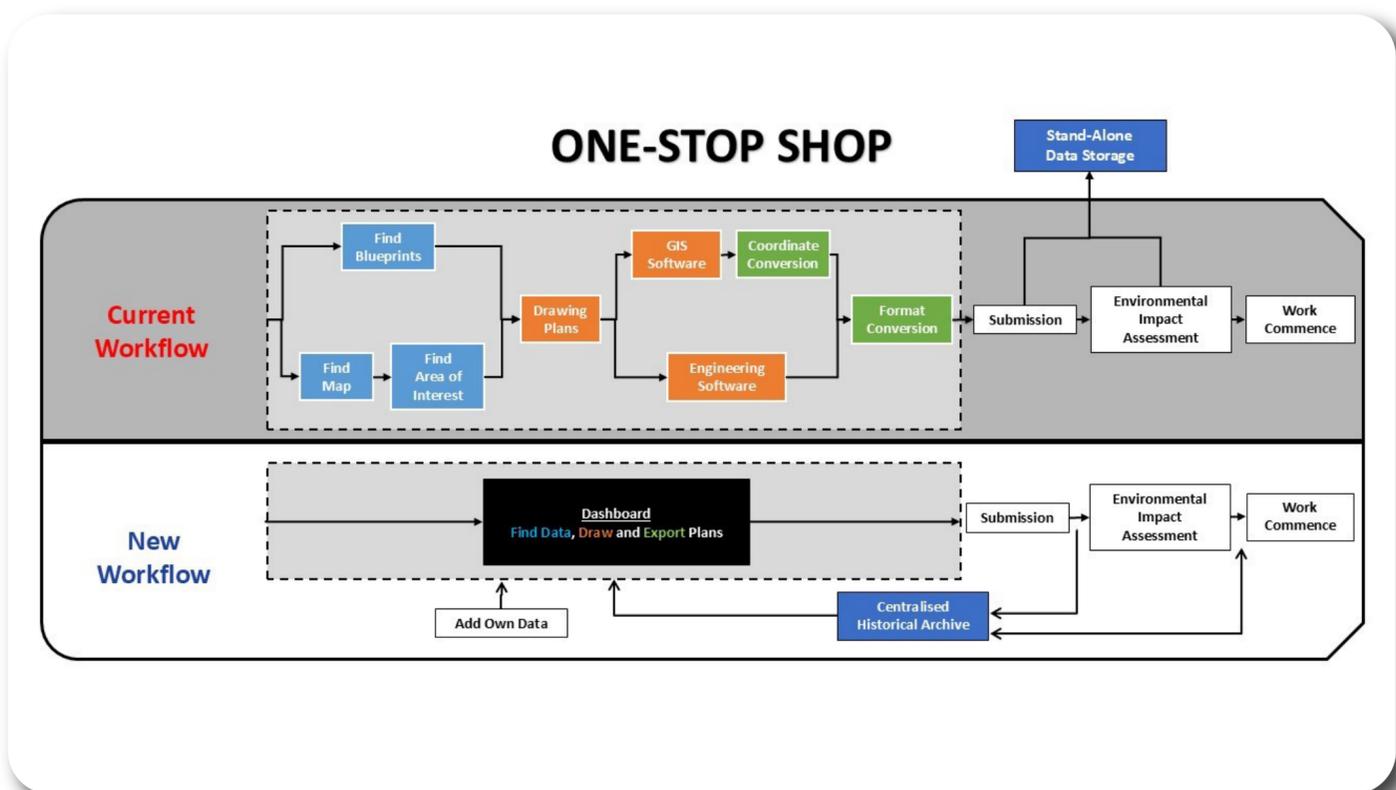


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MONITORING MARINE PROJECTS IN SINGAPORE WATERS



PROJECT TEAM



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IMPETUS FOR PROJECT

Singapore's waters are among the busiest and most constrained in the world. A wide range of activities such as shipping, port operations, bunkering, aquaculture, biodiversity conservation, coastal infrastructure, and leisure are all competing for the same limited sea space. In the past, these activities were managed through agency-specific systems designed for distinct operational needs. While effective within their own domains, these systems operate independently and do not provide a consolidated view of the wider maritime and coastal environment.

The operating environment has shifted. Maritime activity has grown in both pace and complexity. Vessel traffic is increasing, sub-sea developments are expanding, and sustainability imperatives are becoming more urgent. At the same time, land-sea interactions are deepening and require integrated approaches to planning that older systems were not designed to support. This evolving context highlights the limitations of traditional tools. Fragmentation across systems results in duplication of effort, repeated environmental assessments, overlapping data collection, and rising long-term costs to maintain multiple IT platforms.

The challenge today goes beyond efficiency. Singapore must be able to manage its limited sea space in a way that is safe, sustainable, and competitive. Without a shared platform, there is a real risk of slowing down critical national projects and constraining growth. What is needed is a holistic, digitally and spatially enabled platform that integrates marine data across agencies and creates a single source of truth. Such a platform will strengthen coordination in the present and build new capabilities for the future. It will provide foresight, enable proactive planning, and support decision-making at a level of scale and sophistication that was not possible in the past. This will allow Singapore to stay ahead of growing maritime pressures and to capture new opportunities in sea space management.

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IMPETUS FOR PROJECT

Statement of Need:

There is a need for a consolidated, cross-agency platform to access marine and coastal project information, providing visibility across past, ongoing, and planned activities. The increasing pace and complexity of maritime activity have exposed gaps in coordination, foresight, and integrated planning that current systems cannot address. A platform of this kind would reduce duplication in data collection and infrastructure, support the creation of standardised datasets for reuse, and enable controlled sharing of sensitive or high-security information. This capability is essential to manage competing demands, anticipate future pressures, and make informed decisions in a rapidly evolving maritime environment.

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EXTENT OF INNOVATIVENESS

This project represents Singapore's first integrated, cross-agency platform for marine and coastal planning, redefining how the nation manages its increasingly complex sea space. By unifying hydrographic, operational, environmental, and other national datasets, it provides a holistic, authoritative view of past, ongoing, and planned activities, a perspective previously unavailable.

A key innovation is the consolidation of diverse datasets into a single web-based interface. This enables stakeholders to visualise past, ongoing, and planned activities, anticipate conflicts, and assess cumulative impacts. Previously, marine and coastal data were fragmented across separate, agency-specific systems, each with its own software and hardware, which increased duplication, repeated assessments, limited foresight, and poor coordination.

Another innovation lies in the platform's data handling and planning capabilities. Users can import data in multiple formats, layer it to establish geospatial context, and conduct preliminary project planning using drawing tools. The platform then produces geographically accurate outputs in a standardised format, supporting interoperability and data reuse. Traditional systems often locked data within closed software or specific formats, limiting collaboration and slowing coordination. This platform instead builds interoperability and transparency into its design.

The platform enables secure, cross-sector collaboration while protecting sensitive information. Sensitive datasets are not hosted centrally; only relevant parameters are displayed, allowing visibility without compromising safety or confidentiality. Interested parties can coordinate directly with these data owners when deeper access is required. Additionally, imported data exists only within the local instance and is not stored, ensuring confidential plans remain protected. This approach supports the FAIR-TLC (Findable, Accessible, Interoperable, Reusable – Traceable, Licensed, Connected) data principles by making information findable, accessible, interoperable, and reusable wherever appropriate, introducing a new method for collaboration while preserving security and operational control.

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EXTENT OF INNOVATIVENESS

Finally, the platform introduces a forward-looking perspective with spatial and temporal oversight. It provides time-aware insights that transform fragmented decision-making into proactive, coordinated action. Where agencies previously lacked a consolidated view of past, ongoing, and future activities, stakeholders can now consider cumulative impacts and anticipate developments over time, enabling strategic, long-term planning across the maritime domain.

Taken together, these innovations represent a step change in how sea space is managed. Instead of fragmented, reactive, and duplicative practices, Singapore now has a coordinated, holistic, and forward-looking platform, one that transforms maritime spatial planning into a proactive tool for sustainable and strategic national development.

Statement of Innovation Highlights:

This project represents a significant evolution in Singapore's management of its complex maritime and coastal domain, introducing a transformative platform where data integration, cross-sector collaboration, and foresight converge to enable sustainable, strategic, and anticipatory planning. By consolidating hydrographic, operational, environmental, and national datasets into a single web-based interface, the platform provides a holistic and authoritative view of Singapore's waters that was previously unavailable. It breaks down silos across government while beginning to incorporate research and industry partners, supports geospatial layering and time-aware analysis, enables preliminary project planning with standardised, interoperable outputs, and ensures secure, controlled access to sensitive data while upholding FAIR-TLC data principles. Unlike current fragmented, agency-specific systems that require dedicated software or hardware and offer only retrospective or limited views, this platform delivers an integrated, forward-looking, and widely accessible solution, setting a new standard for maritime spatial governance.

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IMPACT AND VALUE-CREATION

The application delivers tangible and measurable productivity and efficiency gains by consolidating historical, current, and planned marine and coastal project data into a single, time-aware dashboard. Agencies can quickly identify overlaps, avoid redundant work, and reduce cycle times for planning and approvals. Man-hours previously spent on repeated data collection, manual coordination, and data reconciliation are freed, allowing personnel to focus on higher-value tasks. As the system tracks more projects, these efficiency gains scale exponentially, creating additional operational capacity. Monetary savings are realised as existing datasets and prior environmental assessments can be reused, reducing the need for duplicate studies, while the platform also leverages existing infrastructure such as buoy deployments, sensors, and other monitoring assets to further enhance efficiency and reduce additional costs. The platform's intuitive, simplified design enables personnel without formal geospatial training to interact with spatial data, visualise project footprints, and develop geospatial competencies, fostering broader skills and capabilities across agencies.

The platform was developed using a user-centric approach, directly addressing the needs and challenges of agencies and personnel involved in marine and coastal planning. Feedback was gathered through the GeoSpace-Sea Steering Committee, Whole-of-Government geospatial meetings, and follow-up discussions with agencies to clarify requirements. Key pain points identified included software licensing restrictions, barriers to entry for smaller or specialised projects, limited awareness of existing works, challenges in sharing classified datasets, reliance on specialised planning tools, and diverse data formats received from contractors. By consolidating these inputs, the application prioritises accessibility, cross-agency visibility, and secure data sharing, ensuring the solution aligns closely with user needs and operational realities while enhancing efficiency, coordination, and collaboration.

Beyond operational efficiency, the platform creates strategic value for Singapore by fostering trust, transparency, and shared situational awareness among stakeholders. It enables anticipatory, forward-looking planning that supports national-level coastal and land development, aligns with sustainability objectives, and strengthens economic competitiveness. By transforming fragmented, reactive workflows into a coordinated, data-driven approach, the platform not only enhances governance but also builds enduring capabilities and competencies, establishing a new benchmark for maritime spatial planning and decision-making.

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PACT AND VALUE-CREATION

Outcome Statement:

This platform transforms Singapore's management of its maritime and coastal domain, converting fragmented, siloed operations into a fully digitised, optimised, and nationally integrated system. For the first time, our waters are mapped and visualised holistically, providing agencies with full oversight and enabling informed, forward-looking decisions. By consolidating historical, current, and planned project data, it reduces duplication, shortens approval cycles, improves coordination, and leverages existing infrastructure such as buoys and sensors. Its intuitive design builds geospatial capabilities across agencies while ensuring secure data sharing, transparency, and shared situational awareness. Beyond operational efficiency, it strengthens resilience, supports sustainable coastal and land development, enhances economic competitiveness, and establishes Singapore as a global leader in strategic maritime spatial governance.

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FEASIBILITY AND SCALABILITY

The project is highly feasible with current technology. The first iteration runs out-of-the-box, leveraging the existing GeoSpace-Sea 1.0 infrastructure, and remains fully functional, demonstrating that the platform operates effectively with current agency workflows and infrastructure. The platform already consolidated data from buoys, sensors, satellite imagery, and historical project records, and its standardised, interoperable design allows integration with other national and agency systems, such as the Dumping Management System or environmental monitoring networks. Future enhancements in GeoSpace-Sea 2.0 will leverage updated technology, increase processing power, and a modular architecture to expand analytical capabilities, integrate additional datasets, and improve performance.

The platform can scale along multiple complementary tracks. **IT scaling** enables the system to process larger and more complex national and regional datasets and integrate multiple agency systems. **Functional scaling** allows near-real-time monitoring, predictive risk modelling, and scenario planning to support operational decision-making, environmental assessments, and anticipatory planning. Automatic Identification System (AIS) data can be incorporated as part of functional scaling to enhance vessel tracking and maritime situational awareness. **Multidomain scaling** can coordinate land, air, and maritime activities together, for example layering aviation height restrictions over land reclamation plans or synchronising port operations with transportation networks. **Regional scaling** can monitor transboundary environmental issues, support bilateral coordination, and leverage historical data for high- and low-risk area identification, informing both national and regional strategies.

By providing a single, integrated, time-aware view of complex maritime and coastal systems, the platform transforms management from fragmented, reactive workflows to coordinated, evidence-based decision-making. It unlocks operational, economic, and sustainability value, strengthens resilience and foresight, and positions Singapore as a national, regional, and global leader in strategic maritime spatial governance. Its modular, expandable framework ensures that these benefits can be scaled across sectors, domains, and borders, setting a benchmark for integrated coastal and maritime management in the region.

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FEASIBILITY AND SCALABILITY

Potential of Project:

Currently in its first iteration, the platform has demonstrated feasibility and initial impact, running out-of-the-box on the existing GeoSpace-Sea 1.0 infrastructure and consolidating marine and coastal data into a single, time-aware system. It can scale along multiple tracks: **IT scaling** to handle larger volumes of national and regional datasets and integrate additional systems; **functional scaling** to support near-real-time monitoring, using AI for predictive risk modelling, and scenario planning; **multidomain scaling** to coordinate land, air, and maritime activities; and **regional scaling** to monitor transboundary environmental issues, support bilateral coordination, and leverage historical data for strategic planning. By executing these scaling tracks, the platform can transform marine and coastal management, enable anticipatory, evidence-based decision-making, and position Singapore as a regional and global leader in integrated spatial governance.