Clean Sky Info Day

Green Regional A/c - ITD

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Politechnika Warszawska

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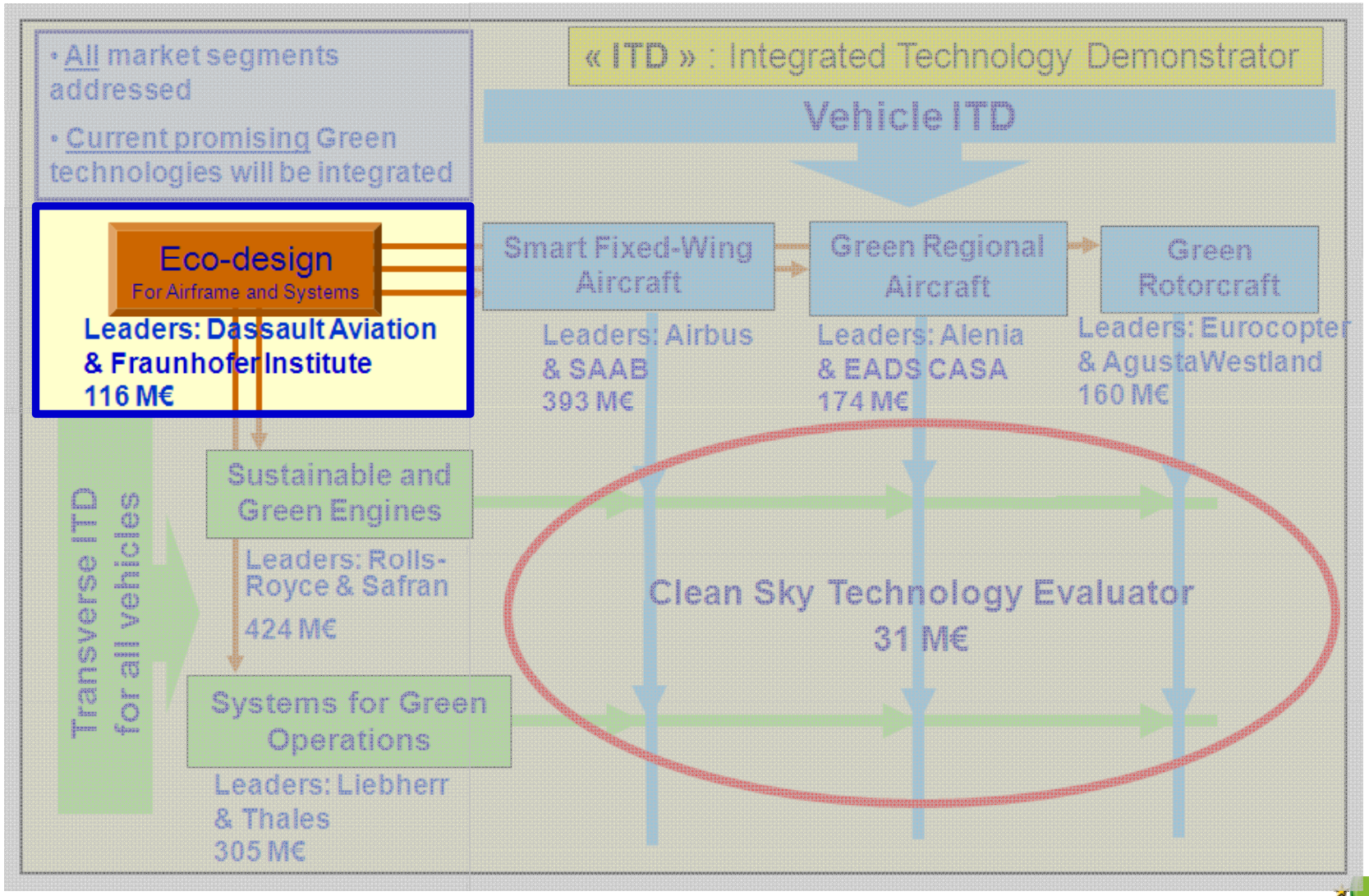
www.cleansky.eu

Outline

- Eco-Design Introduction
- EDA (Eco-Design for Airframe applications)
- EDS (Eco-Design for System applications)
- EDA Achievements
- EDA LCA Data Base

Clean Sky ITD Organisation and Eco-Design Setup

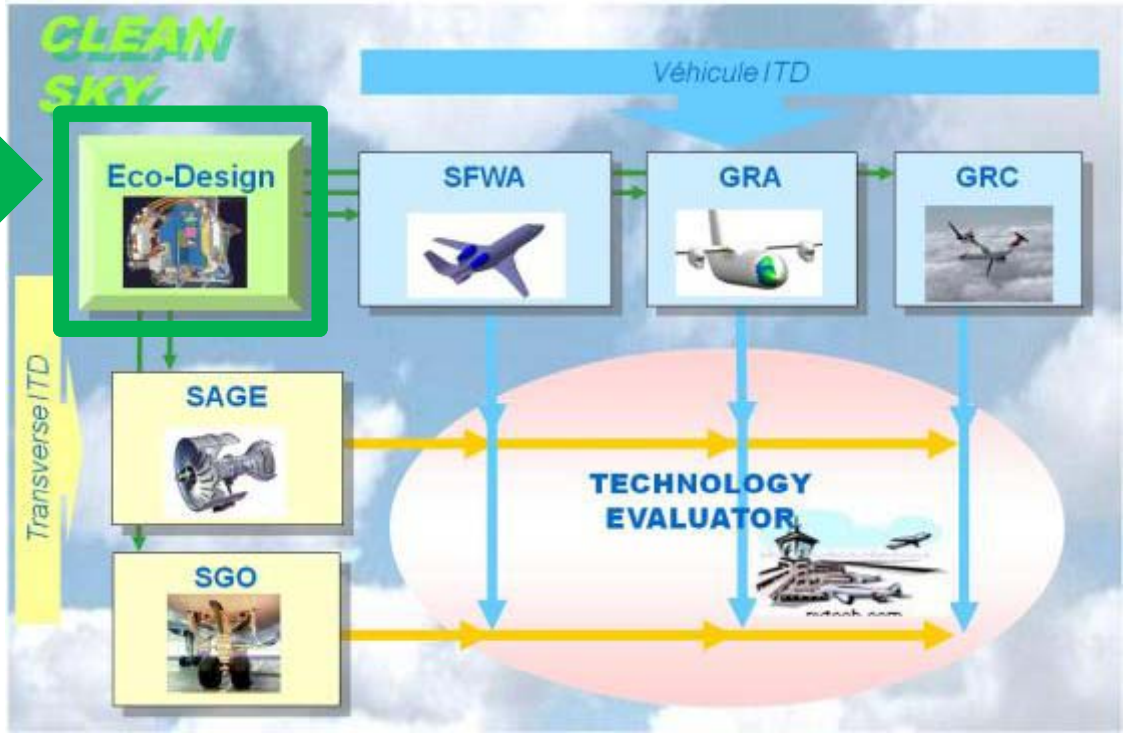


GENERAL ACARE OBJECTIVES

- 80% cut in NOx emissions
- Halving perceived aircraft noise
- 50% cut in CO2 emissions per pass-Km by drastic fuel consumption reduction
- **A green design, manufacturing, maintenance and disposal product life cycle**

ECO-DESIGN ITD

(Airframe part)



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Eco-Design ITD Participants and Global Share

116M€ Total Budget

ITD-Leaders

- **Dassault Av.**
- **Fraunhofer**
- Airbus
- Agusta Westland
- Alenia Aeronautica
- EADS-CASA
- Eurocopter
- Liebherr
- Safran
- Thales

50% of Total Budget

Associate Partners

- **EADS IW**
- **HAI**
- **IAI**
- **STORK-*Cluster***
- **RUAG-*Cluster***

25% of Total Budget

Partners

Partner participation based on Call for Proposals *„CfP“*

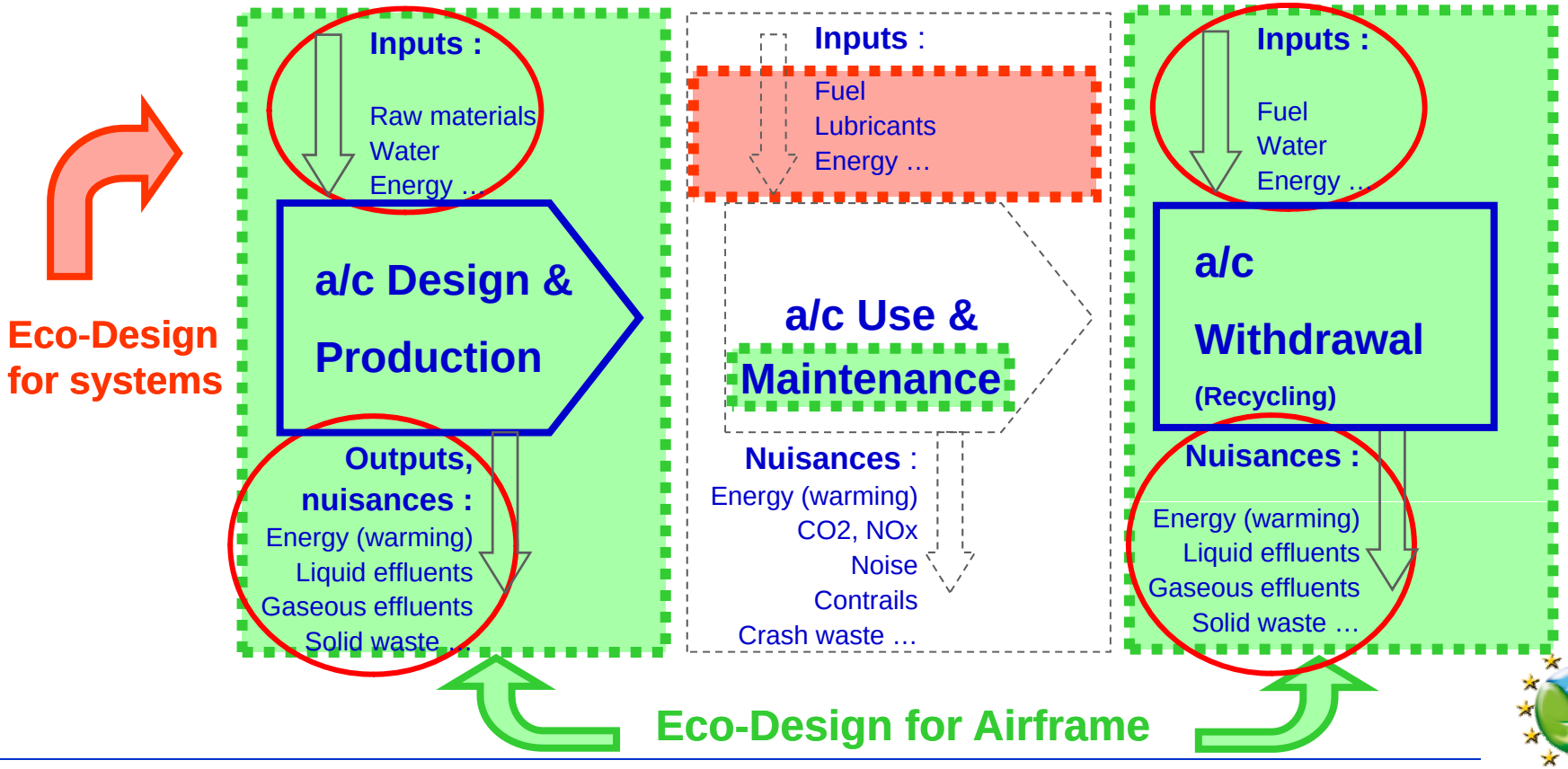
25% of Total Budget

(Cluster)

(Cluster)

Eco-Design ITD Objectives

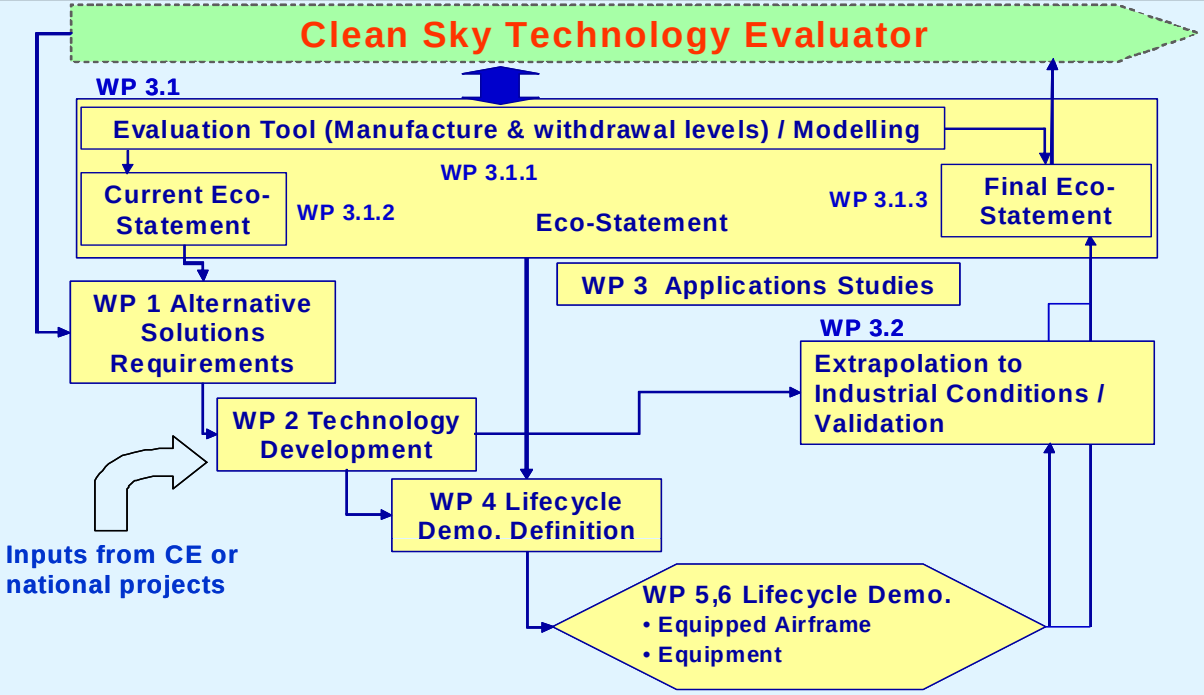
- To design airframe for decreasing inputs, outputs and nuisances during a/c design & production and withdrawal phases: for Airframe Application (EDA)
- To design architectures of a/c systems, towards the more/all electrical a/c, with the objective of reducing use of non-renewable and noxious fluids/ materials during operations and maintenance: for Systems Application (EDS)



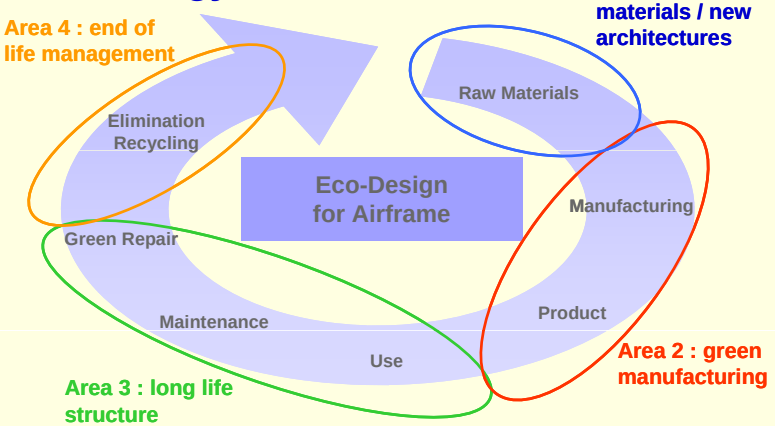
EDA (Eco-Design for Airframe applications)

EDA Overview

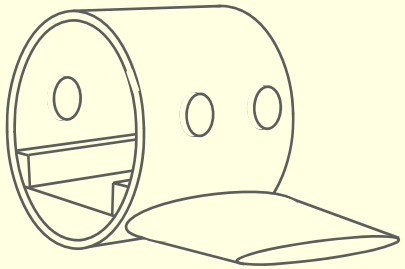
Logic Flow



Technology Areas



Lifecycle demonstration through



Global Demonstrator

Partial Demonstrators

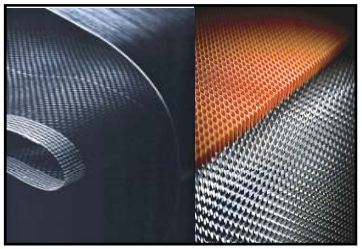
EDA – Objectives

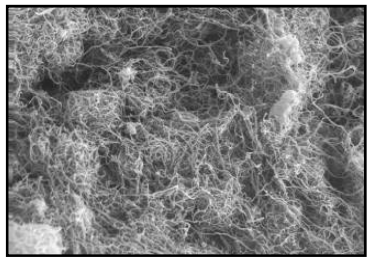
- Design airframe for decreasing inputs, outputs and nuisances during A/C design & production and withdrawal phases
- Deliver eco-design recommendations to the vehicle types ITD considered within Clean Sky
- Evaluate new promising technologies and then to identify and maturate the ecologically sound design solutions
- Introduce eco-design tools in the current aircraft design process

EDA – Area 1: Materials

New materials – Requirements

- **Structural function**
  - Performances : weight saving
  - “Renewability” products
  - “Recyclability”
  - REACH (CMR…)
  - Materials production processes : energy, cost, pollution





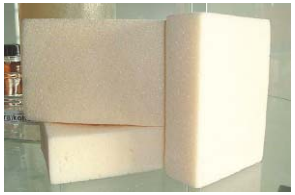
New materials – Requirements

- **New functions**
  - Anti icing
  - Low friction coating
  - Self healing, self cleaning
  - Electrical conductivity
  - …

Modelling

New emerging materials

- **Composite**
  - Resins and fibres made from agriculture
  - nanotechnology, molecular design
  - Thermoplastics
  - Others
- **Metallic**
  - New light alloys
  - Surface treatment, protection



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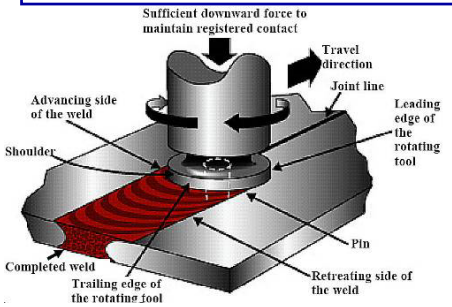
EDA – Area 2: Manufacturing

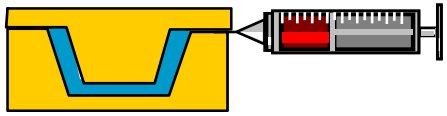
New processes – Requirements

- **Industrial**
  - Optimised Work Flow
  - Highly integrated processes
  - One shot process
  - Dry process
  - Low energy
  - Low emissions (noise)
  - Increased automation
  - Recycling of ancillaries
- **Societal**

Materials – Requirements

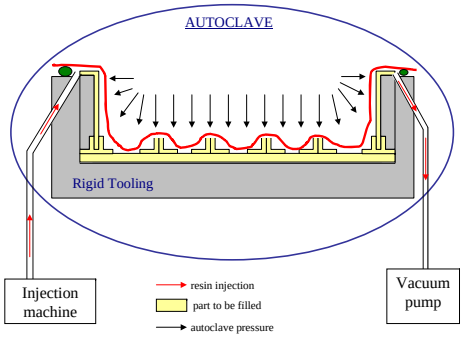
- **Current**
  - Composite, metallic
- **New**
  - Green Composites, metallic
  - Low emissions (VOC, dust)
  - Low production waste and scrap
  - Recyclability





Green Factory

- **Direct manufacturing**
- **Energy management**
- **Virtual Reality**
- **Manufacturing waste management**



Modelling

EDA – Area 3: Long Life Structure

Structural Diagnostic / Prognostic

- Health Usage & Monitoring
- Real time monitoring
- Smart sensors
- Non Destructive Testing

Green Repair Solutions

- Repair solutions for Thermoplastics
- Rework technologies
- Low energy techniques (Inductive devices, IR- devices, oil heated devices, …)
- Repair of severe damages
- Testing and qualification of the repairs

Test Procedures

- Relevant vs in field experience
- Short testing cycle
- Ease of structure repair

EDA – Area 4: End of Life Management

Dismantling processes

- Low energy
- Dry Processes
- Low effluents and waste

Materials end of life treatment for reuse, elimination, storage

- **Metallic**
  - Separation, purification
  - Storage of end products
- **Organic**
  - Physical processing
  - Chemical processing
  - Biological processing
  - Energy
  - Storage of end products
- **Equipment**
  - Traceability all along the supply chain

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EDA – Overall Life Cycle Demonstration

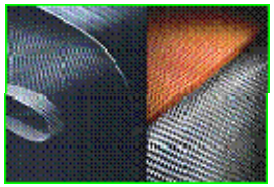
Materials Manufacturing

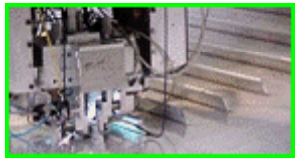
Production Process

Use Maintenance

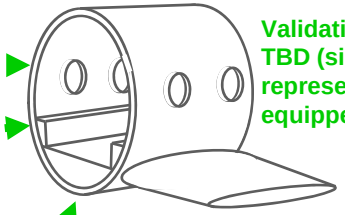
Dismantling

Recycling

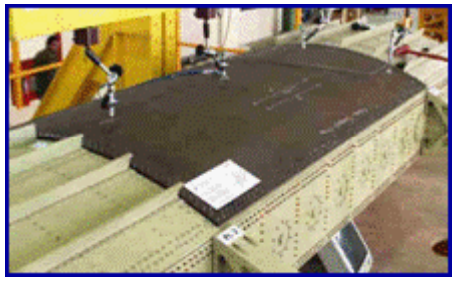




Modelling + manufacturing + testing



Validation article TBD (significant representative equipped structure)



Partial tests

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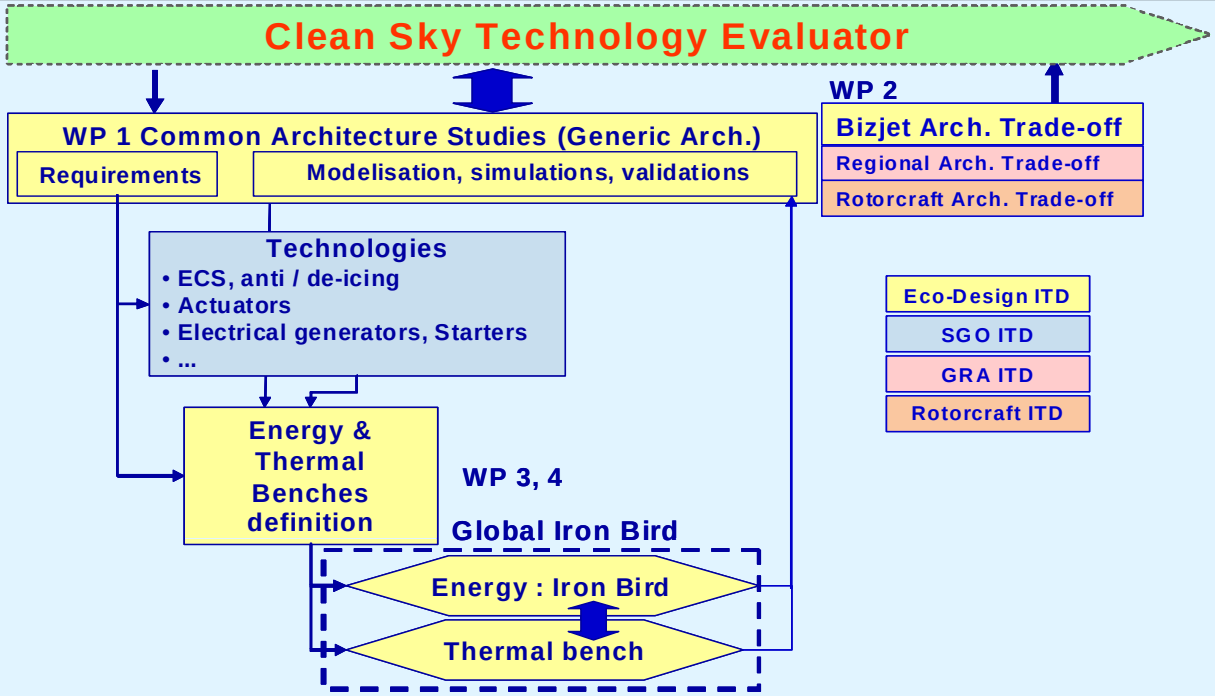
EDS (Eco-Design for System applications)

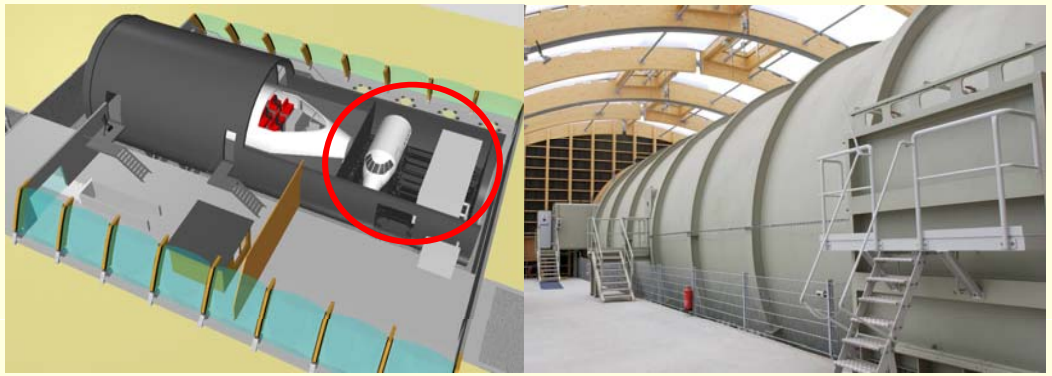
EDS Overview

Logic Flow



Integration and models demonstration through

Electrical test bench



Thermal test bench

EDS – Objectives

- Validate an a/c design methodology and tools for optimisation of Integrated Vehicle Systems Architecture
- Demonstrate feasibility and ecolonomic benefits of the all electric a/c concept
- Evaluation / maturation of electrical & thermal technologies
- Prepare the ecolonomic design through drastic reduction of ground and flight tests thanks to the virtual a/c concept

EDS – Demonstration: Electrical & Thermal Technologies

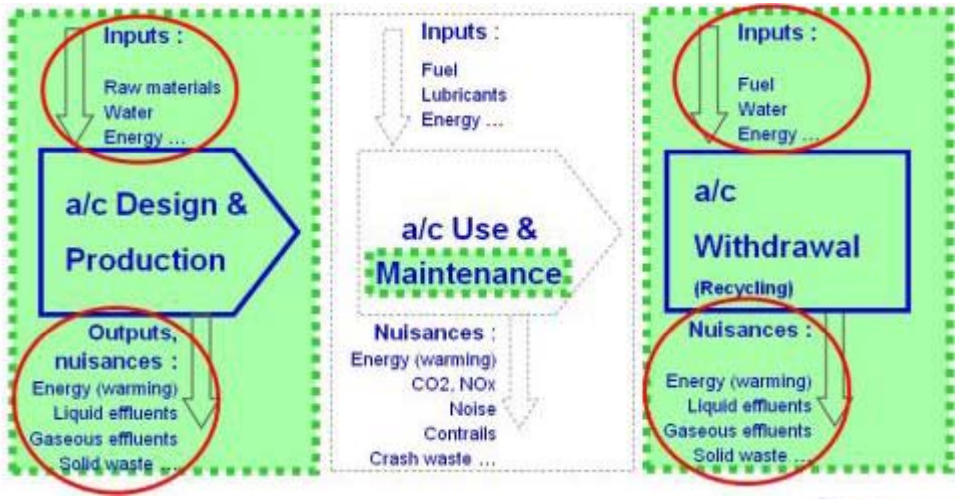
- Demonstrate an optimisation of high power electrical network operation
- Demonstrate optimised air circulation patterns
- Demonstrate passive temperature control (radiation, conduction)
- Demonstrate active temperature control (heat pipe, ...)
- Demonstrate advanced materials in aircraft structures

- Demonstrate accurate modeling of the thermal environment, including the effects of active thermal control technologies
- Validate the methodology and associated modelling for the thermal side

EDA Achievements

Eco-Design for Airframe (EDA) Objectives

- **Development of A/C technologies to reduce environmental impacts during out-of-operation phases of the A/C lifecycle**



Reduction of inputs and outputs

Technology areas along the lifecycle

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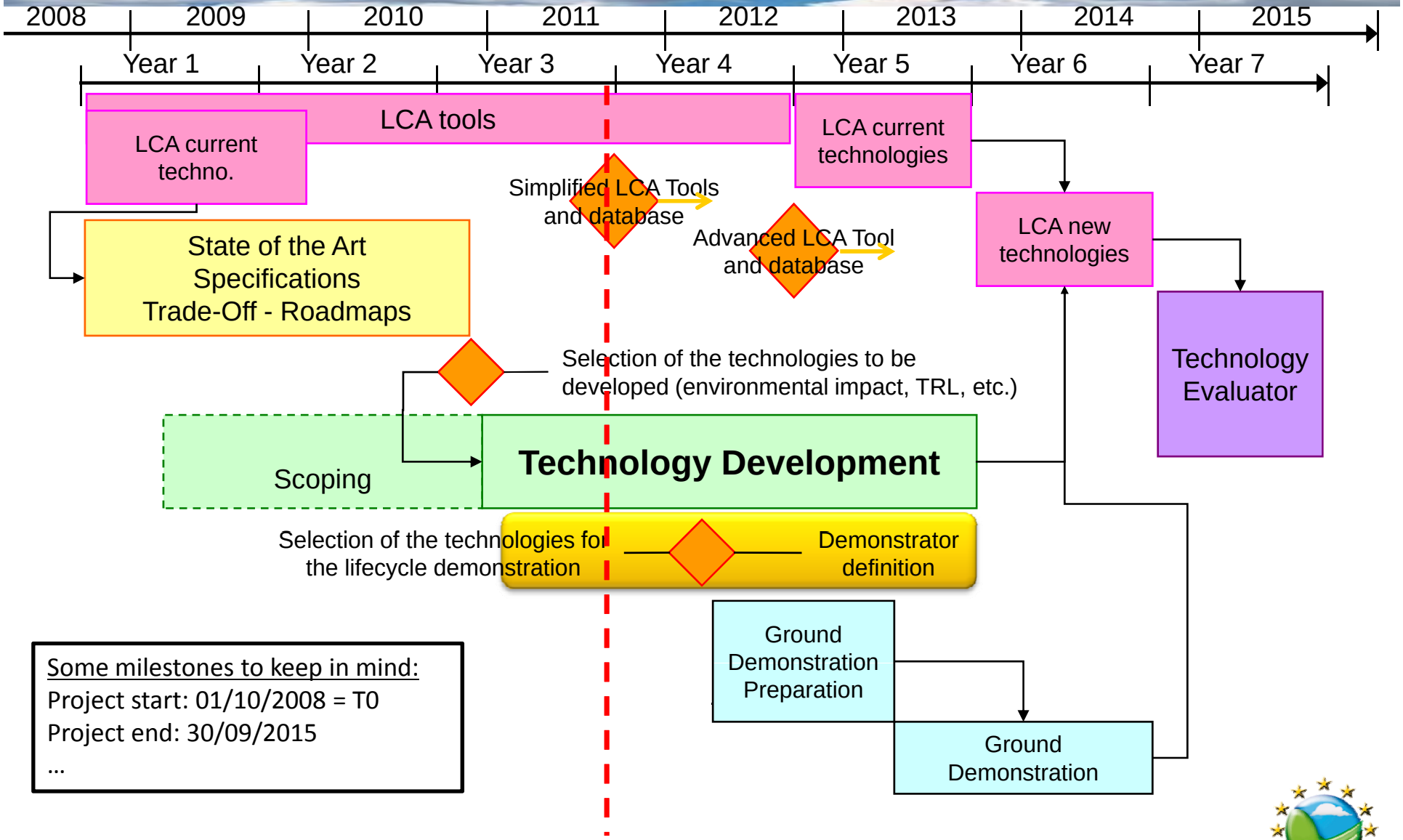
General Planning



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Technology Trade-Off – Final results (2010)

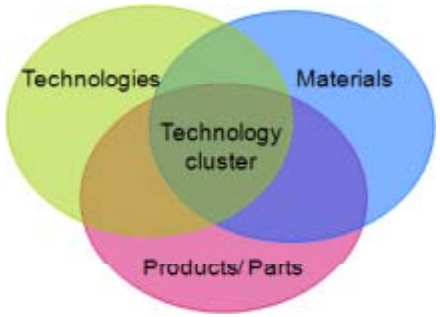
State of the art

SoA where more than 150 tasks were highlighted, that corresponds to 235 “single technologies”

Clustering and downsizing

Downsizing in which EDA consortium members were encouraged to identify their company's favourites

Clustering where WP 2.1 and 2.2 technologies were grouped to stress EDA key topics and to focus the ground demonstration on these key areas



Trade-off based on a scoring

129 Technologies

T0+60

Scoping

Technology Development

T0+6

T0+27

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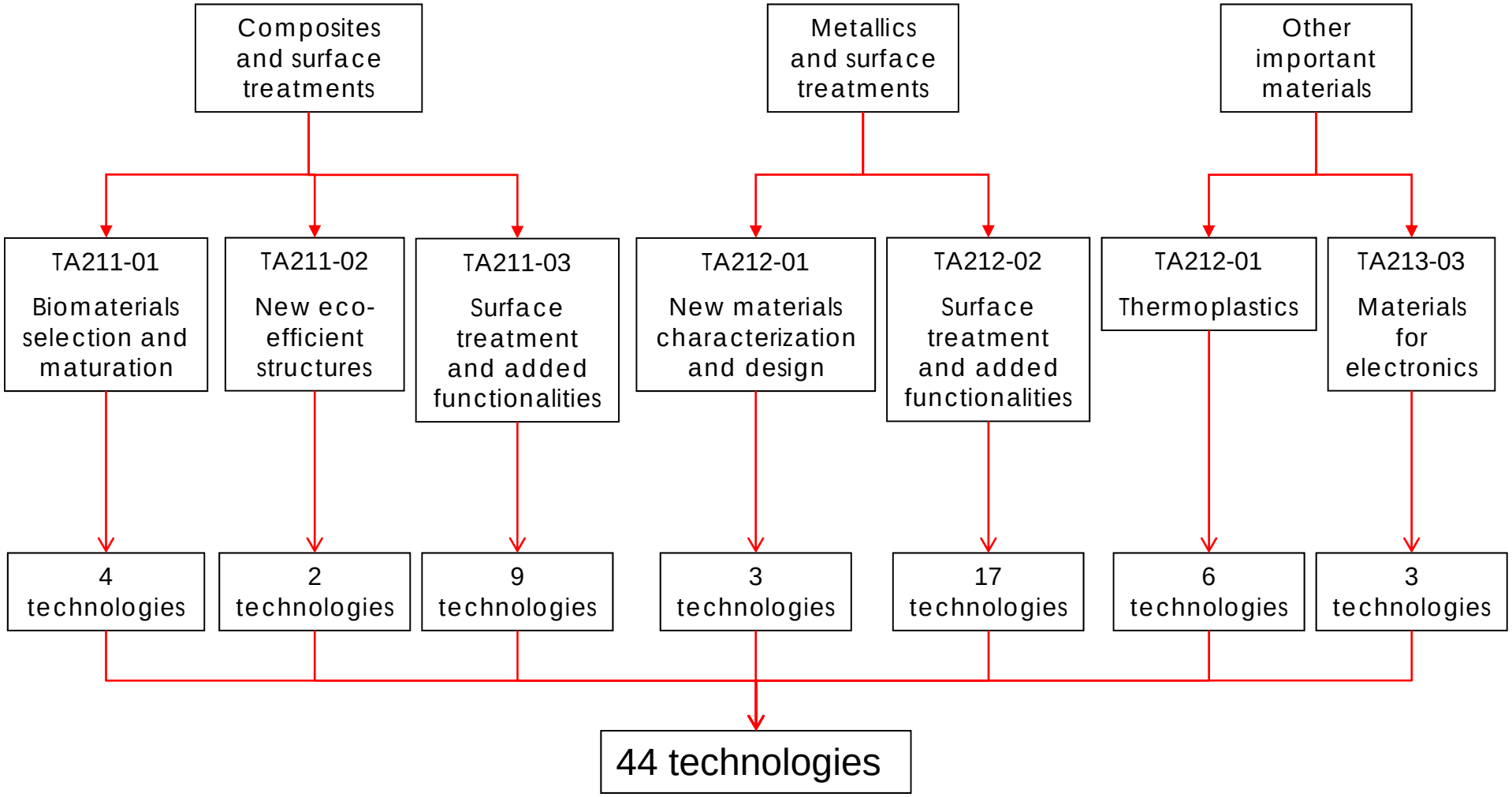
An example - Technologies in the field of materials



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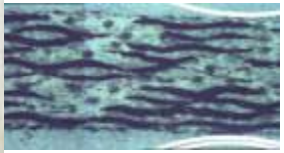
Examples of green technologies WP 2.1 & 2.2

Dry metal machining

Replacement of chemical machining by mechanical machining

Bio-fibbers / bio-resins for cabin interiors and secondary structures



Press forming of TS

Metal scrap management for recycling

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High Level Clusters

- 6 main areas of interest within material and process WPs

High Level Cluster	Number of tech clusters
I - CFRP (cluster no. 1, 7, 9)	3
II - Metallics (2, 8, 11, 12, 15)	5
III - Biomaterials (4, 13)	2
IV - Thermoplastics (5, 6)	2
V - Special polymers applications (3, 10)	3
VI - Electronics (14)	1

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EDA LCA DataBase

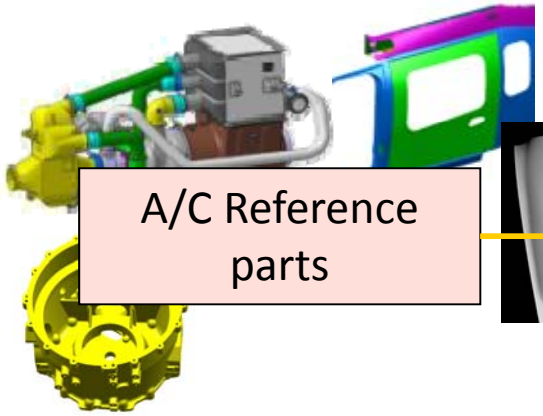
EDA LCA DataBase

- **Objective :**

  Build common consolidated aerospace dedicated database based upon the ELCD format, including data collected from partners

- **EDA LCA DataBase – Current technologies :**
  - Data collection completed for DB first issue
  - DB first issue: July-August 2011
- **EDA LCA DataBase – EDA developed technologies :**
  - Data collection process to be initiated in September 2011
- **Final aim: to become the standard LCA DataBase for European aeronautic industry**

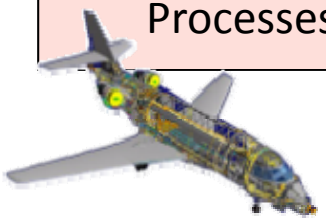
Overall LCA Logic



A/C Reference parts

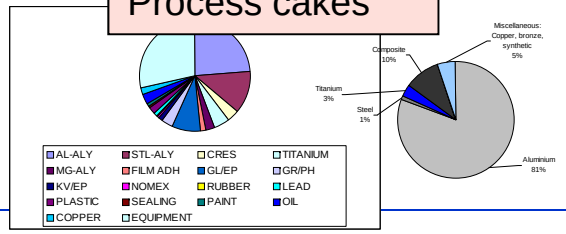
Material & Process Technologies

Bill of Materials & Processes



LCA on Reference parts

A/C Material & Process cakes



Combination for A/C extrapolation

Technologies Eco-Statement
(current & innovative)

A/C Level Eco-Statement
(current & innovative)

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EDA Overall Eco-statement Planning

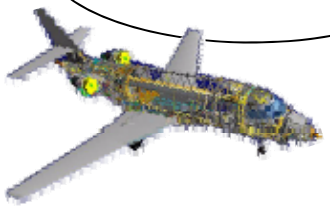
2012 2013 2014

LCA tools

Current Eco-Statement

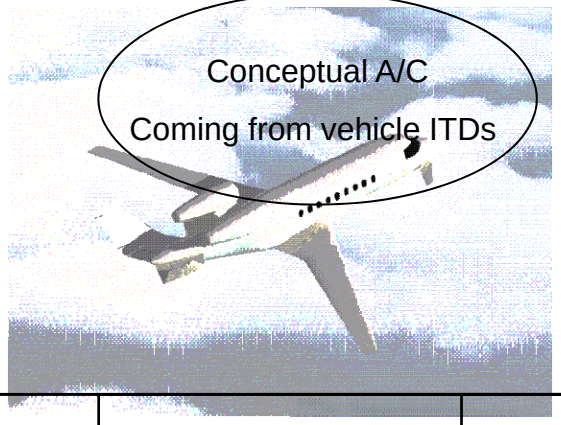
Reference A/C

Coming from vehicle ITDs

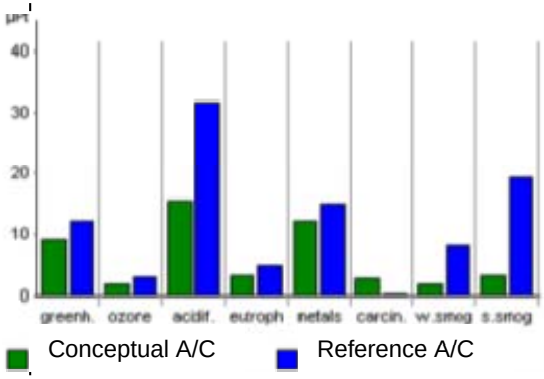


Conceptual A/C

Coming from vehicle ITDs



Final Eco-Statement



Eco-assessment of current / innovative technologies to be carried out on a regular basis

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List of Topics for Call 10

Identification	ITD - AREA - TOPIC	topics	VALUE	MAX FUND
JTI-CS-ECO	**Clean Sky - EcoDesign**	**10**	**2.535.000**	**1.901.250**
JTI-CS-ECO-01	*Area-01 - EDA (Eco-Design for Airframe)*		**2.285.000**	
JTI-CS-2011-3-ECO-01-032	Formulation and characterisation of new aluminium alloys for high temperature applications (250°C)		450.000	
JTI-CS-2011-3-ECO-01-033	Corrosion protection of aluminium unpainted parts: development of an appropriated Cr free sealing		240.000	
JTI-CS-2011-3-ECO-01-034	Metal recycling from a/c sources: Recycling routes screening and metallurgical approaches		200.000	
JTI-CS-2011-3-ECO-01-035	Environmental friendly ancillary materials development: Bio-sourced material, Recycled sourced mat.		160.000	
JTI-CS-2011-3-ECO-01-036	Development of fungi growth inhibition coating for fuel tank		300.000	
JTI-CS-2011-3-ECO-01-037	Disintegration of Fiber Reinforced Composites by electrodynamic fragmentation technique		435.000	
JTI-CS-2011-3-ECO-01-038	Aircraft insulation recycling routes and experiments		200.000	
JTI-CS-2011-3-ECO-01-039	Development of a chromate 6+ free chemical surface treatment for cast magnesium alloys protection		200.000	
JTI-CS-2011-3-ECO-01-040	Devel. of a fully automated preforming process for 3-D shaped composite dry fiber		300.000	
JTI-CS-ECO-02	*Area-02 - EDS (Eco-Design for Systems)*		**250.000**	
JTI-CS-2011-3-ECO-02-012	Intelligent Load Power Management Rig Module		250.000