

DESCRIPTION OF REQUIRED GOODS

1. Background

Transnet National Ports Authority (TNPA) is a wholly owned subsidiary of Transnet SOC Ltd. TNPA is a port authority that manages the eight commercial ports in South Africa. It has several business units providing various services to a diverse spectrum of port users. These services include, but are not limited to Marine Operations, Vessel Traffic Services (VTS), Infrastructure Management, Licensing of port services and facilities, Dredging Services, Lighthouse service, Dry Dock and Ship Repair facilities

One of the fundamental activities at TNPA is the provisioning and maintenance of assets, to ensure optimal efficiencies and productivities in the ports and to lower the cost of doing business for our customers. The Key Performance Indicators for asset usage are reliability, availability, and cost of operations.

2. Motivation and Purpose

As greater demands are placed on existing assets in terms of higher output or increased efficiency, the need to understand when things are starting to go wrong is becoming more important. Unexpected equipment failures can be expensive and potentially catastrophic, resulting in unplanned production downtime and costly replacement of parts with concomitant safety and environmental concerns. Predictive Maintenance capabilities can assist with the monitoring of equipment during operation to identify any deterioration, enabling maintenance to be planned and operational costs to be reduced.

TNPA is using the SAP Plant maintenance solution and will soon be upgrading the same to the S4/HANA platform. The desired Smart Predictive Asset Management Solution will need to integrate to the existing/future SAP landscape and create a connection between the SCADA, eLTE and the corporate network for the management of TNPA assets.

Various desk-top and bench-marking studies have indicated that a technology intervention is required to assist in predictive asset maintenance to improve operations/asset reliability. With predictive maintenance technology intervention, warnings of impending problems can be issued in advance for inspections and repairs to be carried out, and to avoid major disruption to port operations.

TNPA seeks to implement a Smart Predictive Asset Management Solution, built on the latest technologies, which will manage and monitor land and water assets. It is envisioned that a Smart Predictive Asset Management Solution will assist in improving operations reliability, resulting in improved port efficiencies and safety.

The proposed solution must fulfil the following benefits and objectives for TNPA:

- Improved machine reliability through the effective prediction of equipment failures.
- Reduction in Asset Maintenance costs
- Prolonged asset life cycle
- Increased production through greater machine availability
- Reduction in port disruption due to asset breakdown and non-availability
- Improved and efficient service delivery to Customers
- Centralised, accurate, credible and transparent information, readily available to management and Port users
- Minimizing spare holdings
- Reducing the costs of overtime.
- Compatibility with the SAP Plant maintenance System.

3. Scope of work

The scope of work encompasses designing, building, and implementing a Smart Predictive Asset Management Solution for TNPA assets that should interface with the SAP Plant maintenance solution for managing the land and water assets across the eight commercial ports i.e., Richards Bay, Durban, East London, Port Elizabeth, Port Ngqura, Mossel Bay, Cape Town and Saldanha Bay.

Some assets may have Supervisory Control and Data Acquisition (SCADA) and Programmable Logic Controllers (PLC) installed such as Allen Bradley, etc., and these should also be integrated into the proposed solution.

It is crucial that information is recorded, and the system designed for:

- The prediction of which parts will break down and when (machine learning and digital twinning)
- The monitoring of utilities and reporting of consumption (water, electricity), sewerage pump station, air conditioning units and HVAC plans, detection of potential leaks (water), etc.



- The continuous monitoring and reporting of, but not limited to, machine vibration, flow, temperature, pressure, leaks.
- Recording of breakdowns and notification to key personnel for further action.

3.1. Functional Requirements

Predictive Asset maintenance solutions are required for a broad range of critical port assets in both the water and on the land. The proposed solution will need to create a secure connection for information flow across the SCADA, PLC, eLTE and corporate TNPA networks. The solution should provide alerts and notifications for inspections.

A sample of some of the assets is provided below and solutions can be extended to a wide range of assets based on a cost justification exercise.

3.1.1 Waterside Assets

3.1.1.1 Tugs and Dredgers

TNPA is mainly using twin-unit tractor tugs, which have Cummins alternators and a Voith Schneider propeller propulsion system. The super structure maintenance is done daily, every two years, the tug is removed from the water, placed on dry docks, and serviced. The tugs assist vessels to safely enter and exit the port.

TNPA uses IHC dredgers which are used for the maintenance of water depths at the port berths, basins, channels and sand traps.

3.1.1.2 Pilot Boats

TNPA uses pilot boats with Cummins alternators and Twin-Screw propeller propulsion systems. Pilot boats are used to transport Pilots from the Port and on to the incoming vessel.

3.1.1.3 Fleet

TNPA uses small craft for fender maintenance and the inspections of quay walls.

3.1.1.4 Automated Mooring & Sand Bypass systems

The Sand Bypass system in the Port of Ngqura, is the only fixed jet pump Sand Bypass system in the world. It artificially transports the littoral drift from the southern beach of the port to the northern beach to help prevent accretion on the updrift side, and control downdrift erosion.

The Automated Mooring system is used to forestall free movement of the ship on the water.

Both the sand bypass and Automated Mooring system are run on the SCADA and PLC systems. A component of predictive metrics is already present in both systems and being used to inform maintenance activities. These will need to be incorporated into the final solution.

3.1.1.5 Fairway buoys and breakwater lights

TNPA uses Fairway buoys and breakwater lights for safe passage of vessels into the port. The fairway buoys need remote monitoring of its batteries, light signal and position using 4G, to make service and maintenance more efficient.

3.1.1.6 Breakwaters

TNPA uses breakwaters, a permanent structure at Port entrances to protect against tides, currents, waves, and storm surges within the Port.

The dolosse on the breakwater need to be monitored for movement over a lengthy period. This will serve as an early warning for any major failure of the breakwater. This can be done by taking images with drones at various intervals in the year, and then checking each picture for movements.

3.1.2 Landside Assets

3.1.2.1 Substations and buildings

TNPA makes use of numerous substations and buildings to support its operations. The current practise at TNPA is to take a thermal imaging camera into substations and buildings to detect potential malfunctions. It could be beneficial to have a continuous monitoring system in place.

3.1.2.2 Cranes

Cranes are used mainly for mechanized loading, unloading and transfer of heavy loads in ports. TNPA mainly uses overhead and gantry cranes, which are used for ship repair or moving of heavy load in workshops.

3.1.2.3 Fenders

Fenders are used to avoid damages on ship and dock structures during the berthing of vessels. Fender Monitoring Systems are required to predict imminent fender failures due to natural deterioration, which allows pre-emptive fender maintenance to be performed to minimize adverse influences of emergency fender maintenance.

3.1.2.4 Water and Electricity meters

Water and electricity meters are used to bill tenants and plan the upkeep and replacement of pipes. Early detection of any leaks or anomalies is required.

3.1.2.5 Sewer pumpstations

Sewerage pump stations will need to be monitored for machine conditions and failures, including keeping tabs on the normal operations and flows coming into and leaving the pumpstation.

3.1.2.6 Buildings and concrete structures

Visual inspections are normally done to monitor for deterioration and cracking of buildings and structures, including the condition of painted surfaces. The type of defect noted visually normally relates to specific symptoms and have specific mitigating solutions that can be applied. It is anticipated that this can be automated by determining the type of defect, its potential cause and potential remedy.

3.1.3 Simulation

TNPA seeks a visual digital twinning simulation tool that will assist in the modelling and analysis of potential damage and simulate the required maintenance of an asset over time.



4. Technical Requirements

TNPA seeks information on tools, devices and systems in the market that can record data for predictive analysis purposes. The solution should integrate with existing TNPA systems to provide notifications and include continuous monitoring capabilities to detect the onset of component problems in advance.

An integrated system must be designed and built on various devices and technologies, Internet of Things (IoT), artificial intelligence, virtual/augmented reality and architectural standards and processes. A desktop and mobile version of the system is required.

4.1 Integration

The Intelligent Asset Management solution required will need to integrate to the proposed GIS, Smart Traffic and smart meters initiatives in addition to the SAP S4/HANA system. It must also create a secure connection for information flow across the SCADA, PLC, eLTE and corporate TNPA networks.

4.2 Compliance Requirements




The technologies and solutions considered must not void any warranties and compliance measures already in place for the identified assets.

5. Financial Proposal

After the conclusion of the RFI process, it is TNPA's intention to compile a business case and issue an RFP for the Design, Development, Deployment and Maintenance/Support (for a minimum period of three years) for a Smart Predictive Asset Management Solution.

To estimate the financial implications for budgeting and planning purposes, we would like the respondents to provide a Financial Proposal covering the following items, at a minimum:

- a. Design, Development and Implementation Cost
- b. Annual Software License/Maintenance Fee
- c. IOT devices and sensors
- d. 24x7x365 Support and Maintenance for a period of three (3) years

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