GARTEUR GROUP FOR AERONAUTICAL RESEARCH AND TECHNOLOGY IN EUROPE

FRANCE GERMANY ITALY THE NETHERLANDS SPAIN SWEDEN UNITED KINGDOM

HC/AG-24: Helicopter Fuselage Scattering Effects for Exterior/Interior Noise Reduction

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Background

A negative undesirable by-product of the helicopter during its operation is noise generation. Both the main and the tail rotors (including Fenestron) of a helicopter are major sources of noise and contribute significantly to its ground noise footprint. With rising concern for environmental issues and increasingly stringent noise regulation, helicopter noise has gained importance in comparing with performance, safety and reliability.

The main research effort in the past was concentrated on the helicopter rotor noise generation and the reduction of the noise. Extensive work, both theoretical and experimental helped to deepen the understanding of the noise generating mechanisms. Even though the scattering of noise generated by helicopter rotors has been recognized as a significant influence on the noise spectra and directivity, the research effort towards the scattering of noise, especially the scattering of tail rotor noise has not been studied extensively.

To accurately predict the effective helicopter external noise under the influence of the fuselage, advanced analysis tools that overcome the so-called free-field limitation of classical acoustic analogy methods are required. For this purpose, validations of the tools with the experiment data need to be conducted. Until now little activities for generating such database for validation are conducted. Moreover, the evaluation of the scattered acoustic field is of interest for the prediction of the internal noise in the fuselage and its vibrations that, in turn, are a source of interior noise. In addition, the possibility to develop and install acoustically treated panels (liners) on some parts of the fuselage and thus estimate the effect of a wall impedance on the external noise levels, require a particular care in the choice of the wave model. Concerning the helicopter interior noise, vibro-acoustic numerical analyses of different physical sophistication levels require the accurate knowledge of the acoustic pressure distribution on the external skin of the fuselage, and this can be only predicted through an accurate external noise computation.

Programme/Objectives

Objectives

The present research work will address noise propagation in presence of the fuselage. The principal objective of HC-AG24 is then to promote activities to:

- establish unique quality database - for unsteady scattered acoustic pressure on the fuselage and in the far field as well as flow field, including flow refraction and convection effect;
- validated prediction design tools for main and tail rotor noise under influence of fuselage - including main/tail rotor interactions;
- proof of rotor noise reduction through adding acoustic absorbing liner on the part of fuselage.

The timescale for the project is two years during which the following topics are to be addressed:

- Investigate the capability and reliability of tools capable of predicting the effects of noise scattering problems;
- Perform computations of numerical benchmark cases and incorporation of the convective flow effects;
- Study the possibility to account for a surface impedance;
- Define representative test cases for generating a data base with a generic configuration, including sound pressure and flow field data

The work programme is structured in three work packages:

➢ WP 1: Simulation on the acoustic scattering effect

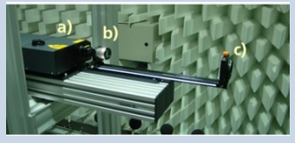
- Code adaptation & prediction
- Code validation & improvement of prediction tools
- Evaluation of noise scattering of various components using validated codes

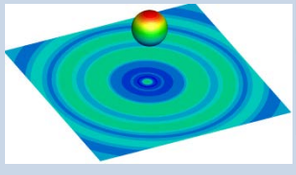
➢ WP 2: Wind Tunnel Tests & Synthesis

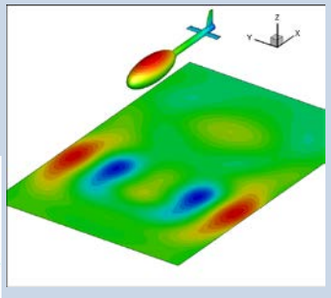
- Model preparation
- Test preparation
- Model setup and installation
- Test matrix & instrumentation
- Test conduct
- Test data compilation & distribution
- Test data analysis

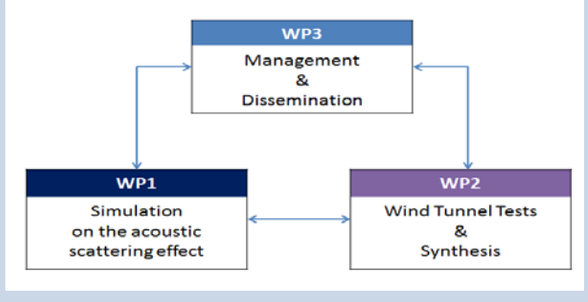
➢ WP 3: Management & Dissemination

- Action group Management
- Exploitation & Info dissemination
- Technology Implementation Plan (TIP)









Results

The action group started the activities in 1st of January 2015.

The kick-off meeting was conducted on March 21st to 22nd, 2015 in DLR Braunschweig. Following results will be achieved in first 6 month:

1. Description of available analytical, experiment test cases including database will be collected;
2. Specifications on the common simulation for the sphere scattering will be defined and the results of sphere simulation will be conducted by all partners. In addition the results will be compared in 6 month review meeting;
3. The size of the generical helicopter composed of simple geometric form will be defined.

Members of the HC/AG-24 group are:
(only contact persons are listed here)

M. Barbarino	CIRA (Vice Chairman)
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J. Yin	DLR (Chairman)
H. Brouwer	NLR
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