Highflyer: reliable radiomonitoring from the air

The higher the vantage point, the more to see. That may be stating the obvious, but the new radiomonitoring and radiolocation system for airborne platforms makes the most of this advantage. Based on the standard radiomonitoring and radiolocation product line, the system is available in customized, aircraft-installed and portable, non-permanent versions.

Greater coverage from the air

The range of radiomonitoring systems depends on the frequency used and a number of physical constraining factors. This is why operators set up their stationary installations at high elevations and equip them with tall antenna masts to extend their range as far as possible. It is also why they operate monitoring vehicles.

Radiomonitoring systems in airborne platforms such as the one from Rohde&Schwarz cut through these kinds of limitations. Compared to stationary or mobile systems on the ground, they offer a number of critical advantages:

- Unobtrusive monitoring of large territories thanks to the extensive interception range (Fig. 2)
- Easy monitoring in hard-to-reach areas such as the open ocean, mountainous or wooded terrain and deserts
- Rapid redeployment to different operating locations
- Easy tracking of objects from the air, under almost any weather conditions and at any time of day or night

Versatility

Depending on the operational objective and the aircraft type, the airborne radiomonitoring system can operate at altitudes ranging from a few hundred meters to several kilometers above ground level and is suitable for speeds from approx. 140 km/h up to 325 km/h. It can be used to conduct brief sweeps of small areas or prolonged sweeps of extensive areas. A civil aircraft type was selected to carry the Rohde&Schwarz system described here.

Prolonged sweeps of wide areas are generally conducted with the aim of intercepting signals from a long distance for subsequent evaluation in a central office or of scanning a large territory for specific radio emissions. Short missions, by comparison, are confined to a limited area and conducted to identify the specific location of known radio signal sources and track them, often in collaboration with task forces on the ground. Scenarios typically involving radiomonitoring from the air include border protection, policing, emergency services, counter-terror or counter-piracy operations, and the protection, supervision and support of task forces on the ground.

A closer look at the airborne radiomonitoring system from Rohde&Schwarz

The new DA42M-NG COMINT system is an EASA-certified, powerful and cost-efficient airborne radiomonitoring solution. Fitted with the latest radiomonitoring and radiolocation equipment from Rohde&Schwarz, the aircraft is capable of intercepting and analyzing signals reliably.

Fig. 1 The flight plan is entered in the flight management system computer.

Thorough mission planning – a prerequisite for effective signal interception

Effective use of airborne COMINT systems calls for thorough planning. The air route and altitude, the start and duration of the operation, and the parameterization of the sensor systems installed in the aircraft need to be defined and coordinated with the crew prior to takeoff. This is done according to the task in hand as well as other factors such as the operational and threat situations, the carrier platform's technical specifications and the monitoring sensors on board.

The pilot must then record the flight parameters in a detailed flight plan which is usually entered directly into the plane's flight management system (Fig. 1). This makes it easier for the pilot to watch the surrounding airspace during the flight and to follow the flight plan. Prior to takeoff, the operator transfers specific configuration files to the on-board radiomonitoring systems containing instrument settings previously prepared in the central office on the ground. This sets up the equipment for the planned mission and ensures that the systems are immediately ready for use following takeoff.

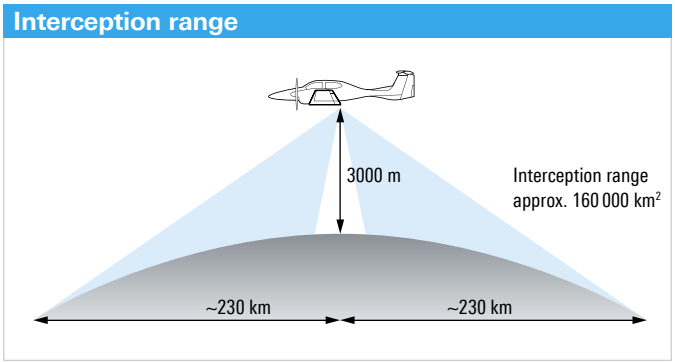

Fig. 2 An airborne radiomonitoring system has greater coverage, substantially increasing the signal interception range.

Photo: Author

Fig. 3 The aircraft fitted with the DA42M-NG COMINT system (above). In the standard version, the R&S®ADD107 and R&S®HE500 antennas and the FLIR UltraForce 350 camera are mounted externally (right).

A multipurpose airborne platform

The airborne platform is based on a special variant of the DA42, a twin-engine aircraft made by Diamond Air, an Austrian aircraft manufacturer (Fig. 3). The DA42M-NG, also known as a multipurpose platform (MPP), was specially prepared by its manufacturer for the installation of electronics systems in order to minimize the noise and infrared signature in operations. Thanks to the aerodynamic design of its carbon-fiber fuselage and its two fuel-efficient engines, the plane is economical to operate, allowing prolonged sweeps over extensive areas. The system operator's station is immediately behind the pilot's seat.

A scalable monitoring system optimized for airborne platforms

The standard version of the DA42M-NG COMINT system can perform direction finding on radio signals in the frequency range from 20 MHz to 1300 MHz. It is capable of intercepting and monitoring up to four radio signals between 20 MHz and 1300 MHz concurrently while digitally recording intermediate frequency signals across a wide band for later evaluation on the ground. Fitted to the belly of the aircraft are an R&S®ADD107 compact DF antenna and an R&S®HE500 broadband active receiving antenna (Fig. 3). An R&S®DDF255 digital direction finder and an R&S®ESMD wideband monitoring receiver are installed in the rear section of the aircraft (Fig. 4). IF signals are recorded on an R&S®GX460 (AMREC) digital wideband storage device installed in the nose (Fig. 5). A high-precision inertial navigation system, also installed in the nose, provides the information on the aircraft's position and attitude needed for radio direction finding (Fig. 5). During monitoring flights, the system operator controls the equipment using the R&S®RAMON COMINT/CESM software. This software runs on a ruggedized laptop installed on the back of the pilot's seat and enables the operator to observe and analyze received radio signals continuously. A separate, high-resolution display allows the operator to arrange the system software's control and information windows efficiently and ergonomically (Fig. 6).

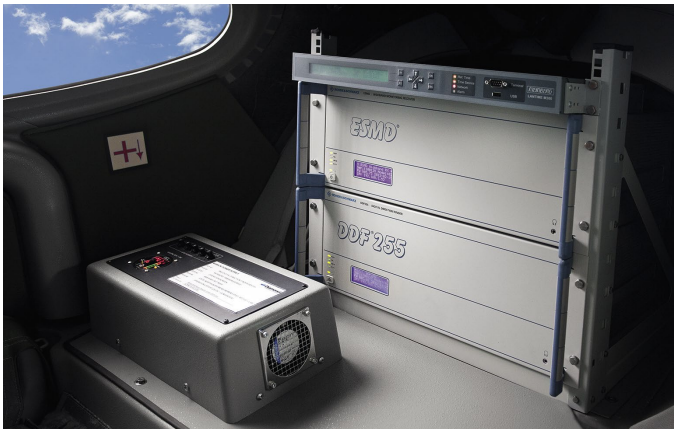

Fig. 4 The R&S®DDF255 digital direction finder and the R&S®ESMD wideband monitoring receiver.

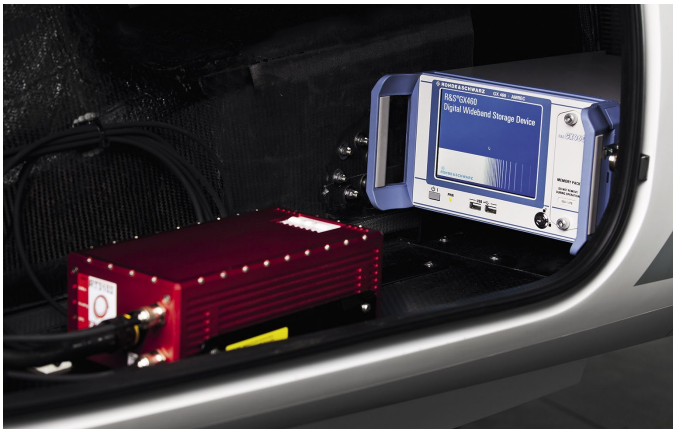

Fig. 5 The R&S®GX460 (AMREC) digital wideband storage device, installed behind the inertial navigation system.

Expansion options and equipment variants

A high-performance camera can be added to the standard DA42M-NG COMINT system. In combination with the radio signal locating equipment, this add-on enables the system operator to visually identify and track objects at distances of up to several kilometers — even in complete darkness, thanks to thermal imaging.

The system can be equipped with a secured radio data link which, if required, can automatically set up a direct microwave link to a ground station or, alternatively, a data link via a satellite. This provides the aircraft with a reliable connection to a ground station or to another similarly equipped aircraft — to enable simultaneous signal location, for example.

R&S®GX435, which supports enhanced, fully automatic signal detection and classification, can be incorporated to multichannel signal analysis perform on complex radio emissions from the air. For users who need radiomonitoring capabilities for satellite communications systems, equipment variants are available based on the R&S®GSA family of satellite monitoring products (Fig. 7).

Professional system integration and customer-specific system design

The Rohde&Schwarz radiomonitoring system for airborne platforms comes with a comprehensive service package provided in collaboration with well-known, certified aircraft manufacturers and integration partners, who help ensure that systems are installed in aircraft according to professional standards. Once the systems have been installed, the aircraft are certified by the partner organizations. Certification is conducted specifically for each carrier platform and each specific project in line with current regulations governing civil and military aviation.

Fig. 6 The operator's station.

Monitoring satellite communications

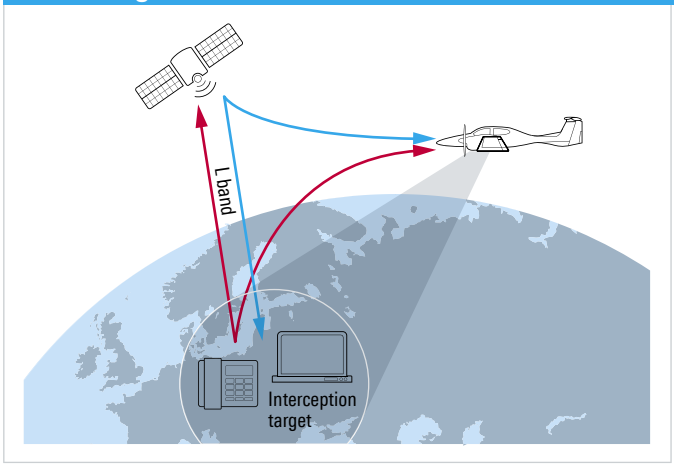

Fig. 7 Using an airborne radiomonitoring system to monitor satellite communications.

Besides custom radiomonitoring systems such as the DA42M-NG COMINT, other customer-specific systems are also available. Rohde&Schwarz offers a variant for non-permanent use in specially equipped aircraft (Fig. 8). This enables users to operate the system inexpensively and on a flexible basis in a plane or helicopter, a vehicle or in a stationary installation. Another advantage is that aircraft can be re-equipped for other applications quickly and easily when the system is removed.

Summary

Rohde&Schwarz radiomonitoring systems in airborne platforms open up a wide range of potential applications. Besides the integrated DA42M-NG COMINT system described here, the company can supply non-permanent and customized aircraft-installed systems that are certified for civil and military aviation.

Henrik Rausch

More information
- Rohde&Schwarz equipment and systems: http://www.2.rohde-schwarz.com (search for type designation)
- Manufacturer information from Diamond Air on the DA42M-NG platform http://www.diamond-sensing.com/index.php?id=2240
- Manufacturer information from FLIR on the optional high-resolution camera system http://gs.flir.com/surveillance-products/ultraforce-350hd
- Manufacturer information from SCOTTY on the optional data transmission system http://www.scottygroup.com/scotty_diamond_da42mpp

Condensed data of the DA42M-NG COMINT

Crew	1 pilot, 1 operator
Standard equipment	R&S®DDF255 digital direction finder, R&S®ESMD wideband monitoring receiver, R&S®GX460 (AMREC) digital wideband storage device, R&S®RAMON COMINT/CESM software
Optional add-ons	FLIR Ultraforce 350 camera system, R&S®GX435 multichannel signal analysis, R&S®GSA family of satellite monitoring systems
Signal interception range	up to 300 km [1]
DF accuracy	typ. 5° RMS [2]
Operating altitude	up to 5500 m above sea level (FL180)
Operating speed	approx. 140 km/h to 325 km/h (75 KIAS to 176 KTAS)
Flight duration	up to 12 h, typ. 6 h to 8 h [3]
Range	up to 2000 km, typ. 1000 km [3]

1) The signal interception range depends, for example, on the frequency, the aircraft altitude and the transmitter's signal strength.
2) The DF accuracy depends, for example, on the frequency as well as the system calibration and where and how the system is installed. Accuracy can be improved by calibrating the system.
3) The maximum flight duration and range can vary due to a number of factors, including altitude and speed.

Fig. 8 Example of a radiomonitoring system for non-permanent installation in an aircraft.