Weather extractors for ATC - radars The GAMIC GWSP Doppler extractor, practical experiences, limits and Future

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(Dated: 29 May 2012)

1. Introduction

GAMIC's ATC Radar Doppler Weather Extractor GWSP enhances any ASR radar by a comprehensive “weather radar like” data output, which can be displayed either as real-time color coded Reflectivity, radial velocity and turbulence display or in CAT8 vectorized EUROCONTROL format on ATC console displays. Such systems are installed at German and Swiss air force sites as well as Schiphol Airport and successfully operated in the controller environment. Operational experiences and limits will be discussed. Potential new applications like fill-in radar source or backup for weather services are envisaged.

2. The FROG_ATC Wetter Extraktor

The goal of the GWSP is the improvement of safety of aircraft operations by means of timely detection and reporting of hazardous weather phenomena in the airport approach area, typically up to 60nm. This information can be extracted from Airport Surveillance Radars (ASR) data in parallel to the standard tracking function. In particular severe precipitation, wind shear near the terminal approach and departure zones of an airport are processed and identified. Specific sources of the hazardous weather are to be detected. Thunderstorms, micro bursts and gust fronts are among those critical events. Also the GWSP will improve the management of air traffic in the terminal area through the forecast of any significant weather at the airport and the detection and tracking of precipitation.

The GWSP is intended to provide fast and precise weather data extraction and display of all weather parameters (Rain Reflectivity, Doppler Velocity and Turbulence) up to 60nm (100km) as available from the Primary ASR receiver. It can be either implemented as modernization, retrofit or improvement of the existing or new ASR systems supporting aviation commerce world wide. ASR radars serviced are Magnetron, Klystron and Solid State.

Weather and warning data are sent to the ATC controller workplaces in ASTERIX CAT 8 format. Other high resolution formats are available.

Systems are contracted and in operation at the German and Swiss Air Forces and at Schiphol Airport, The Netherlands.

Fig. 1 Typical ATC environment (CASSIDIAN)
2.1. Technical solution

System part: Weatherchannel at the ASR-S ATC Radar
1. Component: Adaption-box (ABOX)
2. Component: Weather Signal Processor (WSP)
3. Component: Weather Data Processor (WDP)
- The IF raw signals from the primary radar are measured to determine the quantitative drop density - WSP
- A EADS developed bird tracking processor generated warnings based on raw I/Q data from WSP and WDP. The warnings are later on captured by WSP for processing and display
- The WSP data are corrected and processed to output meteorological moments (Z, V, W)
- The WSP transmits the weather information (including bird tracking) in ASTERIX Cat008 contoured format to the ATC controller workplaces via LAN
- WSP and WDP have BITE modules for remote and local surveillance and control.

2.2 Data examples

![Fig. 4 PPI (Z) real time display, maintenance GUI](image)

![Fig. 5 PPI (V) real time display a the maintenance GUI](image)
3. Comparison with DWD weather radar data

The comparison with data recorded at approximately the same time using German Weather Service DWD radar data shows the following results:
It is observed that the Z intensity is underestimated at longer range, which is expected due to the incomplete filling of the volume in the antenna fan beam case. A good qualitative presentation of the weather situation is obtained, in particular in the vicinity of the radar or airport site – which is most important for the flight operations.

4 Conclusion
The ASR-S weather channel has been tested operationally for a couple of years now, showing satisfactory results in warning controllers and pilots of hazardous weather like strong rain, wind and bird migration events near runways.

The FROG-MURAN derived products optionally can be used to predict the arrival and track weather event motion giving a complete picture of current and future terminal area hazardous weather conditions which may impact runway usage for take-off and landing. The weather channel will detect hazardous weather and bird migration on the ASR-S improving the capabilities security in air traffic control as needed by mission sensitive flight operations.

The GWSP weather channel can easily be integrated with a large variety of operational ATC radar types (Magnetron, Klystron, and TWT, Solid-State) to upgrade the weather detection capabilities to modern technology.

Additionally such ASR weather information can be a supplemental- or fill-in-source of data for “civilian” weather radar networks.

Acknowledgment
GAMIC wishes to thank the experts at CASSIDIAN, in particular Mr. Karl-Josef Mueller, for the fruitful discussions and cooperation during the project.