CHIPS HRRF Presentation

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CHIPS HRRF
Requirements Skyguide

CHIPS: Program Heli-Recording-Random Flights

- CH-Wide Implementation Program for SESAR oriented objectives (SESAR: Single European Sky ATM Research)
- For the program Helicopter Recording Random Flights (HRRF) investigations on the airborne SBAS GPS Systems are required. This in connection with the Low Flight Network, which will specially be used by helicopters.
- RUAG Aviation was in charge for the data acquisition (navigation parameters) in the dedicated helicopter fleet.
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CHIPS: HRRF Data Recording

The requirement is a recording rate of 1 Hz

Minimum variant – not desirable by customer

- GNSS Latitude
- GNSS Longitude
- HDOP
- Date
- UTC/UTC fine
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Enhanced parameter set:

- Reference Latitude
- Reference Longitude
- Measurement Status
- Pseudo Range
- Satellite Vehicle Position
- UTC Measure Time
- GNSS Altitude
- UTC
- Autonomous Horizontal Integrity Limit
- Autonomous Vertical Integrity Limit
- Vertical Figure of Merit
- UTC Fine
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- Horizontal Figure of Merit
- GNSS Sensor Status
- GNSS Height
- User Range Accuracy
- Range Rate and Delta Range
- GNSS Fault Summary

Attitude data
- Pitch angle
- Roll angle
- Yaw angle

Flight Path Information
Helicopters in HRRF

For data recording the following helicopters are used. These helicopters are primarily operated by the partner organizations REGA and Swiss Air Force.

- Swiss Air Force,
  18 Eurocopter type EC635/135

- REGA,
  6 Eurocopter EC145 type,
  11 Agusta / Westland type DaVinci
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Feasibility Study

Situation

- Temporary Installation for long term trials
- Several Helicopter configurations in HRRF Trial Fleet
- Avionics and Installation existing
- Customer requests low cost
- Temporary installation has to be fully certified (Airworthiness Office!)
- SBAS GPS required for LFN
# CHIPS HRRF
## Feasibility Study
### Available Fleet for CHIPS HRRF

<table>
<thead>
<tr>
<th>HELICOPTER</th>
<th>N</th>
<th>GPS1</th>
<th>GPS2</th>
<th>SBAS</th>
<th>MAP</th>
<th>FMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>REGA AW 109SP</td>
<td>6</td>
<td>CHELTON BETA III</td>
<td>CHELTON BETA III (upgrade)</td>
<td>YES</td>
<td>EURONAV 5/RN6</td>
<td>COBHAM</td>
</tr>
<tr>
<td>REGA EC 145</td>
<td>11</td>
<td>CMA 3012 &amp; CMA 3024</td>
<td>-</td>
<td>NO</td>
<td>EURONAV 5/RN6</td>
<td>CMA 9000</td>
</tr>
<tr>
<td>LW EC 635</td>
<td>18</td>
<td>CMA 5024</td>
<td>-</td>
<td>YES</td>
<td>EURONAV 5/RN6</td>
<td>CMA 9000</td>
</tr>
</tbody>
</table>

In addition two AHRS are installed.
Possible Solutions:

- QAR as used as parallel data recorder for Cockpit Voice and Flight Data Recorder (CVFDR): Recording rate same as for CVFDR, this is too slow (EUROCAE ED–55 / ED–56A / ED-112)

- Autonomous GNSS Receiver with temporary installation kit: Parameter not equivalent with integrated system, not accepted by customer, some kits with phase tracking, are prepared as temporary reference
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Data Recorder

- Rack with modules for recording several standards (ARINC, RS,..): Too large and too expensive for installation
- The best solution we found is the “Avionica miniQAR”, which can be configured for specific applications and can be used for ARINC-429 and RS-232
Data download can be done via ETHERNET or wireless via ground-based network.

The decision was to use the ETHERNET, but because this procedure was too slow, it was decided to change the memory card in the miniQAR and mail it to Skyguide for download.
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Experience with Avionica

- The Avionica miniQAR **Hardware** was qualified for the use in an aircraft, some S/W upgrade were required.
- The **Software “AVSCAN.flight”** which is for flight data analysis and was proposed for data download and for tests was not completed. RS-232 was not implemented.
- Skyguide had the intention to write an own **Analysis Software**. In addition they had to write S/W for RS-232 decoding.
CHIPS HRRF (Advanced Support Utility ASU)

CHIPS DATA DOWNLOAD AND PROCESSING

- **MiniQAR MK 3**
  - **DL DOWN LOAD UTILITY**
  - **ASU ADVANCED SUPPORT UTILITY**
    - ASU AND DL ONLY AS DRAFT VERSION AVAILABLE (TO DOWNLOAD TS4 AND TSC)
  - **TSC**
    - **ETH**
    - **TSC**
    - **AVSCAN**
    - **CSV**
    - **EXISTING AVIONICA TOOL BOUGHT FOR CHIPS BUT NOT COMPATIBLE WITH MINIQAR MK 3**
    - **ANALYSE**
    - **CSV Converter**
    - **CSV**
    - **TSC Parser**
    - **Pseudo CSV**
    - **Skyguide in Development**

- **ARINC 429**
  - **ETH**
  - **TS4**
  - **Pseudo CSV**
  - **CSV Converter**
  - **CSV**
  - **429 TSC Parser**
  - **DRAFT VERSION, DEVELOPED FOR CHIPS AS INTERIM TOOL (AVIONICA)**

- **RS232**
  - **Skyguide RS232 Converter**
  - **CSV**
  - **AVIONICA ACTUAL**
    - AVIONICA NOT COMPLETED SKYGUIDE

Beat Fischer 21.11.2013
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Installation EC-145

EC-145

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Installation of the Recordersystem as temporary Installation
15.3.2012 Fb RUAG Aerospace

RED : Temporary T-Cables with Connectors and MiniGAR
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**Installation EC-635**

EC-635
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Installation of the Recordersystem as temporary installation
15.3.2012 Fls RUAG Aerospace

RED : Temporary T-Cables with Connectors and MiniQAR
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Installation AW109SP

AGUSTA AW109SP
CHIPS
Installation of the Recorder system as temporary installation
15.3.2012 Fb RUAG Aerospace

RED : Temporary T-Cables with Connectors and MiniQAR
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Detail Design

- Definition der Einbauorte zusammen mit den Helikopterbetreibern
- Definition der elektrischen Leitungen und Stromversorgung
- Definition der mechanischen Adapter
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Detail Design

- Erstellen der Dokumentation für die Integration und Zertifizierung
  - Modification Description
  - Schemas/Zeichnungen (elektrisch/mechanisch)
  - Engineering Order
  - Testdokumentation
  - Conformity Inspection
  - Instruction for Continued Airworthiness
  - Pilot Information Sheet
  - User Manual Ground Crew
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Integration

- Integration basierend auf einem RUAG-Engineering Order und den dazugehörigen Entwicklungsgrundlagen
- Integration in EC635 im Rahmen jährlicher Kontrolle
- Integration in die REGA-Flotte durch REGA (ausser Prototyp)
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Testing

- Durchführen von Lab-Tests
  - Simulation der Daten (ARINC429 und RS-232)
  - Umgang mit gespeicherten Daten
  - Langzeittests
- Automatische Verbindungstests der Kabelbundles vor Integration
- Ground Tests
- EMI Tests (Hot Run)
Zertifizierungsplan

Certification Compliance Sheet (CS29)

Erstellen von Minor Change Approvals (DOA RUAG)

– miniQAR Installation

– GPS-Wechsel im EC-145 von CMA-3012 und CMA-3024 auf CMA-5024 (SBAS)
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Datenauswertung

- COTS-Datenauswertungssoftware konnte nicht verwendet werden
- Konfigurierbarer Parser (vom OEM entwickelt), wandelt komprimiert gespeicherte Daten in CSV um
- Analyse der CSV durch Skyguide
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Projektbetreuung nach Integration

- Support bei Problemen/Fehlerfällen mit den miniQAR
- Software Updates
- I-Level Maintenance der miniQAR bei RUAG
Vielen Dank für Ihre Aufmerksamkeit!