Station Keeping & Dynamic Positioning System Performance – May 2012
RV Marcus G. Langseth – ML1208 – April 30-May 26, 2012

Langseth DP Equipment:

- One 800 hp tunnel thruster
- Two main engines (3600 hp) operating independently using with variable pitch propellers that each can run at 600 or 750 rpms.
- Two high efficiency rudders capable of acting independently of the other and capable of generating up to almost 90 degrees of thrust.

Sea State Conditions:

In general, weather was moderate but not calm. Winds varied from a low of 10-15 knots or less with seas at ~6' or less, and a current pushing at least 1 knot to the SE. At other stations, the winds were 15+ knots and even up towards 30 knots, with higher seas up towards 12', and the currents either were low or matched the wind direction fairly closely.

The vessel conducted 31 stations for various coring + CTD operations, totaling 8.5 days spent on station, of the 26 day voyage. Water depths at the stations were typically between 2000-4000 meters.

At all but 3 of the stations, the position was maintained with the **DP System** alone controlling the rudders and main propulsion (2 propellers). When tight station control was not a necessity, the Bow Thruster was not used on these stations due primarily to the significant noise from the Bow Thruster when running + operating. Noise from the thruster can interfere with the scientific utilization of the sonars. The location of the Bow Thruster is in close proximity to the accommodation berthing areas as well.

Station Keeping without the Bow Thruster

Performance of the DP system when it does not have access to a Bow Thruster, limits its ability to control the vessels motion in SWAY (side to side or athwartship). It is capable of handling the vessels HEADING and also controlling SURGE (fore /aft motion). And when the DP user manually selects the HEADING to minimize the SWAY motion, vessel motion can be controlled in a manner suitable for the deep CTD and Coring sampling we were tasked with. SWAY was generally limited to within 70 meters (a ship length) and SURGE was controlled within 5 meters. This method requires very frequent assessment and adjustment of the HEADING by the user (Mate on Watch), but still allows enough latitude to maintain a lookout in the low vessel traffic areas we were operating in.

When relying on HEADING selection to balance the forces being put to the vessel to keep it on station, the user is balancing the wind and currents, and the forces the DP uses to counteract changes to HEADING and SURGE. Fluctuations in wind and current strength and direction necessitate adjustments in the manually selected HEADING.

Speed in the SWAY direction when on station, was usually limited to under 0.3 Knots = 0.15 m/s = 9 m/minute. And with generally a limited motion distance of 70 meters, we never experienced a situation where vessel motion impacted how the CTD or Core interacted with the vessel or water.

Station Keeping with the Bow Thruster

3 Stations were conducted entirely or partially with the Bow Thruster running and controlled by the DP System. The reasons for the use of the Bow Thruster and how it performed are summarized below:

1. After transiting to a significantly different area from previous stations, the Bridge was having a hard time finding the balance point which would allow them to maintain the station without the Bow Thruster. Wind forces had reduced, and current forces were shifting significantly. To minimize time lost while we experimented with various headings, the Bow Thruster was engaged. With the Bow Thruster available, the DP System maintained positions in both SURGE and SWAY, and position was maintained within 5 meters of the set point while the core sample was collected.
2. A particular scientific target for coring was deemed to me significantly smaller than the previous locations, so to ensure we maintained a high degree of accuracy over the core target, we engaged the Bow Thruster, and DP System maintained position at the set point to within 5 meters.
3. Upon reaching the specified station, it was determined by Science PI that the desired location was actually 200 meters away from the specified site. To minimize the time needed to move to the new set point, the Bow Thruster was engaged with the DP System. Once repositioned on the new site, we continued to use the Thruster to maintain a close position, until after the station was sampled. Position control was within 5 meters while the Bow Thruster was operating.