



SOLE SOURCE JUSTIFICATION

YSI I3XO ECOMAPPER AUTONOMOUS UNDERWATER VEHICLE

SYSTEM OVERVIEW

The YSI i3XO EcoMapper Autonomous Underwater Vehicle (AUV) is a unique, state-of-the-art, autonomous vehicle that is designed for use in a wide variety of applications requiring water quality and/or bathymetric data. The i3XO EcoMapper is designed to improve the quantity and quality of environmental field data while significantly reducing technician labor and boat time. The EcoMapper is capable of producing high resolution maps of water quality and bathymetry while working in a completely autonomous mode.

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FEATURES AND SPECIFICATIONS

1. The vehicle shall be capable of working in fresh, brackish, or seawater.
2. The vehicle shall be capable of operating to water depths of 100 meters.
3. The vehicle shall not exceed 5.8” in body diameter (not including fins and antenna), 85” in length and not to exceed 85 lbs. in weight.
4. The vehicle shall be capable of operating in a self-powering mode from an internal power system using a set of 800 WHrs of rechargeable Lithium-Ion batteries (>300 cycles). Mission duration is 8-14 hours at an average cruising speed of 2.5 knots.
5. The battery compartment must be sealed and protected by a safety device that protects the operator from a gas pressure build-up in the battery compartment.
6. The vehicle shall have, as a standard, an Intel Dual Core 1.6GHz N2600 processor and up to 512GB solid state drive for data storage
7. The vehicle shall have the capability of updating its internal software with newer versions in the field by the end user via the web or disk.
8. The vehicle shall be supplied with user-friendly mission planning software that accepts most standard geo-referenced chart types.
9. The vehicle shall be supplied with vehicle control software to provide a user interface to the vehicle that allows for mission loading, data transfer, diagnostic checks and manual vehicle control.
10. The vehicle shall be supplied with a location pinger and internal moisture sensors.
11. The vehicle shall have the following sensor payload: Conductivity, Temperature, Depth from Surface, Height from Bottom, Three-Axis Digital Compass. The vehicle shall have sensor ports available for the following optional sensors that are field installable/replaceable: Optical Dissolved Oxygen, Turbidity, Chlorophyll Fluorescence, Blue-green Algae Fluorescence, pH/ORP.
12. The vehicle shall have antenna with GPS capability (WAAS corrected in the United States), a 2.4 GHz radio link when on the surface (Wireless 802.11g Ethernet), location LEDs, and a wet-pluggable battery charging connector.



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13. As an option, the vehicle can be provided with a Rugged Handheld Remote used to for deployment/retrieval, starting/stopping missions, vehicle health information, with 300m range and an IP67 rating.
14. As an option, the vehicle can be provided with iridium communication for providing updates on location and health of vehicle, with a watchdog battery backup that will allow the iridium to continue sending messages for up to 24 hours after the main battery has died. Iridium can also be used to send specific information to vehicle. For example, stopping a mission, starting a mission pre-loaded on vehicle, or sending vehicle to a specific location.
15. The vehicle shall have four independent control planes for navigation and to maintain stable positioning in the water.
16. The instrument shall use a dissolved oxygen sensor that employs the Luminescent “Lifetime” Dissolved Oxygen measurement technique. This sensor shall be capable of measuring dissolved oxygen in the range of 0-20 mg/l with an accuracy of +/- 0.1 mg/l; and in the range of 0 - 200% saturation with an accuracy of +/- 1% air saturation with a response time of less than one minute under all or zero flow conditions without the use of a stirring device. In addition the sensor must be able to measure dissolved oxygen in the range of 20 - 50 mg/l with an accuracy spec at this range of +/- 5% of the reading; and in the range of 200 - 500% saturation with an accuracy spec of +/- 5% of the reading.
17. The vehicle shall be capable of measuring temperature using a thermistor in the range of -5 to 50 degrees C with an accuracy of +/- 0.01 degrees C and a resolution of 0.001 degrees C. The instrument shall also provide, as an option, the capability of having a characterized temperature output with an accuracy of +/- 0.05 degrees C. The output shall be capable of being displayed in Celsius, Fahrenheit, or Kelvin.
18. The vehicle shall be capable of measuring conductivity using a four-nickel electrode cell in the range of 0 -100 mS/cm with an accuracy of +/- 0.5% + 0.001 uS/cm and a resolution of 0.0001 to 0.01 mS/cm. The output shall be capable of being displayed in mS/cm or uS/cm. The conductivity sensor shall be capable of measuring over the entire range (0-100 mS/cm) without changing the cell constant. Capable of measuring Total Dissolved Solids if Conductivity and Temperature used.



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19. The vehicle shall be capable of measuring pH in the range of 0-14 with an accuracy of +/- 0.2 and a resolution of 0.01 using a combination electrode with a gel filled reference electrode. This same sensor is also used for measuring most low-ionic strength waters.
20. The vehicle shall be capable of measuring ORP in the range of -999 to +999 mV with an accuracy of +/- 20 mV and a resolution of 0.1 mV using a combination electrode with a gel filled reference electrode.
21. The instrument shall have available as an output a salinity calculation based on the conductivity and temperature measurements in the range of 0-70 PPT with an accuracy of 1.0% or +/- 0.1 PPT (whichever is greater) and a resolution of 0.01 PPT. The algorithms used for the calculation should be those found in the *Standard Methods for Examination of Water and Wastewater*.
22. The vehicle shall have the capability of being supplied with a nephelometric type turbidity probe capable of measuring turbidity in the 0 – 4000 FNU range with an accuracy of +/- 2% of reading or 0.3 FNU's (whichever is greater) in YSI AMCO-AEPA Polymer standards for range of 0-999 FNU and +/- 5% of reading for 1000-4000 FNU. Resolution of 0.01 FNU's for 0-999 FNU and 0.1 FNU's for 1000-4000 FNU. Measurements should have reasonable agreement to the HACH 2100AN benchtop meter.
23. The vehicle shall have the capability of being supplied with a chlorophyll probe capable of measuring chlorophyll fluorescence in the 0 - 400 ug/L range with a resolution of +/- 0.01ug/L. Part of Total Algae sensor
24. The vehicle shall have the capability of being supplied with a blue-green algae probes capable of measuring blue-green algae fluorescence in the 0 – 100 ug/L range for PC and 0-280 ug/L range for PE. Versions available for either freshwater or marine environments. Part of Total Algae sensor
25. The vehicle shall have the capability of being supplied with an fDOM probe capable of measuring fDOM in the 0-300 ppb QSE range with a detection limit of 0.07 ppb QSE and a resolution of 0.01 ppb QSE.
26. Water quality sensor assembly can be calibrated via wireless Bluetooth communications.



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27. The vehicle shall be supplied with a user-friendly water quality sensor software program providing communication and data processing. Data shall be presented in both report and graphical form, and data statistics will be automatically generated and displayed for Min, Max, Mean, and Standard Deviation. The software program shall be capable of exporting data in comma and quote delimited and ASCII formats.
28. All watertight seals will have redundant seals, thus protecting the internal electronics from the environment.
29. The vehicle shall be supplied with a RDI DVL with 81m range for subsurface navigation and current profiling.
30. The vehicle shall be supplied with a Tritech Starfish SideScan Sonar with a single frequency of 450 kHz

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