Clean Sky Joint Undertaking

European Commission
Research Directorates

Call for Proposals:

CLEAN SKY
RESEARCH and TECHNOLOGY DEVELOPMENT PROJECTS
(CS-RTD Projects):

Call Text

Call Identifier

SP1-JTI-CLEAN SKY-2009-1

UPDATED VERSION 25 June 2009

Topic descriptions have been modified for these topics only**:**
JTI-CS-2009-1-SAGE-02-001, JTI-CS-2009-1-SAGE-02-002,
JTI-CS-2009-1-SAGE-05-003, JTI-CS-2009-1-SAGE-05-004
Call values increased accordingly

Via the Calls for Proposal, Clean Sky aims to incorporate Partners to address very specific tasks which fit into the overall technical Work Programme and time schedule.

Due to the nature of these tasks, the Call is not set up using a set of themes, but it is conceived as a collection of very detailed Topics. The Call text therefore consists of a set of topic fiches, attached here.

Each Topic fiche addresses the following points:

- Topic manager (not to be published)
- Indicative start and Indicative End Dates of the activity
- Description of the task
- Indicative length of the proposal (where applicable)
- Specific skills required from the applicant
- Major deliverables and schedule
- Maximum Topic Budget value
- Remarks (where applicable)

The maximum allowed Topic budget relates to the total scope of work. A Maximum funding is also indicated.
Depending on the nature of the participant, the funding will be between 50% and 75% of the Topic maximum budget indicated. It has to be noted that the Topic budget excludes VAT, as this is not eligible within the frame of Clean Sky.

Call value

The following numbers of Topics have been proposed by the various ITDs:

ITD	Number of Topics	Maximum Budget (M€)	Maximum funding (M€)
GRA – Green Regional Aircraft	34	4.888	3.666
GRC – Green Rotorcraft	4	4.367	3.275
SAGE – Sustainable and Green Engines (revised)	8	11.200	8.400
SFWA – SMART Fixed Wing Aircraft	9	4.250	3.188
SGO – Systems for Green Operations	17	9.53	7.148
TOTAL (revised)	**72**	**34.235**	**25.676**

Thresholds:

As indicated in section 4.6 of the *"Rules for Participation and Rules for Submission of Proposals and the related Evaluation, Selection and Award Procedures"*, each proposal will be evaluated on 6 criteria.

For a Proposal to be considered for funding, it needs to pass the following thresholds:

- **Minimum 3/5** score for each of the 6 criteria,
  AND
- **Minimum 20/30** total score

Only one Grant Agreement (GA) shall be awarded per Topic.

Calendar of events:

• Call Launch:	15 June 2009
• Information Day	10 July 2009
• Call Close:	31 August 2009, 17:00
• Evaluations (indicative):	14-19 and/or 21-26 Sept 2009
• Start of negotiations (indicative):	01 October 2009
• Final date for signature of GA by Partner:	15 December 2009
• Final date for signature of GA by Clean Sky JU:	31 December 2009

IMPORTANT: for budgetary reasons, **it is mandatory that the Grant Agreements are signed before the end of 2009.** This implies that the Partner (or coordinator of the consortium applying) needs to sign before December 15th, and the signature of the Clean Sky Joint Undertaking has to take place before December 31st. This is the date of conclusion of the GA.
If the Grant Agreements are not concluded at that time, the budget is no longer available and the Grant Agreement for the Topic in question shall not be awarded.

Contacts:

All questions regarding the topics published in this Call can be addressed to:
RTD-CLEANSKY@ec.europa.eu.

NOTE: An amendment of the Statutes of Clean Sky is currently taking place, clarifying the meaning of the term "use" in relation with Intellectual Property Rights. The documents *"Rules for Participation and Rules for Submission of Proposals and the related Evaluation, Selection and Award Procedures"* and *"Model Grant Agreement for Partners"* published on the site are subject to the adoption of this modification to the Statutes.

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Topic Description Sheet

Topic Nr.	Title		
JTI-CS-2009-1-SFWA-01-001	CfP WP114_No3: Trailing edge devices for AFC applications; AFC technique upper side of flap	**Indicative End Date**	30.06.2012
		Indicative Start Date	01.10.2009

1. Topic Description

Subject of this call for proposal is the design, manufacturing and qualification of an integrated flow control actuator technique into a TE (trailing edge) device in a mid scale wind tunnel model for a test in an aerodynamic Wind tunnel wrt the Task concept3 “High performance flap” of WP114. The objective is to provide the flow control means of pulsed pressurized and/or piezoelectric flow control technique for an improved high-lift flow for delaying of separation onset on TE (trailing edge) device like on a single slotted flap instrumented with needed sensors and actuator subsystems and set-up on 2.5D model towards testing in selected wind tunnel facility. The practical application of closed loop control is part of the investigation. Conduction of the wind tunnel test and analyse and report of the experimental results.

The delay of separation on a specific configured TE device of a high lift configuration model has to be demonstrated in a previous test on a mid scale, 2.5D, constant chord swept wing, wind tunnel model. The actuator performance has to be designed and proved for low speed applications in wind tunnel at velocity speeds in the range of Ma=0.15 till Ma=0.25 (Ma = Mach number) for an integrated demonstration in a mid scale, constant chord wind tunnel model. The proposed W/T facilities are Filton Low speed Wind tunnel (F-LSWT) by Airbus and DNW-NWB in Brunswick by DNW.

The expected maximum length of the proposal is 25 pages

2. Special Skills, certification or equipment expected from the applicant

- The applicant should have a sound R&T background in design, testing and demonstration of flow control techniques in small and mid scale wind tunnel facilities on own and industrial wind tunnel models.
- The applicant is able to integrated actuator in a wind tunnel model, can manufacture devices and testing of systems for flow control applications in wind tunnels.
- The applicant has to have laboratory testing facilities and equipment necessary for actuator specimen operation and initial functional testing.
- The applicant has to provide support for flow control actuator system integration and operation in upper-coordinate tests including flow control algorithms for closed loop applications.
- All tools for a detailed design process must be available at the applicant.

The to be applied and to be demonstrated flow control actuators on this described 2.5D mid scale wind tunnel model were well proved in system tests on laboratory level outside of this work package, so that the relevant TRL is matured for further application and integration into the defined 2.5D mid scale wind tunnel model. It is sufficient for the applicant, if these actuators and the flow control technique including closed loop application were tested previously successfully on a small scale, at least 2D wind tunnel model and were demonstrated also successfully on an industrial wind tunnel model in cooperation with an industry partner.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1.1.4-CfP3-01	Concept Report	Description of FCC for aerodynamic tests	01.12.2009
D1.1.4-CfP3-02	Pre-tests	Conducted and analysed previous wind tunnel tests on a mid scale W/T model	15.06.2010
D1.1.4-CfP3-03	Final tests	Preparation of conduction and analysis of final wind tunnel tests on a large scale W/T model	15.09.2011
D1.1.4-CfP3-04	Results analysis	Test Data Analysis and final reporting	15.03.2012

4. Topic value (€)

The total value of this work package shall not exceed

€ 300000

Please note that VAT is not applicable in the frame of the *CleanSky* program.

5. Remarks

This call for proposal is the first part of a CfP work package within SFWA/WP1 for the demonstration of the Flow control concept 1 (“FCC1”) of the FoCuS (**F**low c**o**ntrol **C**omm**u**nity **S**trategy) Group for Flow control for low speed / high lift.

Topic Description Sheet

CfP topic number	Title		
JTI-CS-2009-1-SFWA-01-002	Numerical Tool for Aerodynamic Optimization of Laminar Wings	**Indicative End Date**	30April 2010
		Indicative Start Date	01.Oct 2009

1. Topic Description

The objective is to develop and mature shape optimization tools for wings with large extensions of laminar flow. The tool should be capable of optimizing three dimensional wing geometries including a fuselage. The CfP task will be defined within WP1.1.1 but the tool will also be used for WP1.1.2, WP2.1.1 and WP2.1.3 activities.

The method should preferably be gradient-based (e.g. adjoint methods) in order to obtain efficient and robust shape optimization of laminar wings. The work includes coupling between existing Euler/NS solvers (Edge) and BL stability codes (e.g. through boundary-layer equations). Optimization of the wing should also account for geometrical constraints and aerodynamic properties such as lift, drag and pitching moment. The target is to simultaneous minimizing the total drag by skin friction reduction (maximized extension of laminar flow), low pressure drag (no flow separation and thin boundary layers) and minimum wave drag.

One optional objective is the development of efficient multidisciplinary methods of optimization where the structure could be described by a large number of design variables. This requires the capacity to efficiently compute the sensitivities of the extension of the laminar region with respect to an arbitrary number of design variables.

The expected maximum length of the proposal is 15pages

2. Special Skills, certification or equipment expected from the applicant

The applicant should have a good experience in:

- CFD tools (the tool has to be coupled with the EDGE solver)
- Automatic grid adaptation in order to handle shape modification
- Boundary layer stability codes (preferably PSE methods)
- Optimization procedures

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1.1.1-02-01	Tool specification	Description of methodology, functionality and implementation	1 Nov 2009
D1.1.1-02-02	First release of optimization tool	Test version of a shape optimization system, integrated with the existing flow solver and BL stability codes at Saab	30 Nov 2009
D1.1.1-02-03	Final release of optimization tool	Final version of a robust and efficient numerical shape optimization system, integrated with the existing flow solver and BL stability codes at Saab	31 Mar 2010
D1.1.1-02-04	User manual		30 Apr 2010

4. Topic value (€)

The total value of this work package shall not exceed

€ 200000

Please note that VAT is not applicable in the frame of the *CleanSky* program

5. Remarks

None.

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Topic Description

Topic Nr.	Title		
JTI-CS-2009-1-SFWA-01-003	CfP WP114_No1: Wing Leading Edge (LE) box Design and Manufacturing	**Indicative End Date**	30.06.2012
		Indicative Start Date	01.10.2009

1. Topic Description

Subject of this call for proposal is design, construction and manufacture of wing leading edge (LE) box wrt task concept 2 of WP114 for slat-less configurations for application of several active flow control means on lower and upper side of suitable one, mid scaled 2D (two dimensional) and 2.5D (constant chord swept wing) W/T model. Before integration of suitable and efficient working flow control actuators a final system ground test has to be performed. The delivery of model wing LE device instrumented with needed sensors and actuator subsystems and set-up on 2.5D model towards testing in W/T facility. Conduction of the wind tunnel test and analyse and report of the experimental results.

The delay of separation on a specific configured fixed wing LE device of a high lift configuration model has to be demonstrated in a W/T (wind tunnel) test on a mid scale, 2.5D, constant chord swept wing, wind tunnel model. The actuator performance has to be designed and proved for low speed applications in wind tunnel at velocity speeds in the range of Ma=0.15 till Ma=0.25 (Ma = Mach number) for an integrated demonstration in a mid scale, constant chord wind tunnel model. The proposed W/T facilities are the Filton Low speed Wind tunnel (F-LSWT) by Airbus and DNW-NWB in Brunswick by DNW.

The expected maximum length of the proposal is 25pages

2. Special Skills, certification or equipment expected from the applicant

- The applicant should have a sound R&T background in design, testing and demonstration of flow control techniques in small and mid scale wind tunnel facilities on own and industrial wind tunnel models.
- The applicant is able to integrated actuator in a wind tunnel model, can manufacture devices and testing of systems for flow control applications in wind tunnels.
- The applicant has to have laboratory testing facilities and equipment necessary for actuator specimen operation and initial functional testing.
- The applicant has to provide support for flow control actuator system integration and operation in upper-coordinate tests.
- All tools for a detailed design process must be available at the applicant.

The to be applied and to be demonstrated flow control actuators on this described 2.5D mid scale wind tunnel model are well proved in system tests on laboratory level. It is sufficient for applicant, if these actuators and the flow control technique including closed loop application were tested previously successfully on a small scale, at least 2D wind tunnel model and were demonstrated also successfully on an industrial wind tunnel model in cooperation with an industry partner.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1.1.4-CfP1-01	Concept Report	Description of Flow control concept for aerodynamic tests	01.12.2009
D1.1.4-CfP1-	Pre-tests	Conducted and analysed previous wind tunnel	15.06.2010

02		tests on a mid scale W/T model	
D1.1.4-CfP1-03	Final tests	Preparation of conduction and analysis of final wind tunnel tests on a large scale W/T model	15.09.2011
D1.1.4-CfP1-04	Results analysis	Test Data Analysis and final reporting	15.03.2012

4. Topic value (€)

The total value of this work package shall not exceed

€ 300000

Please note that VAT is not applicable in the frame of the *CleanSky* program.

5. Remarks

This call for proposal is the first part of a CfP work package within SFWA/WP1 for the demonstration of the Flow control concept 3 ("FCC3") of the FoCuS (**F**low c**o**ntrol **C**omm**u**nity **S**trategy) Group for Flow control for low speed / high lift.

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Topic Description Sheet

CfP Nr.	Title		
JTI-CS-2009-1-SFWA-02-001	Design of innovative CROR blade and pylon	**Indicative Start Date**	01.09.2009
		Indicative End Date	01.09.2010

1. Topic Description

The European aeronautical industry faces the challenge to counter the environmental impact due to the growth of air transport with low-fuel burn innovative products. Increasing the by-pass ratio of turbofan engines was a successful measure in the past decades. The ultimate in this sense is the Counter Rotating Open Rotor (CROR) which offers a potential of 20% fuel burn reduction relative to the classical turbofan engine in-service today.

The aero-acoustic impact will be a potential driver for a CROR when installed on aircraft. Thus, aero-acoustic design and evaluation of Innovative CROR and Pylon Concepts are proposed in the SFWA JTI WP2.2.2.1, corresponding to a low TRL study, to understand the physics and mechanisms of noise reductions achievable using some innovative design technologies.

On this basis, some innovative active/passive low noise concepts are currently proposed within this WP by different partners - such as TE blowing, serrated TE, active TE for CROR PPS. The starting point of this study will be the reference CROR configuration (based on a generic AI blade design) which will be provided to all WP partners and the CfP selected members during mid 2009

The aim of this CfP is subdivided in two independent parts:

TASK 1: To develop additional CROR blade innovative low noise concepts
TASK 2: To support SAAB in their Noise evaluation of innovative Pylon process

<u>TASK 1 Contract</u>: **Develop Additional Low noise CROR blade designs**

This study aim at developing active/passive low noise concepts where main focus will be on modified blade surfaces. Active measures will be achieved using blade actuation while passive measures incorporated using a porous blade surface. Thus, this work will concern the following two concepts characterised by

Concept A: **Porous blade surface** – reduction of acoustic surface pressure load modifications using surface porosity
Concept B: **Active blade surface** - control of front rotor wake and active area integrated on the aft rotor to dissipate the impinging front rotor wake

Laboratory work should be done to support hardware design and the definition of the advanced surface characteristics for both, the active and passive blade. Laboratory investigations should also be applicable for the down selection of promising parameters and thus for the process of concept optimization iteration.

The selected concepts should be investigated using CFD/CAA tools and/or engineering methods. This work should provide the modified designs of the AI generic blade with the identification of (active/passive) blade areas of interest and the evaluation of the low noise concepts using propagation models as well as the evaluation of the acoustic signature of the innovative CROR configurations (with porous blade and active blade surfaces).

TASK 2 Contract: Support on Noise evaluation of Innovative Pylon Concepts to CROR PPS

The innovative CROR pylon concepts aim at suppressing the flow-generated noise source by damping the unsteady forces acting on the open rotor blades due to upstream wakes generated by the pylon.

The work should provide effective and comprehensive numerical analysis to investigate and assess two potential low noise concepts for innovative pylon design of CROR and, ultimately, to support the design process in close collaboration with an industrial partner (Saab).

This work will concern the following two concepts:

Concept 1: **Pylon Boundary Layer absorption**
Concept 2: **Non Radial Pylon Orientation**

The work includes CFD simulations of open-rotor flows, coupled with numerical analysis of flow-generated noise sources. The near-field and far-field noise should be evaluated using acoustic propagation methods.

The expected maximum length of the proposal is 40pages

2. Special Skills, certification or equipment expected from the applicant

- ***Task 1-*** Very good knowledge of Propeller physics and High level of working experience in CFD/CAA for design concepts. Ability to pursue innovative CROR blades design capabilities.
- ***Task 2-*** Very good knowledge of Pylon flow physics and High level of working experience in CFD/CAA for design concepts. Ability to carry out pylon design process and to pursue collaborative work with industrial partner (Saab)

3. Major deliverables and schedule

Del. Ref. Nr.	Title	Description (if applicable)	Indicative Due Date
D2.2.2.1-T1.01	Report + Blade Geometry	Report on passive low noise blade concept design	01.02.2011
D2.2.2.1-T1.02	Report + Blade geometry	Report on feasibility of active low noise blade concepts	01.04.2011
D2.2.2.1-T2.01	Report	Noise evaluation of Pylon concept #1	31.12.2009
D2.2.2.1-T2.02	Report	Noise evaluation of Pylon concept #2	31.12.2009

4. Value of CfP workpackage

The total value of these tasks in the work package 2.2.2.1 should not exceed

TASK 1: € 300000
TASK 2: € 100000

Please note that VAT is not applicable in the frame of the *CleanSky* program

5. Remarks

None.

Topic Description Sheet

CfP topic number	Title		
JTI-CS-2009-1-SFWA-02-002	Finite Element Models of Counter Rotating Open Rotor blades	**Indicative End Date**	01.09.2010
		Indicative Start Date	01.09.2009

1. Topic Description

The European aeronautical industry faces the challenge to counter the environmental impact due to the growth of air transport with low-fuel burn innovative products. Increasing the by-pass ratio of turbofan engines was a successful measure in the past decades. The ultimate in this sense is the Counter Rotating Open Rotor (CROR) which offers a potential of 20% fuel burn reduction relative to the classical turbofan engine in-service today.

Contrary to the US & Russia, where previous experience with CROR powered aircraft is available, the European community has only recently started to acquire knowledge & experience on this subject. In this context, there is a need to get comprehensive knowledge on the aero-elastic behaviour of CROR-blades. Due to rotor-efficiency & rotor-noise constraints, the rotor blades tend to get very thin, hence the blade bending & torsion stiffness is penalized. At the same time, the rotor blades operate under highly dynamic conditions due to rotor-to-rotor & airframe-to-rotor interactions. Hence, the rotor blades are subjected to wide frequency range of high amplitude excitations.

CROR tests planned in the coming years will be conducted by means of CROR-powered wind tunnel models. The structural layout of scaled wind tunnel model CROR-blades will differ from CROR-blades applied on a full-scale flight engine. Also, the rotational speed of the wind tunnel scale CROR will differ from the flight engine. Hence, the experience that will be obtained with these test articles need to be translated to the full-scale flight engine.

To enable the research on aero-elastic effects, the JTI-SFWA-WP2222 partners have a need for (NASTRAN based) Finite Element Models (FE-Models) of both wind tunnel model scale as well as full flight engine CROR blades. These FE-Models form the prime delivery of the current CfP. However, in the process to arrive at these FE-Models, a structural design of the rotor blades is a necessary but non-trivial intermediate step. The structural layout and sizing of the structural members should take into account the CROR loads & aero-elastic (blade flutter) requirements. It is foreseen that the rotor blades will feature a composite (carbon fibre laminate) structure.

The applicant awarded this contract will be provided with the CROR blade shapes, the blade loads, the blade-flutter constraints, the rotor speed and the wind tunnel model scale factor as input. Based on these inputs, the applicant will make a structural design for the wind tunnel model scale as well as the full-scale flight rotor blades (front & aft rows) subjected to the loads & aero-elastic constraints. Based on this structural design, NASTRAN-based Finite Element Models are constructed that model the aero-elastic blade behaviour. These FE-models together with a report on the applied design process will be delivered to JTI-SFWA-WP2222 partners. *The expected maximum length of the proposal is 15pages*

2. Special Skills, certification or equipment expected from the applicant

- The applicant should have a sound background in structural design of rotating systems for aeronautical products (e.g. compressors, turbines, propellers).
- The applicant should have a thorough knowledge and experience on Finite Element modelling of composite structures.
- The applicant should have acquired proof that his FE-Models are representative for the actual product being modelled.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D2.2.2.2-01	Report	Final report	01.09.2010
D2.2.2.2-02	FE-Models.	FE-Models in NASTRAN format of W/T & full-scale CROR rotor blades.	01.09.2010

4. Topic value (€)

The total value of this work package shall not exceed

€ 200000

Please note that VAT is not applicable in the frame of the *CleanSky* program

5. Remarks

None.

Topic Description Sheet

CfP topic number	Title		
JTI-CS-2009-1-SFWA-02-003	WTT experimental rigs and means detailed design and manufacture	**Indicative End Date**	30.06.2010
		Indicative Start Date	01.09.2009

1. Topic Description

The European aeronautical industry faces the challenge to counter the environmental impact due to the growth of air transport with low-fuel burn innovative products. Increasing the by-pass ratio of turbofan engines was a successful measure in the past decades. The ultimate in this sense is the Counter Rotating Open Rotor (CROR), which offers a potential of 20% fuel burn reduction relative to the classical turbofan engine in-service today.

Contrary to the US & Russia, where previous experience with CROR powered aircraft is available; the European community has only recently started to acquire knowledge & experience on this subject. In this context, there is a need to get comprehensive knowledge on the aero-acoustic behaviour of CROR-blades through experimental characterization.

CROR tests planned in the coming years will be conducted by means of CROR-powered wind tunnel models.

The overall objective of this work package 2.2.2.3 is to provide the wind tunnel associated test technologies in terms of the basic wind tunnel model test rigs that will be required to support a CROR aircraft development program.
Subject of this call for proposal is the detailed design and manufacture of experimental rigs and means related to wind tunnel test of counter rotating open rotor (CROR) models of different scales. It is related to wind tunnel tests equipments for scale 1:7 models to be tested in a large European low speed wind tunnel. These specific rigs are required for both the isolated CROR model (so called “minimum body rig”), and Aircraft complete powered model. These means corresponds to the isolated CROR rig and complete Aircraft model stings, balances and uncoupling systems.

Development of Wind Tunnel Test Rigs and Means:

<u>**Subtask 1:**</u> **Model support for acoustic set-up to include the following major items**:-

- Horizontal sting (for dorsal sting for use in the wind tunnel, could also be used for ventral set-up)
- Integral knee sting interface (for dorsal sting for use in the wind tunnel, could also be used for ventral set-up)
- Vertical sting (for dorsal sting for use in the wind tunnel, could also be used for ventral set-up)
- Model-sting interface (for dorsal sting for use in the wind tunnel, could also be used for ventral set-up)
- Support and air piping (for dorsal sting for use in wind tunnel, could also be used for ventral set-up)
- Dummy calibration sting (for dorsal sting for use in the wind tunnel could also be used for ventral set-up)
- Return air bridge for use in the wind tunnel (RALD)
- New acoustic lining for sting and torpedo for open jet test section (OTJS)

<u>**Subtask 2**</u>: **Airbridge and Decoupling System To include the following major items:-**

- Design and manufacture of a self -compensating decoupling air-bridge system
- Calibration of the above Airbridge in a realistic installation configuration
- Provision for new balance if no suitable existing balance can be used.

<u>**Subtask 3**</u>: **Isolated rig housing and Support:-**
- Design and Manufacture of all hardware associated with an isolated Nacelle.

- Design and Manufacture of all adaptors, control system and instrumentation specific to the Isolated Nacelle
- Shakedown test of isolated Nacelle

The expected maximum length of the proposal is 40pages

2. Special Skills, certification or equipment expected from the applicant

- The applicant has to have a full ISO 9001:2000, ISO 14001:2004 and preferably an OHSAS 18001:1999 certificate;
- The applicant has to have ample knowledge of and experience with designing and building wind tunnel test equipment.
- The applicant should have a sound background and knowledge in powered testing application with specific skills in the design and manufacture of balances and uncoupling systems.

3. Major deliverables and schedule

Del. Ref. Nr.	Title	Description (if applicable)	Indicative Due Date
D2.2.2.3-ST01	**Model support for acoustic set-up**	Design, manufacture and supply of all hardware associated with the model support system (excluding Airbridge and Balance)	Q2 2010
D2.2.2.3-ST02	**Airbridge and Decoupling System**	Design, manufacture, calibration and supply of all hardware associated with the model measuring and decoupling system	30.06.2010
D2.2.2.3-ST03	**Isolated rig housing and Support**	Design, manufacture and supply of all hardware and controls associated with the Isolated rig, including shake-down test	30.06.2010

4. Topic value (€)

The total value of this work package shall not exceed

€ 1200000

Please note that VAT is not applicable in the frame of the *CleanSky* program

5. Remarks

None.

Topic Description Sheet

CfP topic number	Title		
JTI-CS-2009-1-SFWA-02-004	Installed CROR characterisation: detailed design of innovative CROR model	**Indicative End Date**	31.03.2010
		Indicative Start Date	01.10.2009

1. Topic Description

The European aeronautical industry faces the challenge to counter the environmental impact due to the growth of air transport with low-fuel burn innovative products. Increasing the by-pass ratio of turbofan engines was a successful measure in the past decades. The ultimate in this sense is the Counter Rotating Open Rotor (CROR) which offers a potential of 20% fuel burn reduction relative to the classical turbofan engine in-service today.

Contrary to the US & Russia, where previous experience with CROR powered aircraft is available, the European community has only recently started to acquire knowledge & experience on this subject. In this context, there is a need to get comprehensive knowledge on the aero-acoustic behaviour of CROR-blades through experimental characterization.

CROR tests planned in the coming years will be conducted by means of CROR-powered wind tunnel models. In particular, 1/5 to 1/6 high scale rig testing of installed CROR will be conducted.

Subject of this call for proposal is the detailed design two CROR models to be fitted on an existing rig. It includes for each set of design, 2 hubs and associated blades (propeller diameter close to 0,85m). These CROR models have to be compatible with an existing CROR rig.

Task input:

- Rig interfaces
- CROR geometries (blades, hub)
- Model specifications (operation, loads, high level of instrumentation, pitch accuracy…)

Task description:

- Detailed design and structural arrangement of hubs and blades compatible with model specification, based on given shapes and interfaces.

Deliverable:
Two sets of CAO files (Catia V5 R16) and drawings covering model description ready for manufacturing.

The expected maximum length of the proposal is 15pages

2. Special Skills, certification or equipment expected from the applicant

- The applicant has to have a full ISO 14001 certification
- The applicant should have a sound background in structural design of wind tunnel models and propellers.
- The applicant has to have propeller hub and blade WT model design capabilities

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D2.2.2.5-01-04	3D and drawings delivery		31.03.2010

4. Topic value (€)

The total value of this work package shall not exceed

€ 200000

Please note that VAT is not applicable in the frame of the *CleanSky* program

5. Remarks

None.

Topic Description Sheet

CfP topic number	Title		
JTI-CS-2009-1-SFWA-02-005	Ground Based structural/systems demonstrators	**Indicative End Date**	31 Dec 2010
		Indicative Start Date	01 Sep 2009

1. Topic Description

The subject of this call for proposal is support for the development of a number of small scale Feature Demonstrators that will enable down selection of concepts towards a final Integrated Ground Based Demonstrator of the Leading Edge region of a Natural Laminar Flow Wing. The detailed design and layout of the wing will be the responsibility of the Short Range Aircraft Concept team led by Airbus. The joint team of Airbus, Saab and Aernnova will monitor the development and conduct of each of the identified work packages.

Individual work packages will cover some or all of the following Feature Demonstrators and may address activities associated with the design, manufacturing or testing of the following components:

1. Line of Flight (LOF) and Across Line of Flight (ALOF) joint concepts for leading edge panels (CFRP/metal)

2. Wing Ice Protection System (WIPS) for metal or CFRP leading edge components

Each proposal should identify a contribution towards the following tasks for one or both of the above components:

§ Component manufacture and assembly
§ Ground test instrumentation and metrology
§ Ground test facilities, jigs and housing

It is not required that all components above will be launched but that a selection of critical components will be identified based on the proposals received.

<u>*The expected maximum length of the proposal is 10pages*</u>

2. Special Skills, certification or equipment expected from the applicant

Each applicant will be required to demonstrate both a track record of performance in the relevant area and the ability to meet the deadlines required in terms of both resource availability and costs.

3. Major deliverables and schedule

Each successful proposal will be expected to deliver the following outputs

Del. Ref. Nr.	Title	Description (if applicable)	Indicative Due Date
D2.1.3-02-01	Feature demonstration plan	A fully costed plan with appropriate time targets for each of the appropriate work packages	October 2009
D2.1.3-02-02	Component Production	Each Partner to identify delivery dates for relevant components and to integrate these into the Feature Demonstration Plan	March 2010
D2.1.3-02-03	Assembled test rig	An integrated facility including test coupon/article, associated instrumentation and test rig	June 2010
D2.1.3-02-04	Final Report	A final report identify the test outputs against the target requirements	October 2010

4. Topic value (€)

The total value of this work package shall not exceed

€ 250000

Please note that VAT is not applicable in the frame of the *Clean Sky* program

5. Remarks

The work packages associated with the small scale feature demonstrators are only envisaged to operate until the end of 2010. Early in 2010 an improved understanding of the test requirements will be available following the Preliminary design Review of the Short Range Aircraft concept. The output from the Feature Demonstrators will enable a down selection of components to be taken forward as part of the integrated demonstration. Further testing of the Feature Demonstrators i.e. for Bird Strike tolerance, may occur beyond the middle of 2010 as part of a subsequent CfP activity.

Topic Description Sheet

CfP topic number	Title		
JTI-CS-2009-1-SFWA-03-001	NLF Wind Tunnel Test	**Indicative End Date**	31 Jan 2010
		Indicative Start Date	01 Oct 2009

1. Topic Description

Subject of this call for proposal is the realization of Low speed (Mach 0,20) Wind Tunnel Tests for High Speed Demonstrator.

The data gathered in this test will be used to build a set of aerodynamic data for Handling Qualities, Loads and Performances. This one is needed to obtain the flight clearance of the A340 natural laminar flow flight demonstrator.

The test covers the following loads and HQ topics:

§ basic longitudinal HTP off characteristics
§ downwash and HTP effectiveness
§ basic lateral tails off characteristics
§ aileron and spoiler: effectiveness and impact on loads

Measurements shall be carried out with the 6 axis main balance. The coefficients of the forces (and moments, respectively) have to be made dimensionless using the dynamic pressure and the reference surface (and also the mean aerodynamic chord, respectively).

It is around 170 polars that shall be performed between December 2009 and January 2010.
Most of the polars are required for the A340FTB but also for the A340 reference aircraft. It therefore requires exchanging the model wings between the 2 sets of runs.

The typical parameters to be varied are:

§ Angle of attack and sideslip of the model
§ Flaps, ailerons, spoilers and HTP positions

This Call for proposal also includes :

§ Support to the integration of the 6m full span model of an Airbus A340
§ Visualization of plots in real time with video
§ Recording capabilities and data storage

The expected maximum length of the proposal is 10pages

2. Special Skills, certification or equipment expected from the applicant

- The applicant shall have a Wind Tunnel facility able to house an existing 6m span A340 model.
- The applicant shall have a Wind Tunnel facility compatible with requested Low Speed conditions:
    - Re = 4,64 M /m
    - Mach 0,2.
- The applicant shall comply with Airbus procedures.
- The applicant shall have confidential agreement with Airbus.
- Data recording means shall be available and compatible with Airbus models.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D3.1.3-01-01	Wind Tunnel facility disposal		December 2009/ January 2010
D3.1.3-01-02	Aerodynamic data results		January 2010

4. Topic value (€)

The total value of this work package shall not exceed

€ 1200000

Please note that VAT is not applicable in the frame of the *CleanSky* program

5. Remarks

None.

Topic Description REVISED

CfP topic number	Title		
JTI-CS-2009-1-SAGE-02-001	Pitch Change Mechanism – Conceptual & preliminary design activities	**Indicative Start Date**	*01/10/2009*
		Indicative End Date	*31/12/2010*

1. Topic Description

The SAGE2 Demonstration Project aims at designing, manufacturing & testing a Counter-Rotating Open-Rotor Demonstrator. It involves most of the best European Engine & Engine Modules & Sub-systems Manufacturers.

The SAGE2 Demonstrator incorporates two counter-rotating propellers whose pitches have to be controlled through a Pitch Change Mechanism (PCM).

The partner shall perfom the following activities:

Task 1: Work Package management:

Planning and steering activities for the workpackage.

Risk analysis for the work package and construction of the development plan.

Quality management of the work package.

Task 2: PCM conceptual design

Perform concept screening studies in order to feed score cards, and support Snecma to downselect the baseline PCM concept for SAGE2 Demonstrator. Studies to feed concept score cards shall include PCM functional analysis, architecture design (including safety devices), failure mode analysis, mass assessment, mechanical assessment of critical parts, performance assessment, definition of verification means, preliminary bill of material.

After selection of baseline PCM concept by Snecma, partner shall perform conceptual design of the PCM focusing on baseline concept. Conceptual design shall include PCM architecture refinement, description down to part level (3D geometry, detailled bill of material), update of performance analysis, mechanical assessment at part level, definition of verification means and finalization of functional analysis & failure mode analysis.

Task 3: PCM preliminary design

Shall conceptual design be conclusive, partner will perform preliminary design activities of selected PCM concept.

Preliminary studies shall include PCM functional analysis, architecture design (including safety devices), failure mode analysis, mass assessment, mechanical assessment, performance assessment, definition of verification means, bill of material, definition of detailed development plan (incl. potential system rig test), identification of suppliers.

Task 4: Support engine conceptual and preliminary design

As PCM architecture is strongly related to Demonstrator design, partner shall support Demonstrator integration studies, in order to feed engine cross-section & bill of material, digital mock-up, and initiate interface definition with other modules (propeller module, turbine module, PCM actuation system).

Partner shall support Snecma to define verification means and perform failure mode analysis at Demonstrator level.

This support will be requested through regular meetings and updates of data (every 2 months).

2. Special skills, certification or equipment expected from the applicant

Extensive experience in the field of design, certification, manufacturing and assembly of PCM for propellers is mandatory.

English language is mandatory.

3. Major deliverables and schedule

	2009												2010											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Task 1											D1.1	D1.2												D1.3
Task 2											D2.1			D2.2	D2.3	D2.4								
Task 3																						D3.1	D3.2	
Task 4																								

Deliverable	Title	Description (if applicable)	Due date
D1.1	Development plan		Nov 09
D1.2	Work Package report		Dec 09
D1.3	Work Package report		Dec 10
D2,1	Inital score card inputs		Nov 09
D2,2	Final score card inputs		Apr 10
D2.3	PCM Requirement Document v0		Apr 10
D2.4	PCM Description Document v0		Apr 10
D3.1	PCM Requirement Document v1		Nov 10
D3.2	PCM Description Document v1		Nov 10

4. Topic value (€) REVISED

€ 2500000

5. Remarks

None

Topic Description REVISED

CfP topic number	Title		
JTI-CS-2009-1-SAGE-02-002	Power Gear Box (PGB) advanced planet bearings development	**Indicative Start Date**	*01/10/2009*
		Indicative End Date	*31/03/2012*

1. Topic Description

SAGE2 project aims at development and demonstration of a Counter-Rotating Open-Rotor (CROR) Demonstrator.

In this context, R&TD activities are foreseen, on the Gearbox system transferring power from the Low Pressure Turbine to the propellers, with the objective to demonstrate technologies aimed to mature the Geared CROR engine concept, in view of a potential product application.

Gearbox requirements in terms of torque density, working conditions, reliability and operability leads to the need of a step change for critical components design and technologies, in particular for bearings and their integration with the surrounding components (e.g. gears).

Development of planet bearings from a specialized partner with proven experience and know-how in high performance aerospace bearings is required to enable gearbox system optimization for bearing integration and develop associated technologies.

The activity needs to comply with the requirements developed within the concept design phase presently ongoing at SAGE 2 level.

The partner shall in particular perform the following tasks:

Task 1: Advanced Planet Bearing Design

- Support, from early phases of gearbox design, to planet bearings definition and optimization,
- Support the strong integration foreseen for bearing architecture and technology within gearbox design and technologies,
- Definition of technologies to meet requirements (e.g. bearing lives, reliability, low sensitivity to oil contamination) and to improve current state of the art (proposed solutions and technolgies must be agreed and approved by AVIO),
- Detail design of planet bearings.

Task 2: Demonstration of Innovative Technologies for Planet Bearings and Integration with Gear Technologies

- Demonstration through experimental tests of bearing life improvements and oil contamination resistance achieved with proposed design/technologies. Execution of endurance and damage propagation tests shall be carried out by selected partner. Kind and number of experimental test need to be in line with development and demonstration purposes.

- Demonstration through experimental tests of applicability of proposed technologies to gear materials and geometry for optimum bearing integration. Gear material and geometry will be selected by AVIO. Application of technologies on representative (materials and geometry) samples will be carried out by selected partner.

Sets of bearings for technological demonstration need to be in line with demonstration requirements (number of prototypes shall be adequate for statistical analysis of results).

Tests must to be conducted according to approved operating conditions and need to reproduce the normal (air/oil split, loads, vibrations) and emergency (windmilling, unbalance, overtemperature, overload) conditions.

Task 3 : Gearbox demonstration

- Supply sets of planet bearings for development and demonstration purposes at gearbox level (approx 3), in line with the demonstration plan including the support to gearbox assembly activity.

- Post demonstration activity (techical support, hardware inspection and test results review).

2. Special skills, certification or equipment expected from the applicant

Extensive experience in development of bearings for high performance aerospace application. Proven experience in aerospace bearing development for equivalent applications.

Proven experience in application of bearing technologies to gears and integration of bearing design with gears.

Successful experience, with demonstrable benefits, of application of innovative technologies to gears is an asset. Availability of technologies at an high readiness level to minimize program risks is an asset.

Experience in aerospace R&T and R&D programs.

The partner need to demonstrate to be in the position to have access to the test facilities required to meet the goals.

The activity will be managed with a Phase & Gate approach and management plan has to be provided. Avio will approve gates and authorize progress to subsequent phases.

Technical/program documentation, including planning, drawings, design reports, risk analysis, FMEA, test plan and test requirements, test results, test analysis reports must be made available to AVIO.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
D1.1	Concept Design	Planet bearings preliminary design including static and dynamic analysis of at least two configurations.	Mar 2010
D1.2	Technology Development Plan	Analysis report of preliminary design with definition of identified required technologies and related technology development plan	Mar 2010
D2.1	Technology Integration Report	Report of experimental test for introduction of innovative technologies to gears.	June 2010
D1.3	Design Review	Planet bearings detail design including static and dynamic analysis.	Nov 2010
D2.1	Experimental Test Report	Report of experimental test to substantiate improved bearing life and low contamination sensitivity.	June 2011
D3.1	Hardware Supply for Gearbox demonstration	Supply of three sets of planet bearings.	Dec 2011

4. Topic value (€) REVISED

€ 600000

5. Remarks

None

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-SAGE-05-001	Development of a thermoelectricity generator for the supply of the engine control system	**Indicative Start Date**	*01/10/2009*
		Indicative End Date	*28/03/2011*

1. Topic Description

The WP 5.2.5 of SAGE5 Demonstration Project dedicated to the development of an innovative control system, aims also at proof of concept, development and demonstration of a thermoelectrically powered engine control system. Implementing this technology will require one or several partners able to transfer an existing technology (typically automotive applications already exist) to the aeronautic industry and provide a prototype for tests on engine.

The partners will have to:

Bring its knowledge of the technology in the detailed writing of the system high level specification (Performances, Integration, temperature sources, safety/redundancy…)

Benchmark the technical choices and trends in the automotive industry and other industries

Identify the cells technologies compatible with the input specification and the aeronautics industry

Support the integration of the technology on the engine

Provide a prototype and support testing of the technology

2. Special skills, certification or equipment expected from the applicant

High & proven experience in the design & development of thermoelectrically based systems in sever environments (aeronautics, automotive, industry…). Experience in aerospace R&T and R&D programs or similar.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Commonly written high level input specification		01/11/2009
D2	Benchmark / technology compatibility, worthiness and feasibility analysis		01/03/2010
D3	Technology development plan containing: time and costs to develop prototype		01/05/2010
D4	Prototype delivery for test on engine testbench		28/02/2011

4. Topic value (€)

1000000 Euro

5. Remarks

None

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-SAGE-05-002	Development of a high pressure fuel pump with integrated metering system	**Indicative Start Date**	01/10/2009
		Indicative End Date	28/03/2011

1. Topic Description

The WP 5.2.5 of SAGE5 Demonstration Project dedicated to the development of an innovative control system, aims also at proof of concept, development and demonstration of a high pressure fuel pump for turbine applications with an integrated metering system. Implementing this technology will require a partner with high hydromechanical skills, able to provide a reliable concept and a prototype for tests on engine.

The partners will have to:

Bring its knowledge of the technology in the detailed writing of the system high level specification (Performances, Integration, environmental conditions, safety/redundancy…)

Benchmark the technical choices and trends in the automotive industry and other industries (maturity ranking, quote, weight, failure modes analysis, accuracy, system interfaces…)

Propose a concept and achieve the integration study.

Develop a prototype and support the test on hydromechanical testbench

2. Special skills, certification or equipment expected from the applicant

High & proven experience in the design & development of fuel pumps and electromechanical devices. Knowledge of the automotive products. Experience in aerospace R&T and R&D programs or similar.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Commonly written high level input specification		01/11/2009
D2	Benchmark / technology compatibility, worthiness and feasibility analysis		01/03/2010
D3	Technology development plan containing: time and costs to develop prototype		01/05/2010
D4	Prototype delivery for test on engine testbench		28/02/2011

4. Topic value (€)

1500000 Euro

5. Remarks

None

Topic Description REVISED

CfP topic number	Title		
JTI-CS-2009-1-SAGE-05-003	Development of high accuracy, low weight "Smart" sensors for pressure, position, temperature measurement	**Indicative Start Date**	01/10/2009
		Indicative End Date	31/03/2011

1. Topic Description

The WP 5.2.5 of SAGE5 Demonstration Project dedicated to the development of an innovative control system, aims also at developping "Smart" acquisitions paths for pressure, position & temperature measurement. The target is to have optimized acquisition paths in terms of weight & accuracy at an acceptable system-level cost, taking into account the impact on the electronics, the harnesses and the sensor itself.

"smart" means that the sensor will integrate the electronic part and the measurements will concern the temperature and the pressure of oil and fuel and the speed and position acquisition of rotating assemblies (actuators and engine rotating parts).

These sensors are planed to work in normal conditions (T< 125°C) except for the sensor dedicated to speed measurement that will work in a "hot" environment (>300°C).

The final localisation of these sensors is flexible and will be discussed with Turbomeca during the project implementation.

The partner shall:

Bring its knowledge of the technology in the detailed writing of the system high level specification (Performances, Integration, environmental conditions, safety/redundancy…)

Benchmark the technical choices and trends in the automotive industry and other industries (maturity ranking, quote, weight, failure modes analysis, accuracy, system interfaces…)

Select the adequate technology

Perform the mechanical integration as well as the data transmission path integration (especially in regards to EMI/strike)

Develop a prototype and support the test on hydro-mechanical test bench

2. Special skills, certification or equipment expected from the applicant

High & proven experience in the design & development of sensors. Knowledge of the automotive products. Experience in aerospace R&T and R&D programs or similar (automotive …)

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Commonly written high level input specification		01/12/2009
D2	Benchmark / technology compatibility, worthiness and feasibility analysis – technology selection		01/04/2010
D3	Technology development plan containing: time and costs to develop prototype		01/06/2010
D4	Prototype delivery for test on engine test bench		31/03/2011

4. Topic value (€)

800000 Euro

5. Remarks

None

Topic Description REVISED

CfP topic number	Title		
JTI-CS-2009-1-SAGE-05-004	Development of sensor for the measurement of turbine engine temperature.	**Indicative Start Date**	01/10/2009
		Indicative End Date	31/03/2011

1. Topic Description

The WP 5.2.5 of SAGE5 Demonstration Project dedicated to the development of an innovative control system, aims also at developping and testing an accurate mean of measuring directly the temperature of the environment of the engine turbine, allowing better engine performances, hence engine downsizing possibilities.

The new system will have to measure with high accuracy (precision around 10°C) directly the temperature of the high pressure turbine blades (more than 1700°C) or, if it is not possible, the temperature of the gas in the area between the high pressure turbine and the free turbine (more than 1100°C).

The partner shall:

Bring its knowledge of the technology in the detailed writing of the system high level specification (Performances, Integration, environmental conditions, safety/redundancy…)

Benchmark the existing products and applications in the automotive industry and other industries (maturity ranking, quote, weight, failure modes analysis, accuracy, system interfaces…)

Select the adequate technology.

Perform the mechanical integration as well as the data transmission path integration (especially in regards to EMI/strike)

Develop a prototype (including acquisition power stage) and support the test on engine/turbine test bench.

2. Special skills, certification or equipment expected from the applicant

High & proven experience in the design & development of sensors. Experience in aerospace R&T and R&D programs or similar (automotive …)

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Commonly written high level input specification		01/12/2009
D2	Benchmark / technology compatibility, worthiness and feasibility analysis – technology selection		01/04/2010
D3	Technology development plan containing: time and costs to develop prototype		01/06/2010
D4	Prototype delivery for test on engine test bench		31/03/2011

4. Topic value (€)

800000 Euro

5. Remarks

None

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-SAGE-05-005	Development of high temperature survival electronic devices for engine control systems	**Indicative Start Date**	01/10/2009
		Indicative End Date	28/03/2011

1. Topic Description

The WP 5.2.5 of SAGE5 Demonstration Project dedicated to the development of an innovative control system, aims also at developping small affordable high temperature survival electronic platforms (data concentrator type); the target is to have electronics as close as possible to the sensors, enabling higher accuracy sensing acquisition paths, higher modularity and reduced overall shielding weight.

The partner shall:

Bring its knowledge in electronics in the detailed writing of the system high level specification (Performances, available cooling means on engine, integration, environmental conditions, safety/redundancy…)

Benchmark the technical choices, cooling means and trends in the aeronautic/automotive industry and other industries (maturity ranking, quote, weight, failure modes analysis, accuracy, system interfaces…)

Select the adequate technology, cooling technology and packaging

Pre-evaluate architecture (thermal, strike, aspects) and target price

Develop a prototype and perform the tests in lab

2. Special skills, certification or equipment expected from the applicant

High & proven experience in the design & development of electronics. Knowledge of the automotive products. Experience in aerospace R&T and R&D programs or similar (automotive …)

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Commonly written high level input specification		01/11/2009
D2	Benchmark / technology compatibility, worthiness and feasibility analysis – technology selection		01/03/2010
D3	Technology development plan containing: time and costs to develop prototype		01/05/2010
D4	Prototype delivery and tests in lab		28/02/2011

4. Topic value (€)

2000000 Euro

5. Remarks

None

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-SAGE-05-006	Development of high power density electrical actuators with Smart electrical interfaces in severe environment	**Indicative Start Date**	01/10/2009
		Indicative End Date	28/03/2011

1. Topic Description

The WP 5.2.5 of SAGE5 Demonstration Project dedicated to the development of an innovative control system, aims also at developping and testing Smart electrical actuators for turbine engine control systems. The target is to have a light, reliable and "easy to interface to a control unit" electrical actuator.

The partner shall:

Bring its knowledge of the technology in the detailed writing of the system high level specification (Performances, Integration, environmental conditions, safety/redundancy…)

Benchmark the existing products and applications in the automotive industry and other industries (maturity ranking, quote, weight, failure modes analysis, accuracy, system interfaces…)

Select the adequate technology.

Perform the mechanical integration study as well as the electrical interface & internal logic (especially in regards to EMI/strike)

Develop a prototype (including control/command powerstage) and support the test on engine/turbine testbench

2. Special skills, certification or equipment expected from the applicant

High & proven experience in the design & development of actuators and electronics. Experience in aerospace R&T and R&D programs or similar (automotive …)

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Commonly written high level input specification		01/11/2009
D2	Benchmark / technology compatibility, worthiness and feasibility analysis – technology selection		01/03/2010
D3	Technology development plan containing: time and costs to develop prototype		01/05/2010
D4	Prototype delivery for test on engine test bench		28/02/2011

4. Topic value (€)

2000000 Euro

5. Remarks

None

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRC-01-001	Actuator	**Indicative End Date**	30/09/2011
		Indicative Start Date	1/10/2009

1. Topic Description

The Green Rotorcraft research consortium of Clean Sky is aiming at the development of active rotor technologies to provide the greatest possible reduction in rotor noise and fuel consumption. A drawback of all active rotor systems that include discrete mechanical components like hinges, levers or gears is their vulnerability in a helicopter environment with high centrifugal loads and high vibration levels. That's why the idea of using smart materials that are directly embedded in the rotor blade structure is very attractive for this application. Operating as solid state actuators they can generate a twist deformation of the rotor blade without any friction and wear. A promising approach is the integration of low profile piezocomposite actuators into the rotor blade skin. Piezocomposites are a combination of brittle piezoceramic materials with ductile polymer materials to improve the handling qualities, damage tolerance and reliability of the actuator.

The feasibility of this technology has been successfully demonstrated on a model rotor level. The goal of this project is to transfer this technology to a full scale blade segment. An important issue in this context is the piezoelectric actuation system. To provide sufficient strain it is necessary, that the actuator operates in the piezoelectric d_{33}-mode. State of the art piezocomposites that exploit the d_{33}-effect need an operation voltage of up to 1500V. This high voltage is not acceptable for the envisaged application. Therefore it is intended to reduce the operation voltage below 250V. To achieve this goal the consortium wishes to enter into a partnership with a company or consortium able to develop low voltage piezocomposites to be integrated in the rotorblade structure. In cooperation with partners from the Green Rotorcraft research consortium the new partner will:

- Provide piezoelectric semi finished products;
- Integrate the semi finished products into piezocomposites;
- Develop and characterize the piezocomposite actuators with partners from the consortium;
- Deliver the piezocomposite actuators for integration.

The main requirements for the piezocomposite actuators are:

- Exploitation of the piezoelectric d_{33}-effect
- Free actuation strain of >1200µm/m
- Actuation voltage <250V
- Anisotropic actuation
- Robust and damage tolerant design

The proposal should not exceed a length of 50 pages.

2. Special skills, certification or equipment expected from the applicant

The applicant should be able to cover the complete process chain for the manufacturing of piezocomposite transducers. This includes the piezoceramic material, the application of electrodes and the integration of the piezoelectric material into a piezocomposite.

The applicant should have the industrial capacity to exploit the demonstration results – i.e. to further develop, optimise, and produce the actuators under commercial conditions and to support the customers on a sustainable basis.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
1	Requirements	Report on detailed requirements for the actuation system	31/12/2009
2	Prototype actuators	Prototypes of piezocomposite actuators that fulfil the requirements	31/12/2010
3	Actuators for blade integration	Delivery of piezocomposite actuators to be integrated in the blade structure	30/09/2011

4. Topic value (€)

The total value of the proposal shall not exceed: **€ 300000** (VAT not applicable in this programme)

5. Remarks

It is expected that the applicant briefly describes the technical solution for the low voltage actuation system.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRC-04-001	Diesel piston engine for light helicopter	**Indicative End Date**	31/08/2012
		Indicative Start Date	01/10/2009

1. Topic Description

The Green Rotorcraft ITD looks for a Diesel engine supplier.

The Green Rotorcraft Consortium is committed to demonstrate substantial reduction in CO2 emission and fuel consumption by flying a light helicopter powered by a Diesel engine as compared to a helicopter of similar capacity powered by a turboshaft engine.

The helicopter prototype will be a deeply modified version of an existing light helicopter produced by Eurocopter.

Technical requirements

The complete Diesel engine must respond to the following specifications:

? Output shaft power 300 kW at take-off (TOP ~5min) & 280kW (MCP – unlimited)

? Consumption less than 220 grams of kerosene per kW*hour

? Weight less than 185 kg fully equipped (FADEC, all coolers, starter, alternator, inlet and exhaust systems including turbo(s), etc.)

The required operating envelop is:

? Pressure Altitude: -500 to 6000m

? Temperature: -40°C to ISA +35°C max 50°C at SL

? Attitudes & Operating:

On ground (± 15° Roll; ±10° Nose down/up)

In flight (±20° Roll; ±15° (±20° transient 10s) Nose down/up)

Transient conditions :

The engine shall be capable of delivering maximum continuous power from zero power in 3s or less upon helicopter main rotor full pitch angle application in 1 second. (Altitude = 0m, ambient temperature = 15°C)

The output shaft speed shall be between 407rpm?6000rpm (6000rpm being present helicopter transmission input speed).

The output shaft should rotate counter-clockwise when looking from front to aft

The engine design has, at least, to be compliant with regulations CS27 and CS-E for piston engine.

The flightworthy engine prototypes have to include, basically: ? FADEC (Full Authority Digital Engine Control)fully redundant dual channel preferred. *Functionalities include*: *Basic*: Fuel Metering Nr Control Automatic Engine starting and in-flight Engine restarting Engine control mode : STOP, IDLE, FLIGHT Communication with cockpit controls and systems (avionics) Torque limitation (MGB mechanical protection) Emergency Fuel Shut-Off *Is nice to have:* Capability for adaptation of specific means for removal of NOX and particles Fault detection and management Maintenance and monitoring aid ? Starter ? Turbo-charging The Consortium is willing to enter into partnership with a company able to : ? Design or adapt; ? Support the airframer during integration or partially integrate; ? Test on the bench, possibly including pollution measurement; ? And deliver two (2) flightworthy engine prototypes, responding to these general requirements prior April 2012. The Partner should have the industrial capacity to exploit the demonstration results i.e. to further develop, optimise, certify (based on CS(E) regulation), and produce engines of similar size and characteristics under commercial conditions and to support the customers worldwide on a sustainable basis.

2. Special skills, certification or equipment expected from the applicant

Certification for engine (Flight Clearance qualification) Test benches mandatory Pollution measurement means

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
EP_DE_D_XX.1	Engine configuration report		M08
EP_DE_D_XX.2	Engine tests results synthesis		M35
EP_DE_D_XX.3	Engine for demonstrator (part)	Engines	M35

4. Topic value (€)

The total value of the proposal shall not exceed: **€ 3000000** (VAT not applicable in this programme)

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRC-05-001	Emission analysis Tools required to perform the emissions analysis and evaluation methodology	**Indicative End Date**	31/03/2012
		Indicative Start Date	01/10/2009

1. Topic Description

In the frame of the CLEANSKY Joint Undertaking, the Green Rotorcraft Integrated Technology Demonstrator is committed to demonstrate that substantial reduction in CO_2, NO_X emissions and fuel consumption can be achieved by defining, developing and validating Green Mission Profiles. These are alternative helicopter flight paths and/or flight procedures that allow achieving an optimal compromise between the highest possible performances in operating the helicopter and the lowest possible environmental impact.
An essential component in the development of Green Mission Profiles, is the reduction of harmful gas emission and fuel burn. To this end, experimental data, analysis methods and simulation tools are sought to support the analysis of gas emissions resulting from the adoption of Green Mission Profiles. In particular, existing state of the art methods and tools for the measurements and/or the simulation of Helicopter engine emissions will be used to evaluate Helicopter emissions during flight. Correlation analysis will be performed where experimental data acquired on engine test-benches and/or during actual flight will be compared with simulated data resulting from computational tools, with the objective of identifying the most appropriate measurements techniques and the most suited methods and simulation tools that can secure the highest possible accuracy in the prediction of fuel burn, NO_X, CO, Unburned Hydrocarbons (UHC) and CO_2 emissions for a H/C in flying conditions.

2. Special skills, certification or equipment expected from the applicant

GRC-5 Consortium is looking for partner(s) with the following expertise/know-how:

Gas emissions (NO_X, CO, UHC, CO_2) analysis methodologies: methods include one or more of the following methodologies: Empirical models (correlations), Semi empirical models (1D simulation tools), Numerical Model (CFD Simulation), Validated reduced mechanisms, Detailed chemical models;

Gas emissions (NO_X, CO, UHC, CO_2) / fuel burn computational analysis: investigations (modelling activity) of the effects of real fuel composition on pollutant formation;

The capability to use existing software packages will be considered as an asset. A non-exhaustive list of relevant tools includes: KIVA multidimensional reacting flow simulation, FLUENT and FIDAP computational fluid dynamic software, CHEMKIN chemical kinetic analysis software, NASA-Glenn equilibrium code, PYTHIA, GSP (or equivalent tools based on Gas Path Analysis).

The expected maximum length of the technical proposal is 100 pages.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Status of art of the methodologies	Review and summarise the existing knowledge about the prediction of NO_X & CO_2 emissions.	T_0 + 6M
D2	Main parameters and require-ments for helicopter pollutant emissions prediction	Define parameters and requi-rements to be considered for the definition of low emissions profiles for 5.3.2.	T_0 + 8M
D3	Computational tools to predict the NO_X & CO_2 emissions	Critical analysis to define if the existing computational tools are able to predict the emission as required in the frame of H/C flight path optimisation	T_0 + 8M
D4	NO_X and CO_2 prediction code	Apply selected codes in one of the following two alternative ways: Direct use of the existing codes as/if already optimised for this study; Modify/adapt the existing code, then validate and use them.	T_0 + 12M
D5	Emissions Data Bases	Contribution to produce the required Data-Base(s) related to the environmental flight conditions to be used in the optimisation process related to the pollution reduction.	T_0 + 20M
D6	Optimisation Phase	Contribution in the optimisa-tion phase to use the above defined tools to analyse the optimal mission profile focused un the pollutant emission reduction.	T_0 + 30M

4. Topic value (€)

The total value of the proposal shall not exceed: **€ 400000** (VAT not applicable in this programme)

5. Remarks

None

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRC-05-002	ATM Regulations	**Indicative End Date**	31/03/2015
		Indicative Start Date	01/10/2009

1. Topic Description

The Environment-Friendly Flight Path project (GRC-5) is committed to develop and test new rotorcraft-specific flight procedures aiming to reduce significantly the noise footprint and gas emissions. In detail new IFR procedures will be considered and a special attention will be given to Simultaneous Non Interfering (SNI) routes allowing IFR rotorcraft to join busy airports independently of the airplane traffic operating from / to active runways.

To support the development of these new IFR procedures, the GRC-5 consortium looks for expertise in ICAO Air Traffic Management (ATM) and airport / heliport design regulations.

The expertise contribution shall ensure that all the procedures developed for IFR operations in GRC-5 are complying with applicable, or pending, ICAO criteria related to IFR procedures and heliports design. In particular the ATM / Heliport expert(s) will be involved the following work packages of GRC-5:

- o GRC 5.1: Requirement Analysis & Specifications Definition
- o GRC 5.5: Definition of Low Noise IFR Procedures relying on satellite navigation (GNSS)
- o GRC 5.6: Final In-Flight Demonstrations & Conclusions

The work will take in consideration of the ATM concepts and technologies developed in SESAR. The contribution is expected to last for 6 years, starting from May 2009 and stopping after the completion of the final demonstrations mid of 2015.

The expected maximum length of the technical proposal is 100 pages

2. Special skills, certification or equipment expected from the applicant

To achieve successfully the expected contributions, skills and capabilities are required in the following domains:

• Air navigation and Air Traffic Management regulations, including the most recent ones and those currently in preparation by ICAO rulemaking groups.

• Airport / Heliport design, operations and Air Traffic Control (ATC)

• Detailed design, charting and safety analysis of IFR procedures relying on GNSS guidance, in particular SBAS and GBAS

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Air navigation regulations	Identification and analysis of applicable regulations for rotorcraft-specific IFR approaches, departures and navigation under GNSS guidance	T_0+10 M
D2	Criteria for Simultaneous Non Interfering (SNI) Aircraft – Rotorcraft operations	Identification and analysis of applicable criteria for simultaneous independent IFR takeoff, approach and landing, including heliport design aspects	T_0+14 M
D3	Low noise rotorcraft-specific IFR approaches	Generic definition of Direct and Point-in-Space low noise IFR approach procedures under GNSS guidance	T_0+21 M
D4	Low noise rotorcraft-specific IFR departures	Generic definition of Direct and Point-in-Space low noise IFR departure procedures under GNSS guidance	T_0+21 M
D5	RNP routes for helicopter low level IFR navigation	Generic definition of low level / narrow IFR routes based on RNP-RNAV, including airspace integration, control and separation	T_0+24 M
D6	Safety analysis of SNI operations	Detailed safety analysis of Simultaneous Non Interfering (SNI) Aircraft – Rotorcraft operations	T_0+38 M
D7	Detailed procedures definition	Detailed design and charting of the low noise IFR procedures used in the final demonstration, taking care of local constraints	T_0+50 M
D8	Final demonstration test report	Analysis of final demonstration results regarding ATM/ATC aspects	T_0+64 M
D9	Final report	Synthesis report of ATM expertise activities in GRC-5	T_0+66 M

4. Topic value (€)

The total value of the proposal shall not exceed: **€ 667000** (VAT not applicable in this programme)

5. Remarks

1 – In addition to the specific deliverables listed above, a significant contribution of the ATM / Heliport design expert is expected in some of the GRC-5 deliverables. Contributions to these GRC-5 deliverables will be prepared in collaboration with GRC-5 associates involved in the related tasks 2 – In GRC 5.6, the ATM / Heliport design expert will be responsible for the detailed design of IFR procedures and will also be involved in the negotiations with airport authorities in order to allow a full demonstration of aircraft – rotorcraft SNI operations in a real operational environment. This SNI demonstration is planned to be conducted in presence of real commercial aircraft traffic on active runways but in Visual Meteorological Conditions (VMC) for safety reasons.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-001	Software – Detailed weights and manufacturing costs	**Indicative End Date**	01-09-2010
		Indicative Start Date	15-10-2009

1. Topic Description

The software, starting from a first level weight breakdown based on conventional technologies given as input by the user along with other relevant data concerning geometries, design weights, etc. shall have the capability to obtain a detailed weight for each structural item and to provide also detailed information about costs.

1. WEIGHTS

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1a) DEFINITION OF DETAILED WEIGHT BREAKDOWN BASED ON CONVENTIONAL TECHNOLOGIES

The detail of the main structural items shall be provided according to the following breakdown:

WING

- Wing box (skins, stringers, spars, ribs, wing to fuselage joints, fittings, access doors, landing gear support beams)
- Fixed leading edge (panels, ribs, attachments)
- Fixed trailing edge (panels, ribs, attachments)
- Wingtip and winglet if applicable
- Movable surfaces: ailerons, aerodynamic brakes/spoilers, flaps (surfaces, mechanism, fairings, and support beams), slats (surfaces, mechanisms, supports) etc.
- Protection and external paint
- Other miscellaneous elements, if any

Specific installation shall also be estimated and added to each of the above mentioned items.

FUSELAGE

The following details shall be given for each fuselage section, starting from the cockpit up to the tail of the aircraft:

- Skins, stringers, doublers
- Frames
- Door surround structures (pax, service, cargo, etc.)
- Window frames and transparencies
- Keel beam
- Fuselage to wing integration
- Section joints
- Pressure bulkheads
- Landing gear zone bulkheads
- Doors and hatches (pax, service, emergency, cargo, landing gear, apu)
- Miscellaneous access doors

- Detailed floor structure (seat tracks, rails, cross beams, stanchions, longitudinal and stabilization elements, floor
  panel, floor miscellaneous)
- Cargo floor structure (beams, stanchions, fittings etc.), cargo partitions
- Fairings (wing, landing gear, tailplanes, wheel bins)
- Protection and external paint
- Other miscellaneous elements, if any

Specific installation shall also be estimated and added to each of the above mentioned items.

PYLONS

Structure, fairings, attachments, fittings

HORIZONTAL AND VERTICAL TAIL

The level of detail required is similar to the wing detail.

1b) UPDATE OF THE DETAILED WEIGHT BREAKDOWN DUE TO CHANGES TO THE PROJECT

After the definition of the detailed conventional weight breakdown of 1a), the detailed values shall be updated in accordance with the following potential changes to the project:

- New materials (i.e. change from Aluminum to CFRP; change from Aluminum to Aluminum-Lithium etc.)
- New technologies (i.e. new manufacturing processes)
- New design solutions (i.e. one piece frames, different frame and/or stringer spacing, one piece barrels, fuselage panels layout, wings with/without center box etc.)

This tool feature is achieved by accepting as inputs weight technology coefficients, one for each element of the structure breakdown, provided by the user.

The software shall be flexible and give visibility of the weight for the conventional solution, and for each of the different proposed changes.

2. COSTS

After the definition of the “Fly Weight” in 1a) and 1b), the code shall also calculate the “Buy Weight” estimating the material costs. The software shall have the capability to estimate the costs for the conventional solution and for each of the different changes to the project, the latter being assured through user provided inputs of cost technology coefficients, in a manner analogous to what discussed above for the weights.

3. CUSTOMIZATION

The code shall be user-friendly and customizable by the end user. Identified scaling factor and/or other criteria used by the software shall be manually changeable for both the 1) and 2) points.

The following is the required validity range:

MTOW 15.000 – 70.000 Kg,
PAX NUMBER 40-150

RANGE (nm)= 900- 3000 Mach Number = 0.45 – 0.83 Max Flight Altitude= 20000 – 40000 ft

2. Special skills, certification or equipment expected from the applicant

It is necessary to provide the source code and a validation plan by means of specific benchmark cases.

If available data base is limited in scope vs. this specification, the applicant should specify the feasible depth of analysis.

It is strongly recommended that the applicant is linked with a Software House in order to manage the methodology in the future.

The code shall be operative in a Windows environment and assistance for 6 months after code delivery is required.

The applicant shall be familiar with structural design, materials, weight estimation and weight distribution, buy-to-fly ratios, manufacturing costs.

The code will be compliant with the Alenia Aeronautica information technology infrastructure

standards(e.g. operative system, licence manager, security, hw requirements, etc….

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
Deliverable	**Title**	**Description (if applicable)**	**Indicative Due Date**
CSJU-GRA-09-01-1	Code specifications	Methodology to be followed, definition of the database management criteria and data specification	01-02-2010
CSJU-GRA-09-01-2	Code for weight management and manufacturing costs	Code developping	01-05-2010
CSJU-GRA-09-01-3	Validation and example of application	Validation and first example application, and user/theoretical manual making	01-09-2010

4. Topic value (€)

75000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-002	1. Special application of FO like FOBG sensors to investigate corrosion problems, temperature and humidity conditions on surface and inside the metallic materials. 2. FOBG instrumentation system achievement for Flight Test application qualification: Optical section. 3. Development and adoption of a technology based on Fibre Optic for thermal and mechanical strain measurement in a whole area (Distributed sensors): Optical section.	**Indicative End Date**	01/10/2010
		Indicative Start Date	01/10/2009

1. Topic Description

The activity 1 will be addressed to the employment of FOBG sensors as monitoring system for detection of corrosion induced stress and fatigue cracking in aeronautic aluminum specimens. In particular, the FOBG technology must be investigated for direct strain/stress measurement during a fatigue test in corrosive environment, and for monitoring of environmental parameter, like temperature, humidity and pH, which concur to promote the corrosion of aluminum and its alloys, or promote conditions that locally degrade the protective oxide film and minimize the availability of oxygen to rebuild it. With the aim to propose the FOBG technology as a candidate approach for this kind of application, we defined a sequence of sub-tasks:

- analysis of the compatibility of the optical fiber sensors bonding processes with the aqueous solution (typically 3.5 wt% NaCl) utilized for the corrosion generation.
- definition of an experimental methodology and relative setup for the correlation determination between data obtained with standard and new techniques:
  - Ø polarization curves (PC) corrosion testing, performed to evaluate the corrosion evolution by recording electrical potential,
  - Ø strain measurement close to the corrosion area, by means of standard fiber optic sensors,
  - Ø humidity and temperature measurement carried out with FO sensors close to the corrosion area.
- comparative analysis conducted on different aluminum alloys samples under fatigue test in corrosive environment.

Regarding **the activity 2**, in any new technology qualification process for avionic application one crucial step is the test of the novel equipment or procedure during a flight campaign, with the aim to demonstrate the compatibility with the exigent environment and condition present on board during the flight itself.
This task will be focused to the definition, realization and test of a new generation of instrumentation for FOBG sensor system monitoring, fully qualified for flight test activity, both for civil and military application.
Previous experiences, acquired during Flight Test (FT) campaign carried out on civil (Airbus A340) and military aircraft (Alenia C27J) provided a lot of useful indication which are the conceptual basis from where to start the activity of technical improvement of the existing instrumentation, both from optical and from electronic/logic point of view. In particular, from recent experimental tests, arises the need to modify the instrumentation at the moment utilized for such activity in Alenia, with the aim to reach higher sensitivity and reliability and, at the same time, to further reduce volume, weight and system complexity.
In this task the following actions will be performed:

- identification of critical parts of the optical sub-system in the existing instrumentation with the aim to improve its reliability and sensitivity,
- definition of corrective procedures in order to modify the optical sub-system,
- product research on the market concerning new optical components to substitute in the instrumentation,
- modification, test and characterization of updated instrumentation,
- support to the electronic sub-system and software revision,

- support to ground test qualification activity,
- support to flight test qualification activity.

The activity 3 is relative to the objective of distributed mechanical and/or temperature strain sensing using Optical Fibre. These include techniques based on Raman, Brillouin, and Rayleigh scattering as well as those involving multiplexed fiber Bragg gratings (FBGs). Techniques based on scatter typically employ optical time domain reflectometry and are thus limited in spatial resolution to 0.1 to 1 m. FBG methods are often limited by the number of gratings that can be multiplexed in a single fiber. Both FBG-based and scatter-based techniques also often require specialty optical fiber. This sub-task is addressed to the evaluation of a novel technique for ultra-high spatial resolution distributed temperature measurements using standard single-mode fiber. This new technology is based on the so-called swept wavelength interferometry (SWI) to measure the Rayleigh backscatter as a function of length in optical fiber with high spatial resolution. A sensor is formed by measuring the strain and/or temperature-induced shift in the reflected spectrum of the Rayleigh backscatter along a length of fiber. This SWI-based technique enables robust and practical distributed strain and temperature measurements in standard fiber with millimeter-range spatial resolution over tens to hundreds of meters of fiber with strain resolution of about ± 1 ?? and temperature resolution as fine as ± 0.1 °C.
The need to test this technique for ground application and, in perspective for flight application, pushes to focus the attention to commercially available instrumentation, already certified for the use in laboratory environment and potentially qualified for aeronautic application. With this target, an experienced technical advice is required for the following actions:

- determination, starting from an exhaustive market analysis, of the commercial instrumentation suitable for the experimental evaluation phase,
- instrumentation management, operation and maintenance during the experimental test campaign,
- assistance in the specimen preparation, in particular with respect to the optical fiber path definition,
- test resulting data elaboration and interpretation.

2. Special skills, certification or equipment expected from the applicant

1. Knowledge of the corrosion formation process, corrosion analysis and corrosion diagnosis criteria on metallic materials.
2. Proved experience on SHM, crack propagation and interrelation between crack propagation and corrosion development.
3. General Knowledge of distributed sensing technique by Fibre optic.
4. Identification of critical parts of the optical sub-system in the existing instrumentation with the aim to improve its reliability and sensitivity,
5. Definition of corrective procedures in order to modify the optical sub-system,
6. Product research on the market concerning new optical components to substitute in the instrumentation,
7. Modification, test and characterization of updated instrumentation,
8. Support to the electronic sub-system and software revision,
9. Support to ground test qualification activity,
10. Support to flight test qualification activity.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
Report	Special application of FOBG sensors to investigate corrosion problems, temperature and humidity conditions on surface and inside the metallic materials	Activity 1 - Final report	31/03/2010
Report	FOBG instrumentation system achievement for Flight Test application qualification: Optical section	Activity 2 - Final report	31/08/2010
Report	Analysis and results of a technology based on	Activity 3 - Final	01/10/2010

	Fibre Optic for thermal and mechanical strain measurement in a whole area (Distributed sensors): Optical section	report	

4. Topic value (€)

Overall budget 160000 Euro, so splited: **Activity 1: 24000 Euro** **Activity 2: 56000 Euro** **Activity 3: 80000 Euro**

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-003	1. FOBG instrumentation system achievement for Flight Test application qualification: Electronic section. 2. FOBG Optical Assembly and Interconnection technology. 3. Development and adoption of a technology based on Fibre Optic for thermal and mechanical strain measurement, damage detection in a whole area (Distributed sensors): Electronic section.	**Indicative End Date**	01/10/2010
		Indicative Start Date	01/10/2009

1. Topic Description

Starting on the experiences already collected on past activities aimed to develop an instrumentation to measure stress in aeronautical structures by means of BRAGG sensors, Alenia has obtained some significant results also on real Flight conditions during tests performed on civil and military aircraft.
The activity 1 has the scope to improve the system features to achieve a flight qualification. The themes to be studied shall be:

- Increase the instrumentation reliability: start-up time, insensibility to thermal variations and power glitches;
- Increase repeatability and precision of the measurement: analyse the possibility to use different discrimination technologies
- Increase measurement data rate:
    - Ø studying on use of a Digital Signal Processing (DSP) to process in near-real time the data acquired
    - Ø implementation of an embedded O.S. Platform
- System Re-design to approach a flight qualification process
    - Ø remove non-aeronautical standard interfaces
    - Ø increase the aeronautical standard level
    - Ø design the software following the application standard guidelines.

The activity 2 has the scope to study the possibility to use the FOBG measurement system in a centralized network to correlate and integrate measurement with other measurement techniques and to interface the on-board avionics. Particular care will be taken into account related to COTS (Commercial Off The Shelf) opportunities such Ethernet, USB, Serial adapters. Main topics shall be:

- Analysis of other interface measurement systems documents to
    - Ø study on synchronization and data transfer possibility
    - Ø design of new interface implementation.
- Analysis of Interface offered by standard regional class aircraft avionics.
- Analysis of possible application and improvement to a new regional aircraft typology.

Regarding **the activity 3**, a new approach will be investigate, the possibility to have a single fibre optic used as sensor with the objective of distributed mechanical and/or temperature strain sensing. This approach includes techniques based on Raman, Brillouin, and Rayleigh scattering as well as those involving multiplexed Fiber Bragg Gratings (FBGs).
This activity has in charge to study the feasibility to use this new approach in a real “on-field” case, by means of:

- Integration of laboratory commercial equipment for use on field test setup, support to integrate measurement with other already qualified techniques: strain-gage, thermocouple, ultrasound.
- Studying of design a new kind of graphic data presentation to visualize the data acquired on the whole area respect the measures under test (strain, thermal, crack).
- Studying of design of integration of a FOBR measurement system on an Flight system.

2. Special skills, certification or equipment expected from the applicant

1. Knowledge of aircraft electronic,
2. SHM system application in aircraft,
3. Mechanical and electrical interfaces between SHM systems/ FTI,
4. Aeronautic standards experience
5. Support to the electronic sub-system and software revision,
6. Support to ground test qualification activity,
7. Support to flight test qualification activity.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
Report	FOBG instrumentation system achievement for Flight Test application qualification: Electronic section	Activity 1 - Final report	31/05/2010
Report	FOBG Optical Assembly and Interconnection technology.	Activity 2 - Final report	31/05/2010
Report	Analysis and results of a technology based on Fibre Optic for thermal and mechanical strain measurement, damage detection in a whole area (Distributed sensors): Electronic section	Activity 3 - Final report	01/10/2010

4. Topic value (€)

Overall budget 240000 Euro, so splitted:

Activity 1: 120000 Euro

Activity 2: 40000 Euro

Activity 3: 80000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-004	New prepreg	**Indicative End Date**	*01/08/2010*
		Indicative Start Date	*01/10/2009*

1. Topic Description

Within the Clean Sky LWC ITD, employment of a multilayer structure material to improve the impact characteristics of primary structures of fuselage for the Green Regional Aircraft is going to be thoroughly studied and analysed.

The objective can be reached with different typologies of materials with different characteristics, exploiting the different capabilities.

A possible solution is to use a structure made of different layers layer of C/F prepreg material and a layer of metallic mesh with Steel/Ti threads or in alternative Nitinol or similar threads to exploit the improvement due to the super-elastic properties.

The C/F prepreg shall be suitable for aircraft application, having high damage resistance properties, a 180 degrees cure using standard autoclave cycle and shall be qualified or with a high TRL so that it can be easily qualified. Moreover, a complete database should exist and all relevant data on mechanical and physical properties shall be provided.

The metallic mesh prepreg shall have a compatible resin system and shall be layed-up and cured using the same processes used for the CF prepreg.

The use of a metallic mesh allows increasing the absorption of impact energy of a structure realized with innovative multi-layer materials in comparison to traditional composite material.

The possible solutions could include a carbon fibre reinforced polymer material having improved impact strength and resistance to delaminating and perforation combined with a metallic layer which exhibits martensite phase transformations and is incorporated into the composite material (or on outer surface).

During an impact event, high localized stresses are formed at the point of object and laminate contact. By undergoing a stress induced martensite phase transformation, the fibres which exhibit martensite phase transformations dissipate a large amount of strain energy. The phase transformation enables the fibres to accommodate up to 8% reversible strain and up to 20% ultimate strain. The impact energy is more readily dissipated by the fibres which exhibit martensite phase transformations than by the host composite material or by other hybridizing materials.

Impact strain energy dissipated by the fibres which exhibit martensite phase transformation is not available to initiate damage to the host composite material. Furthermore, the fibres which exhibit martensite phase transformations have higher stiffness and strength properties than conventional composite toughening agents such as elastomers and simple polymers.

A multi-layer structure with shape memory alloy (SMA) layer provides super elastic, reversible strain properties that could significantly improve the damage resistance, damage tolerance (e.g. compression-after impact (CAI) strength) and elevated temperature performance of the composite structure without negatively affecting the hot-wet compression strength of the composite structure.

2. Special skills, certification or equipment expected from the applicant

The applicant shall have a proven ability in the production of aerospace composite prepregs having high performance and all the relevant production and lab equipment needed for the complete characterization of the materials.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Feasibility study and test plan of the experimental and process activities		T0+2
D2	Preliminary manufacturing report of a metallic mesh reinforced composite.		T0+6
D3	Final technical report and supply of the produced samples		T0+10

4. Topic value (€)

The value of this topic is estimated in **150000 Euro**

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-005	*Stiffened panel evaluation* Non Destructive Evaluation (NDE) of a Composite JTI GRA Stiffened Panel, Response Functions / Metamodel; (for a full size JTI GRA panel)	**Indicative End Date**	*01-10-2011*
		Indicative Start Date	*01-11-2009*

1. Topic Description

In this work, it is expected that methodologies for non destructive evaluation of composite stiffened panels within the context of structural health monitoring of sensorised panels will be developed. The developed computational tools which should be of high relevance to aerospace industry are required to model an impact event on a sensorised composite stiffened panel. The developed modeling tools are required to assist in defining configurations of sensors and actuators in a way that would allow for effective detection of impact events and possible subsequent damage.

The technologies that should be accounted for in the models include fibre optics and Piezo type sensors. The structural health monitoring approached to be adopted should include Guided Ultrasonic Wave Propagation and Electro Mechanical Impedance Method.

The computational methodologies developed are required to include accurate modeling of composite material to allow characterization of damage from different impact events from sensor information. Developments should include robust modeling (Multilevel/Multiscale) of advanced composites including woven composite in additional to more traditional ones. The methodologies should allow for an efficient modeling of composite materials and ideally allow for detection and characterization of different modes of degradation such as fibre matrix debonding, matrix cracking, delamination and fibre fracture in a Multilevel / Multiscale environment.

The codes developed should allow for use for development of mechanical models and statistical data that can be used to generate response functions of residual strength by parameter variation.

The task split into developments within the following topics:

- Computational tools to model damage detection processes in sensorised composite stiffened panels;
- Computational tools to assist with effective sensor positioning in design of self diagnostic structures; and
- Computational tools to recover magnitude and location of the impactor.
- The code will be compliant with the Alenia Aeronautica information technology infrastructure standards (e.g. operative system, licence manager, security, hw requirements, etc.…

2. Special skills, certification or equipment expected from the applicant

The applicants are expected to have established research track record in aircraft structures research with successful coordination and participation in international projects. The successful University/Institute/Company should have extensive expertise and facilities related to aeronautics to ensure its understanding of the overall projects and enable it to successfully interact and collaborate with other partners in the JTI consortium The applicant should belong to a strong aerospace research department with extensive expertise and track record in Composite Materials, Impact, Damage and Fracture Mechanics, Structural Dynamics and Computational Methods. The team's proven ability in development of innovative methodologies for implementation within both in-house and commercial software is important. Efficient, accurate and validated methods are required in the

specified fields described above. Software modules will be validated against specified test results.

The applicant must be familiar with methodology and technology as above described for industrial applications, using a high level programming language, FEM/BEM theory development with interactive and open environment which will be able to interface with existing and commercial packages.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
CSJU-GRA-	Methodologies for	Report on adopted methodologies for damage detection due to low	04-06-2010

09-05-1	damage detection	velocity impact	
CSJU-GRA-09-05-2	Computational tool for prediction of impact force and location	Report on methodologies developed for recovering the impactor's magnitude and location	04-12-2010
CSJU-GRA-09-05-3	Software code/module for damage detection	Software model based on the developed methodologies. Executable, source code and documentation	04-04-2011
CSJU-GRA-09-05-4	Computational tool for effective positioning of sensors	Report on computational Multilevel/Multiscale tools developed to allow for an effective positioning of sensors and actuators on stiffened composite panels to allow maximum detection of impact event	01-10-2011
CSJU-GRA-09-05-5	Software code/module for impact force and location evaluation	Software model based on the methodlogies developed. Executable, source code and documentation	01-10-2011

4. Topic value (€)

420000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-006	*Stiffened panel* Diagnostic/ Prognostic methodologies/ code (residual strength evaluation) of a composite sensorised multilayer stiffened panel	**Indicative End Date**	*01-10-2011*
		Indicative Start Date	*01-11-2009*

1. Topic Description

This work aims at the development of a software tool that will be able to evaluate and optimize sensorised structures. Information from sensors will be used to evaluate the current and future residual strength of a damaged composite multilayered stiffened panel, by using appropriate Multilevel / Multiscale prognostics and diagnostics methods. This study will enable the monitoring of the structural performance, and the realization of sensor – advised maintenance based on probabilistic principles.

Various design criteria such as weight, structural and sensors reliability, SHM system delectability and maintenance costs will be taken into account to optimize both structure and sensors network. The software tool will be able to run in offline and online mode.

In offline mode, simulation methods will be used to evaluate the performance of sensors and structure.

In online mode real – time signal from sensors will be used to compute maintenance schedule. Its capabilities will be demonstrated by applying it on a tested composite panel. Sensor – advised maintenance strategy will be followed and will prove its efficiency through the comparison with the scheduled maintenance strategy. The code will be compliant with the Alenia Aeronautica information technology infrastructure standards(e.g. operative system, licence manager, security, hw requirements, etc….

2. Special skills, certification or equipment expected from the applicant

In order to ensure the appropriate completion of technical and administrative work, the applicant should exhibit successful coordination and/or participation in international research projects.

The outcome of this project will be a software tool that will integrate appropriate scientific methods for the evaluation and optimal design of sensorized structures. The applicant must be familiar with developing mature software tools for industrial applications, using a high level programming language with interactive and open environment which will be able to interface with existing and commercial packages. The software will consist of integrated methods in Multidisciplinary Design, Optimisation, Decision Making, Probabilistic Design and devising Maintenance Strategies. Accurate and validated methods are required in the specific fields. Software predictions will be validated against specific test results.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
CSJU-GRA-09-06-1	Methodology description	Description of: i) Software specifications ii) Theoretical background, iii) Required infrastructure that will support the development and operation of the Multilevel / Multiscale software tool.	01-04-2010
CSJU-GRA-09-06-2	Completed software - offline function	Software will demonstrate its capabilities in offline mode by	01-04-2011

	demonstration	using simulation tools. A representative test case will be designed and analysed.	
CSJU-GRA-09-06-3	Online function demonstration	Software will demonstrate its capabilities in offline mode using real – time sensor information.	01-06-2011
CSJU-GRA-09-06-4	Software	Executable, source code and documentation	01-10-2011

4. Topic value (€)

550000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-007	*Thermosetting resin*	**Indicative End Date**	*01/03/2010*
		Indicative Start Date	*01/10/2009*

1. Topic Description

The objective of the activity is the development of a thermosetting resin filled with nanomaterials. Mechanical, chemical-physical, rheological characterisations of the new material is necessary for the optimisation of the product in agreement with the process parameters required from the prepreg supplier.

WP	TITLE
WP1	Manufacturing of the nanocharged resin
Task 1.1	Nanoparticles selection
Task 1.2	Set-up of the dispersion method
Task 1.3	Tuning of the cure process
Task 1.4	Nanocharged resins manufacturing
WP2	TESTING OF THE MATERIAL
Task 2.1	Chemical – Physical and Morphological characterisations
Task 2.2	Thermal characterisation
Task 2.3	Mechanical characterisation
Task 2.4	Electrical characterisation
WP3	Assessment and benefit
Task 3.1	Activity assessment

WP1

The objective of the WP1 is to manufacture the nanocharged resins. To develop these material will be necessary to set-up the dispersion method of the selected nanoparticles in the resin. Moreover, there will be the fine tuning of the cure process of the system (resin + nanocharge). Will be manufactured the samples in agreement with the dimensions need for the characterisation.

WP2

The objective of the WP2 is the characterisation of the samples manufactured in the WP1. Chemical – Physical and Morphological characterisations are necessary to evaluate the

dispersion degree of the nanocharges in resin, moreover the rheological characterisations of the new material is required for the optimisation of the product in agreement with the process parameters required from the prepreg supplier.

Thermal, mechanical and electrical characterisations will be performed on the samples in order to evaluate the improvement of the characteristics of the new materials by dispersion in resin of nanoparticles.

WP3

The objective of the WP3 is the evaluation of the benefits of the new material:

? To estimate obtained results relevance

? To evaluate compliance with desirable requirement

? To evaluate limits and lesson learned

? To envisage future development.

This estimation will be evaluated in terms of mechanical and electrical properties of the new developed materials.

	M1	M2	M3	M4	M5
WP1					
WP2					
WP3					

2. Special skills, certification or equipment expected from the applicant

The applicant must have the expertise and equipments to formulate, synthesize and characterize a wide range of thermosetting resin filled with nanoparticles. He must have the possibility of investigating both surface and bulk material characteristics using various microscopy, spectroscopy, thermal analysis and mechanical testing techniques.

He must have the facilities to carry out both short and long term consultancy programmes in the following areas:

1) Resin formulation, by choosing both the suitable precursor and the hardener as curing agent.

2) Nanoparticles selection and preparation among 1D, 2D and 3D fillers. Use of compatibilizing agents..

3) Samples Preparation:
Nanoparticles dispersion with sonication, milling or mechanical mixers.
Mould casting
Cure parameters control (temperature, pressure, time)

4) Morphological Characterization:
Optical microscopy
FTIR spectroscopy
UV spectroscopy
Scanning electron microscopy (SEM)
Atomic force microscopy (AFM)

5) Thermal Properties:
DSC
Modulated DSC
TMA
TGA

6) Volumetric Properties
Density gradient column
Pyknometer

7) Rheology:
Capillary rheometers
Rotational rheometers

8) Mechanical Properties:
Izod and tensile impact
High Force Load Test
DMA

9) Electrical properties characterization
Electromagnetic Characterization of Polymeric Composites in d.c.
Electromagnetic Characterization of in a.c. in the range 10 Hz – 10 MHz.
Electromagnetic Behaviour of materials in temperature and under mechanical stresses.

10) Barrier properties
Gravimetric measurement of absorption
Diffusion determination
Permeability tests.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Technical Report on manufacturing of the nanocharged resin	N/A	01/12/2009
D2	Technical report on testing of the materials	N/A	01/02/2010
D3	Technical Report on assessment and benefit	N/A	01/03/2010

4. Topic value (€)

100000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-008	Resin-nanofiller dispersion	**Indicative End Date**	*01/11/2010*
		Indicative Start Date	*01/11/2009*

1. Topic Description

Within the Clean Sky LWC ITD, the use of a nanocomposite material for primary structures of a Green Regional Aircraft is going to be thoroughly studied and analysed.

The objective will be reached by performing the development of a new nanofilled prepreg. The C/F prepreg shall be realized starting from existing technologies for prepreg manufacturing, leading to a product with minor restrictions in terms of curing cycle and the possibility to be commercialized and qualified.

The production of the new prepreg will be targeted to the realization of coupons and small panels for the demonstration of the applicability of this technology to specific aeronautical applications. Among the different material solutions with multi-functional properties the utilization of carbon nanotubes will be taken into consideration for the potential improvement of the mechanical properties and the electrical conductivity.

WP	TITLE
WP1	**Process study for prepreg development**
Task 1.1	Feasibility study and test plan
Task 1.2	Material selection and dispersion method scale-up
Task 1.3	Tuning of the prepreg manufacturing process
Task 1.4	Realization of prepregs
WP2	**COMPOSITE REALIZATION AND CHARACTERIZATION**
Task 2.1	Realization of coupons and small panels
Task 2.2	Composite characterization
Task 2.3	Assessment and benefit

WP1

The objective of the WP1 is to develop a prepreg material by means of the selection of materials, the study of a resin-nanofiller dispersion system scale-up and its optimization with respect to the prepreg manufacturing process requirements and safe constrains.

WP2

The objective of the WP2 is to manufacture and to characterize samples for testing purpose. The task will include a thermo-physical characterization of the prepreg and cured samples, together with a destructive and not destructive testing phase addressed to evaluate main defects and morphological features of the panels.

A final evaluation of the benefits of the new material will be performed in order to:

- Ø estimate obtained results relevance;

- Ø evaluate compliance with desirable requirements;
- Ø evaluate limits and lesson learned;
- Ø envisage future development.

With this in mind technical results coming from nanofilled composite will be compared with some aircraft structures requirements (e.g. electrostatic discharge, electromagnetic interference shielding and lightning strike protection).

2. Special skills, certification or equipment expected from the applicant

The applicant shall have a proven ability in the production of aerospace composite prepregs having high performance and all the relevant production and lab equipments needed for the complete characterization of the materials.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Technical Report on the feasibility study and test plan		T0+2
D2	Technical Report on manufacturing of the prepreg and panels		T0+10
D3	Technical Report on testing activities		T0+12
D4	Technical Report on assessment and benefit		T0+12

4. Topic value (€)

250000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-009	*Intelligent Stress Health monitoring*	**Indicative End Date**	*01-06-2011*
		Indicative Start Date	*01-12-2009*

1. Topic Description

This work aims at the development of a software tool for designing sensorised structures for maximum detectio capability of impact events on a composite panel. The resulting model system(s) must have the ability to develop a representation of the state of damage of the structure – we might call this a perception of its state in a time varyin environment and to continuously transform raw sensory data into information (interpretations) and then int context-sensitive knowledge (concepts).

In broad terms the requirements that must be satisfied by an integrated and intelligent structural stress healt monitoring system (Multilevel) should propose and demonstrate solutions for (1) the sensing and response syster (the quantities that must be measured, and temporal and spatial measurement and response scales), (2) the placement and the embedding of sensors as well as the subsequent use of such sensors, (3) the need t distinguish structural damage from sensor or system failure (Multiscale / Multilevel) 4) issues of information los and sensor and system reliability, and (5) the need to adopt an integrated approach to the solution of sensing processing, communication and decision-making design problems. Whatever the capabilities of future materials fo self-repair or regeneration, it is concluded that there will be a need for an integrated structural health monitorin system. The code will be compliant with the Alenia Aeronautica information technology infrastructure standards(e.g. operativ system, licence manager, security, hw requirements, etc.…

2. Special skills, certification or equipment expected from the applicant

In order to ensure the appropriate completion of technical and administrative work, the applicant should exhibit successful coordination and/or participation in international research projects.

The outcome of this project will be a software tool that will integrate various scientific methods for the evaluation and design of an SHM system. The applicant must be familiar with developing mature software tools for industrial applications, using a high level programming language with interactive and open environment which will be able to interface with existing and commercial packages. The software will consist of methods in Structural Health Monitoring, Diagnostics, Prognostics, Signal Analysis, Fault Detection, Decision Making and Optimisation. Accurate and validated methods are required in the specific fields. Software predictions will be validated against specific test results

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
CSJU-GRA-09-09-1	Methodology description	Description of: i) Software specifications ii) Theoretical background, iii) Required infrastructure that will support the development and operation of the Multilevel / Multiscale software tool.	30-04-2010

CSJU-GRA-09-09-2	Software demonstration	Software will demonstrate its capabilities using real data.	01-06-2011

4. Topic value (€)

300000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-010	*Smart maintenance with adapted patches*	**Indicative End Date**	*01-06-2011*
		Indicative Start Date	*01-11-2009*

1. Topic Description

Within this topic, it is expected that all the required technology and new generation bonding and processing prototype equipment will be developed, in order to simultaneously enable:

a. Advanced curing of the repair, using the induction heating method, with variable heating energy output, according to heat transfer and heat losses requirements.

b. Minimization of induced thermal strains during heating, by reduction of the area actually heated for the implementation of the repair and rationalization of temperature distribution.

c. Basic features of structural health monitoring after the implementation of the repair, by using appropriate sensors.

d. Performance of ancillary functions (lightning protection, electrical grounding).

e. Portability and robustness of utilized equipment and sensors, to facilitate their future operational use for the implementation of maintenance activities

2. Special skills, certification or equipment expected from the applicant

In order to ensure the appropriate completion of technical and administrative work, the applicant should exhibit successful coordination and/or participation in international research projects; He has to be familiar with the following technical needs:

Bonded composite repair areas of aircraft structures frequently suffer from a variety of factors that may influence their structural integrity, either in short or in long term basis. These factors include mainly residual thermal strains, due to the inevitable heating of a much larger area compared to the repair, in order to achieve the required curing temperature. Moreover, even though optical fibers have proven adequately sensitive for monitoring of repairs, they are equally sensitive to external effects (impacts, treatment etc.), consequently suffering from long term durability and issues related with their handling and connecting. In order to overcome some of these factors, an innovative “sensorized” composite repair set-up is seeked. This set-up, herein referred to as “smart patch”, should combine different technical achievements, aiming to simultaneously accomplish the following maintenance effects:

a. Advanced curing of the repair by induction heating, with multiple local fields to achieve numerous effective heating zones, instead of conventional conduction heating, using resistance powered heating blankets.

b. Reduction of heat residual stresses induced in the repair area, due to the heating of larger than required areas, by localization and regulation of transferred heating energy, according to actual temperature requirements.

c. Basic features of structural health monitoring of the repair, by interrogation of the embedded sensors in regular maintenance intervals, to acquire data concerning changes in the strain field related to accumulated damage. The sensors should be organized according in such an array, in order to enable adequate signal measurements with minimum lead output.

d. Incorporation of “ancillary functions”, such as lighting protection and electrical grounding.

The project should result in a complete chain of operational prototype equipment, software and sensors that will fully renew the technology of composite repair bonding, by combining heating, stress localization, stress compensation, health monitoring, lightning protection and electrical grounding. All the resulting prototype equipment should be robust and portable, to enable greater flexibility for the application of the method in-situ, with minimum energy consumption and infrastructure / environmental requirements.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
CSJU-GRA-09-10-1	Analysis and Evaluation of Basic Requirements	Methodology to be followed, definition of sensors and materials to be used, limitations, test plan.	30-01-2010

CSJU-GRA-09-10-2	FE Analysis	Detailed thermal and mechanical modelling of the effects of induction heating on the repair area.	30-04-2010
CSJU-GRA-09-10-3	First prototype equipment	First prototype of full range of induction heating equipment and related sensors	30-01-2011
CSJU-GRA-09-10-4	Testing	Results from the full series of testing of the first prototype equipment.	15-03-2011
CSJU-GRA-09-10-5	Final prototype equipment	Final prototype of full range of induction heating equipment and related sensors, after implementation of required changes	01-06-2011

4. Topic value (€)

200000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-011	FOBG - Design and validation of FOBG for SHM application	**Indicative End Date**	01/07/2010
		Indicative Start Date	01/10/2009

1. Topic Description

The proposal is focused on the following topics

- Adaptation and supply of sensors for strain measurement (electrical and fiber optical strain gauges) considering the special SHM requirements, regulations and guidelines for aerospace applications.

- Adaption of hardware considering the requirements for aerospace applications (mechanical, thermal and electrical parameters and functionality).

- Development of a concept to compensate temperature influences on the signal (due to the application form of the strain measuring elements)

- Software adaptation for data analysis considering SHM requirements.

- Contribution to Data Analysis and processing for structural and fatigue consideration

2. Special skills, certification or equipment expected from the applicant

Special skills are:

- Commercially available hard- and software combining optical fibre technology and metallic strain gauge technology.

- Supplier of certified sensors

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Sensor Design	Report showing possibilities to adapt sensors, software and hardware on SHM considering aerospace requirements and Technology Readiness Level.	1/07/2010
D2	Sensor Validation	Supply of adapted sensors for validation to the Fraunhofer Gesellschaft	1/07/2010

4. Topic value (€)

78000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-012	Definition and fabrication of specimen, sensor integration, experimental set-up definition	**Indicative End Date**	30/10/2010
		Indicative Start Date	01/10/2009

1. Topic Description

-Definition and fabrication of composite specimens
-contribution to specimen manufacturing with embedded sensors
-reliability analysis of sensors
-development of a concept to evaluate the system reliability of sensorized fiber reinforced structures
-experimental set-up definition (DOE) including sensitivity analysis to reduce test effort for development of sensorized structures

2. Special skills, certification or equipment expected from the applicant

this topic requires special skills and multidisciplinary experience in:
- design of complex lightweight structural components of composites
- design of sensor technologies for SHM
- Adaptronics / Embedding sensors/actuators in composites
- Reliability/Sensitivity analysis of complex systems considering aerospace requirements
- Structural Durability Analysis of composite structures

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Specimen	Report on Definition and fabrication of specimen and experimental set-up definition.	30/10/2010
D2	sensor integration	Report on sensor integration considering reliability requirements	30/10/2010

4. Topic value (€)

80000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-013	Design of sandwich structures for sensor integration, optimisation and manufacturing of sandwich core	**Indicative End Date**	30/10/2010
		Indicative Start Date	01/10/2009

1. Topic Description

The proposal is focused on the following topics:

- Contribution to strength evaluation (e.g. impact, static and fatigue) of foam sandwich structures based on FE-calculations
- Design and supply of special foam cores (raw material and shapes) considering manufacturing and aerospace requirements
- Development of special design rules for the foam core considering SHM-requirements
- Contribution to specimen manufacturing (autoclave technique)

2. Special skills, certification or equipment expected from the applicant

Special skills are:

- Design and manufacturing of structural foam core for lightweight structures under the requirements of aerospace manufacturing for the foam core: strutural intregity at 7 bar pressure at 180°C
- Supplier of certified and commercially available foam core material (raw material and shapes)

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Strength evaluation/design	Report on design of foam cores.	30/10/2010
D2	Validation/Testing	Contribution and Supply for specimen manufacturing	30/10/2010

4. Topic value (€)

77000 Euro

5. Remarks

None

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-014	Modification of Resin	**Indicative End Date**	31/10/2010
		Indicative Start Date	01/10/2009

1. Topic Description

In task 1.3.5.1 nano-particles dispersion models and numerical simulation of interface properties will be applied (Virtual material design). Liquid resins will be characterised with respect to rheological and curing properties. Thermomechanical properties, strength and impact strength of samples containing no fibres will be measured. A correlation between the samples properties and composition / interface composition of the particles will be carried out. It is planed and agreed in this task to evaluate different properties which could be influenced by nano fillers. Cira+ works on the properties “Flame retardancy” and “Electrical conductivity”, Fraunhofer works on “mechanical strength” and “toughness”. Furthermore it is planed to evaluate the potential of blended modified resins to optimise all of the properties. Beside the know how about nano fillers, how to disperse them and stabilise the dispersions at Fraunhofer it is necessary to ensure the availability of nano modified resins in a commercial amount for the introduction in industrial manufacturing. For that it is necessary to cooperate with a commercial supplier. This commercial supplier should have experience in preparation of nano fillers and the production of stable nano modified dispersions.

Work to be carried out:

- *Preparation of master batches (40-50 wt-% of particles) of silica particles in two different epoxy resins. The particles must be ball shaped, not agglomerated and of uniform size.*
- *Variation of the particle size in the range between 10-30 nm.*
- *Preparation of master batches (30-50 wt-% particles) of elastomer particles (cross linked silicone) in two different epoxy resins. The particles must be ball shape, not agglomerated and of uniform size below 100 nm.*

2. Special skills, certification or equipment expected from the applicant

Long term experience in industrial manufacturing of nano filled dispersed resins (epoxy)

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1.3.5-01.1	Technical report on material selection		31.12.2009
D1.3.5-01.2	Test report on mechanical and functional characterization of the nano-composite.		28.02.2010
D1.3.5-01.3	Final test report on mechanical and functional characterization of the nano-composite.		31.10.2010

4. Topic value (€)

55000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-015	Preparation and mechanical test of panels	**Indicative End Date**	*31/10/2010*
		Indicative Start Date	*01/11/2009*

1. Topic Description

In Task 1.3.5.2 pre-preg will be prepared and coupons will be manufactured with the modified resins developed in task 1.3.5.1. The coupons will be tested with respect to thermo-mechanical properties, strength and impact strength. Samples for FST tests according to DIN EN 6038 will be prepared. The modification of the resins in task 1.3.5.1 will be performed by Fraunhofer and the project partner CIRA+. Different modification of the resins are planed or already part of ongoing project work. Also it is agreed to reduce the number of modified resins after the first work period in task 1.3.5.1 (after the first deliverable in April 2009) a large number of panels have to be prepared and tested. The preparation and testing of CFRP panels is, also state of the art, a high complex and difficult work. A lot of potential source of errors could occur by the preparation, which sophisticates the influence of the nano particles in the resins. Besides this especially for the FST testing appropriate testing devices and know how in performing the testing is necessary. Another aspect to spread the preparation and testing work is the evaluation of “robustness of results”. Some of the samples prepared with the same parameters and materials should be tested by different partners/institute. The comparison of these results should give a conclusion of reproducibility and robustness of working with nano modified resins later on in industrial processes.

Second topic of this CfP is the R&D work regarding the interaction of the modified resin with the carbon fibre. It is known that the material behaviour of CFRP depend on the interactions of the resins and the fibre. More depth informations about these interactions are necessary to understand the desired changes in mechanical strength of the CFRP material caused through the nano modified resins.

Therefore this CfP is announced to institutes which have a long time experience for the preparation, testing of CFRP panels and analysing of the fibre – resins interactions. The proposal should imply therefore the topics:

Work to be carried out:

- Manufacturing, cutting and mechanical testing of CFRP samples with sizes up to 50x50 cm.
- SAC testing (DIN EN 6038).
- Determination of fiber content.
- Determination of single fiber adhesion including improvement of measurement method.

2. Special skills, certification or equipment expected from the applicant

- Long time experience in pre-preg manufacturing.
- Long time experience in manufacturing of coupons at least of the size 50 x 50 cm.
- Long time experience in thermo-mechanical testing of coupons material.
- Long time experience in mechanical testing of CFRP.
- Long time experience in strength after compression test according DIN EN 6038
- Long time experience in evaluation of fibre amount
- Experience in testing of single fibre behaviour

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D.1.3.5-02.1	Report on SAC Testing		01/02/2010
D.1.3.5-02.2	Report on single fibre adhesion		01/06/2010
D.1.3.5-02.3	Report on performed tests		31/10/2010

4. Topic value (€)

45000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-016	Definition of requirements and tests of practicability	**Indicative End Date**	*30/06/2011*
		Indicative Start Date	*01/10/2009*

1. Topic Description

Definition of requirements and test of practicability from airline perspective

In Task 1.3.6-02, adhesive joining technology is being tailored for new composite materials to enable repair solutions based on adhesively bonded CFRP patches. This R&D work is performed by the Fraunhofer Gesellschaft at the Institute IFAM in Bremen, Germany. To ensure that the research results are applicable in aircraft maintenance, it is important to take care that the joining technology fulfils the specific requirements. For example these requirements have to cover factors like allowed adhesive and laminate material with the appropriate curing temperatures, the expected loads in service, the working environment which is given in aircraft overhaul and maintennace (e.g. hangars or workshops) and the skill level of workers. The contribution of the partner searched in this call for proposal will guarantee that all relevant requirements will be considered, so that the technological solutions will not only work under conditions of academic research, but also work reliably if applied in commercial aircraft maintenance. This practical applicability of the technology will also be demonstrated in WP 1.3.7, representing the first demonstration phase of the project, where maintenance personal shall perform repairs on test panels.

The following tasks have to be performed:

1. Definition of requirements:

A list of requirements from the airline perspective of view has to be defined. The list considers general requirements for the repair process and the repaired structure. It describes the specific requirements for a selected repair case in detail. This repair case has yet to be defined by the project partners.

The list of requirements will consider

a. Requirements for selection of adhesives
b. Requirements for selection of processes
c. Contamination of damaged structure
d. Pre-treatment of structure
e. Temperature range for curing
f. In-service conditions

This list is still incomplete. It will be a main contribution of the MRO company to check that norequirements important for the practical application of the project results will be forgotten in the research on T1.3.6-02. The requirements specified from airline perspective of view (in this CfP topic) and from aircraft manufacturer perspective (defined by project partners in T1.3.6-01) will provide a basis for the selection of adhesives, pre-treatment processes, inspection processes and test conditions in T1.3.6-02.

2. Supervision of patch manufacture

The CFRP patches used for coupon tests and exemplary repairs will be manufactured by Fraunhofer. To ensure that the material is comparable with material used in maintenance, the first manufacturing batches will be produced by specialists of the MRO company and Fraunhofer together. This work will be performed at the facilities of Fraunhofer IFAM.

3. Repair of test components

Test components will be repaired by personal of the MRO company. This work will be performed at the facilities of Fraunhofer IFAM. The repair will be based on the materials and processes selected and developed by Fraunhofer in T1.3.6-02. The MRO company will evaluate the practicability of the repair process and derive suggestions for further improvements. The evaluation will focus on the pre-treatment and inspection processes for the new composite materials. Especially the robustness, speed, worker skill level reqirements, logistical effort and cost of the processes will be considered.

4. Repair of demonstrator

A demonstrator will be repaired by the MRO company. This work will be performed at the facilities of one of the CLEANKY GRA project partners. It will contribute to WP 1.3.7 where test panels are manufactured to integrate the results of the work on different technologies in the preceding work packages.

2. Special skills, certification or equipment expected from the applicant

Two OEMs, Alenia and ATR, are partners directly involved in WP 1.3.6. Still missing is the airline perspective of view. Therefore, this CfP asks companies with long term experience in maintenance, repair and overhaul (MRO) of commercial aircraft to apply. The company should have a longterm experience in composite repair and bonded repair, too. Furthermore, it needs to be up to date concerning the international state of the art of composite repair. A profound knowledge of the repair technology developments currently discussed by OEMs and airlines is required.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
1	Definition of requirements	Report on requirements for repair process and repaired structure	01/12/2009
2	Repair of test components	Report on the test repairs with special consideration of the practicability of surface-pre-treatment and inspection processes	01/07/2010
3	Repair of demonstrator	Report on the demonstrator repair	30/06/2011

4. Topic value (€)

100000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-017	Numerical simulation	**Indicative End Date**	*01/05/2010*
		Indicative Start Date	*01/10/2009*

1. Topic Description

Simulation of the load-bearing characteristics of thin-walled integral aircraft-structures and deduction of proposals for improved light weight integrals structures with predominantly static loading conditions in the lower fuselage structure

Based on load cases, typical for lower fuselage structures, a fusalage optimization with the aim weight reduction should be carried out:

1) calculation of stresses, deformation and strains of riveted structure for the load cases compression and shear & compression for given Aluminium Alloy (basis for comparision)

2) calculation of stresses, deformation and strains for laser welded integral structure with similar mass; evaluation and conduction of proposals for weight optimized fuselage structure

3) design proposal for load adapted stringer and frame design as well as welded integral knots (stringer-frame-skin-joints) for welded integral structure

4) evaluation of weight saving potential of new weldable Alluminium Alloy

2. Special skills, certification or equipment expected from the applicant

Experience for FEM-simualtion of large components for air craft fuselage structures

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1.3.8-01.1	Numerical simulation for optimized welded integral structure	Design proposal for load adapted design of welded stiffer and integral knots for predominantly static loading conditions	01.03.2010
D1.3.8-01.2	Final report on the numerical simulation		01.05.2010

4. Topic value (€)

100000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-018	System integration for broadband acousto-ultrasonics and electromechanical impedance monitoring technology	**Indicative End Date**	*01.10.2010*
		Indicative Start Date	*31.10.2009*

1. Topic Description

The task includes the development of concepts for the system integration of structural health monitoring methods, as well as the set up of prototype hardware and testing.

Based on specifications gained from preliminary experiments a concept for the implementation of the structural health monitoring methods and signal processing algorithms based on broad band acousto-ultrasonics and electromechical impedance (EMI) has to be developed with focus on embeddable hardware and software. This includes the design of electronic PCBs, the manufacturing and the programming of algorithms.

Hardware prototypes will be built and tested regarding their performance compared to the laboratory off-the-shelf hardware available.

2. Special skills, certification or equipment expected from the applicant

Skills in electronic design, including simulation and layout. Programming of embedded systems, preferably using automatic code generation from Simulink. Skills in analog and digital processing

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	System for Electro-Mechanical-Impedance (EMI)	Hardware/Software system implementing the electro-mechanical impedance method implemented and tested	31.10.2010
D2	System for AU-BB	Hardware/Software system implementing the broadband acousto-ultrasonic method implemented and tested	31.10.2010

4. Topic value (€)

60000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-019	Miniaturized Sensors	**Indicative End Date**	*01/05/2010*
		Indicative Start Date	*01/10/2009*

1. Topic Description

Development of Wireless Sensor Network Nodes for Operation in an Airborne Environment

1.1 Scope of Work

The work will focus on the design of the hardware for a wireless sensor network node that will be installed in a regional aircraft. The design should encounter all limitations and constraints imposed by operation in an airborne environment, according to FAA regulations.

1.2 Reference documents

a) LW assumption for Green A/C configuration definition (Preliminary), GRA -1.1.0 –TS-ATR-TECH-209001 A, WP 1.1.0 Deliverable
b) Definition of Requirements for the Proposed Sensor Technologies, GRA -1.3.1 –TD-HAI-TECH-209001 A, WP 1.3.1- 03 Deliverable

1.3 Requirements

Specific requirements regarding operating frequency, system operating conditions, software compatibility are specified in paragraph 2.

2. Special skills, certification or equipment expected from the applicant

This CfP targets the development of a self-powered node for Wireless Sensor Networks. The node could be based on a commercially available Sensor Node architecture (such as MicaZ by Crossbow Tech. Inc.) but it should include additional features that will make it suitable for in-flight operation. The applicant should be able to develop a Wireless Sensor Network with the following features:

1. Frequency transmission band: 2.45GHz±50MHz.
2. Antenna printed on the PCB.
3. Compatibility with 802.15.x standard and wireless network protocols, particularly ZigBee.
4. Support for standard Wireless Sensors Operating Systems such as TinyOS for the utilized CPU.
5. Power supplied by an alternate power source such as temperature gradients, vibration harvesting etc. Ideally non-replaceable parts (such as gold caps) should be used instead of batteries. If replaceable batteries are used, replacement time should be at least 18 months.
6. Small form-factor design with minimum dimensions (about 20-30 cm2) and weight (~20gr for the assembled node PCB).
7. Dimensions and weight of power source unit TBD.
8. System operating environment conditions:
   a) Temperature -55°C to +85°C
   b) Humidity 20-80% relative, non-condensing
   c) Vibration 5g
9. Communication port for proceeding node, or alternatively, capability for direct communication with more than 4 and not less than 8 sensors.
10. Complete system able to be certified for operation in airborne environment, according to FAA regulations

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
CfP 1.3.1-01	Analysis & Evaluation of Basic Requirements based on Specifications. Process Feasibility Assessment	Bandwidth requirements, electromagnetic interference requirements, energy constraints, etc., should be taken into account in the design of the wireless sensor network. The applicant should provide detailed information, regarding the feasibility of the respective requirements and constraints.	30/11/2009
CfP 1.3.1-02	System Architecture & Prototype Demonstration	One or more of the architecture variants should be built in hardware and software and demonstrated.	31/03/2010
CfP 1.3.1-03	Final Product	Final product should be delivered, according to the CfP requirements.	30/04/2010

4. Topic value (€)

118000 Euro

5. Remarks

During the period allocated for the CfP, it is possible that additional information / requirements are given to the partner. The partner shall therefore adjust accordingly and embody the given information / requirements, prior to delivery of final product.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-020	Sensorised Composite	**Indicative End Date**	*01/05/2010*
		Indicative Start Date	*01/10/2009*

1. Topic Description

Development of Numerical Tool for the Optimum Placement of the SHM Sensors

1.4 Scope of Work

Structural health monitoring system is based on the principle of measuring physical magnitudes (e.g. strain fields) at the healthy structure and / or during the initiation and / or propagation of damage. Physically, monitoring is based on sensors that will be able to measure physical quantities.

The changes in the measured magnitudes of damaged structure are compared with those of the healthy structure, in order to identify the structural integrity, under the specific loading conditions.

1.5 Reference documents

1.6 LW assumption for Green A/C configuration definition (Preliminary), GRA -1.1.0 –TS-ATR-TECH-209001 A, WP 1.1.0 Deliverable

1.7 Requirements

Taking into the account that the type of damage within WP 1.3.4, is considered delamination of a composite material structure caused by low velocity impact, optimum placement of the sensors is an important issue for the maximum efficiency of the monitoring system.

2. Special skills, certification or equipment expected from the applicant

Through the current Call for Proposal, the applicant should develop a numerical code that will be able to optimize the location of the sensors in order to be able to measure strain fields prior to the damage initiation, during the damage initiation and during the damage propagation until the end of the operational life of the structure. This optimization procedure will be based on a certain structural geometry (made of composite material), certain loading conditions and certain impact scenario. Furthermore, the numerical code should also satisfy the following:

1. Criteria of optimum placement of the sensors based on the data extracted by the FEM model, in relation to the physical meaning of the measured magnitudes, the current geometry, the material data and loading conditions
2. Sensitivity analysis procedure (if required)
3. Capability to communicate with commerical finite element software (MSC Nastran/Patran).
4. Input/Output interface compatible with the current commercial software format.
5. Parameterised representation of the basic geometrical data, material data and applied loading conditions.
6. Capability of further modifications (open code) by the Consortium, in order to be integrated with other numerical tools, which are developed parallel by other activities of the project.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
CfP 1.3.4-01	Analysis and Evaluation of Basic Requirements based on Specifications	Methodologies definition, mathematical algorithm Flow Chart, determination of interface with commercial FEM Software, limitations	30/11/2009
CfP 1.3.4-02	Software & Manual	The applicant should deliver a numerical model (open code) that will define the optimum location of the sensors. The numerical code should be integrated with commercial FEM software. Additionally, the applicant should provide a User's Manual, including installation instructions, methodology, mathematical description, limitations. Finally, installation/demonstration of the code in local PC would be expected.	30/04/2010

4. Topic value (€)

30000 Euro

5. Remarks

During the period allocated for the CfP, it is possible that additional information / requirements are given to the partner. The partner shall therefore adjust accordingly and embody the given information / requirements, prior to delivery of final product.

The applicant should be responsible for maintenance/support of the code till the end of WP 1.3.4 (M34)

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-021	Organic-modification tailored to promote the correct interaction between the polymer and the filler	**Indicative End Date**	*01/03/2010*
		Indicative Start Date	*01/10/2009*

1. Topic Description

Objective

The contractor shall develop and apply appropriate organic modifications to different class of nanoscale polymer fillers, in order to increase their affinity with epoxy-based thermoset resins. The contractor shall also produce nanocomposite samples using the nanoscale fillers organo-modified with the selected surfactants and with the identified modification procedure and demonstrate the effectiveness of the organo-modification in improving resin-filler interactions as well as resin base properties with respect to unmodified fillers.

Activity Description

Polymer nanocomposites represent a fairly new class of polymeric composites with promising mechanical, thermal, optical and physic-chemical properties, obtained with a rather low filler loading. The filler employed in the production of nanocomposite resins are typically clays (layered silicates), nanospheres (silica), nanoscopic metal or metal oxides, and carbon nanotubes and fullerenes. Generally, the nanometric fillers are chemically treated with organic modifications in order to improve their affinity with the polymer chains, thus helping the nanoscale dispersion process.

Within the present activity, the external contractor shall work out suitable organic modifications for different class of nanofillers, aimed at the production of epoxy-based nanocomposite matrices. Three main class of fillers will be considered: nanoclays (both cationic and anionic clays), POSS, carbon nanofibres (Vapour Grown Carbon Fibres) and multi-wall carbon nanotubes. The objective of the organic modification shall be twofold:

- Improve the dispersion process by promoting an uniform distribution of the fillers within the host matrix
- Improve the property enhancement in the final nanocomposite product with respect to a similare nanocomposite composition obtained using non-modified nanofillers

The activities that shall be performed by the contractor are divided into the following two work-packages:

WP 1000 – Nanofillers procurement and organo-modification set-up:

The contractor shall procure commercially available nanofillers belonging to the following 3 categories:

Nanoclays: cationic clays (layered silicates), anionic clays (bilayered hydroxides); POSS; Carbon nanofibres (VGCF) and Carbon Nanotubes; and realize tailored organic modifications for each nanofiller procured. For each nanofiller, various organic modifications shall be set-up in order to achieve the following results: Increase the easy of processing of these nanofiller with thermoset epoxy resins; Improve, in the final nanofilled resin, different classes of properties (mechanical properties like tensile strength, toughness, impact performance; electrical conductivity; flame retardancy)

WP 2000 – Nanocomposite samples preparation and evaluation of organo-modification effectiveness:

The contractor shall produce nanocomposite samples and carry out the following basic material characterization: microstructural analysis (evaluation of the degree of dispersion); basic thermal analysis; mechanical testing (tensile, flexural, toughness, impact strenght). These tests shall be performed on samples produced using unmodified nanofillers and modified nanofillers, in order to assess the role and effectiveness of the organo-modification in achieving the property improvement.

2. Special skills, certification or equipment expected from the applicant

The contractor shall have a proven experience in the field of polymer composites and nanocomposites processing and characterization, and have full access to polymer composites processing plants and characterization labs.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
Del.1	Organic modification technical report	This document shall include full details on the organic modifications employed for each filler as well as on the processing techniques used to organo-modify the fillers	30/10/2009
Del.2	Organo-modified filler batches	The quantity to be provided will be specified by the prime, (within reason, having in mind a R&D application)	30/11/2009
Del.3	Nanocomposite preparation technical report	This report shall include full details on the processing procedure employed to produce the nanocomposite samples	30/12/2009
Del.4	Nanocomposite test report	The report will include: a detailed description of all the test procedure adopted, with the standards used (where applicable); full account of all the measured data; a sum-up database	01/03/2010

4. Topic value (€)

60000 Euro

5. Remarks

The activity will be monitored by mean of monthly meetings that will be held alternatively at the prime's or the contractor's premises. Within each of these meetings, a progress report shall be delivered by the contractor.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-022	Functional laminates development. Components compatibility and feasibility assessment.	**Indicative End Date**	*30/Sep/2011*
		Indicative Start Date	*01/Nov/2009*

1. Topic Description

Please indicate the expected proposal maximum length

The subject of this CfP is to higlight activities to be performed on CFRP laminated structures, where a combination of different techniques or materials will be used to provide advanced laminates concepts to improve baseline functionality. In this context following points provide overview of involved tasks:

1- Selection of material candidates (elastomer or similar) for laminate integration with acoustic damping charateristics

2- Structural properties of selected material acounting for anti-erosion characteristics for external aplication.

3- Elastomer treatment (interface) to be embedded in the composite structure (laminate and sandwich).

4- Manufacturing trade-offs for material selection

5- Manufacturing consolidation through plain laminates and honey-comb panels with elastomer layers in conjuction with lighting strike protection mesh

6- Evaluation of mechanical characteristics of manufacturing trials through a set of nominal testing for basic properties comparison.

7- Evaluation of acoustic transmisibility and structural damping characteristics of manufactured configuration relative to correspondent baseline structural concepts.

8- Evaluation of lightning strike direct effect protection to evaluate damages on CFRP structures where acoustic and metallization materials has been combined

9- Evaluation of moisture ingress protection, since the use of elastomers will be an improvement, specially for sandwich constructions.

10- Damage growth assessment and involved material properties

Main Tasks:

a- Identification of feasible materials and selection of candidates (at least two). Materials properties usefull for the structural aplication being studied should be provided jointly during selection (i.e. for elastomeric matarials dependence of mechanical properties with respect to temperature and frequency –nomogram or master curve)

b- Manufacturing trade-offs for several laminates conceptual approaches. Assessment of compatibility for various temparature and moisture conditions supported by test evidence.

- Plain laminate feasibility coupons (at least two types of elastomer) to validate metallic mesh and painting interface
- Sandwich feasibility coupons (two types of core / two types of elastomer)

c- Evaluation of anti-erosion characteristics for external aplications

Blast testing with different erosive materials and energies (sand & hail and water drops)

d- Manufacturing trials for mechanical evaluation

A set of coupons will be extracted from manufacturing trials to evaluate structural properties described in paragraph (h) of current task list. In this context, several panels will be manufactured for different configurations to enable at least sets of 10 coupons for each characteristic being compared. Following configurations are foreseen for costs evaluation purposes:

- Conf 1: Basic CFRP w/o additional protection materials, solid laminate, 3 mm thick
- Conf 2: Basic CFRP with an additional layer of protection material (one or two layers) in a solid laminate. 3 mm thick
- Conf 3: Basic sandwich panel 3plies+ 15mm core + 2plies
- Conf 4: Basic CFRP with an external layer of protection material in a sandwich panel, 3plies+ 15mm core + 2plies
- Conf 5: Basic CFRP with an internal layer of protection material in a sandwich panel, 3plies+ 15mm core + 2plies
- Conf 6: Basic CFRP with an external and internal layers of protection material in a sandwich panel, 3plies+ 15mm core + 2plies

Bearing in mind the size of foreseen coupons and the number of specimens needed to accomplish statistics requirements, one flat 1000 x 500 mm panel per configuration is foreseen.

e- Manufacturing trials for lightning direct effect protection evaluation

For such a purpose an overall panel size of 1000 x 500 mm has been generalized for cost estimation

- Conf 1 with external (TBD) metallization
- Conf 2 with external (TBD) metallization (two off) x (2) for metallization alternatives
- Conf 3 with external (TBD) metallization
- Conf 4 with external (TBD) metallization (two off) x (2) for metallization alternatives

f- Manufacturing trials for acoustic and vibrational evaluation

For such a purpose an overall panel size of 1000 x 500 mm has been generalized for cost estimation

- Config 1
- Config 2 (Two off) x(2) for metallization alternatives
- Config 1 with stiffeners TBD
- Config 2 with stiffneres TBD
- Config 3
- Config 4 (Two off)x(2) for metallization alternatives
- Config 5
- Config 6 (optimized for acoustic depending on previous results)

Metallization aspects will be based on lightning protection guidelines. Assessment of the elastomer location and topography on the samples shall be performed for maximum noise and vibration damping efficiency.

g- Manufacturing trials for moisture ingress evaluation

For such a purpose an overall panel size of 500 x 500 mm has been generalized for cost estimation

- Conf 3
- Conf 5 (two off)

h- Moisture ingress evaluation

-Water inmersion according to appropriate RFT

i- Lightning and inspection tests

- Direct ligthning attachment at zone 1A (200KA, 2x 10^6 A^2s) and Zone 2A(100KA, 0.5x 10^6 A^2s) threat
- NDT inspection of tested samples shall be carried out to evaluate damages

j- Mechanical tests

Following porperties will be evaluated and compared with the basic standard flat sandwich and solid laminate panels properties:

- Damage due to a low energy impact: area of the damage, identation and depth of the damage and basic properties from wich damage growth might depend on
- Compression after impact strength at RT/AR and H/W test conditions
- Tension after impact strength at RT/AR and H/W test conditions
- Flat wise tensile strength for sandwich panels
- Interlaminar shear strength for solid laminate

k- Acoustic and vibration tests

The different panels manufactured for such a purpose will be tested to meassure:

- Acoustic Transmission Loss (TL) for acoustic noise between 125Hz and 4Khz
- Structural dynamic response accounting for appropriate means for structural excitation and vibration measurement for frequency range between 0 to 2KHz.
- Optionally, if it becomes feasible, radiated noise measurement

TIME SCHEDULE:

Tasks a, b & c have to be completed by 28/02/2010

Tasks d to h have to be completed by 30/08/2010

Tasks i must be completed by 30/01/2011

Tasks j must be partially finished by 30/01/2011 for RT and completed by 30/06/2011 for H/W specimens.

Tasks k must be completed by 30/08/2011

2. Special skills, certification or equipment expected from the applicant

- Experience in selection of materials (elastomers or similar) and treatment for integration into laminates
- Experience in manufacturing laminates both hand and automatic lay-ups
- Experience in coupons preparation for mechanical testing
- Experience in mechanical evaluation of CFPR aeronautical structures.
- Experience in acoustic and vibration testing of panels and assessment of tets results.
- Experience in lighting strike test

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1.3.3-01	Acoustic material selection. Properties	Document	30/12/2009
D1.3.3-02	Feasibility assessment	Samples + Report	28/02/2010
D1.3.3-03	Panels design and manufacturing	Specimens	30/08/2010
D1.3.3-04	Coupons manufacturing	Samples + Report	30/06/2010
D1.3.3-05	Erosion assessment	Document	30/08/2010

D1.3.3-06	Moisture ingress test results	Document	30/08/2010
D1.3.3-07	Lightning strike test results	Document	30/01/2011
D1.3.3-08	Mechanical test results for RT/AR	Document	30/01/2011
D1.3.3-09	Mechanical test results for H/W	Document	30/06/2011
D1.3.3-10	Acoustic test results	Document	30/08/2011

4. Topic value (€)

The amount of **115000 Euro** has been allocated for the whole CfP,

5. Remarks

The meetings for project monitoring will be held at EADS-CASA installations in Getafe. Foreseen a meeting every three months.

Acoustic and vibration tests should be done using maximum communalities for all panels to optimize subsidiary costs and speed up testing for the whole set of specimens.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-023	**Resin, Laminate and Industrial Nanoparticles Concept and Application**	**Indicative End Date**	*31/Dec./2011*
		Indicative Start Date	*1/Oct/2009*

1. Topic Description

The subject of this CfP is to develop new procceses and technique to improve electrical properties of CFRP laminates maintaining or improving mechanical characteristics by means of adding nanoparticles into the epoxy resin matrix. Interfay sealant for structural assemby and protection paints shall be considered as well. For this purpose the following main tasks are identified:

1. Preparation of basic nanoparticles compounds to be used in CFRP laminates and structural joint assemblies, compatible with aeronautic structures manufacturing. Epoxi resin, interfay sealant and external finish paint shall be used for carbon nanotube loading.
2. Electrical conductivity, Rheologic and Spectroscopic studies of loaded materials shall be carried out.
3. Development of lay-up techniques for atomatic application of nanoparticules into the CFRP laminate.
4. Design and construction of a basic application prototype to be able to work with both, ATL and fibreplacement techniques. Plane and curved (arround 2m diameter) structures should be considered.
5. Deposit of nanoparticles on laminate test samples for structural, electromagnetic and lightning tests. About 25 Laminate test samples 1000x500 mm (including 13 with carbon nanotubes) shall be produced
6. Electromagnetic Shielding and electrical continuity characterization of basic materials. Test on various nanoparticles concentration shall be performed.
7. Shielding test on flat laminated reference and nanoparticle loaded structural joint samples. Test shall be performed from 500MHz to 18GHz. About 10 samples shall be tested.
8. Lightning testing on flat laminated reference and nanoparticle loaded samples.Tests shall be performed at zone 1A & 2A levels, according ED-84 Aircraft Lightning Environment and Related Test Waveforms Standard. About 19 samples shall be tested.
9. After lightning tests all samples shall be NDT inspected to evaluate damages. Suitable report shall be issued.
10. Structural evaluation tests on nanoparticle loaded CFRP laminates. CAI, TAI and BAI testing shall be performed, as well as in–plane and interlaminar shear strength evaluation. All samples shall be inspected after testing. Two 1100x1100 mm samples shall be manufactured.

TIME SCHEDULE:

Tasks 1, 2 shall be complete by December 2009.

Tasks 3, 4, 5 & 6 shall be complete by December 2010.

Tasks 7, 8 and 9 shall be complete by December 2011.

Task 10 shall be complete by July 2011

2. Special skills, certification or equipment expected from the applicant

Experience on compounds preparations of nanoparticles loaded resins, paints and sealants.

Experience on rehologic and Raman spectroscopic evaluation.
Experience on automatic nanoparticles application in curved CFRP laminates.
Experience on structural testing of CFRP laminates
Experience on electromagnetic evaluation of CFRP laminates

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1.3.5-01	Nanoparticles loaded compounds	Material compounds	Dec. 2009
D1.3.5-02	Automatic lay-up prototype	Equipment availability	Dec. 2010
D1.3.5-03	Material Characterization	Document	Apr. 2010
D1.3.5-04	Structural Characterization	Document	Jul. 2011
D1.3.5-05	Electromagnetic Characterization	Document	Dec. 2011

4. Topic value (€)

The amount of **115000 Euro** has been allocated for the whole CfP.

5. Remarks

The meetings for project monitoring will be held at EADS-CASA installations in Getafe. Foreseen a meeting every three months.

At least two types of nanoparticles should be evaluated: multiwalled and singlewalled carbon nanotubes.

Automatic application feasible to be checked on EADS-CASA manufacturing shop

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-01-024	Lightning tests of new concepts of composites	**Indicative End Date**	*01/09/2010*
		Indicative Start Date	*01/10/2009*

1. Topic Description

Lightning certification test consists to apply on a material sample an electric arc in which flows a sequence of lightning current. The lightning tests on new concepts of composites are based on the lightning tests described on the regulation documents SAE ARP 5416 (Aircraft lightning test method; section 5: hight current physical damages tests), ARP5412/ED84 (lightning current waveforms).

Description of 30 preliminary tests on reference coupons (Ref. Coup.) for mechanical constraint sizing:

N°	*Material*	*Analysis*	*Waves*
1-5	*Ref. Coupon (5 tests)*	*Frontal shock wave and magnetic overpressure*	*A,B*
6-10	*Ref. Coupon (5 tests)*	*Frontal shock wave overpressure*	*A,B*
11-15	*Ref. Coupon (5 tests)*	*Radial shock wave overpressure*	*A,B*
16-20	*Ref. Coupon (5 tests)*	*Arc root measurements*	*A,B*
21-25	*Ref. Coupon (5 tests)*	*Magnetic overpressure*	*A,B*
26-30	*Protected ref. Coupon (5 tests)*	*Contribution of exploding wire on overpressure*	*A,B*

Description of the 2 tests on the new concepts of composite:

N°	*Material*	*Analysis*	*Waves*
31-32	*Composite WP 1.3.5 (2 tests)*	*Direct effects damages*	*A,B,C*

2. Special skills, certification or equipment expected from the applicant

Hight current test generator, Reference coupons panels for preliminary tests and calibration, synchronisation system,

Diagnostic required in the test center:

- Stereovision: measurements of 2D deflection of the coupon.
- Arc root displacement (two fast video cameras, 10000fps)
- Electric measurements (current, voltage)
- Possibility of using specific measurements (spectroscopy…)

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Detailed plan of the lightning test campaign		01/12/2009
D2	Lightning test report		After the test campaign

4. Topic value (€)

50000 Euro

5. Remarks

This advanced lightning test campaign is focused on a detailed analysis of the mechanisms that produces the damages on the new concepts of composite. As a result, its *duration* will need to be a minimum of 10 days:

- 7 days for the preliminary tests
- 3 days for the new concepts tests of WP 1.3.5

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-02-001	3D Fluid Dynamic and Aero-acoustic Numerical Analyses of Wing High-Lift Devices Low-Noise Configurations	**Indicative End Date**	*31/10/2010*
		Indicative Start Date (T_0)	*01/11/2009*

1. Topic Description

1.1 Introduction

Within the "Low-Noise Configuration" domain of the Green Regional Aircraft ITD technologies to reduce aerodynamic noise generated by wing High-Lift Devices (HLD) are addressed, ranging from already proved technologies (like those matured during past/on-going European research projects) to more advanced concepts. Among potential solutions, HLD low-noise architectures through enhanced multi-body aerodynamic design combined with optimised kinematics, so as to reduced noise induced by slots and tracks still preserving the wing high-lift performance, will be pursued. Furthermore, HLD low-noise technologies related to passive acoustic treatments will be also accounted for.

1.2 Objectives

Topics and expected outcomes inherent to the present CfP are dealing with a theoretical assessment of airframe noise of wing HLD architectures in a three-dimensional, multi-disciplinary context. In particular, three of the aforementioned HLD conceptual low-noise designs, developed at previous stages of the work programme, will have to be analysed and compared against the relevant baseline configuration at two operating conditions, corresponding to take-off and approach flight phases. Pending on the overall scenario of potential concepts investigated and on relevant results achieved in preceding tasks, multi-body wing configurations to be considered might be either conventional (say three-element) or leading edge gapless (e.g. drooped nose, Krueger shaping) architectures. HLD low-noise technologies based on the adoption of acoustic liners (e.g. embedded porous treatments, serrations) will have also to be assessed. Aspects that will have to be specifically addressed are the wing efficiency and the aerodynamic noise emissions. The final goal being the evaluation of proposed HLD concepts in terms of wing basic aerodynamic performance and acoustic impact, so as to contribute to rank and down-select most promising HLD low-noise solutions in a multi-physics view, prior to proceed toward further stages of the concerned technology studies.

1.3 Description of Work

CFD/CAA based, fluid dynamic and acoustic numerical analyses of wing multi-body configurations at various flight conditions will have to be carried out, in order to evaluate the overall performance and noise emissions of the wing equipped with the proposed HLD architectures and low-noise technologies. In total, four (4) configurations will have to be analysed, one of them applying HLD acoustic liners.

The aerodynamic numerical models used must be able to correctly calculate, at the different asymptotic flow conditions and HLD settings considered, the global forces (lift, drag) acting on the wing, local pressure fields, as well as the vortical flow dynamics (e.g. flap side edge vorticity, upper slat trailing edge vortex shedding) responsible for aerodynamic noise generation. The relevant solvers should be also capable to evaluate the beneficial effect of the aforementioned HLD passive acoustic treatments on the vortex flow induced noise emissions.

Assessed aero-acoustic models should be used to predict the far field noise propagation to virtual observer's positions for different directivity angles. By taking into account that at take-off condition the engine noise (being out of scope of the concerned technology branch) is the predominant aircraft noise source, the aero-acoustic analysis should focus on the approach flight phase when, engines power being at minimum, the airframe noise generated by wing HLD is a major contributor to the aircraft community noise. To this aim a set of virtual observer's positions (given in input) will have to be considered on a far field polar arc, in order to evaluate the acoustic signature for different directivity angles.

1.4 Inputs

i) wing multi-body architectures (CAD geometry) to be analysed, at the respective operating high-lift settings, corresponding to take-off (partial deflections) and approach (full-extended devices) flight conditions;

ii) features (teeth sizing and dimensions) of e.g. slat trailing-edge serrated configurations and/or flap noise weeder, if any, applied to one of the above wing multi-body architectures;

iii) features (sizing, position, acoustic impedance, etc.) of porous materials to correctly simulate (through proper boundary conditions) the concerned HLD passive acoustic treatments, if any, applied to one of the above wing multi-body architectures;

iv) asymptotic flow parameters (Mach, angle of attack) at the specified operating conditions;

v) virtual observer's positions on a 150-foot polar arc at specified directivity angles (from 0 to 180 degrees, likely in 10-degree increments) to compute far field noise spectra at approach flight conditions

Notes

1) The wing multi-body geometry related to the baseline HLD architecture will be released at T_0

2) The wing multi-body geometry relevant to the other HLD architectures, including description of concerned acoustic liners, will be provided at T_0 + 4 months.

1.5 Expected Outputs (for all the wing multi-body configurations to be analysed)

a) Aerodynamic prediction (at take-off and approach flight conditions/HLD settings)

i) Lift, drag and pitching moment global coefficients;

ii) pressure/velocity fields, including turbulent flow structures numerical visualisation

b) Acoustic predictions (at approach flight condition/HLD settings)

i) Near field solutions (i.e. acoustic maps to get indication of contributions of different noise sources: slat/main-body trailing edge noise, slat/flap cove noise, flap side-edge noise, etc.);

ii) Far field noise solutions (i.e. SPL frequency spectra, OASPL) on a specified polar arc at various directivity angles (see inputs list above).

1.6 Milestones

M1 (T_0 + 4 months): Wing multi-element baseline architecture assessed (report: D1)

M2 (T_0 + 10 months): Wing multi-element low-noise architectures assessed (report: D2)

Review meetings to monitor on the work progress will be scheduled likely two weeks before the expected achievement of respective milestones above. On such occasions, recovery actions will be decided, in case of delayed activities, trying to stay in the overall initial planning.

2. Special skills, certification or equipment expected from the applicant

Due the technical complexity of the requested activity and the relevant tight schedule, the proved expertise of the applicants in the concerned technological field will be a key factor of selection.

The use of advanced CFD tools coupled with higher-order acoustic solvers is regarded as a paramount requirement to correctly address the physical phenomena involved.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date

D1	Assessment of basic performance and acoustic impact of wing multi-body baseline configuration	Reporting on the aerodynamic and aero-acoustic numerical analyses (as specified in the list of expected outputs) of the wing high-lift benchmark architecture	T_0 + 4 months
D2	Prediction of basic aerodynamic performance and acoustic impact of wing HLD low-noise architectures	Reporting on the aerodynamic and aero-acoustic numerical analyses (as specified in the list of expected outputs) of the wing equipped with HLD low-noise solutions	T_0 + 10 months
D3	Synthesis of multi-disciplinary assessment of wing HLD low-noise configurations against benchmark architecture and recommendations for concepts down-selection		T_0 + 12 months

4. Topic value (€)

The value of the activity being the subject of the present CfP is **300000 €**

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-02-002	Feasibility analyses (materials, production, installation, maintenance) of potential HLD passive acoustic treatments (brush-like devices, porous surfaces, etc.) to support the ranking of best conceptual solutions.	**Indicative End Date**	30/10/2010
		Indicative Start Date (T_0)	01/11/2009

1. Topic Description

1.1 Introduction

Within the "Low-Noise Configuration" domain of the Green Regional Aircraft ITD enabling technologies to reduce aerodynamic noise generated by wing High-Lift Devices (HLD) are addressed, ranging from already proved technologies (like those matured during past/on-going European research projects) to more advanced concepts. Among potential solutions, most promising for future industrial applications, HLD low-noise technologies related to passive acoustic treatments will be assessed. The relevant activities are spread out over different phases, from the pre-screening of most promising concepts, through multi-disciplinary theoretical studies, to the experimental validation of selected solutions.

1.2 Objectives

Topics and expected outcomes of the present CfP are inherent to feasibility studies of potential HLD passive low-noise treatments (e.g. porous materials, brush-like devices). In particular, based on the results of previous research activities in this field and the relevant requirements identified in further tasks of the work programme, possible implications of such technologies on structures, manufacturing, installation, maintenance will have to be assessed. This in order to support the ranking and down-selection of best conceptual solutions in a multi-physics view during the technology maturation phase, prior to proceed towards relevant application studies to future regional aircraft.

1.3 Description of Work

Accordingly to the general planning of the HLD low-noise technologies assessment as above outlined (par. 1.1), the activity being the subject of the present CfP is scheduled over the tasks described below.

Task 1

State-of-Art analysis from open literature review and/or available project results (e.g. 5^{th} FP European research projects RAIN, SILENCER, etc.) of passive acoustic treatments potential to attenuate HLD vortex flow induced noise emissions. In this respect, several technologies like embodied porous surfaces and brush-like devices are known to be effective in reducing aerodynamic noise generated, for example, by the flap side edge vorticity and the slat upper trailing-edge span wise vortex shedding. The concerned analysis should address such devices as well as other potential solutions, by identifying the relevant required major features (kind of materials, typical sizing, material porosity, brushes density and so on).

Based on the pre-screening of potential solutions and relevant identified characteristics, preliminary evaluation of possible implications of such devices will be done in terms of manufacturing, installation complexity, maintenance, etc., looking for their applicability to regional aircraft.

Input:

Open literature and/or available project results in the field of HLD low-noise technologies

Output:

- State-of-the-Art of HLD passive low-noise treatments technology (review of types and features of potential solutions)

- o Preliminary evaluation/ranking of potential acoustic treatments solutions in terms of their applicability to actual HLD structures (production, integration, maintenance issues, etc.)

Start: T_0

End: T_0 + 4 months

Task 2

Based on the results of task 1, feasibility studies of concerned acoustic treatments will have to be undertaken, dealing with integration issues on given HLD architectures. In this respect, the proposed solutions (given in input) to be analysed will be concerning (1st part) those kind(s) of HLD treatments which may be only experimentally tested and (2nd part) relevant conceptual design(s) derived from preceding theoretical studies. As a whole, four (4) different solutions of passive acoustic treatments should be specifically assessed, implying different materials (e.g. foams, brush-like) and, possibly, different sizing & positioning and/or different characteristics (e.g. porosity, brushes density). The results of this analysis will contribute to the ranking and relevant down-selection of most promising HLD low-noise technologies for the subsequent 3D wind-tunnel testing validation. Therefore, the concerned feasibility studies will have to take into account the following aspects:

- o implications of the identified materials and installation complexity for full-scale application on wing movables architectures (flap, slat) of a regional aircraft;
- o possible implications due to small dimensions on the integration of selected solutions on a scale (say 1:6) HLD test model.

Inputs:

a) Review of the State-of-the-Art of HLD low-noise passive treatments (Task 1 results);
b) 3D geometry (CAD model) and preliminary structural lay-out of HLD architectures (flap, slat) – released at T_0
c) Preliminary design of HLD acoustic treatments (e.g. flap tip treatments proposed solutions in terms of sizing, positioning, material features) for full-scale applications – given at T_0 + 4 (1st part of possible solutions) and at T_0 + 8 (2nd part)
d) Required features (e.g. sizing, positioning, material features) of acoustic treatments for HLD scale models – given at T_0 + 9

Outputs:

- Assessment and relevant ranking of HLD acoustic treatments potential solutions in terms of: production, installation (interface with HLD structure), maintenance, costs, toward their potential applications to regional aircraft;
- Applicability in terms of materials, manufacturing and installation complexity of acoustic treatments potential solutions to HLD scale models.

Start: T_0 + 4 months

End:: T_0 + 12 months

For each task a technical report will be prepared to describe in detail the activities performed and summarise relevant achievements. Such reports will be issued according to the plan shown in sec. 3.

1.4 Milestones

- Ø **M1** (T_0 + 4 months): State-of-the-Art review performed (report: D1)
- Ø **M2** (T_0 + 8 months): Mid-term review of HLD acoustic treatments feasibility studies
- Ø **M3** (T_0 + 12 months): Feasibility studies of HLD acoustic treatments completed (report: D2)

Review meetings to monitor on the work progress will be scheduled likely two weeks before the expected achievement of respective milestones above. On such occasions, recovery actions will be decided, in case of delayed activities, trying to stay in the overall initial planning.

2 Special skills, certification or equipment expected from the applicant

Knowledge in the State-of-the-Art HLD low-noise technologies based on passive acoustic tratments. Experiences in the structural related aspects (materials, production, installation, maintenance issues, etc.) of concerned HLD treatments. Due to the tight schedule of the requested activity, the proved expertise of the applicants in the concerned technological field will be a key factor of selection.

3 Major deliverables and schedule

Deliverable	Title	Description	Indicative Due Date
D1	State-of-the-Art review of HLD low-noise passive treatments.	Technical report	T_0 + 4 months
D2	Feasibility studies of identified HLD low-noise treatments conceptual designs	Technical report	T_0 + 12 months

4 Topic value (€)

The value of the activity being the subject of the present CfP is **80000 €**

5 Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-02-003	D&M SJ actual actuator, Actuator WT model system	**Indicative End Date**	*01/April/2010*
		Indicative Start Date	*01/October/2009*

1. Topic Description

1.8 scope of work

It is related to the GRA LNC WP2.2.1.4

as a development effort for a Synthetic Jet (SJ) Actuator in two tasks to be done in 5 months

a) Design and manufacturing for a system in a wind tunnel application.

b) Design and Manufacturing of an SJ actuator as an improved scaled up, more completed prototype system.

Expertise in Aerodynamics is not necessary since the work will be integrated to a team effort comprising/delivering the aerodynamic specific know-how and specification.

But, expertise and quality manufacturing/craftsmanship is expected. **The time scale for this work in two subtasks is five months**.

A synthetic jet (SJ) actuator is a powered mechanical element which is able in a time varying way (instationary) to affect the flow at the boundary of an airfoil surface. The immediate fluid volume is drawn in and expulged by say a flexing membrane element making up the skin-flush boundary condition. In order to deform this boundary structure an actuation system is needed and must be specially developed. The member cartaking the partner is also delivering to design and manufacture, to integrate the SJ (actuator + deformabale boundary integrated to the airfoil shell) to a likely distribution of these SJ systems. Thus beyond being able to propose options to deliver to a singular [cm scale] or arrayed [mm] scale actuator(s) for the designs, the negotiation with the successful proposer will allow to set down a possible task sharing.

The covered SJ surface where the “pumping with no net flux” would arbitrarily amount to 0,4x0,04m squared, just to give a unit array system size feel, subject to the aerodynamic planning, delivered as input. The immediate vertical thickness (normal to the skin) and mass

of the system should be optimised to a minimum. The delivered substrate into which the deformable boundary with its actuation SJ(s) will be integrated could be designed modular so that itself could be tested separately as a flat piece (with some mechanical flexibility) or later bonded/embedded to a metal or composite structure.

The system

i) shall incorporate ports; mechatronic front ends to allow sinusoidal, multi-frequency or static hold control input of the expected “membrane” boundary surface.

ii) has minimal documentation for the mechanical or electronic interface requirement regarding operation and integration(such as needed finish, electrical isolation)

iii) the expected open loop corner frequency will be high, the partner co informed / involved in the reasoning, but for that the partial system masses should be quite small.

iv) will attempt to avoid chatter, have robust concept, low thermal losses and avoid indifferent resonances.

Rather than tedious reporting, pre open loop trials and the provision of the **loads sheet document** with

adaption to an optimal operating point and then at least two off-designs will be covered, any necessary “how to” descriptions and inputs on request to the WP technical reporting done then by the responsible member.

2. Special skills, certification or equipment expected from the applicant

See chap.1 , tbd. be requested/ negotiated

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	WT SJ actuation system	Basic validation	March 1st 2010
D2	Actuator system, Improved		April 1st 2010

4. Topic value (€)

150000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-02-004	Acoustic semi-empirical laws for 2D design of conventional (three-element airfoil) HLD architectures and gapless (two-element airfoil) HLD architectures	**Indicative End Date**	*31/05/2010*
		Indicative Start Date	*01/11/2009*

1. Topic Description

1.9 Scope of work

The aerodynamic noise generated by High-Lift Devices (HLD) such as slats and flaps contributes significantly to the overall aircraft noise, particularly during the approach. The noise generation mechanism is the interaction between vortical disturbances and the airfoil surface, resulting in the conversion of kinetic turbulent energy into far-field acoustic energy. The effectiveness this conversion mechanism is enhanced by the presence of edges that also affect the noise directivity pattern through diffraction phenomena. In addition, in the presence of multi-component airfoils, the noise generated at an edge is reflected by other parts of the airfoil, thus resulting in a very complex far-field noise directivity pattern. A further element of complexity is represented by the mean-flow wave refraction effects that play a significant role when the acoustic wavelength is small compared to the scale of non-uniformity of the mean flow.

In a typical acoustic analogy fashion, the nonlinear mechanisms responsible for the noise generation, the near-body vorticity dynamics in this case, can be separated from the acoustic scattering process (diffraction and refraction), which is substantially a linear phenomenon described through suitable wave equations. A common practice in HLD noise prediction consists in neglecting the mean-flow refraction effects due to the flow non-uniformities, and accounting only for the constant-flow convection effects. This permits to use boundary-integral approaches based on Green's functions of convected wave equations in order to compute the far-field noise generated by a distribution of elementary source fields. Finally, a convolution of the elementary fields (tailored Green's functions) with aeroacoustic sources extracted from the turbulent flow fluctuations permits to compute the far-field HLD noise spectra.

Regarding the characterization of the aeroacoustic sources to be used in the convolution process, one would require to simulate the unsteady turbulent field by solving fully-resolved or filtered Navier-Stokes equations.

Because of the huge amount of the required computational resources, such an approach, while useful for research scopes and for computing reference numerical solutions, is unpractical for industrial applications, particularly for the preliminary design. A viable solution consists in extracting the required turbulent fluctuation levels and space-time correlation lengths from a statistical representation of the turbulent field computed by solving Reynolds-Averaged Navier-Stokes (RANS) equations. These quantities are used to compute the distribution of the acoustic sources in the HLD near field. Unfortunately, such a statistical source representation relies on semi-empirical formulations that require the tuning of some model parameters. The tuning can be carried out through experimental data or reference numerical results.

The main objective and expected outcome of the present CfP is the development of a semi-empirical HLD noise prediction method based on the following strategy:

1) 2D steady RANS computation of the mean flow and turbulent quantities.
2) The use of a semi-empirical noise source model to compute a space distribution of the aeroacoustic sources required by the far-field integral convolution process.
3) The use of a frequency-domain Boundary Element Method (BEM) for the computation of 2D tailored Green's functions.
4) A validation of the 2D HLD prediction tool against reference experimental and/or numerical data.
5) The generalization of the BEM approach to 3D problems to be applied, for instance, to the prediction of side-edge flap noise.

1.10 Reference documents

N.A.

1.11 Requirements

Specifications and requirements (S&R) about:

- file format,
- programming language and rules,
- computational performances,
- reporting, and software documentation,
- other,

will be released at a later date to the successful applicants.

1.12 Other

N.A.

1.13 Timing

Milestone 1: T0+4

The release of the following sources of software modules (**S&R**) is expected:

Source module-A): interface to read RANS solution and write the input file for the source module-B)
It will support unstructured and multi-block structured format (**S&R**).

Source module-B): Semi-empirical source synthesis module
It will compute and export a source distribution from the RANS data. The model parameters should be provided as an input. The source field will be exported in unstructured format (**S&R**). Both 2D and 3D flow configurations and source distributions will be supported.

Source module-C): 2D BEM module
It will perform the following tasks:

a) Import the noise sources field.
b) Extract the more significant noise source locations with suitable cut-off input parameters.

c) Read an input file with all the required data for the computation of a tailored Green's function (free-stream velocity components, frequency range, microphone locations, etc.).
d) Compute and store all the BEM quantities that are independent on the observation point.
e) Compute the 2D tailored Green's functions for a specified frequency range and range banding, and for all the specified observation points and source locations.
f) Convolute the tailored Green's functions with the imported semi-empirical acoustic sources and compute Sound Pressure Levels (SPL) and power spectral densities.
g) Permit to compute a new set of tailored Green's function by exploiting the pre-computed quantities of item d).
h) Permit to compute the far-field noise spectra from an imported wall distribution of the incident pressure gradient provided in frequency domain for a given frequency range.

These 3 modules will be released at the 1st Milestone of the project together with one validation test case consisting in a 2D three-component HLD RANS solution file, all the input data/files required to run the test-case and reference experimental noise data.

Milestone 2: T0+7

Generalization of the 2D approach for 3D HLD noise prediction (**S&R**).

The 3D BEM HLD noise prediction SW will be released at the 2nd Milestone of the activity together with a validation test case consisting in a 3D HLD noise prediction and comparison against literature reference results.

2. Special skills, certification or equipment expected from the applicant

Due to the technical complexity of the present CfP and to the short duration of the activities, the proved experience and capability of the applicant will be a key element of selection. In particular, experience in the development of efficient BEM codes and proven knowledge of the HLD noise generation mechanisms are mandatory.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1.1	Semi-empirical aeroacoustic source model and 2D BEM SW for HLD noise prediction	Source code & manuals + Validation test case	T0+4
D2.1	3D BEM SW for HLD noise prediction	Source code & manuals+ Validation test case	T0+7

4. Topic value (€)

The value of this topic is **200000 €**

5. Remarks

None.

Topic description

CfP topic number	Title		
JTI-CS-2009-1-GRA-03-001	Software – Development of a software tool to be used during regional a/c preliminary design phase in order to estimate impacts of avionic and on-board general systems on aircraft sizing and performances.	**Indicative End Date**	30.11.2010
		Indicative Start Date	1.11.2009

1. Topic Description

Introduction

Within Clean Sky GRA ITD, innovative tools and methods suitable for the design and simulation will be developed

The two integration domains of the GRA ITD (All Electric Aircraft Domain and Mission and Trajectory Management Domain) will provide data to the New Configuration Domain in order to perform preliminary assessment of several regional aircraft configurations. To determine such data a software tool capable to evaluate conventional systems architectures and also to perform rough estimation of the impacts of new technologies shall be developed.

To perform aircraft sizing (geometry, performance, engine, etc.) and cost estimation, impacts of avionics and on-board general systems on a/c configuration and engine have to be assessed. It is needed to collect performance data (e.g. mass, volume, power demand) and cost of avionics and on-board systems. Apart from system architectures, selected technologies as well as a/c functionalities, these data are in turn depending of a/c configuration and engine (wing size, cabin volume, weight….). The optimal process requires the application of an iterative computation loop for the refinement of the aircraft sizing and performance estimation.

The output of the convergence of this iterative loop is an optimized a/c with optimized **avionics and on-board general systems architecture.**

Description

The selected Candidate shall develop a software tool able to facilitate estimation of avionics and on-board general systems performance and data required as input for the prediction and optimization of aircraft sizing, performances and cost during the preliminary a/c design phase.

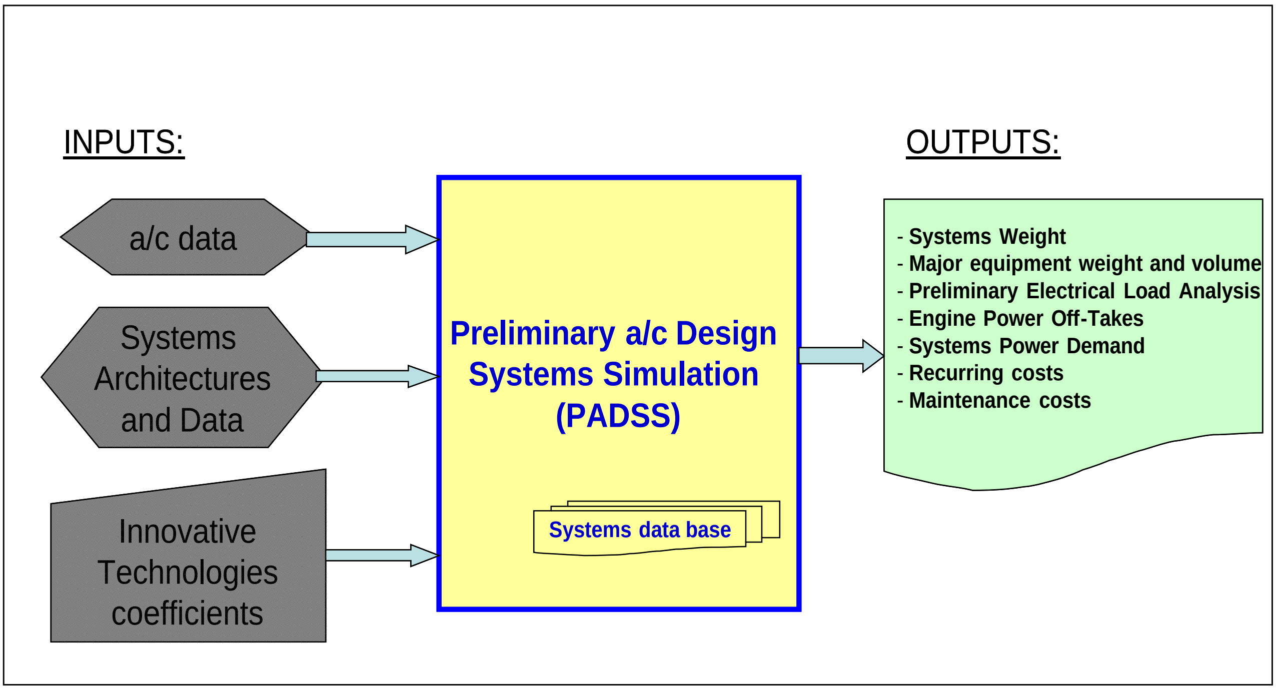
The software tool shall incorporate simplified systems models and a detailed data base, related to conventional system technologies, in order to enable the evaluation of several choises for on-board systems architectures.

Both the data base and the simplified system models shall be developed and incorporated in the software tool by the Candidate.

Moreover, the tool shall be designed so as the User can give as inputs corrective factors to perform comparison evaluation of conventional solutions vs the new solutions that will be investigated in the Clean Sky JTI program, such as technologies targeting the All Electric Aircraft (AEA) and new Avionics technologies.

The tool shall include features to enlarge the database with new architectures and relevant technologies when them will be considered enough mature for application on a regional aircraft.

The following figure gives an overall outline of the expected inputs/outputs. The Candidate shall include in their Proposal detailed information about proposed inputs, outputs, data base features, tool software characteristics.



The software tool shall have an user friendly graphical interface in order to facilitate the User to:

- initialize all the necessary inputs
- select the system(s) to be analyzed
- select the architectural and technology solution to be evaluated
- select the output format

The software tool shall be designed in a modular way in order allow expandibility features for future growing potential of the modules

The code must be compliant with the Alenia Aeronautica Aeronautica Information Technology Infrastructure Standards (e.g. operative system, compiler, licence manager, hw and sw security requirements, dbms,etc..)

Onboard General Systems Modules

The tool shall allow estimation of Systems Weight, Major Equipment Mass and Volume, System Power Demand, Equipment recurring costs , relevant to the following general systems:

- Flight Control System (FCS),
- Environmental Control System (ECS),
- Pressurization
- Electrical Power Generation and Distribution System (EPGDS),
- Ice Protection System,
- Lights
- Oxygen
- Fire protection
- Pneumatic
- Water waste
- Utilities,
- Fuel System,
- Secondary Power System (SPS),
- Hydraulic System,
- Interiors/Furnishing
- Engine Start System.

The tool shall perform system data estimation for different architectures of the above systems. It shall be possible to detail weight, volume and cost for the main system equipment. In order to perform such an estimation, the tool shall allow operator selection of the systems architecture and input of relevant dimensional parameters affecting system mass, volume, power demand and costs.

Operator input of corrective factors in order to take into account new system technologies shall be allowed.

Electrical Energy Management Module

The tool shall include features to perform a preliminary electrical load analysis on the basis of onboard general system and avionics power demand over the different flight phases.

Rating of the Electrical Power Generation shall be determined on the basis of the above electrical load analysis,

In addition, the tool shall accept input tables giving priorities and acceptable degradation modes for the electrical system users in order to roughly simulate the electrical energy management concept.

When the simplified energy management simulation is selected, this module through a simple algorithm shall re-estimate the relevant outputs of Electrical Power Generation and Distribution System (EPGDS) module,

Avionics Systems Module

The tool shall allow estimation of Mass, Volume, power demand and recurring cost starting from:

- list of functionalities and/or related avionic equipment/modules
- avionic systems technology
- reliability and manutenability inputs
- redundancy requirements

In order to perform such an estimation the tool shall be able to correlate, by means of updated databases, each of the above input to evaluate Mass, Volume and costs to be used for a/c sizing.

It shall be possible to detail weight, volume and cost for the main system equipment

Engine Power Off-takes Module

The tool shall compute the overall systems hydraulic, electrical, pneumatic power demand and shall provide as output the resulting engine power off-takes

Systems Installation Weight Module

On the basis of relevant inputs (aircraft geometrical data, systems architecture data, etc) and through proper correlations with its data base, the tool shall be capable to estimate the weight associated to systems installations (including wiring, piping, ducts, racks, installation devices, etc.)

Data Base

Essential for tool build up is the creation of avionics and on-board general systems data base.

The data base shall collect data (architectures, weight, volume, power input, cost) of existing in service systems.

To restrict the range for data gathering, the collection can be limited to avionic and on-board systems of commercial regional aircraft class ranging from:

MTOW: 15000 – 70000 Kg

PAX Number: 40 – 150

RANGE: 900 – 3000 nm

Mach Number: 0.45 – 0.81

Max Flight Altitude: 20000 – 40000 ft

Software Validation

The Candidate shall include in the Proposal a validation plan for the software tool.

Software documentation

The software documentation to be provided with the tool shall be detailed in the Proposal. Such software documentation shall include at least:

- User's Guide
- Software Installation Manual
- Software Code Specification
- Software Validation Documents

2. Special skills, certification or equipment expected from the applicant

The candidate organization shall have recognized knowledge and experience in the Avionics and On-board General Systems disciplines.

The candidate organization shall have recognized experience in the development of optimization software for on-board system engineering applications.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	SW design requirements	Document containing detailed software design requirements	20.01.2010
D2	Review of SW design requirements	Presentations and Minutes of Meeting(s) related to the technical review of software design requirements	15.02.2010
D3	Preliminary Software Tool Release	Release of preliminary (beta) version of software.	30.07.2010
D4	Final Release of Validated Software Tool	Release of final version of software with software documentation and manual and validation documentation.	30.11.2010

4. Topic value (€)

The value of this topic is estimated in **180000 €.**

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-04-001	Study regarding regional aircraft avionics architecture supporting new MTM functionalities.	**Indicative End Date**	30/04/2010
		Indicative Start Date	02/11/2009

1. Topic Description

1.14 Scope of work

Introduction:

GRA ITD WP4 deals with Mission and Trajectory Management (MTM) for regional aircraft.

A significant contribution to achieve a reduction of environmental impact is considered to be provided by a new MTM. For this reason this domain, working in a tight cooperation with SGO (Systems for Green Operations) ITD, will work with the aim of defining a more efficient way to manage trajectories in order to reduce noise emissions and fuel consumption for a typical regional aircraft. Trajectory optimization will be performed both on a single flight phase (e.g. climb, approach, cruise) and on a whole mission profile.

After having defined optimized trajectories, new green technologies integrating these concepts will be developed and integrated in a regional aircraft flight simulator. A demonstration will be performed in order to verify results achievable with these new green technologies. Simulation results will be analysed and a final assessment will provided to European Commision through Technology Evaluator.

GRA WP4 WBS:

1. GRA 4.1 - High level requirements for MTM
   - WP 4.1.1 - A/C high level requirements
   - WP 4.1.2 - Requirements for MTM demo
2. GRA 4.2 - MTM architectures
   - WP 4.2.1 - Avionics Architecture
   - WP 4.2.2 - Basic Prototyping Tool
3. GRA 4.3 - Prototyping tool for MTM functions
4. GRA 4.4 - Definition of flight simulator demo
5. GRA 4.5 - Demo preparation & test for MTM
   - WP 4.5.1 - Preparation of flight simulator demo for MTM
   - WP 4.5.2 - Flight simulator demo for MTM
6. GRA 4.6 - Analysis and final reporting

This Call for Proposal is linked to WP4.2.1 activities. The aim of this WP is to define final avionics architecture able to support all MTM functionalities.

This activity depends on results achieved in GRA WP 4.1.1, which main tasks are:

- High level regional aircraft requirements;
- Definition of MTM requirements peculiar for Green Regional Aircraft.

The first task is in charge of defining regional aircraft requirements able to contribute to Clean Sky objectives in terms of environmental impacts. The second task which is the real starting point of this CfP, deals with definition of new MTM functionalities.

Activity:

The selected candidate will receive a paper including:

- Ø a description of MTM functionalities which have been selected to be part of new regional aircraft avionics architecture;
- Ø requirements/guidelines for design activity (e.g. adoption of Integrate Modular Avionic - IMA).

This paper will be possibly updated untill final decision on MTM functionalities to be defined.

Based on the above information, the selected candidate shall perform a study that will be considered as a starting point for the final avionics architecture definition.

This study shall include:

- Ø market survey;
- Ø architectural solutions and SWOT analysis of the different proposed solutions.

Market survey

The aim of the survey is to identify avionics equipment/modules candidate to host new functionalities.

The survey will be used during definition of different possible avionics architetures. Parameters to be gathered shall help avionic designer to perform the trade off that will allow final avionics architecture selection.

Since IMA is considered as a contributor to weight and power consumption reduction, this design philosophy has to be taken into account for avionic architecture definition. For this reason the selected candidate shall gather data considering both a federate and IMA approach.

This survey shall takeinto account, as a minimum, the following parameters:

- Ø Physical data (e.g. mass, volume, power consumption);
- Ø Reliability, mantenability data (e.g. MTBF);
- Ø Obsolescence/technology maturity aspects;
- Ø Costs

Architectural solutions and SWOT analysis

The selected candidate shall define different architectural solutions starting from information collected with the market survey. Among other aspects, these solutions shall take into account different level of modularity.

In order to facilitate avionic designer to choose the best solution, the selected candidate shall perform a SWOT analysis.

The selected candidate shall:

- Ø define a set of architectural solutions and related assumptions;
- Ø prepare a SWOT analysis containing the following parameters:
  - o Equipment/modules weight;
  - o Wiring weight;
  - o Equipment/modules volume;
  - o Power consumption;
  - o Cooling;
  - o Safety;
  - o Costs;
  - o Scalability;

- Reliability;
- Maintainability
- Interoperability;
- Time to Market;
- Life Cycle Cost;
- Survivability;
- Security;
- Processing Capacity;
- Memory Capacity;
- Modularity;
- Redundancy;
- Certifiability;
- Obsolescence;
- Testability;
- Robustness.

The selected candidate shall note that:

- Ø the above activities shall be done considering SESAR concept of operation (SESAR Deliverable 3) and master plan (SESAR Deliverable 5).
- Ø the SWOT analysis shall take into account guidelines/results achieved by European researches regarding avionics architectures (e.g. DIANA, VICTORIA, SCARLETT).

Activities and planning:

The selected candidate shall:

- Ø analyse the documentation regarding MTM functionalities;
- Ø perform a market survey;
- Ø produce a report including market survey results;
- Ø analyse different architectural solutions;
- Ø perform SWOT analysis;
- Ø produce a report including architectural solutions and related SWOT analysis.

1.15 Reference documents

N/A

1.16 Requirements (some sensitive information may be released only at a later date to the successful applicants),

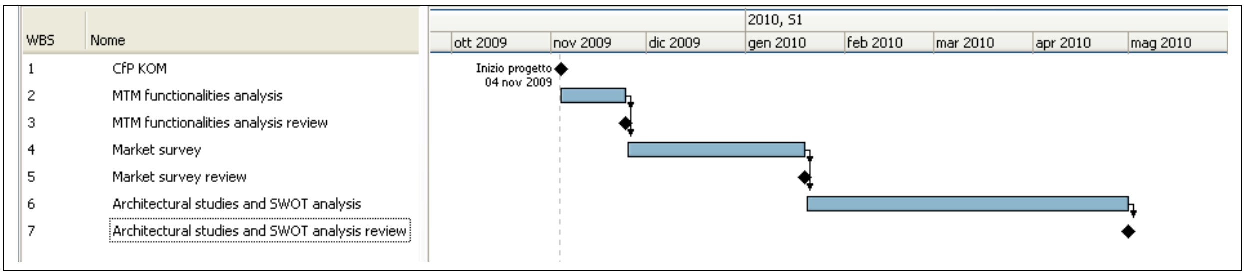
As stated above, the selected candidate will receive at the CfP Kick Off meeting all information necessary to start its activities.

1.17 Other (for instance: Quality assurance, etc, if applicable)

N/A

1.18 Timing

The schedule foreseen for this CfP is:



2. Special skills, certification or equipment expected from the applicant

The selected candidate shall have the following expertise:

- Participation to previous researches;
- Knowledge about operational aspects of current ATM;
- Knowledge about SESAR Concepts of Operations;
- Knoweledge regarding aircraft mission management;
- Knoweledge regarding regional aircraft avionic architectures.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
M1	CfP KOM	Kick Off Meeting	04/11/09
M2	MTM functionalities review		24/11/09
D1	Market survey report		19/01/2010
M3	Market survey review		19/01/2010
D2	Architectural studies and SWOT analysis report		30/04/2010
M4	Architectural studies and SWOT analysis review		30/04/2010

4. Topic value (€)

The value of this topic is estimated at **50000 Euro.**

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-05-001	Preliminary design methodologies	**Indicative End Date**	1/11/2010
		Indicative Start Date	15/10/2009

1. Topic Description

1.0 Introduction

In order to study the future configuration of commercial aircrafts, the Preliminary Design Department is strongly impacted on methodologies improvements including in them more sophisticated new design tools able to take into account coming new technologies and evaluate futuristic aircrafts configuration. New technologies of our interest for the improvement of the department design capability, are the capability to evaluate impact of new materials and structures, new systems, more performing in terms of lower weight, increased performance, new engines. Typically this work is based on analysis of the different aspects of new technologies, but it is also based on a strong knowledge of configurations already developed in the past. Therefore it's important to have a robust - fast and reliable method of preliminary design, but it is very important also a large database that provides information about existing products and gives the right starting point for a preliminary design process for a future advanced technology aircraft.

More stringent future requirements concern the impact in terms of noise levels and engine emission on the airport and flight path environment. These aspects need to be analyzed with a special attention because future developments could impede the operation from a specific airport, if special limits of noise levels and emissions are prescribed.

The methodology is expected to provide aircraft configurations as result of an optimization process that finds the best overall solution based on the maximization of one or more performance or characteristics by analysing the variation of the configuration in terms of the driving parameters.

1.1 METHODOLOGY

A) INPUT DATA: Top level aircraft requirements and specific data for the design

A . 1 Passengers number, inputs concerning interiors, operational items, options, fuselage geometry (cabin length, cross section).

A . 2 Other geometry optional inputs

A . 3 Passenger + baggage weight

A . 4 Design Range and mission profile, alternate airport

A . 5 Time to Climb

A . 6 Cruise speed and Maximum Operating speed

A . 7 Low speed performance: approach speed, take off & landing field length

A . 8 Engine power offtakes

A . 9 Noise levels (engine NPD curves, aircraft certification levels)

A . 10 Engine Emissions requirements

A . 11 Special low noise and pollution trajectories

A . 12 Driving parameters for the optimization process

A . 13 Effect of new technologies on sizing parameters

B) SIZING PROCESS:

The methodology, starting from the input data set, will perform the sizing process taking into account its internal aircraft database and the relevant interpolation algorithms.

The code will be divided into modules:

B . 1 GEOMETRICAL MODULE

This module will manage all main geometrical parameters as fuselage length and cross section (when not provided as input), wing geometry and planform, tail planes size and position, engine and nacelle main geometry (fan or propeller diameter, overall length, etc) landing gear position and relating bay, systems installation bays etc.)

B . 2 AERODYNAMIC MODULE

This module will have the capability to evaluate all aerodynamic characteristic of low and high speed with respect to a calculated geometry (wing + fuselage + tail planes + nacelles) by means of simplified methods. Furthermore this module will provide information about stall characteristics, buffet characteristics, stability, manoeuvrability, etc.

B . 3 ENGINE DATA MODULE

This module based on existing engine information will provide the data in each flight phase required for the aircraft design The following ratings have to be foreseen:

- Take Off all engines operating
- Take off with engine out
- Flight Idle
- Ground Idle
- Max-Climb
- Max-Cruise + Partial Ratings
- Max Continuous with Engine Out
- Idle for Descent

This module shall have also the possibility to evaluate the variation of weight and main dimensions (fan or propeller diameters, overall length) against thrust scaling factor, to use the power offtakes inputs if given, if not to provide this information itself, and to provide as output some parameters. In detail:

Turbofan Engine:

REQUESTED OUTPUT

Installed Thrust, Fuel Flow, Jet Velocity, Emission parameters, weight and dimensions, engine sizing rating

Open Rotor and Turboprop Engines:

REQUESTED OUTPUT

Installed Thrust, Fuel Flow, Power, Jet Velocity, Emission parameters, weight and dimensions, engine sizing rating

B . 4 WEIGHT AND BALANCE MODULE

This module will evaluate weight breakdown and center of gravity position in terms of percent of mean aerodynamic chord and on aircraft reference system. The weight evaluation will be based on statistical approach (data base, algorithms …) and will have the possibility to make more deep assumptions starting from a preliminary structural layout: frames + stringers + skin for fuselage, spars + ribs for wing, nacelle geometry, tail planes structure, and from a very preliminary systems layout in terms of main components allocation (generators, air conditioning packs, etc.). Moreover it will be able to re-calculate components weights during the sizing process.

B . 5 MISSION AND LOW SPEED PERFORMANCE MODULE

This module will be devoted to calculate mission performance and low speed points as approach speed, take off and landing distances. Mission performance module will evaluate the needed fuel to perform the mission with an assigned profile and with specified reserves. The module, starting from information coming from other modules will calculate all flight segments:

Normal Take Off calculation of ground and total distance, time, fuel consumption, rate of climb, special procedures for low noise trajectory

Climb: it will be necessary to foresee these climb techniques:

- Constant Mach
- Constant Calibrated Airspeed
- Mixed constant Vcas/Mach
- Rapid (Best Rate Of Climb)
- Best Climb Gradient

Cruise: it will be necessary to foresee these cruise techniques:

- Constant Mach

- Maximum Range or Long Range Speed
- Constant CL
- Climb Cruise
- Mixed constant Vcas/Mach
- Maximum Efficiency
- Maximum Speed (Minimum Time)
- Step Cruise (given delta distance or delta Weight)

Acceleration/ Deceleration Phases: The methodology will include these two flight phases: the first one will foresee as engine rating the Max Climb rating or Partial rating; the second one Flight Idle rating or Partial Rating.

Descent: The descent phase will be calculated taking into account the following techniques:

- Constant Mach
- Maximum Range or Long Range Speed
- Constant Calibrated Airspeed VCAS
- Mixed constant Vcas/Mach
- Continuous descent

The descent evaluation will be done considering an input value of aircraft rate of descent, a value of cabin rate of descent and furthermore a pressurization law must be assumed (aircraft altitude vs cabin altitude). The calculation, in this way, will take into account correctly the passenger comfort

Landing the phase will have fixed fuel consumption and time to be defined by the module. Brake energy will be calculated.

Single Performance Points : the code will have the capability to evaluate these performance points:

- Emergency Take Off & Landing Performance
- All engines and one engine out ceilings
- Acoustic take off and approach path (the code will evaluate the take off and approach path following current regulation and practice or special trajectories)
- Sustained Turn-Rate
- Maximum Speed
- Specific Range vs Speed Curves

In general the code will have the capability to consider special trajectories relevant to minimize pollution and noise (bend trajectories, steep approach, etc.)

B . 6 COSTS MODULE

A costs analysis will be performed. In detail:

- Direct operating cost evaluation (D.O.C): this module will be devoted to calculate the costs directly related to the aircraft utilisation as fuel costs, crew, maintenance, assurance, landing taxes, etc.
- Recurring production costs

B . 7 ENGINE EMISSIONS MODULE

For a specific trajectory (in terms of latitude, longitude, height, and time flight phases), and for the total mission, the tool will be able to evaluate emissions from a current generation engine sized by the program in the various flight phases in terms of CO_2, CO, NO_x, particulate, and will include emissions during airport operations.

B . 8 NOISE MODULE

The methodology will calculate internal and external noise levels.

Evaluation of external noise will include noise iso-level curves around the airport deriving from standard or special flight paths.

C) OPTIMISATION PROCESS:

The methodology will have an optimisation module to perform the analysis having different input specified objectives for generating the best aircraft layout and most fruitful engine integrating solution. Minimise the M.T.O.W., costs, noise, emissions, are some of the envisaged modes of operation.

D) REPORTING MODULES:

D1 Final Results Table

This output will report the following information:

Geometry of Aircraft and Engine

Characteristic weights

Weight Breakdown

Aerodynamic data (mission and low speed)

Mission results (time, distance, fuel in each flight phase)

Engine thrust in design points

Noise levels and footprints

Engine Emissions

Graphical reports must be generated in two main ways.

Cad drawings

This module it will be able to generate

- Q 2d general layout of the designed configuration
- Q Cabin and passenger internal layout
- Q Structural and system allocation

Performance graphic reporting

This module will be able to generate charts showing the achievable characteristics and performance of the resulting aircraft configuration. Some examples are the following

- Q Payload Range
- Q Block Time and Block fuel
- Q Specific Range
- Q Buffet envelope
- Q Loading and center of gravity diagram
- Q Low and high speed polar drag
- Q High and low speed characteristics
- Q Take off and landing field length
- Q Noise and pollution environmental envelope
- Q Near optimum aircraft designs and performance etc.

E)- TOOL FLEXIBILITY

The tool will accept links to customer provided modules for aerodynamic, weight and engine performance.

2. Special skills, certification or equipment expected from the applicant

It's necessary to provide the source code and a validation plan by means of specific benchmark cases.

It's strongly recommended that the applicant is linked with a Software House in order to manage in the future the methodology.

The code will be operative in Windows environment and assistance for 6 months after code delivery is required.

The code will be compliant with the Alenia Aeronautica information technology infrastructure standards(e.g. operative system, licence manager, security, hw requirements, etc….

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	First issue of tool methodology		Jan 2010
D2	First issue of tool		March 2010
D3	Final issue of Tool		June 2010
D4	Test cases		Sept 2010

4. Topic value (€)

190000 Euro

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-05-002	Theories and Numerical code for prediction of near and far field noise generated by new generation propellers and Open Rotors blade	**Indicative End Date**	*01/06/2010*
		Indicative Start Date	*15/10/2009*

1. Topic Description

1.1 Introduction

Recent progress in aerodynamics, aero-elasticity, materials and structures has enabled the design of innovative propeller configurations which operate at the same cruise speeds as jet-propelled aircraft, and the new Open Rotors engine too imply rotating blades like propellers. The inherently high propulsive efficiency of these advanced propellers and Open Rotors allows fuel savings with a corresponding reduction in exhaust emissions. One of the major drawbacks is the level of noise emitted by blades operating at high rotational speeds. The appropriate design of an aircraft using low noise power plant is one of the major requirements within Clean Sky, therefore it is very important to have available a good calculation procedure of such noise source, in order to use its results for an optimized powerplant-aircraft installation and for minimum noise flight trajectories evaluation.

1.2 Objectives

Topics and expected outcomes inherent to the present CfP are:

reporting on the state of the art on propeller/blade noise prediction
and the related implemented software codes

development of specific module/codes to predict the near
and far field noise of advanced free and installed propellers.
The collaboration with a software commercial
house capable to support later the software utilization is required
validation of developed computer code by comparison of its predictions with available
experimental data.

1.3 Description of work

The first step of work is a bibliographic research to know the present state of art on propeller noise prediction including:

CFD/CAA based, fluid dynamics and acoustics numerical analyses to predict the
propeller noise at various flight conditions in near and far field theories and/or codes
on noise emission of advanced single rotor and counter-rotating propellers

parameters and sources to be taken into account are at least:

angle of attack effect
thickness noise

loading noise
shock noise
quadrupole noise
boundary layer effect
installation effects

theories and relevant prediction codes on sound propagation.

The second step of work is to develop the modules of codes required to fulfill this specification and eventually not yet available and then derive a new code which links all the new modules with the existing ones available to the applicant in order to provide a tool fully satisfying the given requirements.

The third step of work is to validate the new code by comparison of its predictions with available experimental (or already validated results) data concerning the counter-rotating propellers as well as fast single disc propellers.

1.4 Outputs

Computer code to predict the following items for any propeller/open rotor including installation effects and at any flight condition:

Aerodynamic field on the blade
Pressure/velocity fields on the blade
Acoustic prediction at near and far field
Forces and moments transmitted by the blades to the propeller axis

2. Special skills, certification or equipment expected from the applicant

Specialist in Aerodynamic and Acoustic prediction theories and capable to develop simulation codes. A link with expert Software House experienced about aeroacoustic topics is strongly recommended.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Present state of the art on propeller noise predictions including existing software.	Technical report	31/12/2009
D2	Development of modules not yet available and required for a full advanced propeller noise prediction theory	Release of modules	01/04/2010
D3	Final computer code .	Release of full code	01/05/2010
D4	Validation of computer code		01/06/2010

4. Topic value (€)

100000 Euro

5. Remarks

None.

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-05-003	Future Green Regional Aircraft requirements	**Indicative End Date**	*01/06/2010*
		Indicative Start Date	*01/11/2009*

1. Topic Description

In the time framework of Clean Sky, it's necessary to perform an appropriate market research to foresee the airline/operator requirements related to future operational scenarios (new ATM/SESAR, rules, ETS, maintenance, ground operations, end of life issues, etc.) of relevance to regional aircraft and their operators peculiar features.

For this purpose it's request to perform a survey with the main Regional Airlines, making use of already available or ad-hoc developed tools (assessment/trade-off analysis), able to translate the collected information into real technology options to support decision-making during the GRA ITD technology developments.

The work involves three phases:

WP1

The objective of WP1 is focused on the preparation work for the survey.

The survey is intended to collect key information on airline requirements contacting a representative list of high level Executives of major Regional Airlines.

The information to collect is related to issues such as the environmental aspects, on-board comfort, airport capability, operative costs structure and basic performance of future "green" regional aircraft. The information will be utilised for multidisciplinary evaluation of the technologies being developed by GRA.

The survey design, its philosophy and the questionnaire preparation has to be approved by Alenia Aeronautica.

Starting from GRA reference aircraft data and assuming a set of possible variations, it should be possible to identify the relevance of several parameters such as:

- Cabin passenger comfort
- Performance (Range, Cruise Speed, Rate of Climb…)
- Field Performance (Take Off Field Length, Landing Field Length…)
- Engine Type (TurboProp, TurboFan, etc…)
- Avionics functions
- Airport operations
- Operating Costs
- Maintenance operations and their trends
- End of life
- Noise level around airport
- Pollution

WP2

The survey has to be based on the voluntary cooperation of selected Regional airlines.

At least ten airlines have to be considered.

Senior airline managers will be interviewed in the course of a visit to the airline or by telephone. The aim of the interviews is to understand their opinions and ideas on the requirements that have an impact on the technology choices for the future Regional Aircraft.

The individual responses from participating airlines will be confidential.

Alenia delegates will may attend the survey/interviews.

WP3

The objective of WP3 is the interpretation of the significance of the findings of the survey and the presentation of the results by a complete report including all raw data.

The specific evaluation/trade-off models developed in the research have to be available to GRA.

2. Special skills, certification or equipment expected from the applicant

The applicant must have proved extensive experience in the air travel market research sector and well introduced into airline industry.

The applicant must have conducted similar survey; It's required an adequate dedicate staff and management capability to assure the objective and schedule of the project.

Previous published research studies on specialized aeronautic journals are appreciated.

The documentation and the reports are to be in english and also available in electronic format (Windows operative system).

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
WP1	Survey preparation - Methodology	Preparation work for the survey and questionnaire	31/12/09
WP2	Survey	Interviews	28/02/10
WP3	Assessment work and final report	Interpretation of the significance of the findings of the survey	01/06/10

4. Topic value (€)

50000 Euro

5. Remarks

None

Topic Description

CfP topic number	Title		
JTI-CS-2009-1-GRA-05-004	Pod techniques	**Indicative End Date**	*1/04/2010*
		Indicative Start Date	*1/10/2009*

1. Topic Description

1.19 Scope of work

In the framework of GRA it is planned to define and study general architecture and performance of different green A/C configurations:

? Green turboprop

? Green open rotor

? Green turbofan

For each Green aircraft, starting from reference configuration, the preliminary layout configuration will be prepared and will be optimized.

For each Green aircraft, the best layout configuration will be selected. Main system and main structure architectures will be defined for such configurations.

A preliminary activity will consist in preparing methods and tools necessary for aircraft design and for configuration trade off studies.

One of the key topics will be the aerodynamic design of the new configuration. Such a kind of activity, especially when the focus is centered on non-conventional and innovative configurations, may require high fidelity CFD tools, and, hence, may require a computational effort that is beyond the feasible limits of the general architecture definition and performance evaluation of the GRA design phase. Indeed, even though powerful and efficient tools for aerodynamics evaluation and optimization would be available, the huge number of generated configuration that should be evaluated would make their use unpractical.. A possible remedy to the contrasting needs of high fidelity results and constrained computational resources may come from the use of Proper Orthogonal Decomposition (POD) techniques.

POD may be defined as a mathematical process that transforms a number of possibly correlated variables into a smaller number of uncorrelated ones called principal components. The first principal component accounts for as much of the variability in the data as possible, and each subsequent component accounts for as much of the remaining variability as possible. Recent studies have demonstrated the capability of POD techniques to be used within an aerodynamic optimization process to build complex predictive models of the aerodynamic characteristics with limited use of high fidelity flow field evaluation tools.

The applicant will develop and will provide a methodology for the implementation of Proper Orthogonal Decomposition techniques aimed at a satisfactory aerodynamic performance prediction within a design and optimization context, when limited computational resources are available for high fidelity aerodynamic computations.

The applicant will provide a software tool (source code) for application of POD techniques within a design and optimisation framework and will give support for the definition of a typical test case in the framework of GRA activities.

1.20 Reference documents

Not applicable

1.21 Requirements

Although the project is aimed to reduce computational effort in the outlined context, it should be clear that both in the software development phase and in the usage of the developed tool, a remarkable computational power is still required, as a (possibly reduced) number of high fidelity flow field evaluations will be unavoidable.

The developed software tool will have to be easily installable starting from sources on a multi processor hardware platform equipped with a Linux operating system. Therefore the use of the C/C++ and Fortran languages of the standard GNU tool chain is highly desirable. Other options are also acceptable, such as the use of Python language, but should be adequately motivated, and subject to the commissioner approval.

Consolidated standards for parallel code development (if applicable) such as MPI or OpenMP are required.

1.22 Other (for instance: Quality assurance, etc, if applicable)

A correct and punctual reporting activity is considered of paramount importance for a correct evaluation of the activity. Therefore the applicant should be prepared to provide a software design and implementation report after the first three months of activity, and subsequently a bi-monthly progress report.

A kick-off meeting, a progress meeting and a final meeting for the deliver of deliverables will be scheduled at the responsible member site. Within the final meeting a demonstration of application of the developed tool will be performed.

1.23 Timing

The Applicant will provide a Software design and implementation plan report three months after the start of activity while will provide the source software code and the technical documentation at the end of the activity (six month after the start of activities)

2. Special skills, certification or equipment expected from the applicant

The applicant should have well consolidated expertise in POD theory and applications, as well as in CFD techniques applied to aerodynamics and design.

The applicant is expected to have access to Linux/Unix clusters or multi-processor machines with the required computational power.

Regarding the software requirements, the applicant should use software tools for the high fidelity aerodynamic evaluation chain (e.g. From grid generation to flow field computation to data post processing) compliant with the requirements defined by the commissioner and whose access is available to him.

The applicant should be able to use standard tools for software management and development and documentation, such as SVN (http://subversion.tigris.org/), TRAC (http://trac.edgewall.org/) and DOXYGEN (http://www.stack.nl/~dimitri/doxygen/index.html).

The usage of standard version management and documentation tools will greatly help, among the other things, the maintenance and development of the code after the project conclusion.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Technical report	Software design and implementation plan report.	M3
D2	Software	Source code software of POD techniques to be used within an aerodynamics optimization framework. The code will be provided with included reference test cases (input and output files)	M6
D3	Technical documentation	The applicant will provide an user manual for the user of the software and a theoretical manual providing a technical description of the theoretical methods implemented in the software.	M6

4. Topic value (€)

The value of this topic is estimated in the range of up to **60000 €**

5. Remarks

Not applicable

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-02-001	Acoustic and thermal instrumentation, tests and modelling of engine surface coolers in representative aerodynamic conditions	**Indicative End Date**	04.06.2011
		Indicative Start Date	01.09.2009

1. Topic Description

In addition to aerodynamic and aero-thermal tests performed on surface coolers in a regional funded project, complementary tests will be led on acoustic and thermal characterisation of these equipments. These tests will be led in wind tunnels and/or on engine.The activities to be performed by the selected partner are:

* Based on the test requirement from Techspace Aero,

* Propose instrumentation and test plan

* Manufacture instrumentation

* Adapt existing test bench

* Perform the tests in wind tunnel

* Support the tests on engine

* Design and tune models based on test results

Remark: This Topic could be split in different CFP based on the results of the first activities.

2. Special skills, certification or equipment expected from the applicant

Research center having high speed wind tunnel facilities AND experience in surface ACOC experiments, instrumentation and CFD, AND experience in lubrication test benches

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Test engine ready for acoustic tests		02.12.2009
D2	Analysis of the acoustic impact		02.12.2009
D3	Test bench ready for fully representative aero-thermal experiments		01.02.2010
D4	thermal and aero performance analysis		03.08.2010

4. Topic value (€)

The **maximum value** for this topic is **300000€.**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-02-002	Nacelle Anti Ice Power generation design & manufacture	**Indicative End Date**	04.06.2011
		Indicative Start Date	01.09.2009

1. Topic Description

The call for proposal aims to select a partner that will be in charge of a 35KW power generator and its control electronics. The partner will be in charge of the:

* Design
* Manufacturing
* Tests including reliability demonstration
* Support to system verification tests
* Delivery of 2 sets of hardware to Safran (hardware required for reliability demonstration not included)

This power generator will be based on a wound field – oil cooled technology

2. Special skills, certification or equipment expected from the applicant

- Electro-technical company with experience in aeronautics' wound field generators
- Company proposal has to be compliant with generator reliability requirement specific to the application

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Generator + associated electronics Preliminary Design Review		02.12.2009
D2	Generator + associated electronics Critical Design Review		03.06.2010
D3	Generator + associated electronics Delivery to Safran (2 sets)		03.12.2010
D4	Reliability demonstration		04.06.2011

4. Topic value (€)

The **maximum value** for this topic is **500000 Euro**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-02-003	Tool for wire gauge optimization	**Indicative End Date**	03.06.2010
		Indicative Start Date	01.10.2009

1. Topic Description

The call for proposal aims to select a partner that will be in charge of the development of a tool that will support wire size optimization. The tool will use the electrical data (xml format) defined by the integrator and will perform the following analysis.

- Aggregation of the wire harness network from the electrical dataset.
- Voltage drop on the end to end liaison including the path for the current return
- Voltage drop by wire harness
- Current versus time in the harness
- Temperature model by wire and harness and by branch from the zone environment parameters
- Management of the business rules related to the functionality of the tool. (Segregation, thermal coupling, electrical rules, ….)
- Wire type and gauge optimisation regarding the above analysis on the end to end liaison

The output file will be a xml file by wire harness. Temperature models will be used to create a map of the wiring thermal sources by environment zones. The optimisation process shall not hinder the electrical definition process.

The development of the tool will also consist in a module allowing or proposing an optimized connector with respect to the filling ratio. The objective will be to reduce the global weight of the connectors, by decreasing the quantity of connectors used in the wiring, optimising the part number and potentially to reduce the size and/or the number of disconnect panels.

Note: The tool will not take into account EMC constraints.

2. Special skills, certification or equipment expected from the applicant

- software development company
- development of multiphysical optimisation tools
- experience in electrical business
- knowledge of general aircraft requirements used in the electrical domain could be appreciate, but it is not mandatory

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Software Input: electrical data from integrator Output: proposal for new gauge by wire harnesses taking into account the length, the		03.03.2010

	environment and the current.		

4. Topic value (€)

The maximum value for this topic is **500000 Euro**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-02-004	Development and manufacturing of an Electro-thermal Ice Protection Assembly	**Indicative End Date**	04.10.2011
		Indicative Start Date	01.10.2009

1. Topic Description

The objective of the call is to find a partner who will support Liebherr Aerospace in building up an A320 slat equipped with an electro-thermal solution for ice protection. The selected partner will have to build up a first technological demonstrator to validate electro-thermal system integration and address materials and process issues. Icing wind tunnel will be then necessary to validate ice protection performances, especially in case of de-icing mode. Aerodynamic and icing parameters could have significant impact on ice shedding and thermal behavior of the electrothermal system, and sensibility analysis will have to be performed to check the performances of the ice protection system for the whole flight and icing envelop. Flight test campaign will then be performed to validate the system in real conditions. This step will be mainly useful to address issues related to the real 3D geometry of aircraft which could have a strong impact on the control system and on the performances of the electrothermal device. The campaign will be performed on simplified demonstrators using current slat structure slightly modified to assemble the anti-icing system. This set-up will have to be partially qualified regarding structural and system aspects.

Costs related to icing wind tunnel and Flight test campaigns (Modification and use of the experimental devices) are not included in this call for proposal.

2. Special skills, certification or equipment expected from the applicant

Company having :

- experience on slat manufacturing compatible with aero requirements
- knowledge of material, process and performances issues for integration of heating mats inside the slat structure

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Icing wind tunnel SGO demonstrator		03.11.2010
D2	Flight test SGO demonstrator		04.10.2011
D3			
D4			
D5			

4. Topic value (€)

The **maximum value** for this topic is **1500000 Euro**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-02-005	Develop and manufacture scoop intake and channel incl. ice and debris protection and acoustics absorbers	**Indicative End Date**	03.11.2010
		Indicative Start Date	01.10.2009

1. Topic Description

In this task, techniques should be explored to manufacture a lightweight scoop intake made of CFRP including the following components:

* Erosion shield

* Lightning protection

* Electrically insulated high power heating system (power densities > 20 kW / m²) as part of an ice protection system

* Temperature sensing elements, used for system control and monitoring (i.a. the excess of temperature limits of the CFRP has to be avoided)

* Acoustical treatment of intake.

The task includes manufacturing of several items to verify proposed integration principles including two full-scale prototypes of the lip for integration of electrical ice protection and of the duct with integrated acoustic absorbers. The final deliverable of this task will be a scoop to be tested in a separate task in an icing wind tunnel under simulated icing conditions. Manufacturing techniques do not need to conform to proceedures and materials that are flight worthy although it should be possible to adapt the integration principles to flightworthy designs, processes and materials.

The dimensions of the intake cross section will be approximately 0.1 m x 0.3 m (maximum).

The intake mass flow will be approximately 1 kg/s (maximum).

2. Special skills, certification or equipment expected from the applicant

Research institute/SME specialized in CFRP manufacturing techniques with experience of including high power electrical heaters and temperature sensing elements into solid CFRP parts. Access to knowledge of integrating acoustical treatment into CFRP parts should be available.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Prototypical scoop inlet lip including integrated electrical ice protection		03.03.2010
D2	Prototypical lightweight duct with acoustic absorbers		03.05.2010
D3	Complete scoop inlet with ice protection and acoustic absorber.		03.07.2010

4. Topic value (€)

The maximum value for this topic is **500000 Euro**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-02-006	Supercooled Large Droplets Icing Wind Tunnel adaptation and Ice Detection test sessions for pre-design validation and final tests for qualification. (Icing tests for scoop intake and channel)	**Indicative End Date**	03.08.2010
		Indicative Start Date	01.10.2009

1. Topic Description

This task consists of the preparation and execution of an icing tunnel test for a scoop type air intake with integrated ice protection system and acoustic treatment. The scoop type air intake will be manufactured in a separate task.

The main purpose of this task is twofold:

* First of all, the test program shall explore whether the ice protection system designed without testing the design rules is able to keep all components of the air intake free of ice accretion in continuous maximum and intermittent maximum icing conditions as defined in EASA CS-25, Appendix C.

* Moreover, the test shall explore the possible design space for an ice protection system and provide reference cases for validating the methodology used for designing the ice protection system.

If possible, also operation of the air intake in freezing fog conditions, super cooled large droplet conditions and with snowfall should be tested.For the icing test, the scoop intake will be installed in the test section. Air flow through the intake should be measured and controlled (e.g. by a suitable restrictor and/or blower). To minimize cooling requirements, the air flow through the scoop intake will have to be injected back into the tunnel. Icing conditions will be generated by a spray rig installed in front of the test article. This test campaign will require careful calibration of the test conditions at the location of the test article.

2. Special skills, certification or equipment expected from the applicant

Operator of an icing wind tunnel (IWT). IWT should have the following capabilities:

* Max. wind speed: 30-70 m/s

* Test section size: larger or equal to 0,8 x 0,5 m²

* Liquid water content (LWC) and droplet diameter should cover EASA CS-25, Appendix C

* Usable area of test section with LWC variation < 10% of nominal value: greater 0,5 x 0,3 m² Instrumentation to characterize wind speed, LWC, droplet diameter should be available

* Blower should be available to simulate attached systems (magnitude 0.8 – 1.2 kg/s)

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Icing tunnel test performed		03.08.2010
D2			
D3			
D4			
D5			

4. Topic value (€)

The **maximum value** for this topic is **180000 Euro**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-02-007	Development and manufacturing of the EPDS Integration rig(s).	**Indicative End Date**	04.10.2012
	(Design, manufacturing, integration and validation of AFD function)	**Indicative Start Date**	01.10.2009

1. Topic Description

Objective:

Today's experience shows that protections do not cover all failure cases, more specifically arc conditions (low energy events). The objective of Arc Fault Detection (AFD) is to detect an arc event and to analyze whether it is harmfull or harmless to its environment. Studies are currently in progress to develop and standardize arc fault protection for low voltage networks (115VAC/28VDC), and do not cover new high voltage networks (230VAC/540VDC).

The objective of this task is to develop, test, and deliver AFD modules adapted to high voltage networks to be integrated into EPDS high voltage switching components (electro-mechanical or solid state), as well as supporting integration of standardized arc fault protection modules on EPDS low voltage switching components.

Tasks foreseen:

1. Definition:

1.1 Characterisation of an arc in an high voltage (AC, DC) aircraft environment (event condition, effects...)

1.2 Modelling of the arc

1.3 Identification of recommendation to limit arc fault occurence, and of methods to detect arc

1.4 Participation to trade off studies on integration options into switching components

2. Development:

2.1 Development of a detection algorithm

2.2 Module definition & realisation (HW and/or SW)

3. Validation:

3.1 Standalone module validation & testing

3.2 TRL demonstration

4. Integration:

4.1 Support integration & test of AFD function/modules into EPDS switching components

2. Special skills, certification or equipment expected from the applicant

Aerospace Circuit Breaker supplier familiar with:

- aerospace low voltage AFD
- AS5692 standard
- aerospace electrical network environment, including EMI, HIRF & lightning

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Arc fault in high voltage aircraft environment study (characterization, detection		03.04.2010

	methods...)		
D2	AFD modules to be integrated into switching components		02.01.2011
D3	AFD module test report (including TRL evidence)		04.04.2011
D4	Technical support to integration & test of AFD function into switching components		04.10.2012
D5			

4. Topic value (€)

The **maximum value** for this topic is **1200000 Euro.**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-02-008	Actuator test bench	**Indicative End Date**	02.12.2010
		Indicative Start Date	01.10.2009

1. Topic Description

The call for proposal aims to select a partner that will be in charge of an actuator test bench. The partner will be responsible for:

* Design
* Manufacturing
* Bench tuning
* Delivery to Safran
* Technical support during bench operation

This test bench will be able to apply a programmable counter load on two different types of linear actuators:

* First type: short course (approx 100mm), medium load (approx 5000N), high speed (approx 0,9 m/s)
* Second type: large course (approx 600mm), high load (approx 25000N), medium speed (approx 0,4 m/s)

The bench will allow synchronization test of 2 actuators of the same type. As a consequence, the bench will provide a counter load for 2 actuators at the same time with the ability to apply a different load for each actuator.Bench to cope with operation of one actuator type one (smaller one) within a thermal chamberThe bench has to include automatic safety controls so it can be safely run without an operator during endurance tests.

2. Special skills, certification or equipment expected from the applicant

- company specialized in test bench development & manufacturing
- experience in linear counter loads with high dynamics
- company availability compliant with challenging timescale for test bench development & delivery

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Bench Preliminary Design Review		02.12.2009
D2	Bench Critical Design Review		03.04.2010
D3	Bench Delivery to Safran		02.09.2010
D4	Technical support during bench operation when necessary		

4. Topic value (€)

The maximum value for this topic is **250000 Euro.**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-02-009	Development of an hybrid low power Ice Protection modellisation tool and Icing Wind tunnel tests to validate the tool and the system performance.These activities are linked with IWT activites required for "Wing Ice Protection system for Businessl Aircraft" See WP 2.3.4.3.2 (WIPS for BJ)	**Indicative End Date**	31.07.2013
		Indicative Start Date	24.09.2009

1. Topic Description

Within the Clean Sky SGO ITD, the development and adaptation of an innovative, low-power Wing Ice Protection System (WIPS) for the Green Regional Aircraft and Eco Design for Systems ITDs is going to be thoroughly studied and analysed. The system will exploit hybrid Electrothermal/Electromechanical actuators electrically driven by dedicated power electronics, with the main target of meeting the low energy consumption objectives into the aircraft Energy Management framework.

Main issues include definition of the ice protection performance and requirements such as residual ice limits and allowable inter-cycle ice to have suitable handling qualities, definition of protected surfaces and their extent, ice protection cycles optimization.

The WIPS shall be compliant with Civil Certification requirements of aircraft Ice Protection, covering maximum continuous and intermittent maximum conditions, the behaviour in the Super-Cooled Large Droplets conditions shall also be considered.

The scope of the present Call for Proposal is to perform activities for the WIPS performance verification and to develop associated parametric simulation design tools.

These achievements shall be pursued by means of:

- an Icing Wing Tunnel test campaign on a full-scale wing section, equipped with WIPS devices. IWT test campaign shall allow both WIPS performance verification in a representative ice environment and numerical simulation model and tool validation.

- the development of a tool for the numerical simulation of the protection system including the aerodynamic effects, and thermal and mechanical effects of the WIPS integrated with the specific ice accretion dynamics. The numerical simulation tool development shall be aimed at consolidating a flexible methodology to perform parametric studies for different wing geometries, actuators distribution configurations and protection strategy and sequencing.

Technical Information

Icing Wind Tunnel testing of hybrid Wing Ice Protection System

Icing Wind Tunnel test campaign shall reproduce the icing conditions foreseen during a typical aircraft operative profile, in a controlled and repeatable ice accretion environment simultaneously reproducing altitude, temperature, humidity and velocity conditions of the main flight operative phases where icing conditions may be encountered (take-off, climb, holding pattern, descent).

Testing activity will be performed on a wing section equipped with a hybrid de-icing system based on electrothermal mats and electromechanical actuators: suitable and enough test data shall be collected to provide an experimental evaluation of system performances and effectiveness.

Test points shall include conditions reported by the Civil Certification requirements (CS/FAR 25.1419 and the associated Appendix C "Continuous maximum icing" and "Intermittent maximum icing"). Super-cooled Large Droplets (SLD) conditions shall also be addressed as representative of the most hazardous icing condition for the aircraft.

Icing Wind Tunnel Test expected data

The Icing Wind Tunnel testing activities shall provide data to fully characterize the icing conditions, and WIPS effectiveness and performance.

Parameters for ice accretion studies

Ice build-up at different angle of attack shall be characterized by means of the following pieces of information recorded during the test execution:

-Droplet diameter-size as a function of simulated altitude and cloud properties

- Rate of ice accretion, ice type and shapes mapping
- Particle trajectory/droplet impingement
- Ice thickness measurements
- Video recording of ice build-up

Test parameters for de-icing system analysis

- Detailed mapping of accreted, residual and intercycle ice and runback water refreeze at different wing positions
- Specific parameters acquisition for system performance evaluation and monitoring (local surface temperature and acceleration, etc.)

Input to Icing Wing Tunnel testing

For the purposes of the IWT test execution, the selected candidate will be provided with a test article consisting of a wing section equipped with the hybrid ice protection system and sensors for system performance parameter acquisition: test article preparation and delivery will be under the responsibility of Dassault Aviation, in the framework of the activities included in the SGO WP 2.3.4.3.2 linked to Eco Design ITD.

Information for the test article integration into the test chamber will be agreed with the selected candidate. This will include:

- Wing section geometry and weight
- Wing Ice Protection System electrical interfaces
- Wing Ice Protection System actuation sequences

The model subjected to the test activity will be equipped with sensors for the measurement of airfoil skin temperature in the area of the thermal ice protection system and deformation induced by the electromechanical devices: mechanical integration with the test facility apparatus shall be assured by the selected candidate, on the basis of the provided interface information.

Acquisition of wind tunnel parameters during tests will be under the selected candidate's responsibility; moreover, the selected candidate shall support the CfP proposers (Alenia Aeronautica, Zodiac Aerospace and Dassault Aviation) for the acquisition of parameters relevant to the WIPS performance evaluation regarding the thermal behavior and surface deformation.

Numerical Simulation of hybrid Wing Ice Protection system

The numerical simulation tool will be an integrated, modular environment for the ice accretion calculation and ice protection performance evaluation, allowing system design analysis verification.

The tool shall predict the simultaneous and interacting phenomena involved in the ice formation on aerodynamic surfaces and thermal and mechanical effects of the wing ice protection devices, embodying the capability to simulate the aerodynamic field and the rate of ice accretion, the prediction of ice shapes on the aerodynamic surfaces, coupled with the heat transfer model and structure mechanical model.

Use of existing validated simulation codes within the simulation tool can be proposed, and nevertheless shall be agreed with the CfP proposers.

The expected simulation strategy shall be organized in a way to allow a step-by-step approach as herein depicted:

- ice accretion simulation
- electrothermal protection simulation/runback water refreeze simulation
- electromechanical protection simulation and ice detachment prediction

Model validation based on the results obtained in the parallel Icing Wind Tunnel test campaign (as described above) shall demonstrate the proposed simulation strategy effectiveness.

Herein reported are the guidelines for the development of the numerical simulation tool, including the main phenomena and expected simulation capabilities: details about the simulation strategy, assumptions of simplified model development and verification and validation plan shall be agreed between the selected candidate and the CfP proposers, within the activities expected for the Deliverable D1.

Ice accretion model requirements

The ice accretion simulation shall be based on a three-dimensional flow field solver integrated with a water impingement module. Simulation models of multibody/multielement surfaces shall be considered.

In order to predict the ice shape evolution on the unprotected surface and residual ice after ice protection actuation, ice shapes shall be evaluated and updated in a multiple time step framework. Ice shapes evolution calculation shall be possible with both the Wing Ice Protection System inoperative and operative.

Methods for prediction of runback ice build-up caused by water rivulets generated by the ice protection actuation shall be proposed within the framework of the simulation tool.

The tool shall also simulate variable environmental conditions, in particular the presence of a variable cloud environment, in terms of LWC and MVD of water droplets, including SLD conditions.

Main simulation tool components/modules:

- Air flow field solution
- Particle trajectory, impingement limits calculation
- Droplets collection efficiency calculation
- Ice growth ice shapes calculation/mesh adaptation

Electrothermal actuator simulation requirements

The simulation of the thermodynamic effects on the surfaces shall be integrated with a thermal model prediction the electrothermal mats behaviour and performances, including prescribed cycling and sequencing.

Main simulation tool components/modules:

- thermal model of anisotropic materials
- temperature-dependent thermal resistances
- individual electrothermal mat cycling control, including separate power densities
- thermal distribution in the airfoil skin and ice layer, including phase changes

Electromechanical actuator simulation requirements

The action of the electromechanical actuators shall be reproduced by means of the numerical simulation of the mechanical deformation of the airfoil skin and the included ice shapes. Numerical simulation shall be based on the nonlinear transient three-dimensional stress analysis of the structural parts affected by the ice accretion that accounts for the adherence force at the ice skin interface.

Main components/modules:

- FEM model for structure and ice shape
- Adhesion force modelling / ice characterization
- Ice detachment prediction
- Evaluation of residual ice

Simulation data and post-processing

Simulation points shall include but shall not be limited to those tested in the framework of the IWT test activities, for the purposes of the tool validation.

- Identification of optimum extent of the heated area in chordwise direction
- Identification of energy requirements necessary to melt ice layer
- Analysis of the effectiveness of the system as function of wet ice surface
- Identification of parametric study advantages towards the possibilities of reducing the weight and energy consumption of the de-icing system

Post-processing of simulation data and output capability shall be guaranteed, either by a built-in package or by using existing computational tools, upon agreement with the CfP proposers. For all the main physical properties (flow field velocities, surface temperatures, ice thickness), contour plots as well as parameter vs time plots generation capability shall be provided; ice shapes evolution plots, water impingement and shed ice trajectories shall also be generated.

Nonetheless, the set of parameter, data and output required for the code validation will be agreed with the selected candidate, as well as the information required for the evaluation of the ice protection system effectiveness in terms of aerodynamic performances.

Inputs for the simulation

All the pieces of information necessary to develop and verify the single components of the will be provided to the selected candidate. These will include:

- Aerodynamic surface geometries in the different configuration under test
- Electrothermal/electromechanical actuators geometries and performance parameters (e.g. power densities, force distribution)
- Actuation control logic and cycles

Ice protection simulation methodology

In the effort to develop a design and calculation process for the Wing Ice Protection, the simulation tool shall be also evaluated in terms of computational effort requirements. This shall include evaluation of each model component as well as of the integrated simulation environment, in terms of computational time per number of mesh cells and per number of cores.

Hardware and System description

To guarantee the evaluation of technical approach and to allow the analysis of data results will be necessary to provide technical details about facility characteristics, capability and instrumentation involved in data acquisition processing.

- Test chamber instrumentation calibration
- Water cloud generator characterization and calibration
- Test Procedures
- Test section characteristics
- Visual Data Acquisition
- De-Icing Image setup

Reporting

Activities reporting shall be in the form of:

- Test results technical report
- Performance data
- Video report

- Numerical simulation technical reports
- Model validation report by experimental data correlation

Meeting and review during development

Progress meeting shall be periodically planned between the parts during all development phases to evaluate and agree on requirements and results assessments.

Technical meeting shall take place on Alenia and Zodiac request, in order to discuss in details specific technical points.

Review meeting shall materialize the development steps and to state if all the works and documents foreseen for these review have been performed and are acceptable.

Management meeting shall be periodically planned during the development phases to advancements and project management issues.

2. Special skills, certification or equipment expected from the applicant

The candidate organization shall have recognized experience in the ice protection studies either in the numerical simulation of ice shapes, droplet trajectories and ice protection system performance and in the icing testing set-up and test execution.

The proposed icing wind tunnel facility shall reproduce the real icing environment in terms of air velocity droplet size and liquid water content, following EASA ice envelope and using the given full size testing fixture. It will be a plus if effects of altitude and ice accretion size are correctly reproduced in the test facility without use of parametric escalation methods.

Icing Wind Tunnel capability

Herein reported are the ranges of the main parameters that the test facility shall reproduce during the test campaign:

- Mach number: up to 0.25
- Altitude: 0-22.000 ft
- Ambient temperature: -30 °C to 0 °C
- Liquid Water Content : 0.1 -3.0 g/m^3
- Droplet size: 5-250 µm

Moreover the Icing Wind Tunnel shall guarantee:

- Low turbulence level
- Good capability of reproducing supercooled clouds
- Good capability of reproducing different conditions (rime, mixed and glaze ice)
- Water cloud and cloud consistency full characterization and real-time control
- Equipped wing section full scale testing (test chamber minimal size 3.5 m)

It is expected that the selected facilities assure capability to maintain the air temperature and velocity profiles uniform across the test section for the whole test duration and to assure the production of a uniform water cloud over the test section.

The water droplet generation system shall be capable of reproducing wide range of liquid water contents, droplets size spectra and droplet median volumetric diameters defined in the Appendix C of CS/FAR 25.

Water droplet generators shall be fully characterized over the environmental test envelope; water cloud generators shall be monitored during the test execution in order get real-time control of the testing conditions.

Scale parameters laws would be useful to adjust controllable parameters, thus allowing simulation of different flight conditions.

Main simulation capabilities
The simulation shall integrate a set of solver including the following components:
- Flow field solver
- Ice accretion model
- Ice-shape driven mesh generator
- Structure/ice thermal interaction and thermodynamic models (including the electrothermal mats effect)
- Mechanical deformation induced by the electromechanical mats
- Ice detachment model
- Shed ice paths solver
The simulation tool shall have a modular structure; parametric input interfaces are highly recommended in order to provide the highest flexibility to the computational capability.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Simulation strategy / V&V plan	Definition of the main simulation objectives and strategy of the model development and organization. Definition of the simulation tool verification and validation plan against the experimental test data	30.06.2010
D2	IWT test plan	Icing Wind Tunnel test plan shall detail test objectives, test points, measured parameters	15.01.2012
D3	IWT test set-up	Test article integration, facility and instrumentation calibration demonstration	01.08.2012
D4	IWT test results and assessment	Final experimental test report. Validation of the numerical simulation tool.	31.07.2013
D5	Validated simulation tool release	Release of the numerical simulation tool and validation documentation	31.07.2013

4. Topic value (€)

The maximum value for this topic is **1200000 Euro.**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-02-010	Electric motor & sensor design and manufacture.	**Indicative End Date**	03.05.2010
		Indicative Start Date	01.09.2009

1. Topic Description

The call for proposal aims to select a partner that will be in charge of an electric motor + Sensor designed for a nacelle actuation system. The partner will be in charge of :

* Design
* Manufacturing
* Tests
* Delivery of 8 sets of hardware to Safran
* Support during system verification tests

Motor technology required is permanent magnet – low short circuit current, sine wave driven.

Approximate characteristics are: intermittent power: 3KW, Torque: 5 Nm, speed: 10000tr/minHigh precision resolver

Max ambient operating temperature: approximately 100 C .

2. Special skills, certification or equipment expected from the applicant

- Electro-mechanical company with experience in electric motor design & manufacturing
- experience required in motor architecture for low short circuit current

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Motor + sensor Preliminary Design Review		02.12.2009
D2	Motor + sensor Critical Design Review		01.02.2010
D3	Motor + sensor Delivery to Safran (8 sets)		03.05.2010

4. Topic value (€)

The **maximum value** for this topic is **200000 Euro.**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-02-011	Engine Thrust Reverser Actuation System (ETRAS) mechanical transmission design/manufacture	**Indicative End Date**	03.12.2010
		Indicative Start Date	01.09.2009

1. Topic Description

The call for proposal aims to select a partner that will be in charge of the screw-jackelectromechanical actuator for the Thrust Reverser function (excluding the electrical motor).The partner will be responsible for:

* Design
* Manufacturing 2 preliminary and partial demo (screw and gear box)
* Manufacturing 4 final demo to be incorporated in the nacelle integration test bench (fully function integrated)
* Technical support during endurance operation

Actuators main characteristics:

* 500 mm stroke approx. 2000 daN load approx. speed 0,3 m/s approx
* Equipped with 1synchro resolver, 1 brake, 1 locking device and solenoid release, 2 proxi sensors
* Jam reliability < 1E-7

The actuators will receive an electrical motor (2,5kW approx) mounted on the actuator gear box

2. Special skills, certification or equipment expected from the applicant

- Company specialized in test bench development & electromechanical actuator manufacturing
- Company availability compliant with challenging timescale for EMA sizing, manufacturing

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Preliminary Design Review		02.12.2009
D2	Critical Design Review		03.05.2010
D3	Delivery of the 2 partial prototypes		03.06.2010
D4	Delivery of the 4 endurance prototypes		03.12.2010

4. Topic value (€)

The **maximum value** for this topic is **200000 Euro.**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-03-001	Advanced turbofan engine gaseous emissions model	**Indicative End Date**	2011
		Indicative Start Date	01.09.2009

1. Topic Description

The Systems for Green Operations ITD is looking for an advanced turbofan gaseous emissions computerized numerical model supplier to become a partner of the consortium.

The Systems for Green Operations research consortium of Clean Sky aims to demonstrate substantial reductions in CO2/ NOx/ H2O… emissions and fuel consumption in civil commercial mainline and regional aircraft powered by a turbofan engine.

The aimed turbofan computerized model shall at least encompass different engines types (two or three-shafts compressors, single/twin annular combustor). The model will be delivered to Clean Sky partners for integration in their analysis suite. This suite is used for off-line computation of gaseous emissions along aircraft complete trajectories (from regional to long range flights).

The consortium wishes to enter into partnership with a company able to design or adapt and enhance existing turbofan computerized gaseous emission model responding to these general requirements by December 2009.

The new partner will:

- Identify the driving parameters and propose the inputs/outputs parameters set
- Design or adapt the turbofan numerical model of gaseous emissions and fuel consumption;
- Provide evidence of model pertinence consisting in comparison of estimated data against experimental data (reference test data files);
- Deliver the turbofan computerized model of gaseous emissions and fuel consumption and its associated documentation.
- Provide post delivery support;

The model is expected to be delivered as a software package running on MS windows XP Operating System preferably.

The model under consideration will take the following variables as inputs:

- Altitude
- Indicated airspeed
- Outside static air temperature
- Humidity
- Atmospheric static pressure
- Thrust level
- Aircraft configuration (high lift devices and landing gear)

Those values will be provided as a file describing a whole flight profile along time, from take off to landing (representing many hours of duration) with a sample rate TBD.

The output of the model is expected to be an amount of each of the species along time. The computation for the complete emissions profiles is expected to last less than the actual flight time.

The format of the input file is TBD. Provisions to change the input from a file to a network protocol or an inter process communication within a reasonable development effort is considered an asset.

Regarding water emissions, the model should be able to determine the mass turning into a condensation trail and the life time of this condensation trail.

The partner organization should have the industrial capacity to maintain the model until end 2011 – i.e. to further adapt, optimize, certify, and produce updated versions of the turbofan and airframe numerical noise model. Joint ventures with legal personality and liability can also respond to the Call for Proposal. The answer to this call for proposal must include a detailed technical description of the solution with the associated evidence of the expertise and pre-existing know how.

2. Special skills, certification or equipment expected from the applicant

Skills in modelling and emission.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Model Technical Specification (TS)		02.11.2009
D2	Model Definition and Justification Document (DJD)		01.02.2010
D3	Model Validation Test Plan (VTP)		03.04.2010
D4	First numerical Model SW Model User Manual Validation Test Report (VTR) Reference tests data files		03.05.2010
D5	Problem report and model modification request		02.09.2010
D6	Model Technical Specification update (TS) Model Validation Test Plan update (VTP)		02.10.2010
D7	Final release of the numerical model software, with problem fixes Model User Manual update Final Validation Test Report (VTR) Reference tests data files		02.11.2010
D8	Numerical model software and data package update for problem fixes or evolutions		2011

4. Topic value (€)

The maximum value for this topic is **300000 Euro.**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-03-002	Advanced turbofan equipped aircraft noise model	**Indicative End Date**	2011
		Indicative Start Date	27.05.2009

1. Topic Description

The Systems for Green Operations ITD is looking for an advanced turbofan Noise emissions computerized numerical model supplier to become a partner of the consortium.

The Systems for Green Operations research consortium of Clean Sky aims to demonstrate substantial reductions in Noise emissions in civil commercial mainline and regional aircraft powered by turbofan engines.

The aimed turbofan computerized model shall at least encompass different aircrafts (engines types and thrust settings, airframes types, configurations and geometries). The model will be delivered to Clean Sky partners for integration in their analysis suite. This suite is used for off-line computation of ground perceived noise emissions along aircraft terminal area trajectories, depending at least from aircraft noise emission diagram, environmental conditions, local terrains.

The consortium wishes to enter into partnership with a company able to design or adapt and enhance existing turbofan and airframe computerized noise emission model responding to these general requirements by December 2009.

The new partner will:

- Identify the driving parameters and propose the inputs/outputs parameters set
- Design or adapt the turbofan and airframe numerical model of noise emissions;
- Provide evidence of model pertinence consisting in comparison of estimated noise emissions against noise experimental data –(reference test data files);
- Deliver the turbofan and airframe computerized model of noise emissions and its associated documentation;
- Provide post delivery support.

The model is expected to be delivered as a software package running on MS windows XP Operating System preferably.

The model under consideration will take the following variables as inputs:

- Altitude
- Indicated airspeed
- Outside static air temperature
- Humidity
- Atmospheric static pressure
- Thrust level
- Aircraft configuration (high lift devices and landing gear)

Those values will be provided as a file describing the flight profile in the terminal manoeuvre area along time, with a sample rate TBD. The output of the model is expected to be a perceived noise map spreading across the audible spectrum (with a decomposition per frequency).

The model should come with references to the geographical data used to compute reflections on topographical features. This information should allow worldwide computations to be performed. A population distribution database matching this geographical information is considered an asset. The format of the input file is TBD. Provisions to change the input from a file to a network protocol or an inter process communication within a reasonable development effort are considered an asset. The partner organization should have the industrial capacity to maintain the model until end 2011 – i.e. to further adapt, optimize, certify, and produce updated versions of the turbofan and airframe numerical noise model. Joint ventures with legal personality and liability can also respond to the Call for Proposal. The answer to this call for proposal must include a detailed technical description of the solution with the associated evidence of the expertise and pre-existing know how.

2. Special skills, certification or equipment expected from the applicant

Skills in modelling and emission.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Model Technical Specification (TS)		01.11.2009
D2	Model Definition and Justification Document (DJD)		03.02.2010
D3	Model Validation Test Plan (VTP)		02.04.2010
D4	First Numerical Model Software Model User Manual Validation Test Report (VTR) Reference tests data files		03.05.2010
D5	Problem report and model modification request		Sept 2010
D6	Model Technical Specification update (TS) Model Validation Test Plan update (VTP)		Oct 2010
D7	Final release of the numerical model software, with problem fixes Model User Manual update Final Validation Test Report (VTR) Reference tests data files		Nov 2010
D8	Numerical model software and data package update for problem fixes or evolutions		2011

4. Topic value (€)

The maximum value for this topic is **500000 Euro.**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-03-003	Supply of weather data service for simulation (Meteorological concept validation)	**Indicative End Date**	01.01.2010
		Indicative Start Date	01.09.2009

1. Topic Description

Airbus has foreseen to develop for its commercial aircraft on-board system that provides meteorological data measured along the trajectory, including atmospheric humidity, associated to ground data transmission. Such system will help to improve meteorological forecasts for e.g. air trajectory optimisations.

Based on previous studies, Airbus will propose parameters and mode of transmission. In particular, type of data that can be measured, frequency and accuracy of measures, type of transmission selected, volume and frequency of transmission will be described.

The objective of this Call for Proposal is two-fold:

* Elaborate a state-of-the-art definition of the meteorological chain and market for civil aviation use (airlines, meteorological centers, Air Navigation Service Providers, ...)

* Obtain the agreement from international meteorological community about the foreseen system. This task will include the validation by this meteorological community as main user of the data transmission proposed by Airbus. If modifications are required, the applicant will propose amendments to the concept for Airbus analysis and validation by all parties. The report shall also describe the visionary implementation of such a system and its integration in the existing aeronautical chain as far as civil aviation is concerned.

2. Special skills, certification or equipment expected from the applicant

Meteorological centres or affiliates

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Report containing validation meteorological concept by concerned parties, with description of data transmitted by the aircraft to the ground.		01.01.2010
D2	Report on the state-of-the-art of the meteorological chain and market for civil aviation		01.01.2010
D3			
D4			
D5			

4. Topic value (€)

The **maximum value** for this topic is **100000 Euro.**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-03-004	Economical modelling according to airline model (e.g. : flag carrier, charter, low cost, regional)	**Indicative End Date**	04.12.2011
		Indicative Start Date	01.09.2009

1. Topic Description

The Systems for Green Operations ITD is looking for (a) supplier(s) of a business analysis of how airlines include the environmental impacts on their fleet management, to become a partner of the consortium.

The Systems for Green Operations research consortium of Clean Sky aims to demonstrate substantial reductions of environmental impacts in civil commercial mainline and regional aircraft.

Current flight optimisation is based on fuel consumption against flight time; tomorrow flight optimisation will address additional environmental criteria to reduce noise and gaseous emission.

The aimed analysis shall encompass flag carrier/ Network airlines Cost/Benefit Analysis and low cost carriers Cost/Benefit Analysis. A survey of the different existing local airports charging policies shall also be performed.

The consortium wishes to enter into partnership by September 2009 with (a) companies (y) able to establish an analysis report responding to these general requirements. The new partner(s) will:

- Assess typical environmental performance of actual flights compared to optimal trajectory computed for a given flight plan. The deviations shall be characterised per flight phase and possible root causes analysed. This work will be used as a basis for quantified optimisation of trajectories. Expected activities are as follows:

o Define the key characteristics expected from air routes to be analysed from an environmental impact perspective

o According to the previously defined criteria, select a set of representative routes among those available in the actual flights records database

o Perform a dispersion analysis of aircraft key parameters for flights along the selected routes in the flights database

o Extract, process, and synthesise aircraft recorded data for flights along selected routes to allow comparison of environmental performance of actual flights and Clean Sky optimised flights in the project simulation environment

- Identify the costs associated with environmental aspects (taxes, permits and quota). Revenue sources should also be considered (e.g. better aircraft fill rates with a greener brand image).

o The goal is to get general trends of environmental costs vs. mission profile. e.g. :Are the taxes based on actual/estimated emissions or based on the filed flight plan? What is the geographical dependency of the fees?

o The goal is to understand how current fuel/time optimisation is managed. e.g. is this optimisation under pilot responsibility, or predefined by operational control? What kind of refuelling policies are in place?

o The goal is to understand how tomorrow optimisation will be managed by the airlines. e.g.: How will environmental impacts optimisations be taken into account? : In aircraft use model or in operation economical model? Will a priority exist between the environmental impacts and will costs associated to Noise, CO_2 and NOX emissions be managed independently?

- Those costs should be considered in their balance against other operating costs:

o Costs associated to delays (missed connections …).

o Increase of seat occupancy rate permitted by shorter flight times (interaction with flight booking systems)

o Labour cost (supplemental crews) o … - Identify how these costs are taken into account by the airlines: o On a mission per mission basis o On a fleet wide basis o On an annual or seasonal basis o Through AOC planning or flight crew planning… - Survey envisioned mid term evolutions of system of trading and environmental control The partner organization should have the capacity to maintain the business model and aircraft data reference until end 2011 – i.e. to further adapt, refine the analysis. Joint ventures with legal personality and liability can also respond to the Call for Proposal. The answer to this call for proposal must include a detailed technical description of the solution with the associated evidence of the expertise and pre-existing know how

2. Special skills, certification or equipment expected from the applicant

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Air routes key characteristics definition and actual routes selection proposal		02.12.2009
D2	Preliminary business analysis report for flag carriers / Network airlines Preliminary business analysis report for low cost airlines		02.12.2009
D3	Aircraft data dispersion per flight phase analysis report		03.04.2010
D4	Final business analysis report for flag carriers / Network airlinesFinal business analysis report for low cost airlines		03.04.2010
D5	Extracted flight data for use in Clean Sky simulations		03.10.2010
D6	- Supplements and updates of the business analysis - Provision of additional flights data		2011

4. Topic value (€)

The **maximum value** for this topic is **1000000 Euro.**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-03-005	Generic aircraft flight dynamics modelling	**Indicative End Date**	03.04.2010
		Indicative Start Date	01.01.2010

1. Topic Description

The Systems for Green Operations ITD is looking for (a) supplier(s) of an accurate simulation of aircraft movement (in terms of flight mechanics) for Aircraft Control use (flight control, autopilot, auto throttle, FMS, …) to become a partner of the consortium;

The Systems for Green Operations research consortium of Clean Sky aims to demonstrate substantial reductions of environmental impacts in civil commercial mainline, regional aircraft and business jet.

The aimed simulation of aircraft movement shall at least encompass:

- Aerodynamics with the following outputs:
    - Aerodynamic force (Fax, Fay, Faz) expressed in the aircraft body axis
    - Aerodynamic moment (La, Ma, Na) expressed in the aircraft body axis
- Flight Dynamics (equations of motion): 6 Degrees Of Freedom (DOF)
- Engine model including electronic control computer. Outputs should be depending on the number of engines running:
    - Thrust force (FTx, Fty, FTz) expressed in the aircraft body axis
    - Thrust moment (LT, MT, NT) expressed in the aircraft body axis
- “Simplified” Electrical Flight Controls including accurate non-linear and dynamic (delays, …) characteristics
- Auto Flight Control System (AFCS) with Auto Pilot and Auto Throttle functionalities
- Sensors and actuators linked to AFCS and flight controls (IRS, ADS, ILS receiver,...)

The Aircraft simulation model shall be able to take into account:

- Weather/atmospheric parameters
- Flight Management System commands.

In order to take into account future aircraft concepts, the aircraft simulation model should also provide a parameterization capability, allowing to adjust the aircraft characteristics (geometry, aerodynamic performance, engine…) around the nominal configuration.

As the model will be integrated into a simulation bench, a definition under MATLAB is required.

The consortium wishes to enter into partnership with a company able to provide virtual or existing aircraft simulation model responding to these general requirements by December 2009. Usage of the aircraft simulation model shall not be restricted by confidentiality of performance data.

The new partner will:

- Propose the inputs/outputs parameters set,
- Design or adapt the aircraft simulation;
- Provide evidence of aircraft simulation pertinence consisting preferably in comparison of estimated data against experimental data;
- Support the system provider during integration;
- Deliver the aircraft simulation and its associated documentation.

The partner organization should have the industrial capacity to maintain the model until mid 2012.– i.e. to further adapt, optimize, certify, and produce updated versions of the aircraft model. Joint ventures with legal personality and liability can also respond to the Call for Proposal.

The answer to this call for proposal must include a detailed technical description of the solution with the

associated evidence of the expertise and pre-existing know how

2. Special skills, certification or equipment expected from the applicant

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Model Technical Specification (TS)		03.03.2010
D2	Model Validation Test Plan (VTP)		03.06.2010
D3	Validation Test Report (VTR) Reference tests data files		02.09.2010
D4	Release of the Aircraft Simulation model software Model User Manual (user guide and interfaces description) Aircraft Flight Manual		03.10.2010
D5	Problem report and model modification request		03.12.2010
D6	Model Technical Specification update (TS) Model Validation Test Plan update (VTP)		02.02.2011
D7	Final release of the Aircraft Simulation model software, with problem fixes Model User Manual and Aircraft Flight Manual update Validation Test Report (VTR) update Reference tests data files update		03.04.2011
D8	Numerical model software and data package update for problem fixes or evolutions		02.12.2011
D9			

4. Topic value (€)

The **maximum value** for this topic is **500000 Euro.**

5. Remarks

None.

Topic description

CfP Topic Nbr	Title		
JTI-CS-2009-1-SGO-03-006	Statistical models for representative weather phenomena	**Indicative End Date**	04.12.2011
		Indicative Start Date	01.01.2010

1. Topic Description

The Systems for Green Operations ITD is looking for (a) supplier(s) of a representative weather phenomena and relative atmosphere model, to become a partner of the consortium.

The Systems for Green Operations research consortium of Clean Sky aims to demonstrate substantial reductions of environmental impacts in civil commercial mainline and regional aircraft. Accurate representation of atmosphere and weather phenomena is required to perform the mission trajectories simulations and environmental impact assessments.

The aimed representative weather phenomena (precipitation, convective activity…) and associated atmosphere parameters (wind, air density, humidity, temperature, water vapor…) model shall:

- Encompass worldwide weather and atmosphere real data recordings,
- Encompass several years round,
- Guarantee consistency between weather phenomena and atmosphere parameters

The weather model should:

- Provide higher spatial and temporal resolution in the airport areas for descent/approach and take-off/climb phases than in the rest of the airspace where the aircraft is in the cruise phase.

For simulation purpose, the model shall also have the capabilities:

- [search capability] to provide “search” functions in order to find

o Atmospheric and weather data at a specified 3D position (latitude, longitude, altitude) and a date & time.

o The 3D position (latitude, longitude, altitude) and date & time where stand the required atmospheric conditions or weather phenomena,

- [trajectory capability] to provide atmospheric parameters along a set of related time-position (a trajectory) updated at the highest possible rate (typical target 1s), as a continuous atmospheric profile.

For use in stochastic simulations [Stochastic capability], the model shall also provide randomly (e.g. Monte Carlo) generated, statically realistic, variations of the weather atmospheric conditions along a trajectory.

The consortium wishes to enter into partnership with a company able to design or adapt and enhance existing weather/atmosphere model responding to these general requirements by November 2009.

The new partner(s) will:

- Identify the driving parameters and propose the inputs/outputs parameters set;
- Design or adapt the weather/atmosphere model;
- Provide evidence of model representativeness, consisting in comparison of estimated data against experimental data;
- Deliver the weather/atmosphere model and its associated documentation;
- Support the consortium(s) member(s) during integration of the model in simulation means.

The partner organization should have the capacity to maintain the model until end 2011 – i.e. to further adapt, refine, optimize, and produce updated versions of the model. Joint ventures with legal personality and liability can also respond to the Call for Proposal.

The answer to this call for proposal must include a detailed technical description of the solution with the associated evidence of the expertise and pre-existing know how.

2. Special skills, certification or equipment expected from the applicant

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Indicative Due Date
D1	Model Technical Specification (TS)		02.12.2009
D2	(*) First early release of the numerical model software,with the 'search capability'		01.01.2010
D3	Model Definition and Justification Document (DJD)		01.02.2010
D4	(*) Second early release of the numerical model software, with the 'search capability' and the 'trajectory capability'		03.03.2010
D5	Model Validation Test Plan (VTP)		03.04.2010
D6	First release of the numerical model software, with full capabilities Model User Manual Validation Test Report (VTR) Reference tests data files		May 2010
D7	Problem report and model modification request		Sept 2010
D8	Model Technical Specification update (TS) Model Validation Test Plan update (VTP)		Oct 2010
D9	Final release of the numerical model software, with problem fixes Final Validation Test Report (VTR) Reference tests data files Model User Manual update		Nov 2010
D10	Numerical model software and data package update for problem fixes or evolutions		2011
(*): These early releases should include minimum test coverage of the capability to enable the validation of the design.			

4. Topic value (€)

The **maximum value** for this topic is **600000 Euro.**

5. Remarks

None.