

Airborne Radio Interference Localization and Monitoring System **AD-ARLOC II**

Today's intensive use of the radio frequency spectrum by very different users creates more and more conflicts of radio signal interferences. Normally, if Radio Frequency Interference (RFI) is identified during flight inspection, the task of the flight inspection crew ends. A special educated crew is brought into place for the complex task of locating the RFI source. Typically this is performed by ground based equipment in fixed, portable or mobile installations. If the RFI analysis equipment must be transported to the area of interest first, this could take a lot of time. Another problem might be limited access to the area of interest by ground vehicles.

Solution

The Aerodata Airborne Radio Interference Localization and Monitoring System II (AD-ARLOC II) is the solution for enabling your AeroFIS® to identify, analyze and locate interference sources from the air.



System Components of AD-ARLOC II

In comparison to ground based interference localization, localization from the air using the AD-ARLOC II is much faster, since the position of the aircraft in relation to the interference source changes rapidly. The reference position of the AeroFIS® in combination with the continuously provided relative bearing of a Direction Finder (DF) is used to calculate the position of the interference source in WGS84 coordinates.

Principle of Operation

In case of interference the corresponding frequency spectrum can be analyzed by the digital spectrum analyzer, e.g. Rohde&Schwarz FSV4. Automatic measurement programs for remote control of the spectrum analyzer can be executed via the AeroFIS® software. Automatically the spectrum analyzer is connected to the corresponding antenna via the RF switching unit. The measured frequency, the power level and timing of the interference is directly indicated by the spectrum analyzer. The audio demodulator of the spectrum analyzer provides listening to the audio modulation of the interference. The audio characteristics allow classification of the interference source to be e.g.:

- Analog voice (e.g. radio station)
- Digital data burst
- Harmonics
- Multiple modulation

Subsequently an on-board Direction Finder is tuned to the interference frequency and provides continuously relative bearings to the source of interference. The AeroFIS® position reference data and the Direction Finder bearings are feed to the sophisticated interference localization algorithms of the AeroFIS® software for calculation of the interference source position in WGS84 coordinates.

AD-ARLOC II Equipment

The AD-ARLOC II is based on the following equipment:

Direction Finder:

- Direction Finder processor
- Direction Finder antenna coupler
- Direction Finder antenna array

Spectrum Analyzer:

- Spectrum Analyzer Antennas:
 - o VHF/UHF Broad band
 - o L-Band antenna (DME/TACAN/SSR)
 - o GNSS antenna
 - o Existing VOR/LLZ antenna
 - o Existing GS antenna
- Existing Spectrum Analyzer of AeroFIS® or alternatively: installation of a new Spectrum Analyzer, e.g. Rohde&Schwarz FSV4
- Existing RF Switching unit of AeroFIS®

AeroFIS® Direction Finder Software:

The control of the AD-ARLOC II is fully integrated into the AeroFIS® Software:

- Remote control of Spectrum Analyzer
- Recording of Spectrum Analyzer graphs for time synchronized replay
- Recording of interference audio (MP3)
- Automatic Spectrum Analyzer antenna switching
- Remote control of Direction Finder (DF)
- DF antenna bearing error compensation (antenna calibration)
- DF bearing indication to pilots
- Algorithms for interference localization
- Visualization in Google Earth

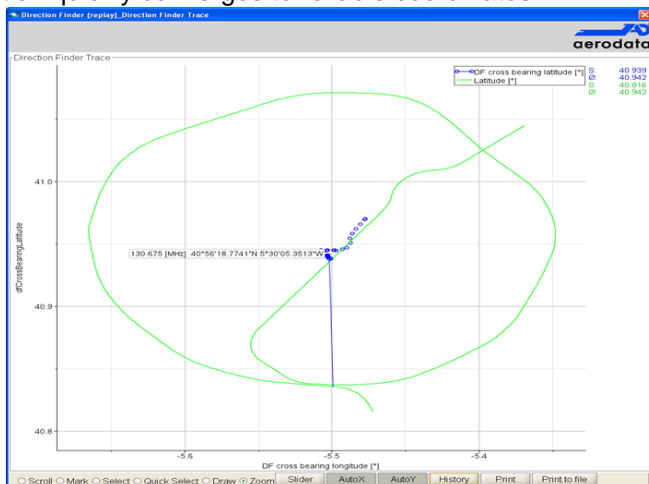
DF Antenna Pattern Compensation

The bearing error patterns of the DF antenna arrays are measured after the antenna installation on the aircraft. The corresponding patterns are stored within the AeroFIS® software and applied to the DF bearing for compensation.

Localization Algorithms

Sophisticated algorithms for fast localization of interference sources are implemented as part of the AeroFIS® Direction Finder software. The error corrected DF bearing and the reference position are used as input to the triangulation algorithms for position determination. The algorithms consider the DF bearings weighted according to the signal quality. The huge number of triangulation calculations eliminates statistical and systematic errors of the DF installation to the highest extent.

Since the geometry between the aircraft and the interference source changes rapidly, the calculated position quickly converges to reliable coordinates.



Converging Interference Position and Flight Track



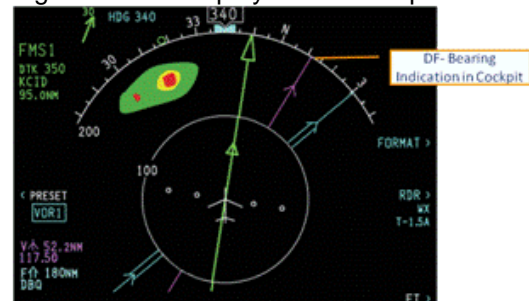
DF Control via AeroFIS

An export function provides direct position indication in Google Earth:



Position Indication in Google Earth

The DF bearing can be selected by the pilots as bearing source for display on the cockpit EHSI/MFD:



DF Bearing in Cockpit

In addition the pilots can use the AeroFIS® flight guidance interface to the EFIS for flying search patterns using by autopilot.

AD-ARLOC II

For finding Interference Sources quickly!

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