

Senior Design Project in Electrical & Computer Engineering



NMEA 2000 Recorder & Analyzer

1/c Matthew Lynne, 1/c Joshua Freivald, 1/c Jacob Bibb

Advisors: LT Steven Myers

Sponsor: C4IT Service Center & CG-761

Project Background

The new NMEA 2000 data protocol for marine electronics interconnection is rapidly replacing legacy NMEA 0183 systems in Coast Guard use on boats and cutters. NMEA 2000 offers many advantages including easy access to and organization of network sensor data. The USCG needs a dedicated, reliable, easy to use quality assurance and data monitoring program to review the quality of operations such as boat speed and direction. An affordable, small, light-weight "black box" prototype needs to be developed to monitor, record, and store boat data.



System Components & Sensors

- NMEA 2000 Network composed of an Airmar PB2000, a NMEA 2000 to USB adapter, and a 12 V power supply.
- The black box components consisted of an Ethernet starter kit from Microchip, an I/O expansion board CANBus daughter card, and a SD Card daughter card.



Objectives & Requirements

Objective:

The objective of this project is to create a test bed NMEA 2000 network that record small boat data and that can operate with little to no user interface. The device needs a method for extracting the data and a system for easily analyzing the data. The final objective is to research NMEA 2000 data strings currently in use, other possible strings that could be utilized, and ways in which the captured data could improve the Coast Guard's work process.

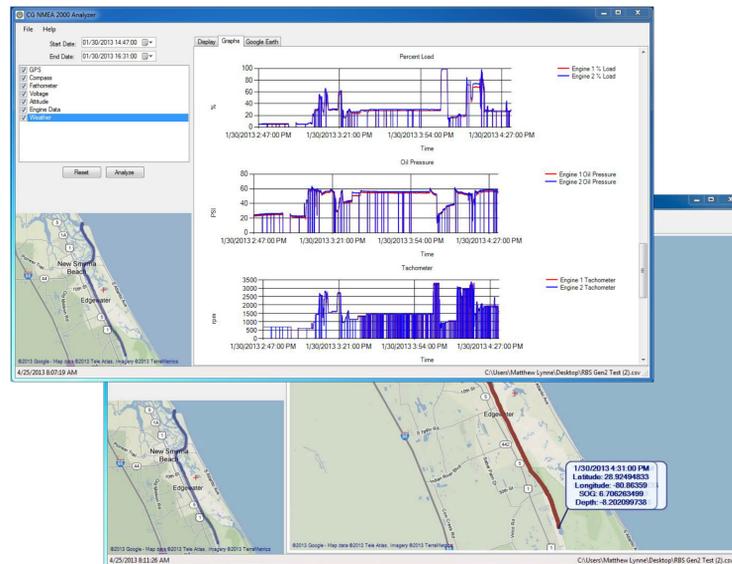
Requirements:

- The black box shall be able to withstand severe vibrations.
- Shall interface with the NMEA 2000 network onboard the RBS Gen II
- Shall store all NMEA 2000 data to a storage device for post analysis.
- Create software to analyze the NMEA 2000 data via a friendly user interface.
- Shall be able to filter the data so that only what the user wants is displayed.

Results

Software:

- Loads in a .csv file with NMEA 2000 data to the backend database.
- Allows the user to filter the data by time and by equipment.
- Displays to the user the data in graphs, a Google Maps overlay, or straight numbers.



Future Goals

Software:

- Have the software parse the data captured by the PIC Microprocessor.
- Allow the user to filter more of the data.
- Allow the user to print a report of the data.
- Allow the user to access different reports for different Coast Guard assets.

PIC32:

The PIC32 microprocessor has an immense amount of potential for future work. The future plans for development on this robust platform include communications systems which would allow wireless downloading of data files, remote access from the home port, station, or district. Further developing a board layout to send to Microchip, the manufacturer of the PIC32, and have a small, compact board with only the essentials printed to fit in a rugged box and placed on the boat.

Sensor Study

Airmar PB200 Weather Station

- Added Functionality:
 - Wind Data
 - Air Pressure
 - Air Temperature
 - Humidity
 - Rate of Turn

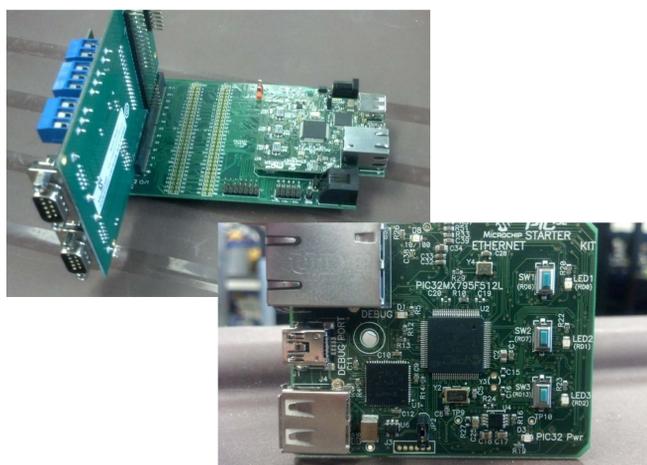
Maretron DST110 Depth/Speed/Temp Triducer

- Added Functionality:
 - Water Temperature

Maretron TLM150 Tank Level Monitor (Gasolinie)

- Added Functionality:
 - Tank Level

The PIC32 microprocessor (pictured below) developed by Microchip offers a robust platform for data recording. Using this product on various development boards offered by microchip, the data being communicated over the NMEA 2000 network was successfully captured and saved automatically to a removable digital storage device.



We would like to give a special thanks to our advisor LT Myers, our sponsor LT Wyman, and everyone else who assisted us in the process.

