INTECSEA
WorleyParsons Group

Offshore Pipelines

Capability and Experience

Capability Overview

As an industry leader in deepwater pipeline technology, INTECSEA assists operators worldwide with unique solutions to hydrocarbon production and transportation system needs.

INTECSEA designs and manages offshore pipeline projects, leading the industry in the execution of ultra-deepwater marine pipeline projects.

INTECSEA's extensive project experience includes practical design and installation technology required for cost effective completion and operation of marine pipeline facilities in all environments. In addition to deepwater pipeline applications, INTECSEA has also been responsible for many long distance, large diameter transmission pipeline projects and conventional offshore platform-to-platform pipeline projects.

Services

- Technical and Economic Studies
- Route Selection and Survey Supervision
- Preliminary and Detailed Design
- Field Development Engineering
- HP/HT Pipeline Engineering
- Arctic Pipeline Engineering
- Insulated Pipe-in-Pipe Engineering
- Deepwater Subsea Flowline Engineering
- Pipeline Repair Engineering
- Materials and NDT Engineering
- Project and Construction Management
- Maintenance Management and Operations Assistance
- Fledermaus Modelling

4,500m

Water depth

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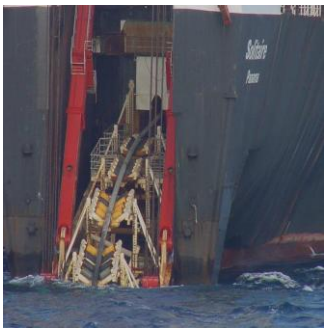
Engineering Services

Conventional Pipeline Design

Preliminary and/or detailed submarine pipeline design generally includes design basis document, safety schematic, pipeline flow assurance and line sizing, pipeline route selection, geohazard analysis, pipeline route alignment drawings, on-bottom stability analysis and determination of weight coating and/or trenching requirements. INTECSEA also determines wall thickness and steel grade using traditional or limit state design criteria and associated mechanical design. Other services include; pipe spanning analysis and determination of pipe support requirements and design, risk study and definition of remedial measures as well as pipeline installation studies to verify alternative installation options.

Long Distance and Deepwater Pipeline Design



The design of long distance and deepwater pipelines encompasses most of the fundamentals of conventional pipeline design. However, several additional aspects warrant a thorough and rigorous level of engineering. The design of long distance and deepwater pipelines require particular attention to flow assurance to maintain deliverability and to prevent or mitigate the formation of hydrates, paraffin and/or asphaltenes. Furthermore, the system design effort must consider the capabilities and requirements for all parts of the system throughout the entire service life. Pipeline routing is a major factor that can directly influence the cost and feasibility of a pipeline project.

Production Flowline Design

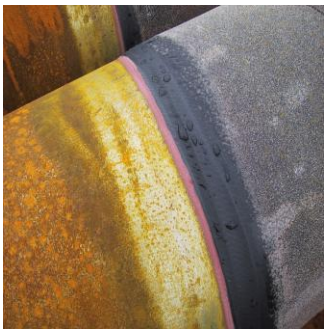
There are several important issues related specifically to (HT/HP) field developments. These include thermal expansion, pipeline/flowline lateral or upheaval buckling, stress/strain localization, corrosion protection systems, flowline and component material selection and flow assurance. As many of these issues are interdependent, a clear understanding of the limitations, interaction and interdependency is required to develop a robust and reliable system design. INTECSEA's experience and understanding of the issues and solutions provides a cost effective, fit-for purpose design.

INTECSEA has extensive expertise in the design of flowline systems for HP/HT applications including Pipe-in-Pipe and Bundled Flowlines, Externally Insulated Flowlines and Flexible Pipe Flowlines.

Pipeline Shore Crossing Design

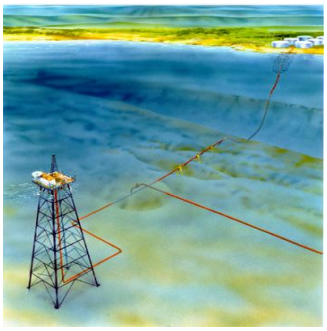
The shore crossing design for a pipeline system is a combination of site selection and design activities required to maintain pipeline stability and integrity while minimizing impact to environmentally sensitive areas and adjacent property or facilities. Key activities include site selection, design basis definition, pipeline stability analyses, operational requirements and construction methods. A thorough and rigorous degree of engineering is often warranted in view of the potential for significant construction cost reduction and operational reliability of the pipeline system. INTECSEA's technical expertise and involvement in a wide range of shore crossing designs provide the basis for implementing a cost-effective design.

Shore Crossing Construction Methods



Different construction methods are evaluated to define the resultant trench cross sections. Dredging (hydraulic and conventional), directional drilling, drilling and blasting, mechanical trenching, jetting and plowing techniques are considered in conjunction with seabed soils data to determine method suitability. Shore crossing installation methods and equipment, including pipe pull, pipelay, horizontal directional drilling and/or a combination of these methods, may be evaluated. Pipe weight, stiffness, pulling requirements, bathymetry and shore crossing length are considered for each installation method. In addition, selection of the optimum construction methods and, the availability of the required construction equipment must also be considered. In some cases the preferred method may not be cost effective due to lack of availability and/or high mobilization costs. Vessel draft limitations in the shore approach may also limit the type of trenching/dredging and pipeline construction equipment which can be used.

Pipeline Shore Approaches



INTECSEA has extensive experience in the design and construction of pipeline shore approaches. Our design approach extends well beyond the basic mechanical design of the shore approach and includes geotechnical engineering and marine geology aspects as well. As a world leader in pipeline design and construction management, INTECSEA has had the opportunity to showcase this experience on a number of challenging projects for which shore approach studies, design and/or construction was a part

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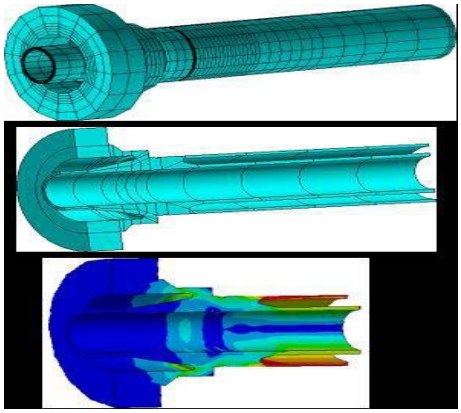
Project Experience

Project: **Mica Flowline**
Client: **ExxonMobil**
Phases: IDENTIFY EVALUATE **DEFINE** **EXECUTE** OPERATE

Gulf of Mexico, USA

Preliminary and detailed engineering design of the production flowlines and associated risers

The Mica Field is located in Mississippi Canyon Block 211 in the Gulf of Mexico, approximately 100 miles south of Mobile Bay, Alabama in water depth of 4,350 ft. Two 28 mile long production flowlines (an 8-inch x 12-inch pipe-in-pipe insulated flowline and an 8-inch uninsulated flowline) will transport hydrocarbons from a subsea manifold to the BP Pompano platform in Viosca Knoll Block 989. The Pompano platform is located in a water depth of 1,300 ft. The two flowlines terminate at the top of a single existing J-tube on the Pompano platform, and are linked via a pigging loop at the subsea manifold to enable round trip pigging operations.



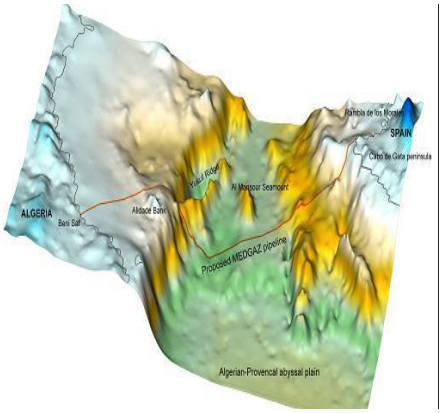
Project: **Algeria to Spain Gas Pipeline**
Client: **MEDGAZ**
Phases: IDENTIFY EVALUATE **DEFINE** EXECUTE OPERATE

Mediterranean Sea

Front-end engineering design, pipeline design and preparing the EPIC (engineering, procurement, installation and commissioning) bid packages

MEDGAZ involves the construction of 200 km (124 miles) of dual 24-in. high-pressure ultra-deepwater gas pipelines, designed to deliver as much as 16 billion m^3/year of Algerian natural gas under the Mediterranean Sea to Spain and other European markets from Beni Saf, Algeria, to a landfall at Playa del Charco, near Almeria, Spain.

The lines included shore approaches and short onshore pipeline sections connecting onshore terminals at each end of the pipelines. The pipelines traverse a maximum water depth of 2,160 m (7,087 ft).



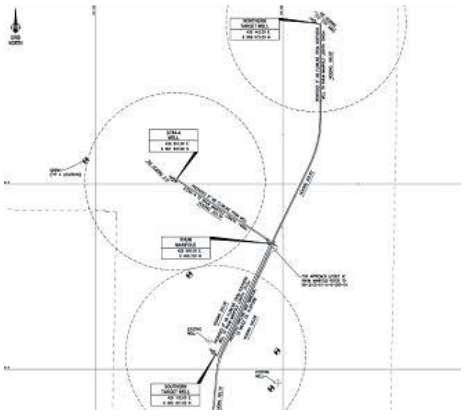
Project: **Maoming Subsea Pipeline Integrity Check**
Client: **Maoming King Ming Petroleum Co Ltd (MKMPCL)**
Phases: IDENTIFY EVALUATE **DEFINE** EXECUTE OPERATE

Gulf of Mexico, USA

A fitness-for-purpose assessment

The Rhum field is a high temperature, high pressure reservoir (705 bar and 130°C), corrosive (6.5% CO2 and 10ppm H2S) gas field development requiring exotic materials, long distance PIP systems and subsea High Integrity Pressure Protection System (HIPPS). The Rhum field is located 380 km northeast of Aberdeen in Block 3/29 in 109m water depth. The development includes a subsea tie-back to the Bruce field. First gas was achieved in 2005.

Rhum represents the first development in the North Sea for IOC (50%). It was developed with co-venture and operator BP (50%).



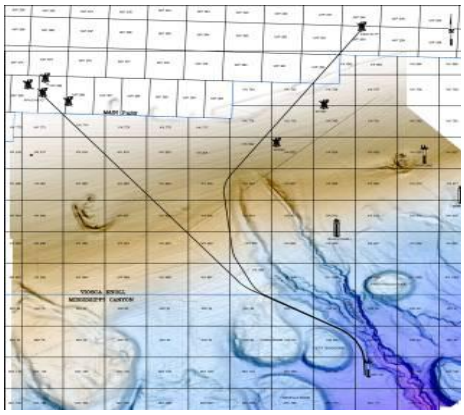
Project: **Horn Mountain Pipeline**
Client: **BP**
Phases: IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Gulf of Mexico, USA

Preparation of survey documentation and selection of marine survey contractor, marine survey supervision

The BP Horn Mountain Field Development is located 84 miles offshore in Mississippi Canyon Block 126 and 127 of the Gulf of Mexico. The field has been developed with a SPAR-based production facility. The gas export pipeline extends approximately 41 miles to a fixed platform in 300 ft water depth in Main Pass 260, and the oil pipeline extends approximately 36 miles to a fixed platform in 414 ft water depth in Main Pass 289.

INTECSEA performed an engineering study for VASTAR to determine design fundamentals for the export pipeline system, prepared project cost estimates, and prepared specifications for inclusion in ITB packages. INTECSEA also prepared ITB packages and evaluated material and construction bids. Following completion of the front end engineering design, INTECSEA was awarded the detailed design contract for the export pipelines and risers.



Project: **Guanabara Bay PE-3 Pipeline**
Client: **Petrobras**
Phases: IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

Guanabara Bay, Brazil

Perform preliminary and detail engineering for the PE-3 pipeline project

PETROBRAS plans to install a new 18-inch diameter Heavy Fuel Oil (HFO) pipeline, designated PE-3, to replace the existing 16-inch diameter PE-2 (HFO) pipeline. The overall PETROBRAS objective for the PE-3 pipeline was to design a world-class pipeline system to transport refinery products from the facility at REDUC to loading piers. Protection of sensitive environmental resources, safety, and protection of the public property were of utmost importance and primary goal of the design.

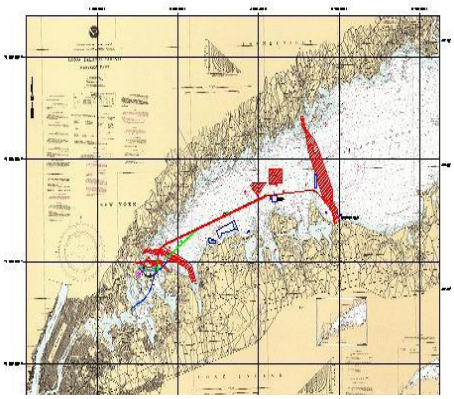
Project: **Iroquois Pipeline Extension**
Client: **Iroquois Gas Transmission Operating Company**
Phases: IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

New York, USA

All design activities for the marine section of the pipeline, and technical support for the application of the FERC permit

INTECSEA was selected to manage a survey across Long Island Sound, and design a 24-inch high pressure gas pipeline for Phase 1 FERC permit application. The pipeline was brought ashore close to the Bronx and Westchester, NY county lines, and ties into the existing Con-Ed power facilities in New York. The route crossed shorelines with densely populated residential areas, a heavily used shipping lane and fishing areas. The offshore geology was complex and variable, with boulder-laced glacial fills and rock outcrops. The marine survey was planned and supervised by INTECSEA.

In June 2000, INTECSEA was awarded the detailed engineering design of the Eastchester Pipeline Extension Project which included continued permit application support and construction cost estimating. In addition, INTECSEA worked closely with an environmental consultant to evaluate and assess the project's environmental impact during pipeline engineering, construction and operation.



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About INTECSEA (click here to learn more about INTECSEA)

For more than 25 years, INTECSEA has provided frontier technology leadership for the energy industry's most challenging offshore field development and pipeline projects.

INTECSEA was formed in 1984 and provides design for floating systems, risers, pipelines, and subsea engineering and construction management services within the global WorleyParsons Group. INTECSEA has established operating offices in Houston, Kuala Lumpur, Singapore, Delft, Rio de Janeiro, Jakarta, Angola, Cairo, St. John's, Perth, Melbourne, and London. (see all WorleyParsons' locations)

INTECSEA's major areas of expertise include deepwater subsea and floating production systems, marine pipeline and riser systems, Arctic pipelines, marine terminal systems, and Arctic structures. Additional areas of expertise include flow assurance and operability, marine surveys, marine operations, and offshore equipment design.

A History of Innovation and Benchmark Achievements…

SUBSEA

- Deepest Subsea Production
- Longest Oil Tieback
- Longest Gas Tieback
- First Subsea Allocation Flow Meters
- First 15,000 psi Subsea Trees
- First Electrically Heated Pipe-in-Pipe Flowlines
- Deepest Multiphase Subsea Pumps
- First Super Duplex Umbilical
- First Diaphragm Chemical Injection System

RISERS

- First Pipe-in-Pipe Steel Catenary Riser
- First Reeled Steel Catenary Riser
- The Deepest Steel Catenary Risers
- Most Shallow Catenary Riser
- Largest Diameter Flexible SCR Joint
- First SCRs on an FPSO
- Most Direct Vertical Access Risers
- First GOM Free-Standing Riser

FLOATING SYSTEMS

- Largest FPSO
- Deepest TLP at Time of Installation
- Deepest SPAR at Time of Installation
- Most Installed TLPs
- First Deepwater FPU Operated with a Drilling Tender
- Most Types of Floating Systems

MARINE PIPELINES

- **Deepest S-lay Pipeline**
- **Deepest J-lay Pipeline**
- **Longest Offshore Pipeline**
- **First Offshore Arctic Pipeline**
- **First Arctic Pipeline Leak Detection System**
- **First Piggable Wyes**
- **First Arctic Pipeline Bundle**

(for more capabilities information click here)

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Global Reach,
Local Knowledge,
Global Solutions

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