



# Shuttle Tanker DP (FPSO/FSU Version) SeaStream™ DP Special Functions

GE's latest generation of SeaStream™ DP is fully adapted to support the requirements of offshore shuttle tankers including those that work in harmony with FPSOs and FSUs. These features were designed by GE in close collaboration with vessel owners and operators to ensure that the special features adhere to the underlying SeaStream™ design philosophy. The specialised shuttle tanker functions are provided to help the user to do their job – better and more efficiently.

## The Task

The key task of the DP system is to support offshore loading between an FPSO/FSU and the shuttle tanker. The shuttle tanker's position and heading are measured and controlled in relation to FPSO/FSU position and heading. Multiple sources of position information are input into the DP including DGNS systems such as Seatex DARPS (using absolute and relative position information), Laser (CyScan) and microwave (Artemis).

The basics of shuttle tanker operations are:

- Approach the FPSO/FSU's offshore loading point (OLP) in a safe manner to prepare for connection prior to transfer of cargo
- Maintain the vessel in a stable and power efficient position during the loading phase (which can last many hours)

## Shuttle Tanker Approach

Approach mode takes the shuttle tanker from the outer perimeter of the controlled area surrounding the offloading point, to a position to select Loading mode, while maintaining a heading into the prevailing weather. In the case of FPSO/FSU, the shuttle tanker heads towards the OLP and the position setpoint moves around an arc centred on the OLP. There is also an option to select a fixed heading in calm weather or whenever preferred.

## Shuttle Tanker Loading

Loading mode positions and holds the vessel at a suitable position for offloading. The vessel moves on an arc, maintaining a heading towards the loading point and into the prevailing weather. With an FPSO/FSU, the arc is limited by the loading boundaries. There is also an option to select a fixed heading in calm weather, or whenever preferred.

The Loading page shows operational information associated with offshore loading and various operator selections.

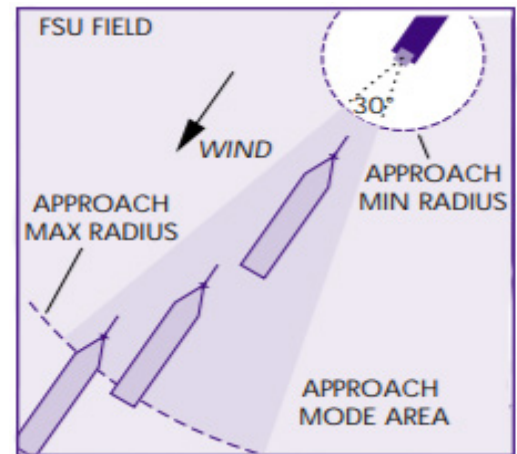


Fig 1. Shuttle Tanker Approach

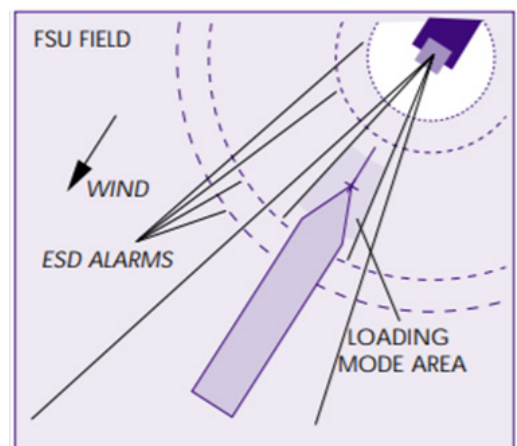


Fig 2. Shuttle Tanker Loading



## Field Data

Before a shuttle tanker can use the approach and loading modes, the details of the specific production field being used must be selected. This is done on the Field Data page. Each field has a base position, the approach and loading radii and the radii at which the emergency shutdown alarms are activated.

- **Field Name** displays the field name selected in the Setup tab. This information is predetermined in the DP software
- **Field Type** displays the field type associated with the field name
- **Range Error** shows the error between the target and vessel position
- **Offloading Position** shows the Range & Bearing to the COR
- **FPSO/FSU Heading** information is automatically displayed when the heading is selected from an available position reference system (e.g. Artemis, DARPS, Cyscan). If FPSO/FSU heading information is not available or selected then the FPSO/FSU heading can be manually entered by the operator.
- **Hawser Tension** information is displayed and can be used as a feed forward term in the control system by selecting **Tension feed-forward**
- **Loading Rectangle** is a box drawn around the FPSO/FSU offshore loading point (OLP), within the box the FPSO/FSU OLP point can move without the shuttle tanker tracking the movement. If the FPSO/FSU moves outside the box the shuttle tanker will reposition
- **Align heading** to FPSO/FSU is selected when the operator requires the shuttle tanker to be aligned with the FPSO/FSU heading shown on this page
- **Fixed Heading** is selected when the operator requires the shuttle tanker heading to be controlled by the system automatically and not free to weather vane

## Position Measuring Equipment

A range of position measurement systems are input into the shuttle tanker DP system. A combination of absolute and relative systems are employed in order that the shuttle tanker may track the position and heading of the FPSO/FSU when required.

Typical measuring systems can include:

- DGNSS (absolute position)
- Differential and relative Positioning system (DARPS)
- Artemis microwave
- CyScan or Fanbeam laser
- Other systems on request

All of the above-mentioned position measuring systems are sourced by GE and are fully integrated into the SeaStream™ DP system.

Specialist systems can be provided in which independent UHF telemetry systems such as DARPS 900B are incorporated to support safe and reliable 'Green-line' control during loading operations.

FIELD DATA			
FIELD NAME	"TYPICAL"		
FIELD TYPE:	FSU		
BASE POSITION:	Latitude	Longitude	
	060°20'37.06"N	004°00'51.94"W	
ANTENNA:	Altitude		
	41.0m	fore/aft	port/stbd
OLP POSITION:	-120.0m	-8.6m	
PME POSITION:	fore/aft	port/stbd	
	ARTEMIS	-120.0m	-7.6m
	Fanbeam	-120.0m	-7.6m
	REL GPS	-120.0m	-7.6m
BOUNDARIES:	Approach	Loading	
	30°	15°	
	Max. Radius	Min. Radius	Max. Speed
APPROACH:	1000m	55m	1.9 kts
LOADING:	150m	24m	0.5 kts
ESD ALARMS I	85m	55m	
ESD ALARMS II	105m	45m	

Fig 3. Field Data Set Up



To find out more about GE's Shuttle Tanker DP (FPSO/FSU Version) - SeaStream™ DP Special Functions, please contact:

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