



Precision Navigation for DP Drilling

Knorr 167/168



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Requirements

- Maximum radial excursion
 - Started at 5% of water depth
 - Evolved to $< 3\%$ WD
 - Actual limit remains a mystery
- Desired Duration: forever?
- Cheap.....
- Easy to install.....

Potential Methods

- Three point moor
 - Expensive
- Bottom reference (acoustic beacon)
 - Expensive
 - May not be accurate enough
- Filtered Differential GPS
 - Works, but.....

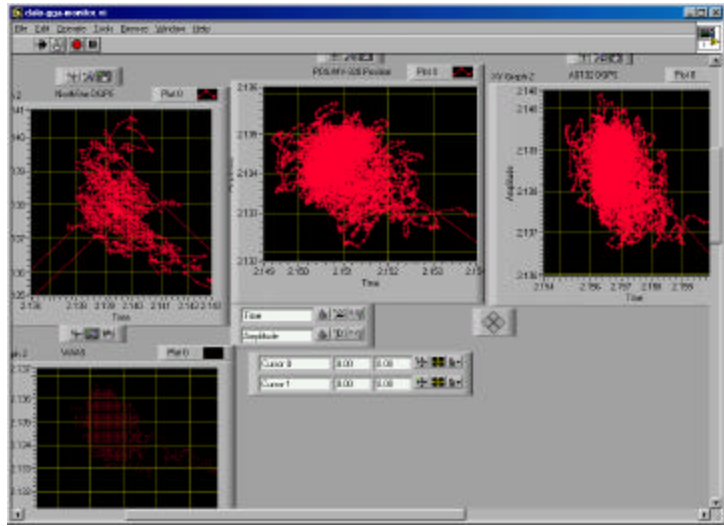
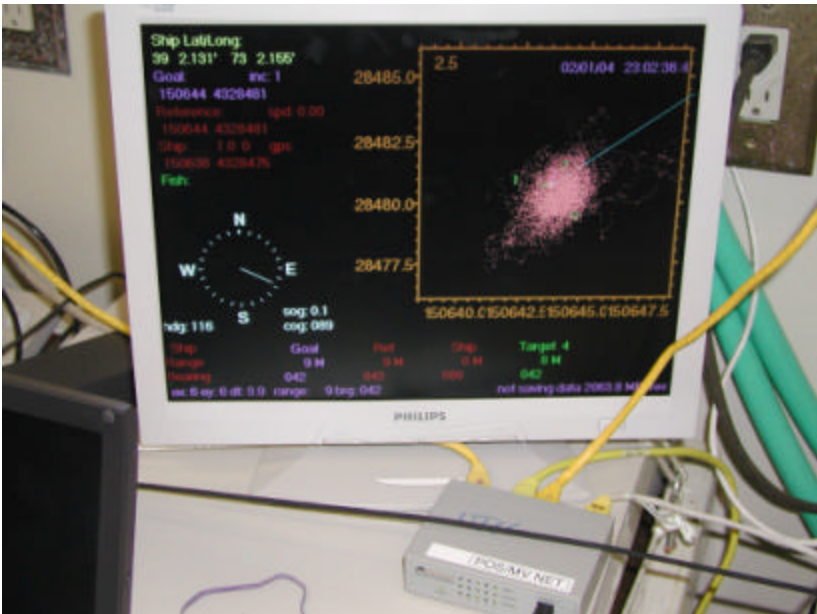
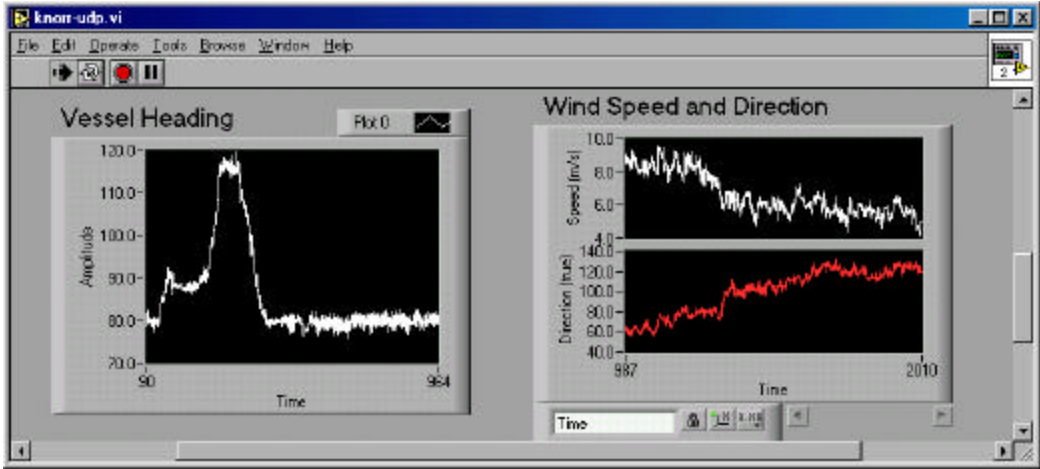
Approach

- Multiple GPS solutions
 - Satellite D-GPS (Ag-132 w/ Omnistar)
 - USCG Beacon D-GPS
 - WAAS
 - P-Code
- GPS-aided Inertial Navigator (POS/MV)
- Real-time radial limit filter (custom code)
- Multiple real-time displays (custom code)

Sequence of Events

- Install the equipment
- Calibrate the ship's dynamic positioning controller and interface
- Test the limits (before drilling)
- Debug the drilling & navigation systems
- Drill
- Run from weather

Results (1)



Results (2)

- In constant wind and sea conditions, where the assumptions of the Robertson DP system apply, we stay within a 2.5 m radius over 6 hours, with only 1% of fixes over 1.8m, in ~15 kt winds
- In more variable conditions, where the wind direction and speed was not so constant, we maintained 7m worst case, with 1% > 4.4m over 4.7 hours. In this latter case, the seas eventually exceeded the heave limit of the drill rig, and the wind was varying 20 degrees over short time scales.