

***INTECSEA***

WorleyParsons Group

# Survey and Geosciences

Capability & Experience





# Capability Overview

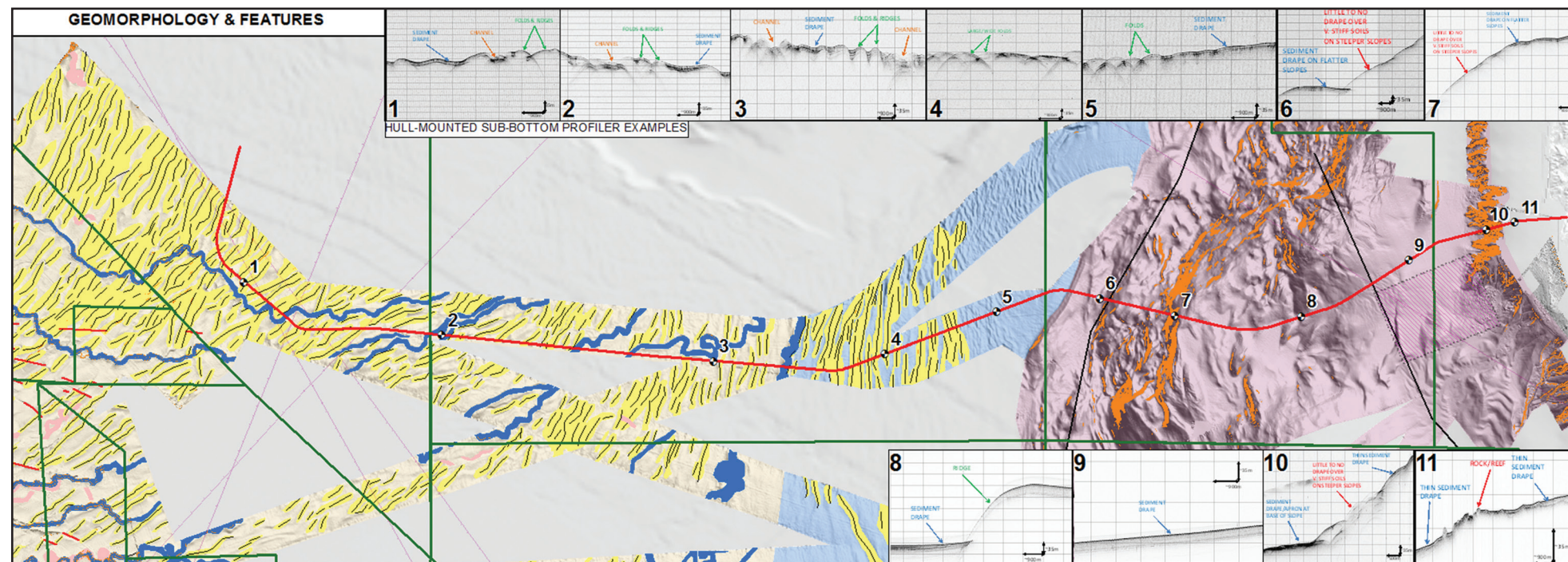
INTECSEA's Survey and Geoscience group is a team of Subject-Matter Experts in survey, geology and geophysics, geohazards, geotechnical engineering, GIS and geospatial data management systems, pipeline routing, site characterization, and engineering soil models.

From pre-exploration wellsite drilling hazard assessments through *Select* pipeline route and in-field layout desktop studies, to a multi-phased integrated site characterization in complex or frontier regions, INTECSEA's Survey and Geosciences group work together with pipeline and subsea engineers to deliver single-source, multi-disciplinary geo-solutions to our customers.

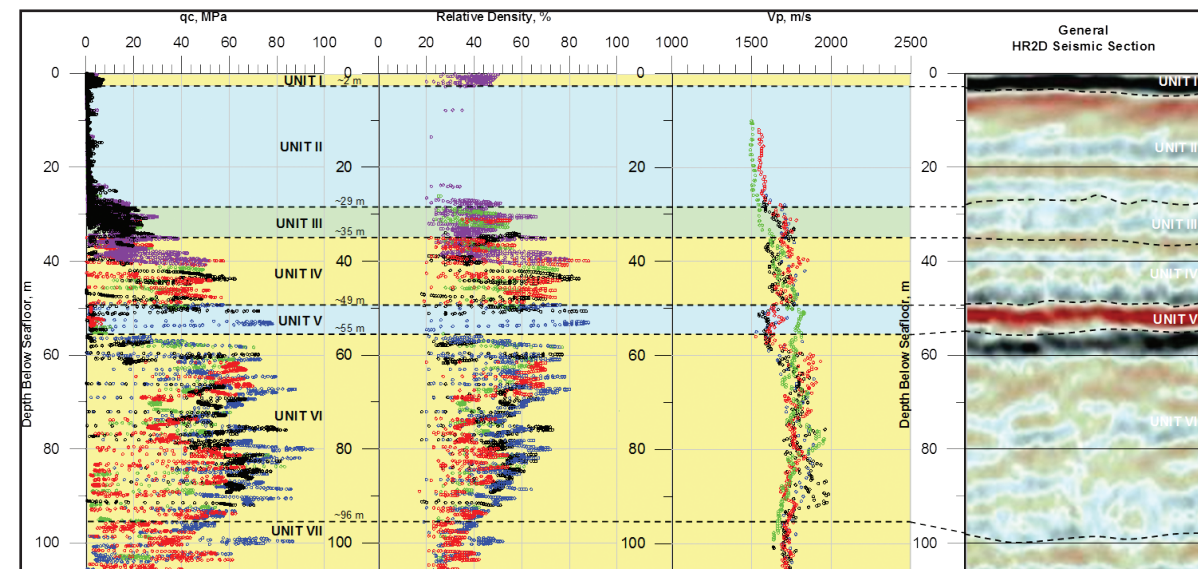
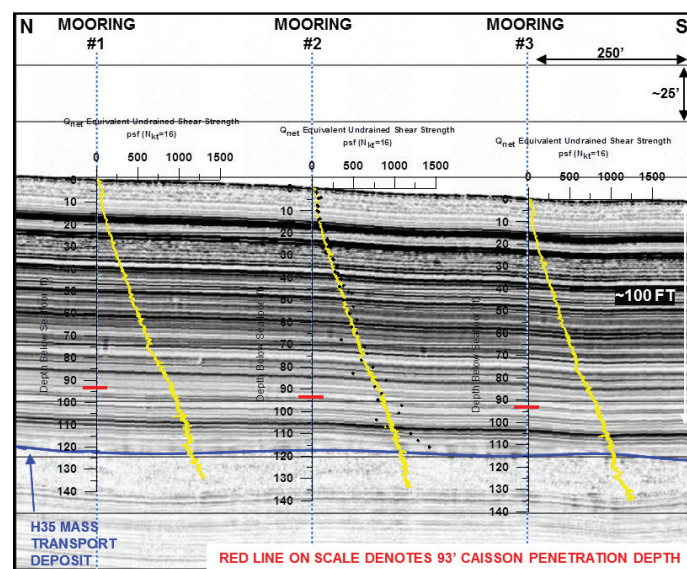
The Survey and Geosciences group provides global integrated geo-support to engineering projects from *Select* through Commissioning and into Operations phases, as well as independent specialist consultancy to our customers when and where they need it.

Through involvement with project engineering teams, and direct interfaces with customer project engineering management, the Survey and Geosciences group SMEs acquire hands-on experience in how engineers utilize geoscience data toward practical subsea design.

This cross-disciplinary subsea engineering experience uniquely positions the INTECSEA Survey and Geoscience Group to deliver comprehensive yet practical engineering-focused geo-solutions tailored to meet our customer's immediate and long-term project needs.



2,800m water depth  
and beyond





# Engineering Services

## Geotechnical

INTECSEA's Geotechnical engineers plan and manage acquisition of geotechnical data, assign and interpret basic and advanced laboratory testing, classify soils as an engineering material for the purposes of design offshore foundations and pipelines. INTECSEA designs foundations for subsea structures and moorings for floating systems.

### Services:

- Scoping, management and execution of offshore geotechnical investigations and onshore laboratory testing
- Customer representation, QA/QC during geotechnical investigations
- Geotechnical interpretation
- Development of static and dynamic soil design parameters
- Sizing and design of mudmat, suction caisson, hybrid and driven pile foundations
- Development of soil springs for pipe-soil interaction
- Slope stability assessment
- Bottom roughness and span analyses
- Finite element modeling of soil/structure interactions
- Integrated soil/stratigraphic ground models

## Geology/Geophysics

INTECSEA's Geologists and Geophysicists work with multiple types of geophysical data to develop an engineering geologic model for the purposes of planning surveys, identification and classification of geohazards, geo-risk assessment, and optimized pipeline route and field layout selection.

### Services:

- Scoping, management and execution of geophysical surveys
- 2D & 3D geophysical mapping and interpretations
- Wellsite and pipeline route geohazards assessment and clearance
- Integrated soil/stratigraphic ground models for engineering
- Desktop to detailed pipeline route and site characterization studies
- ISO-compliant formal geo-risk assessment
- Criteria-based GIS studies for pipeline and field development feasibility
- Multi-disciplinary, integrated geoscience studies

## Survey and Positioning

INTECSEA's Survey and Positioning experts have broad experience with contemporary geophysical survey and subsea positioning technologies allowing for proper specification, design, and field support for a variety of survey, installation, and positioning activities.

### Services:

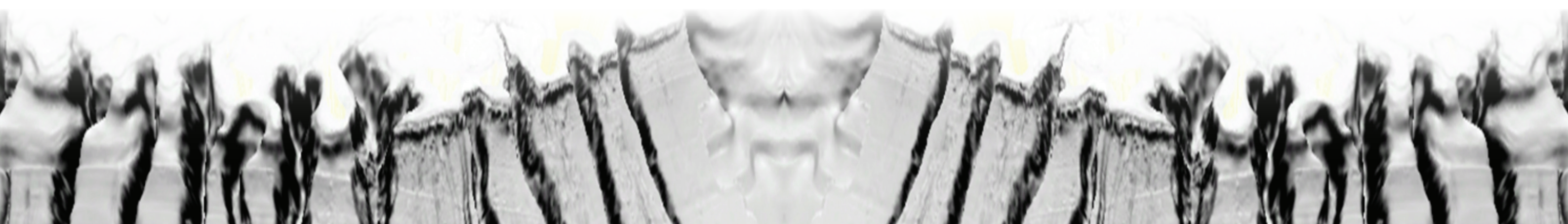
- Technical review and validation of survey or positioning equipment
- Equipment specifications
- Bid review and support for survey and positioning programs
- Survey design, cost and schedule estimates
- Positioning array design, cost and schedule estimates
- Offshore QA/QC during survey, positioning and installation activities
- Survey data processing
- Data interpretation and reporting
- Customer representation during surveys, installation, and positioning planning and execution

## Geomatics

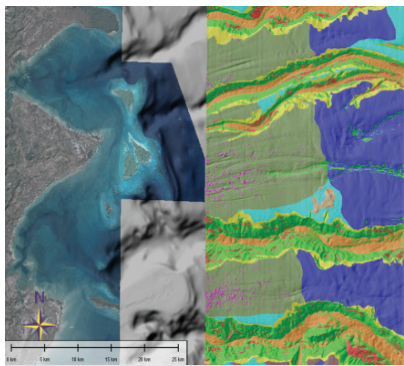
INTECSEA's Geomatics experts offer a comprehensive GIS data management system to provide a wide range of Geospatial and Asset Integrity Management (AIM) related services and solutions in support of both S&G Group activities and overall Project-based geospatial requirements.

### Services:

- Project GIS web servers and portals
- GIS-based alignment sheets and Map Books
- Project SSDM (seabed survey data model) managing survey, geologic, and geotechnical data
- Project PODS GIS database development and management
- GIS management of geotechnical data
- Life-of-Project GIS database and document management philosophy and plan
- Fitness-for-service analysis
- Subsea risk assessment
- Risk-based inspection
- Spatial asset management through system integration
- Integrity risk sheets



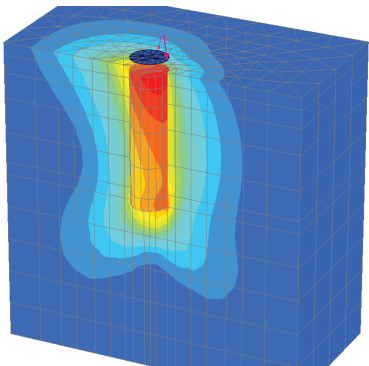
# Project Experience



**Prosperidade Gas Field & Onshore LNG Plant**  
CUSTOMER Anadarko  
LOCATION Mozambique



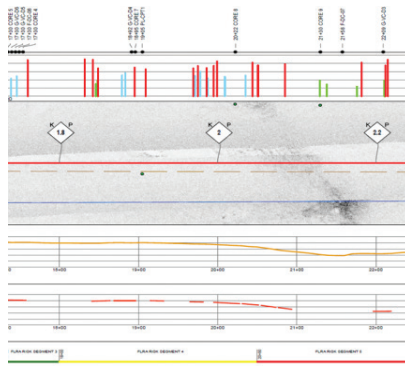
Comprehensive onshore and offshore geoscience solutions for the future, frontier-area 4 BCF/day deepwater gas field with a 48 km tieback to an onshore LNG plant. Programs designed and data utilized during survey support activities included: land soil borings and LiDAR survey for LNG plant site characterization; marine core locations, shallow water borings, deep water borings, CPTs, shallow water analogue survey, deep water AUV survey, and ROV survey for offshore field development. Support activities included survey management and scoping, data interpretation, geo-risk assessment, site characterization for subsea engineering, field and export pipeline layout optimizations.



**Tamar Deepwater Gas Field & Subsea Tieback System**  
CUSTOMER Noble Energy  
LOCATION Eastern Mediterranean



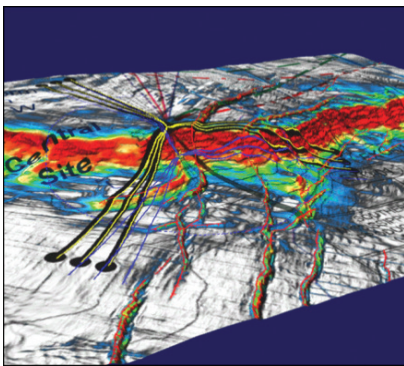
Tamar is the first deepwater field in production in the Eastern Mediterranean Levant Basin and is currently the longest subsea gas tie-back of its kind in the world. INTECSEA provided multi-disciplinary geoscience project support. Project activities included oversight, and interpretation of all acquired geophysical and geotechnical data, integrated site characterization for subsea layout and location optimization for receiving platform jacket and foundation design. Route selection was performed in real-time during route surveys. The S&G Group also performed geotechnical design and sizing of the first-ever suction caisson installed in this deepwater region.



**Juniper Subsea Gas Field Development**  
CUSTOMER BP Trinidad Tobago  
LOCATION Trinidad



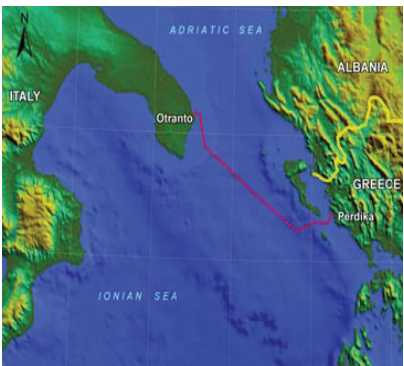
Juniper is the first subsea development in Trinidad. For system definition and future operations-based Integrity Management INTECSEA implemented a first-by-customer PODS GIS into the Define-phase engineering. An Integrated Soil Ground Model was developed to manage geotechnical design parameters during subsea layout revisions, confirming viability of layout changes as well as cost reduction by not requiring additional soil borings. INTECSEA conducted an ISO-compliant geo-risk assessment, established a methodology for geotechnical static and earthquake design for pipelines and subsea structures, performed slope stability analyses for a 26” pipeline crossing of a scarp, and consulted on fault hazard assessment.



**Tubular Bells Deepwater Oil & Gas Development**  
CUSTOMER Hess Corp./Williams  
LOCATION Gulf of Mexico



Tubular Bells located in ~4,000 ft of water in the Mississippi Canyon area is expected to produce 40k to 45k BOE per day. INTECSEA provided Hess with a geoscience team for the SURF design, a second geoscience team was provided to Williams for the export pipeline system and Gulfstar I SPAR, in order to provide geo-solutions for the respective parts of the project. Both S&G teams, operating independently of each other, provided full planning and oversight of geotechnical and geophysical acquisition, interpretations, soil/pipeline interaction analyses, shallow foundation and suction caisson design, integrated, mooring site clearance for CVA approval, and subsea structures installation management.



**IGI Poseidon FEED**  
CUSTOMER Poseidon  
LOCATION Ionian Sea



The IGI Project will allow the supply of gas from the Middle East and Caspian region to the European market through the interconnection of the Greek and Italian gas networks. The offshore section (about 200 km, ca. 1370 m water depth) originates in the Thesprotia area in Greece, crosses the Greek shelf, descends the slope into the north Ionian Basin and then ascends the Italian slope, to make landfall east of Otranto; INTECSEA’s scope for IGI included FEED design, survey of the onshore route sections and management of the detailed marine geophysical, AUV and geotechnical surveys on behalf of IGI Poseidon Company.



**South Stream Pipeline System**  
CUSTOMER South Stream  
LOCATION Black Sea



The offshore section of South Stream will transport gas 930 km across the Black Sea from Anapa in Russia to a landfall near Varna in Bulgaria, and be installed in water depths up to 2200m. For South Stream INTECSEA has provided survey management services for the offshore pipeline. Services included scoping and management of shallow water and deep water reconnaissance surveys, HR2D seismic surveys, AUV surveys. Soil investigations included shallow and deep geotechnical investigations for geohazards assessment and collection of soil design parameters for pipe-soil interaction as well as collection of soil samples for assessment of the potentially aggressive corrosive subsea environment.

# Success Through Insight