

Modulated Microwave Position & Heading Reference Sensor

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Abstract

For decades radar has been the principal technology for modern marine safety and navigation and is trusted and relied upon by mariners everywhere. Obviously the advent of global satellite position (GPS) technologies has had an ever increasing impact and represents an important functional addition to conventional radar. However, as a position reference sensor (PRS) for vessels with dynamic positioning (DP) capabilities radar has never played a significant role whereas GPS is virtually always the system of choice even when assisted by further acoustic, laser or mechanical sensors to achieve the required redundancy. Thus the advantages of radar such as its independence to difficult weather conditions and its ability to provide local reference measurements over significant range have hardly been exploited for DP-controlled station-keeping applications such as diving support, supply vessels and shuttle tankers etc.

This paper presents an innovative and ground-breaking microwave radar PRS providing highly accurate local position and heading information for any ship-to-ship or ship-to-rig DP application up to 2km in range. Unlike existing VHF based or active microwave systems this PRS does not require the installation and configuration of cumbersome remote transmitters or relay stations. Instead it uses totally passive, compact, lightweight, low-cost and maintenance-free radar retro-reflectors equivalent to the reflective tape used for laser ranging systems. The presentation outlines the theory of operation encompassing the physics of radar retro-reflectors, the innovative coupling with active modulation to solve the radar clutter problem and the algorithm for accurate position and orientation computation. The paper concludes with details on the RF front-end and digital signal processing implementation supported by laboratory and field results from the pre-production prototype.

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