Marine Plant Systems Pty Ltd

Business Case: Procurement and Installation of a Reverse Osmosis Plant On-Board a Ship

1. Introduction

This document presents a comprehensive business case for the procurement and installation of a reverse osmosis (RO) plant on-board a naval vessel. The primary objective of this project is to establish a reliable and independent source of potable water for the ship's crew and operational needs, thereby enhancing its self-sufficiency and reducing reliance on external supply chains. The increasing strategic importance of potable water independence for naval vessels cannot be overstated, particularly in the context of extended deployments, operations in remote regions, and potential disruptions to conventional supply methods. This business case will address the key requirements and considerations for this project, as specified by the stakeholders, including the manufacturer's demonstrated experience with naval forces, with a specific emphasis on references from the Royal Australian Navy (RAN). Furthermore, it will detail the critical aspects of equipment quality and safety, the availability of comprehensive after-sales support within Australia, the necessity of a robust crew training program, and the importance of annual equipment inspections conducted by the original equipment manufacturer (OEM) or their authorised Australian representatives. Finally, this document will assess the capability of potential manufacturers to supply and support other potable water equipment commonly utilised on-board naval vessels.

2. Executive Summary

The analysis detailed in this business case strongly supports the procurement and installation of an on-board reverse osmosis plant. This initiative represents a strategically sound investment that offers substantial long-term benefits to the vessel and the broader naval organisation. Achieving self-sufficiency in potable water production is of paramount importance, offering significant advantages in terms of operational independence, potential for considerable cost savings compared to the ongoing expense of external water procurement, and anticipated improvements in overall operational efficiency and the well-being of the ship's crew. The recommended approach involves a rigorous selection process for the RO plant manufacturer, prioritising those with proven naval experience, particularly with the Royal Australian Navy, and a commitment to high equipment quality and safety standards. Key considerations for successful implementation include securing readily available after-sales support within Australia, ensuring a thorough crew training program is in place, and establishing a schedule for regular annual inspections by the OEM or their Australian representatives. The financial projections indicate a positive return on investment over the lifespan of the RO plant, and comprehensive risk mitigation strategies have been identified to address potential challenges. In conclusion, the procurement and installation of a reverse osmosis plant is a strategically and economically justifiable project that will significantly enhance the vessel's operational capabilities and long-term sustainability.

3. Reasons for the Project

The imperative to install an on-board reverse osmosis plant stems from several critical operational and economic factors. Currently, the vessel relies on external sources for its potable water needs, a practice that presents inherent limitations and potential risks.

3.1 Operational Independence

Dependence on external potable water supplies introduces logistical complexities, considerable costs, and potential vulnerabilities, especially during extended deployments or when operating in remote geographical areas. Securing water from ports or water barges can be a time-consuming process, potentially impacting mission timelines and operational readiness. An on-board RO plant offers a continuous and independent source of freshwater, directly mitigating these logistical challenges and enhancing the vessel's autonomy [1]. This self-reliance is particularly crucial in scenarios where access to shore-based facilities is limited, unreliable, or even contested. Marine desalination systems are a needed water treatment solution for ships that spend a great deal of time out at sea, providing the means for crew members to produce fresh water for essential applications.

3.2 Cost Reduction

The financial implications of consistently procuring, transporting, and storing large volumes of potable water can be substantial over the operational life of a naval vessel. These expenses include the direct cost of the water itself, the fuel consumed by the vessel or support craft for transportation, personnel costs associated with the resupply process, and potential port fees incurred during water loading. Implementing an on-board RO plant has the potential to significantly reduce these recurring expenditures by utilising the readily available seawater as the raw water source [1]. Makers emphasise the cost-effectiveness of reverse osmosis in converting seawater to fresh drinking water. This shift from a continuous operational expense to a capital investment with lower ongoing operational costs presents a compelling financial argument for the project.

3.3 Enhanced Operational Efficiency

The necessity of making port calls or coordinating with water barges solely for the purpose of replenishing potable water supplies can detract from the vessel's primary operational objectives and reduce its overall efficiency. By enabling on-board water production, the RO plant eliminates these non-mission-critical stops or delays, thereby increasing the ship's operational tempo and flexibility [1]. This capability allows for more adaptable mission planning and execution, as the vessel is less constrained by the logistical requirements of water resupply. Makers underscores this benefit by mentioning the "Make Water Anywhere" capability of their systems, which greatly increases freshwater availability and allows ships to remain "on station" without needing to transit to shore for water.

3.4 Improved Crew Welfare

A consistent and high-quality supply of potable water is fundamental to the health, hygiene, and overall morale of the ship's crew. Adequate access to fresh water for drinking, sanitation, and personal hygiene contributes directly to their well-being and, consequently, to their operational effectiveness. An on-board RO plant ensures a reliable source of high-quality water, mitigating potential issues associated with the quality or availability of externally supplied water [1].

3.5 Water Scarcity and Contamination

Global concerns regarding the increasing scarcity of freshwater resources and the potential for contamination of shore-based water supplies further emphasise the strategic value of on-board desalination capabilities [1]. Reliance on potentially stressed or compromised external sources introduces a level of risk that can be effectively mitigated by the installation of an RO plant. Makers highlight risks associated with potable water hose handling and storage, suggesting potential contamination of external supplies. Makers also point to challenges in ensuring the quality of bunkered water. These factors underscore the prudence of establishing an independent, quality-controlled water source on-board.

This project aligns directly with the organisation's broader strategic objectives of enhancing operational capabilities, achieving long-term cost efficiencies, and ensuring the health and well-being of its personnel. The limitations and potential risks associated with the current reliance on external water supply, including logistical delays, quality control issues, and vulnerability to supply disruptions, necessitate a more resilient and self-sufficient approach. The increasing scarcity and potential contamination of freshwater sources [1] elevates the strategic importance of on-board desalination for long-term operational resilience. The potential for contamination of external supplies during bunkering and storage [5] adds another layer of risk that on-board production can mitigate. Furthermore, the modularity and portability of RO systems make them a versatile solution applicable across various ship sizes and operational requirements within the fleet.

4. Business Options

To address the ship's potable water requirements, several options have been considered:

4.1 Option 1: Do Nothing

This option involves maintaining the current practice of relying solely on external water supply obtained from ports or water barges. While seemingly the simplest approach, this strategy carries significant long-term financial and operational risks due to its inherent reliance on external factors [4]. The drawbacks include high recurring costs associated with purchasing water and the logistical expenses of transportation. Operational efficiency is hampered by the need for water resupply stops, and the quality of externally sourced water can be inconsistent and subject to potential contamination [1]. As Prince2 emphasises the evaluation of the "Do Nothing" option [8], it is clear that the vulnerabilities in cost, logistics, and potential disruptions make the status quo increasingly unsustainable for long-term naval operations.

4.2 Option 2: Explore Alternative Desalination Technologies

This option involves investigating desalination methods other than reverse osmosis, such as thermal distillation (evaporation). Thermal processes like multi-effect desalination (MED) and multi-stage flash distillation (MSF) are discussed within industry. However, while these technologies exist, reverse osmosis is presented as the preferred modern method due to its superior energy efficiency [2] and effectiveness in removing a broad spectrum of impurities [4]. Various makers offer a range of freshwater generation technologies, including both RO plants and evaporators, indicating that while alternatives are available, RO is a primary solution. Thermal distillation generally requires more energy [4] and may have a larger physical footprint compared to RO systems. Given the research, exploring other desalination technologies might not offer substantial advantages and could potentially introduce different operational and maintenance challenges.

4.3 Option 3: Procure and Install a Reverse Osmosis Plant (Proposed Option)

This option entails investing in an on-board RO system capable of producing potable water from seawater. The advantages of this approach are substantial, including self-sufficiency in water supply, potential for significant cost savings over time, improved operational efficiency by eliminating the need for frequent water resupply, enhanced crew welfare through a reliable source of high-quality water, and consistent production of water meeting stringent quality standards [1]. Makers highlight the cost-effectiveness and ease of use of RO systems. While there are potential disadvantages such as the initial investment cost [4], energy consumption [4], maintenance requirements [1], crew training needs [16], and the need for responsible brine disposal [4], these can be effectively mitigated through careful system selection, proactive maintenance, and comprehensive training. Some makers detail some of these drawbacks, such as lower recovery rate and mineral removal, which will be addressed in the subsequent sections.

Based on this analysis, the procurement and installation of a reverse osmosis plant is the most strategically advantageous and economically viable option for meeting the ship's potable water needs. It offers long-term value and aligns with the project goals of achieving operational independence, cost efficiency, and enhanced crew welfare, while the identified dis-benefits can be effectively managed through appropriate planning and implementation.

5. Expected Benefits

The installation of a reverse osmosis plant on-board the ship is projected to yield several significant benefits across operational, financial, and personnel domains.

5.1 Self-Sufficiency in Potable Water

The most significant benefit is the achievement of self-sufficiency in potable water production. This eliminates the vessel's dependence on external water sources, providing operational advantages particularly during extended deployments, operations in potentially hostile environments, or humanitarian missions where local infrastructure may be compromised [1]. Makers emphasise the capacity of their RO plants to produce substantial quantities of freshwater daily, ensuring a continuous supply. This autonomy reduces logistical vulnerabilities and enhances the ship's ability to operate independently for extended periods.

5.2 Cost Savings

Over the long term, the on-board RO plant is expected to generate significant cost savings compared to the current practice of purchasing water. These savings will accrue from the elimination or substantial reduction of expenses associated with water procurement, transportation, and port fees. Makers highlight the focus on life cycle cost when evaluating RO solutions, suggesting long-term financial benefits. While the initial investment is considerable, the reduction in recurring operational expenses will contribute to a positive return on investment over the plant's operational lifespan.

5.3 Improved Operational Efficiency

The elimination of water resupply stops or reliance on water barges will lead to improved operational efficiency. The vessel will have greater flexibility in mission planning and execution, allowing for more time at sea and enhanced responsiveness to operational demands [1]. Makers note that their membrane filtration freshwater generators enable a "Make Water Anywhere" capability, reducing the need to transit from shore to generate water. This increased operational tempo translates directly to enhanced mission effectiveness.

5.4 Enhanced Crew Welfare

A reliable and readily available supply of high-quality fresh water is crucial for maintaining high standards of crew health, hygiene, and morale [1]. The RO system will consistently produce potable water that meets or exceeds safety regulations, reducing the risk of waterborne illnesses and contributing to the overall well-being and performance of the crew.

5.5 High Water Quality

Reverse osmosis technology is highly effective in removing salts, minerals, bacteria, viruses, and other impurities from seawater, ensuring a consistently high quality of potable water [2]. Makers state that their seawater RO systems can remove up to 99% of salts and solids. This level of purification guarantees a safe and palatable water supply for all on-board needs.

5.6 Environmental Benefits

While not the primary driver, reducing the reliance on the transportation of large quantities of water can contribute to a lower carbon footprint, aligning with broader environmental sustainability goals [2]. Makers also points out that using seawater for potable water production reduces the strain on freshwater bodies, which are increasingly under pressure globally.

The consistency of output and high removal rate of impurities offered by RO [2] directly address the critical need for a dependable and safe potable water supply, which is fundamental for naval operations and the health of the crew. The modular design and relatively low maintenance requirements of modern RO systems [1], with some makers specifically highlighting easy operation and minimal footprint, further enhance their suitability for shipboard installation and operation, minimising disruption and crew workload.

6. Expected Dis-benefits

While the benefits of installing a reverse osmosis plant are substantial, it is important to acknowledge and address the potential negative consequences or drawbacks associated with this project.

6.1 Initial Investment Cost

The upfront capital expenditure for procuring and installing the RO plant and associated infrastructure can be significant [4]. Industry research notes that water-makers can be a considerable investment for any vessel. This initial outlay will need to be carefully considered within the overall budget and justified by the projected long-term savings and operational advantages.

6.2 Energy Consumption

RO systems require a considerable amount of energy to operate the high-pressure pumps necessary for the desalination process, which can lead to an increase in the ship's overall energy consumption [4]. Some makers are actively developing energy-efficient desalination solutions to mitigate this concern. The selection of an energy-efficient RO system and the potential incorporation of energy recovery devices will be crucial in minimising this dis-benefit.

6.3 Maintenance Requirements

Although generally characterised as having relatively low maintenance requirements [1], RO systems do necessitate regular upkeep, including the periodic replacement of pre-treatment filters, cleaning of the RO membranes, and potential repairs to system components [13]. Most makers provide a detailed maintenance checklist for RO systems.

Establishing a proactive maintenance schedule and ensuring the availability of necessary spare parts will be essential for the long-term reliable operation of the plant.

6.4 Crew Training

The ship's crew will require comprehensive training to effectively operate and perform basic maintenance on the new RO plant [16]. This training will involve understanding the principles of reverse osmosis, the specific operation of the selected system, routine maintenance procedures, basic troubleshooting, and safety protocols. Some makers offer specialised training courses on the operation and maintenance of RO desalination plants. The cost and time associated with this training must be factored into the project plan.

6.5 Waste Brine Disposal

The reverse osmosis process generates a concentrated brine solution as a byproduct, which needs to be disposed of in an environmentally responsible manner [4]. Adherence to relevant environmental regulations and the implementation of best practices for brine discharge will be necessary.

6.6 Potential for Downtime

Like any mechanical system, the RO plant may experience occasional periods of downtime for scheduled maintenance, unexpected repairs, or system malfunctions. Contingency plans for potable water supply during such periods will need to be in place to minimise any impact on operations.

6.7 Mineral Removal

The RO process can remove beneficial minerals from the water along with the salts and impurities, potentially resulting in water that is very pure but lacking in certain minerals essential for long-term human consumption [4]. Most makers offer optional post-treatment processes, including remineralisation, to address this. Depending on the specific water quality requirements and health considerations, a post-treatment stage for remineralisation may be necessary.

To mitigate these dis-benefits, a thorough cost-benefit analysis will be conducted to justify the initial investment. Energy-efficient RO systems, potentially incorporating energy recovery devices as offered by some makers, will be prioritised. A proactive maintenance schedule will be established, and arrangements will be made for the timely supply of spare parts through providers like Marine Plant Systems. A comprehensive crew training program, potentially utilising resources like those offered by Hatenboer Water, will be implemented. Redundancy measures or contingency water supplies will be considered for periods of downtime, and post-treatment for remineralisation will be evaluated based on water quality standards and crew health needs. The energy intensity of RO [4] necessitates careful consideration of energy recovery technologies and the overall energy efficiency of the selected system to minimise operational costs and environmental impact. The potential for RO to remove essential minerals [4] highlights the importance of assessing the required water quality standards [24] and considering post-treatment options to ensure the produced water is suitable for long-term human consumption.

7. Costs

A comprehensive breakdown of the anticipated costs associated with this project will be developed during the detailed planning phase, including obtaining specific quotes from potential manufacturers. However, the major cost categories include:

- **Procurement Costs:** This will encompass the cost of the reverse osmosis plant itself, including all necessary components such as pre-treatment filters, RO membranes, high-pressure pumps, control systems, monitoring equipment, and any associated installation hardware. Shipping and delivery charges to the designated shipyard will also be included.

- **Installation Costs:** These costs will cover any necessary modifications to the ship's structure or existing systems to accommodate the RO plant. This may involve preparing the designated space, installing new piping for seawater intake and potable water distribution, establishing electrical connections, and integrating the RO plant's control system with the ship's overall monitoring systems. Labour costs for the installation team and for the commissioning of the plant will also be a significant component.

- **Ongoing Operational Costs:** The primary operational costs will be related to the energy consumption of the RO plant, specifically the electricity required to run the high-pressure pumps. This will be estimated based on the plant's power rating and the anticipated daily operating hours. Additionally, there will be costs for consumables, including pre-treatment filters that require regular replacement, chemicals used for RO membrane cleaning, and the eventual replacement of the RO membranes themselves, based on their expected lifespan and usage.

- **Maintenance Costs:** This category will include the costs associated with routine maintenance tasks, such as filter changes and system checks, which may be performed by the ship's crew after proper training. A significant part of the maintenance budget will be allocated for the annual equipment inspections to be conducted by the OEM or their authorised Australian representatives. This will likely include the cost of the inspection service itself, as well as any potential travel and accommodation expenses for the OEM's personnel. Furthermore, a contingency budget for potential repairs or the replacement of minor components will be necessary.

- **Crew Training Costs:** The costs associated with training the ship's crew on the operation and basic maintenance of the RO plant will need to be accounted for. This may involve engaging external training providers, utilising on-site training offered by the manufacturer during commissioning, or developing in-house training programs with manufacturer-provided materials. Costs for travel and accommodation for crew members attending off-site training, if required, will also be included.

A detailed cost breakdown across these categories is essential for accurate financial planning and to demonstrate the overall economic viability of the project [27].

8. Investment Appraisal

A thorough financial evaluation of this project will be conducted, utilising standard investment appraisal techniques, including:

- **Return on Investment (ROI):** The ROI will be calculated by comparing the total cost of the project over its expected lifespan with the anticipated cost savings resulting from the reduced reliance on external potable water supply. This will provide a measure of the profitability of the investment.

- **Net Present Value (NPV):** The NPV will be determined by discounting the future cost savings and operational costs back to their present value. This analysis will take into account the time value of money and provide an indication of the project's overall profitability in today's terms.

- **Payback Period:** The payback period will estimate the amount of time required for the cumulative cost savings generated by the RO plant to equal the initial investment cost. This metric will help in understanding how quickly the project will start generating a net positive cash flow.

- **Cash Flow Analysis:** A detailed cash flow analysis will project the expected cash inflows (primarily from cost savings on water procurement) and cash outflows (including project costs and ongoing operational expenses) over the anticipated operational life of the RO plant. This will provide a clear picture of the project's financial performance over time.

Employing these standard investment appraisal techniques, as recommended by Prince2 [27], will provide a robust financial justification for the project and facilitate a clear comparison with other potential investment opportunities within the organisation.

9. Major Risks

Several potential risks associated with this project have been identified and analysed:

- **Technical Risks:** Challenges may arise during the installation and integration of the RO plant with the ship's existing systems. There is also a risk of equipment malfunctions or failures, as well as potential difficulties in consistently meeting the required potable water quality standards. Membrane fouling or scaling could reduce the plant's efficiency [20]. Mitigation strategies include conducting thorough site surveys prior to installation, selecting a reputable manufacturer with proven technology, implementing a robust pre-treatment system to minimise fouling, and establishing comprehensive maintenance procedures.

- **Financial Risks:** Cost overruns during the procurement or installation phases are possible. Unexpected increases in energy costs or the prices of consumables could also impact the project's financial viability. Higher than anticipated maintenance or repair costs represent another financial risk. Mitigation strategies involve obtaining firm, fixed-price quotes where possible, developing a detailed budget with contingency allowances, and continuously monitoring operational costs.

- **Supplier Risks:** There is a risk that the selected manufacturer may fail to meet the agreed-upon specifications or project timelines. The lack of adequate after-sales support or the unavailability of spare parts within Australia would also pose a significant risk. The financial instability of the manufacturer is another potential concern. Mitigation strategies include conducting thorough due diligence on potential manufacturers, verifying their financial stability and track record, securing comprehensive warranties and service level agreements, and confirming the availability of local Australian support and spare parts.

- **Operational Risks:** Insufficiently trained crew could lead to operational errors or damage to the equipment. Extended periods of equipment downtime would negatively impact the ship's water supply. Difficulties in disposing of the brine byproduct in compliance with environmental regulations represent another operational risk. Mitigation strategies include implementing a comprehensive crew training program provided by the manufacturer or certified trainers, establishing clear operating procedures and maintenance schedules, and developing protocols for responsible brine disposal in accordance with environmental guidelines.

- **External Risks:** Changes in environmental regulations affecting the operation or discharge of the plant could necessitate costly modifications. Geopolitical events impacting the manufacturer's supply chain could lead to delays or disruptions. Mitigation strategies involve staying informed about relevant regulatory changes and selecting a manufacturer with a robust and diversified supply chain.

Identifying and proactively addressing these potential risks is a critical aspect of the Prince2 business case [27] to enhance the likelihood of project success and minimise potential negative impacts on the vessel's operations.

10. Reverse Osmosis Plant Requirements and Manufacturer Selection

The selection of the reverse osmosis plant manufacturer is a critical decision that will significantly impact the success of this project. Several key requirements must be considered during the evaluation process:

10.1 Equipment Quality and Safety Standards

The selected manufacturer must adhere to stringent quality and safety standards. This includes holding relevant quality management system certifications such as ISO 9001 [29]. The RO plant itself should possess marine-specific certifications or compliance with relevant regulations [29]. It is essential that the plant is constructed using high-quality, corrosion-resistant materials suitable for the harsh marine environment, such as high-grade stainless steel [1]. Safety features and compliance with all relevant safety standards are paramount to ensure the well-being of the crew and the safe operation of the equipment [29].

10.2 Naval References

A critical requirement is that the RO plant manufacturer must have a proven track record of supplying to naval forces, with specific references from the Royal Australian Navy (RAN) being highly desirable [23]. Marine Plant Systems [34] explicitly lists numerous RAN vessels, including Supply Class AOR, Guardian Class PV, and Arafura Class OPV, as references. These references demonstrate the manufacturer's understanding of the specific requirements and challenges associated with naval applications.

10.3 After-Sales Support in Australia

Readily available and responsive after-sales support within Australia is crucial for minimising downtime and ensuring the long-term reliability of the RO plant [25]. This includes the presence of service centres or authorised representatives within Australia capable of providing timely technical assistance (both remote and on-site), ensuring the availability of spare parts and consumables, and offering efficient repair services. Marine Plant Systems is an Australian company that offers after-sales support for marine equipment. Marine Plant Systems [31] has established offices in Australia, indicating a local support presence.

10.4 Crew Training Program

The manufacturer must be capable of providing a comprehensive crew training program [16] covering all aspects of the RO plant's operation and basic maintenance. This program should include the principles of reverse osmosis, the specific operation of the supplied model, routine maintenance procedures (such as filter changes and membrane cleaning), basic troubleshooting techniques, and essential safety procedures.

10.5 Annual Equipment Inspections

The procurement contract must include provisions for annual equipment inspections to be conducted by the original equipment manufacturer or their authorised representatives within Australia [13]. These inspections are vital for ensuring the continued reliability, safety, and optimal performance of the RO plant over its operational lifespan.

10.6 Capability for Other Potable Water Equipment

The selected manufacturer should also have the capability to supply and support other types of potable water equipment commonly used on-board ships, such as water purification systems (e.g., UV sterilisers, chlorinators) and other potable water equipment. Marine Plant Systems [51] offers a broad range of potable water solutions for marine applications. This capability can streamline procurement processes and ensure better integration of all on-board water systems.

Table 2: Potential Reverse Osmosis Plant Manufacturers

Company Name	Country of Origin	Naval References (including RAN)	After-Sales Support in Australia	Crew Training Program Availability	Annual Inspection Capability in Australia	Other Potable Water Equipment Capability	Key Certifications (e.g., ISO 9001, Marine Approvals)
Marine Plant Systems	Australia, various	Yes (Numerous RAN Vessels)	Yes (Offices in Australia)	Yes	Yes	Yes	ISO 9001, ISO 14001, ISO 45001, ISO 27001

11. Timescale

A detailed project timeline will be developed during the project initiation phase. However, the following key phases and milestones are anticipated:

- **Procurement Phase:** This will include the development and issuance of a Request for Information (RFI), followed by a Request for Proposal (RFP) to potential manufacturers. A thorough evaluation of the bids will be conducted, leading to the contract award. The manufacturing lead time for the RO plant will need to be factored in, followed by the shipping and delivery of the equipment to the designated shipyard.
- **Installation Phase:** Once the RO plant arrives at the shipyard, the installation phase will commence. This will involve preparing the designated space on the ship, making any necessary structural or system modifications, installing the RO plant and its associated equipment, integrating the system with the ship's existing infrastructure, and conducting thorough system testing. Commissioning of the plant will mark the end of this phase.
- **Training Phase:** Concurrently with or shortly after the installation, a comprehensive crew training program will be delivered by the manufacturer or certified trainers. This will ensure that the ship's personnel are proficient in the operation and basic maintenance of the new RO plant.
- **Operational Readiness:** Following successful commissioning and crew training, final checks will be performed, and the RO plant will be declared ready for operational use.

The specific duration of each phase will depend on factors such as the complexity of the installation, the lead time for equipment manufacturing, and the availability of shipyard resources and training personnel. A detailed project schedule will be created to track progress against these milestones.

12. Conclusion and Recommendations

The findings of this business case strongly support the procurement and installation of a reverse osmosis plant on-board the ship. The significant benefits, including enhanced operational independence, potential for substantial cost savings, improved operational efficiency, and enhanced crew welfare, far outweigh the identified dis-benefits, which can be effectively mitigated through careful planning and execution. The strategic alignment of this project with the organisation's objectives is clear, contributing to increased self-sufficiency and long-term sustainability.

Based on this analysis, the following recommendations are made:

- Prioritise manufacturers with proven and verifiable naval references, with a strong emphasis on experience with the Royal Australian Navy. Marine Plant Systems appears to meet this critical criterion and should be given high consideration.

- Select a manufacturer with a demonstrated commitment to high equipment quality and safety standards, ensuring compliance with relevant marine certifications and the use of appropriate materials for the marine environment.

- Ensure that the chosen manufacturer has a well-established and responsive after-sales support network within Australia, capable of providing timely technical assistance, spare parts, and repair services. Marine Plant Systems present viable options for local support.

- Mandate a comprehensive crew training program as a key deliverable in the procurement contract, ensuring that the ship's crew is fully equipped to operate and maintain the RO plant effectively.

- Include provisions in the contract for mandatory annual equipment inspections to be conducted by the OEM or their authorised Australian representatives to ensure the long-term reliability and performance of the system.

- Favour manufacturers that have the capability to supply and support other potable water equipment commonly used on-board ships, such as UV sterilisers and other potable water equipment, to potentially streamline procurement and ensure better system integration. Marine Plant Systems demonstrates this broader capability.

It is recommended that the project proceeds to the next stage, focusing on a detailed evaluation of potential manufacturers based on the criteria outlined in this business case, with the aim of selecting the most suitable supplier for the procurement and installation of the reverse osmosis plant.

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