New Message Broadcasts

06 June 2012

Vienna, Austria

International Committee on
Global Navigation Satellite Systems

Background

- Recommendation from ICG6 for WG-B to investigate on New Message Broadcasts in New Signals by means of a dedicated workshop involving also ICG external fora (e.g. SBAS IWG)

- Recommendation identifies already possible signals that could host additional data
  - SBAS L5
  - New GNSS signals

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Background

- Before calling for this workshop WG-B needs to establish concrete proposals for new data broadcasts and assess the enhancement in performance achieved

- This presentation

  – Identifies new services achievable by new message broadcasts as discussed already in WG-B

  – Sets out a number of questions to be answered ahead of the workshop

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Three Step Approach to Identify New Message Broadcasts

1. Identification of the most promising evolution directions capable to significantly enhance the existing or planned services through the provision of additional data.

2. Assessment of the requirements for the additional data considering aspects like
   – Authority to provide this data (GNSS service provider vs. external entity),
   – Data bandwidth,
   – Timeliness of data dissemination,
   – Liability,
   – Others.

3. Identification of the most suitable dissemination channel (space vs. ground based) following some cost/benefit trade-off.

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New Message Broadcast 1 ARAIM

– Classical GPS RAIM for NPA used since years

– Evolving GNSS environment

  – Multi-GNSS GPS/Galileo/Glonass/Compass/QZSS

  – Dual-frequency signals (E1/L1/B1 + E5a/L5/B2)

➔ Evolve current NPA RAIM concept to allow precision approach procedures

  – APV-I, LPV-200

– Rebalance integrity burden allocated to ground and user segment

  – Allocate less burden on the ground, and more on the user

  – Reduction of real-time requirement for ground segment

– Considerations for future standardization

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ARAIM – List of Threats

Nominal errors

o   Nominal Clock and ephemeris errors

o   Nominal signal deformation errors

o   Antenna bias

o   Tropospheric errors

o   Code noise and multipath

Narrow failure errors

o   Clock and ephemeris estimation errors

o   Signal deformations

o   Code-carrier incoherency

o   **Wide failure errors**

o   Induced by inadequate manned operations

  o   Update of operational G/S

  o   Commanding of S/C

o   Induced by G/S facilities

  o   Nav message generation and uplink

  o   S/C and constellation control

o   Externally induced

  o   EoP and EoPP

    o   Type A (Earth motion changed since update)

    o   Type B (EoPPs in OD process bad and not detected in GNSS ground segment)

To each threat a dynamic level can be associated

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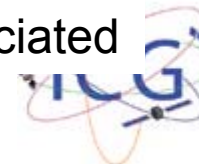
ARAIM Threat Mitigation

- Threat mitigation needs to involve 3 levels
  - GNSS ground segment
  - Independent ARAIM ground segment
  - User receiver

- ARAIM studies see the need for an ARAIM ground monitoring network (external to GNSS service provider) to determine and provide relevant ARAIM algorithm input to user

  → **Integrity Support Message (ISM)**

- Detailed characteristics of ISM currently under investigation

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ARAIM ISM Dissemination

- Modifications at avionics level required to support ARAIM in the future to be kept to minimum extent possible

- Reuse of already available data links

  - L-Band RNSS allocation

    - GNSS

    - SBAS L5

  - VHF Aeronautical Mobile Route Services (AMRS) Allocation

  - ISM dissemination at gate dispatch

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ARAIM Data

Concept	Data Provider	Data Bandwidth	Timeliness	Data Dissemination
ARAIM	ARAIM Ground Segment (potentially external to GNSS service provider)	TBD	No real time requirement	GNSS/SBAS/ terrestrial

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New Message Broadcast 2
Early Warning Service (EWS)

- In event of natural disaster classical ground- or satellite-based communication means might not be available to alert people in distress situation
  - Communication lines might be destroyed or overloaded in these circumstances
- One-way nature of GNSS signals
  - Elegant way to provide disaster specific information at short notice
  - Combination with GNSS allows to alert only affected people

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EWS Implementation Aspects

- Considering above rational together with market penetration aspects EWS dissemination through GNSS/SBAS most favourable

- Data handling aspects need to be considered

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EWS Data

Concept	Data Provider	Data Bandwidth	Timeliness	Data Dissemination
Location Based Early Warning Service	GNSS external entity	250 bit [TBC]	Close to real time data provision required	GNSS/ SBAS

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Identification of Additional Concepts?

- Additional concepts may be identified allowing for

  – Performance enhancement of existing services

  – Provision of innovative/new services

- Are there additional concepts already identified?

- Beyond this, how are new message broadcasts to be identified?

  – Which fora should be consulted?

  – How should these fora be consulted?

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Assessment of Existing/Additional Concepts?

- Detailed assessment of existing and potentially new concepts needs to be carried out in order to come up with clear message requirements in terms of
    - Data characteristics (bandwidth, timeliness, etc.)
    - Data provider
    - Etc.

- Is this assessment already existing?

- For new concepts still to be identified, who will carry out this assessment?

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Dissemination Means?

- What dissemination means are available to host new data?
    - Terrestrial channels
    - SBAS
    - GNSS

- How to identify the potentially open capabilities of each channel?
    - Involvement of Providers Forum?
    - Other fora?

- Careful channel selection needed considering
    - Regulatory issues
    - Liability issues
    - Etc.

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Towards the Workshop

- Which external entities to be involved in the workshop?

- When to organize the workshop?

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