

GARDEN GNSS-based ATM for Rotorcraft to DEcrease Noise



State of the art – Background

Elaborating and implementing eco-friendly initiatives and research programmes has never been so high on the agenda of the aviation industry stakeholders. Working towards greener skies, the European Commission has created jointly with the aviation industry the CleanSky Joint Undertaking to develop technologies aiming to mitigate the impact of air transport on the environment.

At the same time, the demand for rotorcraft operations is expected to grow in Europe especially for medical and passenger transport. Increasing rotorcraft operations should thus take care of environmental impact as well as developing specific procedures not interfering with existing aircraft traffic at airports. In this context, Global Navigation Satellite System (GNSS) guidance is a key solution as it enables accurate navigation capability on isolated platforms and steep approaches with reduced noise footprint.

One of the initiatives launched by CleanSky JU in this perspective is the GARDEN project. In the aim to obtain additional expertise and support in this framework, CleanSky JU selected through a Call for Proposals process an ad-hoc consortium of experts led by Egis Avia and gathering the French Direction Générale de l'Aviation Civile, Pildo Consulting, and CGx AERO.

Objectives

The GARDEN project consists in developing new IFR flight procedures based on the use of GNSS and enabling rotorcraft to reach busy airports fully independently of the airplane traffic operating from or to active runways. Thanks to a strong coordination with the "Environment Friendly Flight Paths" projects GRC-5 TP3 & TP7 of CleanSky Green Rotorcraft Integrated Technology Demonstrator (GRC-ITD), the design of the new IFR procedures will be based on low-noise flight paths.

The objectives that will be achieved in the frame of this project are to:

- Identify and analyse the existing regulation for helicopter operations based on GNSS;
- Define new Instrument Flight Rules (IFR) operations for rotorcraft relying on GNSS guidance with the related safety assessment;
- Define generic IFR procedures minimising noise footprint and allowing rotorcraft to reach or

depart from airports independently from the fixed-wing aircraft traffic (called SNI – Simultaneous Non Interfering procedures);

- Perform in-flight demonstrations at a medium airport with commercial traffic (Toulouse Blagnac);

- Provide expert support to CleanSky Green Rotorcraft project GRC-5/TP3 for developing and testing low noise rotorcraft-specific IFR procedures.

Description of work

The GARDEN project is structured in five main Work Packages (WPs):

- WP1 – Regulations Baseline: this first activity encompasses the inventory of existing regulation criteria applicable to rotorcraft GNSS IFR procedures and SNI operations.

- WP2 – Generic Green Procedures: this second part of the activities consists in the definition of guidance material for designing IFR low noise procedures (approaches, departures and low level routes) for rotorcraft operations. IFR procedures design is based on noise optimised flight paths provided by GRC-5. A safety analysis for the use of these procedures in a Simultaneous Non Interfering context is conducted in parallel.

- WP3 – Procedure Implementation and Validation: this third part of the activities consists to use the generic procedure guidelines (WP2 outputs) to design and implement low noise IFR procedures at two specific sites. The first site is Toulouse Blagnac airport (France) to assess Simultaneous Non Interfering (SNI) Rotorcraft – Aircraft operations. The second site is the airport of La Seu d'Urgell (Spain) to consider specific constraints related to urban and mountainous areas. In both cases, the focus is made on environmental impact in terms of noise footprint minimisation. An implementation of Low level IFR route in vicinity of urban areas such as for the purpose of medical transport is also proposed in the frame of the design.

- WP4 – Demonstrations: this part of the activities consists to achieve a concrete implementation of low noise IFR procedures through in-flight demonstrations. These In-flight demonstrations will be conducted by Airbus Helicopters at Toulouse airport. The noise footprint will be predicted by GRC-5 TP3 using a validated noise prediction tool. The efficiency of green rotorcraft

procedures at medium airport will be validated through the flight demonstrations.

- WP5 – Disseminations: In addition to the information exchanges with GRC-5 TP3, the regulation analysis and design criteria for low noise IFR rotorcraft procedures proposed by GARDEN will be disseminated to relevant rulemaking bodies such as EASA and ICAO. The achievements of GARDEN will be presented in a User Forum organised around October 2015 after the completion of the in-flight demonstrations. Additionally to GARDEN, a focus will also be made on results obtained in the frame of the CARE project (Curved Application for Rotorcraft Environmental enhancements).

Expected results

a) Timeline & main milestones

GARDEN project started in January 2010 and lasts 5 years and a half.

Analysis of regulations and proposals for evolutions (WP1) has been completed since mid-2011..

WP2 dealing with generic low noise IFR procedures is completed: guidance material for designing rotorcraft IFR Simultaneous Non Interfering (SNI) procedures minimising noise disturbance has been finalised in April 2012. The related safety assessment lasted until mid-2013.

Procedure implementation and validation (WP3) started in 2013 and is under finalisation. The procedures to be flown in Toulouse airport mid-2015 have been refined after an iterative process with a local safety study.

b) Environmental benefits

Noise minimisation of IFR procedures is the main challenge tackled by the GARDEN project. Indeed, rotorcraft IFR procedures that are considered are related to departures, approaches and low level routes flown close to the ground and consequently, could disturb local residents if no precaution taken. GARDEN gives high priority in reducing noise footprint by designing flexible

rotorcraft specific IFR procedures using steep slope flight profiles and avoiding most noise sensitive urban areas.

c) Maturity of works performed

At regulatory level after having achieved the comprehensive survey of all existing regulations for IFR procedures design, the following conclusions can be drawn:

- Current Instrument approach procedures are optimized only for fixed-wing aircraft.

- Required adaptations of ICAO design criteria to achieve efficient and environment friendly IFR rotorcraft operations have been identified.

- PinS (Point in Space) concept is essential for successful implementation of environment friendly SNI approaches and departures. SNI criteria developed in GARDEN are complying with the existing provisions accepted at ICAO level for fixed-wing aircraft independent simultaneous approach and departure procedures.

The regulatory work has been presented by Egis Avia and Airbus Helicopters during the 5th EASA rotorcraft symposium held on the 7th and 8th of December 2011.

The safety study for those operations was conducted following a 3-step approach:

- Firstly, it allowed to analyse in depth the Steep LPV approach and PinS LPV approach concepts, or a combination of both;

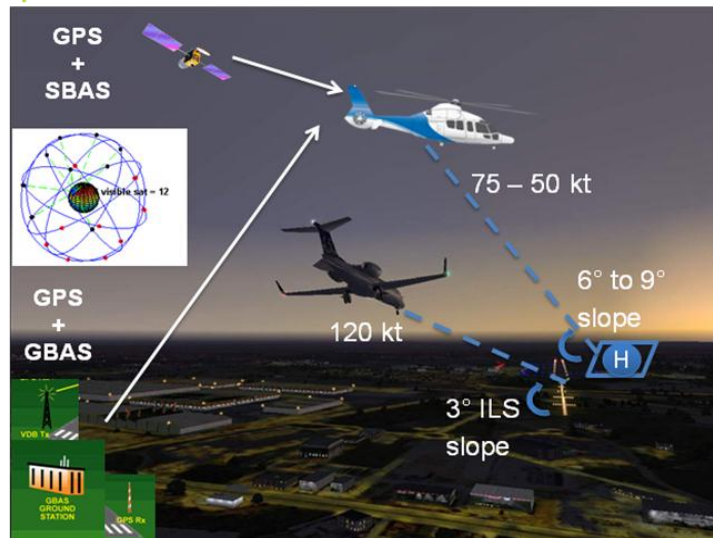
- Then, before completion of the safety assessment of the SNI operations, it was important to define the operational model of SNI aircraft-rotorcraft operations based on GNSS;

- Finally, The impact of the implementation of such procedures on the air traffic system has been addressed through the safety assessment of the SNI operations.

A presentation of the GARDEN safety activities has been delivered by Egis Avia and Airbus Helicopters at the 7th EASA Rotorcraft Symposium on Dec. 5, 2013.

The SNI concept

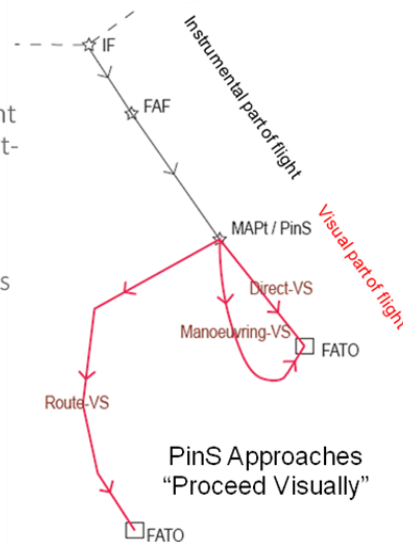
- ▶ Simultaneous Non Interfering procedures allow rotorcraft to approach / depart independently from fixed wing traffic
- ▶ SNI is also key enabler to achieve low noise rotorcraft operations at airports
 - ▶ Conventional ILS procedures are not adapted for rotorcraft noise reduction



Presentation of the SNI Concept

The PinS concept

- ▶ The PinS concept consist to fly under instrument meteorological conditions (IMC) to/from a Point-in-Space (PinS) in the vicinity of the landing/departure site
- ▶ The segment joining the PinS and the landing/departure site is flown visually but does not require VFR minima
- ▶ PinS procedures allow IFR flights to/from non IFR sites (aerodromes, heliports, helidecks)
- ▶ For approaches, the PinS is also the Missed Approach Point (MAPt). When arriving at the PinS (MAPt), 2 possibilities:
 - ▶ The pilot can see the FATO → Proceed Visually
 - ▶ The pilot cannot see the FATO → Missed Approach



Presentation of the Point in Space Concept

Project Summary

Acronym : GARDEN
Name of proposal: GNSS-based ATM for Rotorcraft to DEcrease Noise
Technical domain: IFR Rotorcraft Procedures
Involved ITD Green Rotorcraft
Grant Agreement: 255886
Instrument: Clean Sky
Total Cost: 586 770€
Clean Sky contribution: 370 231€
Call: SP1- JTI-CS-2009-01
Starting date: January 2010
Ending date: June 2015
Duration: 66 months
GRC-5 Topic Manager: Philippe Rollet

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