COOEC
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IMR & Decommissioning

OFFSHORE OIL ENGINEERING

水下设施IMR Subsea Facility IMR

业务简介

水下设施I.M.R.业务是水下油气田完整性管理的关键业务，在整个水下油气田投产后的运营过程中，对水下生产设施进行检测、维修、维护等一系列水下运维作业支持。

作业内容

涉及系泊系统、SPS水下生产系统、以及飞溅区以下结构物检测，维护和维修工作。

作业方式

- 主要依托MSV（多功能支持船）、DSV（潜水支持船）等水下工程船进行
- 空气潜水检测:潜水员通过吊篮及潜水梯入水，最大作业水深50m
- 饱和潜水检测:潜水员通过闭式钟入水，最大作业水深300m
- ROV潜水检测:ROV由随船领航员遥控工作，最大作业水深3000米

Introduction

Subsea facilities I.M.R. is a key business for the integrity management of offshore oil and gas fields, including inspection, maintenance and repair services throughout the life cycle after they are put into production.

Scope of Services

Professional inspection, maintenance and repair services of mooring system, SPS, and subsea structure.

How We Operate

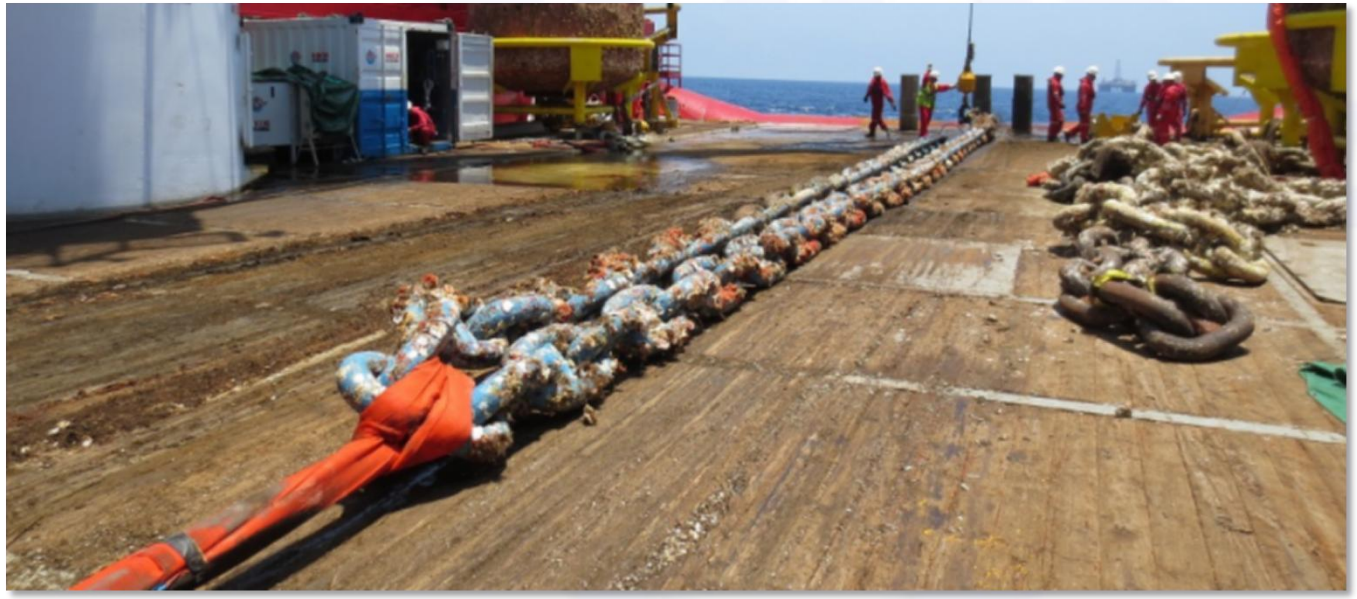
- Based on MSV and DSVs
- Air Diving: max. 50 meters
- Saturation Diving: max. 300 meters
- ROV: max. 3,000 meters

水下设施IMR　Subsea Facility IMR

锚泊系统 IMR　Mooring IMR

近年来，通过参与实施海洋石油111FPSO锚系更换，南海奋进锚系更换，海洋石油119锚系安装，海洋石油118锚系安装，陵水17-2锚系安装等一系列的锚系安装，检测，维护作业，海油工程积累了较强的从百米水深至千米水深的锚系整体安装，维护，维修能力。掌握了一整套深水吸力锚安装，超深水打桩，深水锚链，钢缆和聚酯缆铺设和回收等关键技术。

In recent years, by participating in a series of mooring system IMR projects, such as HYSY 111FPSO mooring replacement, NHFJ mooring replacement, HYSY119 mooring installation, HYSY118 mooring installation, LS17-2 mooring installation, etc., COOEC has built strong mooring system installation and IMR capabilities from 100 meters to 1,500+ meters water depth. We have mastered a complete set of key technologies such as deepwater suction anchor installation, ultra-deepwater piling, deepwater mooring chain, steel cable and polyester cable laying and recycling, etc.



水下设施IMR Subsea Facility IMR

水下生产系统 IMR SPS IMR

主要涉及水下采油树/采气树、水下管汇、水下基盘等水下生产设施。海油工程运营的5艘多功能支持船与自有的17台ROV已具备基本的水下生产系统安装施工和I.M.R.能力，已形成1500米水深水下采油树等水下生产系统基本的IMR能力，并于2017年开始为南海海域水下生产系统进行IMR服务。随着ROV工具逐步完善，水下生产系统I.M.R.能力将逐步升提至3000米。

It mainly involves SPS such as subsea production trees, manifolds, and PLET. The 5 MSVs and 17 ROVs operated by the company have comprehensive I.M.R. capability in 1,500 meters ultra-deep water，and have been providing IMR services for SPS in the South China Sea since 2017. With the improvement of ROV tools, the capacity of our IMR services will be increased to 3,000 meters water depth.

水下生产系统IMR业务能力清单 Subsea SPS IMR Capabilities			
SCM/SRM更换 SCM/SRM Replacement	CIMV更换 CIMV Replacement	SSIV更换 SSIV Replacement	WGFM更换 WGFM Replacement
HFL/EFL/FOFL/MFL/MEG Bundle/PFL等各类飞线更换 HFL/EFL/FOFL/MFL/MEG Bundle/PFL Replacement			坠落物保护罩安装 Protection Frame Installation
SLJ/Rigid & Flexible Jumper/Horizontal Spool/Bridge Jumper等各类跨接管更换 SLJ/Rigid & Flexible Jumper/Horizontal Spool/Bridge Jumper Replacement			
Acoustic Pig Detector更换 Acoustic Pig Detector Replacement	Acoustic Sand Detector更换 Acoustic Sand Detector Replacement		海生物清理 Biofouling Treatment
Subsea Tree Choke更换 Subsea Tree Choke Replacement	RODU/REDU更换 RODU/REDU Replacement	水下采油树更换 Subsea Production Tree Replacement	
Logic Cap Stab Plate/Production Stab Plate/Workover Bridging Stab Plate更换 Logic Cap Stab Plate/Production Stab Plate/Workover Bridging Stab Plate Replacement			
Subsea Monitoring Module更换 Subsea Monitoring Module Replacement	水下阀门介入 Subsea Valve Intervention	水合物治理 Hydrate Remediation	
SPS测试与清理 SPS Test & Cleaning	SPS测漏 SPS Leakage Test	阳极安装与更换 Anode Installation & Replacement	悬跨处理 Rectification

注：深灰色底纹为已经具有实际项目业绩的服务内容 Deep Grey = Services with Track Record

水下设施IMR Subsea Facility IMR

船舶资源：3,000m深水多功能作业工程船舶5艘 5 x 3,000m Deepwater MSVs


HYSY 285

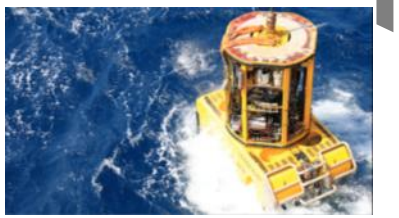

HYSY 286


HYSY 287


HYSY 289


HYSY 291

各级ROV:17台
17 x ROVs



饱和潜水系统
Saturation Diving System

空潜系统及潜水员团队
Air Diving System and Diving Team

平台拆除设备
Decommission Equipment

水合物治理设备
Remediation Equipment

柔性管缆铺设设备
SURF Installation Equipment

挖沟设备
Trenching Equipment

飞线更换设备
Flying-lead Replacement

海管应急救援设备
DPRS System

管缆IMR　SURF IMR

能力介绍 Capabilities

管缆完整性分析与评估

- 生产适应性评估
- 海管工艺校核
- 海管结构校核
- 腐蚀评估及内腐蚀直接评价（ICDA）
- 应急抢修方案
- 焊缝异常及裂纹评估
- 海底管道延寿评估
- 管网输送优化及安全保障技术

- Production suitability assessment
- Pipe process check
- Pipe structure Inspection
- Corrosion Assessment and Internal Corrosion Direct Evaluation (ICDA)
- Emergency repair plan
- Weld anomalies and crack assessments
- Subsea pipeline life extension assessment
- Pipeline network transportation optimization and safety assurance technology

管缆完整性工程服务

- 水下钢制管线IMR
- 软管IMR
- 动态/静态立管IMR
- 海底电缆/脐带缆IMR
- 电飞线，液飞线IMR
- 悬跨/沙坡/沙脊处理服务
- 创新型海管/海缆挖沟及配套服务
- 海对海定向钻工程服务

- Rigid pipe IMR
- Flexible pipe IMR
- Dynamic/Static Riser IMR
- Submarine cable/umbilical IMR
- EFL/HFL IMR
- Free span ratification
- Innovative trenching services
- Sea-to-sea directional drilling

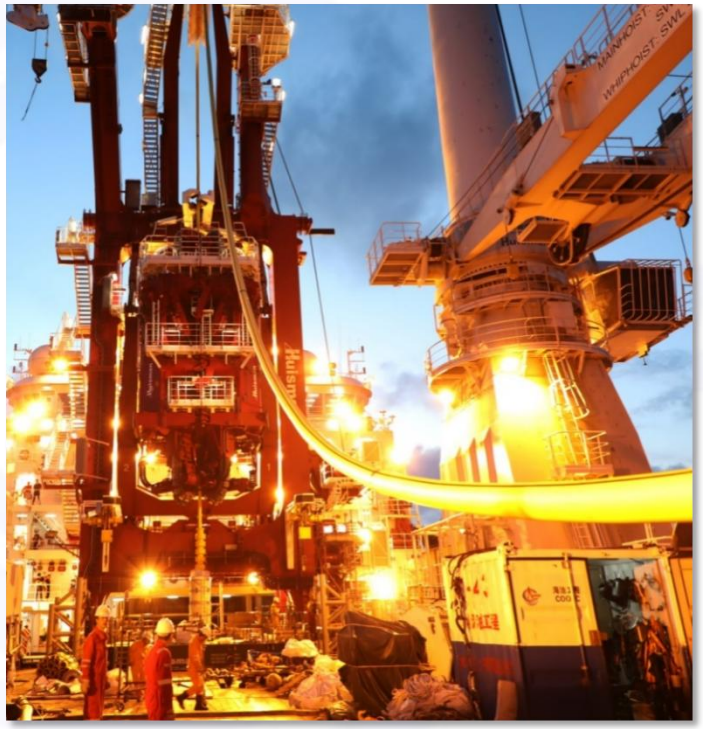
管缆IMR　SURF IMR

管缆系统 IMR　SURF System IMR

从2014年开始进行水下海管、软管，脐带缆、海缆IMR施工，目前已经开始介入水下电飞线，液飞线等IMR作业。从荔湾3-1气田投产开始至今，已经为该气田水下SURF进行了多次检测，检修等IMR作业，作业水深达1400米。

We have been carrying out IMR services for subsea pipes, flexible pipes, umbilical, cables since 2014, and have begun to provide in IMR services for EFL/HFL recently. Since the Liwan 3-1 gasfield was put into production, we have been providing years of IMR operations for its SURF system in water depth more than 1,400 meters.

水下管缆系统IMR经典业绩 SURF IMR Signature Experience
文昌19-1A至14-3A平台间受损海缆水下ROV切割、密封、回收和重新铺设 WC16-1A to 14-3A Damaged Subsea Cable Cutting, Sealing, Recycling and Re-installation by ROV
文昌13-6至文昌14-3平台间水下软管修复作业 WC13-6 to WC14-3 Flexible Pipe Repair
崖城13-1气田28寸海管（整体长度778公里）不排空更换受损管段及2个阀撬的工作 YC13-1 Gasfield 28-in Pipeline (778km) and 2 Valve Skids Replacement Without Drainage
HZ至XJ平台间强外力拉断海缆海上修复作业 HZ to XJ Platform Damaged Cable Repair
崖城13-4采用饱和潜水回收、更换和修复损坏的脐带缆、电/液飞线等 YC13-4 Umbilical, EFL, HFL Recovered, Replacement and Repair by Saturation Diving



管缆IMR　SURF IMR

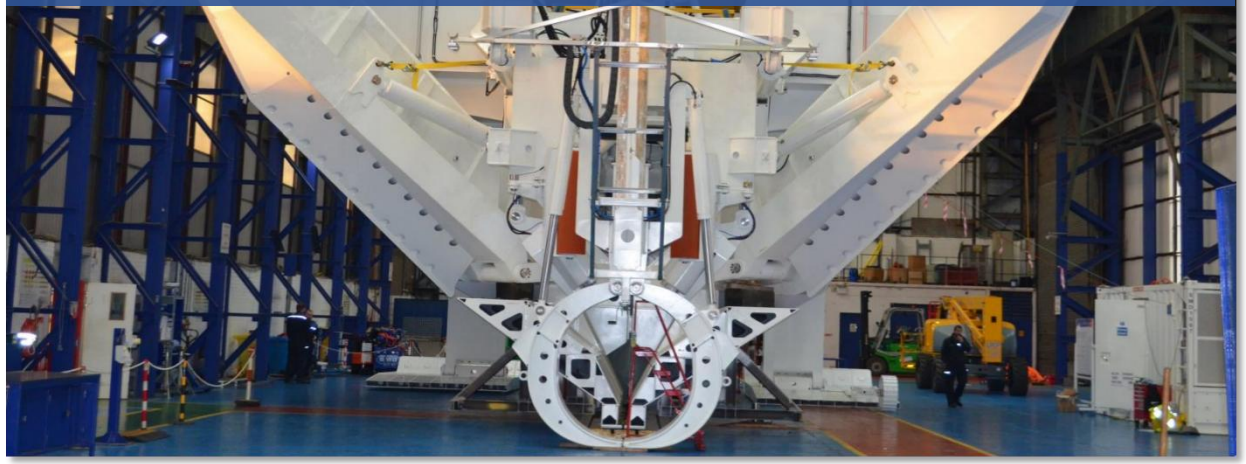
创新型管缆治理　Innovative Pipeline Integrity Management

- 犁式挖沟模式具有挖沟效率高、沟型规则和土壤强度适应范围广的特点，是海底输油/输气管线后保护的最佳选择，也为后续在役管道治理提供了新的解决方案。
- QT1600挖沟机具有挖沟效率高、操作灵活，挖沟后自然回填速度快的优点，应用场景覆盖脐带缆、电缆、柔性软管、硬质海管等所有类型的水下管缆。

- Plough trenching has the advantages of high trenching efficiency, clean trench shape and application in wide range of soil strength, which is the best choice for the post-protection of subsea pipelines, and also provides a new solution for the pipeline integrity management.
- QT1600 ROV trencher has the advantages of high trenching efficiency, flexible operation, and fast natural backfill speed after trenching, it is applicable for all types of subsea pipes/cables/umbilical.

HYSY291船搭载自有VMP500犁式挖沟机，安全、高效完成了ZZ项目的两个工程段海管后挖沟作业。

HYSY291 vessel is equipped with the VMP500 plough, and has safely and efficiently completed the two sections of post-trenching operation of the ZZ project.



DP船搭载QT1600挖沟机顺利完成了渤中19-6项目18寸硬管的挖沟作业，验证了QT1600进行硬质海管挖沟的可行性和高效性。

DP Vessel equipped with QT1600 ROV trencher successfully completed the trenching operation of the 18-inch rigid pipeline of the BZ19-6 project, which verified the feasibility and efficiency of the QT1600 trenching of the rigid pipes.

管缆IMR　SURF IMR

Vertical Lay System (VLS)
垂直软铺系统

- Maximum Line Tension: 325t
  最大张紧力：325吨

Flex-lay Equipment
柔性管缆铺设设备

- 1 x 3,000t Carousel
  3,000吨卷缆盘1套
- 1 x 2,500t Carousel
  2,500吨卷缆盘1套
- 1 x 350t Real Hub Drive System (RHDS)
  350吨滚筒驱动装置1套
- 1 x 100t Tensioner, 1 x 50t Tensioner
  100/50吨张紧器各1台
- 3 x 15t Tensioner
  15吨张紧器3台

Subsea Flooding & Hydrotesting Module (SFHM)
深水水下清管试压模块

Maximum working depth 3,000m	最大作业水深3000米
Maximum testing pressure 700bar	最大试压压力700bar
Staged Orifice for stable flooding	多级节流设计，注入速度稳定可控
4 kinds of chemical injection with total volume of 6m³	满足4种不同化学药剂同时注入，最大容量6m³
Different ways of data monitoring, recording and wireless transferring	多种数据记录、传输模式，可连续记录数据30天

Deepwater Reel Intervention System
深水海管预调试水下连接系统

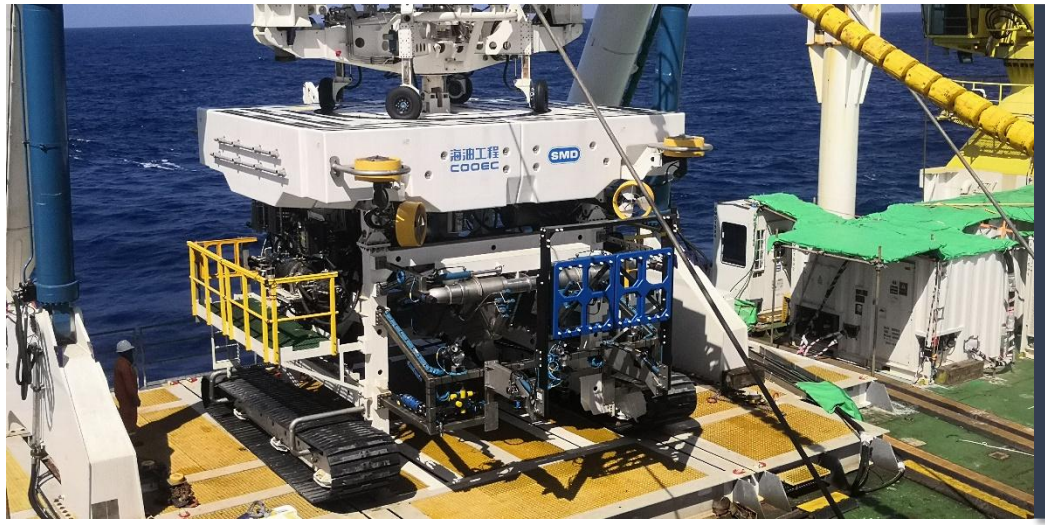
Maximum pipeline diameter 3.5-in, maximum length 2,000m	最大管径3.5"，最大长度2000米
Maximum working pressure 6,900psi	最大工作压力6900psi
Subsea emergency break-out device	配备水下紧急自动断开装置
On top emergency cutting device	配备甲板应急切断装置
Suitable for deepwater pipeline pre-commissioning operation	适用于深水海管清管试压排水干燥惰化作业

管缆IMR　SURF IMR

VMP500 Plough
VMP500 犁式挖沟机

作业水深：500米
最大系柱压力：180吨
挖沟深度范围：2.0/2.5米（1st/2nd）
适应最大管径：1,420mm
土壤剪切力：Min./Max. 5kPa/400kPa

Depth Rating: 500m
Max. Bollard Pull: 180t
Trenching Depth: 2.0/2.5m (1st/2nd)
Max. Product Diameter: 1,420mm
Ground Capacity: Min./Max. 5kPa/400kPa



QT1600 ROV Trencher
QT1600 ROV挖沟机

作业水深：2000米
最大系柱压力：1000公斤
适应最大管径：800mm

Depth Rating: 2,000m
Max. Bollard Pull: 1,000kg
Max. Product Diameter: 800mm

平台IMR　Platform IMR

能力介绍 Capbility

平台升级改造/延寿是公司的传统业务,经过20余年的能力建设，目前已具备老平台智能化升级改造技术能力，涉及甲板外扩、结构加强、设备安装、总体配管、工艺流程改造、电气设备安装、新增仪表控制系统改造等; 具备老平台及FPSO、LNG终端、海上油气田陆地终端等设施的改扩建技术能力。曾成功完成过多个国内外大型平台升级改造/延寿项目，助力海上油气田延寿、增产。

The company has more than 20 years of experience & track record of 500+ projects in platform modification services. To extend the life of platform, FPSO, LNG & land terminals, we offer intelligent upgrading and modification services including deck expansion, structural strengthening, equipment installation, piping, process modification, instrument replacement, and control system modification etc.

- 大型平台整体升级改造/延寿　Large platform modification/life extension modification
- 平台设备/撬块更换和维修　Equipment/skid replacement and repair
- FPSO设备设施升级改造/延寿　FPSO modification/life extension modification
- 陆地终端升级改造　Land terminal modification
- 平台智能化改造　Intelligent upgrading and modification


井口管线连接
Wellhead Pipeline Connection


消防管线连接
Hose Pipe Connection


管汇现场制作
Manifold Fabrication


捕集器安装
Collector Installation


单点工艺管线连接
SPM Process Pipe Connection


透平拆迁及安装
Turbine Installation

平台IMR　Platform IMR

01

核心业务 Core Service

- 海上油气平台及陆地油气终端的工艺流程改造
- 井口回接改造
- 平台设备设施维修更换
- 大型平台综合型改造等各类型维修改造项目

- Platform and land terminal process modification
- Wellhead tie-in
- Equipment and facility repair/replacement
- Comprehensive modification of large-scale platforms

02

核心竞争力 Core Competitiveness

- 海洋工程和海洋油气工程涉及详细设计能力
- 技术方案设计及现场的组织实施；
- 质量管控能力；
- 安全管理能力，施工规范有序。

- Detail Design Capability in Offshore Engineering
- Technical Design and on-site operation
- Quality Control
- Safety Management

03

核心技术 Core Technology

- 综合性改造项目的改造设计
- 结构、机管电相关改造设计
- 大型设备浮吊吊装就位技术
- 立管及立管卡子安装技术
- 关键设备现场吊运技术

- Comprehensive modification technology
- Structure, piping, E&I modification technology
- Large equipment floating crane lifting & positioning
- Riser and riser clamp installation technology
- On-site lifting and transportation technology

平台IMR　Platform IMR

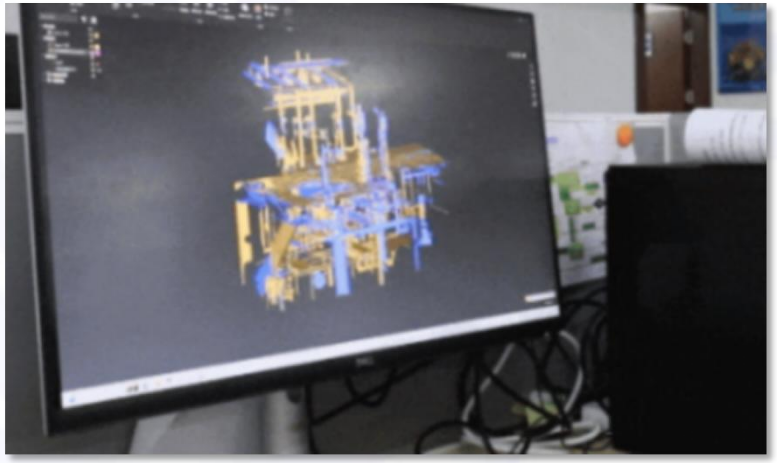
数字集成一体化改造技术　Digital Integration Modification Technology

海上平台等油气田设施进行升级改造、抢修及维保作业不仅投入人力成本大，人工采集信息效率和信息准确度也相对较低。基于数字集成一体化改造技术设计而成的**“魔笛系统”**，涵盖陆地预制、海上安装等全流程设计功能，平台改造的“痛点”得以迎刃而解，为油田平台改造作业注入了强大的动力。

- 魔笛系统的三维激光扫描仪通过“非接触式”扫描，采集多专业“海量”数据，较以往人力调研准确度平均提升**近20%**
- 平台分区扫描后收集的数据经过系统处理可构建出包含规格尺寸、坐标方位、材质等属性的**超高清三维模型**
- 改造人员可以**直观验证出施工方案的可行性**，实现陆地预制率大幅提高，同时进一步降低海上施工成本，让改造设计**实施快、看得见、算得准**
- 系统集成了改造工程的设计、交底、施工及验收交付等**全部流程**
- 目前，该系统已在多个工程实践中成功应用。其中，在恩平油田群总包工程项目中，数字集成一体化改造技术将**陆地预制率由60%提升至85%**

The IMR of offshore facilities not only requires a large labor cost, but also has relatively low efficiency and accuracy of manual information collection. The “MODI" system is designed based on digital integration technology and covers the whole process such as onshore pre-fabrication and offshore installation, which solves the above problems and brings the platform IMR services to a higher level.

- The 3D laser scanner collects multi-disciplinary data through "non-contact" scanning, which improves the accuracy by nearly 20%
- The data processed by the system was used to build an ultra-high-definition 3D model that includes specifications, dimensions, coordinates, orientation, materials and other attributes
- Engineers can visually verify the feasibility of the construction plan, which greatly increase the onshore pre-fabrication rate, and further reduce the cost of offshore construction
- At present, the system has been successfully applied in several projects. In EP Oilfield Project, this technology was managed to improve the onshore prefabrication rate from 60% to 85%



应急维抢修 Offshore Emergency Repair

技术优势 Technical Advantages

公司具备从方案设计、抢险作业、风险评估等“一条龙”式的作业能力，具备完善的海底管道和水下生产系统维抢修体系和丰富的成功经验，能够解决目前国内1500米以内所有水深的海管、脐带缆/海缆、飞线等维修问题，掌握各种浅水海底管道维抢修技术能力、部分深水海底管道维抢修能力和脐带缆飞线更换维修能力，在国内海底管道应急抢险领域拥有绝对的领先地位。

The company offers comprehensive emergency repair services including design, operation and assessment, etc. With a complete submarine pipeline and SPS maintenance and repair technology system and extensive experience, we are the leading company in China with professional repair technologies for subsea pipelines, umbilical, cables, flying-leads and other facilities up to 1,500 meters.

应急维抢修 Offshore Emergency Repair

Pipeline Cutting Equipment
海管切割设备

海管切割类设备现有11套，能够满足作业水深100米内海管切割需求，目前能够覆盖4"-52"海底管道切割，管道轴向切割能够覆盖10"-36"海底管道。

11 sets of pipeline cutting equipment with operation depth within 100m. They are capable of 4"-52" subsea pipeline cutting, and 10"-36" subsea pipeline axial cutting.

Coating Cleaning Equipment
涂层清理设备

涂层清理类设备现有8套，能够满足作业水深100米内海管涂层清理需求，目前能够覆盖8″-42″海底管道涂层清理，适用涂层厚度不超过100mm。

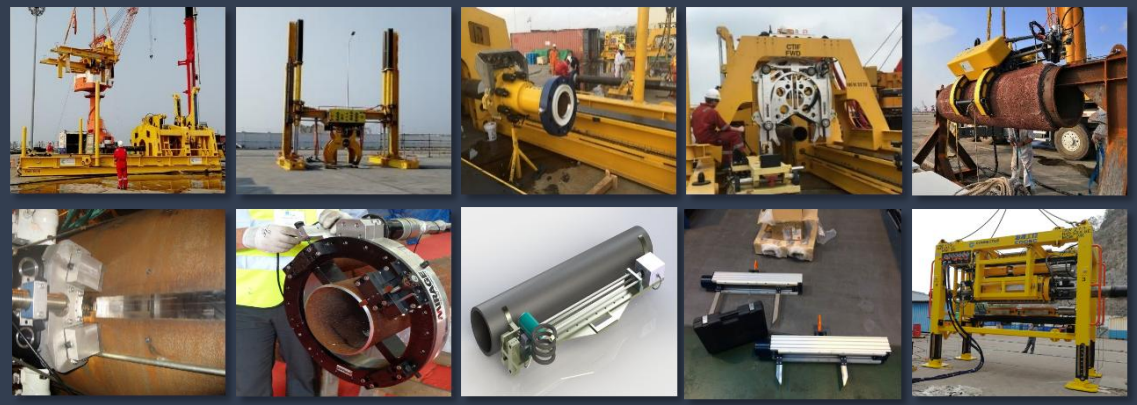
8 sets of coating cleaning equipment with operation depth within 100m. They are capable of 8″-42″ subsea pipelines and coating thickness up to 100mm.

应急维抢修 Offshore Emergency Repair

DPRS
深水海管应急抢修装备系统

公司自有的Deepwater Pipeline Repair System（DPRS）深水海管维修系统，全部为ROV操作式，可以解决最深至2000米的大部分海管事故。

Our in-house Deepwater Pipeline Repair System (DPRS) is operated by ROV and is capable to solve most of subsea pipeline problems up to 2,000m water depth.



拆除与弃置 Decommissioning

能力范围 capbility

Engineering

- Feasibility studies
- Conceptual design
- Detailed design
- Shop design

设计

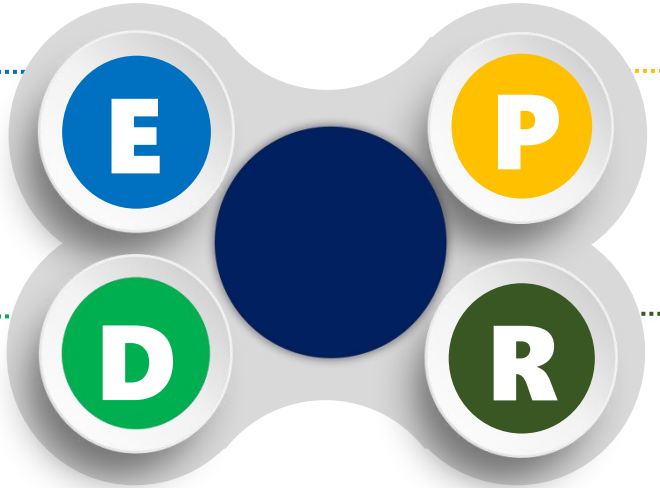
- 可行性分析
- 概念设计
- 详细设计
- 方案设计

Dismantling

- Offloading at jetty
- Onshore dismantling

拆解

- 现场装船
- 陆地拆解
- 回收利用



采办

- 专业采办流程对海内外弃置项目提供最优化支持

Procurement

- Professional procurement process to support the implementation of domestic and overseas projects

弃置

- 预调查及检验
- 水上水下弃置
- 固定及运输
- 现场清理及后调查

Removal

- Pre-survey & inspection
- Removal of offshore & subsea facilities
- Sea-fastening and transportation
- Site clearance and post-survey

2002

开始开展油田弃置相关研究工作

Started R&D for offshore decommissioning

2006

成立平台检测拆除室，并着手研究及购置拆除专业化设备

Established offshore decommissioning team

2011

平台检测拆除部成立

Established Offshore Decommissioning Dept.

2017

完成泰国雪佛龙弃置项目，海外业务实现突破。

Chevron Thailand Decommissioning

2024

累计完成20+ 海内外弃置项目

20+ Decommissioning projects completed

拆除与弃置 Decommissioning

平台及导管架弃置

公司具备成熟的结构物检测、清理、切割、装载和拖航等技术能力，可满足300米水深海洋设施的拆除和弃置施工需求。具备一系列专业的切割设备，钢材最大切割厚度可达到100mm以上。已顺利完成了国内外共20余个拆除项目，累计拆除海洋设施18座，累计拆除钢材量超过22000吨，并已走向国际弃置市场。

- 海上平台组块拆除、运输、卸船和陆地拆解
- 海上平台导管架拆除、运输、卸船和陆地拆解

More than 10 years of experience in inspection, cleaning, loading/unloading, towing, decommissioning & disposal of offshore facilities within 300m of water depth. Our state-of-art cutting equipment is capable to cut more than 100mm thickness of steel. Since 2011, we have successfully completed more than 20 international decommissioning projects, with over 22,000 tons of steel weight removed.

- Decommissioning, transportation, unloading & dismantling of offshore platform module
- Decommissioning, transportation, unloading & dismantling of offshore platform jacket

拆除与弃置 Decommissioning

水下生产系统弃置

初步掌握水下生产系统弃置能力，依托2019年国内首个水下生产系统整体弃置回收项目-崖城13-4气田拆除及水下生产装置利旧处置项目，形成了基于饱和潜水作业的水下生产设施整体拆除、回收、弃置技术能力。

- 单点/多点锚系拆除、回收和弃置
- 水下结构物拆除、回收和弃置
- 管缆及水下设备/设施拆除、回收和弃置

Practical experience in different subsea facility decommissioning, recovery and disposal. Based on the first subsea production system decommissioning & recovery project in China, Yacheng 13-4 Gasfield Decommissioning Project in 2019, the company developed saturation diving based decommissioning capacity of the whole subsea production system.

- Single/multiple point mooring system de-commissioning, recovery & disposal
- Subsea structure decommissioning, recovery & disposal
- SURF de-commissioning, recovery & disposal
- SPS de-commissioning, recovery & disposal

拆除与弃置 Decommissioning

Dredging Equipment
排泥设备

Design and fabrication capability	自主设计与制造能力
Internal/external dredging	内/外排泥
Air compressor: 30m3/min, 20bar	空压机： 30m³/min, 20bar
High pressure pump: 6,000psi, 30m³/h	高压射流泵： 6,000psi, 30m³/h
Dredging efficiency: 200m³/h (slurry)	排泥效率： 200m³/h (slurry)

High Pressure Water Abrasive Cutting
高压水射流切割设备

Water Depth: 0-320m	作业水深：0-320米
Cutting Thickness: <100mm/600mm	切割厚度：<100mm
Opn. pressure: 5,000/7,500/30,000psi	操作压力：7500psi
External Cutting-Diameter of pile: 200mm-5,000mm	外切割直径： 200mm-5,000mm
Internal Cutting-Diameter of pile: 762mm-1,850mm	内切割直径： 762mm-1,850mm

拆除与弃置 Decommissioning

Hydraulic Shear
液压剪

Shear Weight: 10,750kg	自重： 10,750kg
Jaw Opening: 1,118mm	开口高度： 1,118mm
Jaw Depth: 1,118mm	开口深度： 1,118mm
Shear Force(@345bar): 23,042kn	剪切力： (@345bar) 23,042kn
Shear Force(@380bar): 25,346kn	剪切力： (@380bar) 25,346kn
Dimension: 4.3 x 0.5 x 2.0m	尺寸： 4.3 x 0.5 x 2.0m

Diamond Wire Saw
金刚石绳锯机

Can be used in any water depth and is able to cut structure of different materials, thicknesses and shapes

适用于任何水深，可适配多种不同材料、厚度和形状进行切割

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THANKS

谢 谢

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