



## FIELD CHARACTERISTICS

Location	190km west of Shetland Islands
Block numbers	204/19 and 204/24a
Water Depth	330m (G31) – 520m (West WI)
Estimated recovery	380 million bbls of oil 230 billion cubic feet of gas
Development	FPSO (floating production storage offloading) with wet trees
Discovered	1992
Development Consent	1994
First Oil	1997
Plateau oil production	85,000 bbls/d now debottlenecked to 100,000 bbls/d
Peak production	130,000 bbls/d
Participants	Main field – BP, Marathon Foinaven East – BP, Marathon, Shell
Development cost	£750 million

## Foinaven Subsea & Wells

Drill Centres	4 with 32 wells
Wells Production	22
Water injection:	9
Gas Disposal:	1
Production flowlines / risers:	4 x 8", 4 x 10"
Gas injection flowlines / risers:	1 x 8"
Water injection flowlines / risers:	1 x 10"
Control umbilical risers:	2
Owned and operated by:	Foinaven FPSO (Floating Production Storage and Offloading system) PGS Production
Length:	240m
Breadth:	34m
Depth:	13m
Dead Weight:	93,000 tonnes
Operating Depth:	455m
Turret:	12m diameter with 360° rotation
Riser slots:	14 (10 currently in use)
Mooring:	10 anchors
Topsides Payload:	12,000 tonnes
Accommodation:	75 persons maximum
Normal Crew:	45 persons

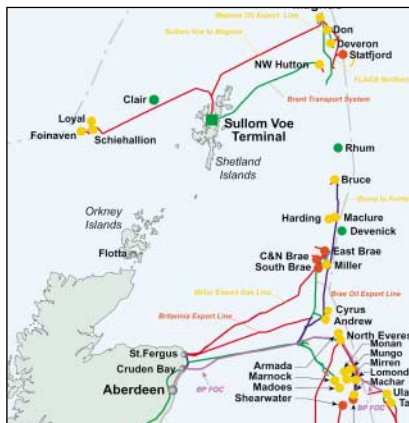
## Oil Production & Storage

Oil Rate:	120, 000 bbl/d (peak)
Gas compression capacity:	114 million scf/d
Produced Water:	165,000 bbl/d (peak)
Water Injection	172,000 bbl/d
Oil storage:	280,000 bbls
Storage Tanks:	15

## Gas Export

Pipeline Diameter:	20 inches (510mm)
Maximum capacity:	190 million scf/d (4.5 million scm/d)
Operating pressure:	235 bar max (155bar normal operating)
Pipeline lengths:	Western leg (Foinaven / Schiehallion to Sullom Voe) 198km (123 miles) Eastern leg (Sullom Voe to Magnus) 210km (130 miles)

# The Foinaven Field



**The Foinaven field is located 190 km west of the Shetland Islands in UK blocks 204/19 and 204/24a and takes its name from the prominent mountain of North West Sutherland.**

It was the first UK deepwater oil field to be developed in the Atlantic margin being sanctioned in 1994, first oil produced in 1997 and Phase 1 (21 wells) completed in 2000 which established the design oil production plateau of c85,000 bopd (peak rates of up to 120,000 bopd).



BP operates the field in partnership with Marathon and Shell and overall BP equity is around 70% - varies depending on contribution from satellites. Considerable additional opportunities were identified during phase 1 and continued further development phases have been sanctioned and executed since 1999:

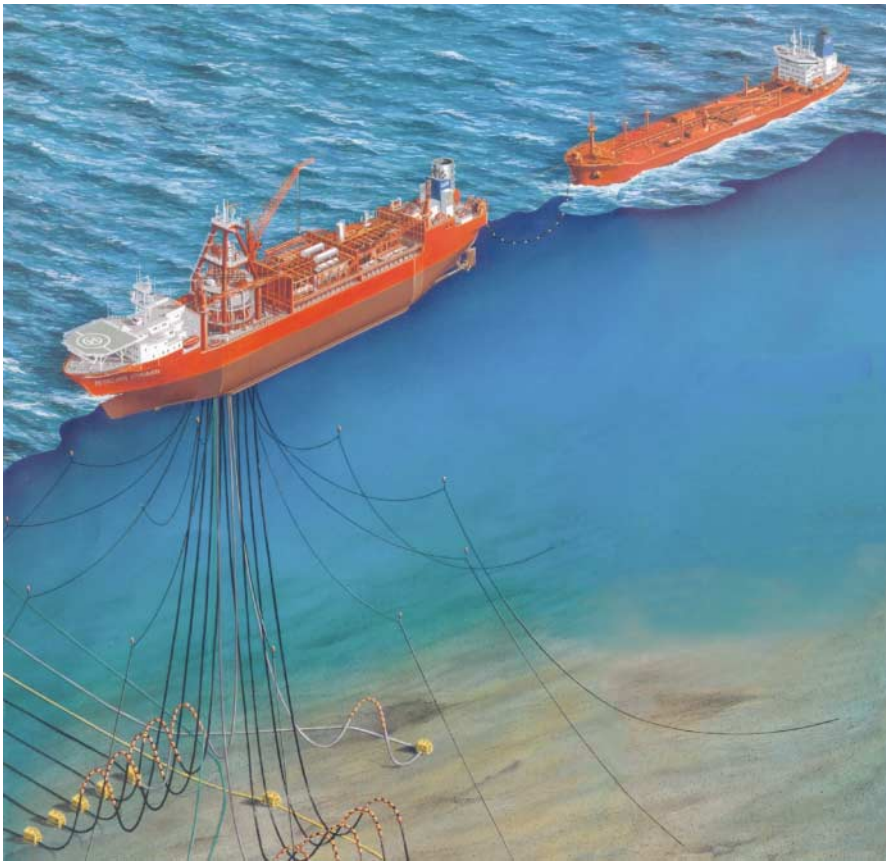
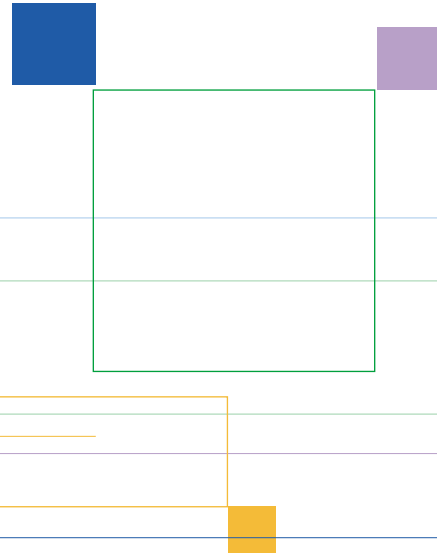
- 1999 – First satellite (T35) sanctioned as a single well development. Drilled, completed and brought on line mid 2000.
- 2000 – Phase 2 sanctioned as 5 well infill program (4 production, 1 water injection). Drilled, completed and brought on line through 2001 and 2002.
- 2000 – Second satellite (East Foinaven) sanctioned as a 3 well development (2 production, 1 water injection). Drilled, completed and tied back during 2001.

- 2000 – Gas export pipeline linking Foinaven and Schiehallion, via Sullom Voe terminal, to Magus field in Northern North Sea was sanctioned. Pipe-lay, Sullom Voe and Magnus construction carried out through 2001 with first gas mid 2002.
- 2001 – Two week production shutdown to carry out modifications and debottlenecking to facilitate oil production plateau of c 100,000 bopd.
- 2002 – Production growth of around 30% compared to 2001.
- 2002 – Third satellite (T25) sanctioned as two-well development. Drilling and tie-in planned for 2003.
- 2003 – Progress sanction of further phases of infill drilling and satellite development.

This combined activity has more than doubled initial reserved estimates from 200 million barrels equivalent at sanction (1994) to around 415 million barrels of oil equivalent in 2003 and has established a new oil production plateau nearly 20% above original design.

## Infrastructure

The average water depth at field location is circa 450m (1470ft) - beyond the limits of most fixed jacket installations commonly used in the more shallow waters of the North Sea and floating processing facilities with remote subsea drill centres with "wet" wellheads (xmas trees) was the development scheme adopted.



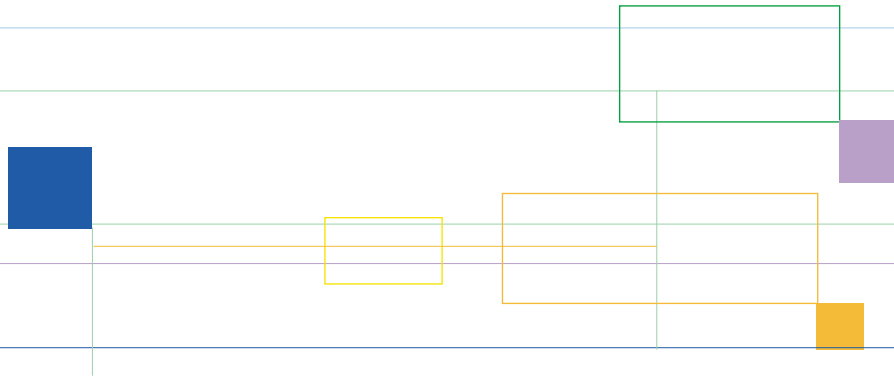
Process facilities consist of two parallel oil separation and gas compression trains with a combined liquid handling capacity of 180,000 bbls per day (upgraded from 145,000 bbls per day in 2001) and 114 million standard cubic feet (scf) per day of gas. Gas compression capacity is shared approximately 50/50 between export and providing artificial lift to oil production wells (gas-lift). Currently around 15% of produced gas is used as fuel.

The optimum oil recovery mechanism requires hydrocarbon production volumes to be replaced by injecting sea water into the reservoir via dedicated water injection wells. The FPSO is free to rotate around a 26m diameter turret which is anchored to the seabed with ten mooring lines tensioned over "springer" buoys. Eight flexible production risers, a single water injection riser, a gas injection riser and two control umbilicals are hung from the turret and provides the connection to the subsea system. Under light wind and current conditions, the FPSO (and attached tanker) "weather vane" around the turret but during periods of high winds and currents, the FPSO utilises three propeller thrusters to rotate to the optimum heading and allow offloading to continue. This system has allowed extremely high export regularities to be achieved – much higher than originally anticipated (e.g. 99.97% in 2002)

Crude offloading and fiscal metering facilities are installed at the stern of the FPSO and shuttle tanker hook up and load approximately every two days at current oil production rates. Two new 600,000 bbl shuttle tankers were commissioned in early 2003 (Petronordic and Petroatlantic) and transport oil primarily to the Flotta oil terminal in Orkney with a small number to Tranmere on Merseyside.

#### Surface Facilities

The Petrojarl Foinaven FPSO (floating production storage offloading) was the result of a major conversion of the Russian submarine tender ship Anadyr by PGS Production (formerly Golar Nor) at the Ferrol yard in northwest Spain during 1995 and 1996. The key part of the modification was to cut the vessel in two and insert a new 142m long, 34m wide, 145,000 tonnes double skinned centre-section with fourteen outer wall ballast tanks. The result was a vessel which has an overall length of 240m and an oil storage capacity of c300,000 bbls.



### Subsea Facilities

The subsea system provides the link between the FPSO processing facilities and the remote wells (production & injection) on the seabed and consists of:

- Wellheads.
- Manifolds.
- Flexible jumpers.
- Oil production flowlines.
- Gas injection lines.
- Water injection lines.
- Flexible risers.

By end 2003, there will be a total of 32 subsea wells primarily associated with four clusters or drill centres (DC). DC 3 consists of a single gas disposal well (G31), DC4 currently has two East Foinaven wells and the majority of wells are tied to the two main-field drill centres (DC1 & DC2).

### Technology

The Foinaven project, since its conception in the mid 1990's, has moved from a high-risk opportunity in a new operating environment to an operationally reliable business. Some examples of successful technology application in Foinaven:

- Time-lapse seismic (4D) to image hydrocarbons.
- Subsea repairs.
- Downhole flow control ("Smart" Wells).
- Subsea sand detection.
- Calcium nitrate treatment of Injection water.
- Through tubing drilling (TTD).



# The Foinaven Field

Oil from the Foinaven field is produced using a floating production storage and offloading vessel - The Petrojarl Foinaven. The field is being developed through infill drilling and satellites.



## Environment

BP is committed to sound environmental management and like all of the company's North Sea developments, Foinaven has been subject to an Environmental Assessment. The EA is performed to ensure that the impact on the environment of operations is kept to an absolute minimum. Part of this process has involved undertaking numerous studies to gain a greater insight into the environmental impacts of the development and the most recent of these, carried out during the summer of 2002, involved the use of ROV's during periods of operational downtime to study the behaviour of various benthic species and several observations new to science were made.

The key distinctive physical characteristics of the marine environment in the Foinaven area are the water depth (450m), strong subsea currents (4.5 km/hr) and low seabed temperatures (-1.5C). Key biological features include *Lophelia Pertusa*, a cold deepwater reef building coral; *Calanus Finmarchicus*, a herbivorous copepod which is an important source of food for juvenile fish; large numbers of seabirds during the months of May to July; cetaceans such as fin and humpback whale as well smaller toothed species such as bottlenose dolphins. Large numbers of deepwater and pelagic fish are found in the area and the field lies in the vicinity of the a mackerel migration and wintering area used by a large proportion of the Western Europe mackerel stock.

Throughout all development phases of the projects, BP and partners, on a purely voluntary basis consulted widely with interested parties. One result of this work was robust and detailed oil spill contingency plans and a significant investment in a powerful and versatile field support vessel, the Grampian Frontier. The nearby Schiehallion field has a similar vessel, the Highland Spirit, and together they represent a major resource to support operations in the area. The oil spill contingency plan is held as a living document that is continually updated in the light of operational experience and is tested and exercised on a regular basis.

Foinaven is included in BP's environmental management scheme in accordance with the international standard ISO 14001 that ensures effective and correct environmental control and management processes are in place. In addition, it also engenders a philosophy of continuous improvement and requires the publication of an independently verified environmental statement detailing Foinaven's environmental performance. These will be produced annually and made publicly available.

