SUPPLY AND INSTALL OF AIDS TO NAVIGATION ON LAKE KARIBA ON BEHALF OF GIZ FOR THE IMPLEMENTATION OF THE AFRICAN UNION BORDER PROGRAMME (AUBP)

PREPARED FOR:

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Contents

Request for Quotations	
Introduction	GIZ seeks quotations from suitably qualified service providers to quote, supply and install the following Aids to Navigation on Lake Kariba.
Requirements	Refer Schedule of Requirements below
Notes	Quotes must include the cost of delivery to Zimbabwe and the installation of the Aids to Navigation on Lake Kariba. The GIZ project supports the implementation of the African Union Border Programme (AUBP) management.
Location	Delivery to Zambezi River Authority Kariba Office Administration Block 21 Lake Drive Pvt. Bag 2001 Kariba, Zimbabwe
Delivery, Dates and Times	Please call the office prior to delivering the Aids to Navigation to ensure that staff is available to receive the goods.
Recipients	Joint Boundary Commission of Zambia and Zimbabwe and The Zambezi River Authority

SCHEDULE OF REQUIREMENTS

Aids to Navigation for the Lake Kariba under the management of GIZ

Note: The illustrations below do not indicate a lantern, however the buoys should have integrated mounts for optional mounting for self-contained navigational lights below the top marks.

1. Rotomolded Polyethylene Marine Navigational Buoys, as per Section 2					
Item	**Quantity**	**Type & Illustration**		**Basic Description**	**Lanterns to be fitted, or not**
1.1.	12	Special Mark		• Yellow Pillar Buoy • Including Ballast & Foam • Top mark - Single Yellow 3D Diagonal Cross • With mould-in graphics, reading: Border	Yes
1.2.	1	Special Mark		• Yellow Pillar Buoy • Including Ballast & Foam • Top mark - Single Yellow 3D Diagonal Cross • With mould-in graphics, reading: Border	No, to be used as spare
1.3.	12	Complete moorings, including the mooring line and sinker/anchor			
1.4.	1	Spare mooring, including the mooring line and sinker/anchor			
1.5.	1	Sets of instruction manual(s) detailing the maintenance and troubleshooting of the buoys.			

Note: The provisional co-ordinates of the location of the buoys appear at **Annexes A**.

2. Self-contained marine LED Lanterns as per Section 3					
Item	**Quantity**	**Colour**	**Character**	**Range**	**GNSS synchronise ability**
2.1.	12	Yellow	Refer to Annex A	Refer to **Annex B**	Refer to **Annex B**
2.2.	1	Yellow (Spare)	To cater for all characters as listed on **Annex B**	To cater for all ranges as listed on **Annex B**	Refer to **Annex B**
2.3.	1	Hand-held, infrared remote programmer to enable the remote programming of the LED lanterns called for in **Section 3, item 1.4**.			
2.4.	1	Sets of Instruction manual(s) detailing the operation, maintenance and troubleshooting of the lanterns			

Note: The provisional characteristics of the lanterns appear at **Annex A**.

3. Installation and deployment as per Section 1, clause 15					
3.1.	The bidder is able to supply the following:				
3.1.1.	Buoys and mooring	Yes		~~No~~	
3.1.2.	Lanterns	Yes		~~No~~	
3.1.3.	Transport, custom clearance and installation	Yes		~~No~~	
3.1.4.	Vessel Hire	~~Yes~~		No	Under the responsibility of Zambezi River Authority

SECTION 1

Specification for the supply, delivery and installation of various aids to navigation equipment

1. General

1.1. Introduction

The GIZ project has the responsibility to implement the required Aids to Navigation (AtoN), both fixed and floating, and demarcation marker for as boundary markers on Lake Kariba in the area of Sampa Karuma.
GIZ project supports the implementation of the African Union Border Programme (AUBP) with a focus on three areas:

Delimitation and Demarcation: The project supports selected AU Member States to better define their borders and to use improved planning and technical capabilities for joint border definition. The better definition of borders includes increasing the number (densification) and renewal of dilapidated border markings, as well as mapping border areas. It also includes the reform or creation of border commissions. Working with the local border to communities to create awareness about the relevance of borders and to prevent conflicts is another important aspect to foster peace and security.

Cross-Border Cooperation: The project works with border communities, local, civil society, and state actors to implement cross-border cooperation projects at selected borders.

Strengthening the AU and RECs (Regional Economic Communities): The AUBP-unit and Regional Economic Communities (RECs) are strengthened in supporting border governance initiatives of their Member States.

The Zambezi River Authority has to ensure compliance to the South African Maritime Safety Authority (SAMSA) Aids to Navigation Standards; SAMSA Marine Notice No. 8 of 2016 - ***"Standards for Aids to Navigation in South African waters and Inland Waterways"*** or equivalent standards to the specific country.

This specification forms an integral part towards compliance to SAMSA's Aids to Navigation Standards

1.2. Scope

1.2.1. The specification describes the minimum requirements, all of which is to be supplied, installed and deployed as per the Schedule of Requirements.

(a) Section 2 - Rotomolded Polyethylene Marine Navigational Buoy, with mooring

(b) Section 3 - Self-contained LED marine lantern

(c) Section 4 – Vessel (under the responsibility of Zambezi River Authority)

1.2.2. As the equipment (equipment means all products to be provided under the contract awarded) will operate under automatic conditions, it is essential that all the equipment comply with the following requirements:

(a) Proven technology

(b) Rugged construction and sealing

(c) Long life span

(d) Maximum reliability

(e) Minimum maintenance requirements

(f) Maximum reliability

(g) Compliance to Relevant International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendations

2. Service Conditions / Environment

2.1.1. The equipment shall be designed and tested to operate reliably in the harshest of environmental conditions.

2.1.2. The equipment shall operate under the environmental conditions outlined below and must be fully protected against failure and damage by these conditions.

(a) Extreme temperature

Exposure to temperatures from -5 to +50 degrees C.

(b) Humidity

Exposure to relative humidity from 0 to 100%, including horizontal driving rain.

(c) Wind speed

Exposure to wind speeds up to 120 km/hour.

(d) Ultraviolet exposure

Continuous exposure to ultraviolet light for the duration of the advertised service life of the beacon, as is typically encountered at sea level at between 0°S and 35°S latitudes.

3. Quality and Workmanship

3.1.1. All products and services supplied under this contract shall conform to this specification, shall be of good design and construction and shall be suitable for the use intended.

3.1.2. To ensure the quality and consistency of the supplied products, the Supplier/Manufacturer and successful Bidder shall have an accredited Quality Management System in place, which shall preferably be in accordance with ISO 9001. The Bidder shall submit a copy of their quality statement and Quality Assurance Certificate with their proposal.

3.1.3. The successful Bidder's Quality Assurance Manual shall be made available upon request.

3.1.4. The successful Bidder shall implement professional quality control and assurance procedures when carrying out its duties under this Contract.

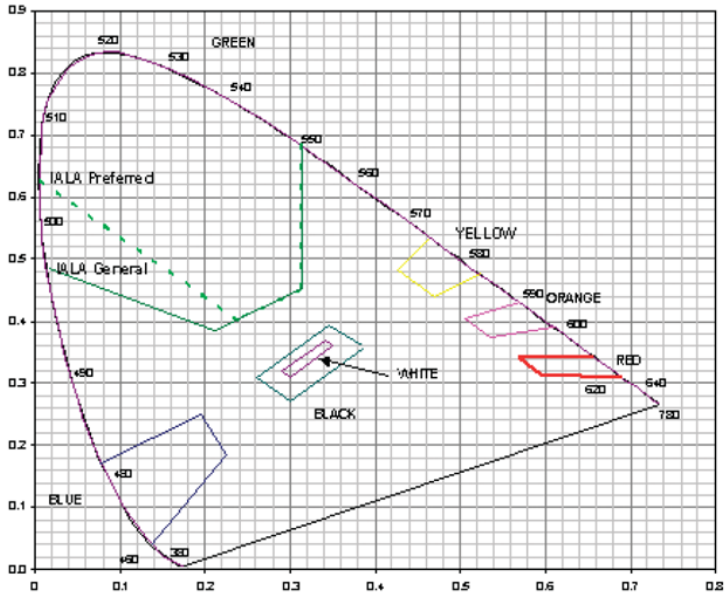
3.1.5. The design and final products shall comply with the internationally accepted Legislation, Regulations and Codes of Practice.

4. Standards

4.1.1. Except where otherwise provided for in this specification, the equipment offered must comply with the relevant IALA Recommendations and the South African Maritime Safety Authority (SAMSA) AtoN Standards, i.e.

"SAMSA Marine Notice No. 8 of 2016 - ***"Standards for Aids to Navigation in South African waters and Inland Waterways***".

4.1.2. The colour of the lights and surfaces (buoys and top marks) shall comply with the IALA Recommendation and Guideline for surface colours used as visual signals on AtoN (IALA chromaticity areas as plotted on the 1983 CIE chromaticity diagram below).



4.1.3. Where the equipment offered complies with the recognised standards of the country of manufacture and not specifically with the standards required by this specification, such equipment will be considered at the discretion of GIZ (the Purchaser) in which case the Bidders may be required to supply copies of such standards translated into English.

5. Submission of Bids

5.1.1. Bidders need to ensure that their bids comply 100% in terms of the Specification, otherwise their bids would be judged as non-responsive and shall be rejected. This shall include, but not be limited to:

(a) The completeness of and compliance to all bidding forms

(b) Inclusion of costs for all relevant items

(c) The arithmetic's of the cost of the line items vs. totals

5.1.2. Bidders must include the supply of all the equipment listed in the Schedule of Requirements.

5.1.3. The equipment will be checked and upon reception by the Zambezi River Authority.

5.1.4. Bidders must state in detail (using the same numbered paragraph headings of this specification) in what respects their offers comply with or differ from the requirements of this specification. Failure to provide these may disqualify a bid.

It is preferred that wherever possible, Bidders offer their standard equipment most closely complying with this specification, provided that the standard equipment provides better but NOT worse facilities, than required by this specification.

Where alternative offers are made, each offer must be complete in terms of this specification.

5.1.5. All Bidders and associated literature must be submitted in English.

5.1.6. The submission of manufacturer's data sheets and advertising pamphlets without the necessary amplification, will not be acceptable.

5.1.7. Detailed description and information are required of all products offered.

5.1.8. Bidders must complete the technical data sheets which are attached as annexes to this specification. Failure to do so would result in a bid being declared non-responsive.

6. Bill of Quantities

No Bill of quantities is provided. The Bidder shall determine and verify all work and material required and quote accordingly. No variations orders shall be applicable.

7. Warranty, including Defects Liability Period

7.1. The successful Tenderer shall guarantee that the equipment, including the colour stability, supplied shall, when installed and commissioned, constitute a reliable and efficient system.

7.2. The colour stability shall be guaranteed for a period of not less than twenty-four (24) months from the date of deployment.

7.3. If during the first twelve (12) months that the equipment is in service, any inherent faults develop not due to fair wear and tear, of which the purchaser is not aware at the time of acceptance of the offer; the purchaser reserves the right to return it to the supplier; all or part of the complete equipment.

7.4. The supplier/s shall assume full liability for the cost of the equipment and such transport charges between the factory and the site as the purchaser may have incurred. Under these circumstances, the purchaser shall not be liable for any depreciation or wear and tear of the apparatus whilst it was in service.

7.5. The Defects Liability Period shall be a period of 12 months, calculated from the date of placing the buoy in service.

7.6. During the Defects Liability Period, the Contractor shall be responsible for making good with all possible speed, at his/her own expense, any defect in or damage to any part of the equipment which results in the failure thereof to meet this Specification, and which arises from defective materials, workmanship or design.

7.7. Nothing in this Clause or in the successful Tenderer's performance thereof shall in any way act as a waiver or release the successful Tenderer from any of his obligations, including but not limited to the requirement to perform the Works in accordance with the Specification.

7.8. The tenderer shall state how long the equipment offered has been and is likely to remain in production.

7.9. GIZ will not consider tenders that do not include a guarantee for the twelve (12) months as indicated above.

8. Reliability

Bidders are requested to supply details, e.g. location, conditions of operation, type of equipment etc., of any similar equipment supplied by them to other Administrations.

9. Documentation

All equipment shall be supplied with an instruction manual(s) detailing the installation, operation, maintenance and troubleshooting.

10. Spares

Bidders shall quote separately for a complete set of spares of each type of equipment and component in order to maintain the equipment in a fully working condition. A list showing the individual items and price of each item shall accompany the bid.

11. Verification

Standard commercial literature shall be included in the bid package to verify compliance with Commercial Off the Shelf requirement. Test documents to show verification of the requirements may be included.

12. Transport, customs and delivery

12.1. All equipment is to be delivered to Kariba. The final delivery address is the following:

Zambezi River Authority

Kariba Office

Administration Block

21 Lake Drive

Pvt. Bag 2001 Kariba, Zimbabwe

12.2. Delivery costs are the responsibility of the selected service provider, including customs clearance costs.

13. Packing

All equipment must be packed in such a manner that it will be fully protected against damage during

handling, transport by sea and/or rail and must be adequately protected against vibration and moisture.

14. Special Note

It may decide to reserve the right to annul the tendering process and not award the contracts, accept all, or only part of the quantity as indicated on the Schedule of Requirements.

15. Installation of all equipment & Deployment

Should the Schedule of Requirements call for the successful Bidder to install and deploy the buoys:

15.1. The successful Bidder shall supply:

15.1.1. All the staff, mooring and sinkers/anchors and installation materials necessary to install, test and commission the required equipment.

15.1.2. An additional quantity amounting to 10% of the total number of bolts, washers, nuts and shackles shall be provided.

15.2. The provisional coordinates of the locations where the buoys are to be deployed are given at **Annex A,** and the final coordinates will be provided to the successful Bidder.

15.3. The successful Bidder shall be responsible for all site works and services in connection with the pre-installation, preparation and installation of the equipment.

15.4. All installations shall be neat and tidy.

15.5. The successful Bidder shall clear away all rubbish, debris, rubbish and excess material, etc. and leave the site and surrounding area in a clean and acceptable state.

15.6. The Purchaser representatives shall be present during the installation, testing and commissioning phases, unless otherwise agreed.

16. Evaluation criteria

16.1. The bidders that do not meet all the technical requirements will be eliminated. Among the bidders that meet all the technical requirements, the lowest bidder will get the market awarded.

SECTION 2

Rotomolded Polyethylene Marine Navigational Buoys and mooring

1. General

1.1. Scope

1.1.1. This specification covers the requirements for the manufacture, supply and delivery of a high performance, low maintenance, rotomolded polyethylene type marine navigational buoy to be used in reasonable sheltered waters.

1.1.2. Requirements pertaining to the buoys; this is in addition to the type of buoys required in terms of the Schedule of Requirements.

Description	Dimensions
Minimum "Focal plane" of buoy (mm), without any lantern. This is the height of the buoy above the waterline on which the lantern would be mounted.	1,180 mm
Hull diameter, not less than	1,200 mm
Average mooring depths. This is only a guideline, and the successful Bidder would be responsible to establish the depths at the various locations to ensure a suitable length mooring is supplied for each location.	±80 Metres on average, but extends up to 100 metres in places
Minimum reserve buoyance of	120 kgs

1.1.3. Failure to comply with these requirements will preclude the tender from further consideration.

1.1.4. The work shall include the supply of all the items listed on the relevant documentation.

1.1.5. It is essential that the buoy complies with the following requirements:

(a) Easy deployment

(b) Good visual presence

(c) Good station keeping and stability.

(d) To be able to track well in currents of up to 6 knots.

(e) Minimum maintenance attention

(f) Minimal marine growth

(g) Designed to withstand the high corrosive marine environment it will be operating in

(h) Designed to withstand the harsh weather conditions that it will be it will be operating in

(i) To be able to take reasonable knocks and/or collisions without being severely damaged and causing it to sink.

(j) IALA Recommendations

1.2. Standards

1.1.1. The manufacture and finish of the buoy shall comply with all relevant Codes and/or Standards that are statutory requirements in South Africa.

1.1.2. Tenderers must state the national and or international standard/s to which the buoy and or its components comply with.

1.1.3. The colour and shape of the buoy and its top mark shall comply with the IALA Recommendations:

(i) IALA Maritime Buoyage System for Region A

(ii) Surface colours used as visual signals on AtoN.

1.3. **Guarantees**

1.3.1. The successful Tenderer shall guarantee that the equipment, including the colour stability, supplied shall, when installed and commissioned, constitute a reliable and efficient system.

1.3.2. The tenderer shall state how long the equipment offered has been and is likely to remain in production.

1.4. **Inspection, testing and certification.**

Regular in-house inspections shall be undertaken by the manufacturer to ensure adherence to the requirements of this specification.

2. Buoy

2.1 **General requirements**

2.1.1 The buoy's hull and top shape (super structure) shall be supplied in accordance with this specification and the Schedule of Requirements.

2.1.2 All parts, excluding the metal parts, shall be rotationally moulded from high quality UV-stabilised, polyethylene to form a seamless, watertight buoy body with a wall thickness of at least 9 mm. The mould design and manufacturing process shall increase the thickness of the polyethylene at the major stress points.

2.1.3 Prior to moulding, a colour pigment shall be blended into the polyethylene material eliminating the need for painting.

2.1.4 When deployed, the buoy shall be stable and be capable of supporting a marine lantern, solar system & battery, and submerged weight of the mooring chain.

2.1.5 When fully assembled, the buoy shall stand upright on the ground without the need of a cradle or other supports.

2.1.6 The buoy shall be completely assembled and tested before delivery.

2.2 **Buoy body**

2.2.1 The buoy body shall be completely watertight but should not deform after deployment due to altitude / air pressure.

2.2.2 Each buoy shall have self-contained, customised concrete ballast.

2.2.3 The buoy shall be designed with the necessary ballast to be able to stand upright on its own and to ensure that the buoy is able to track well (do not lean over excessively) during high winds and/or choppy water conditions; with the standard top mark and lanterns; **at wind speeds of up to 15 m/s (54 km/h)**

2.2.4 The buoy's hull shall be filled with Rigid Closed Cell High Density Polyurethane Foam, filling all void areas, to form a single block to effectively allow minimal ingress of water should a leak occur.

2.2.5 The polyethylene shall contain a colouring pigment within the material which is colour stabilized to a minimum **UV-08 level index**. The colour pigments shall be imbedded in the polyethylene and not be added as a coating.

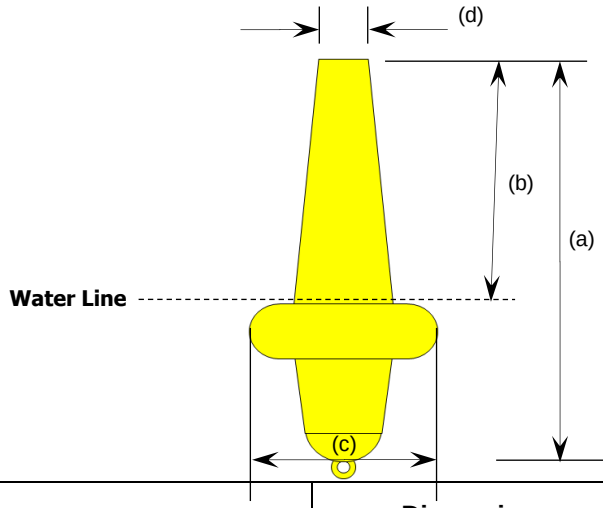
2.2.6 The top section shall have a suitable flat top-mounting surface to allow for the fixing of a marine light and top mark, or other relevant equipment for navigational purposes, with the following fixing arrangements:

(a) Three (3), 13mm stainless steel mounting inserts, or studs at a PCD of 200mm

(b) Four (4), 13mm stainless steel mounting inserts, or studs at a PCD of 465mm

2.2.7 Dimensions

The buoy shall have the following minimum dimensions:

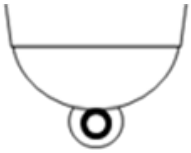


Description		Dimensions
(a)	Total Length (Height)	≤ 1,200 mm
(b)	Length (Height) above Water Line	≤1.000 mm
(c)	Diameter at Water Line	≤ 1200 mm
(d)	Diameter at Top of Buoy	≤ 200 mm

2.3 Lifting and mooring Eyes

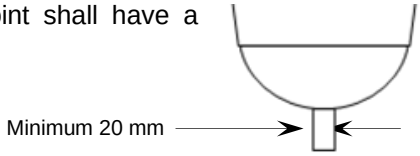
2.3.1 The buoy shall have a rigid lifting eye.

2.3.2 The buoy shall have a rigid mooring eye / fixing point at the bottom with a with an inside diameter of not less than 15 mm.



2.3.3 The wearing section of the mooring eyes shall be easily removable and replaceable.

2.3.4 The width of the plastic at the mooring eye / fixing point shall have a minimum thickness of 20 mm.



2.3.5 The mooring and lifting eyes shall be cross-braced and secured in such a manner that no undue strain is placed on the body when the buoy is being lifted by the lifting eyes or by the forces exerted by the mooring. Full detail as to how this would be done shall be submitted with the tender, including a cross-sectional drawing indicating the method of cross-bracing.

2.3.6 The lifting eyes, the mooring eyes and cross-bracing shall have a suitable proof load to enable the buoy and mooring to be lifted within the relevant safety requirements.

2.3.7 The lifting eyes, the mooring eyes and the cross bracing are to be tested and certified individually, as well as an assembled unit by a qualified body to a safe working load (SWL) of the mass of the buoy, the mooring chain and any other equipment fitted to the buoy, plus a safety margin of at least 15%. This certificate shall be supplied as an integral part of the deliverables with the buoy at the time of delivery.

2.5 **Top marks**

2.5.1 Each buoy shall be supplied with a suitable top mark mounting facility. The various top marks shall be supplied as a unit and packed separately to avoid damage during transport.

2.5.2 Top marks shall be supplied as called for in the Schedule of Requirements.

2.5.3 The top mark shall be able to withstand the harsh conditions that the buoy will be exposed to and not be damaged by these operational conditions.

2.5.4 One (1) top mark per buoy shall be provided per buoy, according to the shape of the buoy as called for in the Schedule of Requirements.

2.5.5 Each top mark shall be supplied complete with all the necessary hardware to be able to mount/attached these to the buoy body.

2.5.6 The top mark shall be fitted to the top of the buoy in such a way not to negatively affect:

(a) The visibility of the buoy lantern

(b) The solar charging of a self-contained buoy lantern

2.5.7 To ensure that the shape of a mark is clearly identifiable, its visible dimensions shall comply with the proportions indicated below:

(a) 'X' (Single 3-D Yellow Diagonal Cross) top marks (for special marks)

(i) The arms of the 'X' should be diagonally contained within a square with length of side of about 33% of the buoy diameter at the waterline.

(ii) The width of the arms of the 'X' should be about 15% of the length of side of the square.

(iii) The vertical space between the lowest part of the square and all other parts of the mark should be at least 35% of the height of the square.

2.5.8 All top marks will be fitted, using stainless steel support structure, with a minimum diameter of 10 mm. Stiffeners/gussets shall be welded to Base Plate and Top mark support structure to ensure stability and strength.

2.5.9 It shall be fitted in such a way that it could not be unscrewed / removed from the buoy mounting facility stainless steel support.

2.5.10 Provision shall be made for a lantern to be mounted below the top mark for all lit buoys.

2.6 **Numbering**

2.6.1 Graphics

(a) Should mould in graphics and/or vinyl wraps with custom graphics and/or logos be required, it will be indicated as such on the Schedule of Requirements. Bidders could also suggest alternative measures to display and mount corrosion-free, custom graphics and/or logos.

(b) The Special Mark buoys may be required to have mould-in graphics appearing thereon. If required, each buoy will contain two (2) sets of, e.g., "Border" mould-in graphics spaced proportionally around the buoy.

GIZ will advise the final requirements in this regard to the successful Bidder, including the direction of the lettering.

(c) The marking / number will be legible with the letters and numerals a minimum of 15 mm high, to ensure easy identification. The marking / number should also not be able to be scratched off or removed from the buoy.

(d) Black lettering should be typically Aerial Bold and each letter should not be smaller than 40 mm high and 30 mm wide.

(e) The lettering should be spaced so that the last letter is at least 200 mm above the waterline.

(f) The graphics should resist attack from chemicals, solvents and exposure to extreme weather conditions.

(g) The graphics should be embedded in a layer of plastic resin, or vinyl wraps to protect it from fading, cracking, chipping or peeling.

(h) Bidders could also suggest alternative measures to display and mount corrosion-free, custom graphics and/or logos.

2.7 **Metal parts**

2.7.1 All metal parts, including the lifting eyes, mooring eye, radar reflector and mounting hardware, the top mark mounting facility, lantern guard, etc. shall be stainless steel grade 316L, or better, but not worse.

2.7.2 All external stainless-steel parts shall be electro polished.

2.7.3 All stainless-steel parts shall be:

(a) Pickled

(b) Passivated

3. Mooring System

0.1. A complete mooring system is required for each buoy. It could consist of chain, cable, or synthetic rope, or a combination of all three.

0.2. Complete with shackles and swivels to ensure a complete mooring line that is connected to the buoy body and sinker/anchor.

0.2.1. Cable mooring – Minimum breaking load of 1500kg

The cable mooring should comprise:

(a) Bridle

(b) Chain (Riding Chain, Thrash Chain & Ground Chain)

(c) A swivel is required between the bridal and the mooring chain.

0.2.2. Fibre rope mooring - Minimum breaking load of 1500kg

The mooring must be designed so that the rope is never in contact with the buoy body or tail tube and is never in contact with the seabed.

These criteria can be achieved in a normal buoy mooring by utilising a ground chain that absorbs the wear on the seabed to which a rope “riser” is attached. Sub-floats may be incorporated to keep the rope off the seabed. The rope “riser” component of the mooring shall be of such a length that even at the lowest tides the rope is never chaffing on the seabed.

The rope may be attached directly to the buoy if the mooring eye is in a suitable position such that the rope will always be clear of the buoy.

In other cases, a short length of chain (or bridle in the case of two mooring eyes) may be used to absorb any chafe.

The load imparted by the buoy due to wind/wave action and water velocity, and the strength necessary to lift the sinker (or anchor) would determine the size of rope to be used.

A rope with strength equal to twice the lifting capacity of the servicing vessel should be offered.

0.3. Containing swinging circle

The swinging circle of the buoy is to be contained using a sub-float and weights system to always keep the mooring as “short” as possible.

0.4. Shackles and Swivels

The shackles and swivels safe working load should be at least twice the minimum breaking load of the mooring specification.

0.5. Sinkers/Anchors

0.5.1. Reinforced concrete sinker.

Reinforced concrete block to be a minimum of 750kg in weight

A marine Grade 316 stainless Steel rod, minimum 16mm Ø, should be utilised as reinforcement for concrete mooring blocks, and the mooring eye.

0.5.2. Steel anchor

Minimum weight of 400kg, stockless anchor preferable.

0.6. Average depth

The average depth of the water where the buoys are to be deployed is given in **Section 2, clause 1.1.2**. The total length of the mooring should be designed to take into consideration the varying water depths between high and low spring water and any tidal differences.

The total length of the mooring should not be less than 1.2 times the average depth of the water.

4. Accuracy

Required accuracy of deployed anchors should be with in 10m of GPS location.

5. Documentation

Bidders shall quote separately for a complete set of documentation as per **Section 1**, **clause 9**.

6. Spares

Bidders shall quote separately for a complete set of spares as per **Section 1, clause 10.**

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SECTION 3

Self-contained LED marine lanterns

1. Functional requirements

This is a general description to cover the requirements of a complete self-contained LED marine beacon.

(a)	Colour	Yellow	
(b)	Range	2 – 3 NM	
(c)	Minimum Autonomy	Days	3
(d)	Divergence		Minimum 7°

1.1 **General description**

1.2 The lantern shall be completely self-contained and watertight and designed to operate reliably in the harshest of environmental conditions. The lantern shall require no external power source for it to operate.

1.3 The internal battery should be charged during the day, even under cloudy conditions. The light shall be switched on automatically during night-time and off during daytime or as the ambient light levels dictate. It should contain sophisticated microprocessor intelligence that enables advanced light output control and battery power management, as well as ensures that the light emits precisely controlled flash rates.

1.4 The lantern shall have up to 15 remote controlled, programmable effective intensity options. Where flash characters are used, automatic Schmidt-Clausen correction shall occur to increase the intensity to maintain the effective range of the lantern.

1.5 The lantern's service life shall be greater than 10 years. As the battery life is usually shorter than that of the optics, it is a requirement that the internal battery shall be able to be replaced with easy and without any damage to the lantern.

1.6 Each lantern shall be delivered fully assembled and ready for operational purposes.

2. Optics

2.1 A single, an array, or multiple arrays of high-intensity LEDs shall be used to produce light.

2.2 The lifespan of the LEDs shall be >90,000 hours.

2.3 The colours of the lights shall meet the IALA chromaticity recommendation.

2.4 An acrylic, UV-protected lens shall be used to maximise the light capture from the LEDs.

2.5 The LEDs are to precisely graded and placed to produce a light beam with minimum variation in intensity.

2.6 All lanterns shall be tested in a zero-range light tunnel prior to shipment to ensure the light output meets the required specification.

2.7 The rated intensity percentile shall be in accordance with IALA recommendations.

2.8 The lantern shall produce a uniform 360° horizontal fan beam. The peak intensity of the beam, in any direction in the focal plane, shall not vary by more than ± 15% from the mean.

2.9 The equivalent peak intensity candelas of the light signal in the focal plane after stabilisation when operated at 25 ± 5 °C shall be indicated on the attached Technical Data Sheet. The rated peak intensity shall be determined by the value met or exceeded by 90% of the measured values.

2.10 The maximum effective luminous intensity of the lantern signal shall be indicated on the attached Technical Data Sheet when calculated using the method of Schmidt-Clausen.

2.11 The vertical divergence of the lanterns shall be available in 7° and 10°.

3. Degradation

Tenderers shall indicate the period of time (in years) the lantern shall maintain its effective intensity of operation when operated at night with a 30% duty cycle.

4. Optical performance

The optical performance requirements listed hereunder shall be met for all colour light signals. Lanterns that use rapidly pulsed LEDs to provide the light signal shall operate at frequencies equal to or greater than 100 Hz. **Peak** and effective intensities are to be measured after values stabilise to account for intensity reduction due to LED junction heating.

The lantern shall automatically maintain the effective range of the light by increasing the intensity to compensate for shorter flash periods. This is to be done according to the Schmidt Clausen multiplier.

5. Characteristic control

5.1 Each lantern shall be capable of producing up to 246 standard flash characters, up to 20 factory set custom characters and at least one additional programmable custom character.

5.2 The required characters are to be able to be selected and/or adjusted by means of a remote controller device.

6. Daylight control

6.1 The lantern shall be switched on automatically during night-time and off during daytime or as the ambient light levels dictate. At a minimum, the lantern shall switch on whenever the ambient illumination, measured on a horizontal plane, falls below 50 – 100 lux. The lantern shall not switch off until the ambient illumination rises above 150 – 200 lux.

6.2 The hysteresis for the daylight control shall be 50-100 lux.

6.3 The lantern's internal photocell shall have a minimum of 9 selectable threshold levels.

7. Power supply requirements

7.1 When the internal battery power is applied, no other devices shall be necessary to produce a complete marine aid-to-navigation light signal.

7.2 The lantern shall be powered by a minimum of three integrated solar photovoltaic modules, charging an internal, removable/replaceable battery, with the battery matching the capacity of the solar modules.

7.3 The lantern shall have built in transient protection.

7.4 A switch mode regulator shall maintain the light output of the LEDs independent of the input voltage and temperature.

7.5 The power control of the lantern shall be continuous, based on power step and temperature.

7.6 Power consumption - ON

With the LED module energised, the total power requirement of the lantern shall be kept to a minimum. Relevant information is called for in the attached technical data sheet that needs to be completed by the Tenderer.

7.7 Power consumption - OFF

With the LED module off, whether between flashes or during daytime hours, the total power requirement of the lantern shall be kept to a minimum. Relevant information is called for in the attached technical data sheet that needs to be completed by the Tenderer.

7.8 In order to protect the LEDs, the output is to be maintained by microprocessor control from -30°C to +60° and to be reduced should the temperature rises above 60°C.

8. Low voltage

8.1 The lantern shall make provision for a programmable low voltage cut-out threshold in order to switch off when the programmed low threshold is reached. This feature shall be able to be disabled if not required.

8.2 Should the voltage drop below 10.3 Vdc and the cut-out feature is activated, the lantern shall resume proper operation as soon as the voltage rises above 10.5 Vdc again.

8.3 The lantern shall not be damaged if the input voltage drops below 10.5 Vdc.

9. Solar Photovoltaic system

9.1 The integrated solar modules shall be of the mono-crystalline.

9.2 The housing that accommodates the solar modules and battery shall be pyramid shaped with a minimum of 3 sides and shall be available in a minimum of five different solar capacities.

9.3 The sides of the body are to form an equilateral triangle with the inside angle between the solar panels of 60 degrees. The inclination of the solar panels shall be 80 degrees from the horizontal and 120° apart in azimuth.

9.4 The solar charger shall be designed for the type of battery being used.

9.5 The solar charger shall monitor the temperature and the voltage and shall charge the battery when the voltage level at the solar panels exceeds the voltage of the battery.

9.6 The solar charger shall contain a microprocessor-based charge controller to manage the charge rate to the battery, depending on the temperature and voltage and prevent the overcharging of the battery and possible release of hydrogen gas caused by overcharging.

10. Battery

10.1 The internal battery shall be able to be removed and replaced and the size shall match the capacity of the solar panels on each size type body.

10.2 Different battery sizes shall be able to fit in the body to enable the battery to match the capacity of the solar modules.

10.3 The battery shall be well secured, but ease to be replaced and re-secured.

11. Mechanical

11.1 All external materials shall be UV resistant.

11.2 Mounting provisions

The lantern shall have a mounting base with three different bolt patterns, including a 3-and 4-hole 200 mm pattern, a 3-hole 150mm bolt pattern, and a 4-hole 162 mm bolt pattern.

11.3 Enclosure & finish

(a) External components shall have a smooth finish, and shall be uniform in colour and appearance.

11.4 Material for body and base

(a) The body and base of the lantern shall be manufactured from UV-stabilized Polycarbonate.

(b) The lens of the lantern shall be manufactured from UV-stabilized Polycarbonate.

11.5 Polarity protection

The lantern shall not experience damage in the event that the battery is connected in reverse polarity. The lantern shall resume proper operation as soon as the correct polarity is provided.

11.6 Short-circuit protection.

The lantern shall have short-circuit protection so that connecting one of the power leads to the lantern housing while the other is attached to either the positive (+) or negative (-) terminal shall not result in damage to the lantern. The lantern shall resume proper operation as soon as the power leads are properly connected to the input terminals.

12. Service Conditions / Environment

12.1 The LED lantern and body shall be completely watertight and designed to operate reliably in harshest of environmental conditions.

12.2 The LED lantern, solar modules and battery shall operate under the environmental conditions outlined below and must be fully protected against failure and damage by these conditions.

12.3 Immersion

After total immersion in water to depths of 1 meter for periods of up to 1 hour.

12.4 Electromagnetic interference

The lantern shall not be susceptible to interference from radiating devices normally found in the marine environment. This includes signals from VHF radios and marine radars.

12.5 Static discharge

The lantern shall incorporate protection from static discharges and induced, transient voltages as may occur due to nearby lightning strikes.

12.6 Moisture Intrusion

(a) The lantern shall be sufficiently sealed to protect the LEDs from moisture ingress (moisture intrusion has been shown to cause premature failure of LED junctions), as well as the solar modules and battery.

(b) The lantern shall make provision for Pressure Equalisation.

12.7 Cooling

Cooling shall be by natural radiation only without any mechanical or electrical intervention.

13. Preventive maintenance requirements

The lantern shall be maintenance-free, other than periodic cleaning of external surfaces.

14. Programming / system checks

14.1 The various features of the lantern shall be able to be programmed by means of a handled infrared programmer.

14.2 The lantern shall allow the user to “read” any setting that is programmed in the lantern. When a setting is requested, the lantern shall respond with a series of flash groups resembling the programme code of that particular feature, i.e. flash character, day or night intensity, software version etc.

14.3 The lantern shall allow for a System Check option to access, amongst others:

(a) The software version and LED type used, and

(b) The battery voltage.

15. Documentation

Bidders shall quote separately for a complete set of documentation as per **Section 1**, clause 9.

16. Spares

Bidders shall quote separately for a complete set of spares as per **Section 1**, clause 10.

SECTION 4

Vessel Charter

1. Functional requirements

This is a general description to cover the requirements for the installation of mooring and buoys. This vessel will fall under the responsibility of the Zambezi River Authority. This section shall not be included in the financial offer.

1.1 **General description**

1.2 The vessel should be large enough to accommodate a buoy / buoys, its mooring including anchor and two field technicians.

1.3 The vessel should adhere to all local marine safety requirements.

1.4 The vessel should have ample deck space to safely deploy the buoy, mooring.

1.5 The vessel should have a winch or A frame to deploy the mooring anchors.

The vessel will be provided by the Zambezi River Authority

ANNEX A

Provisional coordinates of where the buoys are to be deployed

	Reference no. (as per AtoN Plan)	Type	Used for	Location	
				Latitude	Longitude
1.	BP1	Fast Water Buoy	Special marker	16°32' 39.52" S	28°44' 30.11" E
2.	BP2	Fast Water Buoy	Special marker	16°33' 50.05" S	28°38' 20.09" E
3.	IP1	Fast Water Buoy	Special marker	16°32' 46.31" S	28°43' 54.50" E
4.	IP10	Fast Water Buoy	Special marker	16°33' 47.40" S	28°38' 33.97" E
5.	IP2	Fast Water Buoy	Special marker	16°32' 53.09" S	28°43' 18.88" E
6.	IP3	Fast Water Buoy	Special marker	16°32' 59.88" S	28°42' 43.27" E
7.	IP4	Fast Water Buoy	Special marker	16°33' 6.67" S	28°42' 7.65" E
8.	IP5	Fast Water Buoy	Special marker	16°33' 13.46" S	28°41' 32.04" E
9.	IP6	Fast Water Buoy	Special marker	16°33' 20.25" S	28°40' 56.43" E
10.	IP7	Fast Water Buoy	Special marker	16°33' 27.04" S	28°40' 20.81" E
11.	IP8	Fast Water Buoy	Special marker	16°33' 33.83" S	28°39' 45.20" E
12.	IP9	Fast Water Buoy	Special marker	16°33' 40.62" S	28°39' 9.58" E

ANNEX B

Detail of lanterns and provisional characteristics

	Reference no. (as per AtoN Plan)	AtoN type	Lights						
			Colour	Effective range at T=0.74	Vertical Divergence	Flash Characters		Horizontal Output	GNSS Synchronisation abled
						Rhythm	Characteristic detail		
1.	BP1	Special Marker	Yellow	2	≥7°	Fl(4).Y.11s	0.5+1.5, 0.5+1.5, 0.5+1.5, 0.5+4.5	360°	Yes
2.	BP2	Special Marker	Yellow	2	≥7°	Fl(4).Y.11s	0.5+1.5, 0.5+1.5, 0.5+1.5, 0.5+4.5	360°	Yes
3.	IP1	Special Marker	Yellow	2	≥7°	Fl(4).Y.11s	0.5+1.5, 0.5+1.5, 0.5+1.5, 0.5+4.5	360°	Yes
4.	IP10	Special Marker	Yellow	2	≥7°	Fl(4).Y.11s	0.5+1.5, 0.5+1.5, 0.5+1.5, 0.5+4.5	360°	Yes
5.	IP2	Special Marker	Yellow	2	≥7°	Fl(4).Y.11s	0.5+1.5, 0.5+1.5, 0.5+1.5, 0.5+4.5	360°	Yes
6.	IP3	Special Marker	Yellow	2	≥7°	Fl(4).Y.11s	0.5+1.5, 0.5+1.5, 0.5+1.5, 0.5+4.5	360°	Yes
7.	IP4	Special Marker	Yellow	2	≥7°	Fl(4).Y.11s	0.5+1.5, 0.5+1.5, 0.5+1.5, 0.5+4.5	360°	Yes
8.	IP5	Special Marker	Yellow	2	≥7°	Fl(4).Y.11s	0.5+1.5, 0.5+1.5, 0.5+1.5, 0.5+4.5	360°	Yes
9.	IP6	Special Marker	Yellow	2	≥7°	Fl(4).Y.11s	0.5+1.5, 0.5+1.5, 0.5+1.5, 0.5+4.5	360°	Yes
10.	IP7	Special Marker	Yellow	2	≥7°	Fl(4).Y.11s	0.5+1.5, 0.5+1.5, 0.5+1.5, 0.5+4.5	360°	Yes
11.	IP8	Special Marker	Yellow	2	≥7°	Fl(4).Y.11s	0.5+1.5, 0.5+1.5, 0.5+1.5, 0.5+4.5	360°	Yes

	Reference no. (as per AtoN Plan)	AtoN type	Lights						
			Colour	Effective range at T=0.74	Vertical Divergence	Flash Characters		Horizontal Output	GNSS Synchronisation abled
						Rhythm	Characteristic detail		
12.	IP9	Special Marker	Yellow	2	≥7°	Fl(4).Y.11s	0.5+1.5, 0.5+1.5, 0.5+1.5, 0.5+4.5	360°	Yes

ANNEX C

Technical data sheet - rotomolded buoy

(Must be completed by Bidder and submitted with the tender documents)

1.	**Buoy**						
1.1.	Make						
1.2.	Model name						
1.3.	"Focal height" of buoy. This is the height of the buoy above the waterline On which the lantern would be mounted – dimensions to exclude any lantern and top mark.					mm	
1.4.	Overall height without top mark					mm	
1.5.	Overall height including the top mark					mm	
1.6.	Hull wall thickness					mm	
1.7.	Hull diameter					mm	
1.8.	Draft with no mooring					mm	
1.9.	Draft with mooring					mm	
1.10.	Inside diameter of lifting eye					mm	
1.11.	Inside diameter of mooring eyes					mm	
1.12.	Total air weight of the assembled buoy, including ballast					Kg	
1.13.	Total top load that the buoy can support					Kg	
1.14.	Maximum submerged mooring load capability					Kg	
1.15.	How long has the buoy on offer been in production?					Years	
1.16.	How long is the buoy on offer likely to remain in production?					Years	
2.	**Mooring**						
2.1.	Type of mooring (mark with "X" where appropriate)	Cable		Fibre Rope		Combination	
2.2.	Length of total mooring					metres	
2.3.	**Bridle, if applicable**						
2.4.	Type						
2.5.	Size					mm	
2.6.	Length					metre	

2.7.	**Mooring chain, if applicable**		
2.7.1.	Riding chain		
(a)	Type of chain		
(b)	Chain size	mm	
(c)	Length of chain	metre	
2.7.2.	Thrash Chain		
(a)	Type of chain		
(b)	Chain size	mm	
(c)	Length of chain	metre	
2.7.3.	Ground Chain		
(a)	Type of chain		
(b)	Chain size	mm	
(c)	Length of chain	metre	
2.7.4.	Type and size of shackles		
2.7.5.	Type and size of swivels		
3.	**Fibre rope, if applicable**		
3.1.	Type of rope		
3.2.	Rope size	mm	
3.3.	Rope break load	kg	
3.4.	Rope weight per meter	gr	
3.5.	Type and size of shackles		
3.6.	Type and size of swivels		
4.	**Cable**		
4.1.	Type of Cable		
4.2.	Cable size	mm	
4.3.	Cable break load	kg	
4.4.	Cable weight per meter	gr	
4.4.1.	Type and size of shackles		
4.4.2.	Type and size of swivels		

5.	**Contain swing circle of buoy**					
5.1.	Describe method and material used to contain swinging circle					
6.	**Sinker, if applicable**					
6.1.	Type of sinker					
6.2.	Sinker material					
6.3.	Sinker weight	Kg				
6.4.	Size of sinker					
6.5.	Type of reinforcement					
6.6.	Diameter of reinforcement	mm				
6.7.	Diameter of mooring eye	mm				
7.	**Anchor, if applicable**					
7.1.	Type of anchor					
7.2.	Anchor material					
7.3.	Size of anchor					
7.4.	Length of anchor	mm				
7.5.	Anchor weight	Kg				
8.	**AtoN Supplier**					
8.1.	Supplied by an IALA Industrial Member? (mark with “X” where appropriate)		Yes		No	
8.2.	If clause 8.1 indicates a “Yes”, provide the name of the IALA Industrial Member					

ANNEX D

Technical data sheet self-contained led lantern

(Must be completed by Bidder and submitted with the tender documents)

1.	**Make**									
2.	**Model name**									
3.	**Vertical Divergence options available (mark with a ✓ where applicable**	2.5°		5°		7°		10°		
4.	**Light Output (cd) – to be inserted below**									
5.	**Efficiency**									
	Candela produced per Watt									**Cd**
	Typical current at 77 candela									**mA**
	Solar charger - Watts consumed while charging									**mW**
6.	**Power at 12Vdc**									
	On-current (light on) if the character is steady (permanently ON)									**mA**
	On-current (light on) when light has a flash character of 60 flashes (0.3 flash, 0.7 eclipse) per minute									**mA**
	Quiescent Current (light off) during daytime									**mA**
	Quiescent Current (light off) during night-time									**mA**
	Current drawn by internal synchronisation unit									**mA**
7.	**Solar Module(s) - Type & description**									
8.	**Internal Battery - Type & description**									

9.	**Autonomy -** at a flash rate of 60 flashes (0.3 sec flash, 0.7 sec eclipse) per minute and NO sun						**Hours**
	No. of solar modules	**Solar module wattage**	**Battery capacity**				
10.	How long has the equipment on offer been in production?						
11.	How long is the equipment on offer likely to remain in production?						
12.	**AtoN Supplier**						
12.1.	Supplied by an IALA Industrial Member? (mark with "X" where appropriate)			Yes		No	
12.2.	If clause 12.1 indicates a "Yes", provide the name of the IALA Industrial Member						

ANNEX E

Pricing schedule

RFQ SCHEDULE OF PRICES – REQUEST FOR QUOTATION (RFQ) NUMBER: _____ (Please also provide quote on your company letterhead)

NAME of BIDDER:	_____
TOTAL RFQ PRICE	_____

Note that all bidders MUST use this template for pricing. If a bidder makes any changes on the product, description or quantities will be disqualified for further evaluation.

	Description	QTY	Unit Price (ZAR)	Total Price (ZAR)
1.	**Rotomolded Polyethylene Marine Navigational Buoys**			
1.1.	Safe Water Mark buoys	12		
1.2.	Spare Safe Water Mark buoys	1		
1.3.	Special Mark buoys	12		
1.4.	Complete moorings, including the mooring line and sinker/anchor	12 Sets		
1.5.	Spare Complete moorings, including the mooring line and sinker/anchor	1		
	Sub-total 1			
2.	**Self-contained marine LED Lanterns**			

	Description	QTY	Unit Price (ZAR)	Total Price (ZAR)
2.1.	Yellow self-contained LED lanterns	12		
2.2.	Spare Yellow self-contained LED lanterns	1		
2.3.	Hand-held, infrared remote programmer to enable the remote programming of the LED lanterns	1		
2.4.	Sets of Instruction manual(s) detailing the operation, maintenance and troubleshooting of the lanterns	1		
	Sub-total 2			
3.	**Installation**			
3.1.	Lanterns and top marks on buoys	1		
3.2.	Buoys on location	1		
	Sub-total 3			
4.	**Delivery**			
4.1.	Delivery of all equipment	1		
	Sub-total 4			
5.	**Vessel hire**			
5.1.	Vessel hire			
	Sub-total 5			
	GRAND TOTAL (All items), excluding VAT			

Notes: