

CLAS Technical Library

Technical Project Report – TPR 001

**Project Experience Report – Reconstruction of the Martigues Breakwater
Using ACCROPODE™ II Armour Units:**

Technical Assistance and Independent Certification by CLAS

Technical Assistance – Training – Quality Control – Certification

English Version



About ACCROPODE™ II Technology

ACCROPODE™ II technology is an evolution of the single-layer armour concept developed in the late 1990s. Although the patents protecting this technology have now expired, the technical principles they covered are part of the public domain. However, ACCROPODE™ remains a registered trademark of the ARTELIA Group, with usage rights licensed through its subsidiary CLI.

The ACCROPODE™ trademark is used in this document solely to identify the armour unit technology implemented during the reconstruction of the Martigues breakwater.

For this project, the construction joint venture responsible for the works entered into the licensing agreement with CLI required for the use of ACCROPODE™ II technology.

In addition, the joint venture appointed CLAS to provide training, technical assistance, quality control and independent certification throughout the project. The purpose of this assignment was to support the construction teams during all phases of the works and to provide independent technical expertise based exclusively on engineering criteria, project requirements and recognised good engineering practice.

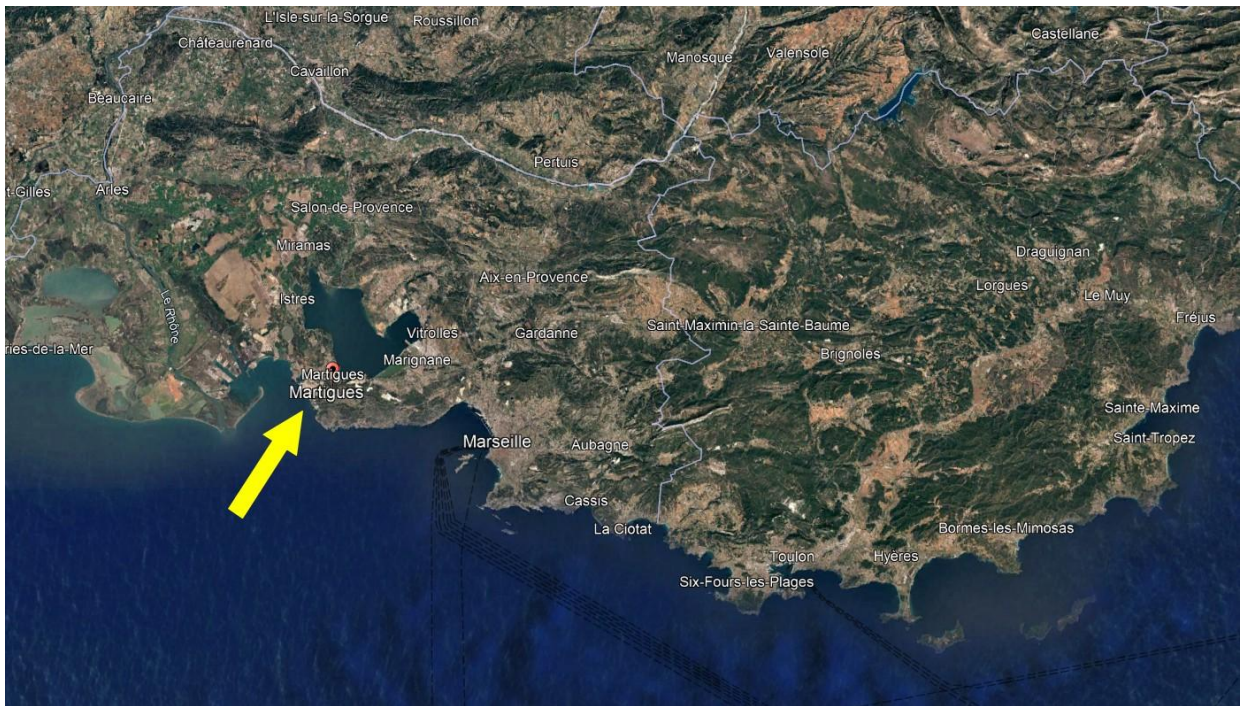
CLAS provides services for maritime structures incorporating artificial armour units, regardless of their technology or trademark. This independence ensures that all recommendations, inspections and certifications are delivered without any commercial relationship with the owners of the trademarks or licences associated with the technologies concerned.

1. Project Overview

Why ACCROPODE™ II?

ACCROPODE™ II armour units are widely used for the construction and rehabilitation of maritime breakwaters exposed to severe wave conditions. This single-layer armour technology relies on the mechanical interlocking of individual units, the overall performance of which depends directly on the quality of their placement. Beyond compliance with the design, the long-term performance of the structure requires strict application of the placement rules to achieve a homogeneous and durable interlocking pattern throughout the armour layer. Placement inspection ensures that every armour unit contributes correctly to the overall behaviour of the structure and to the expected level of coastal protection.

Located on the Mediterranean coast in southern France, the EDF Martigues power station supplies part of the electricity demand for the region. The original rubble mound breakwater had suffered progressive deterioration following successive storms. Increasing storm intensity and frequency, together with the anticipated rise in sea level, led the Owner to select the ACCROPODE™ II armour system, whose trademark usage rights are licensed by CLI.



Given the economic and strategic importance of the project, the BUESA–GUINTOLI joint venture appointed CLAS to provide training, technical assistance, quality control and independent certification of the completed works. This assignment complemented the license agreement concluded with CLI for the use of ACCROPODE™ II technology. Restaurer durablement un ouvrage stratégique.

2. Project Data Sheet

Project	Reconstruction of the Martigues Breakwater
Country	France
Period	2023–2024
Owner	EDF
Contractor	BUESA – GUINTOLI Joint Venture
CLAS Assignment	Training – Technical Assistance – Quality Control – Independent Certification
Armour Units	ACCROPODE™II
Quantity	910 units

The project involved the reconstruction of the main armour layer of the breakwater protecting the EDF Martigues power station. The works had to be carried out while maintaining normal operation of the power plant, requiring rigorous planning of all construction activities and continuous management of the risks associated with the seawater intake system.

3. Technical Challenges and Implemented Solutions

The EDF power station was required to remain fully operational throughout the construction period. The seawater intake system used for cooling the plant had to remain in service at all times.

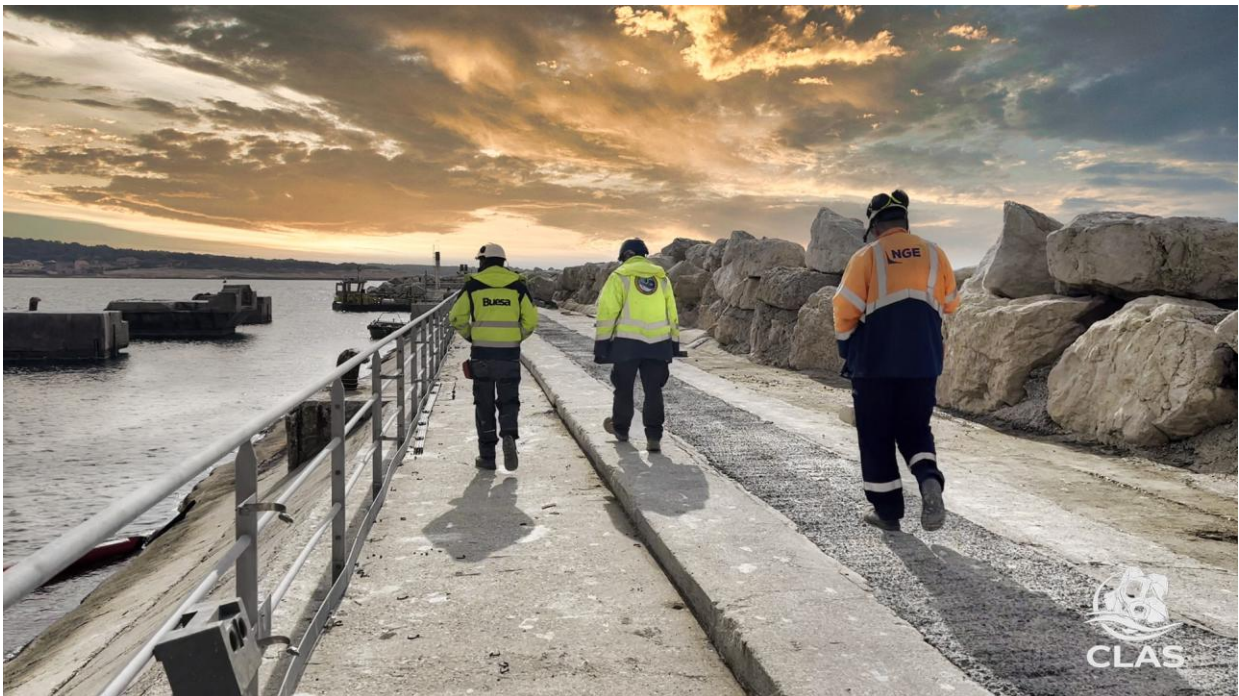
The BUESA–GUINTOLI Joint Venture, responsible for constructing the breakwater and placing the ACCROPODE™ II armour units in accordance with the project requirements, had carefully examined all available options to minimise the use of divers during construction.

CLAS was first commissioned to assess the specific risks associated with the seawater intake system and to propose appropriate technical solutions. An initial coordination meeting was held at the CLAS offices in Andorra, where the project documentation provided by the Joint Venture was reviewed in detail before construction activities commenced.



Documentary review of the EDF Martigues power station seawater intake system at the CLAS headquarters in Andorra.

This document review highlighted the need to carry out a site safety assessment prior to the start of construction.



Initial site visit to the Martigues breakwater reconstruction project to prepare the project risk assessments, safety training programme and ACCROPODE™ II placement training for the Joint Venture teams.

The site visit confirmed the need to carry out a physical assessment of the risks faced by the divers responsible for inspecting the placement of the ACCROPODE™ II armour units. The objective was to define and implement operational procedures ensuring diver safety with regard to the seawater intake system, in addition to the inherent risks associated with the placement and inspection of heavy armour units.

To avoid exposing a diver to any suction hazard, it was first necessary to deploy a remotely operated vehicle (ROV) to assess the actual suction forces generated by the intake system and to inspect the general condition of the diver protection screens that had been installed for many years, for which no recent information was available.

CLAS deployed its BLUEROV2 inspection ROV equipped with high-definition cameras. A graduated pole fitted with a fabric streamer was attached to the vehicle in order to determine the distance from the diver protection screens at which the suction effects became detectable.



A CLAS inspector prepares the ROV for the inspection of the EDF Martigues power station seawater intake structures.

The ROV inspection provided detailed video footage of the seawater intakes and their protective screens, revealing that several of the diver protection screens were incomplete or no longer fully effective.



The residual suction force acting through the protective screens was then assessed:



With a clear understanding of the identified hazards, CLAS was able to establish the safety procedures required for the works.

4. CLAS Assignment

The assignment entrusted to CLAS included training, technical assistance, quality control and independent certification of the works. These activities were intended to support the construction teams throughout the project and to provide the Contractor with independent information regarding the conformity of the works with the project requirements.

For the placement of the ACCROPODE™ II armour units, the Technical Information Document issued to the Joint Venture by CLI under the trademark licence agreement constituted the reference document governing the placement methodology.



This photograph illustrates the theoretical training session covering all aspects of ACCROPODE™ II armour unit placement on the Martigues project.

5. Construction Activities

This section presents the main stages of the reconstruction of the breakwater armour layer and the technical support provided by CLAS throughout the execution of the works.

The ACCROPODE™ II armour units were placed progressively in accordance with the approved placement plan and the project requirements. The BUESA–GUINTOLI Joint Venture teams were supported to ensure correct placement techniques, safe working practices and the quality of the completed armour layer.

Site supervision included in particular:

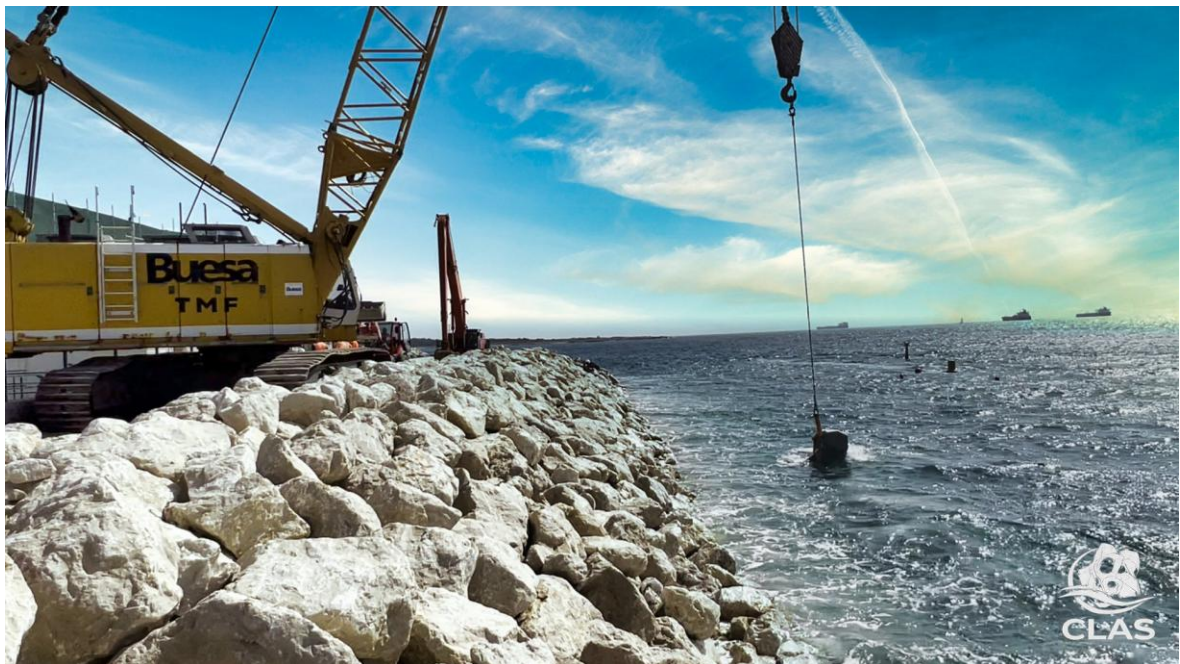
- observation of the initial placement operations;
- technical support to the construction teams;
- inspection of the interlocking and orientation of the armour units;
- identification of any corrective actions required;
- monitoring of the works through to project completion.

The photographs below illustrate several representative stages of the construction works.

Rigging and identification marking of ACCROPODE™ II armour units by the Joint Venture personnel.



Placement of ACCROPODE™ II armour units by crane on the breakwater armour layer.

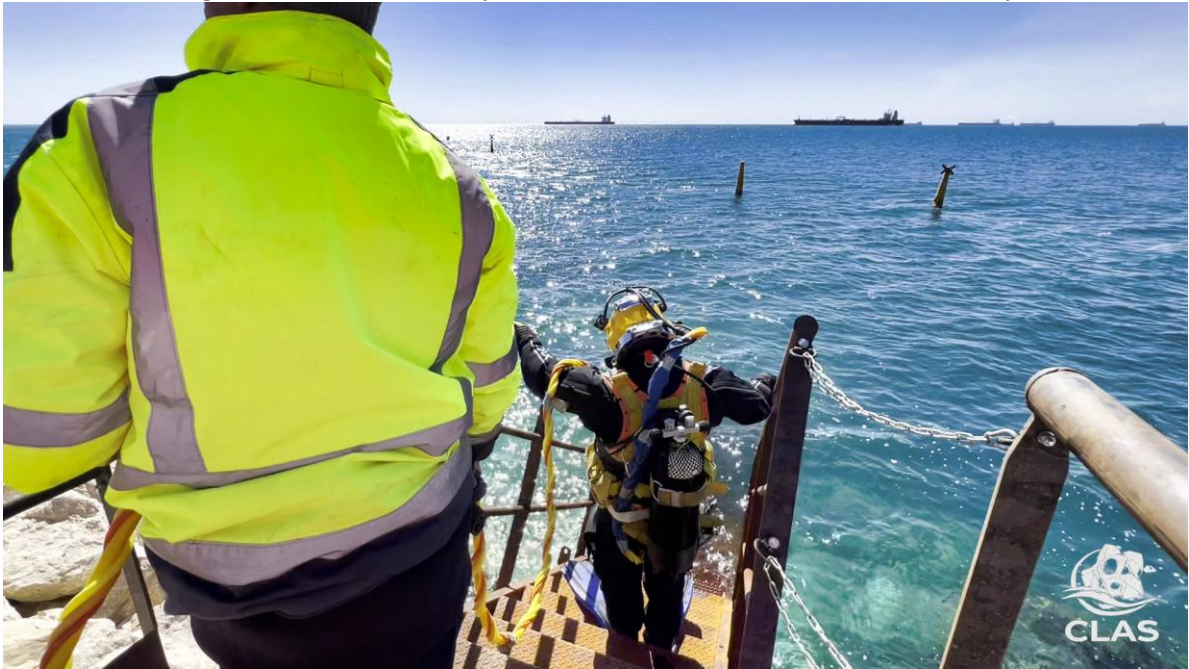


Preparation and deployment of the diver responsible for inspecting the placement of the ACCROPODE™ II armour units.



The diving helmet is an essential safety device, protecting the diver from accidental impacts during underwater operations.

The diver begins the underwater inspection of the ACCROPODE™ II armour unit placement.



The diver access ladder provides a safe means of diver deployment and recovery. It is an essential component of both diving safety and operational efficiency.

Inspection to verify compliance with the ACCROPODE™ II armour layer acceptance criteria.



The exposed section of the ACCROPODE™ II armour layer is inspected using a drone.



CLAS inspectors are certified drone pilots.

6. Results Achieved

The production objectives established by the Joint Venture and the quality requirements set by EDF were successfully achieved.

The completed works were accepted without reservations.

In recognition of its contribution to the project, CLAS was honoured to be invited to the official inauguration of the reconstructed breakwater.



7. Client Testimonial

Subject: Certificate of Satisfaction

Reference: PAI.IP14 – EDF – Martigues CCG Breakwater Rehabilitation Project

I, the undersigned, David Garreau, Project Manager for the reconstruction of the EDF Combined Cycle Gas (CCG) breakwater at Martigues (Bouches-du-Rhône, France), acting on behalf of GUINTOLI, the company responsible, within a joint venture led by BUESA, for the construction of the breakwater armour layer, hereby certify that CLAS SLU performed all the services entrusted to it to our complete satisfaction.

The assignment consisted of providing technical assistance to GUINTOLI during the reconstruction of the Martigues CCG breakwater armour layer. The services performed by CLAS included, in particular:

- Providing technical assistance during the evaluation of construction solutions, whenever required.
- Delivering and supervising safety training and ACCROPODE™ II armour unit placement training for construction personnel.
- Providing full-time technical assistance during the construction phase.
- Assisting the Contractor in achieving the required production and quality objectives.
- Carrying out the independent quality certification of the works for submission to the Engineer and the Owner, in accordance with the requirements applicable to a Class A breakwater.

CLAS fulfilled its assignment in a highly professional manner and completed all services within the agreed schedule. The completed works were accepted without reservations, and the certification dossier prepared by CLAS for the breakwater was incorporated into the As-Built Documentation.

GUINTOLI has no hesitation in recommending CLAS for similar assignments involving maritime breakwaters constructed with artificial armour units.

CLAS Technical Library

The CLAS Technical Library is progressively building a collection of project experience reports, technical guides and reference documents dedicated to maritime breakwaters, artificial armour units and coastal protection technologies.

Each new publication enriches this library by sharing field experience, inspection methods and technical solutions developed on projects carried out around the world.

To follow the development of the CLAS Technical Library, visit:

www.clascertification.com