Clean Sky programme

Systems for Green Operations ITD overview

Ruud DEN BOER,

Project Officer ***SGO***

CLEAN SKY Info Day
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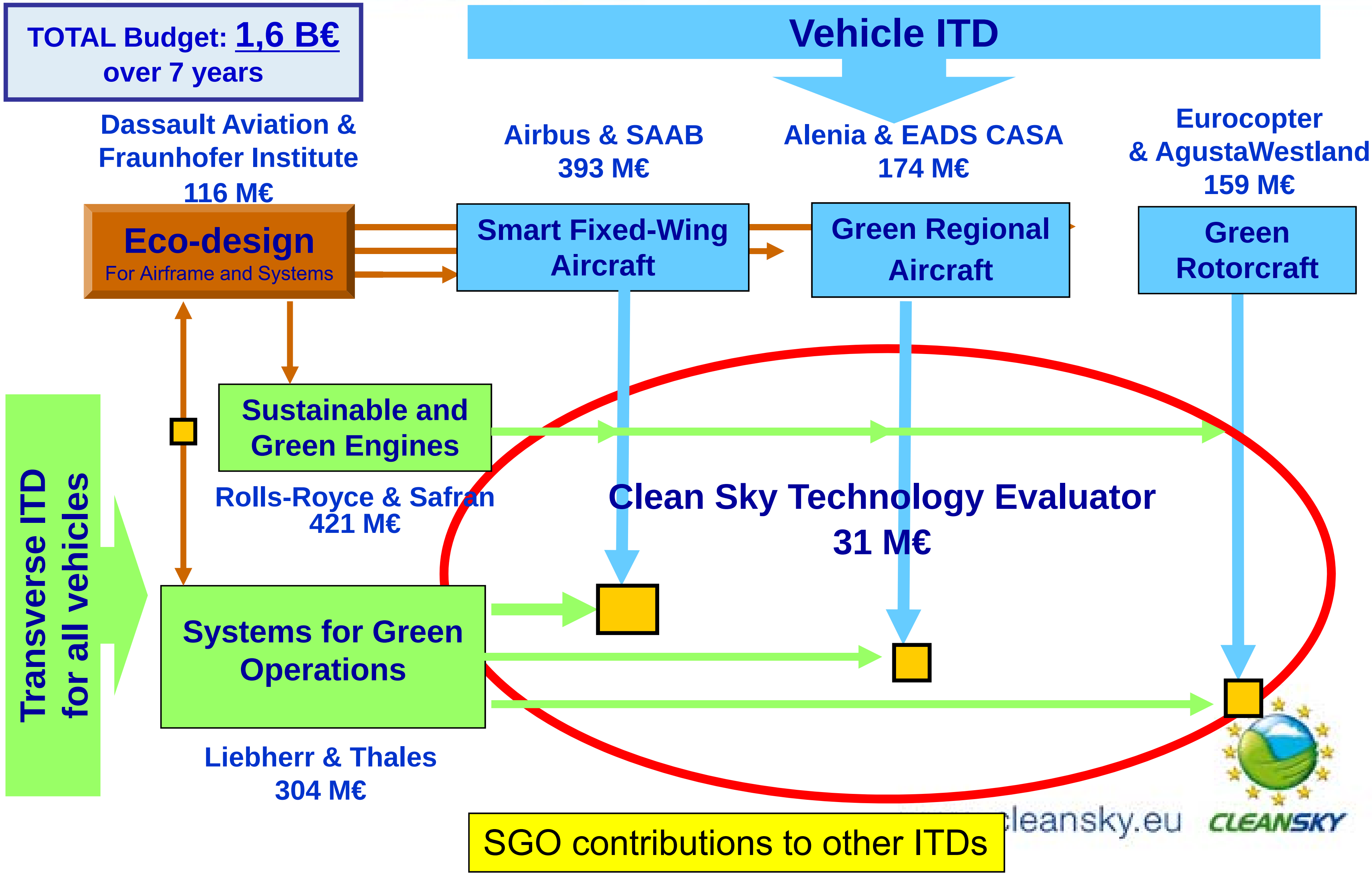
Outline

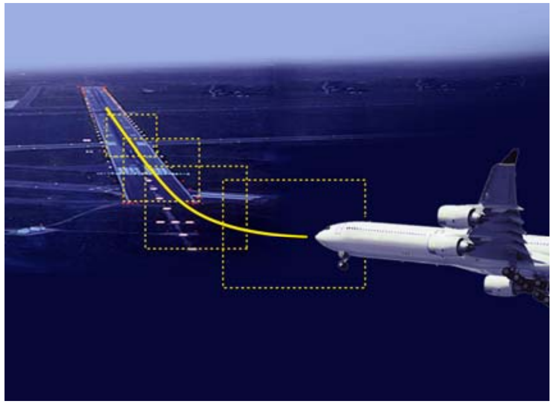
- SGO at a glance
- Management of Aircraft Energy
- Management of the Trajectory and Mission
- CfP Call 10

Clean Sky: An integrated and comprehensive approach



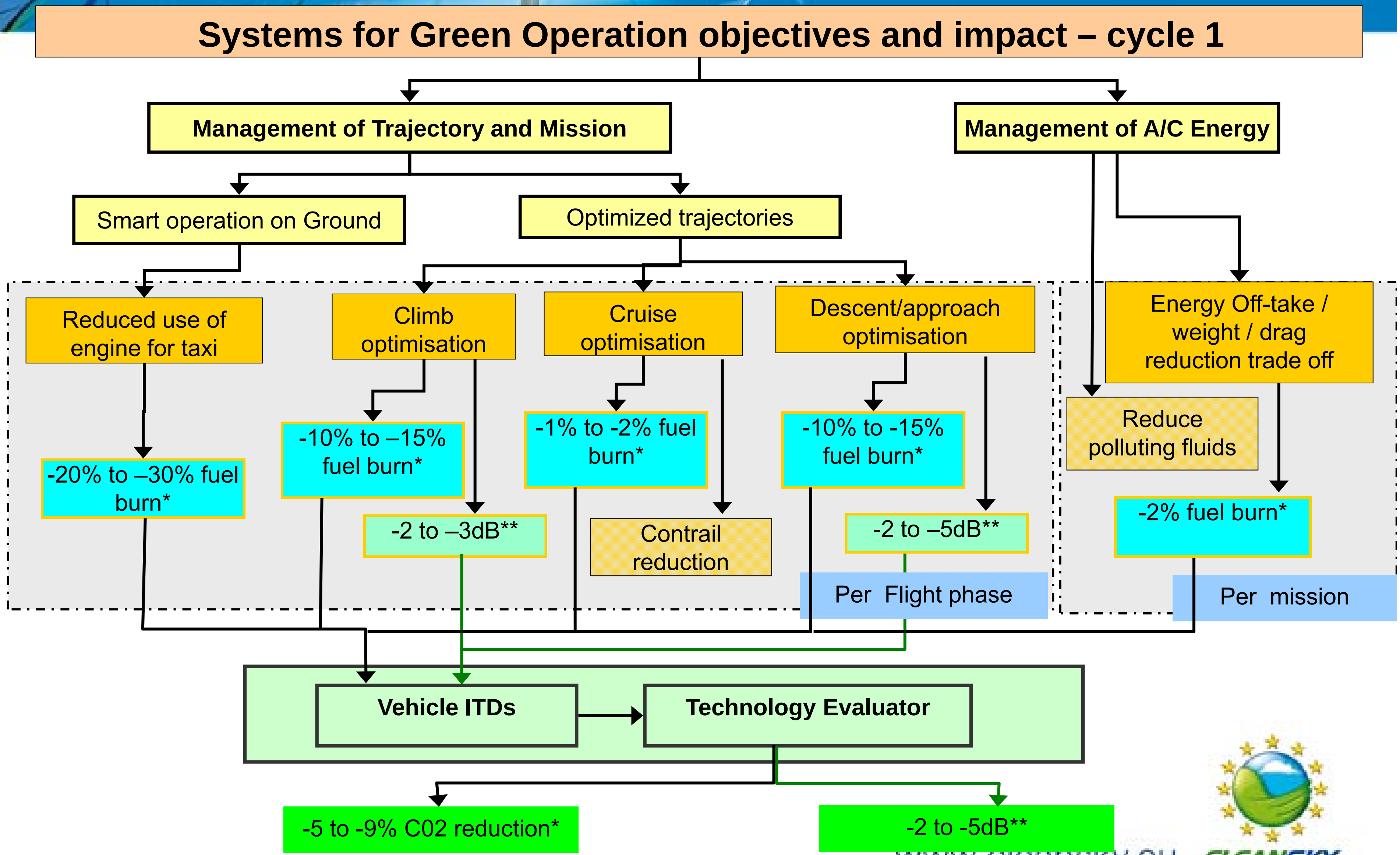
Systems for Green Operation: the concepts

- **Pillar 1: Management of Aircraft Energy (MAE)**
  - The use of **all-electric equipment system architectures** will allow a more fuel-efficient use of secondary power, from electrical generation and distribution to electrical aircraft systems.
  - **Thermal management** will address many levels, particularly relating to electric aircraft, from hot spots in large power electronics to motor drive system cooling, to overall aircraft solutions.



- **Pillar 2: Management of Trajectory and Mission (MTM)**
  - The **silent and agile aircraft** will generate a reduced noise footprint during approach, both through design changes in aircraft systems which generate a large amount of noise and by flying optimised trajectories.
  - Aircraft will be able to fly a **green mission** from start to finish, thanks to technologies which allow to avoid fuel consuming meteorological hazards and to adapt flight path to known local conditions

SGO Environemental Objectives



* Values computed at aircraft level

** Single measurement points values – computed at aircraft level

ITD SGO: Participants and Global Shares

304M€ Total Budget

ITD-leaders	*Associate Partners*
Airbus	**Diehl Aerospace**
Alenia	**DLR**
Fraunhofer	**EADS-IW**
Liebherr ***(co-Leader)***	**Galileo-Avionica**
Rolls – Royce	**GSAF** (***cluster: UoC, NLR, Aeronamic, TU Delft, UoM***)
Saab	**University of Nottingham**
Safran	**Zodiac-intertechnique**
Thales ***(co-Leader)***	

Main Stakeholders of the domain present in the ITD SGO:

- **Airframers**
- **Innovative European research centers**
- **Systems suppliers**

15 members represented by 35 legal entities

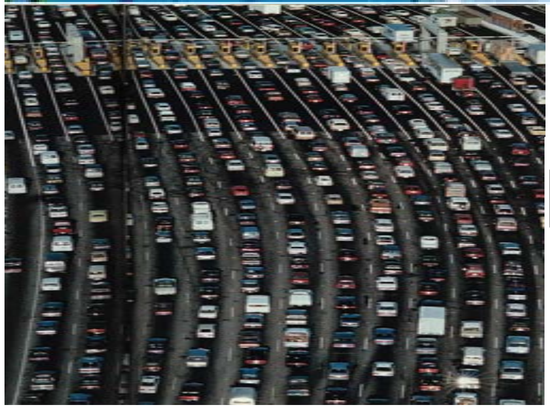
SGO partners

To date

- Von Karman institute
- Université libre de Bruxelles
- LMS
- SONACA
- GKN Industries
- Aerotex
- Fatronik
- Envisa
- U of Manchester
- Atmosphere
- U du Pirée
- Open Airlines
- Politecnico di Torino
- GTD
- Goodrich
- Aeroconseil
- Eaton
- Skysoft

- … many more to come !

Clean Sky – SESAR: close together…



Both are needed for the future of air transport

SESAR works primarily on traffic efficiency,

CLEANSKY on "cars" improvement.

Management of Aircraft Energy (MAE)

Why a More Electrical Aircraft (MEA)?

From POA (2002 -2005) and MOET (2006-2009)…

… to CLEAN SKY

- **Promising results:**
  - ✓ **Energy Efficiency improved**
  - ✓ **Environmental issues tackled**

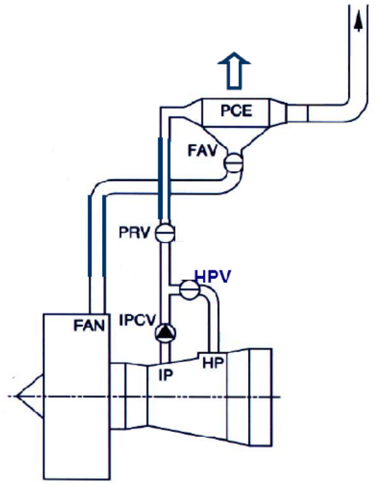
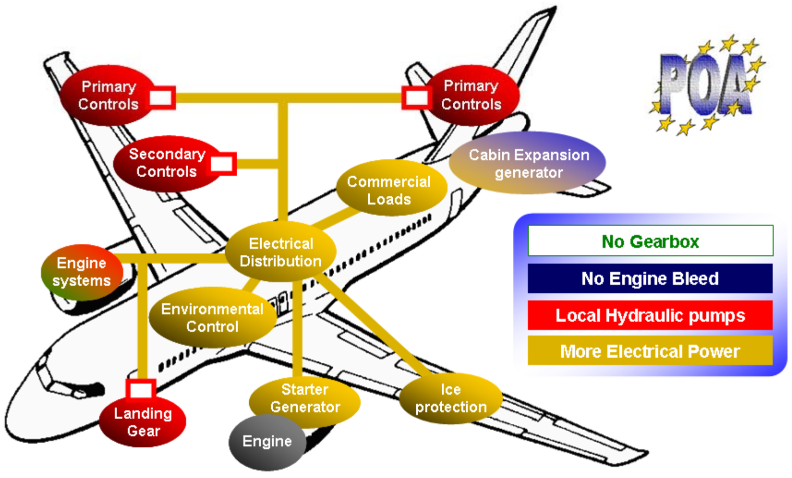


Fig 5: Typical engine bleed air system



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More Electric Technology Contributes to Fuel Savings

Function	777-200	787-8
Engine Start	Pneumatic	Electric
Cabin pressure & Heat	Pneumatic	Electric
Wing De-icing	Pneumatic	Electric
High Demand Hydraulic Power	Pneumatic	Electric
Hydraulic Pressure	3000 psi	5000 psi
Braking	Hydraulic	Electric
Flight Control Power	Hydraulic	Hydraulic & Electric
In-Flight Entertainment systems	Cable bundles to Seats	Wireless
Load Alleviation	None	Wing Horizontal Tail Vertical Tail

Net Results: ~3% fuel saving

Source: Boeing Commercial Aircraft

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Management of Aircraft Energy: Key objectives in Clean Sky

Management of Aircraft Energy (MAE) encompasses all aspects of on-board energy provision, storage, distribution and consumption

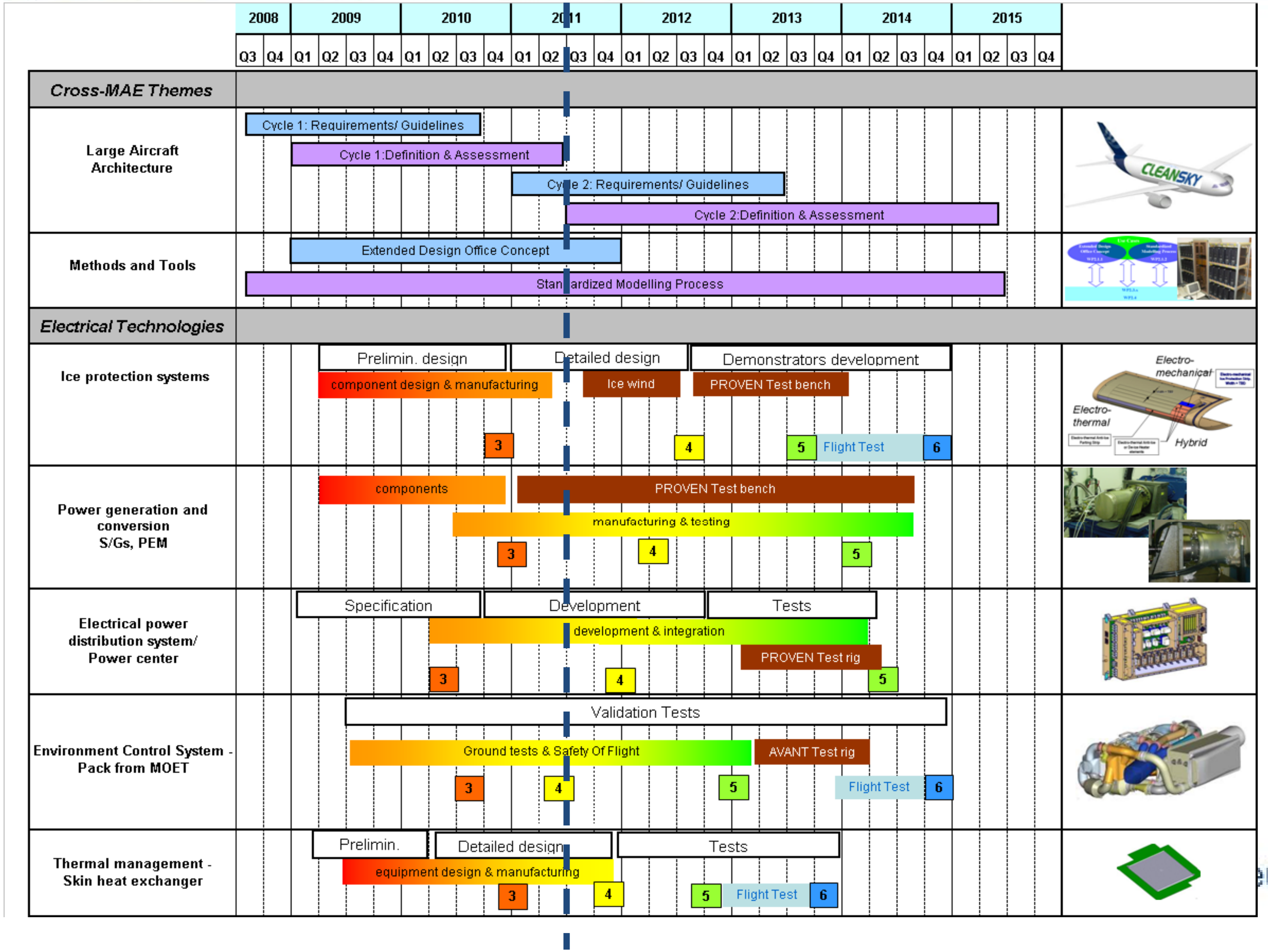
❖ **Study & design of all-electrical system architectures/ systems and equipment featuring:**

- ✓ No-bleed systems architecture
- ✓ Removal of Hydraulic fluids and sources
- ✓ Further system integration or down-sizing large equipments
- ✓ Weight reduction

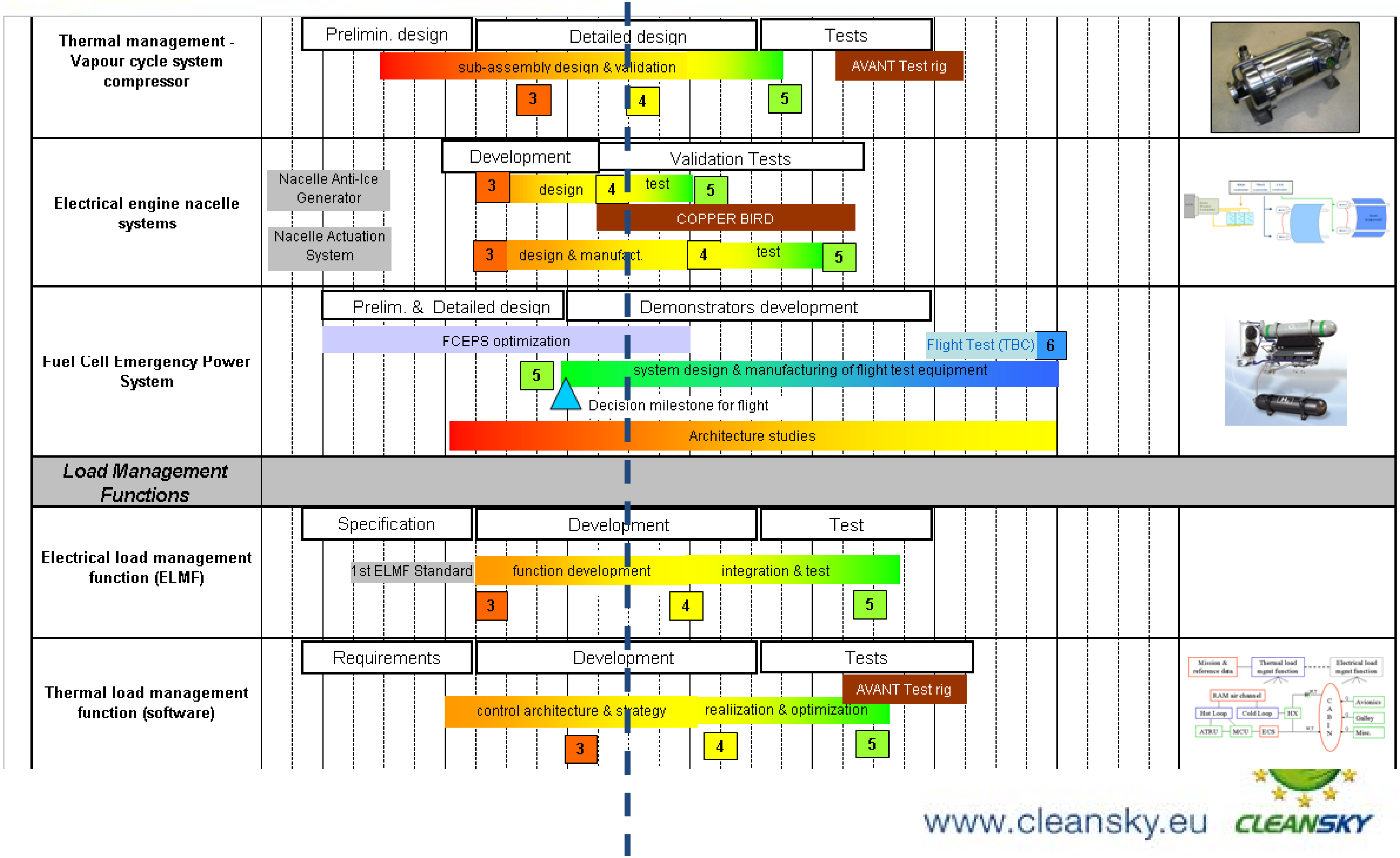
❖ **Highly mature demonstrators for Large Aircraft, business jet, Regional Aircraft and Helicopter**

➡ **A leap forward towards mature environmentally friendly solutions for future aircraft**

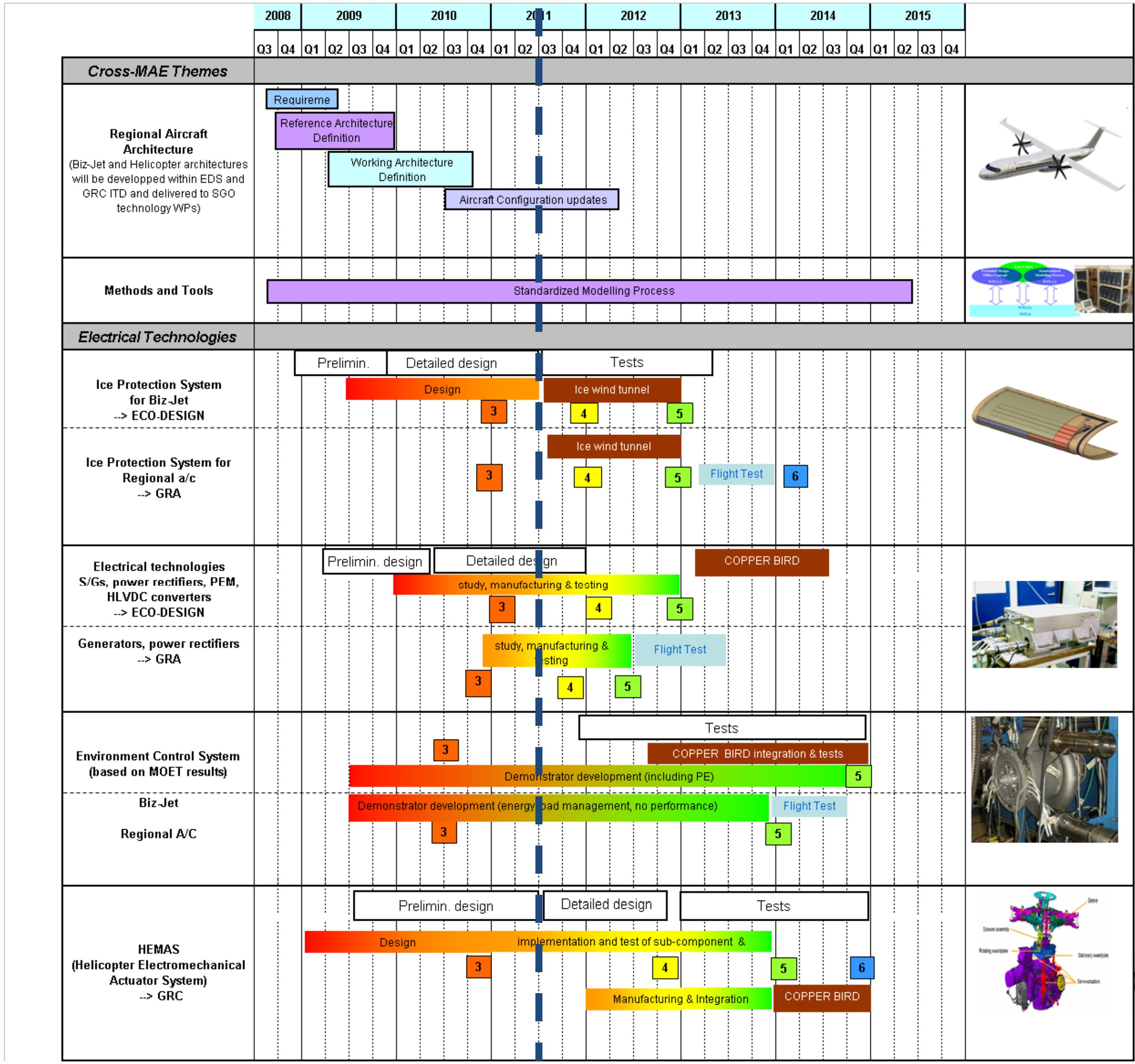
MAE planning– Large Aircraft



MAE planning – Large Aircraft (cont‘d)



MAE planning 2010 update – Other Aircraft



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Focus on one Technology

Electrical Environmental Control System (E-ECS) Pack for Large Aircraft

- Context
- Input for CLEAN SKY from previous research project MOET
- Objectives for CLEAN SKY
- Status

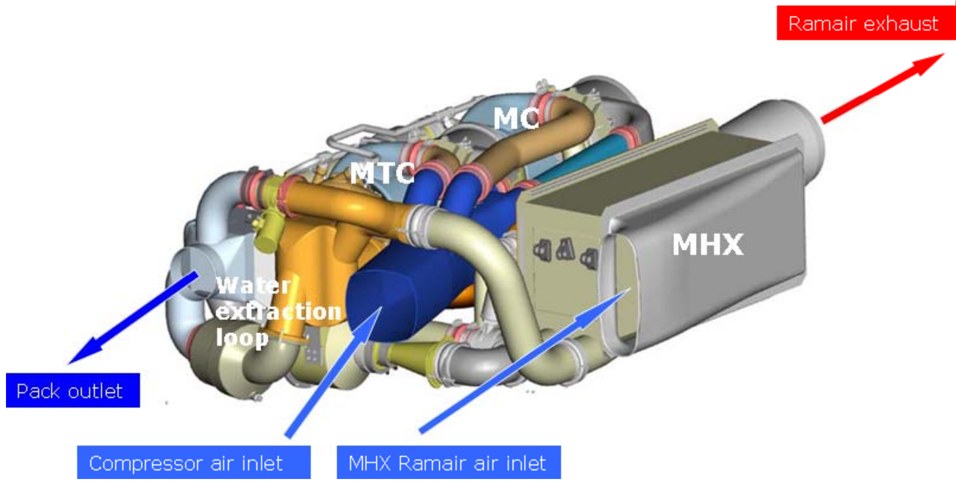
Demonstrator development within the MOET project (FP6) – Input for CLEAN SKY

MOET
MORE OPEN ELECTRICAL TECHNOLOGIES

Achievements from MOET:

- Demonstration of architecture feasibility
- Development and validation of key technologies
- Identification of potential benefit and improvement at aircraft level

Project co-funded by the European Commission within the Sixth Framework Programme

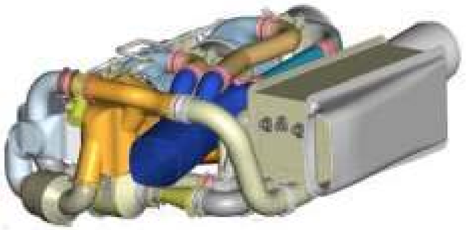


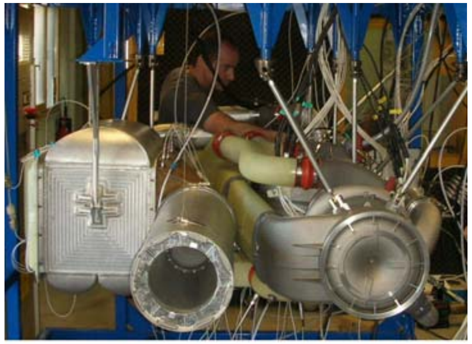
LIEBHERR Aerospace

E-ECS Objectives for Clean Sky

Objectives for the JTI CLEAN SKY project:

- Technology maturity validation up to TRL6
- Flight test validation
- Pack weight optimization
- Studies of advanced E-ECS architectures
- Global cooling optimization by integrating the pack within aircraft thermal management system

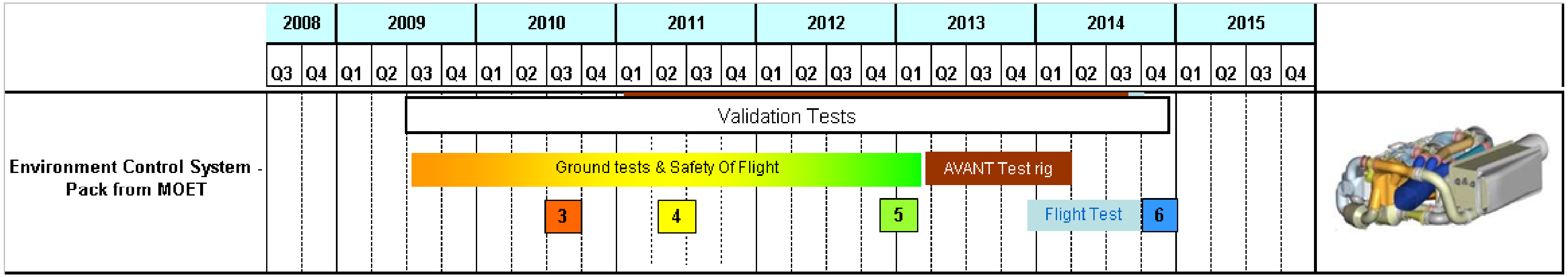




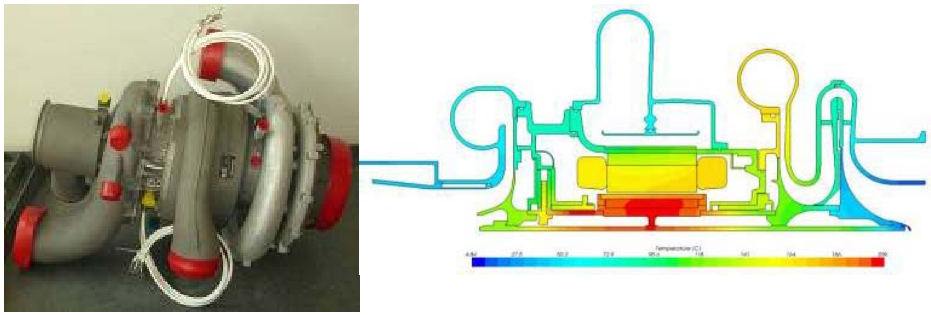
From ground to flight tests

E-ECS Pack - Status

Status



– Architecture specifications issued
– Flight test demo: integration study based on installation requirements started
– Preparation for safety of flight test campaign started
– Ground test validation: for components performed, for the pack (system demo) close to completion

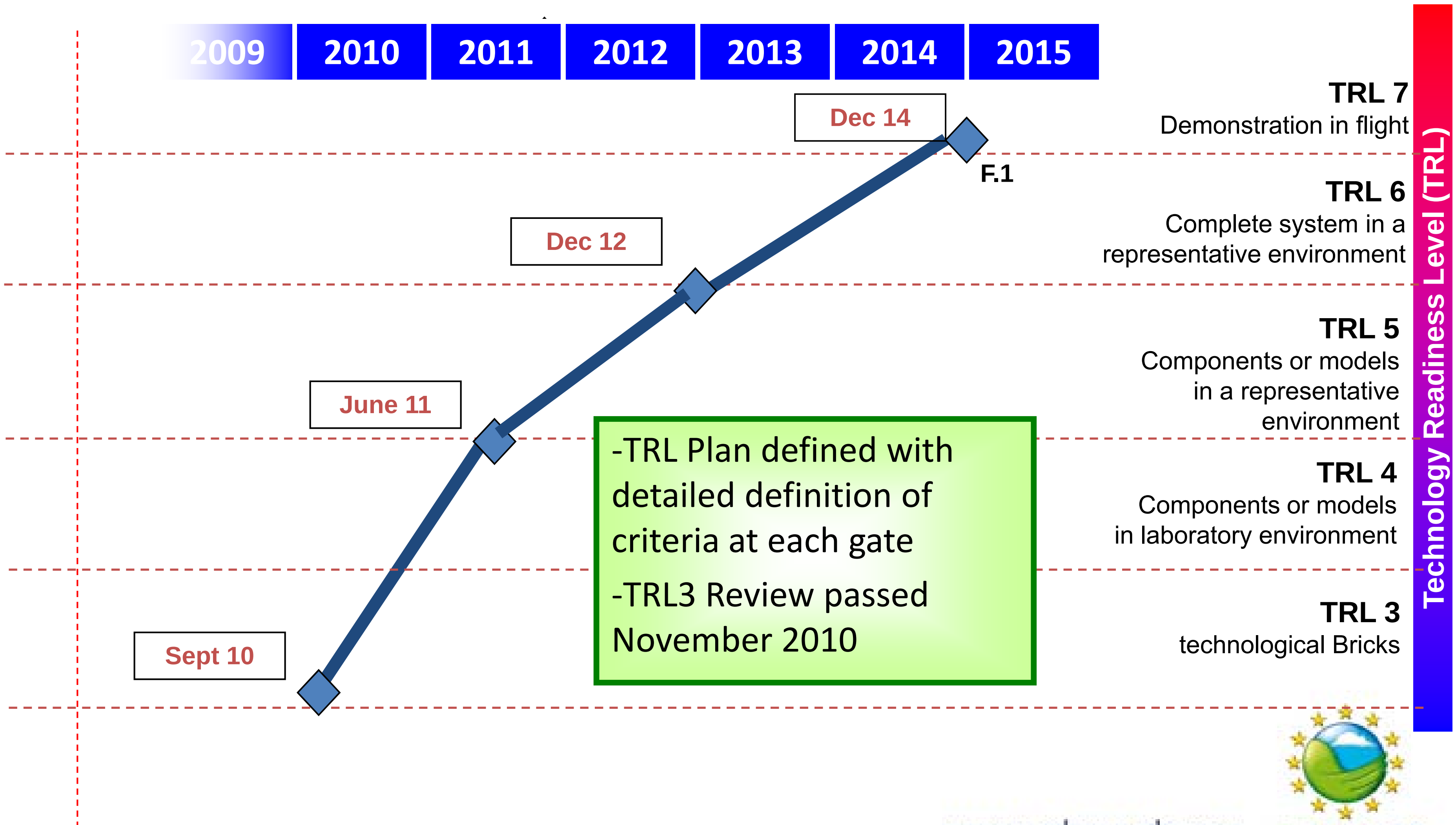


Validation of turbomachinery (performance, integration, cooling

Validation of air intakes

Pack performance validation

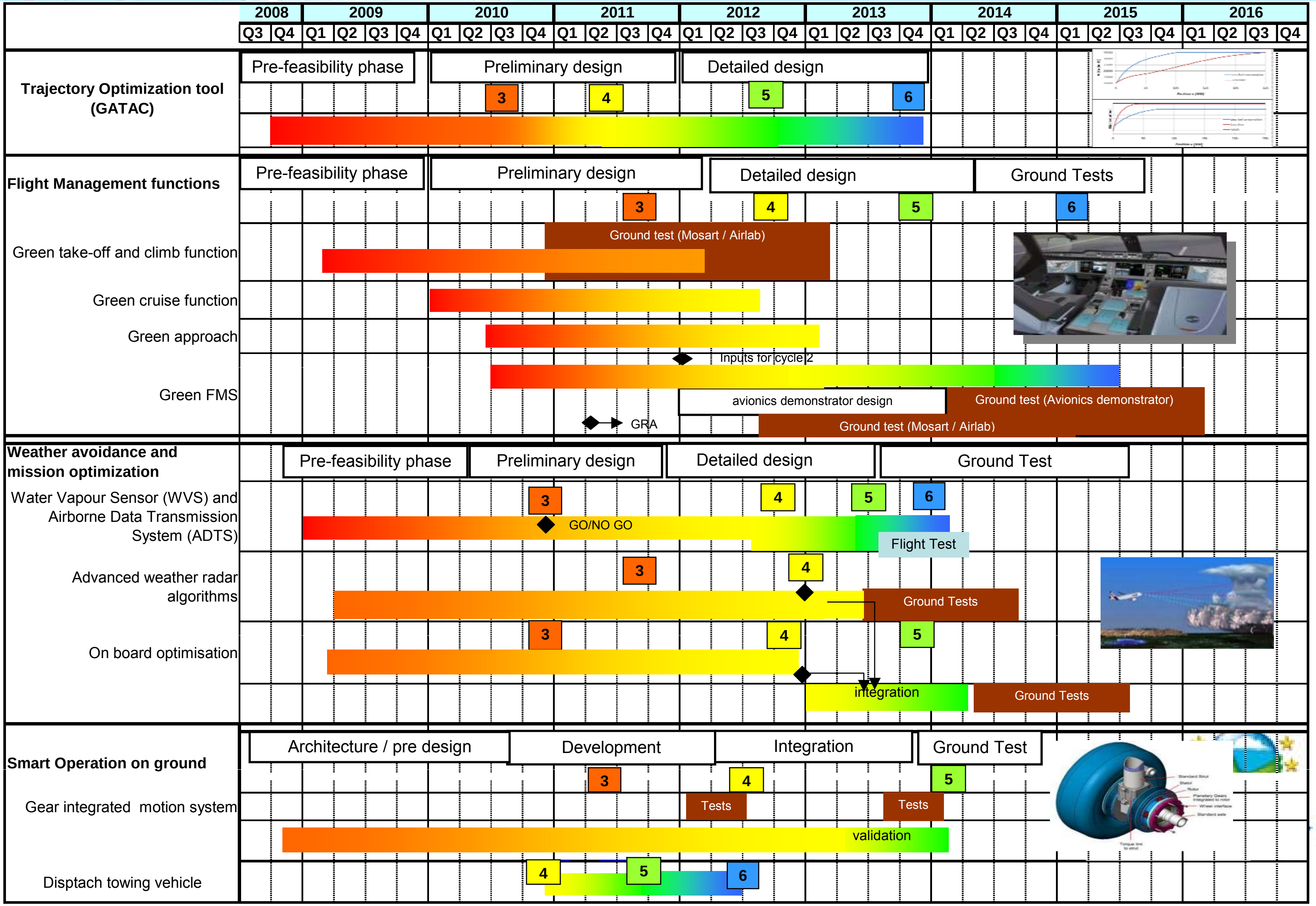
TRL Plan – E-ECS (Mid Size Pack Demonstrator)



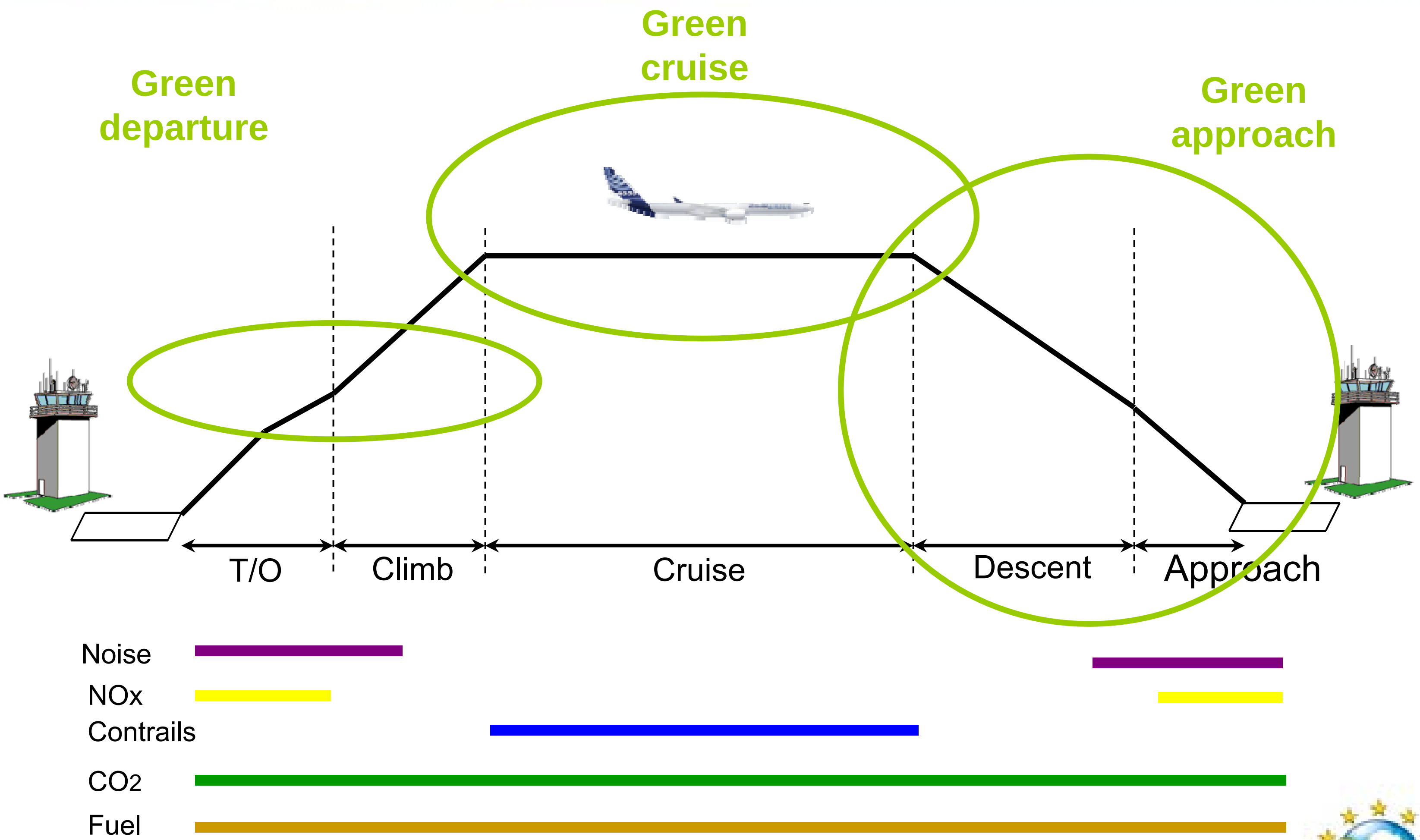
- TRL Plan defined with detailed definition of criteria at each gate
- TRL3 Review passed November 2010

Management of Trajectory and Mission (MTM)

MTM planning



Trajectory optimisation in 3 flight phases



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FMS Green functions : Green Objectives

CO2 emissions reduction -1 to -2% during cruise

No persistent condensation trails formation

NOx emissions any reduction, to assess

Noise reduction -2dB for low altitude segment

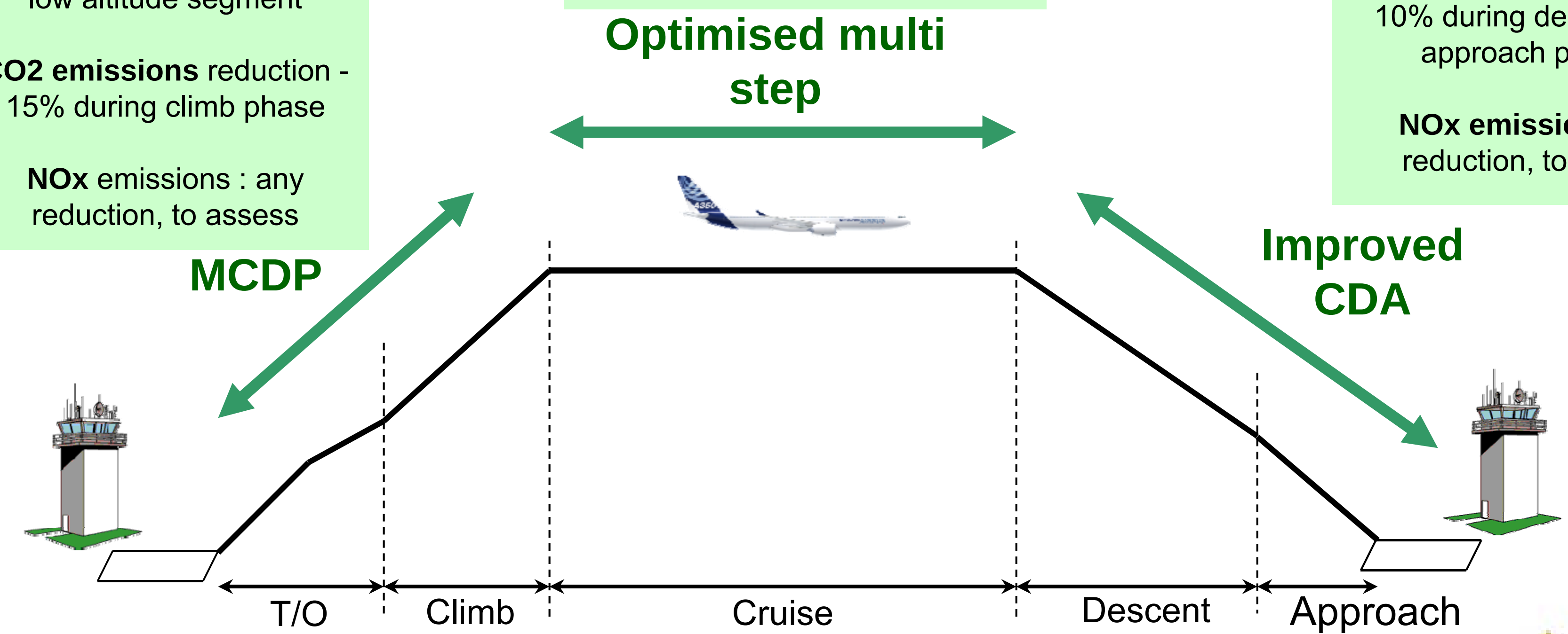
CO2 emissions reduction -15% during climb phase

NOx emissions : any reduction, to assess

Noise reduction -3dB for low altitude segment

CO2 emissions reduction -10% during descent and approach phases

NOx emissions any reduction, to assess



Env. Performance targets broken down into function objectives

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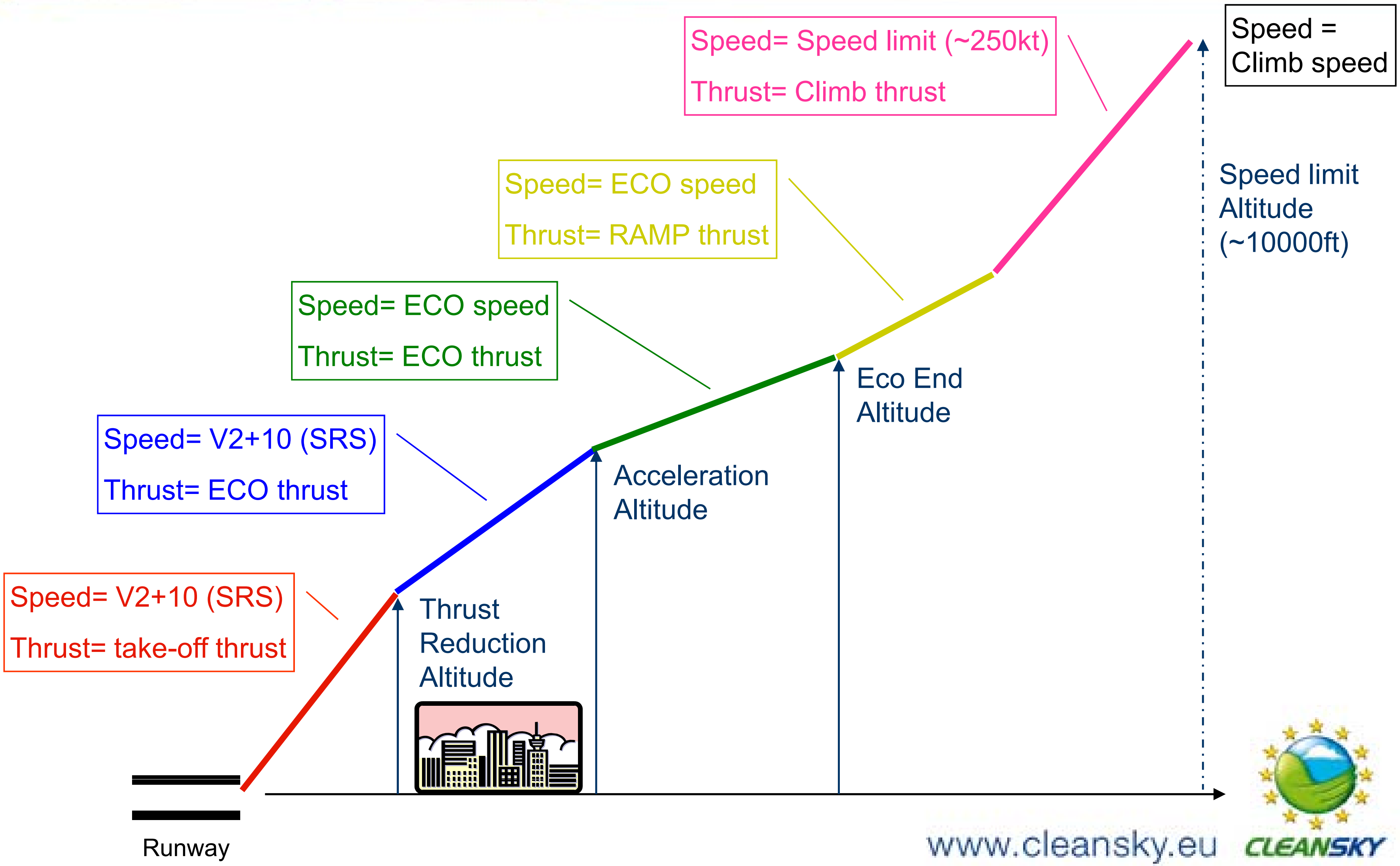
Multi-Criteria Departure Procedure (MCDP) Preamble

- **Rationale and context for the MCDP concept**
  - Ensure noise reduction whilst minimising CO2 emissions for given mission conditions : departure runway, aircraft weight and weather conditions
    - Up to 15% fuel & CO2 theoretical saving on T.O / initial climb (< 3000 ft)
    - Up to 2dB theoretical noise reduction compared to standard NADP
    - Noise / CO2 gains cannot be mutually achieved and operational gains result from trade-offs

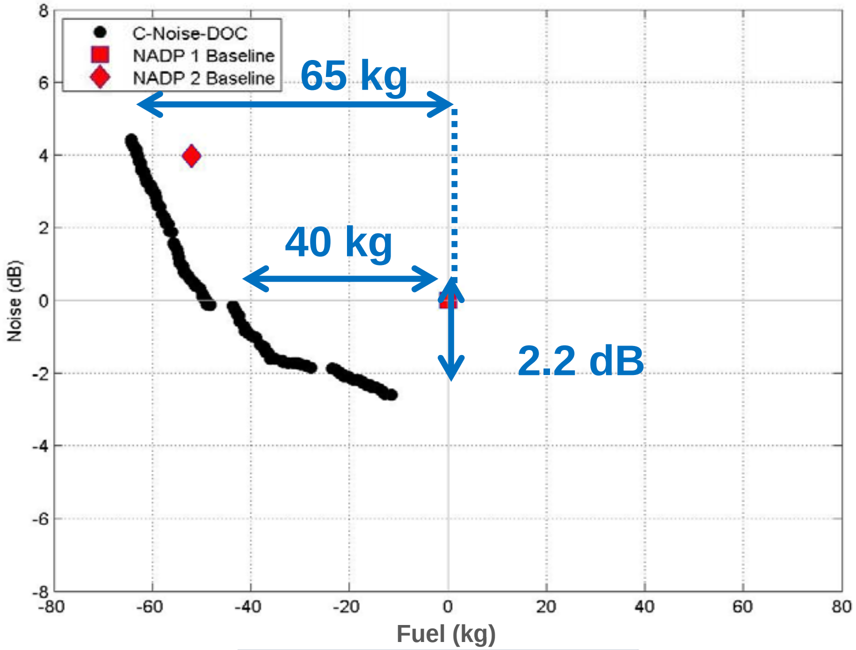
Preliminary assessment – To be consolidated

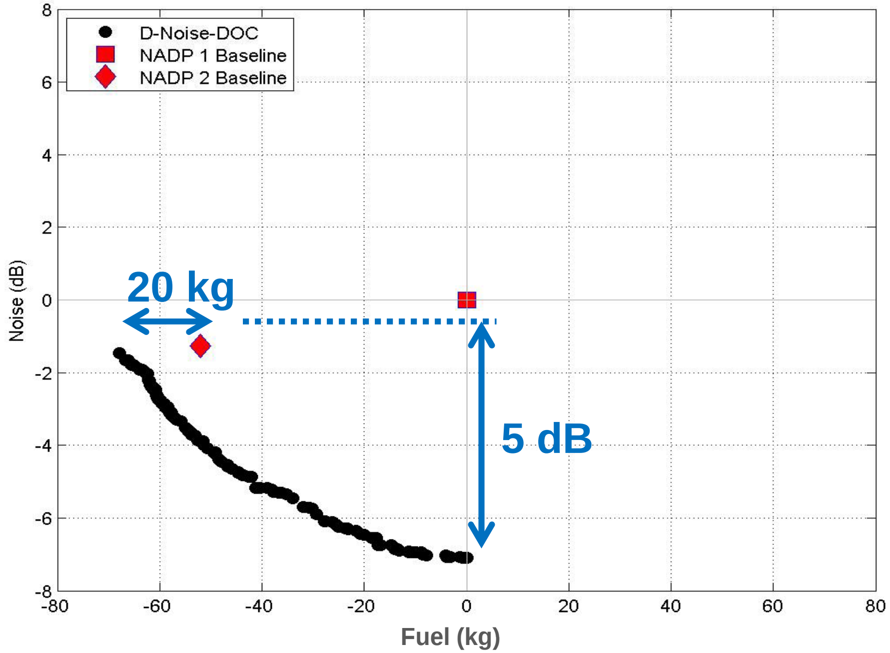
- **General concept of the concept**
  - The concept is based on NADP, extended to emission reduction in addition to noise.
    - As a reminder, two kinds of typical vertical trajectory for Noise Abatement Departure Procedures are described in the Procedures for Air Navigation Services/ Operations (PANS/Ops) ICAO document 8168.
    - NADP procedures are designed in order to perform noise reduction in airports vicinity. Noise gains are obtained for local area (either close or distant from airport), these areas are very case dependant of each airport noise politic.
  - MCDP concept principle is to <u>optimise NADP parameters</u> in order to comply with published procedures while <u>providing flexibility to the airline</u> to optimise emissions and/or noise for each mission

Multi-Criteria Departure Procedure (MCDP) Vertical modes



Potential Savings : robustness to noise scenario *Close-in and distant scenarios*





Close-in scenario

Noise savings : 2.2 dB

Fuel savings* :

- At iso noise : 40 kg
- Maximum : 65 kg

Distant scenario

Noise savings : 5 dB

Fuel savings* : 20 kg

Aircraft : A320-214

TOW : 62.5 T

No performance limited take-off

*: fuel savings are computed at a common mission point

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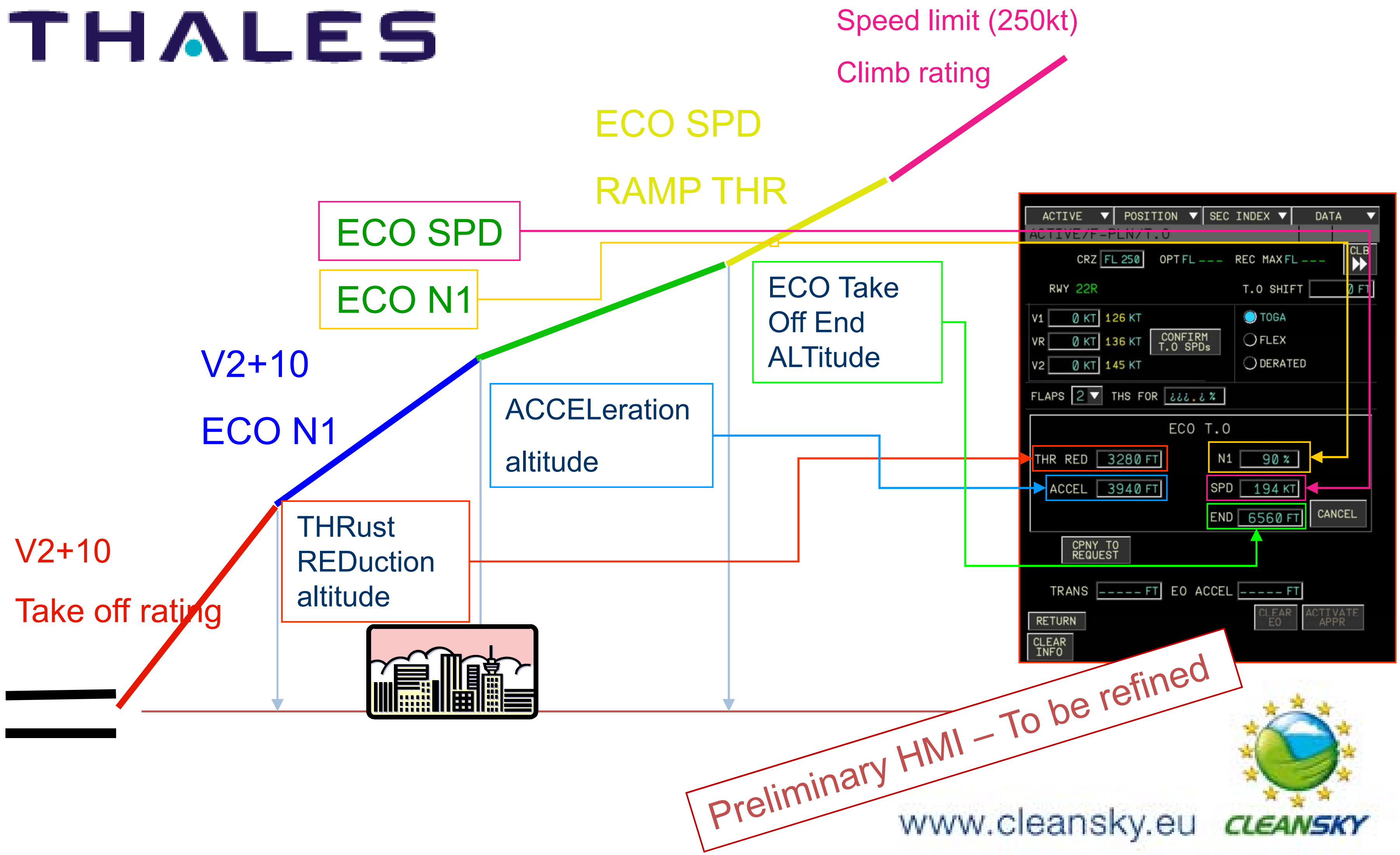
Multi-Criteria Departure Procedure

HMI prototyping

THALES



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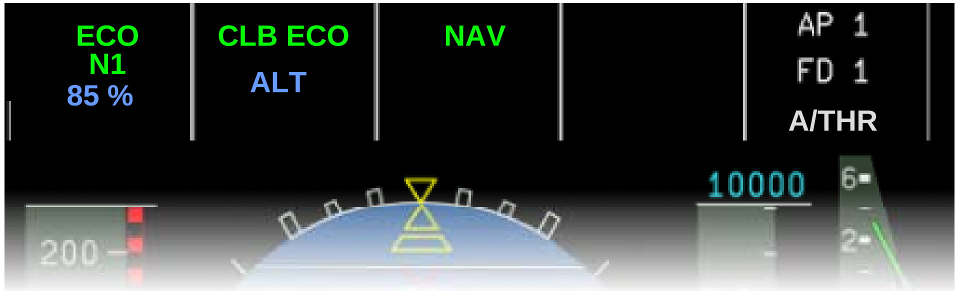
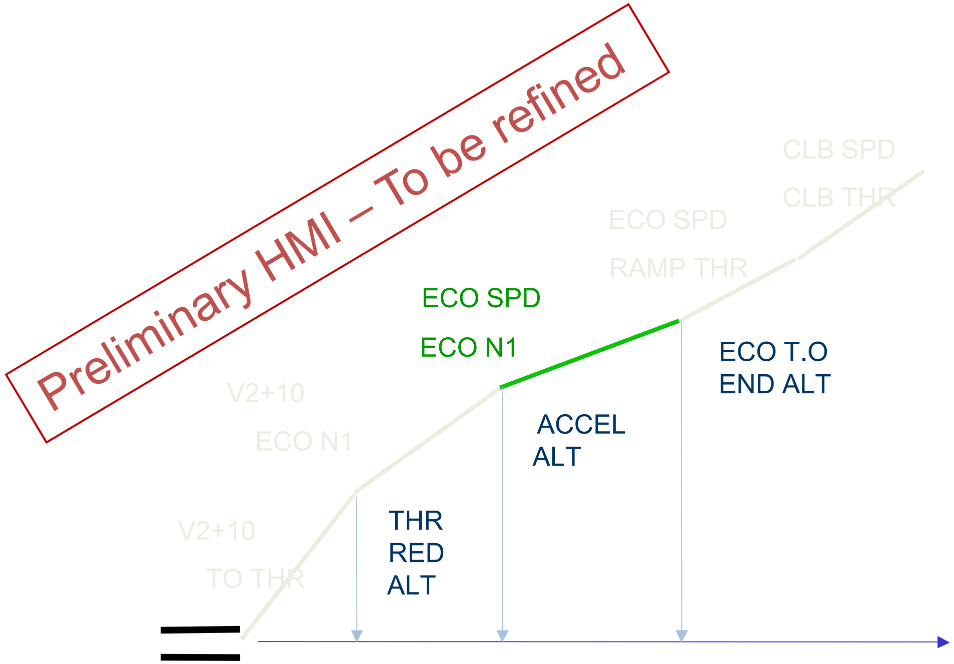
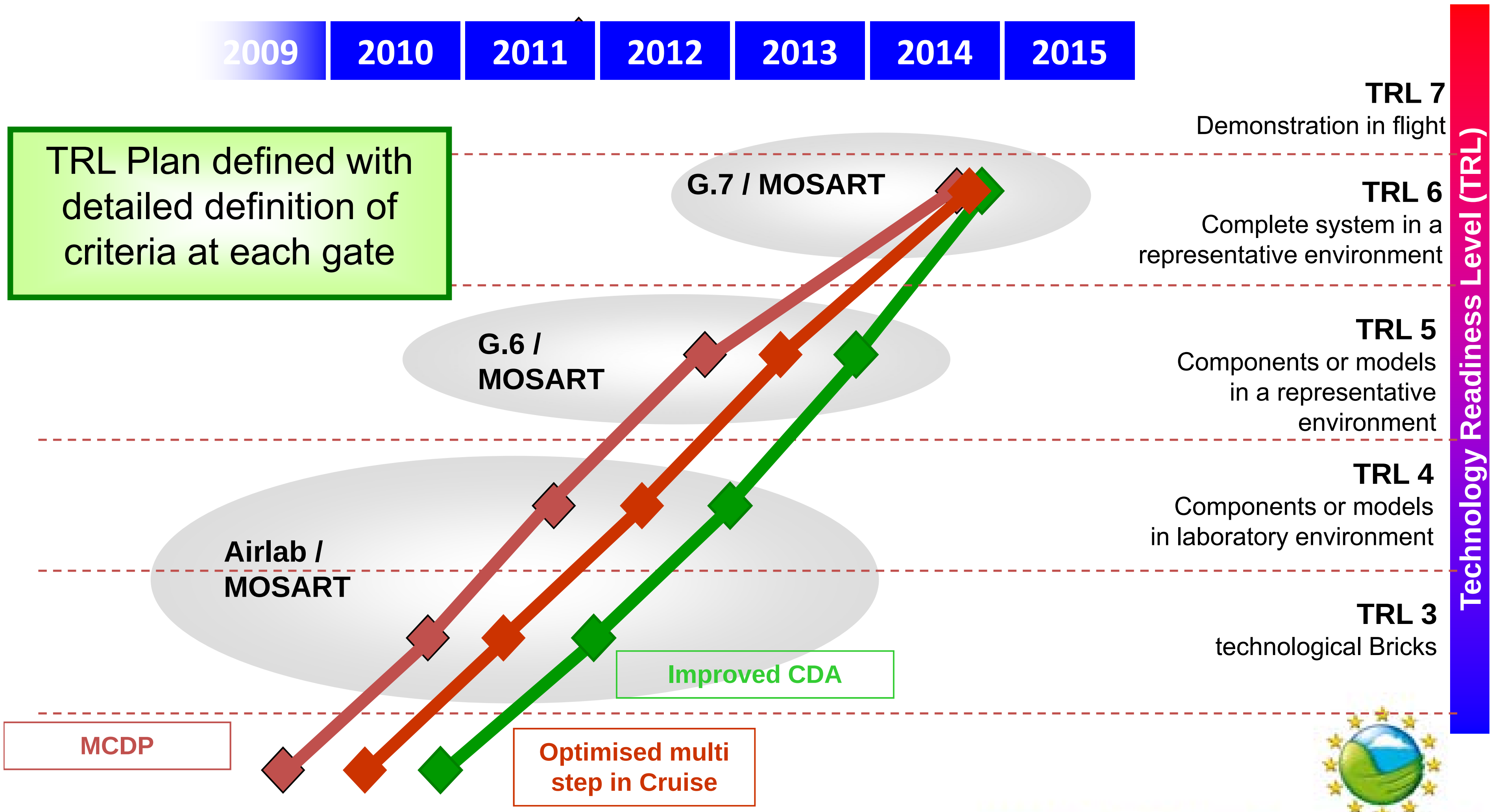
Multi-Criteria Departure Procedure

In flight mode awareness : FMA modifications





FMS Green functions : TRL roadmap



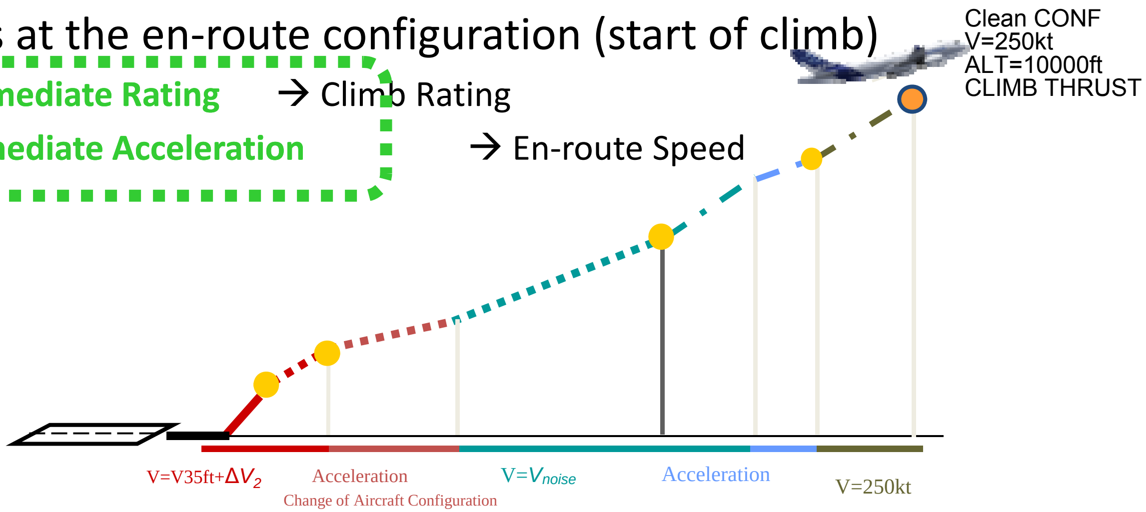
MCDP – ECO Take off : concept

Optimization of a **N**oise **A**batement **D**eparture **P**rocedure (**NADP**) , with multiple criteria ➔ Multi-Criteria **D**eparture **P**rocedure (**MCDP**)

- Optimization of the Vertical profile. The lateral route is imposed
- NADP begins at 35ft and finishes at the en-route configuration (start of climb)

Thrust: Take Off Rating → **Intermediate Rating** → Climb Rating

Speed: V35ft+DV2 → **Intermediate Acceleration** → En-route Speed



- Optimisation Parameters
  - Zpr : Thrust Cutback Altitude
  - $N1_{noise}$: Reduced Engine Rating
  - Zpa : Acceleration Altitude
  - V_{noise} : Intermediate Speed Target
  - Zpf : Setting of Climb Rating and Start of Acceleration to En-route Speed
  - ΔV2 : fraction of speed at 35ft in excess of safety minimum (V2)

- Trajectory computed using OCTOPER: Airbus software for operational trajectory computations

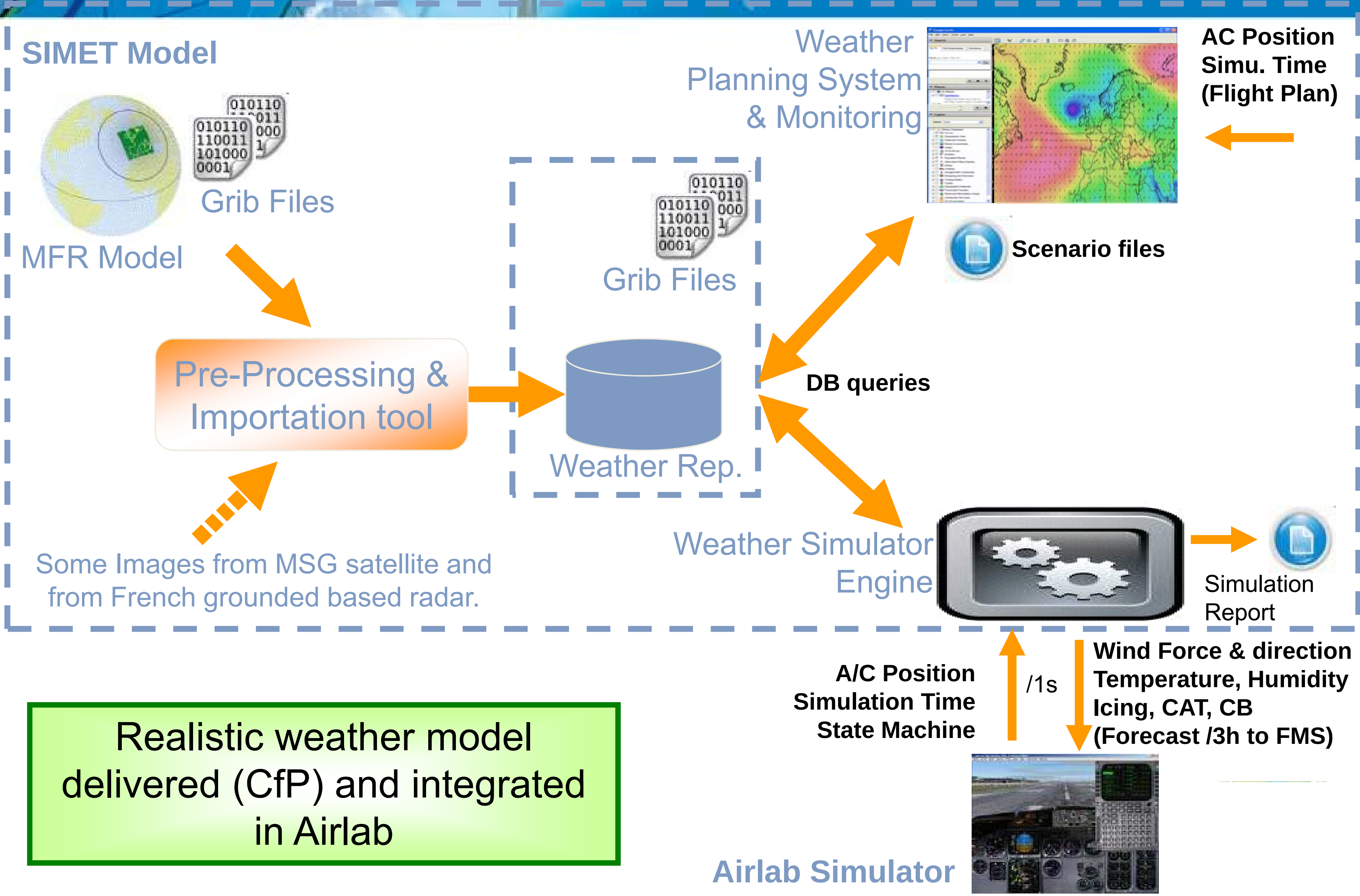
Functional concept study completed

MCDP – Flight Management HMI

- Evolution of Perf Take off FMD page and pilot interaction defined, and implemented (A661 based)
- In line for Pilot evaluation end 2010

FM function specification
Implementation in mock-up
HMI modification

Model Development Overview



Realistic weather model delivered (CfP) and integrated in Airlab

CfP Call 10 examples

Overview of Calls from SGO

- 10 topics in 3 areas

CfP Nbr	WP L1	WP	Description	Est. Cost [k€]
JTI-CS-2011-3-SGO-03-015	WP3	3.1.5	Simplified noise models for real time on-board applications	400
JTI-CS-2011-3-SGO-02-035	WP2	2.3.4	Disconnect device for jam-tolerant linear actuators	600
JTI-CS-2011-3-SGO-03-016	WP3	3.6	Development of an Electronic Flight Bag platform with integrated A-WXR and Q-AI Agents SW and related interfaces with FMS to be integrated in Mission/Flight Simulator.	750
JTI-CS-2011-3-SGO-03-014	WP3	3.7.3	Smart Operations on Ground power electronics with energy recycling system	1390
JTI-CS-2011-3-SGO-04-004	WP4	4.4.1	Design and manufacturing of a flight worthy intake system (scoop/NACA divergent intake)	750
JTI-CS-2011-3-SGO-02-036	WP2	2.3.4	Design and optimisation of locally reacting acoustic material	300
JTI-CS-2011-3-SGO-02-037	WP2	2.3.2	Feasibility study of full SiC High Integrated Power Electronic Module (HIPEM) for Aeronautic Application”	500
JTI-CS-2011-3-SGO-02-021	WP2	2.3.4	Development of key technology components for high power-density power converters for rotorcraft swashplate actuators	250
JTI-CS-2011-3-SGO-02-014	WP2	2.3	Construction of bespoke evaluation Power Modules	250
JTI-CS-2011-3-SGO-02-033	WP2	2.3.4	Optimisation of coating for low pressure operation of power electronics and identification of pass and fail criteria for respective corona testing	500
			Total budget	5690
			Number of topics	10

Optimization of coating for the operation of power electronics in non pressurized area

- Topic #: JTI-CS-2011-3-SGO-02-33 :
- 1. Context and technical challenges
  - In the frame of SGO WP2.3.4.1 & WP2.3.4.3, the objective is to develop respectively an electrical driven air system and a electrothermal wing Ice protection system.

  - For these applications, a weight optimized power electronic operating in pressurized or non pressurized area (depending on installation requirements) is foreseen in order to drive the system
  - Key target for non pressurized area application is to develop the capabilities to achieve a a so-called “open box” power electronics with light weight housing and withstanding low pressure and condensating water conditions.

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Optimization of coating for the operation of power electronics in non pressurized area

2. Expected feedback

- This call aims to optimize the coating for the operation of power electronics with “open-box”-housing in high altitude and to identify of pass and fail criteria for respective corona testing.
- The partner will be in charge of:
  - the choice of coating for the PE and signal boards withstanding low pressure operation, temperature variations, humidity and vibrations
  - the elaboration of processes for the application of the coating material during the assembly phase
  - the derivation and description of pass and fail criteria for corona testing, the choice of test equipment and the testing of corona itself
- The Power Electronic itself will be developed by the SGO member

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Optimization of coating for the operation of power electronics in non pressurized area

3. Additional information:
The applicant should have a significative experience in coating materials and processes and corona testing

4. Topic value
500k€ <u>maximum budget</u>

Disconnect device for jam-tolerant linear actuators

- Topic #: JTI-CS-2011-3-SGO-02-035:
- 1. Context and technical challenges
  - SGO aims to develop EMAs for h/c swash plate actuation
  - Free-wheeling or jamming of any of the 3 actuators of conventional swash plate actuation system is catastrophic
  - Free-wheel and jamming are credible & relevant failure modes of EMAs

  → Redundant parallel actuators are provided in case one actuator fails
  - Any jammed actuator needs to be disconnected not to jam the redundant one

  → Disconnect Device (DD) required: fast, reliable, compact, light weight, robust
- 2. Expected feedback
  - Design study, development, implementation and validation testing of Disconnect Device (DD) for EMAs
  - Design Study covering single-shot to fully reversible and testable designs
  - Pyrotechnical DDs shall be considered as one single-shot option

Disconnect device for jam-tolerant linear actuators

3. Additional information

- D1 (Dec-2012): Design study concluded. Design options evaluated.
  →Concept Design Review with Caller. Down-selection to two solution concepts.
- D2 (Jun-2013): Solution concepts validated, good design confidence established
- D3 (Jan-2014): First prototypes available (1 per solution concept)
- D4 (Sep-2014): Validation testing complete
- Delivery of 8 units of each design (total 16 units) expected for integration into full-scale actuators

Consortium of applicants should include:

- Universities/research institutions. Focus: Design study, methodical product development
- Manufacturer(s) of couplings/machine elements; aerospace experience desirable
- Expertise in pyrotechnical elements/actuators should be present in consortium

4. Topic value

600k€ maximum budget

Feasibility Study of intelligent High Integrated Power Electronic Module(HIPEM) dedicated for Aeronautic Applications

- Topic #: JTI-CS-2011-3-SGO-02-037
- 1. Context and technical challenges

  - Today, power electronics based on components with existing technology not allow to achieve drastic weight reduction and volume objectives targeted for More and All Electrical Aircrafts.

  - Compactness, efficiency, robustness and availability (fault tolerance …) are main **key drivers** to be mastered for the design of next generation of power converters.

  - The **H**igh **I**ntegrated **P**ower **E**lectronic **M**odule (**HIPEM**) is **key block** on what the design of electronic modular systems concept will be built in order to optimise and manage the onboard energy for futures aircrafts.

  - This work will be focused on **technical challenges** (electrical/physical/thermal integration, environment including EMC,) with physical demonstration of modules with SiC MOSFET, but also, **economic** (market and cost prospective) and **industrialisation process** will be investigated.

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Feasibility Study of intelligent High Integrated Power Electronic Module(HIPEM) dedicated for Aeronautic Applications

2. Expected feedback

- Better knowledge on the design criteria and rules **to built intelligent HIPEM** (first generation) **based on available and advanced assembling material** like SiC**.**
- Better view on internal architecture and functionality **of 1st generation of intelligent HIPEM** (functions to be integrated in HIPEM today linked to advanced assembling material properties and environment constrains)
- Better knowledge **on electrical and thermal** performances and capability **of HIPEM demonstrators built during this work.**
- Better view on expected improvements **of 1st generation of HIPEM** (where we are?, where we go? what are the limitations and next steps to improve at design and material proprieties…?)
- Prospective view **for industrialization and economic study of 1st and 2nd generation of HIPEM**

Innovativeness expected of advanced assembling techniques will be the design of the internal structure in order to reach following objectives:·

Reduction of electro thermal constrains (improvement of cooling and reliability of assembling material)·

Reduction of power consumption,·Immunity of EMC constrains· Reduction of parasitic effect (wire inductance …)· Reduction of weight and size,·Increase of power density ….

Feasibility Study of intelligent High Integrated Power Electronic Module(HIPEM) dedicated for Aeronautic Applications

3. Additional information

•Activities of this work will be limited to 24 months time period.
•Good background and experience in assembling technologies, drivers functionality and Semiconductors activities is expected

4. Topic Value

- **Maximum budget: 500k€.**

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Smart Operations on Ground power electronics with energy recycling system

- Topic #: JTI-CS-2011-3-SGO-03-014
- 1. Context and technical challenges
- SGO supports the development of new aircraft function which allow both economical and ecological benefits. An autonomous taxiing system which is based on wheel actuators integrated in aircraft main landing gear wheels driven by power electronics

- The main difficulties to be met in developing such a system are :
  - ➢ Developing a complex power electronic which includes energy recycling system
  - ➢ Using technology and design compliant with aeronautical rules

- In order to increase SOG system efficiency , this topic is aimed to develop and manufacture both a power electronic which drives wheel actuator and an energy recycling system which manages power exchanges between aircraft network and SOG system

Smart Operations on Ground power electronics with energy recycling system

- 2. Expected feedback

- Provide a prototype of a power electronics which is able to drive Nottingham motor topology in functional and performances expected in the specification

- Get feedback and experiences of the system behaviour during regenerative power phases (stability) in order to implement cruise control function

3. Additional information

Participation of a partner aware of aeronautical development constraints in the candidate organisation or consortium would be an asset

4. Topic value

1390k€ <u>maximum budget</u>

Simplified noise models for real time on-board applications

- Topic #: JTI-CS-2011-3-SGO-03-015 :
- 1. Context and technical challenges
  - The end-product of this topic is a detailed specification and design for the implementation of the noise model in avionics software, thus with limited computing resources. The qualities of the model design will be tried and validated on mock-up of the model.
  - The challenge is to provide a model :
    - Sufficiently accurate in the relevant usage domain to allow for the use in embedded trajectory optimization function.
    - Compatible with limited on-board computing resources

Simplified noise models for real time on-board applications

3. Additional information

- Computation of noise is performed in a few (typically 4 to 10) discrete microphone locations around an airport. These locations depend on the airport.
- The required response time for the noise computation of each take-off and approach/landing trajectory segment is less than 20 milliseconds (TBC) on a current generation PC.
- Expected accuracy is in the range of 1dB (comparison with a reference model)

4. Topic value

400k€ maximum budget

Flight worthy intake system (NACA/Scoop)

- Topic #: JTI-CS-2011-3-SGO-04-004 :
- 1. Context and technical challenges

  - Context: Flight testing of an electrical Environmental Control System (ECS) on a large transport aircraft.
  - Bleed air no longer used as fresh air for cabin ventilation
  - Extra scoop intake will provide electrical ECS with fresh air.
  - Lightweight combination of a NACA and a Scoop intake to be installed on flight test aircraft.

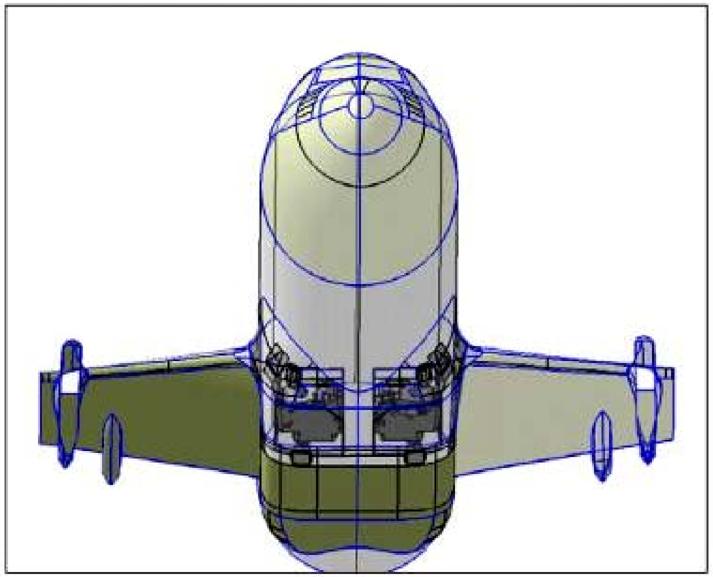
- 2. Expected feedback

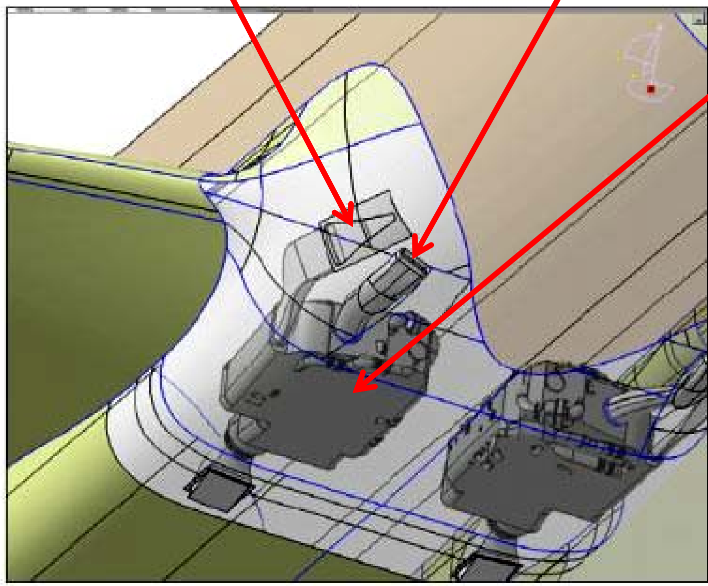
  - Demonstration of the candidates capability to master the innovation required to design and manufacture a lightweight, high production rate, flight worthy intake system conforming to the CfP requirements.

Flight worthy intake system (NACA/Scoop)

3. Additional information
   None

4. Topic value
   750k€ <u>maximum budget</u>





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Contact us

For further information:

info-call-2011-03@cleansky.eu

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Systems for green operations

Management of Aircraft Energy

- The use of all-electric equipment system architectures will allow a more fuel-efficient use of secondary power, from electrical generation and distribution to electrical aircraft systems.
- Thermal management will address many levels, particularly relating to electric aircraft, from hot spots in large power electronics to motor drive system cooling, to overall aircraft solutions.

Management of Trajectory and Mission

- Systems and procedures will be designed to perform high precision optimised trajectories to minimise noise and emissions impact in airport areas.
- New aircraft systems for Smart Ground Operations will optimise use of engine power when aircraft is on ground and provide silent taxing capabilities
- Aircraft will be able to fly green missions from start to finish, thanks to technologies which allow to avoid fuel consuming meteorological hazards and to adapt flight path to known local conditions

➔**Validation by ground based rigs and flight testing**

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Construction of bespoke evaluation modules

- Topic #: JTI-CS-2011-3-SGO-02-017:

- 1. Context and technical challenges
  - 1) Design study:
    - mechanical and thermal design for the planar module assembly process
  - 2) Technologies for planar module substrate fabrication:
    - Establish rapid prototyping and volume manufacturing technologies to realise contact features and interconnect posts on DBC or AMB substrates.
  - 3) Cost-effective manufacturing route:
    - Establish a manufacturing process, employing diffusion soldering, to assemble planar modules using the substrates developed in 1) and a minimum of additional piece parts and processes.
    - The maximum allowable assembly temperature is 300° C.

Construction of bespoke evaluation modules

- 2. Expected feedback
  - Detailed substrate and process design
    - Fully justified design including mechanical, thermal and life models
  - Substrate technology delivered
    - Samples of substrates to agreed specification available
  - Assembly technology delivered
    - Samples of assembled planar modules available
  - Prototypes
    - Planar modules for 10 off converter assemblies delivered
- 3. Topic value
  - 250k€ maximum budget

Development of key components for high power-density power converters for rotorcraft swashplate actuators

•Topic #: JTI-CS-2011-3-SGO-02-021:

•1. Context and technical challenges

In WP2.3.4.2 SGO aims to develop electro-mechanical actuation systems for rotor aircraft control surfaces to reduce system weight, increase reliability and lower maintenance costs. This CfP deals with the development and manufacturing of high performance power electronic converters able to drive the associated electrical machines that in turn, actuate the main rotor of a medium-sized rotorcraft.

Key Challenges:

- Reliability/availability
- 70ºC Ambient
- Integration of sensors
- Weight
- Thermal cycling
- Failure Diagnostics
- No forced cooling
- Resistance to induced failures

•2. Expected feedback

The successful partner will have:

1. Experience in design and manufacture of power modules for high reliability
2. A track record in design and manufacturing electrical power stacks/converters
3. Flexible manufacturing facilities to enable alternative concepts .
4. Experience in the drive, control and monitoring of IGBT and/or related devices.

Development of key components for high power-density power converters for rotorcraft swashplate actuators

3. Additional information

The modules should b e designed for minimum electrical losses, potentially using novel semiconductor technologies such as SiC, maximum thermal conductivity through to the ambient air and with a high degree of tolerance to thermal cycling related failures.
Each three phase motor output should be designed to be resistant to failures from other power modules within the converter (3X3 option) or parts of a fully integrated (9Xoutput option) power module. Robustness to withstand vibration is also essential.
Robust, innovative, sensor / detection techniques should be developed or demonstrated so that faulty components can be taken out of use as quickly as possible to enable the continued operation of the rest of the system. Sensors to perform the control of the converter should also be integrated into the converter/power stack and where possible, into the power module

4. Topic value

250k€ maximum budget

Design and optimisation of locally reacting acoustic material

- Topic #: JTI-CS-2011-1-SGO-02-36 :
- 1. Context and technical challenges

  - In the frame of Clean Sky SGO ITD, one of the project members is developing an electrically driven air system enabling both air conditioning and thermal loads management

  - This air system is composed of an air jet pump or electrical air fan that generates noise at the aircraft skin and contributes directly to ramp noise.

  - Key target is to develop a locally reacting material with a small radius of curvature in the mid-to-low frequencies and a robust industrial process that allows a high percentage of acoustically treated surface area.

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Design and optimisation of locally reacting acoustic material

2. Expected feedback

- This call aims to optimize acoustic attenuation in the low-to-mid frequencies using locally reacting material, high frequency noise reduction being achieved with bulk material.

- The partner will be in charge of:

- the design of suitable materials to achieve acoustic attenuation in the frequency range [500-3500] Hz based on SDOF and DDOF solutions
- performing or specifying acoustic test on laboratory samples of the proposed solution
- manufacturing 2 prototypes applied to an electrical fan and a jet pump

The test in representative conditions (pressure, temperature, mass flow) will be carried out by the CFP partner.

Design and optimisation of locally reacting acoustic material

3. Additional information:

The applicant should have significant experience in locally reacting acoustic material design, acoustic modelling and prediction of acoustic treatment performance, acoustic testing with flow, industrial process and integration knowledge.

4. Topic value

300k€ maximum budget

SMART Electronic Flight Bag (EFB)

- Topic #: JTI-CS-2011-3-SGO-03-016 :

1. **Context and technical challenges:**

The goal is to provide an innovative, flexible EFB with enhanced GUI to be interfaced in different environment simulating the true flight conditions, to demonstrate new technologies in the field of:

- trajectory optimisation
- advanced weather radar algorithms
- Artificial Intelligence

and to improve Decision Support System features.

2. **Expected feedback:**

Proposal for a solution to provide a customized EFB class 2 Type B with Standard Hardware, customized libraries, flexible interfaces and a new configurable GUI suitable for pilot requirements (including also Software applications to receive voice commands from the pilot and recognize pilot mouth position to validate the commands), running software packages implementing both Weather Radar Data and Image Processing algorithms and Artificial Intelligence Agents, aimed to trajectory optimisation and Support to Decision.

SMART Electronic Flight Bag (EFB)

3. **Additional information**

The Applicant shall have:

- Documented Experience in dedicated Hardware and SW applications development
- Software integration capabilities
- Documented Experience in software science, and Human Computer Interfaces (HCI).
- Documented experience in Radar Signal Processing and in particular in Weather Radar algorithms,
- Documented experience in Image Processing
- Documented experience in Artificial Intelligence Science and in Optimisation Algorithms.

The Applicant shall provide a Gantt Diagram of the work, indicating Work Packages, time schedule, required inputs and outputs according to the scheduled deliverables

4. **Topic value**

750k€ maximum budget

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