Title: **Qualification of a Hybrid GNSS and IMU Solution**

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Abstract

Advanced GPS and GPS/Glonass solutions utilizing modern clock/orbit correction services provide accurate and reliable positions under almost all conditions. However, there still are failure modes and risks related to e.g. high ionospheric activity, HDOP spikes caused by signal blocking or variations in the satellite coverage and interference either caused by other radio frequency emitting equipment or hostile jammers.

An approach to further improvement of GNSS solutions is to combine satellite observations with inertial measurements. An overall integration scheme and a proposed system configuration are described and exemplified by the DPS 4D product.

The challenge of improving already accurate and reliable GNSS solutions by using inertial technology is considerable and an insight into the quality management process with explicit focus on test activities during the development cycle, is presented. Some of the advanced simulation and different test platforms for inertial and GNSS equipment are described. Extended verification and validation also involve pre-release installations and operation onboard large vessels to ensure full performance and operational capabilities.

Examples of results from the verification and validation activities demonstrating the increased capabilities of a hybrid GNSS/IMU solution compared to advanced GNSS-only solutions, are covered. The scenarios covered are performance achievements under normal conditions, satellite signal obstruction, signal scintillations, possible re-init of clock/orbit solutions and temporarily access denial of satellite signals (e.g. jamming) is presented. The integrated GNSS/IMU solution demonstrates improvements under all these scenarios.

The final section of the paper highlights some aspects regarding installation and surveying of the sensors constituting a hybrid GNSS/IMU solution, since installation aspects will be crucial to maintain optimum performance.

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