

ANNEXE 1

**English version of the document:
Hydrophone_CCTP_CNRS DR016_A08**

PARIS-NORMANDIE DELEGATION

SPECIAL TECHNICAL SPECIFICATIONS

(In french : CCTP = Cahier des Clauses Techniques Particulières)

PUBLIC SUPPLY CONTRACTS

SUBJECT:

**Purchase of Broadband Hydrophone
for new detection lines for the KM3NeT-ORCA project as part of
NEPTUNE funding by the Normandy region.**

Lot n°08

BUYER :

CNRS-Délégation Paris-Normandie
3 rue Michel Ange
75794 PARIS Cedex 16

CONTRACTUAL FORM:

Single-award framework agreement based on unit prices following a formal open tender procedure in accordance with Articles L. 2124-2, R. 2124-2 and R. 2161-2 to R. 2161-5 of the Public Procurement Code.

This is a supply contract subject to the provisions of the General Administrative Clauses for Public Supply Contracts (CCAG/FCS) issued by the decree of 31 March 2021.

This document comprises 14 pages, including the cover page.

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LIST OF ABBREVIATIONS

CCAG	Cahier des Clauses Administratives Générale = General Administrative Terms and Conditions
CCTP	Cahier des Clauses Techniques Particulières = Special Technical Specifications
CCAP	Cahier des Clauses Administratives Particulières = Special Administrative Terms and Conditions
EPST	Etablissement public à caractère scientifique et technologique = Public scientific and technological institution
FCS	Fournitures courantes ou services = Routine supplies or services
HT	Hors taxes = Excluding taxes
RC	Règlement de la consultation = Consultation rules
RGPD	Règlement général sur la protection des données personnelles = General Data Protection Regulation
PEPR	Programmes et équipements prioritaires de recherche = Priority research programmes and equipment
SCTD	Service centralisé de traitement de la dépense = Centralised expenditure processing service
CNRS	Centre national de la recherche scientifique = National Centre for Scientific Research
LPCC	Laboratoire de Physique Corpusculaire de Caen = Caen Particle Physics Laboratory
LNS	Laboratori Nazionali del Sud (Catane -Italie)
KM3NeT	Kilomètre cube Neutrino Telescope
ORCA	Oscillation Research with Cosmics in the Abyss
ARCA	Astroparticle Research with Cosmics in the Abyss
NEPTUNE	Neutrino Physics with Telescope Underwater
DU	Detection Unit
BM	Base Module
AES/EBU	Audio Engineering Society / European Broadcasting Union

APPENDICES TO « French CCTP »

Annexe 1	English translation of these Special Conditions of Contract
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In these Special Conditions of Contract:

- The terms "equipment", "supplies" and "materials" refer interchangeably to the materials to be supplied for each lot;
- The term "Contractor", "holder", "supplier" "successful tenderer" refers to the company that is awarded one or more lots of the contract.;
- - The term "Contract" refers to the agreement concluded between the CNRS and the Holder of each lot.

1 Preamble

The provision of the services defined in this document constitutes a contract with a public institution with an obligation of means and results.

The Contractor undertakes that it is able to perform this contract in strict compliance with the obligations set out in the contract documents, in particular with regard to confidentiality, qualification and insurance clauses.

The Contractor shall be deemed, under its responsibility and regardless of any justifications provided, to have received the legal authorisations to perform and to possess the professional qualifications corresponding to the nature and importance of the service covered by this contract. The Contractor shall be solely liable for any consequences that may arise from the fact that these qualifications do not comply with regulations or are incorrect and, in particular, for the consequences of any termination that the CNRS may rightly decide to implement as a result.

In addition to the documents constituting the consultation file, the Contract Holder is required to comply with the specifications and requirements of the decrees, orders, regulations, standards and texts in force on the date of submission of its tender.

2 Presentation

The national centre for scientific research (hereinafter « CNRS » - Centre National de la Recherche Scientifique) is a public research organisation (a public scientific and technological institution, EPST, under the supervision of the Ministry of Higher Education, Research and Innovation). It produces knowledge and puts this knowledge at the service of society.

Its governance is ensured by a chief executive officer, assisted by deputy chief executives.

With over 33,000 employees, a budget of €3.5 billion and a presence throughout France, the CNRS is active in all fields of knowledge, drawing on more than 1,100 laboratories.

Present in all fields of knowledge

As France's leading multidisciplinary research organisation, the CNRS conducts research in all scientific, technological and societal fields. It covers the entire spectrum of scientific disciplines.

The CNRS is active in all major disciplines, grouped into 10 institutes, and focuses on developing collaborations between specialists from different disciplines, particularly with universities, opening up new fields of research that meet the needs of the economy and society.

Present throughout the country

17 regional delegations ensure direct, local management of laboratories and maintain links with local partners and local authorities.

2.1 General context of the project

The NEPTUNE project, funded by the Normandy Region, aims to continue the construction of underwater infrastructure to establish a KM3NeT ORCA underwater observatory for neutrino research, which will ultimately consist of around 115 detection lines and instrumentation for marine and environmental science. It is located approximately 40 km south of Toulon at a depth of 2,500 m.

In addition to this deep-sea telescope, a number of instruments are installed to measure the properties of the marine environment. The purpose of this document is to specify the supply of broadband hydrophones installed on the feet of the detection lines to monitor acoustic activity in the marine environment and, in particular, to search for bioacoustic emissions from cetaceans.

2.2 Background to the purchase

The purpose of this consultation is to procure broadband hydrophones, equipped with preamplifiers and analogue-to-digital converters, which will be installed on the anchor of the KM3NeT/ORCA detection lines approximately 1.5 m above the seabed and connected to an electronic acquisition container for real-time transmission of recorded acoustic signals.

These technical specifications describe all of the contractor's technical obligations. These constitute an obligation of results for the contractor.

2.3 Subject matter of the contract

Purchase of broadband hydrophones, equipped with preamplifiers and analogue-to-digital converters for new detection lines for the KM3NeT-ORCA project as part of NEPTUNE funding by the Normandy region.

Quantity : 11 units (Estimated quantity in relation to the budget allocation).

2.4 Allotment

This contract is a supply contract.

The contract is divided into 08 separate lots. Each lot is the subject of a separate contract.

Lots	Lot names
01	Cable vertical Opto-Electrique (VEOC)
02	Structure de support des bouées
03	Carte électronique BPS (Base Power System)
04	Pénétrateur VEOC dans le Base Module
05	Conteneur cylindrique du Base Module
06	Carte électronique CLB (Central Logic Board)
07	TSFP optical Transceiver
08	Hydrophone

3 Description of expected equipment and general and technical specifications

3.1 Description of the expected equipment

3.1.1 Environment and conditions of use

The terms of use are as follows:

- Operating pressure: 250 bar,
- Test pressure: 310 bar,
- Storage temperature: -10°C / +60°C,
- Sea water temperature: 13°C,
- Mechanical constraints:
 - Vibrations experienced during transport
 - There is no mechanical stress on the cable during use; stress may only occur during handling or assembly operations.

The lifespan of objects must be at **least 10 years**.

3.1.2 General specifications

The required hydrophones are high-sensitivity, omnidirectional, broadband digital hydrophones.

Acoustic signals must be amplified with two different gains, sampled at a frequency of 195.3 kHz with a 24-bit analogue-to-digital converter, and transmitted in digital format according to the AES/EBU protocol.

The hydrophone will receive an external 25 MHz digital clock signal provided as input on its connector.

The electrical and mechanical characteristics, as well as the sensitivities and performance of hydrophones, are detailed in the following sections.

3.1.3 Sensitivities and performance

Hydrophones shall meet the following specifications::

Specifications	Performances
Minimum bandwidth	5 Hz – 80 kHz
High gain sensitivity	> - 160 dB re 1 V/ μ Pa @ 5 kHz
Low gain sensitivity	> - 180 dB re 1 V/ μ Pa @ 5 kHz
Directivity in the plane perpendicular to the preamplifier-cable axis	Omnidirectional (± 2 dB)
Directivity in the plane parallel to the preamplifier-cable axis	Omnidirectional (± 3 dB) over $\pm 120^\circ$
Equivalent acoustic noise at input	<+35 dB re 1 μ Pa/ $\sqrt{\text{Hz}}$ @ 5 kHz

Hydrophones shall also meet the following specifications:

Specifications	Values
Supply voltage	9 – 18 VDC
Power consumption	< 120 mA at a supply voltage of 12 VDC
Analogue-to-digital converter	24 bits
Sampling frequency	195.3 kHz
Dynamic range	> 90 dB
Digital output signal protocol	AES/EBU
External digital clock supplied at input	25 MHz
Input impedance	10 M Ω
Lifespan	minimum 10 years

3.1.4 Mechanical characteristics and communication interface

Hydrophones shall be manufactured from materials compatible with the service life specifications under the conditions of use and environment specified below, particularly in terms of hydrostatic pressure and corrosion.

All metal parts in contact with the marine environment must be made of **titanium**.

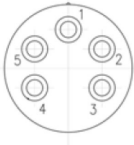
Each hydrophone shall be equipped with an electrical connection cable at least 4 metres long (the same length for all hydrophones) terminated with a Seacon male connector ref. Micro WET-CON MC-IL-5M or Subconn ref. MC-IL-5M, equipped with a locking ring and a female protective cap (used when not connected)..

The choice of connector will be specified when ordering..

The cable shall have an impedance of 60 Ohms that does not vary with pressure and shall be equipped with at least two shielded twisted pairs over which clock information shall be transmitted at the input and AES/EBU at the output (such as, for example, the Xtreme cable ref. FM022208-08 from Falmat).

Each twisted pair must be galvanically isolated.

The connector wiring must comply with the following diagram:

Connector	Pinout	Signal	Conductor
 MC-BH / MC-IL-5	1	Blindage externe	Blindage externe
	2	CLK +	Paire 1
	3	CLK -	Paire 1
	4	AES/EBU +	Paire 2
	5	AES/EBU -	Paire 2

3.2 3.2 Supplementary benefits

3.2.1 Factory acceptance tests and measurements

The tests, with reports, to be carried out by the holder for each hydrophone before delivery are:

- Resistance test in a hyperbaric chamber at a test pressure of 310 bar for 1 hour (functionality test before and after)
- An active cycling test (measurement of the hydrophone signal during cycling) would be a significant advantage.
- Measurement of sensitivity at low gain and high gain as a function of frequency (measurement at 1 atm)
- Measurement of directivity in planes parallel and perpendicular to the preamplifier-cable axis (measurement at 1 atm)
- Measurement of acoustic signal latency due to electronics, at low gain and high gain
- Measurement of electrical consumption for a supply voltage of 12 VDC
- An X-ray inspection of the hydrophones and moulding would be a significant advantage. This is particularly important when moulding connectors. The presence of an air bubble at this pressure can cause damage to the equipment.

3.2.2 Product identification

Each hydrophone shall be marked with a unique serial number.

3.2.3 Packaging for transport and storage

The equipment must be delivered in a box that protects it during transport.

The packaging must protect the equipment from mechanical shocks during transport.

The packaging must protect the equipment from electric shocks.

Each box must be accompanied by a sheet detailing the technical specifications of the equipment contained within.

The format of the digital file detailing the characteristics of each piece of equipment and the association between the supplier's serial number and the UPI KM3NeT will be defined with the supplier at the end of the tender process.

Impact indicators must be present on transport boxes.

The holder assumes all responsibility for transport, including insurance.

Transport costs will be paid by the holder, including any import costs.

4 Delivery times / Terms and conditions of delivery and performance of services

Delivery is at the expense of the holder.

The equipment will be packaged to ensure safe transport.

Delivery will be made in a single phase.

The delivery time must be stated in the tender by the contractor, provided that it does not exceed the maximum time limit.

4.1 Maximum delivery time for all products

Maximum time limit : 04 months

4.2 Delivery terms and premises layout

Deliveries are made on working days from Monday to Friday between 9am and 12pm and between 2pm and 5pm.

Packaging and delivery shall be borne by the contractor.

The contractor is responsible for packaging, packing, loading and stowage operations.

The risks associated with transport to the place of delivery are borne by the contractor.

The exact date of delivery of the services will be agreed upon between the laboratory and the contractor

The services delivered by the contractor or their representative must be accompanied by a delivery note drawn up in duplicate, specifying:

- ✧ The date of dispatch,
- ✧ Tender references,
- ✧ Identification of the contractor,
- ✧ Identification of delivered supplies.

Damage caused by deliveries and installations:

The holder remains liable for any damage of any kind caused by their agents or the carrier to equipment: buildings, land, plantations, installations, etc.....

The CNRS reserves the right to carry out itself or have carried out, on behalf of the holder, the repair of any damage caused.

4.3 CNRS Technical Correspondents

Jérôme PERRONNEL
Laboratoire de Physique Corpusculaire de Caen - LPCC
6 Boulevard Maréchal Juin
14050 Caen cedex
France

4.4 KM3NeT Technical Correspondents

Daniele VIVOLO
INFN-NA
Laboratorio CAPACITY
Viale Carlo III di Borbone 153,
San Nicola La Strada 81020,
Italy

4.5 Delivery locations / Access

Delivery must be made to the following addresses:

Centre de Physique des Particules de Marseille - CPPM
Attn : Nick LUMB
163, avenue de Luminy - Case 902
13288 Marseille cedex 09
France

- Access: Articulated trucks are not permitted on the CPPM campus.
Only straight trucks may access the campus (length < 13 meters).

5 Documentation to be provided by the Holder

Documents must be in French and/or English.

5.1 Documentation upon delivery

- A technical description of the hydrophones (mechanical design, electrical interfaces, etc.)
- A user manual
- The measurement and acceptance test reports described in §3.2.1.

5.2 Documentation for the call for tenders

- A technical description of the proposed hydrophones, including their characteristics and dimensions
- A production and delivery schedule
- A price quotation detailing the cost of the hydrophones, testing and transport
- A quality plan compliant with ISO 9001 or equivalent (see § 5.3)

5.3 Quality assurance (to be attached to the technical proposal)

The successful bidder must provide in their bid a quality plan compliant with ISO 9001 or equivalent, defining the procedures implemented. They must also indicate the actions taken to enhance the reliability of the electronics and minimise the failure rate of its components.

6 Verification operations

Upon delivery, the CNRS carries out the following checks and tests :

- Visual inspection
- Checking that hydrophones are working properly
- Checking documentation and factory acceptance test results

6.1 Terms and conditions for final acceptance of services

Final acceptance shall be declared within a maximum of two weeks after delivery, following the checks described in § 6 and the provision of the documentation listed in § 5.1.