

Assessment of indoor GPS (SubWAVE) of Syntony GNSS in road tunnels

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Abstract: Global navigation satellite systems (GNSS), such as GPS, have transformed how people travel and the way many industries operate. But, since radio waves from satellites cannot penetrate through the earth, these systems are unreliable or unusable in underground infrastructure without some kind of technological intervention. At Syntony GNSS, we have a solution to this issue with SubWAVE, the first underground GPS coverage extension solution working in tunnels. The solution, which is compatible with existing GPS receivers, recreates GPS coverage in places such as subway, railway or road tunnels, and mines, allowing people and assets to be accurately located as easily as if they were outdoors. It also assists with navigation, locating people in an emergency, monitoring worker safety, and time synchronization. The GPS coverage extension solution, SubWAVE, was successfully tested by MLIT in a trial road tunnel in Japan in the first quarter of 2021, with up to a few meters' accuracy thanks to an indoor RTK type augmentation. Our presentation will present the results of this trial project in the MLIT trial road tunnel, but as well, as a comparison, the results of the first deployment ever, done by Syntony in an urban road tunnel in Stockholm, operated by Trafikverket.

1. Introduction

Through its relationship with EU–Japan Centre for Industrial Cooperation in Tokyo, Syntony has secured an opportunity to participate in a trial project initiated by the Regional Kanto office of the Japan's Ministry of Land, Infrastructure, Transport and Tourism (MLIT). The project, which took place in the first quarter of 2021, called for technologies that enable real-time positioning of moving objects — such as pedestrians and vehicles — in dead sections where it is not possible to receive signals from GNSS satellites.

Syntony, with several partners in Japan has built a project consortium to respond to this MLIT consultation. This project consortium included Stealth Consulting, Syntony, EU–Japan Centre for Industrial Cooperation, IPNTJ and SPAC.

SubWAVE has been installed in January 2021 in a trial tunnel of MLIT in Tsukuba, for a temporary installation. The test and measurement campaign have been run in January 2021, with the following weeks used for the analysis and the publication of the results. These results are put in perspective of the results of a more permanent

installation of SubWAVE in a road tunnel in operation located in Stockholm, Sweden, and operated by Trafikverket. This SubWAVE deployment has been done in 2020 in a tunnel of the Stockholm Ring. Test campaigns have been done during the year 2021, and have shown very encouraging results, in terms of compatibility with receivers, and in terms of static and dynamic accuracy.

2. Acknowledgments

We express our thanks to EU–Japan Centre for Industrial Cooperation, for Stealth consulting, and for IPNTJ for the support provided for the realization of the project all along the project phases, from contracting with MLIT, the implementation of the SubWAVE solution, the realization of the tests and the publication of the results. We also express our thanks to Trafikverket in Sweden for their trust in the SubWAVE solution and the opportunity given to conduct extensive tests and measurements in one of their tunnels in operation in Stockholm.

3. References

High precision monitoring in satellite reception dead sections; Publication of results by the Kanto Regional Development Office of MLIT; Kanto Road Maintenance Center; 3rd of June 2021

Demonstration and Assessment of indoor GPS of Syntony GNSS in an urban highway tunnel of Stockholm; Aurelien Korsakissok1 and Joel Korsakissok (Syntony); Paper ID # 696; 27th ITS World Congress, Hamburg, Germany, 11-15 October 2021.