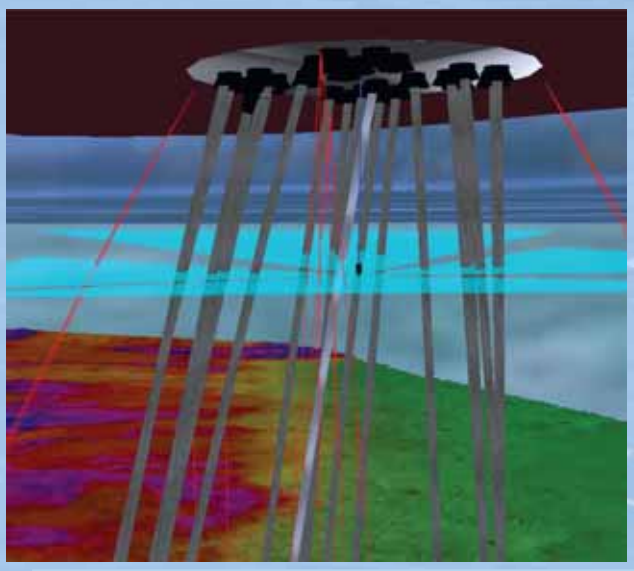
RAMS

Riser and Anchor Chain Monitoring System



As part of the continuous refinement of SRD's Pipe Exit Monitoring (PEMS) and Pipe Lay Support (PLS) systems, SRD has developed an FPSO riser and anchor chain monitoring system by adapting its proven acoustic technology.

RAMS comprises a compact sonar array deployed, for example, beneath an FPSO turret, which transmits in and around the horizontal plane. It detects and analyses returning signals from multiple in-water features (targets) at various levels within the water column. RAMS was designed around the following principal requirements:

- Continuous round-the-clock monitoring capability, requiring only limited operator involvement
- Non-intrusive system providing remote measurement and tracking from a "standoff" position
- Long term deployment/immersion capability – no mechanically moving parts
- Simultaneous measurement of all riser positions
- Simultaneous monitoring of the presence of all anchor chains/mooring lines
- High precision measurement of absolute and relative position

The RAMS control and processing software uses specialised range and bearing calculations to derive precision single-point target positions from the received acoustic responses.

Any potential for interaction between risers or their excessive movement outside given parameters can be closely monitored. In addition, any mooring failure will be flagged immediately by the system, giving the earliest possible warning of remedial action required.

System Capabilities

The data acquired by RAMS can be used and analysed in various ways. Alarms can be set to activate under conditions defined by the client, e.g. when the absence of any expected signal indicates failure or breakage, or when a riser movement exceeds its design criteria. Measurements derived by the system might also be used to predict possible critical/failure conditions of bend stiffeners.

The system can also be configured to take in other environmental variables such as sea state, current profiles, wind direction and vessel motion, as well as additional sensor data such as strain and tension, and present these as a comprehensive data set of riser and mooring line behaviour in various operating conditions.

Deployment

Two main deployment techniques are possible:

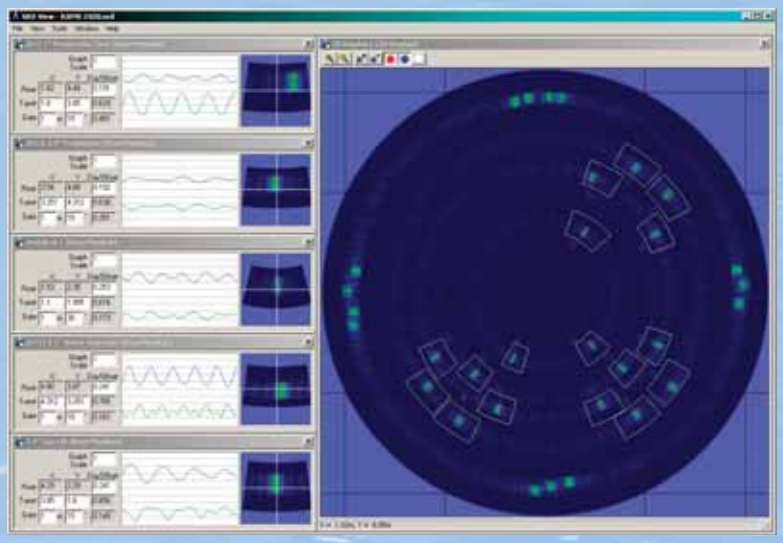
- Deploy the system externally to the pattern of risers or anchor chains, and monitor the returning acoustic signals using a pair of linear transducers. Such an array could be affixed to one of the outer risers or to the hull of a vessel to view the remaining pattern of targets.

- Deploy the system within the centre of the risers and anchor chains (e.g. vertically below the turret) and monitor using a compact 360° conformal sonar transducer array. In this manner the acoustic targets presented to the sensor would be radially discrete, with less likelihood of the shadowing of one target behind another.

For near-surface monitoring, the transducer mounting can be rigidly attached (e.g. vessel hull or turret), thereby relating all movements detected in the risers and moorings directly to a known reference position.

Example Configuration

A single 360° transducer allows the monitoring of the full riser and mooring spread. This design greatly simplifies the mounting arrangements (e.g. for a turret or spar configuration) and reduces the overall size and weight of the monitoring system.



The image on the left shows a screen capture from RAMS processing and control software.

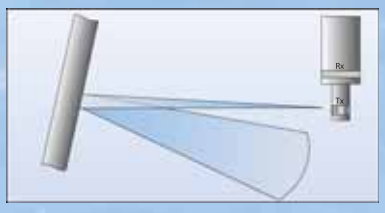
On the right is the plan view of the area around a turret-based, 360° RAMS sensor. In this example, three quadrants are populated with risers and the anchor chains are visible around the outer edge in groups of three and four. Gates with automatic tracking have been set around the nominal riser positions and the system measures the position of the risers within these gates.

On the left hand side of the image, movement is shown graphically for each of the risers on one of the selected quadrant groups.

These movements are time tagged and stored together with the environmental data ready for export.

The linear transducer configuration illuminates a forward sector, typically 120° wide. This variant is more suited to a sensor position external to the pattern of risers.

Fixed Angle Transmitter



Beam Steered Transmitter

Beam Steerable Transmitter

When using a fixed angle transmitter, the angled riser reflects the majority of the acoustic energy away from the receiver transducer, thus reducing the accuracy of the measured result.

To compensate for this reduction in echo strength, the system design incorporates capability for the electronic steering of the transmit beam in the vertical plane to provide a normal reflection from the riser.

Echoes are still present when the transmit beam is not perpendicular to the riser. By electronically sweeping the transmit beam up and down, whole sections of the risers may also be measured automatically, particularly bend stiffener transitions. Using beam steering not only gives the position of the riser and/or bend stiffener, but can also give information relating to its vertical deflection angle.

Specification

		240 ATR/360°	240 ATR Linear
Sensor Array Configuration		Singular	Dual 'T'
Operating Frequency		240kHz	240kHz
Dimensions (mm)		563 x 220 Ø	546 x 134 x 115
Beam Width (Nominal)		360°	120° Max
No. of Beams		768	170/340
Range		100m	160m
Sample Resolution	Angular	2.0°	0.78°
	Range	3.75cm	2.5cm
Weight (Approx.)	Dry	25kg	17kg
	Wet	9kg	8kg
Deployment Method		Turret	Other

Notes for 240 ATR Linear:

- Compact and higher resolution systems are also available.
- This configuration requires a pair of transducers. Weights and dimensions quoted are for a single unit.

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