

Appendix A: SPECIFICATION OF 3 AUTONOMOUS UNDERWATER GLIDERS

1. Introduction

NWO-I / Royal Netherlands Institute for Sea Research is the national oceanographic institute and principally performs and promotes academically excellent multidisciplinary fundamental and frontier applied marine research addressing important scientific and societal questions pertinent to the functioning of oceans and seas. NIOZ serves as national marine research facilitator (NMF) for The Netherlands scientific community.

2. Abbreviations

CTD	Conductivity Temperature Depth
CDOM	Chromophoric Dissolved Organic Matter
OS	Operating System
OEM	Original Equipment Manufacturer

3. Application and intended use

The underwater gliders will be used to perform marine research in seas and oceans. Deployments can vary between several weeks up to eight months and preferably more. Satellite communications will allow retrieval of most data in near real time and piloting.

4. Three underwater gliders with a depth rating of minimum 1,000 m.

4.1 *Two of the three gliders should be equipped with the following requirements:*

- Primary lithium batteries.
- An extended battery bay including batteries enabling an extended endurance.

Both gliders must be equipped with the following sensors:

- Non pumped CTD, RBR Legato3 or equivalent.
- Oxygen optode, Aanderaa 4831 or equivalent.
- Ecopuck, measuring chlorophyll, turbidity and CDOM, Wetlabs FLBBOD or equivalent.

For both gliders, the following instrument should be quoted as optional:

- Acoustic modem, low frequency, broad antenna pattern, for acoustic data recovery from a subsea mooring, Benthos ATM-900 or equal. The interface from the glider OS to the modem should be included.

Please describe which sensors/instruments are fixed and which are easy to remove, and include technical details on how to exchange the sensors.

4.2 *The third glider should be equipped with the following requirements:*

- Rechargeable lithium batteries, including charger and charger cables.

The following items should be quoted as optional:

- A nose recovery system.
- An auxiliary thruster.

This glider must be equipped with the following sensors:

- Non pumped CTD, RBR Legato3 or equivalent.
- Oxygen optode, Aanderaa 4831 or equivalent.

- f. Ecopuck, measuring chlorophyll, turbidity and CDOM, Wetlabs FLBBOD or equal.

The following sensors should be quoted as optional:

- g. Nitrate, SBE Suna or equivalent.
- h. Micro turbulence including probes and thermistors, RSI MicroRider-1000 or equivalent.
- i. pH, SBE ISFET or equivalent.

Not all sensors for this glider need to be used simultaneously. Please specify which combinations are possible.

Please describe which sensors/instruments are fixed and which are easy to remove, and include technical details on how to exchange the sensors.

4.3 All three gliders must be equipped with:

- a. Iridium telemetry, GPS and altimeter.
- b. Glider management and piloting software for use on a desktop computer and, if possible, a mobile phone.
- c. Software for making endurance and range calculations.
- d. All required cables, tooling, ballasting weights, additional buoyancy, etc.
- e. Argos backup tracking pinger.
- f. The quotation shall specify requirements for data communication and hardware.
- g. Transit case.
- h. A custom cart.
- i. 2 year spare parts kit.
- j. Software licenses for a minimum duration of two years.
- k. Documentation: system description, user manual, piloting manual, maintenance manual and sensor manuals. For each glider: one paper version and one digital version.

All three gliders must be capable of using both *primary lithium batteries* and *rechargeable batteries*.

The following items should be quoted as optional:

- l. Strobe light for easy recovery.

5. Endurance and range

Realistic endurance and range calculations will be provided by the supplier for:

5.1 Setup I

- a. Extended primary lithium batteries.
- b. Sensors: unpumped CTD and Oxygen Optode.

5.2 Setup II

- a. Standard rechargeable lithium batteries.
- b. Sensors: unpumped CTD, Ecopuck and nitrate sensor.

Additional info for the calculations for both setups:

- Diving depth: 1,000 m.
- Sampling modes: descent and climb, and descent only.
- Area: Irminger Sea.

- Average sea water temperature: 4°C at 1 km depth, 15°C at surface.
- A density profile is added in Appendix B.
- No battery capacity kept in reserve.
- The endurance should be specified in days and the range in kilometres.

6. Shore side of the acoustic data recovery from a sub-surface mooring

This item should be quoted as an option.

Using the glider-mounted acoustic modem (§ 4.1.f), data can be recovered from a subsea mooring. The acoustic-satellite link will allow bi-directional communication.

The shore-side data management system and a dock server will be included. The system will contain: sorting of received files, a master file per mooring, the tracking of missed records, etc.

In a field test and demonstration a demo modem will be set up, a glider will be deployed, and a working system will be approved.

Please advise an *acoustic modem OEM board* for integration in a pressure housing in the mooring. NIOZ will design its own mooring and provide the acoustic modem and the sensors.

7. Areas of operation

Typical areas of operation are: North Atlantic, Mid Atlantic, Irminger Sea, Labrador Sea, Mediterranean Sea and North Sea.

Seawater temperature: -2°C to 32°C.

Please specify whether operation in a deep fresh water lake will be possible.

8. Glider tests before delivery

- Factory Acceptance Test – FAT.
- Sea Acceptance Test – SAT. All gliders will be tested over a period of approximately 5 days. The location, vessel or facility for the SAT will be agreed between NIOZ and the supplier.
- The supplier submits a detailed test and time schedule for the delivery inspection to NIOZ in advance for approval.
- All tests will be reported in an acceptance report for each glider.

9. Miscellaneous

- All units should be fully ready for operation.
- A 24/7 helpdesk service will be available.
- Please specify online pilot assistance helpdesk availability for the first 2 glider missions, each for an estimated duration of 2 months.

10. Maintenance and operational costs

Please indicate if you have a glider service centre in Europe. If so, where is this centre located?

The quotation shall specify:

- Costs of spare parts for 2 year operation based on 4 months deployment /year;
- Lead time for spares and consumables.

11. Warranty

The standard warranty period is one year after successful delivery and acceptance of the gliders.

The warranty will comprise:

- Repair or replacement of defective components.
- Technical support service (phone/email) for assistance in solving problems during operation of the gliders.
- Software maintenance and new software releases.

A 2 years extended warranty should be quoted as an option.