

**CONCEPTUAL STUDY OF A REAL TIME MOORING FOR DEEP
SEA OBSERVATORIES, INCLUDING NUMERICAL SIMULATIONS
OF THE BEHAVIOR OF THE SYSTEM IN THE ATLANTIC
ENVIRONNEMENT.**

CONTRACT N° 10/2 211 586

BETWEEN :

MBARI a company duly registered under the laws of USA, hereafter referred to as "MBARI", whose headquarters are in USA, 7700 Sandholdt Road, Moss Landing, CA 95039 and represented by its Chief executive officer or its representative,

On the one hand,

AND :

INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER, a French Public Scientific Research Agency, hereafter referred to as "IFREMER", whose headquarters are in FRANCE, 155, rue Jean-Jacques Rousseau, 92138 - ISSY-LES-MOULINEAUX CEDEX and represented by M. Philippe MARCHAND, Chief Executive of the IFREMER Centre of Brest,

On the other hand,

Herewith referred to collectively as "the Parties" or individually as "the Party".

WHEREAS:

IFREMER, within the ESONET consortium and through the EMSO project, is developing the main components of the future European deep sea observatory.

The first deployments, in the development phase, and in remote locations, shall use a real time link by means of a large buoy moored by an electromechanical (or optical) cable. The mooring cable is assumed to stand for one of the weakest parts of the system.

Since, MBARI has a well-tried experience in this advanced mooring, a collaboration with MBARI may speed up the development of this mooring.

IFREMER has a long experience of the deployment of complex systems in deep sea but only buoys with acoustic link has been moored in the past.

Aiming at preparing the near future, IFREMER is willing to entrust MBARI with a conceptual study of the real time mooring.

THE FOLLOWING HAS BEEN LAID DOWN:

ARTICLE 1 - PURPOSE

- 1.1. The purpose of this Contract is to define the conditions under which MBARI shall perform, for IFREMER, a **"conceptual study of a real-time mooring, including numerical simulations of the behaviour of the system, in the Atlantic environment"**, hereinafter referred to as the 'Study'.
- 1.2. The technical description of the Study is enclosed in Appendix 1.

ARTICLE 2 – COMMITMENTS OF THE PARTIES

- 2.1 MBARI shall perform the Study with reasonable skill and care in accordance with the terms of the Contract.
MBARI undertakes to provide IFREMER with the Study described in Appendix 1, and the following deliverables:

2.1.1. Item N°1: Delivery of a progress report on the Study



Such intermediate report shall present the on-going experimentations and the expected results of the Study.

MBARI pledges to deliver such report on ~~1st~~ ¹⁵ December 2010 at the latest.

2.1.2. Item N°2: Delivery of a final report on the Study



Such report shall include the concept design, the results of the numerical simulations of the behaviour of the system and recommendations for further detailed design studies of critical mooring subsystems.

MBARI pledges to deliver the report ~~at the beginning of 2011.~~ ^{01 February 2011}

2.1.3. Item N°3: Leading of an MBARI representative to a workshop in Brest



Such workshop shall take place ~~at the beginning of 2011~~ ^{01 February 2011} and shall put on the agenda: the presentation of the results of the Study and discussions in the prospect of potential future developments including the possibility of a collaboration between the Parties on the sensitive components of the system.

Pursuant to IFREMER request, MBARI shall also provide IFREMER with the ocean environmental data required by MBARI to perform the Study.

- 2.2. IFREMER undertakes to provide MBARI with a total payload weight for the surface mooring to allow specification of the system buoyancy and modelling of the dynamic performance.

ARTICLE 3 - AMOUNT – PAYMENT CONDITIONS

3.1. The total amount of the Study performed by MBARI is fixed to the lump sum of **33, 512 Euros**, such amount includes a sum of 1,810 Euros for the supply of ocean environmental data (hereafter called "the Amount").

3.2. This Amount splits as follows:

3.2.1. A fixed lump sum of **13,400 Euros** as regard to Item N°1.

3.2.2. A fixed lump sum of **13,400 Euros** as regards Item N°2.

3.2.3. A fixed lump sum of **6,292 Euros** as regards Item N°3.

3.3. The Amount shall be paid by IFREMER under the following terms of payment:



	INSTALMENT	TECHNICAL KEY	AMOUNT	DEADLINE
3.3.1	100 %	Item N° 1	13 400 €	01/12/2010 15/12/2010
3.3.2	100 %	Item N° 2	13 820 €	01/02/2011
3.3.3	100 %	Item N° 3	6 292 €	01/04/2011

3.4. The amounts of Item N°1 and N°2 shall be paid by IFREMER after acceptance of the respective reports. This acceptance and this certification shall be notified by writing to MBARI.

3.5. The amount of Item N°3 shall be paid by IFREMER after the holding of the workshop.

ARTICLE 4 - FINANCIAL CONDITIONS

4.1. Invoices

MBARI invoices related to the instalments 3.3. shall be sent in duplicate to :

IFREMER
Service Financier
BP70
29280 PLOUZANE
FRANCE

The invoices shall bear the reference number **10/2 211 586** of the present Contract, the intra-community Value Added Tax of IFREMER FR 46.330.715.638 and MBARI's complete bank account number, in order to allow IFREMER to make payments.

The payments shall be made within 45 (forty five) days from the receipt of the invoice.

IFREMER's accountant in charge of payment is:
l'Agent Comptable Secondaire du Centre Ifremer de Brest.

4.2. Taxes

Payments made by IFREMER under the present contract are subject to the French Value Added Tax at the rate of 19, 6%. This VAT shall be paid by IFREMER to the French fiscal Service.

ARTICLE 5 - DURATION, DATE AND PLACE OF DELIVERY

- 5.1. The Contract shall come into force as from the date of its signature, and remain effective until the 1st April 2011, except in the case of an early cancellation.
- 5.2. Any extension of the duration of the Contract as defined in article 5.1. shall be agreed within a codicil to this Contract signed by the duly authorised representatives of both Parties.

ARTICLE 6 - FOLLOW-UP OF THIS CONTRACT - STEERING COMMITTEE

- 6.1. Each Party shall appoint a representative in charge of following the enforcement of the Contract.
- 6.2. The Parties shall form a Steering Committee composed of representatives of MBARI and IFREMER. The Steering Committee shall be in charge of scrutinizing any questions relating to the correct enforcement of the Contract. In general, the Steering Committee shall ensure that the work is carried out correctly and shall try to remedy any eventual litigation that may arise between the Parties.
- 6.3. All propositions of the Steering Committee which may modify the amount of the Contract, terms of payment or any other term of this Contract should be the object of a codicil to the present Contract, in order to be effective.

ARTICLE 7 - INTELLECTUAL PROPERTY RIGHTS / CONFIDENTIALITY

7.1. INTELLECTUAL PROPERTY

7.1.1 Background Information

As used in this article, "Background Information" shall mean any Information, in whatsoever form, such as but not limited to, data, products, technical specifications, processes, know-how, methods covered or not by an Intellectual Property right and owned by each Party at time of signature of the Contract. Background Information held by each Party remain its sole property.

7.1.2. Foreground Information

As used in this article, "Foreground Information" shall mean any new information, in whatsoever form, such as but not limited to new results or knowledge, improvement of know-how arising out from the performance of the Contract.

IFREMER shall remain the sole owner of the Foreground Information obtained during the performance of the Contract by MBARI.

7.2. Confidentiality

As used in this agreement, "Confidential Information" shall mean the present Contract and all relevant documents on the one hand, and any Background or Foreground Information, in any form whatsoever, including oral, written and machine readable form provided by one party to the other under the present agreement, on the other hand.

Both Parties agree to employ all reasonable efforts to maintain the Confidential Information secret and confidential, such efforts to be no less than the degree of care employed by each Party, to preserve and safeguard its own Confidential Information. The Confidential Information shall not be disclosed, revealed, nor given to third parties without the prior consent of each Party. Both Parties agree to take all reasonable endeavours to make its employees comply with the restrictions of the present Contract.

Obligations under the above-article shall not extend to any part of Confidential Information:

(a) that can be shown by the Party to have been in the public domain or publicly known and readily available to the public prior to the date of the disclosure through no fault of the said Party ;

(b) that can be demonstrated to have been independently developed by employees of each Party who had no access to the Confidential Information.

ARTICLE 8 - LIABILITY



- 8.1. ~~Each Party shall hold the other Party harmless from claims, demands, and causes of action of every type that are asserted by any person (including each~~

MBARI and IFREMER agree to defend, indemnify and hold one another, their officers, agents and employees, harmless from and against any and all liability, loss, expense, attorneys' fees, or claims for injury or damages arising out of performance of this agreement, but only in proportion to and to the extent such liability, loss, expense, fees or claims for injury or damages are caused by or result from the negligent or intentional acts or omissions of the indemnifying Party.

~~Party's employees) for the personal injury, or loss of or damage to property that results from an Act arising out from the performance of the present contract.~~

- 8.2. Neither Party shall be liable for any consequential or indirect damages such as but not limited to loss of profits or anticipated revenues sustained by the other Party.

ARTICLE 9 - TERMINATION OF THE CONTRACT



~~If MBARI acts in breach of the Contract, IFREMER shall be entitled to terminate the Contract by notice in writing to MBARI. IFREMER should only pay to MBARI the part of the study performed at the date of termination.~~

Either MBARI or IFREMER may terminate this agreement for cause upon thirty (30) days written notification to each other. In the event of the termination of the agreement, MBARI and IFREMER shall agree to a final settlement regarding costs incurred during the conduct of this project. Settlement costs shall include previously unreimbursed allowable expenses plus such uncancellable contractual commitments properly made on behalf of the project prior to the receipt of the notice of termination.

ARTICLE 10 DISPUTES

In case of a dispute arising out between IFREMER and MBARI concerning the Contract, the Parties shall endeavour to settle such a dispute amicably within the Steering Committee. If the dispute is not settled within 4 (four) weeks after it was first raised, the dispute shall be submitted to arbitration in the International Chamber of Commerce of Paris, FRANCE.

ARTICLE 11 - LAW OF THE AGREEMENT

This Contract shall be construed and interpreted under French Law.

ARTICLE 12 - ASSIGNMENT

12.1. Addresses

The Parties agree that all notices, letters and documents in connection with or required under the Contract shall be sent or communicated to the respective Party to the following addresses:

- MBARI
7700 Sandholdt Road
Moss Landing, CA 95039
USA
Tel: (831) 775-1700
For the attention of Mr. Mark Chaffey

■ IFREMER Centre de Brest
BP 70
29280 PLOUZANE
FRANCE
Fax : (33) 2 98 22 41 35
Telephone :(33) 2 98 22 40 93
For the attention of Mr. Yannick Aoustin

12.2. Delegation



^{and IFREMER}
MBARI shall not delegate its performance or assign any of its rights under the present contract without the prior consent of ~~IFREMER~~ ^{of each Party.}

ARTICLE 13 - LANGUAGE

This Contract is written in English.

ARTICLE 14 - APPENDICES

In the event of discrepancies between the Contract and its appendices, the provisions of the Contract shall prevail.

Appendix 1: Description of the Study

Established in triplicate Brest, on

2010

For MBARI

For IFREMER

APPENDIX 1

Proposal for a Conceptual Study of a Real-Time Mooring Including numerical simulations of the Behavior of the System in the Atlantic Environment

Rev. MAY10 Final

1.0. Introduction.

MBARI proposes to the Institut Français de Recherche Pour L'exploitation de la Mer (the French Institute for the Exploitation of the Sea or IFREMER) to provide a conceptual study of a mooring system with a direct connection through the anchor cable to the seafloor (using electro-mechanical (EM) or electro-optical-mechanical (EOM) cable). The purpose of the mooring system is to provide power to seafloor instruments and return data in real time from the seafloor using line-of-sight radio or satellite telemetry communications.

The conceptual design work proposed includes calculation of the mooring surface float size, the weights and balances of the surface float including the bridle and tower, and the calculation of buoyancy, righting moment and static loads. We will complete a numerical simulation of the mooring system dynamic loads using environmental data for significant wave height and ocean currents. Based on the results of the dynamic simulation we will recommend mooring cable designs, mooring deployment methods and predict the cable loads during installation and operation.

A general illustration of the real time mooring system is shown in figure 1 below. The system concept design would include the equipment shown in the illustration and consist of the surface mooring, a riser cable and a subsurface float and anchor assembly.

2.0 **Project schedule.** The concept design study will be completed and submitted to IFREMER no later than ~~October 1, 2010~~. *February 1, 2011*

3.0 **Technical plan detail.** The specific details of the technical plan for the concept design study are described below.

4.0 Numerical simulation and mooring configuration design.

4.1 Andy Hamilton at MBARI will conduct a time domain numerical simulation of the mooring response to wave and current forcing and predict the static and dynamic loads on the riser cable using the modeling program WHOI cable. This work will include modeling the anticipated loads, specifying the construction and the length of the anchor cable ("scope"), specifying the volume of the surface float, specifying the number, type and location of any required intermediate cable floats and specifying the weight and construction of the anchor and anchor float.



- 4.2. IFREMER will provide the approximate site location coordinates, water depth and a 10 year record of environmental data for the site. This data will include a time series of surface currents, surface winds, and significant wave heights. If IFREMER cannot produce the required environmental data MBARI can procure it from OceanWeather <http://www.oceanweather.com/metocean/> for an additional estimated cost of \$2300. This information must be available by ~~August 2, 2010~~ **November 15, 2010** to meet the proposed October schedule.



- 4.3. IFREMER will provide a total payload weight for the surface mooring to allow specification of the system buoyancy and modeling of the dynamic performance. The payload is specified in mass and height relative to the water line. If the total surface float payload is over 1500 kg then there should be further discussion between IFREMER and MBARI on the methods of analysis. The payload information will need to be provided by ~~August 2nd, 2010~~ **November 15, 2010** to meet the proposed October schedule.

5.0 **Recommendations for qualification of critical mooring components.**

- 5.1 **EOM or EM anchor cable.** MBARI will describe the mechanical bending stress qualification procedure used for fatigue testing mooring cables and recommend methods to be used for qualifying cables from alternate vendors.
- 5.2 **Additional critical components for qualification.** Based on MBARI's experience deploying observatory moorings, MBARI will provide recommendations for design studies and qualification tests for the following critical mooring components:
- 5.2.1 EM or EOM cable termination.
 - 5.2.2 Cable floats and attachment hardware.
 - 5.2.3 Upper and lower strain reliefs.
 - 5.2.4 The mooring cable strain relief assembly, or "Snubber".
 - 5.2.5 The cable assemblies that connect the seafloor mooring controller at the base of the anchor with the seafloor instrument packages.
 - 5.2.6 The material and size for connection shackles and chains.
 - 5.2.7 System design for ROV installation



6.0 **Presentation of concept design and numerical modeling results.**

- 6.1 The results of the concept design and numerical simulation studies and recommendations for further detailed design studies of critical mooring^s subsystems will be presented in Brest France in ~~October 2010~~ **February 1, 2011**

7.0 **Resource estimates.**

- 7.1 **Andy Hamilton four weeks:** Dynamic modeling of mooring loads during specified environmental conditions, calculation of deployment loads. Presentation of results in Brest, France.
- 7.2 **Mark Chaffey one week:** Recommendations for qualification of critical components. Design of the Snubber bending strain relief elements. Design of the cable terminations.

- 8.0 **Proposal Costs.** Total proposal cost: \$40,302
- 8.1 **Personnel subtotal:**
- 8.1.1 Andy Hamilton – Four weeks dynamic simulation,
one week travel: Salary: \$12,420
- 8.1.2 Mark Chaffey – One week: Salary \$3,126
- 8.1.3 Fringe Benefits – \$8,084
- 8.2 **Travel subtotal. Andy Hamilton**
- 8.2.1 Travel from San Francisco to Brest France for 5 days, total: \$3,060
- 8.2.1.1 Airfare = \$1500
- 8.2.1.2 Car fare = \$60
- 8.2.1.3 Hotel in Brest = \$750
- 8.2.1.4 Train = \$150
- 8.2.1.5 Meals = \$600
- 8.3 **Overhead Costs:**
- 8.3.1 Indirect Cost calculated at 51% of Modified Total Direct Cost: \$13,612. The base excludes capital items, participant support costs, and subcontract costs exceeding the first 25K of each subcontract.

