# `

# 

# **Proteus**

# Unmanned Surface Vessel

# Manual

Contents

[` 1](#_Toc52526498)

[X-Craft Proteus 1](#_Toc52526499)

[Unmanned Surface Vessel - Manual 1](#_Toc52526500)

[Overview 3](#_Toc52526501)

[Components 4](#_Toc52526502)

[ROCOS Raspberry Pi 4](#_Toc52526503)

[Technical Info: 4](#_Toc52526504)

[OpenCPN and OpenPlotter Raspberry Pi 5](#_Toc52526505)

[Technical Info: 5](#_Toc52526506)

[ZeroTier Raspberry Pi 5](#_Toc52526507)

[Technical Info: 6](#_Toc52526508)

[IP Camera 6](#_Toc52526509)

[Technical Info: 6](#_Toc52526510)

[Solar Array and Solar Controller 6](#_Toc52526511)

[Technical Info: 6](#_Toc52526512)

[Virtual Radar AI boat and object detection 6](#_Toc52526513)

[HV Battery Voltage and Current Monitor 6](#_Toc52526514)

[HV 48v Batteries 6](#_Toc52526515)

[LV and 12V Battery 6](#_Toc52526516)

[Steering Controllers 7](#_Toc52526517)

[Throttle Controllers 7](#_Toc52526518)

## Overview

Proteus is a trimaran planform electric powered seacraft. It features 10KW of battery driving 2x 8HP electric motors. For navigation the boat uses an Ardupilot system to assist with automatic waypoint navigation. The boat features various systems to enable safe, effective and reliable operation remotely with no personal on-board.

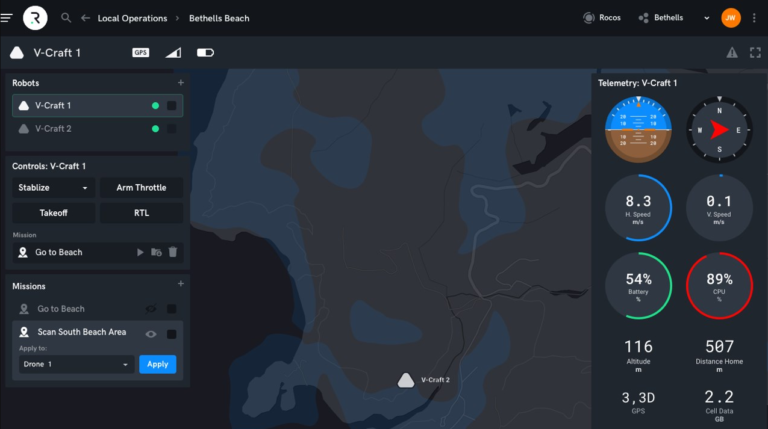


# 

# Components

## ROCOS Raspberry Pi

Forwards Autopilot Mavlink data to ROCOS. Online ROCOS dashboard presents data in a user-friendly way as well as storing MavLink data for later analysis. A live video feed is also available.



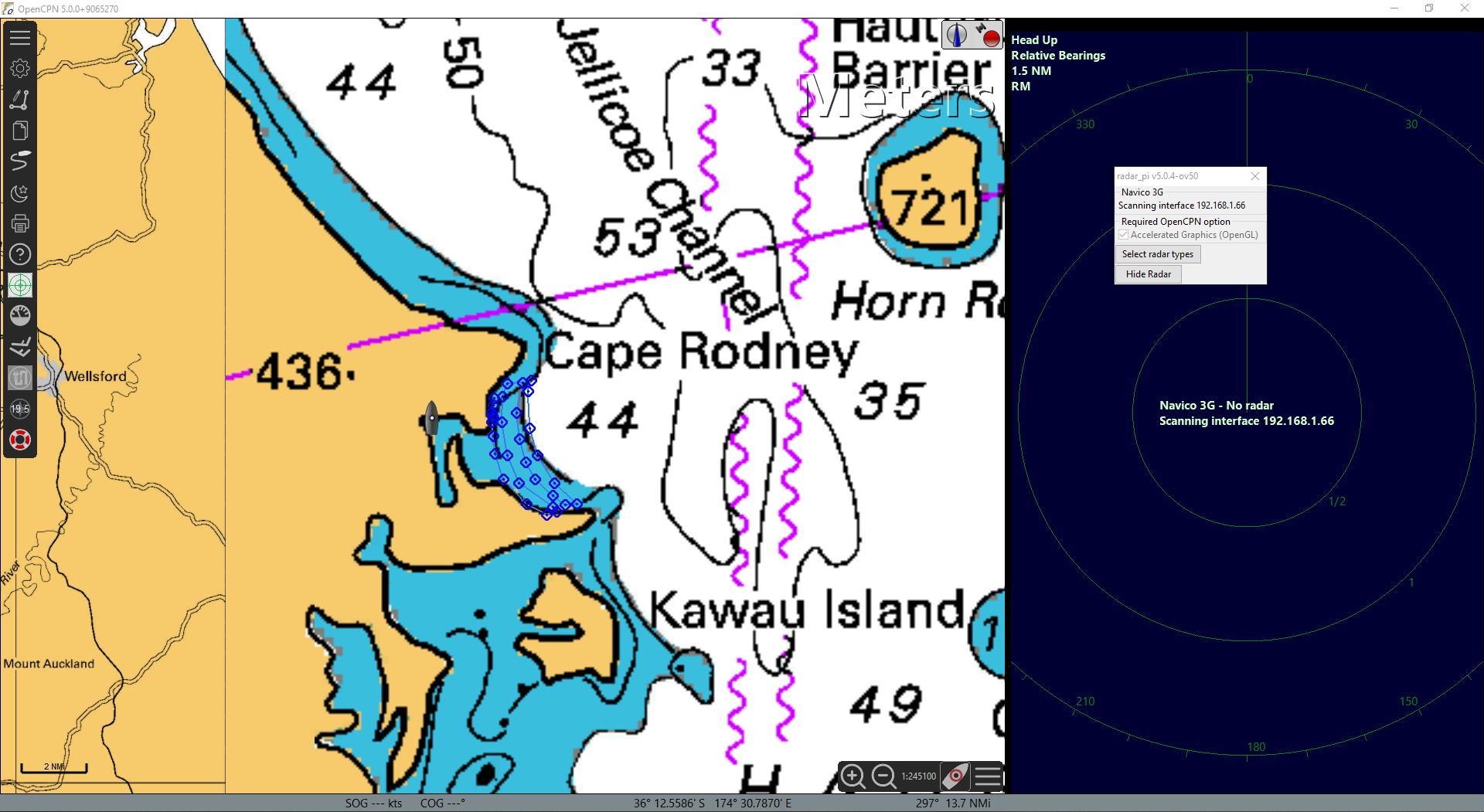
### Technical Info:

USB connection to autopilot to raspberry pi baud: 115200.

User login: <https://portal.rocos.io/>

Username, [mtb4nz@gmail.com](mailto:mtb4nz@gmail.com), Password: Tonall09

## OpenCPN and OpenPlotter Raspberry Pi



Open Plotter is a combination of software and hardware to be used as a navigational aid on small and medium boats. It is also the hub of an on-board vessel automation system. It runs on the Raspberry Pi and is open source.

In our case we are using the system as a secondary positional system for Proteus on marine maps, and as a networking translation hub for our Semrad radar, AIS receiver, GPS Receiver, compass and barometer. Down the road we are also looking to use open plotter to translate on boat weather station readings as well as other useful sensors.

Open Plotter can forward data through TCP/UDP. This capability allows OpenCPN to run and connect on external devices on the local network. Combining with Zero-tier to expand our local network we can access the forwarded data anywhere.

### Technical Info:

By default, SIMRAD Radar broadcasts multicast UDP packets on the local network. While this simplifies multiple devices on the local network obtaining Radar data, it presents a problem in two ways. One, packets are uncompressed, representing a high network overhead two ZeroTier VPN will attempted to forward broadcast packets. To solve this problem it is advised that VNC is used to create a remote desktop connection to the OpenCPN/OpenPlotter raspberry pi, returning a streamed image of the radar view. This represents a significantly lower network overhead.

## ZeroTier Raspberry Pi

This raspberry pi is setup as a bridge between ZeroTier and the boats physical network. Any device on the boats network should be accessible remotely if correctly set to a specific IP range. The ROCOS system does not use the zero tier network for communication.

Managed through online dashboard; <https://my.zerotier.com/>

Username: [mtb4nz@gmail.com](mailto:mtb4nz@gmail.com), Password: Tonall09

### Technical Info:

Physical LAN Subnet: 192.168.56.0/24

Physical LAN DHCP Range: 1921.168.58.65 through 192.168.58.126

ZeroTier Auto-Assign Range: 192.168.58.129 through 192.168.58.190

ZeroTier Network: a0cbf4b62a821435

## 

## IP Camera

This camera is mounted on the radar tower and moved in pan/tilt directions. The camera can be accessed through a web interface, through directly accessing the RTSP stream with an application like VLC media player or online with the ROCOS dashboard.

### Technical Info:

RTSP: rtsp://admin:Tonall09@192.168.58.50:88:/videoMain

Camera IP Address: 192.168.58.50:88

User: admin, Password: Tonall09

## 

## Solar Array and Solar Controller

A Tristar TS-MPPT-60 solar controller is used. This solar controller features networking for remote monitoring of solar array and battery status. The boat uses 4 panels, wired as two series pairs. The solar controller directly charges the HV battery packs with a maximum charge voltage of 54V.

### Technical Info:

Solar controller IP Address: 192.168.58.6

## 

## Virtual Radar AI boat and object detection

## 

## HV Battery Voltage and Current Monitor

To allow remote monitoring of both packs and independent battery voltage current monitor is used to obtain voltage and current readings independent of the state of the HV systems. This battery monitor interfaces through the MavLink interface and battery stats for the HV systems are available through ROCOS.

## HV 48v Batteries

Proteus features two 48V 5kwH packs in parallel for a total of 10Kwh. The systems are designed to deliver up to 10kw continuous.

Both packs feature individual BMS charge/discharge controllers with charge and discharge contactors controlled by the ZEVA BMS and 120amp fuses. Isolation switches are wired to sleep each BMS for low parasitic draw.

## LV and 12V Battery

Most of proteus systems run off the LV 12v system. This is system consists of 48V to 12V 300W DC-DC converter. The converter is set to provide a 13.5V floating voltage to the large AGM battery at the from the craft. The 12V AGM battery is large enough to provide days of systems operation to the craft in event of a charging failure.

Monitoring of voltage and charging of the 12V system is achieved via Ardupilot battery monitor. Thus this information is also available through ROCOS remotely.

## 

## Steering Controllers

Proteus uses two independent linear actuators with feedback to control steering. The Jrk G2 18v19 use potentiometer feedback, Steering angle is set through PWM form the Autopilot or Steering controller. Various calibration parameters can be set through the JRK configuration software Via USB.

## 

## Throttle Controllers

The Torqueedo throttle controllers use a magnetic rotatory encoder. It’s a simple 12bit encoder that uses a logic serial interface to communicate with the main logic board. We are supplementing this method of control with a custom developed micro controller.

### Technical Info:

Two in-depend micro controllers mimic the magnetic encoder to replace movement of the default throttle control. This same controller has been setup in each throttle controller to read incoming PWM from the autopilot or joystick and converts this to a throttle position in the style of the logic style interface.