Project proposal template
Graduate School studentships
March 2015

Project title	íNoise Prediction and Reduction Method for Landing-Gear System
First Supervisor	Professor — Jian Wang
Second Supervisor	Dr Sing Lo
School	Aerospace and Aircraft Engineering
Other member of supervisory team (no more than three KU supervisors in total)	Dr Mohamad Askari
Specific requirements beyond 2:1 degree	Engineering graduates who are interested in acoustic analysis and computational modelling. Experience in wind tunnel testing is desirable but not essential.

Project summary

(max 4,000 characters)

The landing gear system of an aircraft comprises of a cavity (for storing the landing gear), pillar, tires and additional components. The landing gear cabin is a typical cavity structure, located at the bottom of the lower fuselage. The cabin, landing gear and other components together form a very complex system. During the take-off or landing stage, the landing gear system is one of the major sources of airframe noise, because of not only their existences, but also the independent motions during take-off and landing.

Flow pulsation around the landing gear and unsteady vortex shedding caused by flow separation lead to a dynamic pressure field around the landing gear and inside its cabin cavity. The dynamic pressure field appears as the turbulence broadband disturbance—the white noise. This phenomena results in a very unpleasant noise, unsteady aerodynamic loading and acoustic loading on the landing gear system as well as the structures around the landing gear system, which in turn leads to onset of the structural vibration of the system. Consequently, the landing gear system and surrounding components are exposed to structural vibration and fatigue damage problems.

In essence, the noise caused by landing gear system is the aerodynamic noise generated by pressure fluctuation, and therefore a reduction in the oscillation intensity of the airflow is beneficial to the reduction of airframe noise and structural vibration.

Further to the research outcomes of collaboration with Chinese colleagues and research conducted by them (supported by funding from Chinese government AVIC 2010ZA53011 and 2011ZA53013), the proposed project will further focus on the flow-structure interaction and pressure fluctuations around landing gear system. This is to primarily understand noise generation mechanism of comprehensive landing gear system by means of wind tunnel experimentation and numerical simulation methods. This project is aiming at an in-depth analysis and correlating the pressure fluctuations and near field noise, as well as determining the characteristics of near field noise spectrum for a complex landing gear-cavity configuration. Therefore, pressure fluctuation suppression and noise reduction methods can be attained through research on the effects of grill, net, hollow filling rectification, etc. using spectrum properties at specified monitoring points.

The target of the project is to accurately predict the aerodynamic and acoustic characteristics and to propose effective noise and vibration suppression control method and finally set foundation for a feasible low-noise double-wheel landing gear-cavity configuration.

The objectives of the projects are:

- Critical literature review to understand the state of the art
- CFD modelling to understand flow structure around the landing gear system
- Using the reverse BEM to characterise the noise source near field properties
- Designing and conducting wind tunnel test to verify and validate the numerical models
- Proposing a way to configure a feasible low-noise double-wheel landing gear-cavity