Galileo Signal

I/NAV Mid-term Update

ICG WG-S, 4 December 2017

Dominic Hayes

European Commission

Context

Original Galileo services included the Galileo "Safety of Life" Service

- *I/NAV message contained integrity information*
- *but, global, real-time integrity very challenging, and expensive!*
- *Safety of Life service 'reprofiled'*
- *I/NAV capacity still there*

- *What to do with it?*

Room for Improvement

Galileo Mission Consolidation Review looked to reuse this capacity, asked EU signal experts to:

- *develop proposals for I/NAV to improve OS performance*
- *but, leave spare capacity for future evolutions*
- *and, minimise impacts on current system*
- *while, remaining fully backward compatible with Galileo receivers (ICD v1.1)*

Ideas

Some areas for consideration:

- Galileo TTFF = 32 secs - can this be *improved?*
- *Can we improve robustness in challenging environments?*

Investigative work carried out over the last few years identified a number of proposals, which were filtered to…

I/NAV Additions

three distinct, but complementary, parts:

- *include compact Clock and Ephemeris Data (CED) in addition to the standard CED*

  -> Allows essential ephemeris data to be downloaded more quickly

- *an additional error correcting code (FEC2)*

  -> Reed-Solomon code, aids data link robustness

- *include a secondary synchronisation pattern*

  -> Further improves robustness by effectively making the whole synchronisation pattern longer

What does this achieve?

- *fast synchronisation capability enabled, with initial clock uncertainty now +/-3s instead of previous +/-0.5s (better compliance with LBS and 3GPP standards on coarse time assistance)*
- *tracking threshold improved by ~3dB*
- *stand-alone TTFF improved from ~30s to ~20s (also helps compliance with LBS/3GPP standards on unassisted TTFF)*

Implementation

Coming soon to a Galileo signal near you…

- *currently I/NAV 'evolution' flowing through the internal system change request process*
- *Planned to be available as a midterm Galileo update in 2018*

- *NO impact on legacy receivers!*
- *Completely optional for manufacturers*
- *But does offer worthwhile performance improvements if implemented in chipsets*
- *To be included in an updated OS SIS ICD*