

## Summary of Professor Lixi HUANG's Sub-theme of 973 Program

In the national medium- to long-term development strategy for science and technology (2006-2020), large passenger aircraft is one of the 16 major national projects China has decided to embark upon. The proposed project responds to the 2011 call for fundamental research aiming at long-term technology development for flying vehicles. The project is inter-disciplinary in nature and the focus is the study of fundamental mechanisms by which excessive noise is radiated by large passenger aircrafts. Acoustic (noise) control is a major part in the overall flight certification process which all passenger aircrafts have to undergo before being launched into the world market. The criteria for noise control are becoming more and more stringent over the past decades, and they have become one of the bottle-necks for the launch of new prototypes. China has a reasonably strong research and production capability in military aircrafts but its capacity for passenger aircraft is currently weak. As a major part of the world economy, aviation is an area where China must take its own share.

Aircraft noise, and the associated science relevant to mechanical safety, has always been an inter-disciplinary subject and China has some way to go to become internationally competitive. It involves aerodynamics and a new branch of acoustics, together known as aeroacoustics, whose foundation was only laid in 1952 when Lighthill, a Lucasian professor at Cambridge University proceeding Stephen Hawking, published his famous acoustic analogy and for the first time introduced a rational basis for the understanding of why and how loud noise is made by high-speed jets, and how that can be modelled mathematically and eventually controlled. The mathematical and engineering tools available today are still insufficient to satisfy the industrial design needs, and a lot of efforts are being made in America and Europe with the development of their new passenger aircrafts with lower environmental noise tolerance. The proposed project will tackle all major aspects of aeroacoustics and aim to provide a solid basis for the rapid development of our own passenger aircraft now underway in Shanghai. There are five teams involved in the proposal,

- Beijing University of Aeronautics and Astronautics (PI)
- Tsinghua University
- Chinese Academy of Sciences (Institute of Acoustics and Institute of Mechanics, both in Beijing)
- Aviation Industry Corporation of China (Institute of Aircraft Material and Strength in Xi'an, and Commercial Aircraft Engine Co. in Shanghai)
- University of Hong Kong (Shenzhen Institute of Research and Innovation)

and five topics

- (1) Engine noise mechanisms and their control
- (2) Fuselage noise modelling and its control
- (3) Acoustic design of engine nacelle
- (4) Cabin noise control with consideration for aerodynamic loading
- (5) Turbulence modelling for computational aeroacoustics

The team of HKU-SIRI will coordinate project (2) and participate in 2,3 and 4.