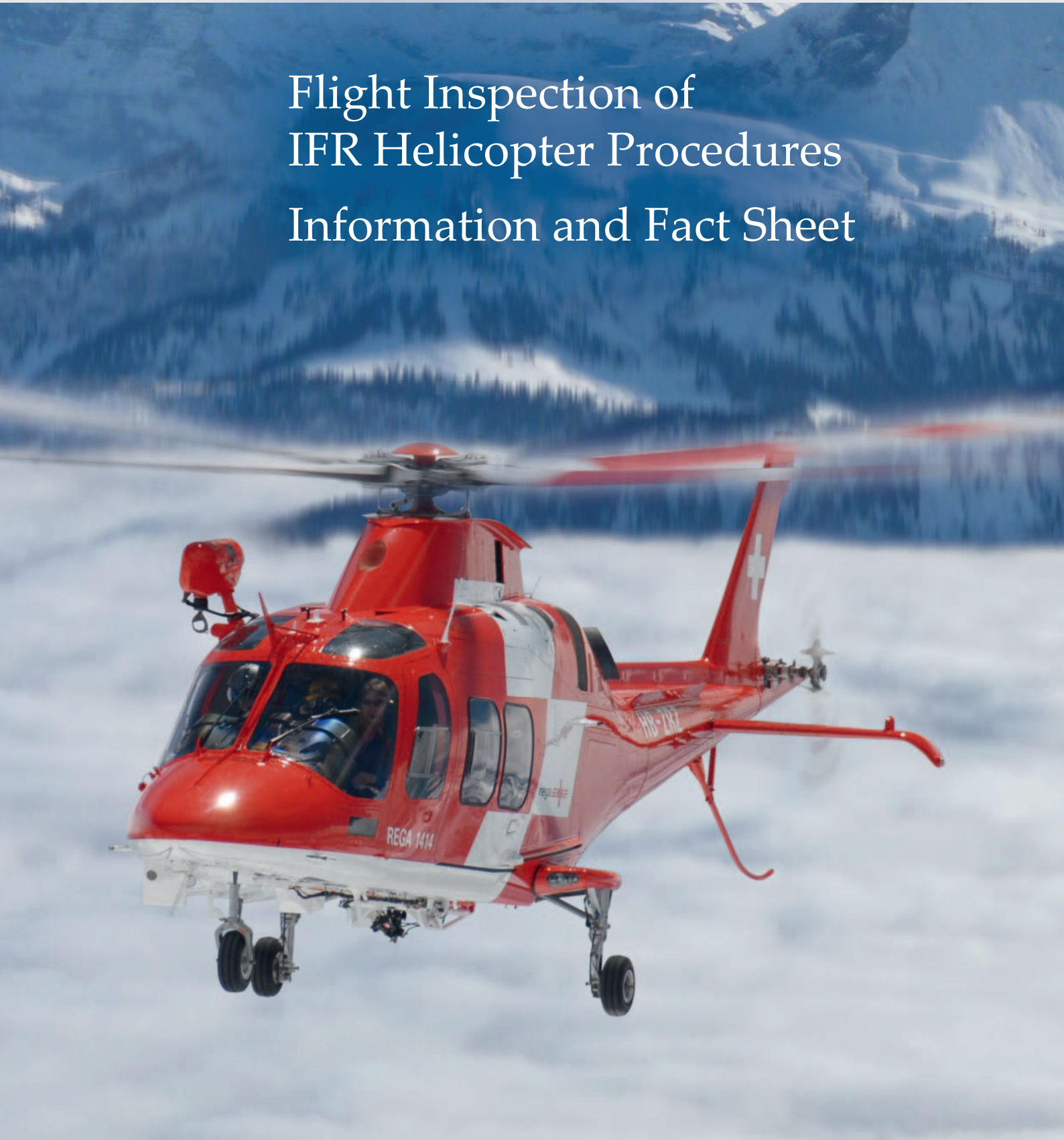
rega

Flight Calibration Services

Flight Inspection of IFR Helicopter Procedures

Information and Fact Sheet

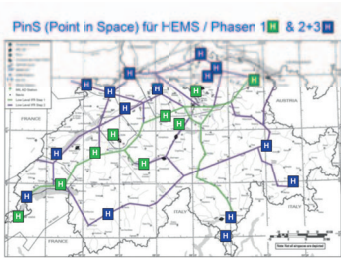


A New Approach for Flight Inspection and Flight Validation

The Challenge

The lack of a smooth process for introducing IFR helicopter procedures hampers helicopter operations in many countries. Whilst in exceptional cases helicopters may use available IFR fixed wing approach procedures (such as ILS), dedicated IFR solutions are clearly needed for operations such as HEMS, government services, oil rig suppliers and other special mission user groups. 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 issues such as communication coverage and database integrity during commissioning flight inspection and flight validation, which are prerequisites for any IFR procedure publication according to ICAO requirements.

The Project



Switzerland will introduce a "low flight network" (LFN) in mountainous terrain with Point-in-Space (PinS) procedures and approaches to hospitals for a country-wide all-weather Helicopter Emergency Medical Service (HEMS). Required Navigation Performance (RNP) is 0.3NM and PinS procedures are mainly Approach Procedures with Vertical guidance (APV) with Space Based Augmentation (SBAS). A cooperation between the Swiss Air-Rescue Operator Rega and FCS Flight Calibration Services GmbH resulted in specially equipping an AgustaWestland AW109SP helicopter with a flight inspection system to analyse the LFN network. Further stakeholders are the Swiss Air Navigation Services (skyguide), the Swiss Air Force (SAF), and the Swiss Federal Office of Civil Aviation (FOCA). The first test flights are scheduled for the second half of 2014.

The Platform

The AgustaWestland AW109SP Da Vinci helicopter earmarked by Rega for the flight inspection task has the following technical specifications:

Rotorcraft data

- MTOW 7,000 lbs
- Max. speed: 168kts; max. range 932 km (503NM)
- Retractable landing gear
- Dual instrumentation and commands, IFR equipped, including 2 primary GNSS receivers and 2 Chelton 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:

- VHF/UHF antenna interface
- Third 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 behaviour, SBAS parameters, interference detection and communication coverage with low measurement uncertainty, a certified high end flight inspection system complying with both international and national standards is required. This provides essential features such as a high accuracy positioning system that operates independently from primary avionics, 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 modules used in the regular FCS fixed-wing King Air 350 aircraft, reconfigured with the parts necessary for helicopter flight inspections. The system records all flight parameters including angles, position and acceleration at 10Hz as well as position accuracy < 0.2m with an angular uncertainty of 0.1° to its differential GPS, INU-supported hybrid truth system. The use of existing software reduces the certification effort. Aerodata also resolved the major challenge to design a small, quick install FIS rack, certified for extremely high g loads. The FIS rack's mechanical interface is a quick-locking device for the helicopter's stretcher base unit. A summary of the technical data is provided overleaf.

Flight Validation and Flight Inspection Process

The flight inspection process as a whole requires highly effective project management. Apart from Jeppesen as the data house including the new test procedures in the ARINC database and Chelton supplying the binary FMS database, this involves skyguide procedure designers, GNSS and communication coverage simulation experts, Rega's flight validation pilots and the FCS flight inspection team. Once proof has been obtained for the full functionality of PinS and APV SBAS procedures and subsequent documentation has been supplied, the last formal act is publication in the national AIP.

Future Applications

The specially equipped AW109SP lends itself to a wide range of other applications such as calibration of precision approach indicators (PAPI), helicopter visual segment approach lighting systems (HALS) and the calibration of precision approach RADAR (PAR) systems, e.g. for high angle airport approaches in the mountains. Even the certification of flight guidance systems is within the application scope due to the extremely precise independent HeliFIS reference system. A more tangible application is the coverage evaluation of a VHF emergency radio communications network operated by Rega that covers the whole of Switzerland.

The combined synergetic experience of FCS flight inspection and Rega's HEMS services offer a perfect new approach to flight inspection and flight validation.

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 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	

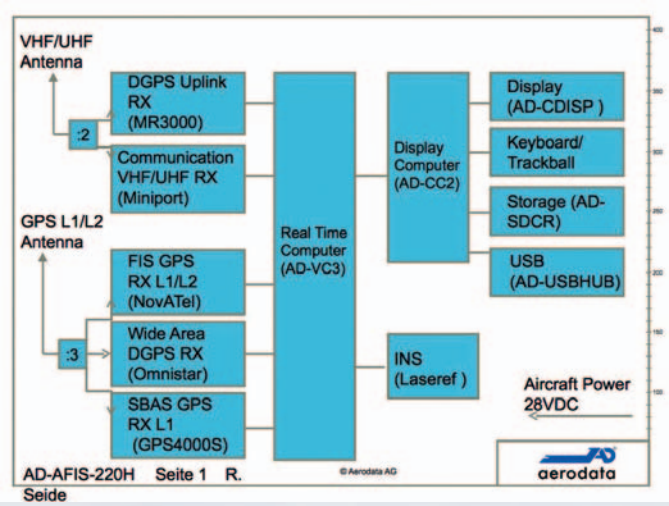
Communications

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	



rega
FCS Flight Calibration Services
aerodata precision in special mission
chips coordination