COMPETITIVE AND SUSTAINABLE GROWTH PROGRAMME

AEROCHINA

PROMOTING SCIENTIFIC COOPERATION BETWEEN EUROPE AND CHINA IN THE FIELD OF MULTIPHYSICS MODELLING, SIMULATION, EXPERIMENTATION AND DESIGN METHODS IN AERONAUTICS

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CIMNE – DASSAULT AVIATION – EADS CRC - EADS M – AIRBUS – IUSTI UMR – INRIA – DLR – ERCOFTAC – UNIV. BIRMINGHAM – IFTR – INGENIA – ACTRI (CADI – NPU – CARIA – SARI – FIA – BUAA – TSINGHUA UNIV. – NUAA – ZHEJIANG UNIV. – PEKING UNIV. – CAAA)

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The aim of AEROCHINA work package 4 “Identification of future RTD activities” is to identify future joint RTD activities in the development and validation of mathematical models and the numerical and experimental methods and test cases necessary in the short/medium range for solving challenging multidisciplinary problems in aeronautics. This document states the results combining both European and Chinese subtask leaders’ reports in a comprehensive joint overview according to the three subtasks defined in the AEROCHINA description of work (DoW).

During the Open Seminar that took place in Xian in October 2006 a complete list of prospective activities from each partner was collected. Table 1 contains the information obtained from this list. Table 1 shows the identified future RTD activities of each partner in the development and validation of numerical methods for analysis and design that will be necessary in the short/medium range for solving challenging multidisciplinary problems in aeronautics. This identification has been used for the selection of the possible joint activities between partners for the short and medium future.

Table 1 also shows the working groups in which the prospective activities of each partner can be classified. The numerical code of the working groups corresponds to the following list:

- WG1: is a working group working on aero-elasticity.
- WG2: is a working group working on aero-combustion.
- WG3: is a working group working on aero-thermal flows.
- WG4: is a working group working on aero-vibro-acoustics.
- WG5: is a working group working on flow control.
- WG6: is a working group working on flight mechanics coupling.

Looking at Table 1, it can be seen the common interest areas were potential future RTD activities between European and Chinese groups could be established. Table 2 shows the potential partners that could be interested in the RTD activities corresponding to each working group.

Partner name	Physical Modelling	Numerical Modelling	Experimental Results	(Optimum) Design
CIMNE				Muldisciplinary design optimization (with uncertainties)
DASSAULT		- Micro and macro actuators for flow control. - Boundary layer separation. - Jet control. - Air inlet control	Additional experiments on AGARD 4456 with other angles of attacks	
EADS CRC			Release DEL-EADS-M Delta wing coupled CFD mechanics results.	Optimization inverse multi-point test case
EADS-M/DE		Flight mechanics coupling during manoeuvring		Multidisciplinary optimisation
AIRBUS		Data from REMFI project about wing deformation	Data from REMFI project about wing deformation	
IUSTI-UNIV. PROV.		- Combustion Processes in a Scramjet Engine - Shock wave impacts on deforming panel		
INRIA		Enabling technologies for integration of platforms in multidiscipinary applications		- Automatic differentiation - Coupling models of various fidelities - Multidisciplinary coupling - Robust optimization
DLR		Different techniques for shape optimization	Advanced optical and acoustical measurement techniques for industrial wind tunnels and flight research	Different techniques for shape optimization
ERCOFTAC		Development of a Framework for CFD Validation and Best Practice		
UNIV. BIRMINGHAM	Bibliographic research about materials		Bibliographic research about materials	
IFTR		Adaptive airbags	Adaptive airbags(actuators)	
INGENIA		- Numerical turbulence		

		modelling - Grid computing - Aeroelasticity - Multi-physics software integration		
ACTRI/AVIC1		- Enabling technologies for integration platforms in multdiscipinary applications - Perturbation field method of moving grid - Polynomial interpolation method between CFD and CSM grids		
CADI			Static aeroelastic loads release	Inlet design
NPU		Aeroelasticity	Flow control	
CARIA		- Flow simulation of synthetic jet - Aeroelasticity simulation of a wing	Dynamic test and manoeuvre simulation in low speed wind tunnel	- Optimum design of synthetic jet - Optimum design of aeroelasticity and aerodynamics
SARI		- Flow control of 2D cavity flow - Aeroacoustic study of cavity flow		
FAI		- Complex configurations - Full aircraft - High-lift device - Aircraft with icing		- Wing of regional aircraft - Winglet, body-wing fairing, fuselage, flap cowling
BUAA		- Flow control via Micro-Blowing technique - Enhanced micromixong in electro-osmotic microchannel flow		
TSHINGHUA UNIV.		- Flow noise control via micro-jet technique - Increasing mixong of supersonic shear layer - Flow characteristics in micronozzle	- Flow noise control via micro-jet technique - Increasing mixong of supersonic shear layer - Flow characteristics in micronozzle	

NUAA		- Mesh free methods for flows over complicated geometry - Testing inverse and optimization on multi element airfoils	- New actuators for flow control - Flow separation control for wings at high angle of attack - Flow control for forebodies at high angle of attack - MEMS based measurement techniques	- Robust design optimization for 2D drag reduction at transonic regime using Nash games and Pareto fronts - Parallel genetic algorithms and automated differentiation
ZHEJIANG UNIV.		- Development of an efficient combustion code to model turbulent combustion for subsonic and supersonic flows - Modeling scramjet engines - Modeling a lab-scale burner witn subsonic flows		
PEKING UNIV.		- Integration of a fast cell sparse solver in existing software - Modification of existing mesh generator for fitting with fluid mesh - Solution of the nonlinear aeroelasticity problem - Coupling of aeroelasticity problem		
CAAA		- Large eddy simulation of transitional and turbulent flow - New flap types for flap-wing at low Reynolds number - Control of separation flows around a slender body at large incidence		

Table 1. Identification of future multidisciplinary research developments for each partner.

Partner name	**Aero-elasticity**	**Aero-combustion**	**Aero-thermal**	**Aero-vibro-acoustics**	**Flow control**	**Flight mechanics coupling**
CIMNE	**X**	**X**				
DASSAULT	**X**					**X**
EADS CRC			**X**	**X**		
EADS-M/DE	**X**			**X**	**X**	
AIRBUS	**X**			**X**	**X**	
IUSTI-UNIV. PROV.		**X**	**X**			
INRIA				**X**		
DLR	**X**					**X**
ERCOFTAC	**X**	**X**		**X**		
UNIV. BIRMINGHAM				**X**		
IFTR				**X**	**X**	
INGENIA	**X**					
ACTRI/AVIC1	**X**				**X**	
CADI	**X**		**X**		**X**	
NPU	**X**	**X**				
CARIA	**X**					
SARI	**X**				**X**	
FAI	**X**				**X**	**X**
BUAA			**X**		**X**	
TSHINGHUA UNIV.		**X**			**X**	
NUAA	**X**			**X**	**X**	**X**
ZHEJIANG UNIV.	**X**	**X**				
PEKING UNIV.			**X**			
CAAA	**X**		**X**		**X**	**X**

Table 2. Identification of potential RTD collaboration areas between partners.