

## Announcement of a planned testing campaign

### Testing campaign title: INAV improvements implementation testing campaign

The European Union Agency for the Space Programme (EUSPA) intends to launch a testing campaign for INAV improvements implementation and hereby invites external stakeholders to express their interest in participating in such testing campaign, having the following characteristics:

**Subject-matter:** The testing will cover any of the three I/NAV improvements (SSP, FEC-2, RedCED), that will be tested in laboratory using simulated realistic scenarios, including open sky as well as impaired environments. The tests will allow the participants to have confirmation of the correct implementation of the OSSISICD 2.0. A test report, including the results of the testing against defined key performance metrics, will be provided to each participant. In case of specific interest, legacy receivers (e.g. not implementing I/NAV improvements) could be also tested, solely at the scope of confirming that they are not impacted anyhow by the introduction of the new I/NAV capabilities (backward compatibility is in any case guaranteed “by design” for any receiver that is fully compliant with the Galileo OS SIS ICD provisions, and referring in particular to section 4.1.2). The interested participants may be invited to provide their product(s) before 15 March, 1 May or 1 August to the premises indicated below according to the terms and conditions that will be communicated by the Agency) and be ready to provide any remote technical assistance needed during the testing as well as all the necessary interface documentation required for the testing. Any further detailed provision, including the possibility to provide the testing laboratories with ad-hoc receiver development platforms facilitating the testing activities, will be discussed with the interested participants.

**Place of performance:** The tests will be executed at the laboratories of the European Commission’s Joint Research Centre<sup>1</sup> in Ispra, Italy, and of the European Space Agency ESA/ESTEC in Noordwijk, The Netherlands. Each applicant will be assigned by EUSPA to any of the two laboratories depending on the specific conditions and availability.

**Estimated timeline for launch of testing:** 15 March, 1 May and 1 August 2022

The EUSPA reserves the right to change the scope, and timeline of the procedure.

If you are interested in participating in the testing campaign above, please express your interest by sending an email before **25/02/2022, 17:00 (Prague local time)** to the following email address: [market@euspa.europa.eu](mailto:market@euspa.europa.eu). The subject of the email shall be “INAV improvements implementation testing campaign”.

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<sup>1</sup> See “JRC Testing and Demonstration Hub for the EU GNSS Programmes”, <https://publications.jrc.ec.europa.eu/repository/handle/JRC125180>

# Annex I – Background information

## INAV Improvements

With the objective to enhance the Galileo services portfolio, three new features will soon be provided free of charge to all the Open Service users. They will be gradually implemented and will be openly accessible through the I/NAV message carried by the E1-B signal.

These new features, whilst ensuring full backward compatibility with existing Galileo receivers, will further improve the robustness of Galileo OS when retrieving the navigation data and in particular in challenging environments, and will enhance the Galileo OS capability to solve the user clock uncertainty.

In that respect, a key performance metric (especially when GNSS operates in unassisted mode) is the time to receive Clock and Ephemeris Data (CED). Two of the newly introduced features contribute in different ways to improve the Time-To-CED, and therefore the overall Time to First Fix (TTFF):

1) Reduced CED (RedCED): A compact set of CED, called Reduced CED, provided within one single I/NAV word (new I/NAV word type 16). The Reduced CED concept allows for a fast initial position fix in exchange of an initial degraded accuracy, by only decoding one single I/NAV word rather than four I/NAV words carrying the full-precision CED. In this way, a Galileo only TTFF (95%) below 20 seconds can be achieved.

2) Reed-Solomon Outer Forward Error Correction (FEC-2): this additional error correction capability, offered on top of the legacy I/NAV CED words 1...4 and realised by means of a Reed-Solomon (RS) outer encoder providing correction of residual errors and recovery of erased information. RS encoded information, providing within the new I/NAV words 17...20, enables the possibility to have an increased demodulation robustness, and therefore the sensitivity in harsh environment. At the same time, it improves the time to retrieve the Clock and Ephemeris data (i.e. the Time-To-CED) thanks to its erasure property.

In addition, a third solution is also introduced which targets in particular application working in GNSS assisted mode, where navigation data is received from non-GNSS channels, and the user knowledge of the Galileo System Time is subject to a certain error, typically in the order of few seconds. In this context, it is key to solve the user clock uncertainty and increase the robustness of the time synchronisation.

3) Secondary Synchronisation Pattern (SSP) is introduced to allow the reconstruction of the Galileo system time as long as a coarse synchronisation of +/-3 seconds is already achieved. The correlation with the SSP sequence can be performed at symbol level without the need to demodulate the navigation message, which enables system time synchronisation with weak signals.

These three new features of the Galileo OS, provided through the E1-B I/NAV message, are described in detail in OS ICD 2.0, released in January 2021.