Annual Implementation Plan 2010

ITD Systems for Green Operations

Annex 1F

RECORD OF REVISIONS

Revisions	Date	Description
Issue 0	13/11/09	Creation of the document

Glossary

A/C	Aircraft
AEA	All Electrical Aircraft
ATRU	Auto Transformer Rectifier Unit
ATS	Air Transport System
ATU	Auto Transformer Unit
AW	AgustaWestland
BJ	Business Jet
CfP	Call for Proposal
CfP	Call for Proposal
CROR	Counter-Rotating Open Rotor engine
Ecg	Eurocopter Group
ED	Eco-Design ITD
FTI	Flight Tests Instrumentation
FTR	Flight Tests Request
G/T	Ground Test
GRA	Green Regional Aircraft ITD
GRC	Green Rotorcraft ITD
H/C	Helicopter
ITD	Integrated Technology Demonstration
ITD	Integrated Technology Demonstrator
IVV	Integration Validation Verification
L/G	Landing Gear
LN	Low Noise
LW	Low Weight
MTM	Mission and Trajectory Management
MTM	Management of Trajectories and Mission
NB	Nota Bene
OAD	? (in SFWA)
RRD	Rolls-Royce Deutschland
RRUK	Rolls-Royce UK
S/S	Sub-system ? (in ED)
SAGE	Sustainable and green Engine ITD
SFW	Smart Fixed Wing
SFWA	Smart Fixed Wing Aircraft ITD
SFWA	Smart Fixed Wing Aircraft

SGO	Systems for Green Operations ITD
SGO	Systems for Green Operations
SOG	Smart Operations on Ground
TBC	To Be Confirmed
TBD	To Be Defined
TE	Technology Evaluator
TRA	Technology Readiness Assessment
TRL	Technology Readiness Level
V&V	Validation & Verification
V&V	Validation and Verification
W/T	Wind-tunnel
WP	Work Package

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1 WP0 MANAGEMENT

This workpackage aims at managing the ITD SGO down to the low level of the organization.

This activity is co-chaired by Thales and Liebherr in 2010.

This activity is performed according to the management principles defined within the ITD and in place within Clean Sky.

2 WP1 DEFINITION OF AIRCRAFT SOLUTIONS AND EXPLOITATION STRATEGIES

2.1 WP1.1 - AIRCRAFT LEVEL TARGETS AND REQUIREMENT

2.1.1 WP1.1.1 LARGE AIRCRAFT

During this period, based on the results of previous projects, WP1.1 will set the framework by defining the working assumptions for cycle 1 as well as the baseline for comparison including aircraft data (type, size, configuration, propulsion, …) and operational scenarios (operational context in which the aircraft will operate).

For MTM and MAE, from both reference and working architectures previously defined, this work package will proceed to a down select a set of technical priorities for MAE and of promising functions for MTM to be further investigated. These priority items will be allocated with environmental targets as design objectives.

This work package will closely monitor the technological developments in WP2 and WP3 and consolidate the technological assessment at aircraft level in order to evaluate the environmental benefits of the developed solutions.

Eventually, based on the proposed architectures, a review of the current regulations will be performed in order to identify any hard point or showstopper from a certification standpoint. The likely evolution of these regulations will be surveyed to extrapolate the impact on the design of the solutions.

2.1.2 WP1.1.2 REGIONAL AIRCRAFT

The activities for the year 2010 will prosecute the ones carried out during the year 2009, mainly addressing the following points:

- Harmonization of the regional a/c systems reference architectures and requirements for MAE
- selection of technical priorities regarding MAE solutions

In 2010, the work will run on the comparison of the regional AEA Aircraft systems reference architectures from GRA to SGO technologies for MAE, in particular it will be taken care of the:

- Harmonization of the Regional A/C Electrical Power Generation and Distribution System (EPGDS) reference architecture and requirements from GRA to SGO technologies for MAE
- Harmonization of the Regional A/C Electrical Environmental Control System (E-ECS) reference architecture and requirements for MAE

2.2 WP1.2 – ASSESSMENT METHODS AND V&V STRATEGY

WP1.2 aims at defining for SGO ITD the overall V&V strategy for the solutions to be developed in this project. It also establishes the methodology and process for the management of the Technology Readiness Levels (TRLs).

The complete V&V plans for the products to be developed during cycle 1 will be delivered.

WP1.2 will initiate and update the overall TRL plan for the SGO ITD products. The way to manage the TRL process in SGO ITD will be updated after discussion with partners and the organisation of the first TRL reviews.

In 2010 Alenia work will contribute to the elaboration of recommendations for V&V strategy & master planning and will perform the Coordination of V&V activities across applications and with other ITDs, in particular with GRA ITD

2.3 WP 1.3 – CLEAN SKY-SESAR LIAISON OFFICE

SESAR and Clean Sky projects have as common objective to contribute, and develop solutions to reduce the impact of the air traffic on environment. In 2010, this work package will set-up synchronisation meetings with the relevant SESAR interface and the Clean Sky Technology Evaluator.

The objective of these meetings will be the validation of the assumptions taken on the Air Traffic Management constraints in a SESAR concept of operations for all flight phases AND to presents first results coming out SGO works to SESAR JU. This will ensure that the trajectory optimisations that will be worked out in WP3 are robust from an ATM perspective and to analyse with SESAR JU what could be refined in the existing CONOPS as far as it might be relevant.

3 WP2 MANAGEMENT OF AIRCRAFT ENERGY

In 2010, the work consists of the continuation of the work packages.

3.1 WP2.1 – METHODS AND TOOLS.

The ‘use cases’ and models which will be required have been defined in 2009. Through continuing workshops, this workpackage will begin to move into more details.

3.2 WP 2.2 – REQUIREMENTS.

This workpackage was cancelled, as it was too small to justify a Level 2 package. The work has been transferred in its entirety into WP 2.3.

3.3 WP 2.3 – TECHNOLOGY ADAPTATION.

This is the core of WP2. After a start on architectural work in 2009, the technologies required are being defined in more detail in these packages. The technological areas involved are:

WP 2.3.1 – Main and auxiliary energy generation

WP 2.3.2 – Electrical energy generation and conversion

WP 2.3.3 – Electrical energy transport

WP 2.3.4 – Environmental control, Ice Protection, Actuation

WP 2.3.5 – Electrical energy control

WP 2.3.6 – Thermal management

In order to assist these WP with the technologies required for these systems, a number of Calls for Proposal have been planned to be launched from this WP. Much of the progress of these packages will depend on the success of the Partner work coming from the first Call for Proposals in 2009.

3.4 WP 2.4 – APPLICATIONS AND ARCHITECTURES

Participants from WP 2.3 will continue to meet together with the aircraft manufacturers to determine the shape of future aircraft system architectures. The documentation of these is currently delayed to end-2009, so the work in 2010 will also be delayed by about three months.

4 WP3 MANAGEMENT OF TRAJECTORY AND MISSION

For the period from January to December 2010, the work consists in :

- the continuation of the work packages 3.1 to 3.4 and 3.7
- the initiation of the work packages 3.5 and 3.6

4.1 WP3.1 – MODELS AND TOOLS

During this period, the work will focus on:

- Adaptation, development and validation of all models for GATAC optimisation framework for Cycle 1
- Development of off-line post processing numerical models emissions and noise to be used in the assessment of environmental performance for the various demonstrations in work package 3. This include development of models by partners selected through Call for Proposals in 2009.
- Development and validation of simulation models to be included in real time flight simulators and
- Initiation of development/adaptation of reduced complexity numerical models of emissions for use in conjunction with on-board real time optimization algorithms.

The analysis of the various main airlines business models will be concluded in order to extract features which could be used to balance environmental performance against standard operational / business considerations. The same kind of analysis will then be initiated for regional and bizjet aircraft operators.

4.2 WP3.2 – THEORETICAL TRANSVERSAL OPTIMISATION AND TRAJECTORY DEFINITION

WP 3.2.1 (Development of the transversal optimisation framework) will continue its work with:

- Evaluate GATAC V1
- Development and Validation of GATAC tool v2 benefiting from an increased portfolio of models. Care will be taken to include in this development the lessons learnt and user feedback from the previous GATAC Version.

WP 3.2.2 (Optimum trajectory design) will be performed for Cycle 1. Activities will consist in:

- Taking existing and identified future ATM constraints to produce typical missions
- Using the GATAC v1, then V2 tool to compute theoretical trajectories between city pairs which are optimal with regard to chemical emissions and perceived noise reduction

In WP3.2.3 (ATM operation context), the synthesis of SESAR context and constraint, delivered in 2009, will be used to model this ATM context for future use in GATAC.

Additionally, an update of the SESAR Conops analysis will be provided, based on the progress from SESAR side, as well as exchanges between SESAR and Cleansky in the frame of SGO/WP1.3.

4.3 WP 3.3 – TECHNOLOGY STUDIES & CONCEPT VALIDATION

For WP 3.3.1 (Technology studies), the activities for 2010 are as follows :

- Thales will pursue the assessment and development of basic algorithms for green FMS functions to be integrated in the frame of large and regional aircrafts. TRL3 gate for the first function will be assessed.
- Saab will develop its high performance trajectory optimisation systems and assess the TRL3 maturity by year end
- GSAF and the DLR will work together on the development of their solutions for flight management algorithms through so called Multi Parameter guidance, using the optimal trajectories determined in WP3.2,
- Galileo Avionica will work on the initial specification and architecture of the quasi artificial intelligence agent to provide decision aids to the flight crew. On the advanced weather radar processing capabilities to allow a smarter avoidance of weather hazards, the work will consist in producing a preliminary study of the weather modelling based on synthetic data.

WP3.3.2 will be kicked-off in the first half of the year, to prepare further development of the Multi-Parameter Guidance technology, from the TRL3 reached in WP3.3.1.

4.4 WP3.4 – LARGE AIRCRAFT APPLICATIONS

WP 3.4 dedicated to Large Aircraft Applications continue activities in the following themes :

- Finalization of specification of first green function for large aircraft (in line with TRL 3 target for the associated technology), with a preliminary estimation of benefits
- Analysis of the impact on aircraft level architecture for the first green function (in particular, ground and onboard segment function allocation)
- Analysis of airlines acceptability from an operational standpoint
- Flight crew acceptance of operations concept and cockpit interfaces impacts through man machine interface simulations on Airbus and Thales research simulators (Airlab)

4.5 WP3.5 – REGIONAL AIRCRAFT APPLICATIONS

WP3.5 deal with Regional a/c applications. In this WP regional a/c peculiarities will be addressed. GATAC tool, developed for trajectory optimization, will be tested (with generic a/c models) and used (with regional a/c models) for trajectory definition.

The major 2010 objective is to adapt GATAC tool for regional purposes. This objective will be supported by the following activities :

T3.5.1 - Regional aircraft adaptation

- Integration of regional a/c models in GATAC tool;
- Testing activity with GATAC including generic models as support to tool development
- Testing activity with GATAC including regional a/c models

T3.5.2 - Regional optimized trajectories

- GATAC test results analysis
- Regional optimized trajectory definition

It should be noted that in 2010 these activities will be performed mainly using GATAC version 1, while in 2011 will be carried on with GATAC following release.

WP3.6 – GREEN TRAJECTORIES AND MISSION DEVELOPMENT

WP 3.6 (Green trajectories and mission development) will be kicked off. Thales will start specification of an architecture mock-up for large aircraft and begin developing a prototype FMS with the algorithms studied in technology studies, in order to bring them in subsequent years at a TRL 5/6. This will be started mainly with initial architecture impact analyses.

Diehl Aerospace will concentrate on assessment of the needed display hardware components for the platform.

4.6 WP 3.7 – SMART OPERATIONS ON GROUND

This work package will provide innovative solutions for Green A/C Operation on Ground:

- Autonomous taxi on ground without the use of main engines
- Low noise emission brake cooling fan

Selected solutions will be validated and tested in order to assess their maturity.

Environmental impacts due to integration of such innovative solutions within airports structure will be also assessed.

Within the WP, the following tasks will be in 2010:

T 3.7.1 : SOG Method, Models & Tools

T 3.7.2 : SOG Requirements & architecture

T 3.7.3 : Technologies for Smart Operation on Ground

T 3.7.6 : SOG Results & Reporting

During year 2010, WP 3.7.1 (SOG Method, Models & Tools) is aimed at:

- Developing an integrated Multi Physic simulation tool for concurrent work based on MODELICA language
- Modeling airport infrastructures thanks to an environmental assessment tool, defining operational scenarios and identifying baseline environmental impacts of the airport

During year 2010, WP 3.7.2 (SOG Requirements & Architecture) is aimed at:

- Issuing the SOG final specification document based on functional analysis results

- Achieving trade-off on On-Board solution architecture
- Starting V&V activities by issuing :
  - Specifications of system components
  - Specifications of test means
- Achieving Assessment on Safety, Maintainability and Certification issues

During year 2010, WP 3.7.3 (Technologies for SOG) is aimed at:

- Progressing on Electro-mechanical drive motion technology
- Progressing on low Noise Brake cooling Fan (modeling and architecture definition)
- Starting Work on Energy recycling and storage
- Progressing on Autonomous motion precision control & monitoring

During year 2010, WP 3.7.6 (SOG Result & Reporting) is aimed at:

- Following the Systems/Equipments/Tools maturity

TRL3 Gate will be assessed by the last quarter of 2010

5 WP 4: LARGE SCALE DEMONSTRATION FOR LARGE AIRCRAFT APPLICATION

5.1 WP 4.1 – LARGE SCALE DEMONSTRATION MANAGEMENT AND SYNCHRONISATION

The objective is to plan, coordinate, monitor and assess all the large-scale ground and flight demonstration activities to be performed in WP4.2 and WP4.3 along the V&V plans for large AC applications.

In 2010, this work package will derive the ground and flight test requirements from the overall strategy and schedule of demonstration activities for the first large aircraft demonstration campaigns of the SGO ITD.

5.2 WP 4.2 – INTEGRATED ENERGY LARGE SCALE GROUND DEMONSTRATION

The objective of this work package is to prepare and execute large-scale ground demonstration activities for Management of Aircraft Energy.

In 2010, the activity will consist in the analysis of the validation & verification plans in order to elaborate the detailed requirements for tests and the definition of the relevant ground test means for the demonstration of equipment and systems delivered from WP2 in a representative architecture for large aircraft.

It will also initiate a virtual rig for integrating and testing models of energy systems.

5.3 WP4.3 INTEGRATED MISSION LARGE SCALE GROUND DEMONSTRATION

This work package aims at setting up and adapting the ground test means for cockpit operations in order to demonstrate new functions to optimise trajectories with regard to environmental impact. The activity will mainly consist in analysing the requirements for V&V in order to define the relevant ground test means to validate the technical solutions developed in WP3.

In 2010, this work package will focus on the validation of the operation concepts for the first green functions.

5.4 WP4.4 FLIGHT TESTS

The activity in WP4.4 will mainly consist in preparing the installation in an aircraft and the flight tests of the technologies developed in SGO ITD.

6 WP5 AIRCRAFT LEVEL ASSESSMENT AND EXPLOITATION

The activity will be kicked of at the end of 2010 in order to start working efficiently on the assessment early 2011 once having the 1st concrete outcomes from WP2 and WP3.