these activities were identified.

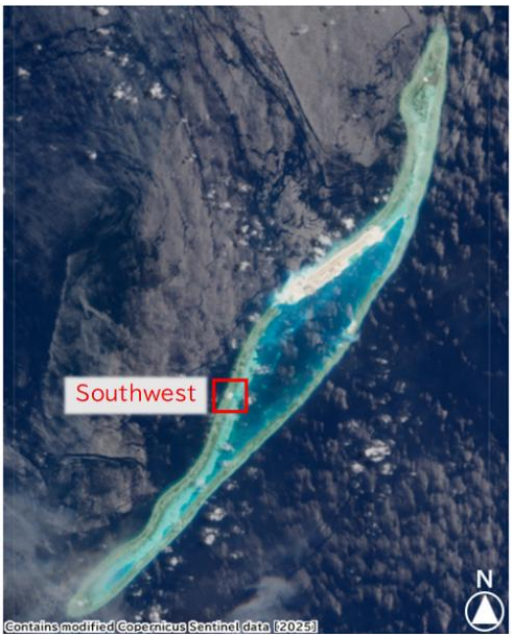

Figure 3: Overview of Barque Canada Reef (August 2025)

3.2 Details

3.2.1 Confirmation of New Land Reclamation and Facility Construction at Barque Canada Reef Using Satellite Data

Using low-resolution optical satellite data (spatial resolution: 10 m) to conduct change detection analysis on Barque Canada Reef, it was revealed, as shown in Figure 4, that new land reclamation had taken place on the southwestern part of the reef between October 2024 and May 2025. At the time this change was detected, no related reports had yet been published. Therefore, to verify the nature of the change, high-resolution optical satellite data (spatial resolution: 0.3 m) was analyzed. This confirmed that, in addition to the land reclamation, new facility construction[6] was also underway, as shown in Figure 5.

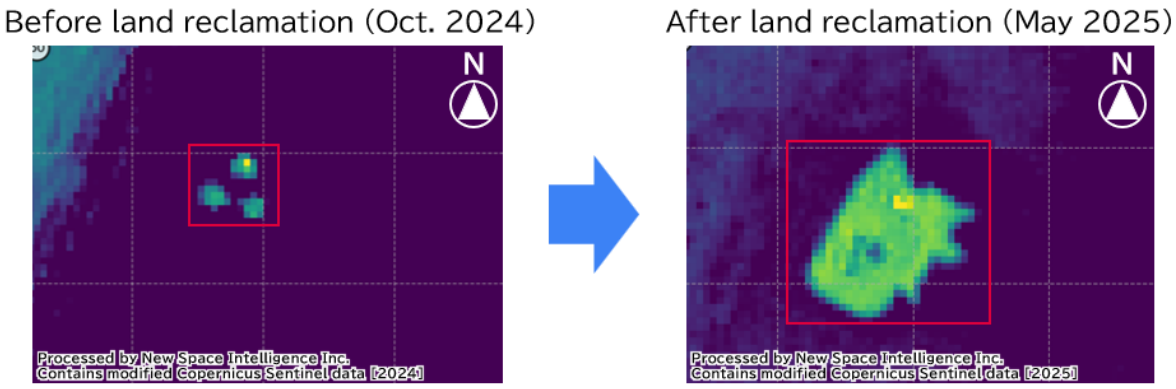

Figure 4: Detection Results for the Southwestern Area of Barque Canada Reef Using Low-Resolution Optical Satellite Data

[6] From visual analysis, the purpose or function of the constructed facility could not be inferred.



Figure 5: Confirmation Results for the Southwestern Area of Barque Canada Reef Using High-Resolution Optical Satellite Data (February 2025)

3.2.2 Identification of Potential Vessels Involved in the New Land Reclamation and Facility Construction Activities Using AIS Data

Based on the findings in Section 3.2.1, analysis of AIS data identified a previously unreported vessel potentially involved in the newly observed land reclamation and construction activities on the southwestern part of Barque Canada Reef. Although the vessel type could not be determined, as shown in Figure 6, the vessel was located near the site during the period when reclamation and construction were underway. The same vessel was also detected near Pearson Reef in October 2025, where similar activities were taking place. These findings suggest that the vessel may be associated with reclamation and construction activities in the South China Sea. Tracking this vessel using AIS data could potentially help identify additional, previously unreported activities in the region.

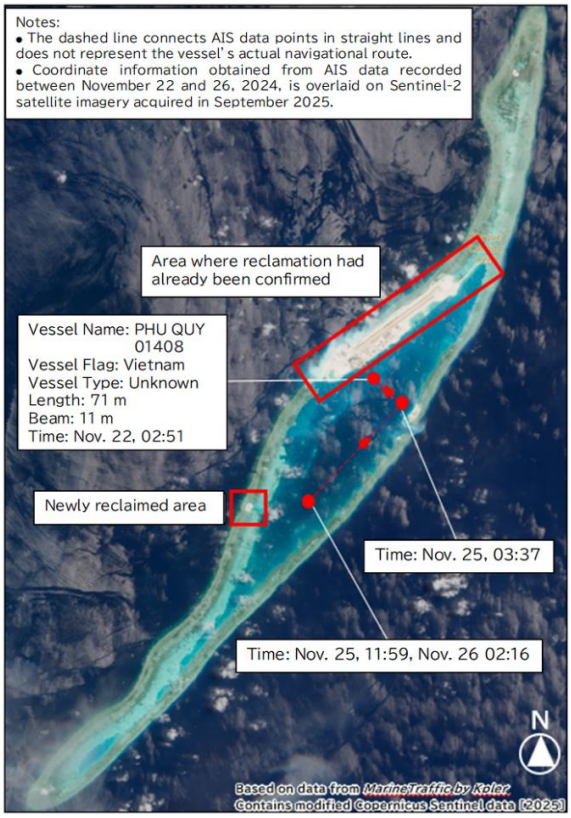

Figure 6: Navigational Track of the Vietnamese-Flagged Vessel Detected Near the Southwestern Area of Barque Canada Reef

3. 2. 3 Collection of Media Reports on Vessel Activities Around Target Islands Using "RoboRisa"

Using "RoboRisa", ten articles were identified that reported on vessel movements and related developments in the South China Sea. Among them, one article[7] covered vessel activities around Second Thomas Shoal, one of the target islands in this analysis. Such reports provide valuable information for satellite data tasking[8] and detailed interpretation of satellite data. However, no articles collected from the selected web media sources covered the new reclamation and construction activities at the southwestern part of Barque Canada Reef revealed through the satellite data and AIS data analysis (Sections 3.2.1 and 3.2.2). This indicates that the combined use of satellite data and AIS data enabled the acquisition of information not reported by publicly available media sources.

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[7] GMA News Online, "PH vows to defend sovereign rights over Ayungin amid increased Chinese presence" https://www.gmanetwork.com/news/topstories/nation/956728/ph-sovereign-rights-ayungin/story/ (Last accessed: October 7, 2025)

[8] Instructing a satellite to capture a specific location at a specific time.

4. Future Plans

Through this PoC, new land reclamation and facility construction were confirmed on the southwestern part of Barque Canada Reef, and vessels potentially involved in these activities were identified. As demonstrated in this PoC, by integrating publicly available information (media reports), satellite data, and vessel (AIS) data—a “multi-intelligence” approach—it is possible to detect and assess geopolitically significant activities at an early stage from multiple perspectives. Going forward, MRI and NSI will expand the analysis beyond the South China Sea to other regions of interest and continue advancing the development of this service.

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