



Flight Calibration Services

# Flight Validation and Flight Inspection of IFR Helicopter Procedures

Information and Fact Sheet





# A New Approach for Flight Validation and Flight Inspection

## The Challenge

The lack of a smooth process for introducing IFR helicopter procedures hampers helicopter operations in many countries. While in special cases helicopters may use available IFR procedures designed for fixed wing aircraft (such as ILS), dedicated IFR procedures are clearly needed for operations such as EMS, government, oil rig supply and other special mission users. Liability issues inherent to procedure design and publication, as well as high regulator (CAA) involvement, make IFR procedure publication a complex and often costly process. The same applies for the assessment of navigation performance and other safety-critical aspects such as database integrity, communication coverage and GPS performance during commissioning Flight Inspection and Flight Validation, which are prerequisites for publication of any IFR procedure according to ICAO requirements. This has been recognized at the European level, and implementation programs such as GSA EGNOS and SESAR PROuD have been established to accelerate the introduction of LPV procedures, including those for helicopters, within Europe.

## The Project

Since the end of 2014, Switzerland has begun introducing a "low flight network" (LFN) in mountainous terrain using Point-in-Space (PinS) procedures and approaches to hospitals for a country-wide, all-weather, Helicopter Emergency Medical Service (HEMS). RNP 0.3 (Required Navigation Performance) and PinS procedures are typically Localizer/Vertical Performance (LPV), equivalent to APV/SBAS (Approach Procedures with Vertical guidance /Space Based Augmentation). The first RNP-AR procedures are planned to be introduced in the 2016/2017 time frame.

A co-operation between the Swiss Air-Rescue Operator, Rega and FCS Flight Calibration Services GmbH resulted in a project to specially equip an AgustaWestland AW109SP helicopter with an Automatic Flight Inspection System, the AD-AFIS-220H, which was completed and certified in late 2014. A second AW109SP will be equipped as a backup aircraft and deliver improved operational flexibility in 2016. Additional project stakeholders are the Swiss Air Navigation

Institute (ANI), skyguide, the Swiss Air Force (SAF), and the Swiss Federal Office of Civil Aviation (FOCA).

## The Platform

The AgustaWestland AW109SP Da Vinci helicopter used for Flight Validation has the following specifications:

### Helicopter data

- MTOW 7,000 lbs
- Max. speed: 168kts; max. range 932 km (503NM)
- Retractable landing gear
- IFR equipped, dual instrumentation including dual primary GNSS receivers and dual Genesys Aerosystems IDU- 450 EFIS/FMS



- RNP 0.3 performance, approach angle up to 9°
- Quick Access Recorder with full ARINC 429 / RS-232 FMS data interface

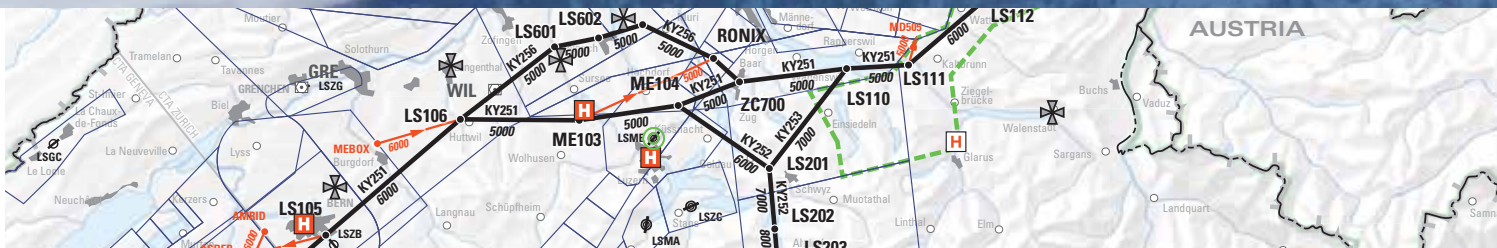
### Flight inspection system (FIS) interfaces:

- Separate VHF/UHF antenna interface
- Separate L1/L2 GPS antenna
- Quick locking stretcher base for Flight Inspection System installation
- 800 W available power

### Certification

- Certified by Rega's engineering department under EASA authorisation.





### Flight Inspection System – the “HeliFIS”

With the focus of Flight Inspection being on GNSS and SBAS performance, interference detection and communication coverage assessment with low measurement uncertainty, a certified high end Flight Inspection System complying with both international and national standards is required. The HeliFIS provides essential features such as a highly accurate positioning system, corrections for antenna data and lever arms, and compensation for cable losses. It was decided to use the Aerodata AD-AFIS-220 Flight Inspection System, as installed in FCS’s King Air 350 Flight Inspection aircraft, in a special configuration for helicopter

operations. The system records all necessary flight parameters including attitude, position and acceleration at 10Hz and achieves a position accuracy of better than



0.2m, with angular uncertainties better than 0.1°, using a differential GPS, INU-supported hybrid truth system which is fully independent from primary avionics. The use of existing software reduces both the certification and training effort. A major challenge was to design a rack certified for both extremely high ‘g’ loads while using a quick-locking mechanical interface with the helicopter’s stretcher base unit for quick installation and removal to revert to the EMS role.

### Flight Validation and Flight Inspection Process

The process, from initial procedure planning to final Flight Validation and Inspection requires highly effective project management. In addition to Jeppesen coding the new procedures into the pre-production ARINC NAV database and Genesys Aerosystems supplying the binary FMS database, the process involves ANI procedure designers, GNSS and communication coverage simulation experts, Rega’s Flight Validation pilots and the FCS Flight Inspection team. Following confirmation that the PinS and LPV procedures provide satisfactory and safe performance, and Flight Validation and Inspection reports are issued, the final formality is publication of the procedure in the national AIP.

### Future Applications

The HeliFIS equipped AW109SP lends itself to a wide range of additional applications such as Flight Inspection of Precision Approach Path Indicators (PAPI), Helicopter Visual Segment Approach Lighting Systems (HALS) and Precision Approach RADAR (PAR) installations with high approach angles such as those found in mountainous terrain. Even the certification of flight guidance systems is within the scope of applications due to the extremely precise and independent position reference system. A further application is the coverage evaluation of a VHF emergency radio communications network operated by Rega and covering the whole of Switzerland.

The combined experience of FCS Flight Inspection and Rega’s HEMS operation define a new standard for Flight Inspection and Flight Validation of helicopter IFR procedures.



## FCS Flight Calibration Services GmbH

Hermann-Blenk-Straße 32 A  
38108 Braunschweig  
Germany  
Tel.: + 49 531 23777-0  
Fax: + 49 531 23777-99

E-Mail: info@flightcalibration.de  
Web: www.flightcalibration.de  
www.fcs.aero

A joint venture of DFS, skyguide and Austro Control

## Technical Data AD-AFIS-220H Helicopter Flight Inspection System



### General

- Data acquisition rate: 10Hz for all parameters
- Online evaluation (standard); optional post flight evaluation
- ASCII data available for all phases of flight.

### Positioning Reference (Truth System)

INS with carrier phase DGPS

Parameter	Measurement Uncertainty (2 sigma)	Parameter	Measurement Uncertainty (2 sigma)
Latitude	< ±0.2m three-dimensional	Pitch angle	0.1°
Longitude		Roll angle	0.1°
Altitude		True heading	0.4°

Note: Measurement uncertainty INS with Wide-Area DGPS (Omnistar VBS); normally used for en-route inspections is less than ±2.4m horizontal

### FIS FMS

The HeliFIS is equipped with an internal, RF-leg capable FMS for error calculation against the reference flight path.

Parameter	Remark
TSE	Crosstrack
NSE	Crosstrack, alongtrack, absolute
Distance to next WP	In WP list
True course to next WP	
Vertical path angle	

### Communications

VHF/UHF Parameters	Measurement Uncertainty	Remarks
Power density / field strength	±3dB	VHF and UHF COM bands
Audio		Demodulation and recording

### GNSS / SBAS

The HeliFIS is equipped with a GNSS/SBAS engineering receiver and a TSO approved aircraft GNSS/SBAS receiver. Error calculations are available for all positions.

Parameter	Remark
Position	Lat, Lon, Alt
Protection level	Horizontal and vertical
FOM	Horizontal and vertical
No. of visible / tracked Sats	
Sat elevation and azimuth	
Sat PRN and CNR	
Sensor operational mode	
DOP	H, V, P, G
MT event	For 2 SBAS SVs
RAIM faults	
SBAS horizontal error	
SBAS vertical error	

