AIP 2012 – Technical description

Green Rotorcraft ITD

In the six technology areas, the activities will progress further in 2012 with manufacturing and testing of components aiming to prepare the final integration and demonstration.

GRC1 – Innovative rotor blades

Component tests relevant to the blade active twist technology will be completed beginning of 2012. According to results, the design of the full scale active blade will be confirmed and manufacturing of the test article will start, along with preparation of the ground testing apparatus.

The optimisation of 3D blade shape (passive full scale rotor) will continue using advanced numerical tools. Following the PDR, the detailed design process, including definition of the manufacturing process and tooling such as moulds will be conducted.

The design of the wind tunnel model incorporating Active Gurney Flaps will be nearly completed in 2012 with the CDR planned early in the following year. The development of full scale rotor equipped with AGF will progress in parallel, with the design of the actuation device, of power transfer, of the control system and of modified blades.

A new call topic will be opened during the year 2012, concerning design and manufacturing of full scale 3D-optimed rotor for whirl tower testing.

GRC2 – Drag reduction of airframe and non lifting rotating systems

Concerning the rotor head drag reduction, wind tunnel tests of the helicopter baseline configurations including fuselage cabin, landing skids, or sponsons, and rotor head, will be completed. The aerodynamic characteristics of the light, medium and heavy class helicopters will be measured in wind tunnel. Moreover the aerodynamic and structural design of a new full scale hub cap for light helicopter will be completed. In the next years manufacturing and flight testing of these new hub cap designs will conducted to assess its benefit in flight.

Concerning the reduction of airframe drag, especially for blunt aft bodies and for the tail, improved aerodynamic design of the common helicopter platform and of the ERICA tilt-rotor will be conducted, incorporating passive and/or active flow control systems. This work will include trade-off studies addressing cost, weight and performance in a consistent industrial approach. Specific wind tunnel tests will be performed about a simplified blunt fuselage cabin model featuring synthetic/and pulsed jet flow control systems in the aft body region. This technology reached in 2011 TRL3 and shall mature in the following two years till TR4. Finally a remotely controlled horizontal stabiliser for the wind tunnel model of the helicopter common platform will be manufactured, together with the remote control system.

As far as turbo shaft engine installation is concerned, the aerodynamic and noise propagation analysis about new side air intakes integrations will continue for light and heavy helicopters. The new nacelle configuration, as obtained in the analytical optimization activity, will be designed for the ERICA tilt rotor model, while a study for evaluation of emission, engine performance and noise will be accomplished. Finally, detailed design studies including global trade-off for cost, weight and performance will start on a light helicopter paving the way for wind tunnel and flight demonstrations to be performed in the next years.

Two new call topics concerning the final wind tunnel test campaigns about an optimised common helicopter platform and an optimised ERICA tilt rotor concepts will be launched in 2012.

In this period GRC2 will continue supporting GRC7 in defining the aerodynamic characteristics of fuselage and empennage of the various helicopter models of the three selected fleets: the 2000 baseline, the 2020+ reference and the 2020+CS conceptual one.

GRC3 – Integration of Innovative Electrical Systems

The preliminary design studies will be completed for the brushless 28V starter-generator and power converters and the rapid energy storage device and the rotor braking system and for the electrical tail rotor drive.

Detailed design studies will be completed for the thermal energy recovery system and the actuators for flight control and for the landing gear, and for the piezo power supply.

The analysis and simulation and assessment of the integrated all-electrical helicopter architecture including the electrical network will will be developed taking into account intermediate results delivered as part of equipment development.

The new system EPGDS technology architecture will be defined integrating energy management and the CfP study applications.

Ongoing CfP programs will be supported in order to ensure the critical requirements, deliverables and milestones are met by the demonstration study team.. and that the technologies are applicable in the common architecture

Higher TRL CfP technology application options will be identified for specific product potential and initial design options developed.

Modelling tools will be established and initial models activities for the electrical system and components created.

Model based analysis of the current aircraft EPGDS and quantification of technology application advantage mechanisms and associated Ecolonomic benefits will be initiated.

Preparatory work for the integrated ground test demonstration will also continue throughout in 2012 with the design and realisation of equipment specific adaptation kits.

GRC4 – Integration of a Diesel engine on a light helicopter

The detailed design of the Diesel power pack for the flight demonstrator will be completed with the critical design review planned in April. Manufacturing and assembly the first power pack prototype will be conducted with delivery to take place end of the year in order to prepare its integration on the helicopter ground test article.
All modified helicopter parts and engine interfaces (airframe, transmission, controls, will be fully designed and manufactured in 2012 and be ready for integration on the ground test article by end of the year.
Concerning the optimised helicopter, the configuration will be frozen by mid 2012 and the detailed studies (cooling, vibration, control) will continue throughout the year.

GRC5 – Environment-friendly flight paths

The development of gas emission simulation tools including generation of experimental data will continue and be completed beginning of 2012. Using these tools, the numerical optimisation of flight profiles will be conducted and be completed by end of the year for conventional helicopter.

Concerning noise abatement, studies for feasibility of low level & narrow helicopter IFR routes will be completed beginning of 2012 (other mission segments completed in 2011). Similar studies for the tilt-rotor configuration will be performed throughout the year.

The development of on-board guidance systems will be completed beginning of 2012.

Flight test campaigns with several helicopters will start in 2012 aiming to validate the noise abatement and gas emission reduction obtained and the guidance systems for both for automatic and piloted flight.

GRC6 – Eco-Design for Rotorcraft Airframe

The design of demonstration articles (thermoplastic helicopter cabin door and structural parts, rotor transmission and mast, intermediate gear box) will continue and be fully completed in the first three months of 2012. Members and Partners will proceed with green manufacturing of the demonstration parts during 2012 and testing will start on some parts before end of 2012. The Life Cycle Analysis will be updated according to findings.

GRC7 – Interface with the Technology Evaluator

Conceptual rotorcraft models will be updated and refined according results recently obtained in the different GRC projects. TE impact studies will be supported by the GRC team. Fleet forecast and mission scenarii may be revised and trade-off studies conducted according the needs.

Main GRC deliverables:

a. For innovative blades (GRC1): active twist specimen tests; preliminary design of 3D optimised blade shape (PDR); design of major components for full scale rotor with active Gurney flaps (PDR);
b. For airframe drag reduction (GRC2): wind tunnel component tests completed (TRL4) concerning the optimised hub caps and the synthetic jet flow control system and the active empennage. Comprehensive analysis completed for air intakes and exhaust nozzles integration.
c. For on-board energy (GRC3): equipment design specifications at preliminary design or critical design levels, agreed between integrators and suppliers (TRL3).
d. For the Diesel-powered helicopter (GRC4): demonstrator engine critical design review (TRL 3); first power pack delivered for ground test article; frozen configuration and specification of the optimised helicopter.
e. For environment-friendly flight paths (GRC5): helicopter flight profiles optimised for low emission; low level/narrow IFR routes for noise abatement with feasibility assessed (TRL3); on-board flight management available; in-flight validation started.
f. For eco-design for rotorcraft airframe (GRC6): design of demonstration articles completed; parts manufactured (partially).
g. Concerning the GRC contribution to TE (GRC7): second annual release of rotorcraft software and data packages delivered to TE.

Estimated Budget 2012 per GAM beneficiaries

GRC Budget (Costs in Euro) Subproject	Total Members
0 - GRC ITD Management Package	894.146
1 - Innovative Rotor Blades	3.970.903
2 - Drag Reduction of Airframe and Non Lifting Rotating Systems	4.807.030
3 - Integration of Innovative Electrical Systems for Rotorcraft	3.061.552
4 - Installation of a Diesel Engine on a Light Helicopter	3.745.045
5 - Environmentally-Friendly Flight Paths	3.568.811
6 - Eco-Design Demonstrators for Rotorcraft	2.191.032
7 - Technology Evaluator for Rotorcraft	1.654.348
Total	23.892.868

Estimated CfP Budget 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 activitie	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		200	
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 meneuvering 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**