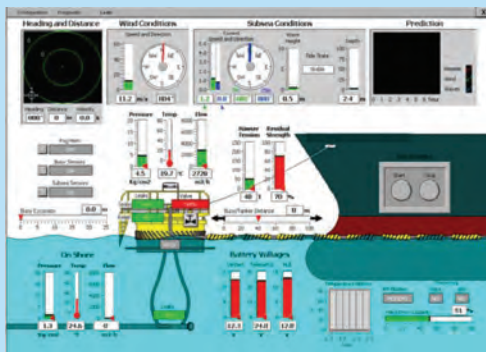


# Single Point Mooring (SPM) Monitoring

BMT's Single Point Mooring Monitoring Systems provide tanker masters and FPSO or Shore Side Control Room Operators real time operational and environment data required to manage the integrity of the loading systems and to make low risk hook up and disconnect decisions. With it, operators can achieve higher cargo transfer rates safely and tanker masters can achieve safer buoy approaches.



Buoy RTU transmitting Hawser Tension to a moored tanker



Integrated MTU/PTU operator screen with Emergency Shut-down Controls

BMT's basic SPM Monitoring System focuses on the following critical functions/measurements:

- Shutdown valve status and control
- Product Temperature, Pressure and Flow rate
- Product Swivel Leakage tank levels
- Hawser Tension
- Buoy/Tanker position and relative speed

To enhance awareness of the environmental forces at work, BMT provides:

- Wind speed and direction
- Current speed and direction (focused on Tanker Depth)
- Wave height and tide

Reliable and secure data and command communication employs proven, dual redundant, high bandwidth, Spread Spectrum, Radio Telemetry. BMT's wireless Ethernet dissemination system for the remote units is proven, robust and secure. Striking, user-friendly displays are a signature of BMT's monitoring systems on both the portable units and consoles in the FPSO/Shore side control room.

BMT has supplied systems to enhance the integrity management of offshore loading systems. Here are a few that are in place and working:

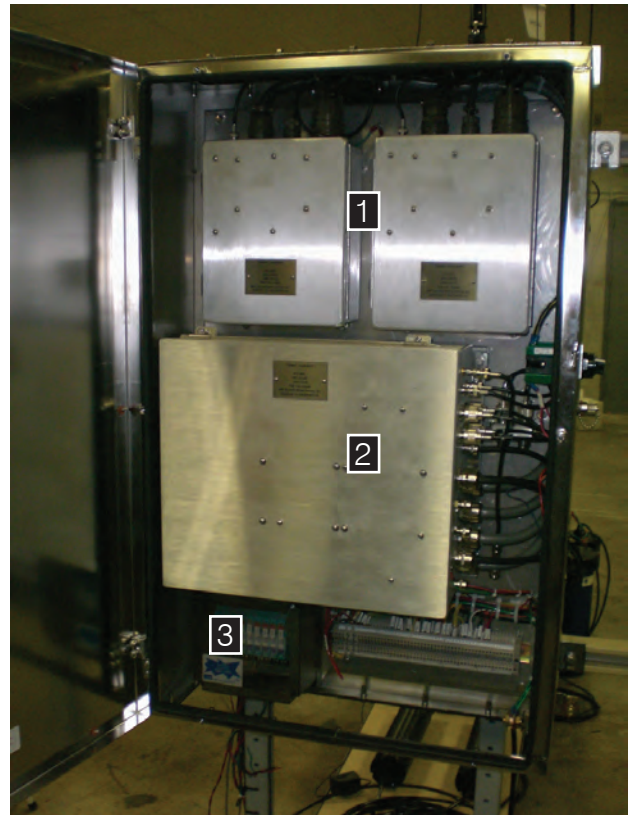
- Buoy Attitude and draft Measurement to detect mooring line failures
- Buoy Mooring line Tension monitoring
- Oil Offloading Lines
  - Stresses
  - Flex Joint inclinations
  - Buoy Motions

## Key System Components

- Remote Telemetry Unit
  - Data Acquisition Computer
  - Telemetry Radios
- GPS Subsystem
  - GPS Receiver
  - Radio to transmit buoy GPS data
- Instruments
  - Hawser Load Pin
  - Meteorological Sensors
  - Level Sensors
  - Flow, Temperature & Pressure
  - Valve Operator
- Buoy Power System
  - Batteries
  - Solar Panels & Wind Generator



Typical PTU tablet with operator screen display



Remote Telemetry Unit (RTU), including:

1. Redundant data acquisition computers and telemetry radios
2. Signal Conditioning, GPS Receiver, GPS Telemetry Radio, Location Select Switch, Coax Cross-point Switch, Modem Sharing Circuits, Computer Switch Over, Control Relays
3. Intrinsically-safe barriers



CALM Buoy replacement for the TERMAP facilities in Comodoro Rivadavia