AeroPortal Brussels Workshop – FP7 Call 3

Engine Industry Management Group

Engine Industry Management Group

The EIMG:

- consists of representatives from each of the major European Aero-engine companies.
- meets regularly to exchange views and share research results
- provides a European aero-engine view on R&T programmes
- aims to maximise leverage of technology acquisition between partners in pre-competitive areas
- undertakes joint actions such as preparation and submission of project proposals to be carried out under European Commission contracts within the Research Framework Programmes
- works closely with AeroPortal SME to support the small and medium sized enterprises throughout Europe

Technology areas

- Mechanical systems (eg gearboxes, seals)
- Turbomachinary (eg compressors, turbines, fans)
- Materials
- Manufacturing
- Mechatronics (eg control systems, instrumentation)
- Low Emissions Combustion
- Noise

Mechanical Systems

MECASYS (Mechanical Engineering and Calibration of AeroSYStems)

To improve the integration and the virtual design/testing and develop innovative technologies on Variable vane system and power off take/gearbox system by

- Innovative design and new technologies using composite
- Advanced modelling
- Validation through testing and demonstration
- Update of design rules and practises for simulation

Turbomachinary (1 of 2)

FACTOR (Full Aerothermal Combustor-Turbine InteractiOn Research)

Build-in a database of test cases representative of HP turbine inlet conditions to validate 3D CFD and thermal codes and improve the numerical methodologies

- upgrade of one existing test rig with combustor simulator
- design and manufacturing of the test rig and turbine
- carry out tests with the highly instrumented test rig
- validate CFD using the available experimental data

Turbomachinary (2 of 2)

REALITY (Real Geometry Effects on Aerodynamics)

Considers the difference between the intended ideal design and the actual geometry (commonly called Real Geometry Effects, RGE) on compressors, turbines and structures

- effect of real geometry defects on performance, life and repairs
- more realistic non-conformance criteria and tolerance schemes
- probabilistic analysis and robust design
- CFD/CAD coordination and database management

Materials (1 of 2)

ClearCUT (Clearance Control of Utility Turbines)

Better prediction of rub-in behavior of seals leading to decreased clearances in seals, decreased failure rates in engines and improved diagnosis of failure events. Technologies to be studied include:-

- advanced seal modelling
- Innovative materials processing
- Validation through testing
- Updated best practises

Materials (2 of 2)

COMMAND (Composites: Optimal Manufacture and Methods for Advanced Numerical Design)

Development of design methods, and advanced manufacturing simulation capability for 3D reinforced composites, including NDE capability acquisition.

- optimise 3D reinforced engine components for weight and cost
- verification of the manufacture process capability
- improved accuracy in analytical verification activities
- use of NDT to validate structural models

Manufacturing (1 of 2)

MERLIN (Aero Engine Manufacture Development using Additive Manufacturing and Near Net Shaping))

- Online NDT
- High Spec Materials
- New Design development for performance
- More Complex Geometries
- Powder Recycling
- Generic Demonstrator
- Faster Laser Metal Deposition

Manufacturing (2 of 2)

WELDMAT (Predictable WELDing of Aerospace MATerial)

Focus of the project is welding simulation and metallurgy of superalloys, to achieve predictable welding. The project will focus on:-

- Joining dissimilar material → reduced cost and weight
- Improved lifing of welds → reduced cost and weight
- Control of tolerances and deformation in welding → improved engine efficiency

Mechatronics

DISTECT (DISTributed Engine ConTrol)

1. Increase maturity of aero-engine distributed control systems 2. Investigate software modules running on bus linked distributed microprocessors. 3. Assess usage and provide knowledge and recommendations for further development

- Architecture and evaluation methods
- Advanced control laws
- SW design & tools evaluation
- Comms sub system design & evaluation by simulation and rig test
- Integrate components to demonstrate local control concepts
- Smarts sensors or components requirements & evaluation

Combustion (1 of 2)

INTELLECT D.M.2 (INTEgrated Lean Low Emission CombusTor Design Methodology 2)

low emissions combustor technologies for aero-engines through:-

- Innovative design methodologies for clean combustion
- Detailed non-intrusive measurements inside low NOx combustion chambers
- Low emission combustors designs with improved operability
- Advanced combustor cooling technologies, design and validation
- Improved knowledge on combustor interfaces, compressor-combustor-turbine modeling and experiments

Combustion (2 of 2)

FIRST (Fuel Injector Research for Sustainable Transport)

Gain better understanding of combustions conditions:-

- Develop tools to predict the fuel injector exit boundary condition
- Investigate fundamentals of break-up physics
- Progress fundamental models to predict spray boundary conditions
- Develop process based models for spray boundary conditions
- Validate with advanced diagnostics

Noise

CONECT (COre Noise REsearch and ConTrol)

Improvement and validation of core noise modelling methods for direct, indirect and transmitted broadband combustion noise. CONECT will also include development and testing of control methods for core noise reduction. Through carefully specified experiments, the project will consider

- Interaction of combustor inhomogeneities with nozzle flows
- Generation of noise and inhomogeneities in the combustion chamber
- Interaction of combustor inhomogeneities with the turbine
- Simulation of Full-Scale Combustion Noise

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FP7 Call 3 Project Proposals - Summary

Project	Main Technology Themes				
MECASYS	Innovative composite design	Advanced modelling	Model validation through testing	Update of design rules	
FACTOR	3D flow in a combined combustor-turbine interaction	Rig & blade design and manufacturing	Blade rig testing	Validating 3D CFD by test	
REALITY	Robust design	Non-conformance criteria	Effect of defects on performance	CFD/CAD Coordination	
ClearCUT	Advanced seal modelling	Seal materials with very complex structure	Innovative materials processing	Validation through testing	
COMMAND	Optimise 3D reinforced engine components	Analytical verification activities	Verification of the manufacture process	Use of NDT in composites	
MERLIN	Online NDT	High Spec Materials	Complex Geometries	Powder Recycling	Faster Laser Metal Deposition
WELDMAT	Metallurgy and constitutive models	Material physical properties characterisation	Simulation Thermo mechanical	Simulation Thermo dynamic	weld trials for model verifications
DISTECT	Advanced control laws	SW design & tools evaluation	Communications sub system design	Smarts sensors & component evaluation	Architecture and evaluation methods
INTELLECT D.M.2	Innovative combuster design methodologies	Non-intrusive combustor measurements	Low emission combustors designs	Advanced combustor cooling technologies	Compressor-combustor-turbine modeling
FIRST	Prediction of fuel injector exit boundary condition	Fundamentals of break-up physics	Prediction of spray boundary conditions	Process based spray boundary models	Advanced combustor diagnostics
CONECT	Hifi-compressible and incompressible simulation	Flow simulation	Reynolds averaged Navier-Stokes plus statisical methods	Analytical / semi-analytical methods / low order simulations	Nozzle/combuster/ turbine tests and full engine fests