Clean Sky
Sustainable and Green Engine ITD

Michel GOULAIN, SAGE
Project Officer

June 1st, 2010, Vienna
Clean Sky JTI – Engine related Activities & Deliveries

ATMS T-Dem.

Engine T-Dem.

A/C S/S T-Dem.

A/C C-Stud.

A/C T-Dem.

A/C S/S C-Stud.

ATMS C-Stud.

ATMS T-Dem.

Impact Assess.

Engine Concepts

Engine Techno.

A/C Concepts

A/C Techno.

A/C S/S Concepts

A/C S/S Techno.

ATMS Concepts

ATMS Techno.

Impacts

Note: CS supporting processes (tools development, …) supposed as included in represented processes
Clean Sky Technical Bodies

- Smart Fixed Wing Aircraft (SFWA)
- Green Regional Aircraft (GRA)
- Green Rotor-Craft (GRC)
- Sustainable And Green Engine (SAGE)
- System for Green Operations (SGO)
- Eco-Design (ED)
- Technology Evaluator (TE)
SAGE ITD – 4 Engine Concepts, 5 Demonstrations

- Geared Pusher
- Counter-Rotating Open Rotor
- Direct Drive Pusher
- Counter-Rotating Open Rotor
- Advanced Large 3-shaft Turbofan
- Advanced Geared Turbofan
- Advanced Turboshaft

CLEANSKY
## SAGE ITD - Time Schedule

<table>
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<tr>
<th>Year</th>
<th>Quarter</th>
<th>SAGE1 Geared Open Rotor</th>
<th>SAGE2 Direct Drive Open Rotor</th>
<th>SAGE3 Large 3-shaft Turbopfan</th>
<th>SAGE4 Geared Turbofan</th>
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Clean Sky Members

- Clean Sky Leaders:
  - Airbus
  - Alenia Aeronautica
  - Rolls-Royce
  - SAFRAN

- Clean Sky Associates:
  - Avio
  - ITP
  - MTU Aero Engines
  - Volvo Aero

Clean Sky Partners

- From Call for Proposals (CfP) #1:
  - GE
  - FAG
  - TRONICO
  - Oxsensis
  - SENER

- From coming CfPs: ...
SAGE ITD – SAGE1, Geared Open Rotor

BR715 core gas generator core
Open rotor assembly
Test Programme

Airframer requirements and installations

Intercase, inc, mount
Rear rotating structure

LPC Booster

Project launch
1 June 2008

Prelim. DR
June 2011

Critical DR
Sept. 2012

Open rotor technology development → full-scale engine demonstration
Concept studies
Demo spec.

Prelim. design
Partner selection

Detail design
Manufacture

Build and test

Project completion
2014

Concept DR
Nov. 2009

Critical DR
Sept. 2012
**SAGE ITD – SAGE2, Direct Drive Open Rotor**

- **SAFRAN**
- **AIRBUS**
- **VOLVO AERO**
- **Avio**
- **AleniaAermacchi**
- **FAG**

**Modules, sub-systems, nacelle items**

- Design integration, assembly
- Test Programme

**Airframer requirements and installations**

**Rotating structure Shafts**

**Power Turbine items**

- PGB for alternate architecture

**Nacelle items**

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**Interim Review**
- Nov. 2009

**Prelim. DR**
- June 2011

**Project completion**
- 2013

**Open rotor technology development → full-scale engine demonstration**

- Concept studies
- Demo spec.
- Prelim. design
- Partner selection
- Detail design
- Manufacture
- Build and test

**Project launch**
- 1 June 2008

**Concept DR**
- Sept. 2010

**Critical DR**
- Dec. 2011
SAGE ITD – SAGE3, Large 3-shaft Demonstrator

Trent 1000 core engine
Composite fan system
Integrated installations
Test programme

Lightweight intercase structures, material characterisation and manufacturing technologies

Project launch
1 Jan. 2009

Prelim. DR
March 2011

Build 1 engine test
2012

Build 2 engine test
2013
SAGE ITD – SAGE4, Geared Turbo Fan

Project launch
1 June 2008

Prelim. DR
Dec. 2010

Critical DR
Sept. 2011

Concept DR
Mar. 2010

Project completion
2013

existing commercial Geared Turbo Fan

HPC

High-Speed LPT

Fan Drive Gear System

Mid Turbine Frame

Concept Definition & Concept Studies
Detail Design Manufacture
Concept Optimization
Assy and Test
SAGE ITD – SAGE5, Turboshaft engine

Innovative Core Engine

Airframer requirements and installations

Built and test

Preliminary DR
Jan. 2010

Engine test
Sept 2012

Turboshaft engine development → full-scale engine demonstration

Demo spec. Prelim. design Detail design Build and
Partner selection Manufacture test

Project launch
1 Jan. 2009

Critical DR
July 2011

Project completion
2013

CLEANSKY
Volvo Aero focus on design, development and manufacturing of complex lightweight static and rotating structures.

Advanced manufacturing and manufacturing process simulation technologies developed in FP5 and FP6 projects are a key to success.
ITP’s contribution in SAGE 1 is design, development and manufacturing of the ORD booster.

In SAGE 3 ITP contributes in technology development for Low Weight Efficient Low Pressure turbines.
AVIO’s key contribution to SAGE is technology development focused to highly efficient and reliable Lower Pressure Turbine and Power Gearbox, both considered core items of future engine architectures.

Technological effort is based on FP5, FP6 and FP7 projects, continuous improvement and excellence partnership network.
In the total project lifetime the SAGE-ITD expect to contribute in CleanSky Call for Proposals (CfP) on

- 100 – 200 topics
- Total value of topics ~ 100M€

In the current calls Industry, Research Establishments and Universities are invited to check your interest and to reply upon

Call #2 – 2010 (30.March 2010 – 30.June 2010 (17:00))
- 0 topic

- 4 topics
- Total value of topics ~ 12.5 M€
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Vielen Dank für Ihre Aufmerksamkeit