





**PAPA TERRA FIELD  
JUMBO OFFSHORE**  
TWD engineer assisting  
offshore

# TEMPORARY WORKS DESIGN

TWD is an engineering company specialized in creating custom-designed tools and structures that allow you to perform transport & installation projects safely and on time. You can regard TWD as your problem solver. The reliable partner that creates functional and creative solutions, no matter what the time frame is, or the complexity of the challenge. Our goal is to reinforce your project team's capabilities and complement them where required, so we can together achieve a successful project execution.

- FLEXIBLE
- PRACTICAL
- CREATIVE

*... are the driving forces behind each of our designs*

Our thorough knowledge of structural and mechanical engineering, hydro-dynamics, finite element methods and design for offshore conditions, enables us to develop the optimal solutions that meet the wide variety of your demands.

Besides the development of practical installation methods and the design of the required tools, TWD engineers can assist during the procurement, fabrication and mobilization phase. This approach allows us to shorten the required lead times, properly integrate the contributions of different subcontractors and assure that our constructions will function as intended.

This document provides an overview of our track record of safe and robust designs used for Offshore Oil and Gas projects. It provides a selection of projects. References and additional examples can be provided upon request.

## MARKETS

- OFFSHORE WIND
- OFFSHORE OIL & GAS
- HEAVY CIVILS
- SALVAGE
- DECOMMISSIONING

## SERVICES

- DESIGN
- FABRICATION SERVICES
- NAVAL ENGINEERING
- SPECIAL DISCIPLINES





# OFFSHORE OIL & GAS



Involvement in a wide range of Oil & Gas projects, TWD has built up the vast expertise in the Oil & Gas sector, required to become your reliable project partner. Our structural and mechanical engineers can assist in your project with the design of tailor made temporary works and tools for transport & installation challenges. With the design specialized equipment like cantilevers for workover operations or by creating innovative tools for an efficient LNG-jetty construction.

With our team of naval architects, we can provide the full range of services required for a successful transport & installation project. Typical examples of our naval engineering services are mooring analyses, subsea lowering analyses, barge stability analyses and dynamic analyses for engineered lifts.

Whether the challenge is simple or complex, TWD designs stand out by their practicality, without compromising on quality and operational safety. Being a smartly designed seafastening for a decommissioning project or a motion compensated pedestal crane for platform supply operations, all our solutions comply with the applicable standards & codes to assure a certified and safe operation.

Our track record, from which examples are included in following sections, illustrates how TWD can contribute to your future Oil & Gas projects.



## PAPA TERRA FIELD JUMBO OFFSHORE

Loading of tendons and buoyancy modules on the Jumbo Javelin for Petrobras' TLP installation in the Papa Terra field





# OFFSHORE OIL & GAS



## TWD DESIGNS & SERVICES INVOLVED IN THE FOLLOWING OIL & GAS PROJECTS

- ALMA & GALIA FIELD, UK
- ANWERUP, BELGIUM
- CAMELOT FIELD, UK
- CINGUVU OIL FIELD, ANGOLA
- COOK INLET, ALASKA
- CONWY FIELD, UK
- DAN BRAVO, DENMARK
- DELTA SOUTH NIGERIA
- GAMBA EXPORT SEALINE, GABON
- GIRASSOL FIELD, ANGOLA
- GREATER STELLA FIELD, UK
- GUERNSEY, UK
- HAY POINT, AUSTRALIA
- ICHTHYS FIELD, AUSTRALIA
- K10-BRAVO, NETHERLANDS
- K5F FIELD, NETHERLANDS
- KEROMAX ANTWERP, BELGIUM
- L4-D FIELD, NETHERLANDS
- LULA FIELD, BRAZIL
- MADURA BD FIELD, INDONESIA
- MALAMPAYA FIELD, PHILLIPINES
- MORROSQUILLO, COLOMBIA
- NORTH SEA, NETHERLANDS
- NORTH WEST HUTTON FIELD, UK
- P11-E FIELD, NETHERLANDS
- PAPA TERRA FIELD, BRAZIL
- PORT MORESBY, PAPUA NEW GUINEA
- PIERCE FIELD, UK
- Q8-A PLATFORM, NETHERLANDS
- SOUTH ARNE FIELD, DENMARK
- SOYO LNG, ANGOLA
- SNS FIELD, UK
- THAMES FIELD, UK
- WESTERN ISLES FIELD, UK
- WHEATSTONE FIELD, AUSTRALIA





**SMARTPIPE CATCHER  
FUGRO**  
Smartpipe catcher inside the  
moonpool of the Synergy

## SMARTPIPE CATCHER - FUGRO SYNERGY

TWD designed a practical solution for the safe handling of a 'SmartPipe' measurement probe through the moonpool of Fugro's drill ship the Synergy. The existing cursor frame onboard was not compatible with the SmartPipe. Therefore, TWD designed a conical catcher below a vertical guide structure, to be able to safely launch and recover the probe. The main challenge in this project were the limitations regarding the orientation of the SmartPipe when lifting through the cursor frame. As the probe only fitted in a certain orientation, TWD included a smartly designed "knuckle", a guide construction, which flawlessly rotated the SmartPipe into the correct position while lifting it through the moonpool.

TWD designers made 3D animations of the operation to assure Fugro upfront that this simple but very effective method would work, no matter the orientation of the SmartPipe. This approach resulted in a cost effective and reliable method, minimizing the risk of failures during the offshore operation.







**PAPA TERRA FIELD**  
**JUMBO OFFSHORE**

Jumbo Javelin handing over anchor piles to McDermott's DB50

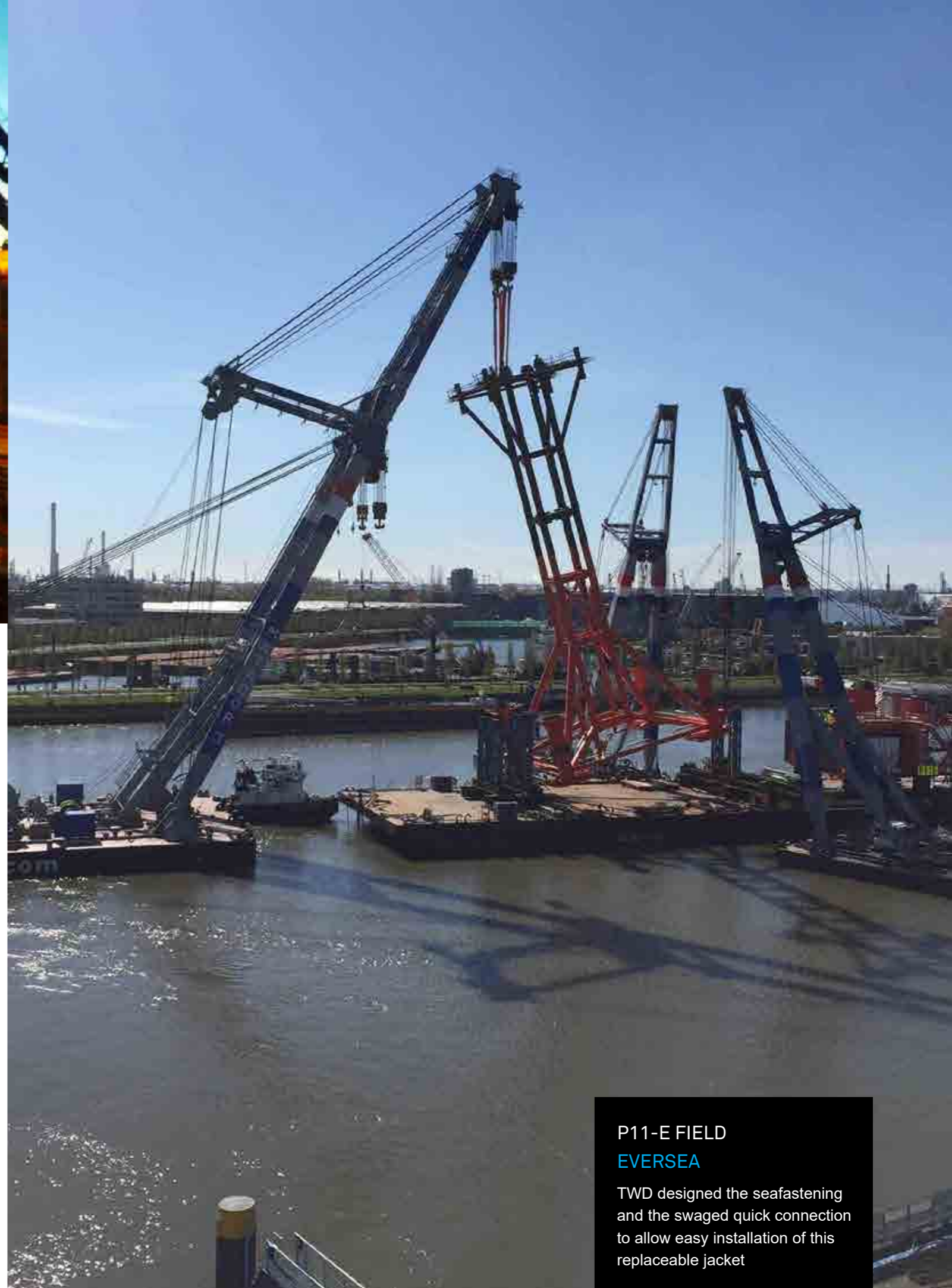
## TENSION LEG INSTALLATION - PAPA TERRA

TWD assisted Jumbo Offshore with transporting and handing over anchoring piles, tendons and buoyancy modules for a tension leg platform for Petrobras. TWD designed the entire installation sequence included loading, upending, and offshore hand-over to the client's vessel. Dynamic analyses were performed to determine the DAFs and feasible seastates to commence the lifting & upending operations. This way Jumbo was able to execute the operation offshore efficiently when a weather window was available.

Furthermore, TWD designed the pile grillage for the 320 t, 103m long piles and the seafastening of the 130 t tendon buoyancy modules. During the offshore campaign several TWD engineers were on board to assist with the operation.

### TWD WAS INVOLVED IN THE FOUNDATION TRANSPORT & INSTALLATION AT:

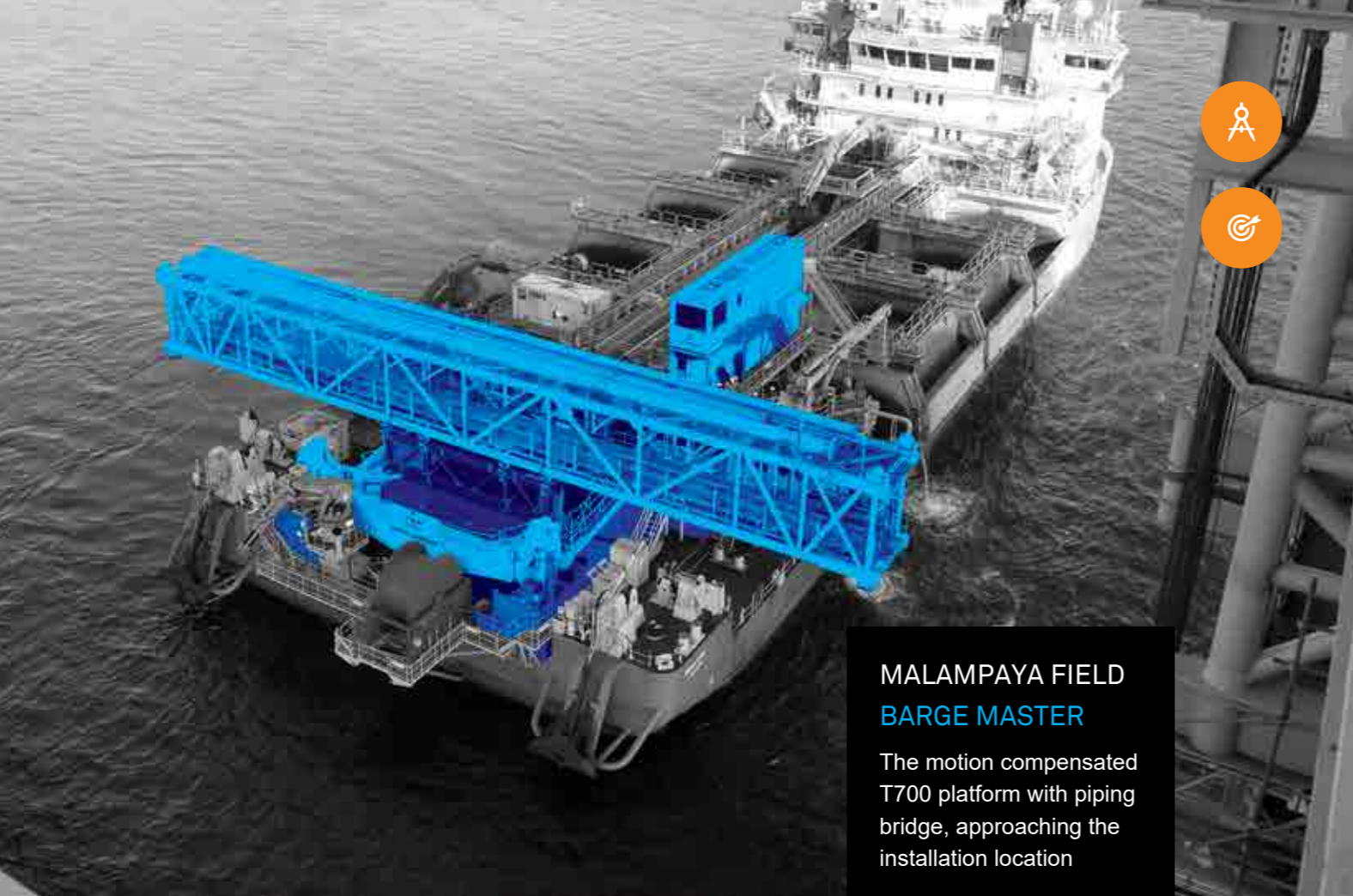
- CONWY FIELD – HSM
- P11-E – EVERSEA
- DELTA SOUTH – SEA TRUCK GROUP



**P11-E FIELD**  
**EVERSEA**

TWD designed the seafastening and the swaged quick connection to allow easy installation of this replaceable jacket





### MALAMPAYA FIELD BARGE MASTER

The motion compensated T700 platform with piping bridge, approaching the installation location



### CONWY FIELD HSM

TWD's scope included the installation method, lifting & stability calculations and temporary structures required for the T&I of the CONWY jacket and topside

## PIPING BRIDGE INSTALLATION - MALAMPAYA FIELD

The Barge Master T700 platform successfully assisted with the installation of a connection bridge between two production platforms for Shell's Malampaya field in the Philippines. Barge Master was contracted by Boskalis to assist in this delicate task. The T700 platform was mounted onto the multipurpose vessel Ndeavor. The installation required a short scheduled shut down of the two platforms during which, no matter the weather conditions, the bridge should be installed. With the T700 platform, the weather window for this critical operation increased drastically, ensuring a safe installation. The motion compensation platform, designed by TWD, increased the reliability and predictability of this critical operation by eliminating roll, pitch and heave motions of the vessel on its load.

Besides the detailed structural and mechanical design of the Barge Master T700 motion compensation system, TWD was responsible for the design of the seafastening and the initial design of the interface between the piping bridge and the triangular platform of the T700.





P67/ P70 FPSO  
**JUMBO OFFSHORE**  
 Jumbo's heavy lift vessel Fairplayer loading an FPSO module

## FPSO MODULE TRANSPORT - P67 / P70 FPSO

Jumbo Offshore successfully transported FPSO modules for Petrobras, from Brazil to China on different Jumbo heavy lift vessels. In total six shipments were arranged in 3 time periods. Every vessel transported 3 or 4 FPSO modules per voyage, with weights ranging from 160 tonnes to 1600 tonnes. The complete operation included lifting the modules to the deck, with either single or dual lifts, skidding of a number of modules to their transit position on deck and offloading of the modules in the destination port. TWD was requested to design the seafastening grillages for the transport of the modules on board of the HLV Fairplayer. Furthermore, TWD provided assistance at the Jumbo office, reviewing the operations and the seafastening of the modules on the remaining three vessels (including transport and lifting analyses, rigging and stowage plans, clearance checks, and strength calculations of grillages and deck during transit and skidding).

### SIMILAR SCOPE PERFORMED ON:

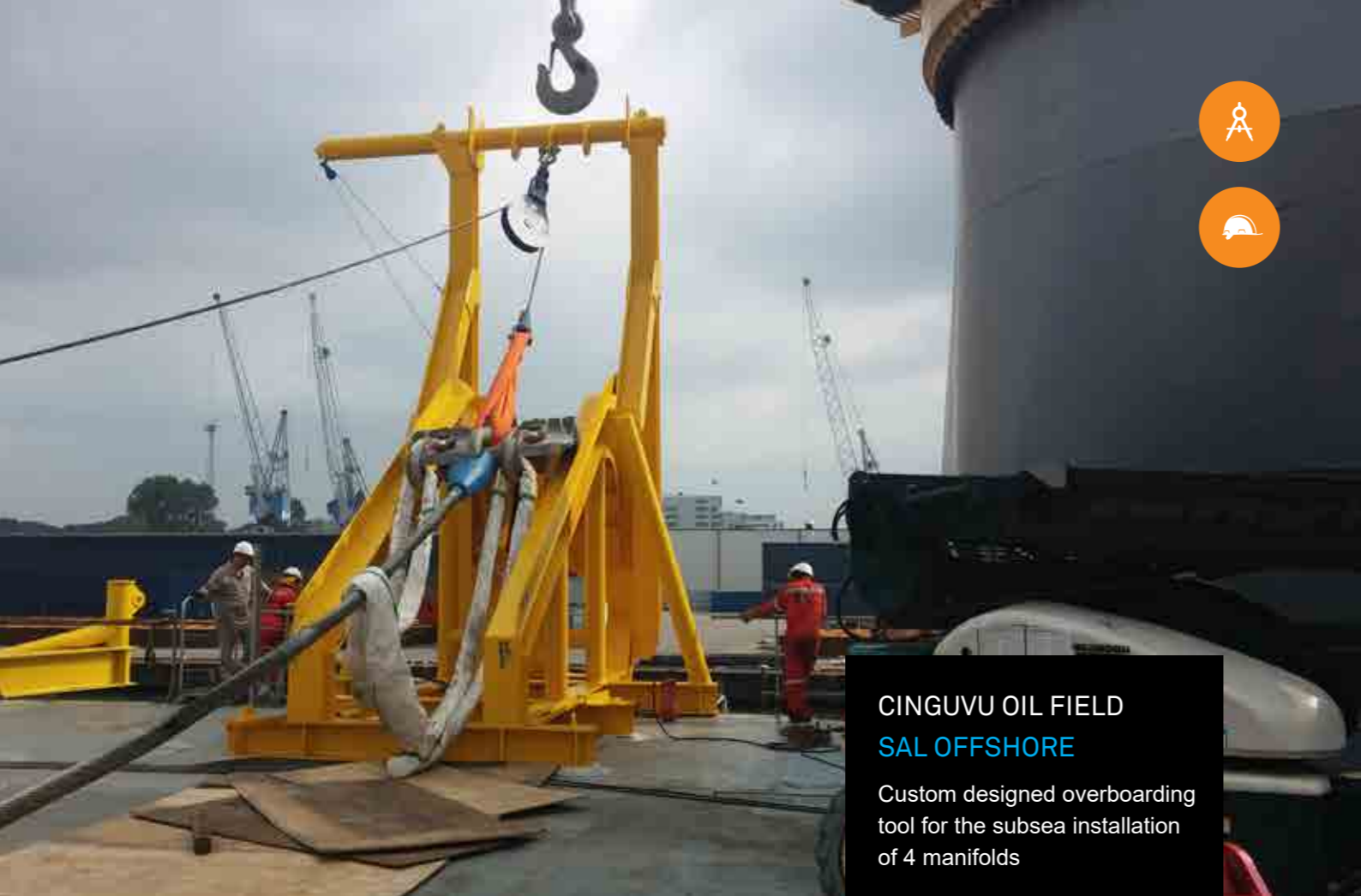
- KEROMAX ANTWERP – COFELY FABRICOM
- WHEATSTONE – BOSKALIS
- GIRRI – COMBI LIFT
- ANWERUP – COFELY FABRICOM
- L2CC – BIGLIFT



### WHEATSTONE FIELD BOSKALIS

TWD assisted Boskalis with the transport plans (stability & motion analyses) and ballasting plans for loadouts of the modules for the Wheatstone project





### CINGUVU OIL FIELD SAL OFFSHORE

Custom designed overboarding tool for the subsea installation of 4 manifolds

## MANIFOLD INSTALLATION - CINGUVU OIL FIELD

SAL Offshore was in need of a partner to assist them in the engineering, procurement, fabrication assistance and mobilization for their Block 15-6 project. The project consists of the transportation, overboarding and lowering of 4 subsea manifolds. The manifolds are handed over to the Technip Deep Pioneer at a water depth of 300 m.

TWD was widely involved in the project. The overboarding operation was engineered by TWD, including deck layout, sequence drawings and detailed design drawings of all additional tools to be constructed. Besides engineering, TWD assisted with the procurement and fabrication of all steel structures that had to be installed on deck. TWD's procurement officer worked full-time at the client's office to unburden the project team by arranging the procurement of all items required for the project, keeping a clear budget overview. The mobilization of the vessel and testing of the overboarding sequence, was successfully performed under the guidance of TWD.



### SOUTH ARNE FIELD BOSKALIS

Hang-off platform and hose clamp for recovery and replacement of a Single Anchor Loading system





**L4-D FIELD**  
**TOTAL**

The retrofit clamp in the construction hall, as used for the replacement of a conductor pipe on the Total L4A platform

## CONDUCTOR PIPE - L4-D FIELD

TWD was requested by Total to assist in the replacement of the conductors on their L4A platform. The work was performed in 4 stages. TWD setup the complete operational sequence for a smart removal of the old conductors and existing clamps. After the removal we re-assessed the structural integrity of the jacket structure. The new designed retro-fit clamp redirected the reaction forces of the conductor pipe due to environmental loads and initial displacement into the L4A structure, and was easily adjustable for conductor pipe deviations. Extra attention was paid to smart details that optimized the installation operation. This way diving operations for the installation of the clamp could be limited and kept as short as possible. The final step of installing the new conductor was done by solely ROV, smart handling details on the new retrofit clamp made this operation as efficient as possible.

TWD designed several high-level concepts in close cooperation with Total E&P. Due to this functional design method, the most optimal solution for the given requirements and boundary conditions could be achieved in a cost-effective way.



**SIEM HELIX 1&2**  
**HELIX ENERGY SOLUTIONS**

Heat shield on 250t well intervention vessel crane





### NORTH SEA BARGE MASTER

The T40 motion compensated knuckle boom crane on the Kroonborg

## T40 ON KROONBORG - NORTH SEA

Besides the T700 motion compensation platform TWD designed the Barge Master T40. This innovative motion compensated knuckle boom crane increases workability and assures safe lifting offshore. It is the first motion compensated crane ever installed on an offshore vessel, which is able to operate in seas with wave heights of  $H_s = 3$  m. During the development of the Barge Master T40, TWD designed the mechanical system and performed the structural analysis for this motion compensated offshore crane.

The Barge Master T40 includes a small triangular base with one cylinder on the inside for the heave compensation, and two cylinders on the outside to compensate the roll and pitch motions. On top of the pedestal, a standard knuckle boom crane is installed. The small footprint is space-saving on deck and allows a convenient placement of the crane on any vessel.

With the innovative Barge Master T40 installed on the Kroonborg, the vessel is used for service and maintenance projects of NAM/Shell gas production platforms in the North Sea.



### NORTH SEA BARGE MASTER

The T40 during a supply operation of an unmanned gas production platform in the North Sea





**COOK INLET**  
**FURIE OPERATING ALASKA**  
Stinger mounted on the side of the Spartan Rig 151, ready for a horizontal drilling operation

## STINGER - COOK INLET

TWD assisted Furie Operating Alaska and Heavy Lift at Sea in designing and constructing a Stinger frame to guide a drill pipe during a horizontal drilling operation. Furie Operating Alaska constructed a new Liquid Natural Gas (LNG) production platform in Cook Inlet, Alaska. The existing onshore pipelines had to be connected to the platform through subsea gas pipeline, installed by Heavy Lift at Sea.

At last moment the choice was made to use a stinger frame to guide the drill pipe. Therefore, it was requested to design, fabricate and fit the stinger frame in less than a month onto the Spartan 151 rig. TWD took this challenge and managed to succeed.

Due to severe tidal currents at the project location, the Stinger frame needed to be able to handle large horizontal shifts of the drill pipe to ensure its integrity. Our integral team of engineers, draftsmen and naval architects performed all dynamic analysis to ensure drill pipe integrity and delivered the required fabrication drawings within one week. Besides the complete design, TWD assisted on site with the fabrication and mobilization works in Alaska.



**JASCON 5**  
**ZEETECH**

TWD scope included the design of the handling frame, sheave blocks and interface between stinger and Jascon 34 pipe-lay barge





**PAPUA NEW GUINEA**  
**BAM INTERNATIONAL**  
 Cantilever bridge constructing  
 the LNG jetty of the PNG  
 LNG project



**HAY POINT**  
**GEOSEA**  
 Piling template mounted on  
 the side of one of GeoSea's  
 jack up barges, used for  
 driving dolphin piles

## CANTILEVER BRIDGE - PAPUA NEW GUINEA

TWD provided the detailed design of a cantilever bridge for BAM International's LNG project in Papua New Guinea. The cantilever bridge was used to build a permanent 2450 m long jetty, which consists of concrete headstocks supporting a roadway and LNG-pipe racks. The design consisted of 3 separate work stations, resulting in a very effective solution for building jetties independent from waves and tide. The cantilever bridge was launched forward and then supported on temporary spuds, while new foundation piles for the next head stock were driven. After completion of the new head stock, the spud units were retracted, roller supports were placed, and the CLB was launched forward to the next headstock location. After successful completion of the first, TWD designed two more cantilever bridges to construct jetties for the Ichthys and Wheatstone fields, Australia.

### TWD WAS INVOLVED IN THE CONSTRUCTION OF:

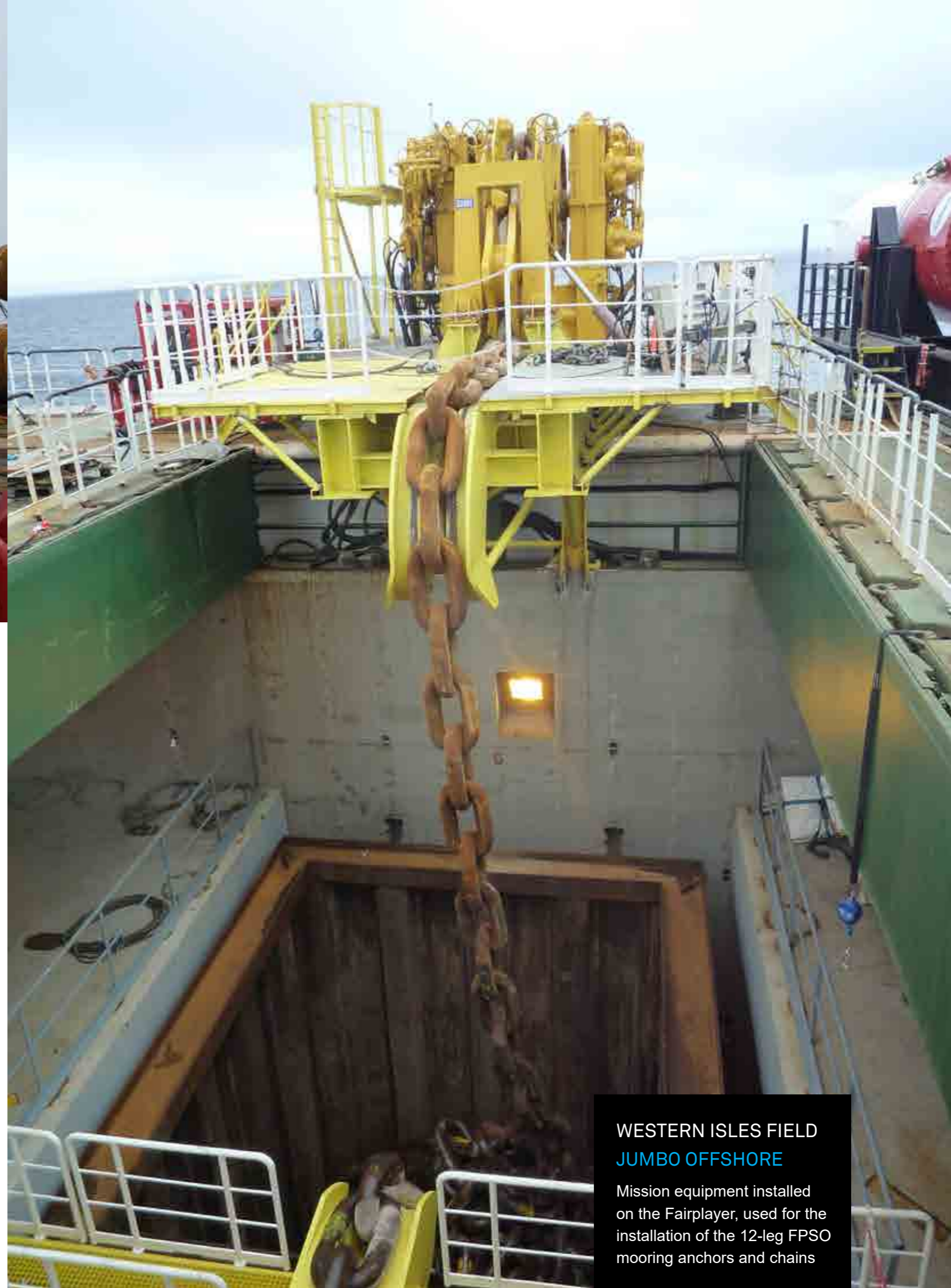
- ANGOLA SOYO LNG JETTY – GEOSEA
- MOROSQUILO LNG JETTY – GEOSEA
- HAYPOINT COAL JETTY – GEOSEA
- WHEATSTONE LNG JETTY – BAM INTERNATIONAL
- ICHTHYS LNG JETTY – BAM INTERNATIONAL





**PIERCE FIELD  
JUMBO OFFSHORE**

Subsea piling template used for the installation of the mooring piles of Shell's Pierce Field FPSO



**WESTERN ISLES FIELD  
JUMBO OFFSHORE**

Mission equipment installed on the Fairplayer, used for the installation of the 12-leg FPSO mooring anchors and chains

## FPSO MOORING - PIERCE FIELD

Jumbo has installed 8 anchor piles for the Pierce Field FPSO in the North Sea. To install these piles within the correct inclination and orientation tolerances a subsea template was needed. TWD successfully delivered the total design within 5 weeks.

TWD has been involved in the development of the operational sequence for multiple FPSO mooring installations. During these projects, TWD developed the installation methods, designed the required project specific mission equipment and provided the required sequence drawings. Specific solutions included the design of seafastening structures, chain lockers, overboarding tools and project specific access & working platforms.

### SIMILAR SCOPE PERFORMED ON:

- ENQUEST FPSO MOORING – JUMBO OFFSHORE
- GREATER STELLA FPSO MOORING – JUMBO OFFSHORE
- MADURA FPSO MOORING – BOSKALIS
- PIERCE FPSO MOORING – JUMBO OFFSHORE
- WESTERN ISLES – JUMBO OFFSHORE





**CAMELOT FIELD**  
**SCALDIS**  
 The Rambiz removing the Camelot topside

## JACKET & PLATFORM REMOVAL – CAMELOT FIELD

Scaldis utilized the Osprey Trader barge to transport the decommissioned topside of the Camelot field. TWD was requested by Scaldis to design the seafastening of the topside and the conductor pipes. The topside is placed on multiple stacks of crawler boards, for a good distribution of the vertical loads. Additionally, TWD determined the stability and required bollard pull for the Osprey Trader barge. The stability of the barge is analysed for both loaded and unloaded condition.

### TWD WAS INVOLVED IN THE DECOMMISSIONING OF THE FOLLOWING PROJECTS:

- THAMES FIELD – SCALDIS/BOSKALIS JV
- NORTH WEST HUTTON FIELD – HEEREMA
- SNS FIELD – SCALDIS/BOSKALIS JV
- Q8A – SMIT
- K10-BRAVO – SCALDIS

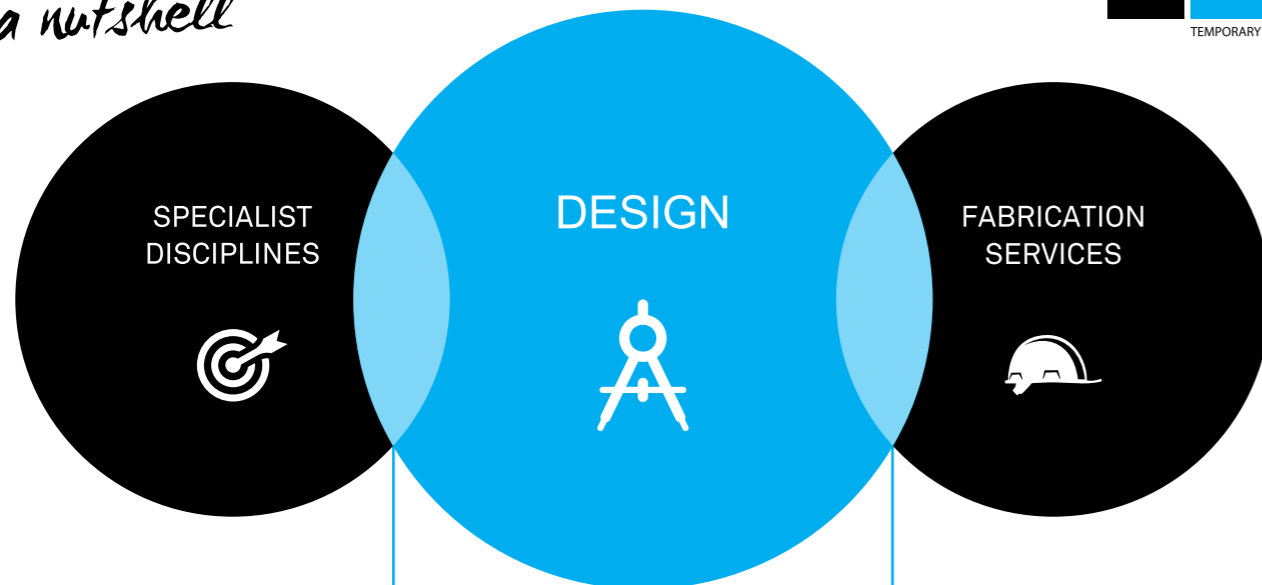


**Q8-A**  
**SMIT**  
 Working platform designed for the decommissioning of the Q8-A platform

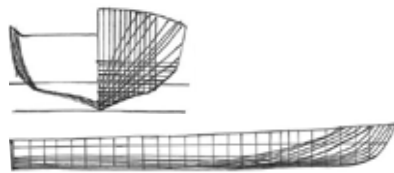


# TEMPORARY WORKS DESIGN

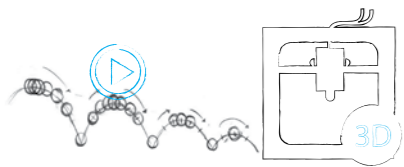
*In a nutshell*



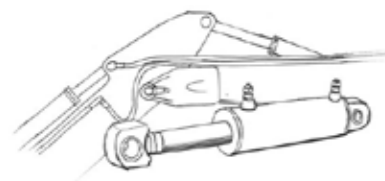
## NAVAL ENGINEERING



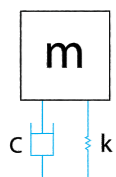
## 3D VISUALIZATIONS



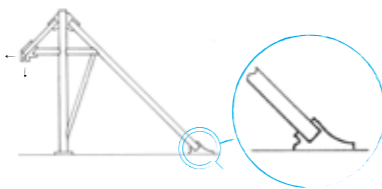
## HYDRAULIC ENGINEERING



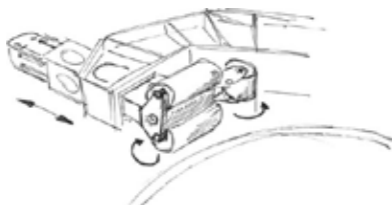
## DYNAMIC ANALYSIS



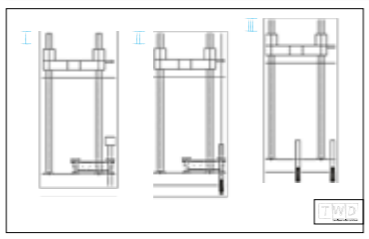
## STRUCTURAL ENGINEERING



## MECHANICAL ENGINEERING



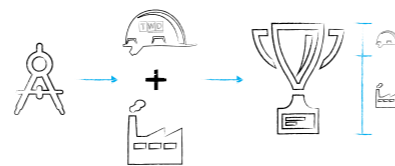
## INSTALLATION ENGINEERING



## PROCUREMENT ASSISTANCE



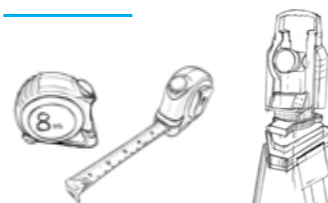
## FABRICATION ASSISTANCE



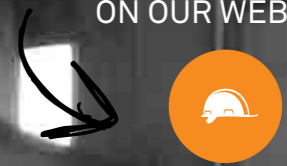
## FIELD ENGINEERING



## MEASUREMENT SERVICES



TAKE A LOOK AT THE  
FABRICATION SERVICES PAGE  
ON OUR WEBSITE



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*Engineered to function*





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## TEMPORARY WORKS DESIGN

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