

**Title: Combining USBL and Inertial Navigation into an Alternative and Improved Reference for DP**

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### **Abstract**

This paper is on an alternative DP position reference system obtained via the combination of high performance (HP) USBL and the Lodestar marine inertial navigation system.

GPS is a reliable position reference for DP. Global commercial DGPS position accuracy has reached the decimetre level. Integrity has improved via, for example: Space Based Augmentation Systems (SBAS) and Receiver Autonomous Integrity Monitoring (RAIM). Further improvement will come from the future operational status of other global satellite navigation systems (GNSS), e.g. Glonass, Galileo and Compass. Nevertheless, these systems are all based on the correct propagation and reception of extremely weak electromagnetic signals and suffer from common failure modes such as scintillation and (un)intentional electromagnetic jamming.

LBL and USBL systems have been available since the early 70's providing convenient subsea acoustic positioning for DP. The performance of these systems has generally improved over the years culminating in the new Marksman combined Long and Ultra-Short Base Line (LUSBL) system. Wideband improves accuracy and provides hundreds of independent acoustic channels. Marksman LUSBL is available in dual redundant configuration and offers greatly reduced time for setting up.

The combination of acoustic positioning and inertial navigation (Lodestar AAINS) offers a third type of position reference system for DP. Operational efficiency is obtained through calibration free use of just one or a few transponders. Careful integration with INS offers a three-fold improvement in accuracy, some immunity to degraded acoustics and a fixed update rate. High performance (HP) Wideband USBL and ping stacking allow accuracy to approach that of DGPS even in deep water. Lodestar AAINS for DP is intended as an improvement to USBL and a supplement to LUSBL. Experimental results are presented.

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