



Call info day

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**Green Rotorcraft: 2012 workplan with topics
presentation**

Brussels, 20th January 2011

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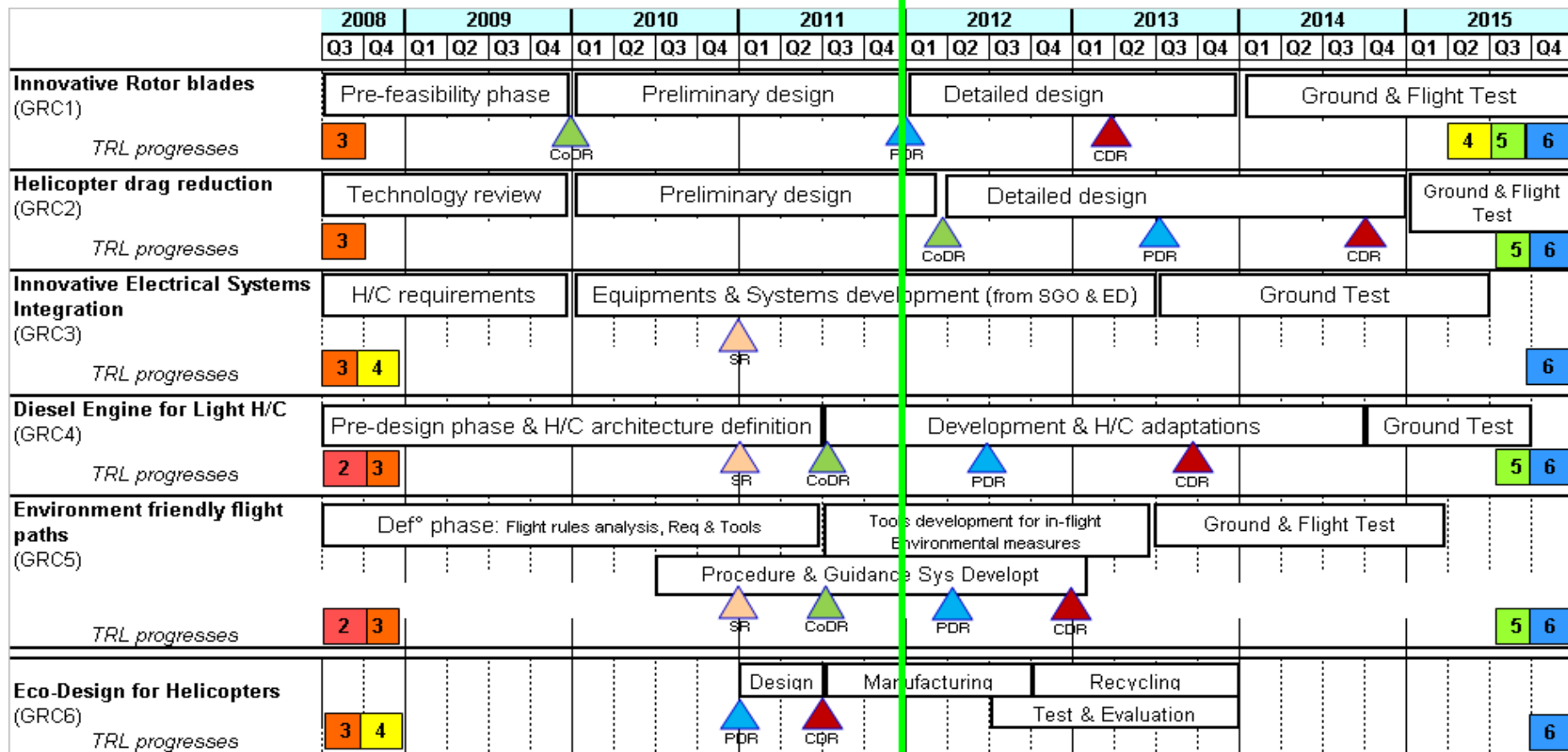
GRC: Detailed WPs



1. **Innovative Rotor Blades**
 - ▶ Active blade devices
 - ▶ Blade stall alleviation, profile drag reduction (tayloring of blade design)
2. **Drag reduction, required power reduction**
 - ▶ Passive and active flow controls for helicopter and tiltrotor components
 - ▶ Integration of MR pylon, hub, aft body, tail, turboshaft engine installation
3. **More electrical Helicopter**
 - ▶ Elimination of noxious hydraulic fluid; optimised on-board energy ; weight reduction
4. **Lean powerplant**
 - ▶ installation of a Diesel engine on a light single HC for low CO2 emission
5. **Environment-Friendly Flight Path**
 - ▶ Noise abatement with optimized flight procedures in VFR & IFR including ATM constraints
 - ▶ Fuel consumption and pollutant emissions reduction through a mission profile optimization
6. **EcoDesign**
 - ▶ Participation to generic studies +demo on specific rotorcraft technologies & components
7. **Technical Evaluator**
 - ▶ Interfacing to the assessment of actual impact of selected technologies for rotorcraft



GRC-ITD Demonstration schedule



Topic lists planned in 2012

Topic Description		Anticipated Duration (months)	Latest starting date to match program target	BUDGET (K€) and Target		
ID or N°	Title			12.1	12.2	12.3
GRC1 - 1	Design of scaled systems representing the GRC1 technologies to be tested at wind tunnel facilities	30	July 12		591	
GRC1 - 2	Develop and manufacture moulds for active model rotor blades	18	July 12	400		
GRC1 - 3	Passive model rotor manufacturing and testing – to be replaced by CfP in support of full scale activities	36	Jan 13		710	
GRC1 - 4	Design and manufacture power supply for full scale active blade	36	Jan 13		250	
GRC1 - 5	Design and manufacture data transfer system for full scale active blade	36	Jan 13		215	
GRC2 - 1	Manufacturing, CFD analysis and WT tests for common platform	36	Sept 12		700	
GRC2 - 2	CFD analysis and WT tests for tilt rotor fuselage	24	Jan 13			600
GRC3 - 1	HPAS Adaptation Kit	12	Aug 12		100	
GRC3 - 2	HEMAS Adaptation Kit	12	Aug 12		1000	
GRC3 - 3	Energy Recovery Adaptation Kit	12	Aug 12		650	
GRC3 - 4	Development and delivery of EMA for a light Helicopter	18	Sept 12	650		
GRC5 - 1	Sensoring and cockpit monitoring to reduce noise in maneuvering flight	24	Sept. 12		1200	
GRC5 - 2	Curved SBAS guided helicopter approaches for low noise landing - Safety & ATM compatibility	24	Sept. 12	400		
GRC6 - 1	Recycling of Metallic Materials from Rotorcraft Transmissions	18	Sept 12	200		
GRC6 - 2	Disassembly of eco-designed helicopter demonstrators	18	Sept 12	200		
	Sub Total			1850	4966	600
	TOTAL Budget					7416



List of topics

❖ 4 topics split as follows:

GRC1: Innovative Rotor Blades

✓ *Mould design and manufacture for the production of a very high tolerance model helicopter blade* 400 k€

GRC3: Integration of innovative electrical systems

✓ *Development and delivery of Electromechanical Actuator for a light H/C* 650 k€

GRC6: Eco Design for Rotorcraft

✓ *Recycling of Metallic Materials from Rotorcraft Transmissions* 200k€

✓ *Disassembly of eco-designed helicopter demonstrators* 200 k€



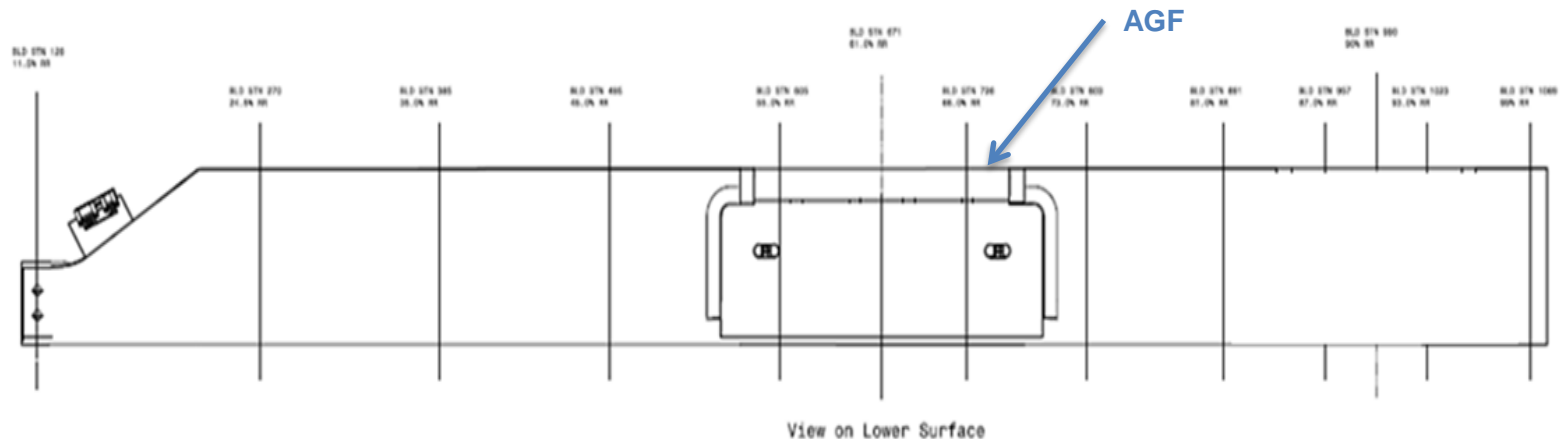


GRC1

**Mould design and manufacture for the
production of a very high tolerance
model helicopter blade**

Background

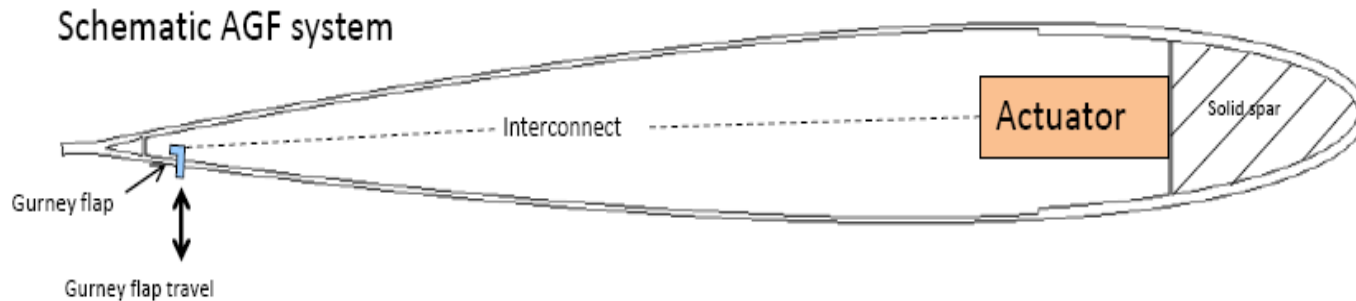
The design and production of high tolerance moulds for a scaled composite helicopter blade with active gurney flap (AGF) for whirl tower testing



number of blades	4
blade radius	1.1 m
blade chord	90 mm
blade twist (centre line to tip)	8°
1 st aerofoil section radius	0.231 m
aerofoil profile – full span	NACA0012
tip planform	Rectangular
direction of rotation	CCW top view

Table 1. Model rotor configuration

Background



Possible AGF geometric layout

Challenge is:

- ❖ to meet strict dimensional tolerances ($< \pm 0.1\text{mm}$) on aerodynamic profile, and
- ❖ to meet strict requirements on mass distribution between each blade produced ($< \pm 3\%$ mass variation).

Details

- ❖ Comparison of two manufacturing methods using standard aerospace-grade composite materials
- ❖ Design and production of at least two moulds (and necessary tooling) for:
 - **Prepreg version**
 - **Resin transfer moulding version**
- ❖ In addition, other ideas eg SQRTM, are welcome!
- ❖ It is not expected that the blades will be made in a one shot process due to complexity of electrical connections required
- ❖ Up to 10 sets of rotor blades for each version must be made, therefore moulds must be durable.
- ❖ AGF will be fitted after moulding process and therefore require a (partially) hollow structure and an access route.



Scope

- ❖ Design of tooling and mould sets including:
 - **method for opening and closing of moulds**
 - **method for heating and cooling of moulds**
 - **design of preform tooling**
 - **integration of temperature sensors for cure monitoring**
 - **feedback to rotor blade design to improve manufacturability**

- ❖ Manufacturing and delivery of tooling and mould sets

- ❖ Process testing/shape monitoring to validate functionality of mould and requirements on model blade will be met

- ❖ The manufacture of 1 prototype per manufacturing process as proof of mould functionality

- ❖ Reporting of routes for industrialisation and manufacturing of full-scale rotor blade

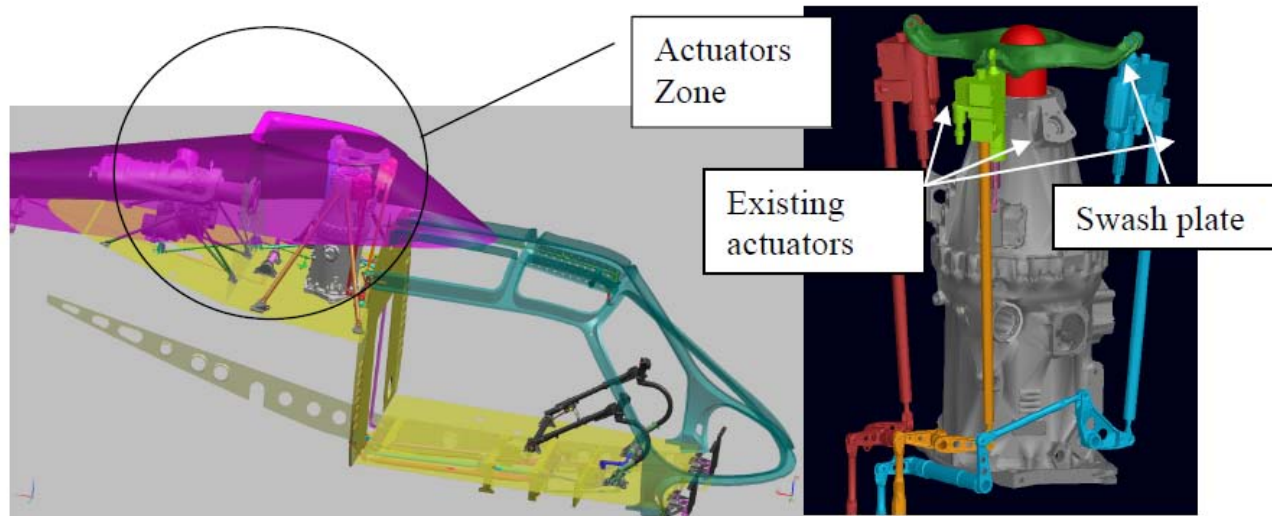
- ❖ Assist in technology transfer to the consortium member such that they may manufacture the blades themselves



GRC3

**Development and delivery of
Electromechanical Actuator for a light H/C**

- ❖ Sub-Project: GRC3 Integration of innovative electrical systems
- ❖ Topic objectives: Develop and design the electromechanical actuator (EMA) with mechanical feed-back system
- ❖ Main features: The EMA will use the existing interfaces and attachments and it will replace the hydraulic actuators located on the main gearbox.



Main features

❖ **Goals: Prototyping and delivery of Electromechanical Actuator for a light H/C**

❖ **Inputs: Requirements including helicopter data**

❖ **Work Plan:**

T0: May 2012

T0+6 months EMA development (PDR) and first mock-up delivery

T0+10 months Final design of EMA (CDR)

T0+14 months Laboratory test results

T0+18 months Delivery of three prototypes

❖ **Topic Value: 650 000 €**



Competencies sought

- Good skill of EMA design
- Knowledge about the EMA application on the aircraft.
- Catia v.5 or NX6 abilities
- Good knowledge in EMA software application (programming)
- Good know-how on the EMA integration on the aircraft flight control system
- EMA manufacturing abilities
- Electromechanical test facilities
- Knowledge of the Civil Certification Rules and Certification activity



GRC6

Recycling of Metallic Materials from Rotorcraft Transmissions

BACKGROUND

Helicopter power transmissions are critical to the operation of the aircraft and consist of a number of gear boxes which transmit power from the engines to the rotors via a series of shafts.

Transmission systems are primarily manufactured from metal alloys, high specification steel gears and casings of aluminium or magnesium alloys.

Performance of parts is enhanced by the use of various surface treatments including carburising or nitriding of steel working surfaces, hard metal plating (generally chromium or nickel), sprayed ceramic coatings and also polymeric coatings of various types.

Transmission components have a finite life after which they must be withdrawn from service and disposed of.

RECYCLING

Out of life components cannot be returned to service and must therefore be returned to the raw material market.

The method for this must be;

- energy efficient

- generate a minimum of environmentally sensitive waste product

- be capable of removing surface treatments cleanly with the minimum of waste product.

- produce recycled materials of a quality acceptable for reuse by the general market without build up of contaminant elements.

- avoid the use or generation of substances listed in REACH candidate lists



SCOPE OF WORK

The aim of this proposal is apply modern recycling methods to aerospace materials and processes commonly found in helicopter gearboxes in a cost effective and environmentally sensitive manner.

GRC 6 partners will provide details of demonstrator components and assemblies and also trial components as appropriate.

The partner/consortium shall;

Apply recycling methods to the demonstrators of each ITD manager and provide detailed analysis.

Provide expert knowledge of recycling, have access to facilities to apply this knowledge and have the ability to measure the cost and efficiency of the processes selected.

TIMESCALES AND DELIVERABLES

Deliverable	Description	Due Date
D1	Survey of gearbox components and suitability for recycling methods.	To +3 Months
D2	Detailed description of the dismantling methodology with several steps : 1 - Separate the different parts 2 - Remove the surface treatment 3 - Recycling the materials (with minimized energy consumption)	To +6 Months
D3	Application of the dismantling methodology	To +9 Months
D4	Evaluate the cost-effectiveness (operation cost and re-use percentage)	To +12 Months

Topic Value to be **€200,000**



GRC6

Disassembly of eco-designed helicopter demonstrators

Background

The current design of structural airframe parts in thermoset based composites makes it difficult to disassemble components in an ecological manner. Many parts are simply scrapped or burnt. To prolong the life of a rotorcraft airframe, it is for example, desired that specific components can be reused after disassembly.

Proposed solution

Thermoplastic composites offer many ecological advantages over thermoset based composites, such as recyclability, longer storage life, fewer additives, etc. Therefore within GRC6, rotorcraft airframe parts made out of thermoplastic composites are being demonstrated.

In addition, by using thermoplastic composites for structural components a new ecological way of disassembly can be made feasible by localised melting and (re-)joining.

Goal

Hence, the goal of this Call is to investigate and evaluate different technology concepts for separation of thermoplastic composite demonstrator components, such that they can thereafter be recycled or reused

Scope

Scope of work:

The applicant is responsible for the following tasks:

- Collect and assess possible component separation technologies and scenarios for particular helicopter structures based on thermoplastic composite materials and junctions, leading to preferred scenarios.
- Investigate the quality of the separated components, to assess the component and waste quality, such that input for a 'waste' or 'second-hand component' catalogue can be made available.
- Investigate the design influence on the solutions for component separation, and provide design recommendations.
- Demonstrate and define with the cooperating companies a component separation plan and carry out demonstration activities for the most meaningful separation processes (demonstrator parts will partly be provided by industrial partner)
- Collect and provide input for the Life Cycle Assessment tool.

Requested skills

Special skills, certification or equipment expected from the applicant

To fulfil the scope of this Call, the applicant (single organisation or a consortium) shall include research laboratories, institutes and/ or companies having the following facilities and knowledge:

- Strong knowledge on aerospace materials (CFRP with thermoplastic as well as thermoset matrices)
- Extensive experience and capabilities for joining and disassembly of thermoplastic composite components and their joints.
- Experience and capabilities for collecting data that serve as input for a life cycle assessment tool

Total Budget: 200.000 €

Duration: 18 months

Summary

Goal:

- Disassembly: separation of structural thermoplastic composite airframe components
 - Extraction of thermoplastic composite parts
 - Presentation of possible end-of-life scenarios, including the proposed disassembly technology

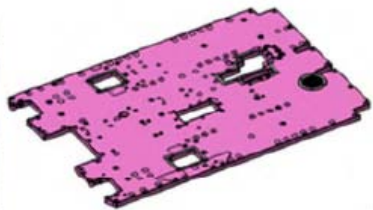
Steps:

- Investigations and demonstration of technologies for disassembly
- Verifying environmental aspects, cost analysis
- Supply of quantitative input for LCA

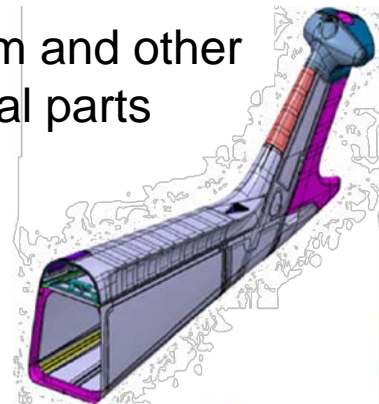
Applications:



Door and floor section



Tailboom and other structural parts



Contact us

For further information:

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