APRESTA

ADS-B performance and GPS degradation assessment tool
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MOTIVATION

DESCRIPTION OF APRESTA

BENEFITS
MOTIVATION

ADS-B, a surveillance technique:

ADS-B extensively used by ANSP (either in operation or deployed).
+1000 ADS-B ground stations deployed by European ANSPs

https://www.eurocontrol.int/service/automatic-dependent-surveillance-broadcast

ADS-B v2 equipage
https://www.eurocontrol.int/service/adsb-equipage
MOTIVATION


• Article 7
1. Air navigation service providers shall assess the level of performance of ground based surveillance chain before putting them into service as well as regularly during the service, in accordance with the requirements set out in Annex V.

• ANNEX V
2. Air navigation service providers shall periodically check the system and its components and develop and enforce a performance validation regime. The periodicity shall be agreed with the national supervisory authority taking into account the specificities of the system and its components.
MOTIVATION

EASA AMC and GM to 1207/2011:

Acceptable Means of Compliance (AMC) and Guidance Material (GM) to IR 1207/2011
ED Decision 2020/014/R

- GM1 Article 7 Associated procedures
  To assess the performance of their surveillance systems, air navigation service providers (ANSPs) may consider the use of the VERIF (verification function) of the Surveillance Analysis Support System for ATC Centre (SASS-C), and refer to Section 4 of EUROCONTROL-SPEC-147.

https://www.eurocontrol.int/online-tool/surveillance-analysis-support-system-atc-centres
**MOTIVATION**

**ENAIRE (DNA234/18):**

Tender for the acquisition of APRESTA:
• analysis of ADS-B performances.
• analysis of ADS-B station status.
• generation of alerts.
• detection of GPS interferences with ADS-B messages.

APRESTA was designed and developed by GMV.

APRESTA algorithms are defined based on the experience of ENAIRE.

<table>
<thead>
<tr>
<th>Functionalities</th>
<th>APRESTA</th>
<th>SASS-C (VERIFication)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveillance data acquisition</td>
<td>Ethernet and files. ASTERIX format.</td>
<td>Ethernet and files. ASTERIX and other formats.</td>
</tr>
<tr>
<td>Computation of ADS-B performance parameters (using Cat021)</td>
<td>ED-129B PU, PLG, kaPU, kaPLG PU per cell</td>
<td>ED-129B*</td>
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<tr>
<td>Computation of station performance parameters (using Cat023 or Cat025)</td>
<td>Station availability. Station events.</td>
<td>No*</td>
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<tr>
<td>Detection of GPS anomalies (interferences) using Quality Indicators (QI)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Reconstruction reference trajectories</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Multi-sensor data association</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Service volume definition (2D+Flight level)</td>
<td>Yes (and excluded areas)</td>
<td>Yes</td>
</tr>
<tr>
<td>Coverage volume definition (3D)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Periodic unattended execution</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Analysis reports</td>
<td>PDF and CSV files Daily and monthly</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Information could not be confirmed.*
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BENEFITS
## Use Cases:

<table>
<thead>
<tr>
<th>Administrator</th>
<th>Operator</th>
<th>Automatic tasks</th>
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</thead>
<tbody>
<tr>
<td>Upload <strong>ASTERIX files</strong> in the system.</td>
<td>Monitor the <strong>status</strong> of input ASTERIX dataflows (running, receiving data ...)</td>
<td><strong>Receive</strong> ASTERIX data (from dataflows):</td>
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<tr>
<td></td>
<td></td>
<td>• Read ASTERIX messages</td>
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<td>• Archive ASTERIX raw data</td>
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<td></td>
<td></td>
<td>• Decode ASTERIX Cat021, Cat023 and Cat025</td>
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<tr>
<td>Set the <strong>configuration</strong> of the system:</td>
<td><strong>Download</strong> automatic analysis reports:</td>
<td><strong>Create</strong> automatic analysis:</td>
</tr>
<tr>
<td>• Definition of ADS-B stations.</td>
<td>• ADS-B performance report</td>
<td>• ADS-B performance report</td>
</tr>
<tr>
<td>• Definition of input ASTERIX dataflows.</td>
<td>• Station performance report</td>
<td>• Station performance report</td>
</tr>
<tr>
<td>• Definition of <strong>automatic analysis</strong>.</td>
<td>• GPS problems report</td>
<td>• GPS problems report</td>
</tr>
<tr>
<td>Repeat automatic analysis.</td>
<td><strong>Request</strong> ADS-B performance report with custom configuration.</td>
<td><strong>Create alerts and send emails.</strong></td>
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<tr>
<td></td>
<td><strong>Download</strong> ASTERIX raw files archived in APRESTA</td>
<td></td>
</tr>
</tbody>
</table>
APRESTA

Outputs:

ADS-B performance report

- PDF report
  - Executive summary: configuration, #msg, #flights...
  - Performance metrics: #gaps, global PU and kaPU, kaPU per cell, PU of non-compliant Target Addresses, global PLG and kaPLG (ED-129B metrics)
  - Quality Indicators: statistics
- CSV data files
  - Per target address: #Msg, Target Identifications...
  - Cat021 data decoded
  - Per target address: statistics QI
- KML file
  - Long gaps (n=3, n≥4)
Outputs:

**ADS-B station performance report**

- PDF report
- Executive summary: configuration, availability
- Events: #events and duration.
- CSV data files
- Per event: start time and duration
APRESTA

Outputs:

GPS problems report
  • PDF report
    • Executive summary: configuration
    • Cell analysis: gps status per cell and per timeslot.
    • Aircraft analysis: gps status per Target Address and timeslot.
  • KML file
    • #GPS status per cell and timeslot

Note. “GPS status” based on the QI reported by the a/c:
  • No Integrity: PIC reported = 0
  • Degraded: PIC reported < PIC estimated (RAIM algorithm)
  • Ok: otherwise
APRESTA

HMI:

Operator HMI
• Web interface
HMI:

Administrator HMI
• Web interface
APRESTA

ADS-B Reports Filtering Feature:

Service Volume
• Defined by:
  • 2D polygon
  • Min and Max Flight Level
  • Excluded areas
• Purpose: limit the analysis to ADS-B messages reported within the service volume.

Coverage Volume
• Defined by:
  • 3D volume defined by 2D slides.
• Purpose:
  • Gaps refinement

*Height not proportional for visualization.
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BENEFITS
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For ADS-B assessment during *Operation*:

**ADS-B performance assessment:**
- *Periodic (daily, monthly) reports:*
  - Routinary check of performance requirements compliance
  - Analysis of time evolution performances.
  - Early detection of non-compliance areas (cells) and aircrafts (Target Address).
  - Coverage refinement to avoid non-compliance false alarms due to lack of coverage.

**ADS-B ground station performance assessment:**
- *Periodic (daily, monthly) reports:*
  - Routinary check of station availability and events reported.

**GPS problems assessment:**
- *Periodic (daily) reports:*
  - Early detection and localization of GPS problems.

**Alert’s generation:**
- *Email*
BENEFITS

For ADS-B analysis/investigation:

**ADS-B performance assessment:**
- **User requested reports:**
  - Analysis of ADS-B performances in customized scenarios.

For ADS-B station commissioning:

**ADS-B performance assessment:**
- **Periodic (3h, 6h, 12h) reports:**
  - Check of performance requirements compliance
  - Early detection of non-compliance areas (cells)
Thank you

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