GNSS-based localization means for safeguard

EXECUTIVE SUMMARY REPORT

ESA Contract N.: 4000129041/19/NL/GLC/vr

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Table of contents

1 Introduction

1.1 Scope and purpose

The purpose of this document is to provide a very high level summary of activities and results obtained within the scope of the GNSS-based localization means for safeguard. For more detailed technical results we refer to the RD's listed in section 1.2.

1.2 Applicable documents

ID	Title	Reference	Issue
AD01	CCN 1 to ESA Contract No. 4000129041/19/NL/GLC/vr	GNSS-based Safeguard Contract	1
AD02	ESA Contract N°4000129041/19/NL/GLC/vr	GNSS-based Safeguard Contract	1
AD03	TASB-PRP-20185-CCN1 (former PRP-18139)	GNSS-Based Localization for Safeguard – Full proposal	2
AD04	TASB-PRP-18139-full_prop	GNSS-Based Localization for Safeguard – Full proposal	1

1.3 project documentation

Doc ID	Document number	Issue	Document title
D1	GNSS-SVG-TASB-RE-0003	03	Tailored URD
D2	GNSS-SVG-TASB-XR-0016	02	Survey Analysis Report
D3	GNSS-SVG-TASB-DS-0010	02	Interface Specification
D4	GNSS-SVG-TASB-DS-0010	02	GNSS based localized architecture rationalized description
D5	GNSS-SVG-TASB-RE-0003	03	Future Demonstrator Specification
D10	NAV-21-000279	03	IMU Test Plan
D11	NAV-21-001962	01	IMU Test Report
D12	NAV-21-000920	02	Functional Specification document
D13	NAV-21-002799	00	Algorithm User Manual
D14	NAV-21-002706	01	Algorithm Test Report

2 Summary

In a first stage the main objective of the project was to select the right IMU for our Future GNSS Receiver Unit (GRU).

Two IMU were selected from their datasheet : µ-UMI-IC-HP from Litef and STIM318 from Sensonor.

These 2 IMU were submitted to hard characterization tests applicable to our Launchers (and HAPS) application.

The conclusion is that the µ-UMI-IC-HP from Litef is the selected IMU for our application. The two IMU provide good results. Thales AVS is able to design a kalman filter compliant to the two IMU characteristics. The navigation performances will be obviously better for Litef IMU that provides a better accuracy and a higher stability. Besides, Sensonor IMU had very bad performances several times. It is not exactly a failure of the component but simply behaviours that happen sometime. It results in performances that are out of the nominal values given in the datasheet. These phenomena seems to be recurrent and will probably not be solved by screening.The Litef IMU has also the benefits to allow an autonomous heading computation and to have a DAL A development level.

The second step of the project was the development of a loose coupling hybrid navigation algorithm (written in C code) coupled with a simulation environment (provided as Matlab/Simulink code) able to provide representative performance results. The code was derived from an existing Thales Avionics software, and customized to the needs of the Callisto Flight Safety Kit.

The hybridization system is supposed to be interfaced with the following assets:

- Two GNSS receivers that provides navigation data (Position, Velocity…) and synchronization signal that provides the time of the measurement. Each antenna are positioned on opposite side of the launcher.

- The IMU that provides increments, health status and a synchronization signal that provides the time of the measurement

- The user that provides commands and receives the hybridization data.

Test results demonstrate that Callisto performance requirements can be met for the considered Callisto trajectories, including self-alignment on the Launchpad, as well as a ‘coasting’ scenario (loss of GNSS signal) during 10 seconds.

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