Clean Sky Joint Undertaking
Call SP1-JTI-CS-2009-02

European Commission
Research Directorates

Call for Proposals:

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

Call Text

Call Identifier

SP1-JTI-CS-2009-02

Rev. 2 - 21 December 2009

Index

Document track changes

Page/topic	*Original*	*Correction or modification*
1		New index including Introduction
1		Track changes section added
2		Section INTRODUCTION added
6	End of February	End of January
page 9 ECO-01-001	Remarks	Introduction of references to ELCD and GaBi links ELCD http://lct.jrc.ec.europa.eu/eplca/doc/ELCD-format-stakeholder-and-interface.pdf GaBi http://www.gabi-software.com/
page 11 ECO-01-002	Remarks	Introduction of references to REACH and e-coating REACH http://ec.europa.eu/enterprise/sectors/chemicals/reach/index_fr.htm **e-coating** E-coating is another name for electrocoating, electropainting, or electrophoretic lacquering. It is used to deposit a paint or lacquer coating as opposed to a metal such as is deposited by electroplating
Page 20	Header	Correction of second line to Call SP1-JTI-CS-2009-02
Page 29	Header	Correction of second line to Call SP1-JTI-CS-2009-02
page 38 GRC-02-001	Remarks	Introduction of clarification wrt effort at topic leader site: With respect to the SITE where the task must be performed, the applicant is requested to quote a conservative estimate for travel and staying at the most distant plant of the helicopter industry leaders, among France and Germany (Eurocopter) and Italy and UK (AgustaWestland); during the negotiation phase with the selected applicant the final location will be agreed.
page 42 GRC-02-001	Value of topic	Correct value at 440.000 € [four hundred forty thousand euro]
Page 53	Header	Introduction of second line to Call SP1-JTI-CS-2009-02
Pages 62-64 SAGE-02-005	Header	Corrected to SAGE-02-005
Page 71	Header	Introduction of second line to Call SP1-JTI-CS-2009-02
Page 76 SGO-04-002	Remarks	Introduction of clarification about topic content and compliance request to applicant; link to MOET forum for technical paper as background. • Revised Scope of work introduces a Technology study phase, and postpones the actual Production to a later phase (perhaps a later call for proposals). • Revised Type of work Defines the Wing icing protection system as optional (to be decided by applicant and topic manager at negotiation). • New revised table of deliverables, both in content and timing. Link to MOET project, for reference: http://www.eurtd.com/moet/
Page 77	Header	Introduction of second line to Call SP1-JTI-CS-2009-02

Introduction

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.

Eligibility criteria

All applicants are requested to verify their actual status of "**affiliate**" with respect to the members of the relevant ITD for whose topic(s) they wish to submit a proposal.
Applicants who are affiliated to any leader or associate of an ITD will be declared not eligible for the topics of that ITD.
Refer to art.12 of the Statute (*Council Regulation (EC) No 71/2007 of 20 December 2007 setting up the Clean Sky Joint Undertaking*) and to page 8 of the Guidelines.

Important note on subcontracting

The applicant is also requested to clearly indicate which activities in its proposal will be **subcontracted**. **According to the provisions of the Grant Agreement for Partners**, those activities should not be "core" parts of the project work, but tasks or activities needed in order to carry out the research, auxiliary to the main object of the project. In cases where it is proposed to subcontract substantial/core parts of the work, the intended subcontractor could instead become a beneficiary, and charge maximum 50% or 75% of its costs depending on its legal status, as any other beneficiary. If it is the case, this will imply a separate analysis by the other beneficiaries on the way to share the not-funded portion of cost (25 to 50%).
A *caveat* in the proposal about this aspect is mandatory to allow a thorough evaluation of all potential implications for the negotiation and financing phases.
For further details refer to the Guidelines on subcontracting published on the Clean Sky website at www.cleansky.eu.

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

Identification	ITD - AREA - TOPIC	topics	VALUE	MAX FUND
JTI-CS-ECO	**Clean Sky - EcoDesign**	**5**	**990**	**742,5**
JTI-CS-ECO-01	*Area-01 - EDA (Eco-Design for Airframe)*			
JTI-CS-2009-2-ECO-01-001	Life Cycle Assessment databases improvement		150	112,5
JTI-CS-2009-2-ECO-01-002	Development of anaphoretic paint capable to protect pickled aluminium alloy surface against corrosive		500	375,0
JTI-CS-ECO-02	*Area-02 - EDS (Eco-Design for Systems)*			
JTI-CS-2009-2-ECO-02-001	Sensor for Convective and/or Radiative Heat Loss		60	45,0
JTI-CS-2009-2-ECO-02-002	Thermo physical Properties Library for Relevant Fluids		80	60,0
JTI-CS-2009-2-ECO-02-003	Methods & Tools - Electrical Network Analysis		200	150,0
JTI-CS-GRA	**Clean Sky - Green Regional Aircraft**	**3**	**380**	**285,0**
JTI-CS-GRA-01	*Area-01 - Low weight configurations*			
JTI-CS-2009-2-GRA-01-025	Fatigue test of sensor integrated CFRP aircraft panels with stiffeners		100	75,0
JTI-CS-GRA-02	*Area-02 - Low noise configurations*			
JTI-CS-2009-2-GRA-02-005	3D design of flap side edge activeflow control		80	60,0
JTI-CS-2009-2-GRA-02-006	Instrumentation-electronic (Optical assembly & Thermal and mechanical strain measurement)		200	150,0
JTI-CS-GRA-03	*Area-03 - All electric aircraft*			
JTI-CS-GRA-04	*Area-04 - Mission and trajectory Management*			
JTI-CS-GRA-05	*Area-05 - New configurations*			
JTI-CS-GRC	**Clean Sky - Green Rotorcraft**	**8**	**5.040**	**3780,0**
JTI-CS-GRC-01	*Area-01 - Innovative Rotor Blades*			
JTI-CS-2009-2-GRC-01-002	Development and provision of a numerical model to solve laminar turbulent boundary layer transition and boundary layer velocity profiles for unsteady flow conditions.		130	97,5
JTI-CS-2009-2-GRC-01-003	Actuation mechanism development and supply for 2D wind tunnel and specimen bench testing		225	168,8
JTI-CS-GRC-02	*Area-02 - Reduced Drag of rotorcraft*			
JTI-CS-2009-2-GRC-02-001	Contribution to the study of the air intake and exhaust integration into a tiltrotor nacelle		395	296,3
JTI-CS-2009-2-GRC-02-002	Contribution to analysis of rotor hub drag reduction		500	375,0
JTI-CS-2009-2-GRC-02-003	Contribution to optimisation of Heavy helicopter engine installation design.		440	330,0
JTI-CS-GRC-03	*Area-03 - Integration of innovative electrical systems*			
JTI-CS-2009-2-GRC-03-001	Electric Tail Drive - Modelling, Simulation and Rig Prototype Development.		2.500	1875,0
JTI-CS-2009-2-GRC-03-002	Innovative energy recovery for electrical use		250	187,5
JTI-CS-GRC-04	*Area-04 - Installation of diesel engines on light helicopters*			
JTI-CS-GRC-05	*Area-05 - Environmentally friendly flight paths*			
JTI-CS-2009-2-GRC-05-003	Emission analysis - Tools required to perform the emissions analysis and evaluation methodology, experimental support		600	450,0
JTI-CS-SAGE	**Clean Sky - Sustainable and Green Engines**	**6**	**1.760**	**1320,0**
JTI-CS-SAGE-01	*Area-01 - Geared Open Rotor*			
JTI-CS-SAGE-02	*Area-02 - Direct Drive Open Rotor*			
JTI-CS-2009-2-SAGE-02-003	Design, computation and drawing of lubrication system equipment		660	495,0
JTI-CS-2009-2-SAGE-02-004	Performance and qualification tests of lubrication system equipment		240	180,0
JTI-CS-2009-2-SAGE-02-005	Design & make of a test bench for Heat Exchanger		400	300,0
JTI-CS-SAGE-03	*Area-03 - Large 3-shaft turbofan*			
JTI-CS-SAGE-04	*Area-04 - Geared Turbofan*			
JTI-CS-SAGE-05	*Area-05 - Turboshaft*			
JTI-CS-2009-2-SAGE-05-007	High temperature material		230	172,5
JTI-CS-2009-2-SAGE-05-008	Oil tank in composite		115	86,3
JTI-CS-2009-2-SAGE-05-009	Casing in composite		115	86,3
JTI-CS-SFWA	**Clean Sky - Smart Fixed Wing Aircraft**	**0**		
JTI-CS-SFWA-01	Area01 – Smart Wing Technology			
JTI-CS-SFWA-02	Area02 – New Configuration			
JTI-CS-SFWA-03	Area03 – Flight Demonstrators			
JTI-CS-SGO	**Clean Sky - Systems for Green Operations**	**2**	**3.000**	**2.250**
JTI-CS-SGO-01	*Area-01 - Definition of Aircraft Solutions and explotation strategies*			
JTI-CS-SGO-02	*Area-02 - Management of Aircraft Energy*			
JTI-CS-SGO-03	*Area-03 - Management of Trajectory and Mission*			
JTI-CS-SGO-04	*Area-04 - Aircraft Demonstrators*			
JTI-CS-2009-2-SGO-04-001	Design and manufacture of an aircraft tractor compliant with specifications for Smart Operations on ground		2.000	1500,0
JTI-CS-2009-2-SGO-04-002	Provision of electrical equipments to complement the PROVEN tests rig		1.000	750,0
JTI-CS-SGO-05	*Area-05 - Aircraft-level assessment and exploitation*			
JTI-CS-TEV	**Clean Sky - Technology Evaluator**	**0**		
		topics	**VALUE**	**FUND**
	totals (K€)	**24**	**11.170**	**8.378**

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:** **25 November 2009**
- Information Day: 15 December 2009
- **Call Close:** **23 February 2010, 17:00**

- Evaluations (indicative): 22-26 March 2010

- Start of negotiations (indicative): 12 April 2010
- Final date for signature of GA by Partner: 15 May 2010
- Final date for signature of GA by Clean Sky JU: 31 May 2010

Contacts:
All questions regarding the topics published in this Call can be addressed to:
info-2ndcall-2009@cleansky.eu

All questions received until end of January 2010 will be answered.
Questions having a general value, either on procedural aspects or specific technical clarifications concerning the call topics, when judged worth being disseminated, will be published in a specific section of the web site (www.cleansky.eu).

All interested applicants are suggested to consult periodically this section, to be updated on explanations being provided on the call content.

Clean Sky - EcoDesign

Identification	ITD - AREA - TOPIC	topics	VALUE [k€]	MAX FUND [k€]
JTI-CS-ECO	**Clean Sky - EcoDesign**	**5**	**990**	**742,5**
JTI-CS-ECO-01	*Area-01 - EDA (Eco-Design for Airframe)*			
JTI-CS-2009-2-ECO-01-001	Life Cycle Assessment databases improvement		150	112,5
JTI-CS-2009-2-ECO-01-002	Development of anaphoretic paint capable to protect pickled aluminium alloy surface against corrosive environment		500	375,0
JTI-CS-ECO-02	*Area-02 - EDS (Eco-Design for Systems)*			
JTI-CS-2009-2-ECO-02-001	Sensor for Convective and/or Radiative Heat Loss		60	45,0
JTI-CS-2009-2-ECO-02-002	Thermo physical Properties Library for Relevant Fluids		80	60,0
JTI-CS-2009-2-ECO-02-003	Methods & Tools - Electrical Network Analysis		200	150,0

Clean Sky Joint Undertaking
JTI-CS-2009-2-ECO-01-001

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-ECO-01-001	LCA Databases Improvement	End date	*To + 10M*
		Start date	*To (01/05/2010)*

1. Topic Description

Improvement of Life Cycle Assessment database, application and customisation for aerospace sector:

- requirements and acquisition of LCA background data and datasets according to the specific needs of the aerospace sector e.g. from materials suppliers
- harmonisation of Eco-Design activities with the ELCD system of the EC
- Life Cycle Assessment (LCA) of current and future system as benchmark (Life Cycle Inventory and Life Cycle Impact Assessment)
- raw material supply
- production and manufacturing
- identification of ecological weak-points
- sensitivity analyses on ecological impacts
- quantification of ecological improvements
- quantification of future improvement potentials

Modeling and calculation of selected parts for the current eco statement in the standard GaBi (Ganzheitliche Bilanzierung) LCA software for verification of data sets

- use of harmonised nomenclature of flows and accounting methods for flows like GaBi which will be clarified for the proposing partner

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

- Use of harmonised and consistent data sets in terms of accounting methods and specific background data
- Use of data covering most of data needs in (energy, materials and transports) and integrate them in a consistent way and according to the ELCD format
- Multi year tack record and application in miscellaneous sectors
- Professional knowledge of data acquisition in various sectors
- Proven network in LCA community and in materials suppliers sector
- LCA data collection and modelling experience of industry specific processes and technologies
- Parameterized and flexible modelling of complex processes, especially in the aeronautic industry

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
1	Database for a/c application	LCA datasets according to the specific needs of the aerospace sector to be used for the current eco statement. Database shall be available in ELCD format to be used independently from GaBi tool.	To + 10M
2	Selected LCA (e.g. GaBi) models	LCA models of the current eco statement based on the selection of representative parts within WP311	To + 10M

4. Topic value (€)

The total value of this work package shall not exceed:

150,000.--€

[One hundred and fifty thousand euro]

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

5. Remarks

References to ELCD and GaBi links:

ELCD
http://lct.jrc.ec.europa.eu/eplca/doc/ELCD-format-stakeholder-and-interface.pdf

GaBi
http://www.gabi-software.com/

Clean Sky Joint Undertaking
JTI-CS-2009-2-ECO-01-002

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-ECO-01-002	Development of anaphoretic paint capable to protect pickled aluminium alloy surface against corrosive environment	**End date**	*To+44 Months*
		Start date	*Tor*

1. Topic Description

The objective is to develop an anionic coating capable to meet the requirements of the most demanding paint technical specification for aircrafts. The anionic coating shall be capable to be applied on pickled surface not anodised with respect to oxide growth during the process, and to replace the currently used two coat system (Primer+top coat). Obviously the product shall be chrome free and all substances shall be REACH compliant.

To apply for the call the applicant shall:

* Its expertise in the field of e-coating
* To provide adequat knowledge in corrosion protection of light alloys 2xxx and 7xxx series
* To demonstrate that his background in paint for aeronautic is at a high level
* To demonstrate that his involvement in aeronautic programme was significant
* If appropriate, to build up a consortium in order to provide a good knowledge on the anionic coat behaviour

Two side objectives shall be adressed:

* How fungi growth inhibition is adressed?
* Stripping processes and touch up shall be addressed

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

Skills:

Management of anionic bath, background in aeronautical protection scheme

Good knowledge of current aeronautic practises

Coating characterisation (cure extent, conductivity, interphase behaviour)

Provided equipments from the applicants :

Surface analysis (XPS, GEOS; TOF-SIMS)

Morphology analysis (SEM)

Test devices in conformity with standards, Electrochemistry, µdielectrometry

Pilot installation for E coat

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
1	Process set up	Report: Small demonstrators	T0 + 4
2	Paint formulation Corrosion inhibition Fungi growth prevention	Synthesis report	T0+ 12
3	Anionic paint characterisation Interphase oxide/paint investigation	Report Report	T0+ 18 T0 + 18
4	Process window	Report	T0 + 24
5	Scaling up	Report Demonstrator	T0 + 44

4. Topic value (€)

The total value of this work package shall not exceed:

500,000.--€

[Five hundred thousand euro]

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

5. Remarks

References to REACH and e-coating

REACH
http://ec.europa.eu/enterprise/sectors/chemicals/reach/index_fr.htm

e-coating
E-coating is another name for electrocoating, electropainting, or electrophoretic lacquering. It is used to deposit a paint or lacquer coating as opposed to a metal such as is deposited by electroplating

Clean Sky Joint Undertaking
JTI-CS-2009-2-ECO-02-001

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-ECO-02-001	Sensor for Convective and/or Radiative Heat Loss	**End date**	*T0+10 M*
		Start date	*T0*

1. Topic Description

Sensors for the measurement of convective and radiative part of heat loss are currently not existing for application in realistic test or real environments. Especially there is little to no knowledge of the actual convective heat transfer at surfaces in dynamic settings. Generally the convective heat transfer coefficient for gases is somewhere between ca. 5 – 25 W/(m²K) for free or ca. 12 – 120 W/(m²K) for forced convection. Thus this parameter may be varied up to a factor of ten without leaving the range of plausibility. Especially when validating dynamic simulations (such as coupled CFD) more detailed knowledge about this parameter is essential – in particular as soon as thermal management processes inside a compartment, e.g. the avionic bay in aircrafts, cockpits or sever rooms, have to be designed with these tools.

Thus this call adresses the development of a sensor for the measurement of convective and radiative heat loss, which is able to record convective and/or radiative properties of the environment **resulting from different air movements, air temperatures, heat radiation and emission properties(which is the innovative challenge)**. **As a help or how to:** The sensor may comprise a temperature-dependent constantly heated plate (e.g. similarly to patent DE000003205704C2). This signal of the output temperature may differ for different materials of the plate for convective and/or radiative properties. Finally it should be possible to deduct the convective heat transfer coefficient with an accuracy in the order of 1 W/(m²K).

A suitable control strategy should be developed, implemented and documented. The measurement surface of the sensor should be detached from a likely processor part to exclude artificial heat sources. The housing of the sensor should be selected suitably to avoid heat conduction. The sensor should operate at relevant conditions in the aircraft environment. It should include an air temperature sensor which is thermally insulated from the sensor housing and a surface temperature sensor which is thermally insulated from the sensor housing and can serve as control input. Optionally a heat flux sensor may be included accordingly. The measurement ranges should consider the full spectrum of conditions in the aircraft environment and will be defined at the start of the project, similarly to the operating conditions. The sensor should provide a USB-connector for PC-use, signal transfer and power supply as well as serial linkage of sensors and an ergonomic GUI for installation, calibration and visualization of the sensor (which includes initial values and calculated values from measurement signals and refers to SI-units). The GUI should be adaptable to the current status of the sensor. Different coatings and/or materials of the sensor surface may be tested for a suitable performance of the sensor. The components and the full system should have long term stability to minimize the calibration necessities.

In parallel an easy calibration procedure for the sensor should be developed. An alternative more sensitive measurement method for the check of the convective part has to be provided. This may be solved via parallel measurement of air temperatures in the boundary layer. A useful sampling rate would be at least 0.05 s to cover air turbulence appropriately. Suitable resistors have to be selected and an interface and GUI for the logging has to be implemented.

The expected maximum length of the proposal is 12 pages.

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

The applicant should have experience in design and development of components for electronic measuring and testing apparatus, in particular temperature sensors.

Besides the applicant should have experience in handling non-linear resistors and inductive components, wireless devices, data logging systems and system software.

Especially the applicant should have experience in the development of low velocity anenometers as well as measurement devices for convective processes.

The applicant has to have facilities to develop and manufacture the sensor. Relevant equipment must be available at the applicant.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
DS1.4.4-CfP JTI-CS-2009-2-ECO-02-001-01	Requirements	Summary of the requirements wrt. operating conditions and measurement ranges	T0+1M
DS1.4.4-CfP JTI-CS-2009-2-ECO-02-001-02	Sensor and GUI	Availability and full documentation of the sensor for convective and/or radiative heat loss and its GUI.	T0+9M
DS1.4.4-CfP JTI-CS-2009-2-ECO-02-001-03	Reference Sensor and GUI	Availability and full documentation of the sensor serving as a reference for the convective part and its GUI.	T0+9M
DS1.4.4-CfP JTI-CS-2009-2-ECO-02-001-04	Calibration Procedure	Detailed description of the calibration procedure.	T0+10M

4. Topic value (€)

The total value of this work package shall not exceed:

60,000.--€

[Sixty thousand euro]

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

5. Remarks

Clean Sky Joint Undertaking
JTI-CS-2009-2-ECO-02-002

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-ECO-02-002	Library for thermodynamic and transport properties	**End date**	*T0+11Months*
		Start date	*T0*

1. Topic Description

Due to the operation of aircrafts in relatively extreme environments difficulties arise when transferring research results or modelling approaches from related fields. In particular this applies to thermodynamic and transport properties, since aircrafts operate in a range of approximately 150 – 1100 hPa and temperatures may fall below -55°C. Since these conditions differ significantly from those that are experienced usually most thermodynamic and transport properties are not valid in the full range. E.g. the common formulation for moist air covers temperatures down to -33.15°C and thus has to be extended for aircraft applications. To be able to map thermodynamic procedures more reliably into the aircraft application this call adresses the implementation of a library for the calculation of thermodynamic and transport properties.

The library should contain relevant media to be used for modelling tasks within the project, such as water and steam, CO_2, air, kerosene, cooling liquids and others. The thermodynamic properties may derive from equations of state (e.g. fundamental equations in the form of the Helmholtz energy), must comply with current standards (e.g. IAPWS-IF97, VDI-4670, etc.) and should be valid in the range of aircraft applications.

The library should be systematised in a way to change and/or introduce the properties easily, e.g. change the cooling liquid of a system from water to galden with one keyword. The usage will be threefold: calculation of properties under given boundary conditions with an MS Excel Add-in, integration as a Modelica-library into modelling packages, such as Dymola, and drawing of diagrams having some input variables unknown in thermodynamic charts.

The library may build upon existing codes and tools but must be extended to the required area of application “aircraft” while keeping full compatibility. The Excel-library should have an intuitive user-interface with some guidance notes. The Modelica-library must have full compatibility with the Modelica.Media-library and should be built upon the same logic. The basis of the Modelica.Media-library is the PartialMedium package which gives the framework for the properties of a medium. The inputs and outputs of necessary functions as well as constants and data types are defined. Recently the PartialMedium package is extended to integrate more complex fluids (e.g. PartialPureSubstance, PartialLinearFluid, etc.) – an appropriate choice should be made in this respect. In terms of compatibility the given function and variable names should be used as well as the specified data types. Reasonable min- and max-values for the data types should be selected. In case of media in forms of mixtures – like kerosene – models for both a pure medium and a mixture of materials should be implemented (e.g. air as pure substance or as mixture out of nitrogen, oxygen, argon, carbon dioxid, etc.). The different types of mixtures should be considered (e.g. for kerosene: there exist at least four major types for civil aviation - depending on the area of application) and where applicable separate models for different aggregate states may be implemented. The flash point should be incorporated as well. The basic properties of a fluid are accessed through the model BaseProperties (e.g. for the air pressure: Modelica.Media.Air.BaseProperties MyAir; MyAir.p=101325;). Very important is the applicability of all information for both ground operation and flight operation of an aircraft, special attention needs amongst others the lower air pressure.

The expected maximum length of the proposal is 15 pages.

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

The applicant should have a sound R&D background in thermodynamics, heat and mass transfer and the measurement and modelling of thermodynamic and transport properties.

The applicant should have insight into the international activities of the harmonisation of thermodynamic and transport properties.

The applicant should have basic laboratory facilities for thermodynamic and transport properties.

The applicant should have experience in developing software tool for thermodynamic and transport properties.

The applicant should have access to the resources needed for the development of a software library.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
DS1.1.4-CfP 01	List of properties	List of thermodynamic and transport properties to be considered .	T0+3M
DS1.1.4-CfP-02	List of media	List of relevant media for aircraft application.	T0+3M
DS1.1.4-CfP-03	Excel-library, code and documentation	Availability of the Excel-library and documentation of its functionality, the implemented media and the corresponding code.	T0+11M
DS1.1.4-CfP-04	Modelica-library, code and documentation	Availability of the Modelica-library and documentation of its functionality, the implemented media and the corresponding code.	T0+11M

4. Topic value (€)

The total value of this work package shall not exceed:

80,000.--€

[Eighty thousand euro]

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

5. Remarks

none

Clean Sky Joint Undertaking
JTI-CS-2009-2-ECO-02-003

Topic description

CfP topic number	Title		
JTI-CS-2009-2-ECO-02-003	Methods & Tools - Electrical Network Analysis: Analysis, development, validation and optimization of a software tool able to convert and integrate electrical network equipment models from SABER format to other types of multi-systems oriented simulation tools (e.g., EASY-5, CATIA V6).	End date	30.06.2012 To+ 24 M
		Start date	01.04.2010

1. Topic Description

Introduction

The demonstration of the "ecolonomic" benefits for the all-electric small a/c concept includes, as a first step, the validation of a/c optimization methodology, based on a set of numerical models and data constituting the *virtual* definition of the a/c Vehicle Systems. The validation of these models and data is obtained through model correlations with ground tests results on the basis of a Generic "Multi-Functional" Architecture common to all small a/c types (i.e., business jet, regional a/c and rotorcraft).

Test activities will be performed to validate the methodology and associated models to optimize complete a/c Vehicle Systems architecture for an all-electric aircraft. The tests will be performed on ground electrical bench representing the generic architecture as defined from the architecture down-selection.

Deviation between test results and simulation results will be assessed and analyzed to refine and validate the models. This will produce a set of updated/corrected models in order to make them as representative to the real behavior of the equipment as possible. An extensive use of extrapolations from these models will be also conducted to investigate the architecture candidates and produce a trade-off analysis toward the proof of "ecolonomic" all-electric concept and benefits.

On an all-electric Vehicle Systems a/c, electricity will be major (maybe the only) media for the energy management. As a consequence, the power level and the interaction between subsystems through the network will be very high. In addition the single energy media increases the common mode failure risk.

Within EDS ITD, the Electrical Network Analysis Model (ENAM) is a representation of the electrical test rig. The main objective of the ENAM is to validate a VS architecture with respect to selected electrical network power quality.

The model shall be representative of the electrical behaviour of the equipment. The representativeness shall be assured both for steady state and transient electrical behaviour;

Besides, the model shall take into account short term changes of the operating point due to mechanical, thermal, environmental changes (e.g. to the shifts of mechanical load in term of speed and torque on actuators/motors equipment, voltage shifts/transients on the network due to external parameters varying, etc..).

The model has also other several functions:

- to support the testing activities: each test can be simulated in order to check good behaviour at the level of the phenomena included in the model;
- to investigate the testing activities: the calibrated model can provide information which has not been measured during a test, and is needed for analysis;
- to size components: the model can be used as a sizing tool for the specification of the requirements of some rig components (e.g., filters and heat sinks).

The electrical network analysis model and the electrical test rig both contribute to the same goals. The

rig extends the model into physical phenomena which are not modelled, the model extends the rig into configurations or parametric changes which cannot be physically performed on the rig.

In addition, the ENAM will demonstrate the capability to anticipate problems on the test bench, and it will be also used to extend the rig into specific configurations (business jet, regional aircraft and helicopter).

The ENAM will be based upon the integration of equipment models provided by SGO ITD as well as by other equipment suppliers. Most of these models are expected to be provided in SABER format, whereas the ENAM should be developed by using multi-systems oriented simulation tools.

Therefore, a key-point for future modelling activities will be to use the models conversion to non homeowner but free libraries based models, like MODELICA (CATIA V6) or EASY-5 libraries.

Description and Work-Flow

Given the above depicted scenario, the selected Candidate shall develop ***a software tool able to convert electrical network equipment models from SABER format to other types of multi-systems oriented simulation tools*** (e.g., EASY-5, CATIA V6,…). That is, such a tool shall accept as input a generic SABER model and it shall produce as output an object which shall be readable by another software language.

The Candidate activity shall be broken down into three tasks:

Task 1: Analysis

A study/evaluation shall be performed by the Candidate in order to give a guideline to convert the SABER code to most significant systems oriented families of software. The selected Candidate shall assess which is the most suitable conversion for future tool orientation and selection.

Task 2: Development

The second step shall cover the creation/implementation of a specific conversion tool which will allow a generic SABER model stand alone and integrated into a network to be readable and used in the selected multi-systems oriented environment.

Task 3: Validation and optimization

Finally, a validation step is necessary in order to assess the overall tool performances and well functioning. To this aim, the selected Candidate shall realize a complete SABER-based network model. The network frame and constraints shall be provided by CfP proposal manager and shall represent the TEST CASE.

Then, the proposed tool shall be applied to the equipment models and the same architecture shall be automatically reproduced in the multi-systems software environment.

A comparison analysis shall be run to check that the same performances are met. Performances shall rely to those specific parameters which currently allow the assessment of electrical network quality through short term transient analysis.

The selected Candidate shall provide a report with the results of Validation and a folder on electronic support with all the origin files for simulation activity in SABER code.

The conversion tool shall be released in the final version upon the optimization coming from validation results.

Other features

The Candidate shall include in its Proposal detailed information about proposed inputs, outputs, database 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 model(s) to be analyzed/converted,

- select the output format.

The code must be compliant with the liaising CleanSky member Standards (e.g. operative system, compiler, licence manager, hw and SW security requirements, DBMSs, etc..)

Software Validation

The Candidate shall include in the Proposal a validation matrix and 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:

- expertise in electrical system design (power generation, power conversion, power network, power consumer),
- a well recognized experience in system simulation methods,
- knowledge of Industrial/Aeronautical field constraints and procedures,
- extensive experience and know how on programming language such as C++, Fortran, Pascal, MS Dos, Visual Basic,
- good practice in English language,
- Availability of basic simulation tools: at least a full SABER code licence (The liaising CleanSky member will for instance be compliant with SABER platform V2004.06-SP1) and a MSC Easy5 simulation code licence.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
D1	Compatibility Analysis Report	Technical report on SABER level of compatibility and conversion toward other software system oriented	15.12.2010 To + 9M
D2	Preliminary Software Tool Release	Release of preliminary (beta) version of the conversion tool	15.09.2011 To + 18M
D3.1	Validation Report	A validation report will be provided including the results of validation. SABER code origin files for simulation shall be provided	15.12.2011 To + 21M
D3.2	Final Release of Validated Conversion Tool	Release of final version of the conversion tool with documentation and User's Guide	30.03.2012 To + 24M

4. Topic value (€)

The total value of this work package shall not exceed:

200,000.--€

[Two hundred thousand euro]

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

5. Remarks

None.

Clean Sky - Green Regional Aircraft

Identification	ITD - AREA - TOPIC	topics	VALUE [k€]	MAX FUND [k€]
JTI-CS-GRA	**Clean Sky - Green Regional Aircraft**	**3**	**380**	**285,0**
JTI-CS-GRA-01	*Area-01 - Low weight configurations*			
JTI-CS-2009-2-GRA-01-025	Fatigue test of sensor integrated CFRP aircraft panels with stiffeners		100	75,0
JTI-CS-GRA-02	*Area-02 - Low noise configurations*			
JTI-CS-2009-2-GRA-02-005	3D design of flap side edge activeflow control		80	60,0
JTI-CS-2009-2-GRA-02-006	Instrumentation-electronic (Optical assembly & Thermal and mechanical strain measurement)		200	150,0
JTI-CS-GRA-03	*Area-03 - All electric aircraft*			
JTI-CS-GRA-04	*Area-04 - Mission and trajectory Management*			
JTI-CS-GRA-05	*Area-05 - New configurations*			

Clean Sky Joint Undertaking
JTI-CS-2009-2-GRA-01-025

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-GRA-01-025	Fatigue test of sensor integrated CFRP aircraft panels with stiffeners	**End date**	*T0 + 10 M*
		Start date	*T0*

1. Topic Description

A fatigue test of a structural aircraft panel made of CFRP shall be performed. In this panel various sensors for SHM based on acoustic emission and acousto-ultrasonics shall be integrated, considering the activities and technologies developped in WP 1.3.1 of the platform GRA, Low Weight Configuration domain.. For that purpose an appropriate specimen with embedded sensors shall be defined and manufactured in close cooperation with the purchaser.

After this initial step a test rig for static and dynamic loading of the panel shall be developed. The test rig shall consist of two clamping devices for the flat panel, an anti buckling device and the measure interface for the integrated sensors.The loading of the panel shall take place with a servo hydraulic cylinder. As loading modes static pressure, static tension or cyclic loading with variable amplitudes shall be available.

After experimental set-up an fatigue test of the panel shall be performed.This shall include preparation of the test machine, mounting and adjustment of the test setup, test of a specimen with a maximum width of at least 760 mm, static tension or pressure mode, fatigue test cycle limit up to 100.000, a maximum load of 100 kN, a cyclic load frequency up to 10 Hz, non-destructive inspection during and after the test, dismounting, failure inspection and documentation.

The expected maximum length of the proposal should be 10 pages.

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

The following specific skills, certifications and equipment is expected for a succesful work:

- Specific know-how resulting from a large number of tests performed for development and certification programs of the international aerospace industry,
- Experience in material-, coupon- and panel tests
- Accredited DAP test labortories according to DIN EN ISO 17025:2005
- Laboratory for vibration testing
- Laboratory for static and dynamic testing
- Laboratory for mechanical-technological testing
- Laboratory for non-destructive testing
- Expert knowledge in CFRP components
- Experience in manufacturing of composite test specimes (coupons, flat panels)
- Equipment for the application of fibres, fabrics, resins and prepreg systems
- Experience in fatigue testing from small to large specimens
- Capability of developing and modifying test methods with regard to material properties
- Experience in FEM modeling of CFRP aircraft panels
- Basic test equipment (state-of-the-art control systems, clamping devices, hydraulic test rigs, actuators and controllers etc.)

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
1	Definition and concept of test specimen and sensors (including FEM simulations)		T0 + 2M
2	Manufacturing of specimen, sensor integration		T0 + 5M
3	Experimental setup definition		T0 + 6M
4	Fatigue test and results of the experimental activity		T0 + 10M

4. Topic value (€)

The total value of this work package shall not exceed:

100,000.--€

[One hundred thousand euro]

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

5. Remarks

The whole work will be performed in close collaboration with the purchaser.

Clean Sky Joint Undertaking
JTI-CS-2009-2-GRA-02-005

Topic Description

CfP topic number	Title		
JTI-CS-2009-GRA-02-005	3D design of flap side edge flow control	**End date**	tbd
		Start date	tbd

1. Topic Description

1.1 Scope of work

During the approach/landing flight phases of an aircraft a significant amount of the overall noise is generated by the unsteady flow in the flap side-edge region. The main objective of the present call for proposal is to develop a flow control system, for the reduction of the flap side-edge noise.

1.2 Background

In the past years, both experimental and numerical investigations have tried to explain the complex noise generation mechanism occurring at the flap side edge. In this region the presence of a dual vortex-system is observed, arising at both the top and bottom surfaces as a consequence of the 3D spanwise flow existing at the outer flap tip. The vortices generation mechanism takes place not too far from the flap leading edge and, as it travels downstream, the bottom vortex (the most intense one) tends to strengthen, enlarges and moves toward the flap top surface. During this phase, it merges with the smaller and weaker top side vortex, ending up with a single, strong vortex. The strengthening mechanism is due to the presence of curved shear layers, formed as a consequence of boundary-layer separation occurring at both bottom and top sharp corners of the flap side. The stronger shear layer coming from the flap bottom surface is considered the main responsible for a continuous feeding of vorticity into the above vortex and is responsible for its strengthening as it moves downstream. Finally, depending on the extent of the flap deflection, and therefore on the strength of the adverse pressure gradient in the flow field, also a breakdown of the post-merged vortex can be observed. Based on such flow phenomena, the main sources of flow unsteadiness and therefore serious noise have been individuated in past studies as: 1) large-scale flow fluctuations associated to the free shear layer, spanning almost the entire flap tip chord, which takes place from the transverse boundary layer leaving the flap bottom edge; 2) large-scale flow fluctuations associated to the post-merged vortex, downstream of the flap mid-chord. Among these, other possible sources of flow unsteadiness and therefore noise are considered to be: 3) the convection of the turbulent boundary layer over the sharp edges at the flap side edge, giving rise to scattering and broadband sound radiation; 4) the vortex merging phenomenon and 5) the vortex breakdown phenomenon.

Several efforts have been spent in recent years, aiming at a reduction of the flap tip vortex generated noise, by using different techniques such as side-edge fences, porous side-edge treatment, continuous blowing, vortex generators (less effective), etc. As an example, in the porous flap-tip case, the overall aim was to reduce the flap loading near the side edge, resulting in a reduced severity of the shear layer roll-up, a reduced strength of the side-edge vortex and elimination of the vortex breakdown phenomenon at large flap deflections.

1.3 Description of Work

The main objective and expected outcome of the present CfP is to carry out a numerical study aimed at the design of a suitable flow control technique, either active or passive, which could be used to mitigate the aerodynamic noise generated at the flap side edge for a typical regional aircraft configuration. The activities foreseen would include the following steps:

1. Selection of a suitable flow control technique among either those proposed in literature or an innovative one proposed by the applicant in agreement with the CfP Manager.
2. Depending upon the selected flow control concept, setting up of an appropriate numerical simulation framework (e.g., RANS/URANS/DES), useful to both properly reproduce the effects of the flow control and whose results can be used as an input to a suitable noise prediction tool (see point 4.).
3. Perform parametric (optimization) studies in order to identify optimum control parameters (e.g., size, location, actuation frequency, mass flow rates, etc.) which minimize the noise generation (sources magnitude).
4. Selection and usage of a suitable numerical simulation framework (e.g., RANS-based semi-empirical approaches, URANS(DES)/FW-H hybrid approaches) to predict and compare the aero-acoustic performance of both the uncontrolled flow and the controlled flow.

At the end of the activities, the applicant will provide detailed technical information about the selected flow control technique, the (optimal) set-up found for the investigated flow control device and the achieved noise reduction. Moreover, detailed technical recommendations are expected about both the implementation and assessment of the concept within a wind tunnel test campaign to be carried out in future activities.

1.4 Reference documents

Not Applicable

1.5 Requirements

Although the project description leaves the applicant to select itself the most appropriate computational tools for a proper simulation of the involved flow phenomena, a remarkable computational power is expected to be required since a parametric study is requested in the proposed research.

1.6 Other

A correct and punctual reporting is considered of paramount importance for a correct evaluation of the activity progresses. Therefore, the applicant should be prepared to provide demonstration of the activities carried out through both intermediate (short) reports and presentations and a final report, as specified in the following.

1.7 Planning

A kick-off meeting, a progress meeting and a final meeting will be scheduled at the topic manager site. They will coincide with both critical milestones and periodic reporting dates.

The following critical milestones have been individuated:

M1 (T0+3)

Bibliographic study completed, candidate flow control concept selected by the applicant in agreement with the CfP Manager, expected improvements quantified, numerical simulation framework identified.

M2 (T0+6)

Completed numerical simulation (parametric) study for a first selected flow control configuration. Assessment of the achieved aero-acoustic performance carried out.

M3 (T0+9)

Flow control concept design refined and completed. Best control set-up identified, aero-acoustic performance of both uncontrolled and controlled flow evaluated. Noise reduction quantified.

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

Due to the technical complexity of the call and to the short duration of the activities, a proved experience of the applicant in the fields of computational fluid dynamics and aero-acoustics will be a key element of the selection.

The applicant is expected to have access to HPC facilities with the necessary computational power.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
D1	Progress Report	Small report containing: - Summary of the bibliographic study - Decision about selected flow control concept and motivations applicant in agreement with the CfP Manager. - Expected noise reduction - Numerical simulation framework defined for both fluid dynamics and aero-acoustics	T0+3
D2	Progress Report	Small report containing: - Progresses about the parametric study on the selected flow control concept (see item 3 and M2 above) - Evaluation of aero-acoustic performance so far	T0+6
D3	Final Report	Report containing: - Summary of activities already reported in D1-D2 - Outcome of the parametric study on the selected flow control concept (see item 3 above) - Noise reduction benefits due to the flow control - Define guidelines for an experimental assessment of the concept	T0+9
D4	CFD database	The most relevant CFD data, at least for the uncontrolled and controlled configurations. In case of unsteady computations, only suitable portions of the flow-field can be provided, stored with a suitable time rate.	T0+9

4. Maximum Allowed Topic Budget (€)

The total value of this work package shall not exceed:

80,000.--€

[Eighty thousand euro]

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

5. Remarks

In case the successful applicant will develop an innovative flow control concept, the intellectual property rights will belong to the applicant. However, the CleanSky-GRA consortium will have the rights to exploit the flow control concept, with no fees, for further numerical, experimental and flight test activities.

Topic Description

CfP topic number	Title		
JTI-CS2009-2-GRA-02-006	LE coupon based technology derivation	**Start date**	*To (01/April/2010)*
		End date	*To +12** (01/April/2011)*

1. Topic Description

Background

The task is related to the support of GRA LNC WP2.2.1.3

Scope of work

Provide functional **material coupon surface strip** applying shape memory technology and separately constitutive **shape memory alloy (**SMA**)** material **component sample(s)** used in the functional coupon.

The scenario for the integration of the material is perceived to be the **Leading Edge (LE)** of a wing. The constituted surface strip behaviour should attempt fore mostly to achieve an actuated deformation of the LE surface structure, with possibly neglected regard to damping behaviour.

The effect of the SMA material component shall be that the hosting surface structure shall be stretched or contracted in the main along the surface short side, see T4 below. In that respect an innovative architecture of the contributing SMA material components would have to be conceived and/or the technical excellence in adapting say a sandwich or other off the shelf or partner's structural conception be involved.

Tasks

T1. With the support of the GRA Member perceive and adapt to the application integration in order to adjust the contributing mechanical behaviour of the coupon passively and actively

T2. Predict with simple methods expected coupon surface response and separately contributing material component as a sample(s) in 1 dimension (to perhaps 2-dimensions depending on effect)

T3. Deliver constituting SMA material sample(s) to conduct safe load, 1D elastic test tbd. to be conducted together with GRA Member at the respective facilities

The Instrumentation will create data from - electronic optical assembly (tbd with GRA Member) & Thermal and mechanical strain measurement plus the SMA sample(s) electrically(Direct Current) driven.

The results of at least one successfully operable sample should be included in the reporting.

T4. Deliver coupon of dimensions:
short side-20cm* x longside (minimally 100cm) x thickness* (0.1cm upwards) that could be bonded on both longsides

*** Dimension can be changed by mutual cooperation in Task 1. and especially in terms of a functional architecture allowing up to maximally 1 cm in-plane deformation**

Reporting

R**A**: Short Report concept sketch following Task 1 with projection for report B

R**B**: Report the loads and interface control document

-short, long side and normal to surface load limits -passive and active displacements with
-thermal equilibriums
-current and voltages applied
-surface properties

i) enabling requirements for possible bonding along sides, not impeding electric activation
ii) here in cooperation with GRA Member, surface geometry continuity/waviness against a 3rd order polynomial (lengthwise short and longside)

Assessments based on simple transparent analytic methods!

R**C**: Report the test results under Task 3 for the sample SMA material element and expected behaviour for the active coupon under Task 4.

R**D**: final short report with summary of activities and description of potentials, risks and challenges including estimated cost reduction measures

Exclusions: It is not expected that the surface coupon shall possess limitless fatigue life but say allow up to 100 deformation activations with a statement to the fatigue mechanism (relating limiting Task 3 load levels) and possible recovery action. This data incorporated and finalised in Task 3.

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

Knowledge of shape memory alloys, ability to translate material behaviour to linearised passive and active behaviour in analytical equations depending on heat and or stress.

It would be useful but not mandatory if the partner(or consortium) has lab level composite fabrication facility and basic tension/compression equipment; sharing of activities with GRA Member can be discussed even to the extent that only a fully metal solution may be considered.

Good performance in this work would strongly recommend and serve as a strong reference for the partner for a proposal contribution in later calls

Reference to hands on activities in the proposal description against the deliverables will be appreciated. It will also be appreciated that the duration is between 12 and maximally 15 months only, so backing this an estimation of available resources to execute the respective task should be stated in the proposal.

3. Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date**
D1	Short report A together with GRA Member	Concept sketch projection of performance	T0+1
D2	Report B	With tabular loads sheets of predictions using the reported analytic formulas	To+4
D3	SMA sample delivered and clamped in a stress and/ or compression testing scenario		T0+7
D4	Report C	On the basis of at least one sample functionally operating	T0 +8**
D5	Delivery of deforming component coupon as described under T4		T0+11**
D6	Report D	With copied in Report B and with possibly revisited and finalised T4 coupon behaviour predictions	T0+12**

4. Topic value (€)

The total value of this work package shall not exceed: **200,000.--€** [Two hundred thousand euro] Please note that VAT is not applicable in the frame of the CleanSky programme

5. Remarks

If applicable *** To and duration may be negotiated on the basis of the final JU time slots.* *Projections from Deliverable D1 may allow duration to increase by up to 3 months if status of WP2213 allows this.*

Clean Sky - Green Rotorcraft

Identification	ITD - AREA - TOPIC	topics	VALUE [k€]	MAX FUND [k€]
JTI-CS-GRC	**Clean Sky - Green Rotorcraft**	**8**	**5.040**	**3780,0**
JTI-CS-GRC-01	*Area-01 - Innovative Rotor Blades*			
JTI-CS-2009-2-GRC-01-002	Development and provision of a numerical model to solve laminar turbulent boundary layer transition and boundary layer velocity profiles for unsteady flow conditions.		130	97,5
JTI-CS-2009-2-GRC-01-003	Actuation mechanism development and supply for 2D wind tunnel and specimen bench testing		225	168,8
JTI-CS-GRC-02	*Area-02 - Reduced Drag of rotorcraft*			
JTI-CS-2009-2-GRC-02-001	Contribution to the study of the air intake and exhaust integration into a tiltrotor nacelle		395	296,3
JTI-CS-2009-2-GRC-02-002	Contribution to analysis of rotor hub drag reduction		500	375,0
JTI-CS-2009-2-GRC-02-003	Contribution to optimisation of Heavy helicopter engine installation design.		440	330,0
JTI-CS-GRC-03	*Area-03 - Integration of innovative electrical systems*			
JTI-CS-2009-2-GRC-03-001	Electric Tail Drive - Modelling, Simulation and Rig Prototype Development.		2.500	1875,0
JTI-CS-2009-2-GRC-03-002	Innovative energy recovery for electrical use		250	187,5
JTI-CS-GRC-04	*Area-04 - Installation of diesel engines on light helicopters*			
JTI-CS-GRC-05	*Area-05 - Environmentally friendly flight paths*			
JTI-CS-2009-2-GRC-05-003	Emission analysis - Tools required to perform the emissions analysis and evaluation methodology, experimental support		600	450,0

Clean Sky Joint Undertaking
JTI-CS-2009-2-GRC-01-002

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-GRC-01-002	*Development and provision of a numerical model to solve laminar turbulent boundary layer transition and boundary layer velocity profiles for unsteady flow conditions.*	**End date**	T_0 + 12 months
		Start date	T_0

Topic Description

1. Background:

The JTI Clean Sky Green Rotorcraft research consortium is aiming at the development of laminar blades (producing lower drag) to provide the greatest possible reduction in fuel consumption. To this end, it is essential to develop numerical tools able to correctly predict the extension and the stability of the laminar flow region on the blades. This requires the capability to compute the unsteady boundary layer (BL) developing on the rotor blades and to perform a linear stability analysis.

As a consequence, the knowledge of the characteristics of the three-dimensional boundary layer on the rotor blades is essential for the prediction of the transition. On the other hand, boundary layer quantities and the location of the transition are mandatory for the design and validation of these laminar blades, as well as for the prediction of the flow properties, losses, and noise. The Coriolis and centrifugal forces generate spanwise flows inside the blade boundary layers, the magnitude of which depends upon the angular velocity of the rotor, the flight conditions, and the rotor-blade geometry. In addition, near the tip and the hub of the rotor complex flow interactions take place. Because of the complex nature of the problem, a general lack of available analytical and numerical techniques that can handle three-dimensional and time-dependent problems has been found. Furthermore, the majority of the available experimental measurement techniques are primarily two-dimensional and steady.

2. Scope of work:

Since one of the objectives of the work package GRC1.1 “Technology Evaluation & Basic Development” is the design of laminar blades for helicopters, the development of numerical tools able to predict the transition location on the rotor blades is mandatory. The prediction of the transition from laminar to turbulent flow can be computed by means of the linear stability theory coupled to the e^N method, but it requires the knowledge of the unsteady laminar boundary layer.

For this reason, in the framework of the subtask GRC1.1.8 “Method Development”, the GRC Consortium requires the development of numerical tools able to: 1) compute the main boundary layer quantities and; 2) to perform the stability analysis through the ray-theory, for the evaluation of the laminar flow region on the blade.

It is specifically required that the boundary layer tool can be “interfaced” with an inviscid flow solver from which it receives, as an input, the three components of the inviscid velocity distribution on the blade surface.

The idea is to approach the problem through the following steps:

a. Development and Validation of an unsteady incompressible 2D boundary layer method (2D - Flat plate);

b. Development and Validation of a Stability Analysis tool for the 2D boundary layer using the multiple scale technique and the ray theory. The source code and the manuals must be provided;

c. Extension and Validation of the 2D boundary layer to an unsteady infinite swept wing boundary layer (2.5D approach);

d. Development and Validation of a Stability Analysis tool for the 2.5D unsteady incompressible boundary layer using the multiple scale technique and the ray theory (constant spanwise wavenumber β). The source code and the manuals must be provided;

e. Feasibility study for the extension of the 2.5D approach to the fully 3D, incompressible and unsteady boundary layer, and the inclusion of centrifugal and Coriolis terms. In perspective, the approach for the stability analysis of 3D incompressible unsteady boundary layers will be based on the multiple scale technique and the ray theory. The disturbance evolution will be computed in time and space and 3D maps showing the laminar flow evolution on the blade and in time will be computed.

Special skills, certification or equipment expected from the applicant

The applicant should have experience in boundary layer and stability analysis of laminar boundary layers by using multiple scale approach and ray theory.

The applicant should have the ability to approach and solve all the steps required for the development of the numerical tools.

Major deliverables and schedule

Deliverable	Title	Short Description (if applicable)	Due date (month)
D1	2D approach	Report on the 2D BL and stability method. Code release (source code and manuals)	T_0 + 04
D2	2.5 approach	Report on the 2.5D BL and stability method. Code release (source code and manuals)	T_0 + 07
D3	3D approach	Report on the feasibility of 3D BL and stability method.	T_0 + 12

Maximum Allowed Topic Budget (€)

The total eligible cost including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

130,000.-- € (VAT not applicable)

[One hundred thirty thousand euro]

The maximum funding which can be granted is between 50% and 75% of the total eligible cost, in compliance with provisions of the Grant Agreement for Partners (Article II.16) appended to the Call for Proposals.

Remarks

- It is expected that the applicant briefly describes the technical solution that he would apply in the development of the numerical methods.
- In compliance with provisions stated in Article 9.3 of the Implementation Agreement or of the GRC Consortium (*), access rights to background and to results delivered by the applicant(s) to the GRC Consortium Parties for use of such results as required in the performance of their own research work within the GRC programme must be granted on a royalty-free basis. Such background and results include in particular any licence needed for the use of the software code to be delivered as specified here above.
- The expected maximum length of the technical proposal is 20 pages.

(*) Whichever Agreement may ultimately be concluded between the Parties submitting the Proposal and some/all GRC Consortium Parties. Both Agreements are appended to the Call for Proposals.

Clean Sky Joint Undertaking
JTI-CS-2009-2-GRC-01-003

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-GRC-01-003	*Actuation mechanism development and supply for 2D wind tunnel and specimen bench testing*	**End date**	To +24 months
		Start date	To

Topic Description

1. Background:

One objective of the Green Rotorcraft Consortium, Innovative Rotor Blades sub-project is to develop active rotor blades in order to achieve the greatest possible reduction in rotor noise and fuel consumption. Several streams of research and development are being undertaken. The work described here relates to the development of an active rotor technology that will enable a helicopter to operate with low rotational speed rotors whilst preserving current flight performance capabilities. A lower main rotor speed will significantly reduce noise rotor noise and fuel consumption, but without active technologies would severely compromise flight speed and pay load.

Since July 2008 a task to review potential active rotor concepts has been in progress. The technologies under investigation are those that increase aerofoil stall incidence or increase maximum lift. The outcome of this task will be the selection of a technology (or technology combination) in December 2009 for further development. The development programme for the selected technology will lead to bench and wind tunnel testing for proof of concept. The selected technology could be a mechanical system to change the shape of the aerofoil section such as variable leading edge droop and variable gurney flap (a retractable wall perpendicular to the surface at the aerofoil trailing edge on the lower surface) or flow control devices, such as synthetic jets (a vibrating diaphragm situated in a cavity beneath the blade skin, exciting the boundary layer by pulsating air through a small aperture in the skin).

2. Scope of work:

From January 2010, for 2 years, the selected technology will undergo a design and development phase leading to manufacture and testing in a subsequent task. In order to design and manufacture an active blade test specimen the consortium wishes to enter into a partnership with a company or consortium who will collaborate with existing Green Rotorcraft Consortium members to support the design of an actuation system to be integrated into a blade segment, and will manufacture and deliver the actuation system.

Given the timescales of the project and the duration required for finding a partner through Call for Proposal it is necessary to launch this Call before the technology has been selected. Proposals may therefore assume the technology is either a mechanical device, deforming or moving the structure, or a flow control technology device. The device selected will not be an active twist concept (the Call for which is now closed).

The partner will be required to:

- Provide detailed requirements specification for the actuation system
- Design the selected actuation system in collaboration with Consortium Members
- Produce three prototype actuation systems with characterised performance.
- Deliver three actuation systems for integration into composite blade specimens

Manufacture of the actuation system is intended to include the actuation device and system interface. Structural composite components of the blade section and power and control systems will be made by Consortium Members. The actuation system will need to fit completely within the blade structure; the aerofoil chord will be around 0.60 m

Special skills, certification or equipment expected from the applicant

The applicant should be able to design and manufacture bespoke actuation systems.

Major deliverables and schedule

Deliverable	Title	Short Description (if applicable)	Due date (month)
D1	*Requirements Specification*	*Detailed actuation system requirements specification*	T_0 + 3 months
D2	*Actuation system drawings and performance predictions*	*Actuation system design drawings and report providing the actuation system performance*	T_0 + 15 months
D3	*First Prototype system*	*First prototype system (1 off)with report detailing performance*	T_0 + 17 months
D4	*Second Prototype system*	*Second prototype system (2 off) with report detailing performance*	T_0 + 20 months
D5	*Actuator system for blade integration*	*Actuation system (3 off) with report detailing performance*	T_0 + 24 months

Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

225,000.-- € (VAT not applicable)

[two hundred twenty five thousand euro]

Remarks

- All core RTD activities have to be performed by the organisation(s) submitting the proposal. If some subcontracting is included in the proposal, it can only concern external support services for assistance with minor tasks that do not represent *per se* project tasks. The proposal must :
- indicate the tasks to be subcontracted ;
- duly justify the recourse to each subcontract ;
- provide an estimation of the costs for each subcontract.

(concerning subcontracting, see provisions of the Grant Agreement Annex II.7)

It is expected that the applicant will provide evidence of their capability to design and manufacture bespoke actuation systems.

- The expected maximum length of the technical proposal is 15 pages.

Clean Sky Joint Undertaking
JTI-CS-2009-2-GRC-02-001

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-GRC-02-001	**Contribution to the study of the air intake and exhaust integration into a tiltrotor nacelle**	End date	T0 +18 months
		Start date	T0

Topic Description

1. Background:

Within the Tiltrotor fuselage drag reduction activity it has been envisaged the need for an expertised partner to support the proposing industry into the design process for enhancing the engine integration efficiency. This support is intended not to be confined to an iterative computing sequence, but it will be rather focused to setting up a comprehensive optimization environment embedded into the industrial process. After a Technology Review in the field, yet accomplished within this GRC, a specific design work is envisaged in order to improve the efficiency of the current ERICA tilt-rotor as far as engine integration is concerned. The basic intake and exhaust design has to be reviewed with the aim to minimize any detrimental effects on drag and engine integration.

2. Scope of work:

The ultimate purpose of this topic is the optimization of the intake and exhaust tiltrotor nacelle geometries in order to improve the engine integration efficiency. To accomplish this, the set up of a comprehensive “optimal design” procedure suitable for industrial purposes is required. The activity must be conducted by means of numerical CFD simulations. The full procedure and all the related tools must be fully integrated within the industrial design environment currently available at the helicopter manufacturer, so the capability to use and integrate CAD, grid generator, solver and otpimizer is mandatory.

First, the whole otpimization procedure will be set up. Specifically, the optimization tool, already available and developed by the applicant, will be coupled with the commercial software codes available at the industrial site and consequently run at the industrial premises, with the optional support of a computer center. It is judged important that the optimizer (i.e. the numerical optimization software) has been conceived, written and implemented by the applicant; this to allow the introduction of any modification, improvement and special features that this kind of project may highlight.

The optimization will be focused on the efficiency improvement of both the nacelle intake and the exhaust duct: specifically, a reduction of the installation losses is required to be accomplished by means of both a reliable intake shaping and an analysis and control of some characteristic features of the intake flowfield, such as flow distorsion, total pressure losses, flow separation, etc. The impact of both the engine and the rotor/propeller inflow on the overall installation efficiency must be taken into account by means of *a posteriori* analysis of the overall propulsion system, including the propeller, the intake, the engine and the exhaust. To this purpose, neither the engine nor the blade geometry will be included directly into the optimization loop; in fact, the influence of the rotor will be considered as a boundary condition for the intake design, while the correct matching between the optimised intake shape and the engine must be evaluated afterwards. Finally, the output of the engine will act as a boundary condition for the design of the exhaust duct.

Once the full optimization process has been set-up at the proposed industrial premises, the geometrical shape optimization will be addressed on the nacelle intake and exhaust configurations.

The optimization will be carried out at the operative points (flight conditions) defined by industry. For the massive optimisation runtime, if needed, the partner is asked to be supported by a dedicated computer center, where the necessary tools will be installed.

The development of an optimization environment (rather than a one-way code), including different optimization strategies, is mandatory. In this context, the leading industry must be left free to choose the algorithm most suitable to the specific otpimization problem being considered. The different optimization techniques can be run sequentially or one at a time, depending upon the specific component to be designed.

Moreover, the capability to efficiently handle multiobjective problems is considered essential. Actually, due to the necessity of reducing computational costs, the optimizer must implement the most advanced tools to accelerate convergence toward the optimal solutions. To this purpose the leading industry will consider the possibility to refer to benchmarks published in the literature as a key aspect in order to validate the otpimizer efficiency. The applicant must be able to demonstrate the performance of its own optimization environment on specific test cases selected from those available in the scientific literature.

Furthermore, it is considered of primary importance that the user can interact with the optimizer and monitor the whole process as it takes place, in order to give the designer a deep insight into the decision process. This is another reason for the optimization code to be implemented by the applicant, in that this will guarantee an appropriate degree of interaction with the rotorcraft designer .

Finally, the optimizer implementation is required to allow for an easy and cost-effective parallelisation within the industry.

The main output of the entire process will be the updated external geometry of the nacelle components, optimized for high efficiency, in the required CAD format. Description reports supporting and substantiating the overall process and results are part of the output.

The proposal must be structured into three main Tasks, with the associated Deliverables as better described in the following pages.

Task 1 - Basic configuration analysis and implementation of the optimization environment

Contents

Basic tiltrotor nacelle geometry (ERICA configuration) will be supplied to the selected partner by leading industry in CATIA V5® format and in the so called CAD repaired version. The geometry will include the nacelle with its external and internal surfaces (including main and by-pass ducts). The nacelle will include the spinner, but not the rotor blades. Engine geometry, accessories, gear and transmission components are not included in this supplied package. Furthermore, the proposing industry will supply some experimental data on the baseline nacelle coming from wind tunnel campaigns (without rotor blades), some data on the rotor inflow and the nacelle CFD model already available. However, the above mentioned experimental data can not be used for validation purposes, being the tested geometry not representative of the actual ERICA intake configuration. Hence, it is intended that they will be used as a reference only for the qualitative judgement of flowfield behavior.

The applicant will:

a) set up the complete CFD model of the above nacelle configuration

b) calculate the aerodynamics characteristics of the basic nacelle geometry and compare the flowfield configuration with the one provided by the industry. The manufacturer will define the flight conditions at which the analysis must be performed

c) set up the complete optimization loop: in this phase the applicant will support the industry in setting up the model and evaluating the solution.

The selected partner is asked to closely and continously interact with the proposing industry for the overall duration of the project; such interaction is required at each level of the model set up in order to fully accomplish the industry needs.

Tools

The tools to be applied for the analysis must be fully available at the proposing site, this in order to guarantee the accomplishment of the next relevant tasks. For this reason it is mandatory that the applicant will use the following softwares to accomplish this task: CATIA V5®, HYPERWORKS®, GAMBIT®, TGRID® and FLUENT®.

Deliverables

The applicant will release the Report on the baseline nacelle/engine properties description. The analytical model input and output files must be also supplied (Deliverable D-1).

Moreover, the applicant will supply the optimization environment which will be ready and installed in the industrial site (CAD, grid generator, solver, optimizer).

Site

This task can be accomplished at the applicant site.

Task 2 - First assessment of the new nacelle geometry

Contents

The optimizer software will be linked and embedded in an existing design and analysis environment at the proposing premises, so the applicant will have to manage and integrate the softwares installed at the proposing industry premises. The core optimizer software must be property of the applicant: this in order to have the full authority and knowledge to modify and to improve it, if required. The optimizer software will still remain property of the applicant, and it will be used at the industrial site only in the framework of this Topic. The full time attendance of the applicant at the industry premises is then required.

Therefore, even in this phase the selected partner is asked to closely interact with the proposing industry in order for the optimization chain to fully accomplish the industry needs.

Tools

The tool to be applied for this task is the comprehensive optimization tool, including the following softwares: the optimizer, CATIA V5®, HYPERWORKS®, GAMBIT®, TGRID® and FLUENT®.

Deliverables

The applicant will release the Preliminary Issue of the Optimization description Report (Deliverable D-2), including the first assessment of the new nacelle geometry.

Site

This task must be accomplished at the leading industry site.

Task 3 - Optimised geometry for nacelle intake and exhaust system

Contents

In this phase the applicant, in close cooperation with the proposing industry, will run the optimization loop in order to identify the final optimised geometry of both the nacelle intake and exhaust. This is essentially a simulation task in which the overall methodology already set up will be applied and used to identify the optimal nacelle configuration. The correct matching among propeller, intake, engine and exhaust subsystems at each of the specified flight conditions must be carefully carried out, in order for the optimised configuration to be fully acceptable. The final geometry must comply with feasibility constraints in order to accomplish industrial needs for protoyping and testing.

Tools

The tool to be applied for this task is the comprehensive optimization tool, including the following softwares: the optimizer, CATIA V5®, HYPERWORKS®, GAMBIT®, TGRID® and FLUENT®.

Deliverables

The applicant will release the Final Issue of the Optimization description Report, showing the final otpimized assessment of the new nacelle geometry, and the CAD geometry of the optimized nacelle intake and exhaust (Deliverable D-3).

Site

This task must be accomplished at the leading industry site.

Special skills, certification or equipment expected from the applicant

The applicant must have a qualified and demonstrated skill in the optimisation disciplines, mainly for CFD, and a specific knowledge on propulsion system. The optimization software must be property of the applicant, who must have the full authority to modify and to improve it, so the detailed knowledge of the theory and of the implementation software statements and routines are expressely required.

Moreover, in case of a pure numerical optimization loop the detailed knowledge of the following commercial softwares, from CAD to solvers, will be fully appreciated during the selection phase: CATIA®, HYPERWORKS®, GAMBIT®, TGRID® and FLUENT®.

List of publications on the relevant international journals is required to certify the expertise in the field. Moreover, the participation in the UE projects in the CFD workpackage will constitute an added value.

Major deliverables and schedule

Deliverable	Title	Short Description (if applicable)	Due date (month)
D-1	Familiarization with the current ERICA engine/nacelle integration and definition of the baseline properties.	• Optimization chain ready and installed in the industry environment (CAD, grid generator, solver, optimizer). • Release of the baseline nacelle/engine properties description Report.	T0+10
D-2	First assessment of the new nacelle geometry	Release of: • Optimization description Report – Preliminary issue	T0+13
D-3	Optimised geometry for nacelle intake and exhaust system	Release of: • Optimization description Report – Final issue • CAD geometry of the optimized nacelle intake and exhaust	T0+18

Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

395,000.-- € (VAT not applicable)

[three hundred ninety five thousand euro]

Remarks

- All core RTD activities have to be performed by the organisation(s) submitting the proposal. If some subcontracting is included in the proposal, it can only concern external support services for assistance with minor tasks that do not represent per se *project* tasks. The proposal must :
- indicate the tasks to be subcontracted ;
- duly justify the recourse to each subcontract ;
- provide an estimation of the costs for each subcontract.

(concerning subcontracting, see provisions of the Grant Agreement Annex II.7)

- The expected maximum length of the technical proposal is 60 pages.

With respect to the SITE where the task must be performed, the applicant is requested to quote a conservative estimate for travel and staying at the most distant plant of the helicopter industry leaders, among France and Germany (Eurocopter) and Italy and UK (AgustaWestland); during the negotiation phase with the selected applicant the final location will be agreed

Clean Sky Joint Undertaking
JTI-CS-2009-2-GRC-02-002

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-GRC-02-002	*Contribution to analysis of rotor hub drag reduction*	End date	To +36 months
		Start date	To

Topic Description

1. Background:

The rotor hub is one of the main contributor to helicopter drag. It is envisaged to reduce the drag of the main rotor hub by optimizing the shape of the hub cap and by adding fairings on some parts of the hub.

After a theoretical study by means of Computational Fluid Dynamics carried out by the CfP-leader, the numerically predicted gains shall be assessed by the Partner through wind tunnel tests.

2. Scope of work:

The first part of the work is to build a rotor hub model and fairings, a partial helicopter fuselage, and several rotor caps. The CfP-leader will provide the description of all geometry components via CATIA V5 files and the detailed test matrix.

In order to limit the overall volume of the fuselage, the dummy fuselage must be realistically shaped in the vicinity of the rotor hub, and in its wake region. The rest will be only aerodynamically smoothed.

The 5 bladed rotor head must be realistic in terms of shape, and must be adjustable (no real time piloting) in collective and cyclic pitch. The blades will be cut at the first third of span. The flapping and lead-lag hinges can be suppressed. A sizing file in terms of loads will have to be provided by the manufacturer to the CfP-leader before model manufacturing (D-1).

The forces and moments applied on the rotor caps will be measured (static and dynamic). Five rotor caps and five rotor fairings will be built (rotor hub definition must permit the fact that a cap can be in fixed frame while the rotor is rotating). The scale will be adapted to fit the wind tunnel size, but the diameter of the smallest cap cannot be smaller than 80mm. The rotation speed will be determined by keeping the advance ratio constant.

Wind tunnel tests will be realized on different geometries at specified angles of attack and side slip.

For each rotor configuration (10 possible), the following tests will be realized:

- First, static measurements will be realized (non rotating rotor head) for 2 rotor azimuthal positions. Angle of attack and side slip will be swept.
- Subsequently, measurements will be done for nominal rotation of the hub for values of collective and cyclic pitch angles, as specified by the CfP-leader. For each setting of the rotor controls, the angle of attack and the side slip angle will be varied.
- Finally, variation of rotor hub rotation speed will be realized with the same rotor controls and fuselage settings as seen previously.

The flow field properties downstream of the hub shall be measured via PIV in order to determine the main effects of the hub cap on the rotor head wake. The interaction between the wake and the fuselage will also be studied. Static forces and moments applied on the rotor hub and the fuselage will be measured.

Special skills, certification or equipment expected from the applicant

A wind tunnel is required. The maximum speed should reach at least 50 m/s. The test section size should be, at least, 3m diameter for a circular cross section or 2.5mx2.5m for a rectangular one. Aerodynamic forces and wake measurement devices are necessary.

The mandatory skills are:

- Mock-up definition and manufacturing.
- Mechanical design skills for rotor hub model definition.
- Aerodynamic and mechanical measurements.
- Wind tunnel management and tests carrying out.

The “nice to have” skills are:

- Aerodynamic analysis capacities.
- Helicopter aerodynamics and dynamics knowledge.

Major deliverables and schedule

Deliverable	Title	Short Description (if applicable)	Due date (month)
D1	Model definition	Complete digital mock-up (Catia v5 format) + Sizing file	T0 + 12
D2	Model manufacturing	Delivery of the complete model equipped with sensors.	T0 + 24
D3	Wind tunnel tests	Delivery of the wind tunnel tests report.	T0 + 30
D4	Final recommendations	Delivery of the final report and wind tunnel data base	T0 + 36

1. Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

500,000.-- € (VAT not applicable)

[five hundred thousand euro]

2. Remarks

- All core RTD activities have to be performed by the organisation(s) submitting the proposal. If some subcontracting is included in the proposal, it can only concern external support services for assistance with minor tasks that do not represent per se *project* tasks. The proposal must :
- indicate the tasks to be subcontracted ;
- duly justify the recourse to each subcontract ;
- provide an estimation of the costs for each subcontract.

(concerning subcontracting, see provisions of the Grant Agreement Annex II.7)

Design of full scale helicopter parts is Intellectual Property of industry providing it.

Clean Sky Joint Undertaking
JTI-CS-2009-2-GRC-02-003

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-GRC-02-003	**Contribution to optimisation of Heavy helicopter engine installation design.**	**End date**	*30/06/2011*
		Start date	*01/07/2009*

Topic Description

Within the Heavy Helicopter activity it is envisaged that a contribution will be required from an outside organisation in order to support the GRC2 consortium, specifically in order to optimize engine installations using existing AgustaWestland methods of simulation. The main goal will be to maximise helicopter performance and to reduce both fuel burn and noise. Engine installations usually take the generic form of an air intake, engine bay cooling system, exhaust system, and inlet partical separator system, all of which will be subject to potential re-design as part of the optimization process.

Aerodynamic design constraints will include: minimising inlet pressure loss and distortion; minimising backpressure on the engine; engine bay cooling; avoidance of tailboom heating; avoidence of hot gas re-ingestion; minimizing fuselage drag etc. Further geometical contraints, imposed in order to ensure that the resulting design remains practially viable, will need to respect engine, drive train and airframe structures. Other constraints will include structural integrity and weight considerations.

It is envisaged that current state-of-the-art design search and optimization [DSO] techniques (ie, highly-computation based parameterized design-of-experiments [DOE] methods), sensitivity-based approaches and Adjoint methods will all be considered as potential integrated packages. Specifically, the geometry and grid generation will be by means of CATIA® and ANSYS/FLUENT® proprietry software. The main output of the entire process will be the development of optimization techniques specifically tailored to this application; novel concepts will be generated by AgustaWestland, whilst partner organizations will be engaged in the setup, analysis and optimization of configurations/geometries. The culmination of this work will be a comparative assessment of the resulting concepts, both against each other and the datum design, this will highlight the potential for improvement that would be available for practical helicopter designs.

Special skills, certification or equipment expected from the applicant

Successful applicants will have a qualified and demonstrable skill set in aerodynamic and CFD disciplines and a track-record in relevant industry sectors. Evidence of publications in the relevant journals or forums would be a good indicator of expertise in the field. An intimate and working knowledge of the following commercial packages is expected: CATIA®, HYPERWORKS®, GAMBIT®, TGRID® and FLUENT®. All software used must be compatible with that used by the industrial partner.

In addition, any software developed within this package must be made available as source code to the industrial partners of the GRC2 consortium

Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
D-1	Dependant on optimization scheme adopted: Fundamental constraints of problem identified and smaller 'trial' problem/project initiated.	Release of: • Initial trial problem results • All input and output geometry and CFD software files	T0 + 3m
D-2	Engine installation problem constrained and scope of solutions identified. Eg. For DOE methodology, experiment map completed and optimized.	Release of: • Stage 1 Report • First set of 'optimized' geometries • All input and output geometry and CFD software files	T0 + 9m
D-3	Further development of selected design(s) geometry and CFD simulation. Including scope to include other departments, eg. stress and therefore further refinement of new or current project.	Release of: • Stage 2 Report • All input and output geometry and CFD software files	T0 + 18m
D-4	Quantification of benefits and recommendations.	Release of: • Final Report • All input and output geometry and CFD software files	T0 + 24m

Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

440,000.-- € (VAT not applicable)

[four hundred forty thousand euro]

Remarks

N.A.

Clean Sky Joint Undertaking
JTI-CS-2009-2-GRC-03-001

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-GRC-03-001	**Electric Tail Drive - Modelling, Simulation and Rig Prototype Development.**	**End date**	To + 66 months
		Start date	To

Topic Description

1.1 Background:

The Green Rotorcraft (GRC) Programme is aimed at reducing the environmental impact of rotorcraft operations. The GRC3 Innovative Electrical Systems element of the GRC Programme includes a task (GRC3.6) to examine the benefits of replacing the conventional, mechanically driven and hydraulically controlled, tail rotor anti-torque device with an alternative that is electrically driven and controlled. The aim is to maximise the efficiency of power usage for rotorcraft and eliminate the use of environmentally unfriendly materials, including hydraulic fluid.

The GRC3.6 work programme includes a number of activities, potentially leading to the design and construction of a laboratory demonstration of an Electric Tail Rotor (ETR) system. The GRC3.6 Project Team are releasing this Call for Proposals (CfPs) to support the overall ETR work programme over its remaining duration. The CfP anticipates a programme of work supporting the areas of analysis, modelling, design, manufacture, test and demonstration activities.

Given the somewhat radical nature of the ETR concept, the CfP programme has been partitioned into two distinct phases of work. In the first phase (first 18 months), the technical feasibility and overall viability of the concept will be established. This first phase of work will be supported by a programme of modelling, requirements analysis and requirements generation which is already being undertaken by the GRC3.6 Project Team. At the end of the first phase, a decision will be made as to how to proceed to a laboratory based demonstration and based upon the results of the first phase, the detailed programme of the second phase will be defined. The second phase will comprise detailed design, manufacture and test of a full scale laboratory based prototype system. The second phase is intended to follow on immediately from the first phase and will have duration 4 years. This CfP requests supporting activity covering a full period of 66 months from issue of contract. Organisations or consortia wishing to bid for this programme of work are advised to provide a single proposal covering both phases of the programme. This should comprise a detailed proposal for the first phase of the work and an outline proposal covering the second phase. It is essential that the partners identified in the proposal have the full range of skills necessary to carry out the complete programme of work. It is anticipated that a detailed definition of the second phase of the work will be developed by the applicants (in conjunction with the GRC3.6 Team) within the scope of the first phase activities. It is important that the applicants clearly specify the budget required to complete the first phase of activity and hence the balance of budget between phase 1 and phase 2 activities within the proposal submission. It is expected that the first phase activity will require between 10% and 15% of the total budget for the whole CfP task.

One of the most challenging aspects of the ETR design is expected to be associated with the thermal management of the ETR machine. Accordingly, the first phase of CfP activity entails developing thermodynamic and electro-mechanical system models of candidate electrical machines that can be used to support the detailed definition of requirements, assessment of benefits and specification of the demonstration equipment. It is anticipated that the first phase programme will start early in 2010 and run for 18 months.

In the second phase of the work, the objective will be to design, develop, manufacture and test a prototype ETR system. As indicated above, the GRC3.6 Team do not expect to receive a detailed proposal covering the activities associated with this phase of the work because the detailed definition of the system will not be available until 2011. Rather, the GRC3.6 Team will be looking for a strong consortium of partners who can demonstrate through recent activity that they have the necessary knowledge, skills and understanding of the task to design, build and test the electrical machine and the associated control, distribution and instrumentation systems.

The CfP will be managed by the GRC3.6 Project Team.

1.2 Scope of work:

Phase 1 Programme

The work to be carried out must culminate in the delivery of a suite of software capable of predicting the thermal and electro-mechanical characteristics of candidate ETR electrical machines together with electro-mechanical behavioural models suitable for system level studies (e.g. such as may be composed with SABER or Matlab/Simulink). In particular, the software models shall be capable of predicting the thermal cycle associated with a variety of candidate ETR solutions subjected to dynamically varying loads covering a range of different electrical machines suiting a range of aircraft weights, roles and configuration classes.
The software model suite shall include multi-phase radial flux and axial flux machines and contain sufficient flexibility to cater for alternative ducted air cooling or liquid cooling options.
The software must be capable of modelling the behaviour of fault tolerant configurations comprising more than one machine or independent phase operation, e.g. up to four electrical machines stacked to provide a redundant drive architecture or loss/thermal imbalance across the winding phases.

Validation evidence for the software models must be provided for the motor technologies listed above. The models will be used to assist the ETR concept design studies. It is highly desirable for the developed software to become part of an integrated set of design scalable tools which can support the detailed electrical machine design. Accordingly, the proposal should indicate the steps that will be taken to ensure ease of integration with other systematic design tools used to assist the electrical design and analyse competing solutions.
The applicants must clearly identify any relevant IPR and Licensing issues.

The first phase work programme will be of 18 months duration and comprise the following stages:

1. A joint activity with the GRC3.6 Team to define the scope and level of depth of the models to be provided (3 months)
2. A model design, development and validation activity (12 months)
3. A results consolidation and preparation for Phase Two (3 months)

Phase 2 Programme

The Phase Two programme will entail detailed design, manufacture and test of a prototype system. The inputs to this task will include the modelling tools together with the requirements and design rationale generated within the first phase activity. The principal focus of the design activity should be targeted on the ETR electrical machine since this is expected to require the most development and hence carry the greatest technical risk. The emphasis should therefore be placed on getting the technology maturity of the electrical machine as close as possible to that which will be required for any follow on flight demonstration activity.
The detailed requirements and the weight category of the target helicopter will be decided within the first phase of the work. However, it is expected that a scalable solution will be required covering an installed continuous tail rotor power requirement in the range between 50kW and 250kW. Clearly, weight will be an important factor in the design and from the preliminary work carried out to date it is expected that the target power density of the active components of the electrical machine (including any cooling) will be in the region of 2.7 to 3.2 kW per kg of installed active mass. It is not anticipated that a viable solution meeting the electrical machine requirements will be found from existing machine technology. Applicants should thus emphasise any specific innovation in their proposed technology approach. The output from the design phase must generate evidence of the fitness for purpose of the emergent design. Design documentation must include as a minimum evidence of machine thermal characteristics against specified loading/duty cycle, evidence of faulted behaviour, dynamic behaviour/controllability and electromagnetic compatibility. It is anticipated that such evidence will be largely derived from simulation models used to support the design phase. With the exception of the thermal properties, it is anticipated that applicants will use existing tools to undertake the necessary simulation and the subsequent analysis. The applicants should identify the set of anticipated tools and any associated costs in the proposal. In the case of the use of in house developed tools, the applicants must clearly identify the relevant IPR and Licensing issues.

A design rationale and technology trade-off study report must be delivered from the machine design phase. Although it is expected that further development of the electrical machine will be required prior to any follow on flight demonstration activities, applicants should emphasise the approach that will be adopted to optimise the machine for the ETR application. Applicants must make provisions for a Preliminary Design Review (PDR) and a Critical Design Review (CDR) within the programme planning. The PDR and CDR shall be undertaken with the full involvement of the GRC3.6 Team.

In addition to the design of prototype electrical sub-system elements, the selected team shall also produce a detailed design for the integrated test rig. System Specifications for the electrical system and the test system shall be produced. The successful team shall also produce a draft test schedule defining the scale and scope of the testing phase activities to ensure that the test requirements are considered within the machine/component design. The proposal must indicate where the test facility will reside and also clearly state the ownership of individual elements of the rig post project completion.

A Redundant/fault tolerant system architecture is anticipated in order to meet an expected target of 10^{-9} failures per flight hour overall system integrity requirement. Consideration must be given in the proposal to candidate architectures that could be used to meet this stringent integrity target and the proposal should include a system architecture diagram for a candidate solution to the electrical machine design.

Within the design phase, consideration must also be given to the instrumentation that is needed within the component elements of the electrical system and applicants must indicate in their proposal the approach that will be adopted for the instrumentation system both in terms of sensor data provision and architecture of the test and data processing system.

It is assumed that existing (in production) systems will be used to provide a representative power source for the ETR laboratory prototype system. Ideally, an aerospace quality supply should be used but consideration should be given to the affordability/cost benefit of using COTS supplies. Similarly, the power conversion system solution should be made as representative as possible of the eventual

system but given the desire to focus on the electrical machine, consideration should also be given to the use of existing hardware. The consortium should assume that they are responsible for the provision of all of the hardware and software necessary to carry out the defined work.

Following a critical design review on the detailed system design, the project shall enter a manufacture phase where all of the components and subsystems shall be procured/manufactured and the subsystems integrated and prepared for a test and evaluation phase.

Finally, a comprehensive set of testing should be identified. The level of testing should be commensurate with verifying conclusively the fitness for purpose of the system design for subsequent development as the basis for a flight demonstration phase.

General Comments/Requirements

Applicants should identify the key skills of the individual partners and should also declare any existing IPR that they intend to bring to the project that could impact project success. Applicants should address the issue of IPR ownership and any proposed licensing of IPR and/or software that is intended within the proposal. IPR conditions must be consistent with the terms of the Consortium Agreement.

The proposal must identify/estimate the cost of all bought out equipment/software and the cost of all major items of equipment must be individually identified.

Special skills, certification or equipment expected from the applicant

The GRC 3.6 Team expect to make best use of existing models simulations and hardware modified as appropriate to meet the requirements of the ETR application. Applicants/consortia for this CfP should preferably have:

1. A track record in modelling the thermal and operational characteristics of electrical machines
2. Existing models that can be modified to produce the required predictive capability
3. Knowledge and experience with relevant existing tools for machine and control electronics design
4. A track record in the development of high power density electrical machines
5. A track record in redundant/fault tolerant electrical machine design
6. A track record in high integrity control systems for electrical drives
7. Experience in the testing of high integrity systems and hardware-in-the-loop load cycle emulation

Major Deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
1	Model Definition Report		T0 + 3
2	Report on Software Integration Strategy		T0 + 9
3	Final Report on First Phase Activities and Detailed Plan for Phase II activity		T0 + 15
4	Software Package Delivery		T0 + 18
5	Design Rationale and Technology Trade-off Study Report		T0 + 24
6	Design Specification for the Prototype System Components		T0 + 27
7	Design Specification for the Integrated Test Rig		T0 + 30
8	Design Specification for the integrated test system		T0 + 32
9	Delivery of Prototype ETR electrical machine		T0 + 48
10	Delivery of Prototype control and power distribution system		T0 + 48
11	Delivery of Integrated Test Rig		T0 + 50
12	Final Test Plan and Test Specification		T0 + 50
13	Report on Results of Testing		T0 + 60
14	Draft Final Report		T0 + 63
15	Final Report		T0 + 66

Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

2,500,000.-- € (VAT not applicable)

[two million five hundred thousand euro]

Note: A *target budget of approximately € 375 000* is anticipated for the first phase activity and *€ 2 125 000 for the second phase activity.*

Remarks

- All core RTD activities have to be performed by the organisation(s) submitting the proposal. If some subcontracting is included in the proposal, it can only concern external support services for assistance with minor tasks that do not represent per se *project* tasks. The proposal must :
- indicate the tasks to be subcontracted ;
- duly justify the resource required for each subcontract activity;
- provide an estimation of the costs for each subcontract.

(concerning subcontracting, see provisions of the Grant Agreement Annex II.7)

At the end of the first phase of this project, a decision will be made as to how to proceed to a laboratory based demonstration. Based on the first phase results, the programme of the second phase will be defined. The Grant Agreement between the Clean Sky JU and the selected Partner or Consortium will be amended to reflect the revised / updated work programme.

The maximum JU contribution for the whole project, as well as the Partners involved in this Grant Agreement, are not affected by such amendment.

- The expected maximum length of the technical proposal is 30 pages.

Clean Sky Joint Undertaking
JTI-CS-2009-2-GRC-03-002

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-GRC-03-002	*Innovative energy recovery for electrical use*	**End date**	*30/06/2012*
		Start date	*1/02/2010*

Topic Description

The Green Rotorcraft research consortium of Clean Sky invites proposals for the generic study and development of innovative solutions for continuous, in flight energy loss recovery in rotary wing aircraft.

The general aim is to minimise energy losses by recovery into electrical form for re-use within the electrical power distribution system. This is to support the greatest possible reduction in vehicle emissions and fuel consumption through reduction of electrical systems power demand from the Engine.

The leading specific objective is to recover electrical power from thermal losses. For example (Engines – transmission Bay – Rotor controls – MGB Oil, avionic systems …), using it as a power source into 270vdc power distribution networks.

The range of recovered power is to be nominally in the order of 1 KW to 10 KW per unit/module, but should be achieved using a scalable technology and generic, modular implementation approach.

Where appropriate the waste thermal energy recovery should be configured to replace conventional cooling systems such as fan assisted mass air cooling.

Critical performance and design criteria include energy conversion efficiency, power density / unit mass and volume. These parameters must be sufficient for the recovery system to be potentially self financing by making a net saving in fuel consumption and through life cost for its introduction. Low maintenance demand will also be a key design migration aim.

Technologies will need to be intrinsically safe and minimise the use of hazardous materials or emission of 'greenhouse' gasses such as CO2.

The study will comprise:-

-Stage 1. Identification of the various loss types, their energy flow and recovery potential into electrical power (This will include consideration of recovery form such as continuous generation, direct re-use/recycling, storage …),

- Stage 2 Potential solution options will be developed sufficiently to identify potential physical implementations and model their behaviour.

- Stage 3. For each solution modelling, aircraft system waveform integration and parametric assessment will be developed to include:

* an energy flow behavioural model including Helicopter network integration,

* a parametric mass / volume / cost effectiveness model.

- Stage 4. An optimal solution will be selected by the CfP Manager , for completion of the following:--

* Part I Detailed study of the solution including behavioural simulation (modelling with SABER simulation tool) ,

* Part II Manufacture of a physical and functional mock up

* Part III Demonstration of capability potential and model verification in a ground/laboratory based example aircraft installation application environment (to be determined).

Note: The Applicant will support integration tests of the mock up on an Electrical network.

The proposal should not exceed a length of 50 pages.

Special skills, certification or equipment expected from the applicant

The applicant should be able to cover the complete process chain from the study of various solutions to the manufacturing of the selected one.

The applicant should have the industrial capacity to exploit the demonstration results – i.e. to further develop, optimise, support the evalutation tests and customers on a sustainable basis.

Major Deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
1	*List of possible solutions*	*Report on the possible solutions including energetic simulation model which fulfil the specification requirements*	*31/05/2010*
2	*Detailed analysis*	*Delivery of the detailed analysis including the behavioural simulation of the retained solution*	*30/11/2010*
3	*Mock up and test results*	*Delivery of physical and functional mock up and of the individual and integration tests results*	*30/06/2011*

Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

250,000.-- € (VAT not applicable)

[two hundred fifty thousand euro]

1. Remarks

It is expected that the applicant briefly describes the technical solution he is aware today.

Clean Sky Joint Undertaking
JTI-CS-2009-2-GRC-05-003

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-GRC-05-003	**Emission analysis** **Tools required to perform the emissions analysis and evaluation methodology, experimental support**	**End date**	*30/06/2012*
		Start date	*01/11/2009*

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, methodologies and tools required to perform accurate experimental emissions measurements are sought, to support the analysis of gas emissions resulting from the adoption of Green Mission Profiles. In particular, Helicopter emissions will be measured during flight and/or ground tests for different environmental conditions such as altitude, outside air temperature (OAT), cruise speed, rate of climb, etc. During the flight/ground tests all relevant engine and flight parameters will be recorded and collected, to correlate the test condition with the emissions level measured.

The experimental emissions data, that will be measured and recorded, will be compared with the data resulting from a computational analysis. The objective of this comparison is the validation of the results coming from the numerical code, which will be used for the emissions computation within GRC5.

The expected maximum length of technical proposals is 60 pages.

Special skills, certification or equipment expected from the applicant

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

Methodologies for the experimental measurement of gas emissions (NO_X, CO, UHC, CO_2) concentration

Partners are sought that have the technical capability to measure helicopter engine emissions concentration (NO_X, CO, UHC, CO_2) for each flight/ground test condition under analysis.

The capability to measure soots will be considered as an asset.

The measurement equipment shall be suitable for operating when installed on an helicopter in different flight/ground test conditions.

Major Deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
D1	Status of art of the measurement systems	Review and summarise the existing knowledge about the measurement systems of NO_X & CO_2 emissions.	T_0 + 2M
D2	Definition of a methodology for the emissions measurement	Definition of the most appropriate methodology and best practices in test/analysis for the measurements of emissions from aeronautical engines.	T_0 + 6M
D3	Support to flight tests	Support the flight/ground tests which will be carried out.	T_0 + 12M
D4	Emissions report	Contribution to produce the required data related to the environmental flight conditions to be used in the optimisation process related to the pollution reduction.	T_0 + 20M

Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

600,000.-- € (VAT not applicable)

[six hundred thousand euro]

Clean Sky - Sustainable and Green Engines

Identification	ITD - AREA - TOPIC	topics	VALUE [k€]	MAX FUND [k€]
JTI-CS-SAGE	**Clean Sky - Sustainable and Green Engines**	**6**	**1.760**	**1320,0**
JTI-CS-SAGE-01	*Area-01 - Geared Open Rotor*			
JTI-CS-SAGE-02	*Area-02 - Direct Drive Open Rotor*			
JTI-CS-2009-2-SAGE-02-003	Design, computation and drawing of lubrication system equipment		660	495,0
JTI-CS-2009-2-SAGE-02-004	Performance and qualification tests of lubrication system equipment		240	180,0
JTI-CS-2009-2-SAGE-02-005	Design & make of a test bench for Heat Exchanger		400	300,0
JTI-CS-SAGE-03	*Area-03 - Large 3-shaft turbofan*			
JTI-CS-SAGE-04	*Area-04 - Geared Turbofan*			
JTI-CS-SAGE-05	*Area-05 - Turboshaft*			
JTI-CS-2009-2-SAGE-05-007	High temperature material		230	172,5
JTI-CS-2009-2-SAGE-05-008	Oil tank in composite		115	86,3
JTI-CS-2009-2-SAGE-05-009	Casing in composite		115	86,3

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-SAGE-02-003	Design, computation and drawing of lubrication system equipment	**Start date**	*01/05/2010*
		End date	*31/12/2013*

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 CROR engine architecture is a challenge for the lubrication and cooling system (LCS). Due to the large complexity of the CROR mechanical architecture, the heat generated by bearings and gears will indeed be much higher than for conventional turbofan architecture. Furthermore, the integration of the equipment in the CROR will be much more difficult due to harsher environment and the limited space available. New architectures and technologies of lubrication system and equipment have therefore to be developed to cope with the needs of such an engine.

The lubrification system equipments covered by this work package are

- lubrification unit
- oil tank
- heat exchanger
- associated filters, valves, accessories

The partner shall perfom the following activities:

Design, computation and drawing of lubrication system equipment

Techspace Aero is and remain responsible for the design of the equipment. In particular, Techspace Aero will

- Perform Design management activities
- Perform Chief engineering and audit activities
- Manage contact with the final user
- Lead the preliminary design activities

The partner will be responsible for different work packages in the equipement development. In particular, the partner will

- Perform drawing activities
- Perform computation activities
- Perform detailed design activities
- Propose the material for the reviews

Task 1: Work Package management:

Organisation

- The partner shall maintain a single point contact who is responsible for all programmatic aspects of this partnership.

- The partner shall nominate a team dedicated to the project and convey to the Techspace Aero project manager the name of his key personnel. As a minimum, responsibility for the following functions shall be clearly identified:

  - Quality assurance manager
  - Chief engineer

- Design Engineer

Progress report

- The partner shall give the Techspace Aero project manager adequate visibility on its activities, by issuing progress reports (1 every 1 months, in a free format), detailing:

- Activities performed during the reporting period, including key points performance and mass status, risks mitigation status and schedule.
- Delivery status (WIP chart)
- Open actions list.

- A meeting shall be held between the partner and Techspace Aero project manager (at Techspace Aero facilities) in order to coordinate their respective activities.

General requirements on documentation

Documentation management

- The partner shall organize a documentation system (design, development, justification, ...) identified in the frame of this partnership.
- The documentation shall be organized to fulfill the following requirements:
  - individual identification
  - ability to trace each document change,
  - allow any inquiry on the product data.
  - assure the traceability of all comprehensive and detailed justifications,
  - integration of the documents submitted to configuration management within an internal configuration status list.

Review

The following development reviews shall be held during the activities:

- Preliminary Design Review (PDR)
- Detailed Design Review (DDR)
- Critical Design Review (CDR)

Preliminary Design Review

- The Preliminary Design Review shall be held before the design phase and before assembly and tests of engineering model hardware. The purpose of this review is :
  - to verify and approve the concept, manufacturing choices and predicted performance with respect to the requirements
  - to review the compliance matrices.
  - to review the preliminary justification file
  - to review the preliminary development plan and associated risks
  - to review the preliminary drawings.
  - to review parts list, materials list & processes list
  - to approve the interfaces and the technical requirements specifications.

Detailed Design Review :

- The Detailed Design Review shall be held before assembly and tests of /CR hardware. The purpose of this review is:
  - to review the development plan and associated risks
  - to freeze the interfaces and the technical requirements specifications
  - to review detailed drawings and procedures
  - to review parts list, materials list & processes list

Critical Design Review :

- The Critical Design Review shall be held before assembly and tests of qualification/certification hardware. - The purpose of this review is :
  - to approve the design (including the materials and process specifications) to qualification/certification.
  - to approve the manufacturing flow chart of qualification/certification hardware

Task 2: Lubrification equipment design and engineering task

Introduction

- The partner shall design, specify (including specifid requirement and drawings) and demonstrate by analysis that the equipment meets all the requirements specified.
- The partner shall produce and submit for approval a Design Verification Matrix which shows how each specified parameter is verified.

Design

- The partner shall ensure that the equipment design fulfils all the applicable requirements. For this purpose, the partner shall be responsible to achieve all the necessary tasks.
- The partner shall demonstrate the compliance to the specified requirements according to the equipment specification, indicating conformance or deviation with the relevant justification.
- Any potential deviation from the applicable requirements shall be submitted to Techspace Aero project manager for approval.
- For any design issue, the partner shall suggest options and trade-off.
- The partner shall keep identification and traceability of all computerised models (2D/3D) which are shared with Techspace Aero project manager. A link between drawings and 3D models shall be established.
- The partner shall identify all critical parameters requiring Techspace Aero project manager visibility and control.
- The partner shall document and make available all design justification data.

Analysis

- The partner shall conduct analysis to demonstrate the integrity and compliance of the product for all modes of operation and for all environmental exposures from completion of manufacture to the end of the equipment lifetime. Margins and test inaccuracies shall be quantified.
- The partner shall supply descriptions of the method of analysis when the results are presented. The partner shall also make available, if requested by Techspace Aero project manager, information concerning any computer program or computer models used in the analysis.
- All the methods and software used for the analysis shall be validated by correlation with actual data demonstrated by tests or flight performance.
- Analysis will be updated whenever changes occurs which would have a significant effect on their results.

Design verification matrix

- The Design Verification Matrix will identify all documents which demonstrate compliance of the design (performances, structural, safety and reliability aspects) with the applicable requirements.

Special skills, certification or equipment expected from the applicant

- Extensive experience in the field of design, drawings, analysis (vibration, pressure, fan blade out, schock…), manufacturing process and assembly of **lubrication system equipment** is mandatory.
- Experience of Techspace Aero (TA) quality requirement and design practices is a key factor.
- Quality certification ISO 9001 and EN 9100 is mandatory
- Master of French and English languages is mandatory.
- Succession of full autonomy and on-site collaborative work periods is required.

Major Deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
D1	3D Model		PDR (Nov 2010)
D2	Compliance Matrix to spec		PDR
D3	Development Plan		KOM (May 2010)
D4	Drawings		PDR
D5	Item Classification Report		PDR
D6	Justification File (including FEA)		PDR
D7	Material List		PDR
D8	Parts List		CDR (May 2011)
D9	RAMS Report		PDR
D10	Risks Analysis Report		PDR
D11	Management Plan		KOM

Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

660,000.-- € (VAT not applicable)

[six hundred sixty thousand euro]

This topic value is a maximum gross value for the work package. Awards between 50% and 75% of this value may be made by the Clean Sky Joint Undertaking.

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-SAGE-02-004	**Performance and qualification tests of lubrication system equipment**	**Start date**	*01/05/2011*
		End date	*31/12/2013*

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 CROR engine architecture is a challenge for the lubrication and cooling system (LCS). Due to the large complexity of the CROR mechanical architecture, the heat generated by bearings and gears will indeed be much higher than for conventional turbofan architecture. Furthermore, the integration of the equipment in the CROR will be much more difficult due to harsher environment and the limited space available. New architectures and technologies of lubrication system and equipment have therefore to be developed to cope with the needs of such an engine. Performance and qualification test rigs and test procedures will then have to be adapted to these new equipment and requirements.

The lubrification system equipments covered by this work package are

- lubrification unit
- oil tank
- heat exchanger
- associated filters, valves, accessories

The partner shall perfom the following activities:

Performance and qualification tests of lubrication system equipment

These tests are required to validate the design and the performance of the components before using them for engine tests.

Techspace Aero is and remain responsible for the delivery of validated components on the engine. In particular, Techspace Aero will

- Perform test management activities
- Perform Chief engineering and audit activities
- Manage contact with the final user

The partner will be responsible for different work packages in the equipement test. In particular, the partner will

- Perform test activities
- Perform test report activities
- Perform test plan activities
- Propose the material for the reviews (see deliverables)

In order to perform these activites,

the partner will have to

- Adapt the existing test rig to the equipment to test and to the the specific tests and procedures of the project.
- Adapt the existing instrumentation tools, install the instrumentation acquire the signal and post treat the inforamtion
- Perform the tests
- Produce requested documentation (test report, log book, …) as per quality requirement

Task 1: Work Package management:

Organisation

- The partner shall maintain a single point contact who is responsible for all programmatic aspects of this partnership.
- The partner shall nominate a team dedicated to the project and convey to the Techspace Aero project manager the name of his key personnel. As a minimum, responsibility for the following functions shall be clearly identified:
  - Quality assurance manager
  - Chief engineer
  - Design Engineer

Progress report

- The partner shall give the Techspace Aero project manager adequate visibility on its activities, by issuing progress reports (1 every 1 months, in a free format), detailing:

  - Activities performed during the reporting period, including key points performance and mass status, risks mitigation status and schedule.
  - Delivery status (WIP chart)
  - Open actions list.
- A meeting shall be held between the partner and Techspace Aero project manager (at Techspace Aero facilities) in order to coordinate their respective activities.

General requirements on documentation

Documentation management

- The partner shall organize a documentation system (design, development, justification, ...) identified in the frame of this contract.
- The documentation shall be organized to fulfill the following requirements:
  - individual identification
  - ability to trace each document change,
  - allow any inquiry on the product data.
  - assure the traceability of all comprehensive and detailed justifications,

- integration of the documents submitted to configuration management within an internal configuration status list.

Review

The following development reviews shall be held during the activities:

- Before Test Review (BTR)
- After Test Review (ATR)

Before Test Review (BTR):

A before test review will be held to formally present the test plan for each individual test. The purpose of this review is :

- to formally approve the test plan.
- to approve the detailed test procedures
- to establish the conformance of the product units to be tested with the test requirement.
- to verify the conformance of the test equipment, facilities and procedure with the requirements

After Test Review (ATR):

A after test will be held to formally present the test results. The purpose of this review is :

- to approve the test results

Task 2: Lubrification system equipment test task

- The partner shall issue a Test Plan that will be reviewed by Techspace Aero project manager.
- The partner shall be responsible to provide all the necessary hardware, instrumentations and facilities for the test activities.
- The partner is responsible to perform the test activities
- The partner shall ensure the traceability and the filing of all records related to the test results.
- The partner is responsible to provide the Test Plan at the BTR and the Test Results at the ATR.

Special skills, certification or equipment expected from the applicant

- Extensive experience in the field of lubrication system equipment test is mandatory.
- Experience of topic coordinator quality requirement and design practices is a key factor
- Existing **qualified** test rig for aero oil system equipment is mandatory
- Existing test rig for pump performance, robustness and pollution tests is mandatory
- Master of French and English languages is mandatory.
- Succession of full autonomy and on-site collaborative work periods is required.

Major Deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
D1	Test Plan		KOM (May 2011)
D2	Test Procedure		BTR (Sep 2011)
D3	Conformance of the test equipment, facilities, instrumentations and procedure with the requirements		BTR
D7	Test Report		ATR (Feb 2012)
D10	Risks Analysis Report		KOM
D11	Management Plan		KOM

Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

240,000.-- € (VAT not applicable)

[two hundred forty thousand euro]

Awards between 50% and 75% of this value may be made by the Clean Sky Joint Undertaking.

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-SAGE-02-005	**Design & make of a test bench for Heat Exchanger**	Start date	*01/05/2010*
		End date	*31/12/2011*

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 CROR engine architecture is a challenge for the lubrication and cooling system (LCS). Due to the large complexity of the CROR mechanical architecture, the heat generated by bearings and gears will indeed be much higher than for conventional turbofan architecture. Therefore, heat exchanger optimisation is a key point for engine performance. Furthermore, the integration of the equipment in the CROR will be much more difficult due to harsher environment and the limited space available.

In the development of heat exchangers, characterization of the performances is essential. Techspace Aero needs to owe an heat exchanger test facility in his facilities order to allow design verification, certification and qualification testing.

The partner shall perfom the following activities:

Design and Make of test bench for Heat Exchanger engineering, qualification and certification tests.

Based on Techspace Aero functional specification, the partner will design, manufacture, install the test bench in Techspace Aero facilities and train Techspace Aero personnel.

The project is splitted in 4 major phases

1. Design
2. Purchase of parts
3. Installation
4. Training

The test rig will allow the test of liquid and air channels heat exchangers

1. Heat Transfer Performance test
2. DP test
3. Decongealing test
4. Valve Opening and closure times, Valve DP
5. Thermal Cycling

The different aeronautic fluids can be used (fuel, oils, air, ..)

The test rig will at least have

1. User-friendly HMI for acquisition and control
2. 1 “liquid loop”. Each loop having motor-pumps (10.000l/h, 50 bars), heater-cooler (200kW), flowmeter, temperature and pressure sensors, tank, air-oil mixture housing. Each loop has to be able to be filled and used with the different fluids for different tests. Supplementary liquid loops allowing to

test mutliple liquid heat exchanger will make this test bench innovative. The manufacturing of supplementary “liquid loop” is thus a key factor for the choice of the partner.

3. 1 “air loop”. Capable of regulated flow up to 6kg/s during at least 5 minutes with flowmeter, temperature and pressure sensors. The pressure and temperature control of this air loop will be a major challenge and a criterion for the choice of the partner. Another challenge which will allow to assess the innovation of the proposal is the capability of continuous use (or the maximum achievable rate of use) of this “air loop” .

Another innovation of interest is about the cost of operation of the test bench. Any mature technology reducing the cost of operation of the test bench (like energy recycling) is an advantadge.

The test bench will be conform to CE reguations and certified by authorised organisms

The test rig will be modular.

1. Allow the addition of air and/or liquid loops
2. Allow the addition of sensors and/or controls
3. Allow the upgrade of the control and acquisition system by Techsapce Aero personnel

Management requirements are the following:

Organisation

- The partner shall maintain a single point contact who is responsible for all programmatic aspects of this partnership.
- The partner shall nominate a team dedicated to the project and convey to the Techspace Aero project manager the name of his key personnel. As a minimum, responsibility for the following functions shall be clearly identified:
    - Quality assurance manager
    - Chief engineer
    - Design Engineer

Progress report

- The partner shall give the Techspace Aero project manager adequate visibility on its activities, by issuing progress reports (1 every 1 months, in a free format), detailing:

    - Activities performed during the reporting period, including key points performance and mass status, risks mitigation status and schedule.
    - Delivery status (WIP chart)
    - Open actions list.
- A meeting shall be held between the partner and Techspace Aero project manager (at Techspace Aero facilities) in order to coordinate their respective activities.

General requirements on documentation

Documentation management

- The partner shall organize a documentation system (design, development, justification, ...) identified in the frame of this partnership.
- The documentation shall be organized to fulfill the following requirements:
    - individual identification
    - ability to trace each document change,
    - allow any inquiry on the product data.

- assure the traceability of all comprehensive and detailed justifications,
- integration of the documents submitted to configuration management within an internal configuration status list.

Special skills, certification or equipment expected from the applicant

- Extensive experience in the field of industrial test bench design and manufacturing is mandatory.
- Experience in test benches for aeronautic fluids and particularly fuel is a key factor
- Experience of Techspace Aero quality requirement and design practices is a key factor
- ISO qualification for the design and manufacturing of industrial test benches is mandatory
- Master of French and English languages is mandatory.
- Succession of full autonomy and on-site collaborative work periods is required.

Major deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
D1	Test Rig Design Review		7/2010
D2	Review before test rig installation		9/2010
D3	Reception of the test rig and documentation		11/2010
D4	Training completed		12/2010

1. Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

400,000.-- € (VAT not applicable)

[four hundred thousand euro]

Awards between 50% and 75% of this value may be made by the Clean Sky Joint Undertaking.

400 k€

Clean Sky Joint Undertaking
JTI-CS-2009-2-SAGE-05-007

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-SAGE-05-007	**(Blades into) High temperature material**	**Start date**	*06/2010*
		End date	*12/2011*

Topic Description

The SAGE5 project aims at developing a new helicopter engine presenting significant improvements in term of noise and gaseous emissions.

In this framework, the WP 5.1.4 is dedicated to the development of an innovative low pressure turbine. A part of the low pressure turbine is composed by blades working in harsh environment.

TiAl alloys are currently considered as promising materials for high temperature parts used between 600°C and 800°C, and presently made of nickel based alloys.

TiAl has been studied and characterized over the last ten years. However, not only the casting but also the machining of TiAl to produce real parts still remains a challenge. The casting of TiAl leads to parts without enough accuracy to be used in aeronautical applications and the machining of TiAL is not an easy way (surface state problem for example).

The aim of this project is to study and to improve the different stages of manufacturing parts in TiAl and to manufacture a batch of around 20 low pressure turbine blades made of TiAl, ready to be tested on an engine. These blades will have a volume of 14 cubic centimetres. This will permit to prove the feasibility of manufacturing parts in TiAl.

Moreover, considering that properties could be affected by burnt gas exposure, those blades will have to be coated.

The partners will have to:

- Study and improve the different stages of manufacturing
- Manufacture raw parts based on Turbomeca's design, by means of an industrial and cost effective process, providing a microstructure able to face high creep stresses.
- Machine these parts to final dimensions, meeting aeronautical quality requirements.
- Provide an oxidation resistant coating for a use up to 800°C, keeping in mind the industrial relevance of the proposed concept and bringing the necessary knowledge for an industrial scale up.

After that Turbomeca will use these blades in an engine test that could be performed in parallel of Clean Sky.

Special skills, certification or equipment expected from the applicant

This task can require several partners, exhibiting high and proven experience in designing, manufacturing and studying TiAl alloys or related technologies.

Major Deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
D1	Raw parts manufactured		T0+10
D2	Parts machined with final dimensions		T0+14
D3	Parts coated with oxidation resistant coating		T0+18

Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

230,000.-- € (VAT not applicable)

[two hundred thirty thousand euro]

Awards between 50% and 75% of this value may be made by the Clean Sky Joint Undertaking.

Clean Sky Joint Undertaking
JTI-CS-2009-2-SAGE-05-008

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-SAGE-05-008	**Oil tank in composite**	**Start date**	*06/2010*
		End date	*12/2011*

Topic Description

The SAGE5 project aims at developing a new helicopter engine presenting significant improvements in term of noise and gaseous emissions

The WP 5.2.1 of SAGE5 Demonstration Project is dedicated to the development of an innovative oil system

Reducing specific fuel consumption is a real challenge for future helicopter engines. This can be achieved by means of increasing the engine performance or reducing the weight. In this latter approach, replacing present metallic alloys by organic materials is an interesting way.

Today, the oil necessary to gears running is contained in gear box casings. The aim of this project is to study and manufacture a specific oil tank made of organic composite material and the associated integration system (pipes) that could be made in an other material.

Based on functional requirements specified by Turbomeca, the partners will have to :

- Assess the feasibility of such a part (mechanical and physical properties, oil compatibility…).
- Design the integration system.
- Manufacture the tank and the integration system, according that materials and manufacturers are not necessarily to be the same for all the parts.
- Characterize the whole system and provide designing data.

After that Turbomeca will use the complete oil tank in an engine test that could be performed in parallel of Clean Sky.

Special skills, certification or equipment expected from the applicant

This task can require several partners, exhibiting high and proven experience in designing and manufacturing organic composite parts, with aeronautical quality level, and ready to share their experience in supporting the manufacturing aspects of the program.

Major Deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
D1	assessment of the feasibility + two materials characterization and designing data		T0+6
D2	Design (drawing and sizing) of the tank and the integration system		T0+10
D3	The tank and the integration system manufactured		T0+14
D4	The two parts characterized		T0+18

Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

115,000.-- € (VAT not applicable)

[one hundred fifteen thousand euro]

Awards between 50% and 75% of this value may be made by the Clean Sky Joint Undertaking.

Clean Sky Joint Undertaking
JTI-CS-2009-2-SAGE-05-009

Topic Description

CfP topic number	Title		
JTI-CS-2009-2-SAGE-05-009	**Casing in composite**	Start date	*06/2010*
		End date	*12/2011*

Topic Description

The SAGE5 project aims at developing a new helicopter engine presenting significant improvements in term of noise and gaseous emissions

The WP 5.1.1 of SAGE5 Demonstration Project is dedicated to the development of the compressor. An **inlet guide vane (IGV)** system is design to pre-rotate or spin the air in the direction of compressor rotation.

An IGV system aims at reducing specific fuel consumption. The variable stator blades rotate inside a casing, and all the system results in several friction issues. Wear can be observed between the casing (made of aluminium alloy) and the different moving parts. Those problems are presently solved by means of including intermediate composite parts or anti wear coatings.

The aim of this study is to design and manufacture an IGV casing made of composite material able to cope with all the friction functions in order to suppress all intermediate parts and coatings.

Based on functional requirements specified by Turbomeca, the partners will have to :

- Assess the feasibility of such a part (mechanical and physical properties, temperature resistance, wear resistance, dimensional aspects and stability, roughness, erosion resistance, chemical compatibility, possible metallic inserts, …).
- Choose a material and characterize it in order to provide designing data.
- Design the casing
- Manufacture the casing

The final product will be used by Turbomeca in an engine test that could be performed in parallel of Clean Sky program.

Special skills, certification or equipment expected from the applicant

The partner will exhibit high and proven experience in designing and manufacturing organic composite parts by means of injection or machining, with aeronautical quality level.

Major Deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
D1	assessment of the feasibility + material characterization and designing data		T0+6
D2	Design (drawing and sizing) of the casing		T0+10
D3	The casing manufactured		T0+14
D4	The casing characterized		T0+18

Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

115,000.-- € (VAT not applicable)

[one hundred fifteen thousand euro]

Awards between 50% and 75% of this value may be made by the Clean Sky Joint Undertaking.

Clean Sky - Smart Fixed Wing Aircraft

Identification	ITD - AREA - TOPIC	topics
JTI-CS-SFWA	Clean Sky - Smart Fixed Wing Aircraft	0

No topics from Smart Fixed Wing Aircraft ITD are included in this call.

Clean Sky - Systems for Green Operations

Identification	ITD - AREA - TOPIC	topics	VALUE [k€]	MAX FUND [k€]
JTI-CS-SGO	**Clean Sky - Systems for Green Operations**	**2**	**3.000**	**2.250**
JTI-CS-SGO-01	*Area-01 - Definition of Aircraft Solutions and explotation strategies*			
JTI-CS-SGO-02	*Area-02 - Management of Aircraft Energy*			
JTI-CS-SGO-03	*Area-03 - Management of Trajectory and Mission*			
JTI-CS-SGO-04	*Area-04 - Aircraft Demonstrators*			
JTI-CS-2009-2-SGO-04-001	Design and manufacture of an aircraft tractor compliant with specifications for Smart Operations on ground		2.000	1500,0
JTI-CS-2009-2-SGO-04-002	Provision of electrical equipments to complement the PROVEN tests rig		1.000	750,0
JTI-CS-SGO-05	*Area-05 - Aircraft-level assessment and exploitation*			

Clean Sky Joint Undertaking
JTI-CS-2009-2-SGO-04-001

Topic description

CfP Nbr	Title		
JTI-CS-2009-2-SGO-04-001	**Design and manufacture of an aircraft tractor compliant with specifications for Smart Operations on ground**	End date	04.05.2011
		Start date	03.05.2010

Background

Clean Sky Systems for Green Operations aims developing systems that will reduce the environmental impact of the aircraft. In this project, work package 4 (WP4) aims at demonstrating the technical solutions for large aircraft application, both on ground test rigs and flight test aircraft.

The Dispatch Towing that consists in towing aircraft with engine off from gate to runway has been identified as a promising solution for greener aircraft operations. Today's aircraft have not been designed for this kind of operation. On the other hand, a procedure such as the Dispatch towing will be defined only if it can be applicable to all the aircraft operating on a platform. As a consequence, the design of a specific **Dispatch Towing Vehicle (DTV)** is required to overcome the limitations of current aircraft.

This DTV prototype will then be used during trials with real aircraft to validate its performance and its compliance to the defined requirements in order to prove the relevance of the concept.

Scope of work

The expected work is to design and manufacture a specific Dispatch Towing Vehicle (DTV) able to perform Dispatch Towing regardless the limitations of current aircraft.

This vehicle will have to fulfil the following requirements:

- The DTV must fulfil the International Standard used for Aircraft ground equipments (when applicable). The list of these standards is given in section 7.

- The DTV must tow aircraft at a speed compatible with the integration into the taxiing traffic.

- The DTV must not impact the structure life of the aircraft, and specifically the fuselage and the nose landing gear (it is the main limitation of current tow tugs)

- The aircraft pilot must be able to drive the DTV as long as it is attached to the aircraft; the behaviour of the DTV during turns and braking must give the feeling to the pilot that he is directly in control of the aircraft

- The DTV must propose a solution that ensures the safety of the aircraft during the towing operation: localisation, obstacle detection and aircraft guidance…

- The DTV must be universal in its aircraft category. Three aircraft categories are identified:
  - Regional aircraft
  - Single aisle (e.g. A320…)
  - Twin aisle (e.g. A330, A380…)

The applicant will design and build a prototype of DTV for single aisle or for twin aisle aircraft family.

The technical concept will be validated versus requirements thanks to a dedicated analysis.

The relevant aircraft data will be provided by Airbus during the negotiation phase with the selected applicant.

Type of work

The expected work will cover specification, design and manufacturing aspects.

Special skills, certification or equipment expected from the applicant

The applicant must have experience on the manufacturing of ground vehicles for industrial application,

and must show a deep understanding of the aircraft towing technical stakes.

Major Deliverables and schedule

Deliverable	Title	Description (if applicable)	Due date
D1	DTV Specifications		01.06.2010
D2	DTV Validation Report	Analysis showing the compliance of the selected technical solution versus the requirements	31.12.2010
D3	DTV Prototype		31.04.2011

Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

2,000,000.-- € (VAT not applicable)

[two millions euro]

Awards between 50% and 75% of this value may be made by the Clean Sky Joint Undertaking.

7. Remarks

List of applicable International standard (not exhaustive) for the development of the DTV.

ISO	6966-1	Aircraft Ground Equipment – Basic Requirements – Part 1: General Design Requirements
	6966-2	Aircraft Ground Equipment – Basic Requirements – Part 2: Safety requirements
	20683-1	Aircraft Ground Equipment – Design, Test and maintenance for towbarless towing vehicles (TLTV) interfaced with nose landing gear – Main line aircraft
SAE	ARP1247C	General requirements for Aerospace Ground Support Equipment, Motorized and Non motorized
	AIR 1328	Aircraft support equipment stability analysis
	AIR 1375B	Minimum Safety Requirements for special purpose airline ground support equipment
	AIR 1838	Pictograms for ground support equipment
	ARP 4852	Design Specification for towbarless push-back tow vehicles
	ARP 4853	Design specification for towbarless tow vehicles
	ARP 5283	Nose gear towbarless tow vehicle basic test requirements
	ARP 5284	TLTV – Aircraft NLG steering and tractive force protection systems or alerting devices – inspection, maintenance and calibration requirements
	ARP 5285	Towbarless towing vehicle operating procedure
EN	12312-7	Airvraft movement equipment

Clean Sky Joint Undertaking
JTI-CS-2009-2-SGO-04-002

Topic description

CfP Nbr	Title		
JTI-CS-2009-2-SGO-04-002	**Electrical equipments to complement the PROVEN tests rig**	**End date**	04.10.2011
		Start date	03.05.2010

Background

Clean Sky systems for Green Operations ITD aims developing systems that will reduce the environmental impact of the aircraft. In this project, work package 4 (WP4) aims at demonstrating the technical solutions for large aircraft application, both on ground test rigs and flight test aircraft.

Due to the recent improvement in power electronics, the More Electrical Aircraft has been identified as a promising concept to reduce the aircraft emissions. Airbus has developed a ground test rig (named PROVEN) to validate the concept of the more electrical aircraft and find the most relevant architectures. Ground tests for new electrical architectures will be performed in WP4 of SGO-ITD.

2. Scope of work for SGO-04-002

The aim of the Call for Proposal is to define additional hardware necessary for the project, and which will be proposed for manufacturing in a subsequent call, if proved relevant.

Previous R&T projects have shown that back-up hardware are necessary to limit test interupt and to keep the schedule, to embrase more solutions and approaches. This hardware would mitigate the risk on the project.

The proposed work will consist in designing equipment to be used on advanced aircraft electrical network. The foreseen equipments are:

- 2 starter generators between 100 kVA & 150kVA for advanced aircraft electrical network

- 1 flexible power electronics centre ensuring about 10 functions, such as engine starting, inverter, active rectifier, …

The applicant will have to deliver a definition dossier for the studied solutions. Each definition dossier has to provide equipment design, performances, justifications for key design choices and interfaces for further rig integration.

The applicant will have to demonstrate key technologies on real hardware and also show compliance of the proposed solutions with Airbus requirements. The applicant could use their current aircraft products, relevant prototype developped in other projects or specific demonstrators.

This CfP is as well an opportunity for companies not in CleanSky to develop their products with Airbus.

3. Type of work for SGO-04-002

The expected work will cover technology studies, specifications and designs. Manufacturing aspect will be covered by a later call.

Special skills, certification or equipment expected from the applicant

Company having experience in developing electrical systems for aeronautical application

5. Major Deliverables and schedule for SGO-04-002

Deliverable	Title	Description (if applicable)	Due date
D1	Preliminary design review for the proposed solutions	- Technology selection - Preliminary definition, main performances	30.09.2010
D2	Starter generators between 100 kVA & 150kVA for advanced electrical network	- Definition dossier - Relevant partial demonstrators	31.03.2011
D3	Flexible power electronics centre ensuring about 10 functions, such as engine starting, inverter, active rectifier, …	- Definition dossier - Relevant partial demonstrators	31.03.2011

Topic value (€)

The total anticipated eligible cost of the proposal including manpower, travel costs, consumables, equipment, other direct costs, indirect costs, and subcontracting shall not exceed:

1,000,000.-- € (VAT not applicable)

[one million euro]

Awards between 50% and 75% of this value may be made by the Clean Sky Joint Undertaking.

Remarks

For reference/

Link to MOET project
http://www.eurtd.com/moet/

The Wing icing protection system is optional (to be decided by applicant and topic manager at negotiation).

Clean Sky - Technology Evaluator

Identification	ITD - AREA - TOPIC	topics
JTI-CS-TEV	Clean Sky - Technology Evaluator	0

No topics from Technology Evaluator are included in this call.