

## FUGRO 3DIRECT®

**Fugro's 3Direct® system provides accurate and continuous position and orientation measurements of monopiles and jackets during placement. The position, heading, and pitch & roll of the monopile or jacket is accurately calculated in real time using advanced vision-based technology.**

Traditional surveying methods typically require the installation of GNSS receivers and supporting equipment on the jacket or monopile.

This method exposes equipment and personnel to risk, due to poor weather, equipment immersion during launch and the need to work at height.

3Direct® provides accurate and robust measurements using cameras mounted at a safe and convenient distance from the jacket or monopile.

Measurements are in real time and intelligent object tracking techniques allow hands-off continuous operation throughout the placement.

### KEY POINTS

- No equipment is installed on jacket or monopile
- Personnel do not need to work near or on the monopile or jacket
- System can work with a single camera  
Multiple cameras are supported for redundancy and to maximise camera visibility
- IMUs are integrated into the weatherproof camera housings to compensate for mounting angles and vessel motion



*IP67 rated camera housing with integrated motion sensors (760 x 235 x 320 mm).*

## 3DIRECT®

### TECHNICAL SPECIFICATIONS

3Direct® uses vision-based technology to reliably track the position of monopile and jacket components during installation. Using a series of high-resolution, digital video cameras mounted at strategic points on the construction vessel, the position, elevation, inclination and heading of structures can be determined and monitored in real time.

Using simple CAD format files to determine the dimensions and configurations of components, 3Direct® can then track their spatial position and movement. In cases where visibility of sufficient edges is problematic, targets can be applied to the structure to improve measurement accuracy or redundancy.

Additional cameras are added beyond the minimum single camera to provide:

- hardware redundancy
- improved visibility of the structure
- greater QC in the solution

To account for vessel pitch and roll, each camera is equipped with an Inertial Measurement Unit (IMU) inside its housing. This avoids delays during mobilisation and avoids time-consuming alignment procedures on board.

Camera images and IMU data are synchronised using Fugro's StarPort technology and processed in real time using Fugro's Starfix.NG navigation suite. All cameras are easily networked to a conveniently located computer running Starfix.NG, and the 3Direct® solution is presented as tabular data and time series in a user-friendly interface.

Integrated QC identifies issues such as a misaligned camera, data input error or accidental target movement in real time.

Built-in uncertainty assessment provides users with a real time calculation of uncertainty. Camera-to-structure distance and geometry, camera location and 3Direct® technical specifications are all taken into account.

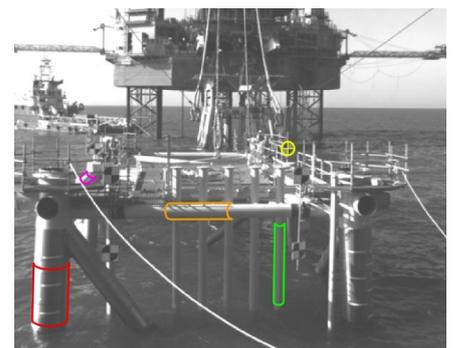
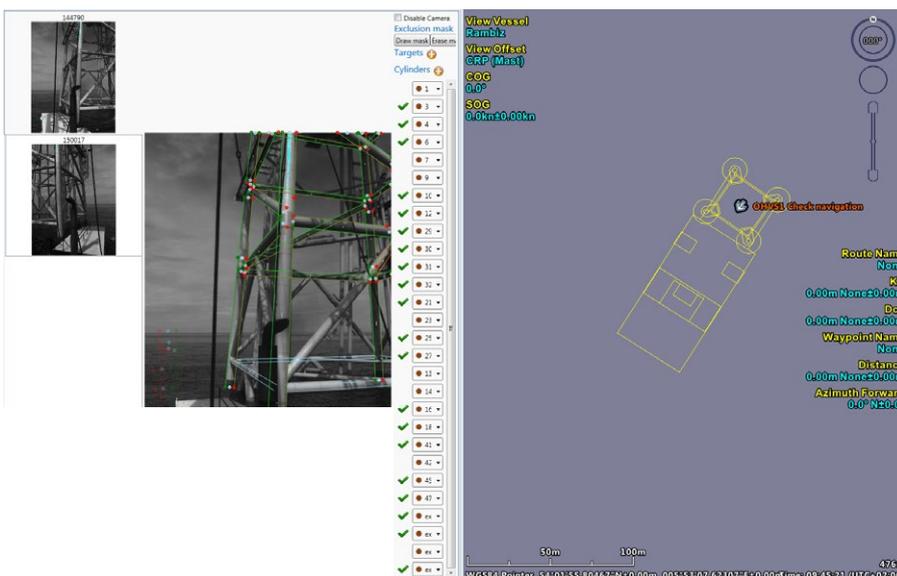
#### Specifications

- 0.1° pitch & roll accuracy
- 0.1° relative heading accuracy
- 0.1 metre relative position and elevation accuracy

*Absolute accuracies in heading and position are subject to the accuracies of the vessel gyro and positioning systems. Quoted pitch, roll and relative heading/position uncertainties are typical and will depend on camera offset measurements, jacket model geometry and accuracy, and image noise.*

#### Features and benefits

- Easily mobilised worldwide
- Greatly reduces HSE risk to personnel
- Real time measurement throughout piling or placement
- No requirement to stop operations to take measurements
- Intuitive user interface for surveyor and crane operator
- Time-stamped imagery collected throughout process



Two 3Direct® cameras used to track edges of structural components, providing real-time feedback on position and attitude to operational personnel. The image to the left, showing tracking aided by vision targets.