Beacon DGPS Base Station

- **World leading DGPS broadcasting stations**
- **System designed as per IALA and RSIM standards**
- **Continuous monitoring of DGPS**
- **Optional Remote Monitoring Stations**
- **Automatic notification to operator/ user of alarm conditions**
- **Powerful control PC software**
- **Unmanned operations - remotely controlled from one or several locations**
- **Systems custom designed based on user's requirements**
- **Extensive report functions**
- **Built-in disk management capabilities**

System Design Overview

Each DGPS Broadcast Station provides DGPS corrections to users in its region via marine radio beacon signals. Marine radio beacons, which operate in the 283.5 to 325.0 KHz frequency band, broadcast DGPS corrections by modulating the normal beacon direction finding signal with the DGPS correction information. The signals are received by the beacon receiver on board the user's vessel and are demodulated to recover the DGPS corrections.

Each Broadcast Station is equipped with three GPS receivers. There is one active and one hot spare (back-up) Reference Receiver, which generate the DGPS messages. The third GPS receiver is an Integrity Monitor, which uses the received DGPS corrections to provide an independent quality check on the broadcast DGPS corrections. The result of the quality check is fed back to the Reference Receiver and is reported in the health status information contained in the header of the DGPS (RTCM) messages. If the Integrity Monitor detects a failure in the primary Reference Receiver, the Broadcast Station software will switch automatically to the backup Reference Receiver.

The Broadcast Station is also designed to provide operator with visual information regarding the quality of the DGPS corrections. Graphic displays and extensive report capabilities present the operator with real-time statistical information regarding the accuracy of the DGPS corrections. Data logging is essential for record keeping and provides an audit trail in the event of a disaster. The Broadcast Station Controller archives all of the recorded data in a logical and intuitive manner. Automatic and manual disk management functions are built into the system to ensure that there will always be ample disk storage space.

System Design / Hardware

The Beacon Broadcast Station consists of two Beacon Reference Stations (each containing a GPS Reference Receiver and an MSK Beacon Modulator), one or two Beacon Integrity Monitor(s) (GPS Integrity Receiver and DGPS receiver / demodulator), a Data I/O chassis which interconnects and switches between the system elements, the Broadcast Station Controller which is the on-site control computer, an Uninterruptible Power Supply (UPS) with battery backup, and Beacon Transmitter (not shown in the picture). The GPS Reference receivers can be L1 or L1/L2 receivers, configured for logging of GPS raw data. The Broadcast Station Controller operates the Broadcast Station and reports Alarms to the operator and to the Remote Control Site.

System Design Software

The DGPS Beacon System is based upon a design that allows flexibility and ease of use with a provision for future expansion. The system supports high-level program languages (such as C or Pascal) and has memory map support with memory protection. Database management, password protection, print spooling, multiple tasking, and linkages with external vendor software packages are incorporated into MX Marine's approach.

Ease of Use

The Broadcast Station Controller appears as a standard Windows Application to the operator. The familiar menu and tool bars, client window, and status bar format are used. Since this is a standard Windows Application, it is possible to change the size or minimize the Main Window. Also, it is possible to run other applications simultaneously while the software continues to perform all real-time functions in the background or while minimized.

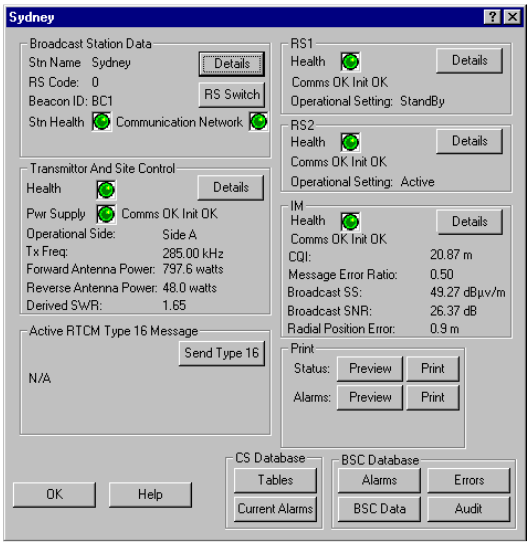

Figure 1: Control Station Overview Window

Standard Windows controls are used for all operator interaction. General overview windows display important system data and traffic light status indicators (refer to Figure 1) are used wherever possible to help the operator determine system status at a glance. Secondary windows are accessed by a simple mouse click. This allows the operator to view the operational status of all system elements while also inspecting various detailed system parameters.

Tab control windows are used to a large extent because of their ability to group data items from a common source in an organized manner. For example, the operator is able to view all data from a Reference Station on a single property sheet containing multiple tabs for specific information categories (refer to Figure 2). This provides an intuitive interface for operator control and inspection.

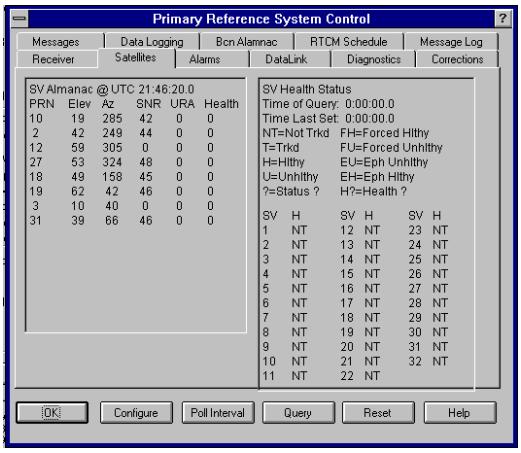

Figure 2: Reference Station Control Window

Statistical Information

Understanding the quality of the DGPS Broadcast is vital to system operation. The Broadcast Station Controller has been designed to present accuracy information in a variety of ways to the user. Figure 3 provides a graphical representation of the accuracy of the DGPS corrections as applied at the Integrity Monitor.

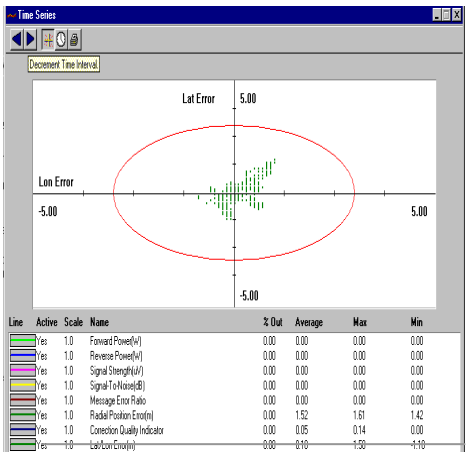

Figure 3: Real time Position Plot

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