TAKE OFF

Informationsveranstaltung

zu Ausschreibungen

nationaler und europäischer

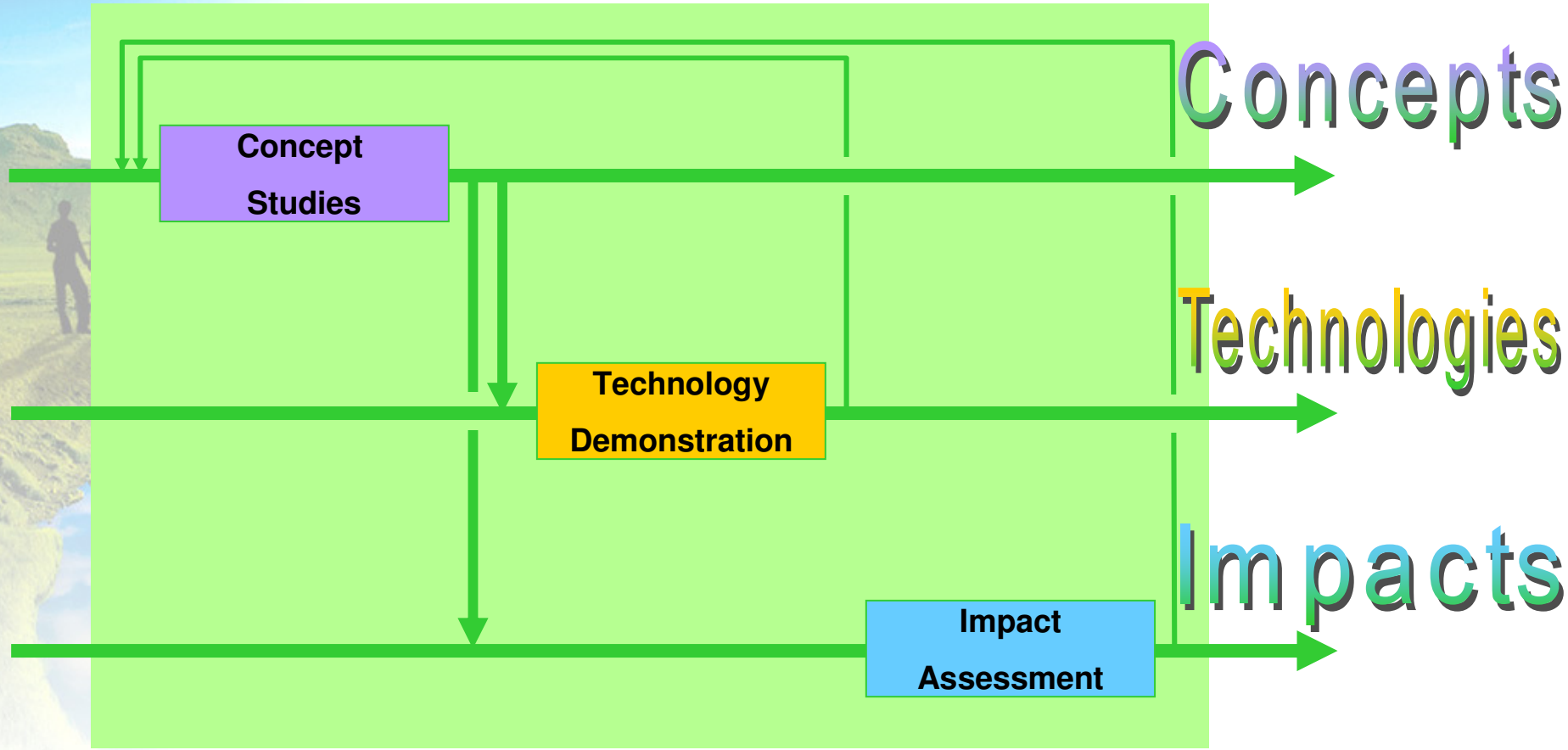
Luftfahrtforschungsprogramme

Clean Sky
Sustainable and Green Engine ITD

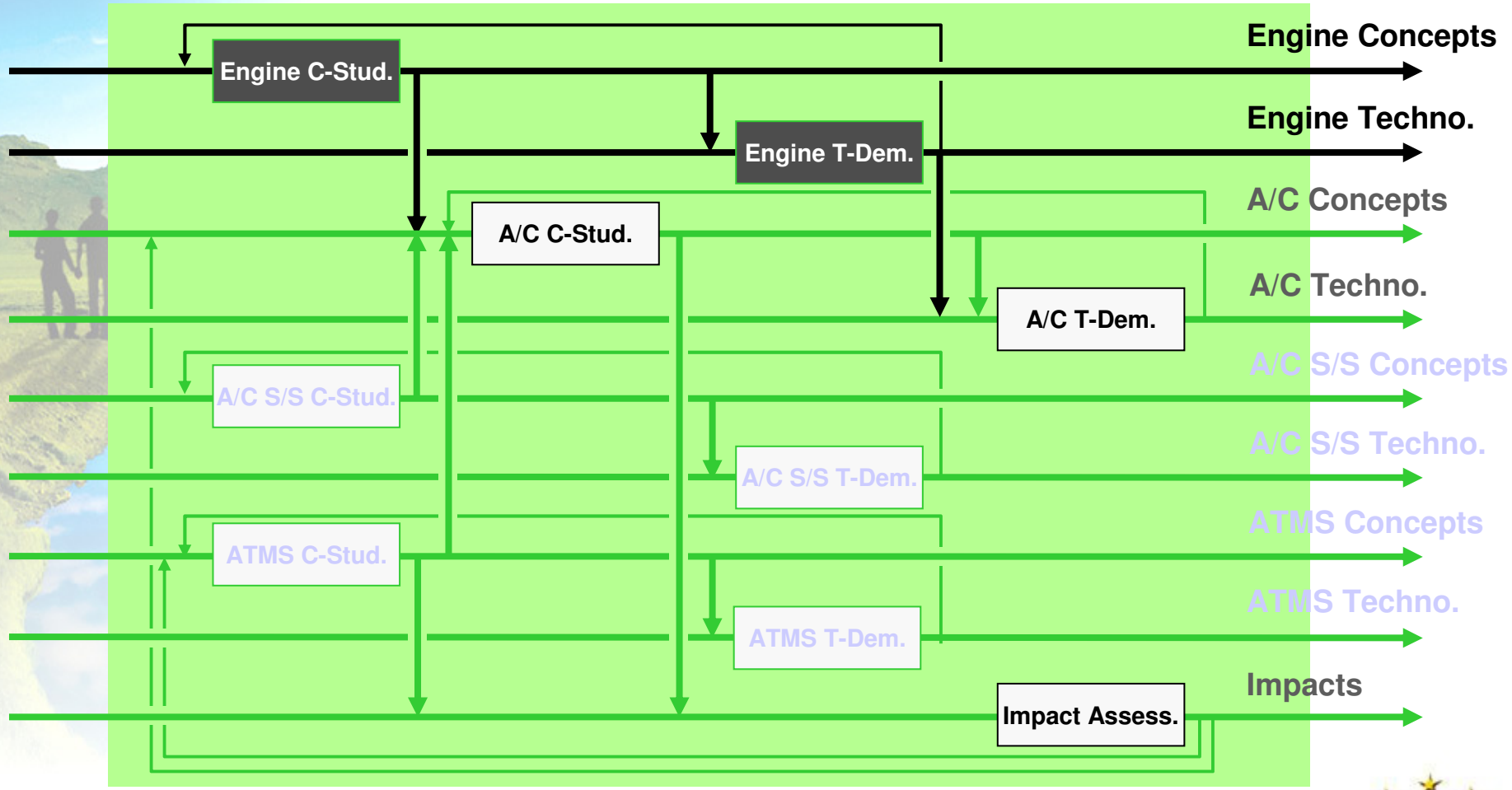
Michel GOULAIN, SAGE
Project Officer

June 1st, 2010, Vienna

Clean Sky JTI – Activities & Deliveries



Clean Sky JTI – Engine related Activities & Deliveries



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

Clean Sky JTI – Engines Activities over ITDs & TE

Clean Sky Technical Bodies

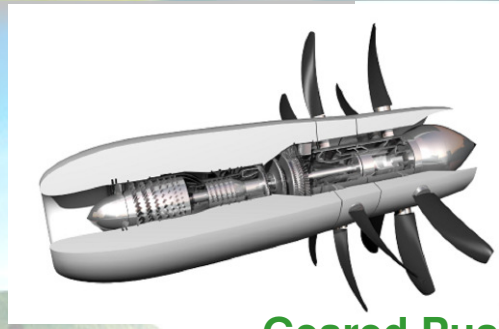
- Smart Fixed Wing Aircraft (SFWA)
- Green Regional Aircraft (GRA)
- Green Rotor-Craft (GRC)
- Sustainable And Green Engine (SAGE)
- System for Green Operations (SGO)
- Eco-Design (ED)
- Technology Evaluator (TE)

SAGE Integrated Technology Demonstrator (ITD)

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

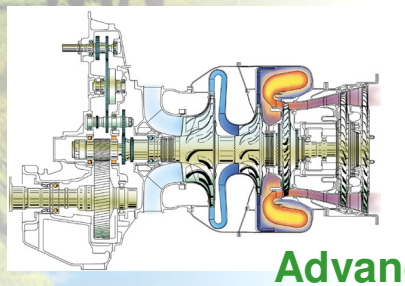
SAGE 1

SAGE 2

SAGE 3

SAGE 4

SAGE 5

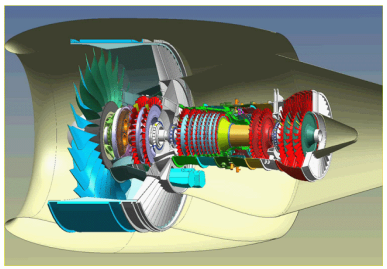


Advanced

Turboshaft

Advanced

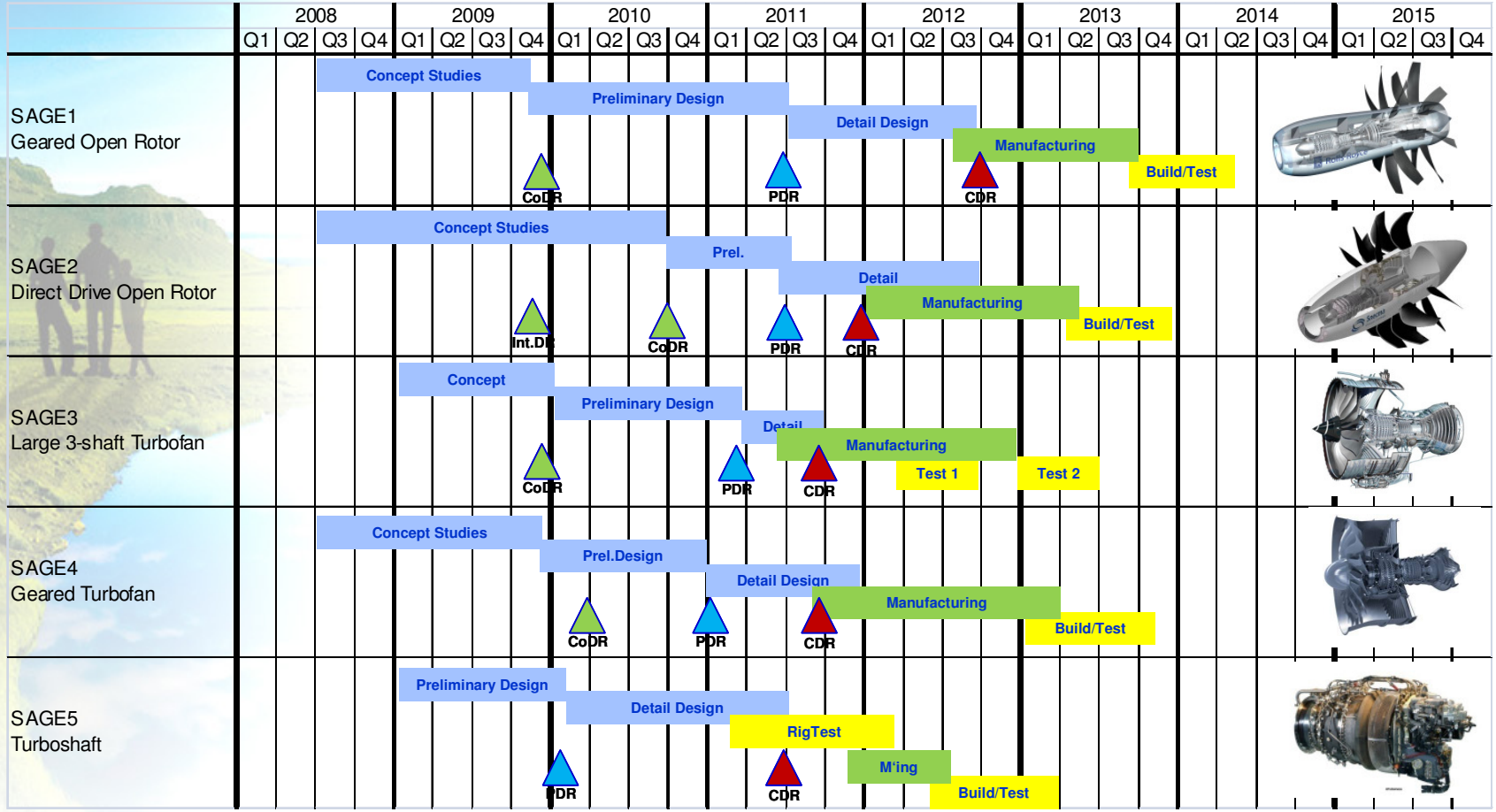
Large 3-shaft Turbofan



Advanced

Geared Turbofan

SAGE ITD – Time Schedule



SAGE ITD – Membership

- Clean Sky Members
  - **Clean Sky Leaders :**

    AIRBUS, AleniaAeronautica (A Finmeccanica Company), Rolls-Royce, SAFRAN
  - **Clean Sky Associates :**

    Avio (innovative propulsion), ITP, MTU Aero Engines, VOLVO AERO
- Clean Sky Partners
  - **From Call for Proposals (CfP) #1 :**

    GE, FAG, TRONICO, inasmet tecnalia, Oxsensis (multi parameter optical sensing), SENER, Warsaw University of Technology
  - **From coming CfPs : …**

SAGE ITD – SAGE1, Geared Open Rotor

Rolls-Royce

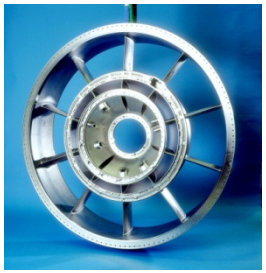
BR715 core gas generator core
Open rotor assembly
Test Programme

AIRBUS

AleniaAeronautica
A Finmeccanica Company

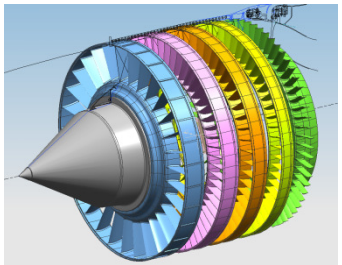
Airframer requirements and installations

VOLVO AERO



Intercase, inc, mount
Rear rotating structure

ITP



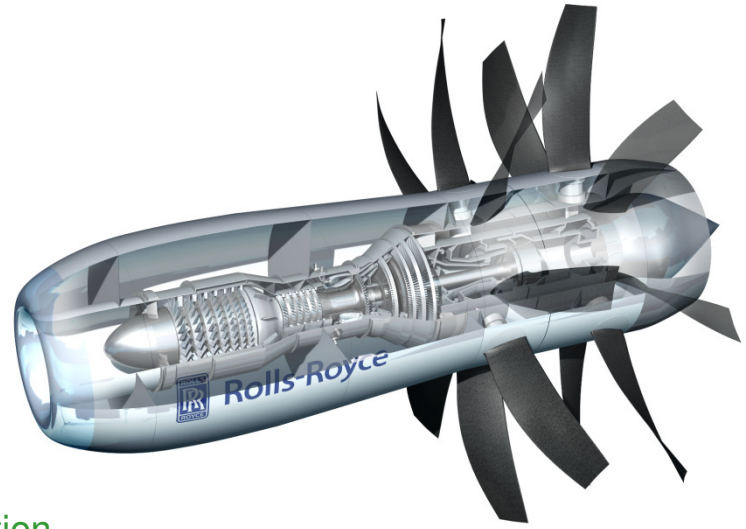
LPC Booster

Concept DR
Nov. 2009

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



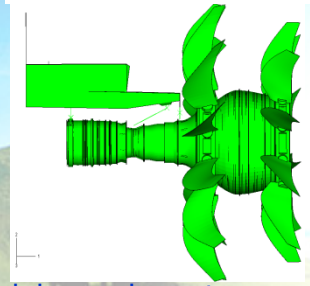
Project launch
1 June 2008

Prelim. DR
June 2011

Project completion
2014

SAGE ITD – SAGE2, Direct Drive Open Rotor

SAFRAN



Modules, sub-systems, nacelle items

Design integration, assembly

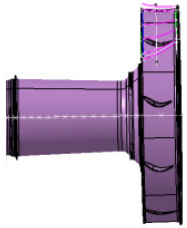
Test Programme

AIRBUS

AleniaAeronautica

Airframer requirements and installations

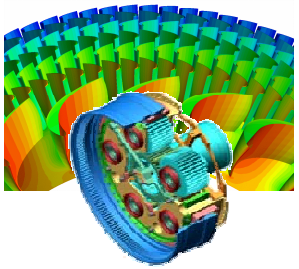
VOLVO AERO



Rotating structure

Shafts

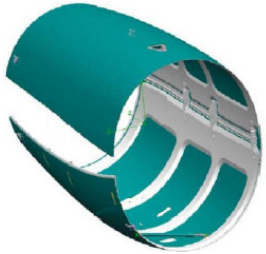
Avio propulsione aerospaziale



Power Turbine items

PGB for alternate architecture

AleniaAermacchi



Nacelle items

Pitch Change Mechanism

FAG

PGB

Bearings

Interim Review
Nov. 2009

Prelim. DR
June 2011

Project completion
2013

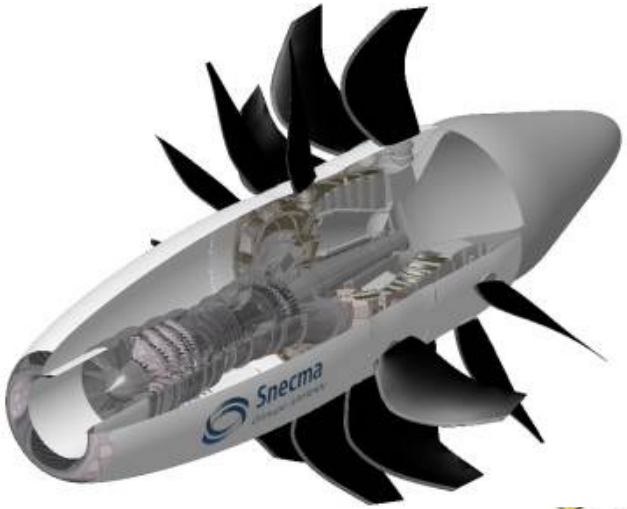
Open rotor technology development → full-scale engine demonstration

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

Project launch
1 June 2008

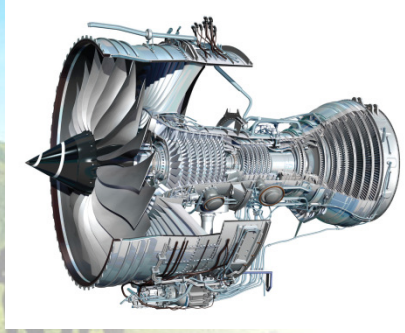
Concept DR
Sept. 2010

Critical DR
Dec. 2011



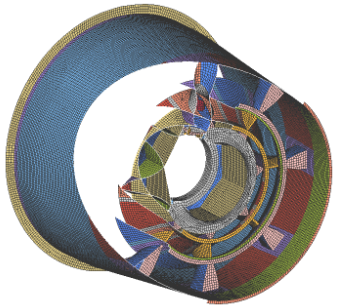
SAGE ITD – SAGE3, Large 3-shaft Demonstrator

Rolls-Royce



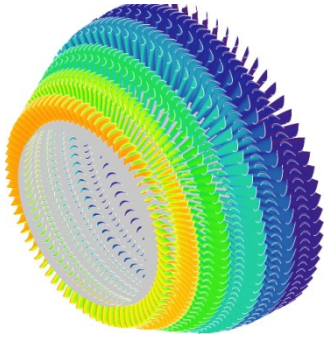
Trent 1000 core engine
Composite fan system
Integrated installations
Test programme

VOLVO AERO



Lightweight intercase structures, material characterisation and manufacturing technologies

ITP



LP Turbine and structures

Concept DR
Dec. 2009

Critical DR
Sept. 2011

Concept studies
Technology selection for demonstration

Prelim. Design
Process development
Partner selection

Detail design
Manufacture
Rig testing

Phased build and technology demonstration

Project launch
1 Jan. 2009

Prelim. DR
March 2011

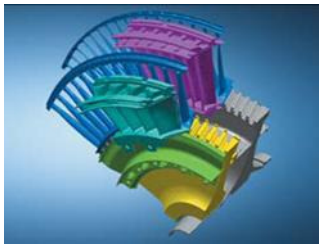
Build 1
engine test
2012

Build 2
engine test
2013

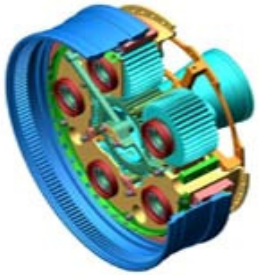
SAGE ITD – SAGE4, Geared Turbo Fan

existing commercial
Geared Turbo Fan

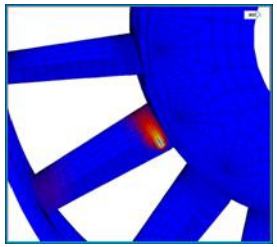
HPC



High-Speed
LPT



Fan Drive
Gear System



Mid Turbine
Frame

Concept DR
Mar. 2010

Critical DR
Sept. 2011

Initial Concept Design

Concept Definition & Concept Studies

Concept Optimization

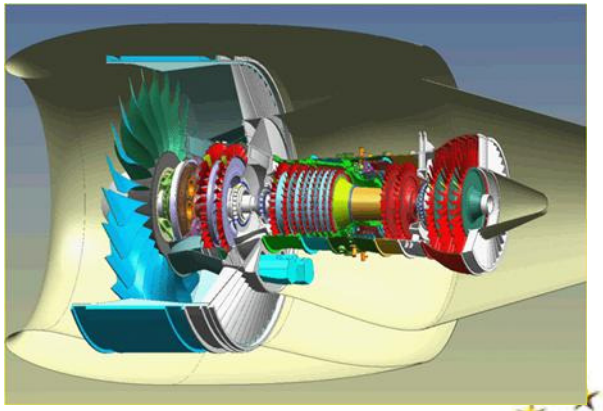
Detail Design Manufacture

Assy and Test

Project launch
1 June 2008

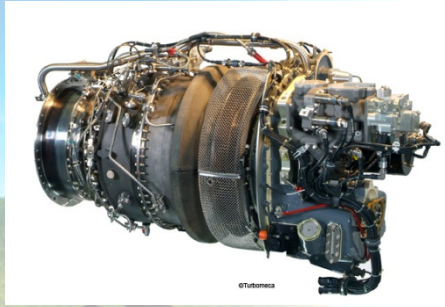
Prelim. DR
Dec. 2010

Project completion
2013



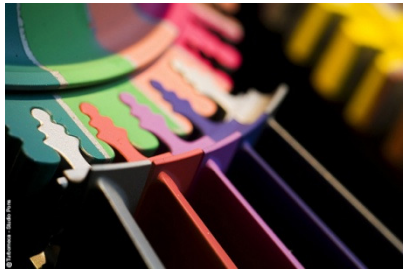
SAGE ITD – SAGE5, Turboshaft engine

Turbomeca
Groupe SAFRAN



Innovative Core Engine

Airframer requirements
and installations



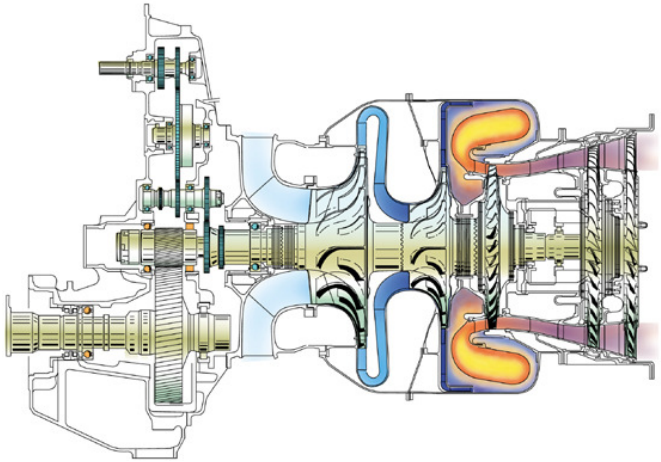
Built and test

Preliminary DR
Jan. 2010

Engine test
Sept 2012

Turboshaft engine development → full-scale engine demonstration

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



Project launch
1 Jan. 2009

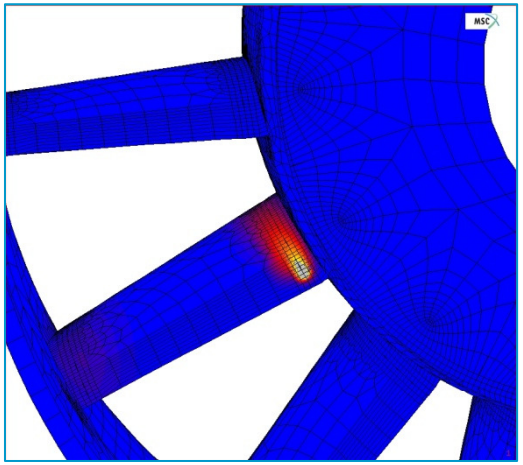
Critical DR
July 2011

Project completion
2013

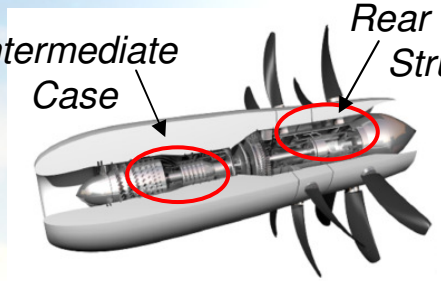
SAGE ITD Associates – Volvo Aero

- 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.

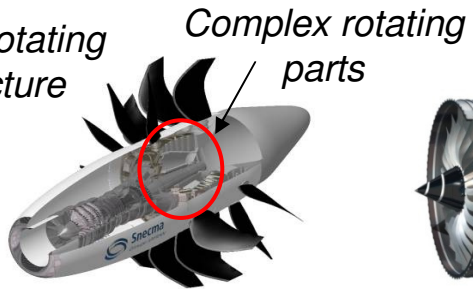
VOLVO AERO



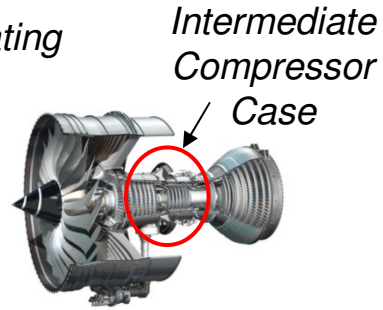
Manufacturing process simulation of welding



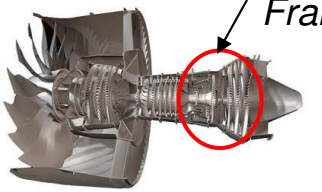
SAGE 1



SAGE 2



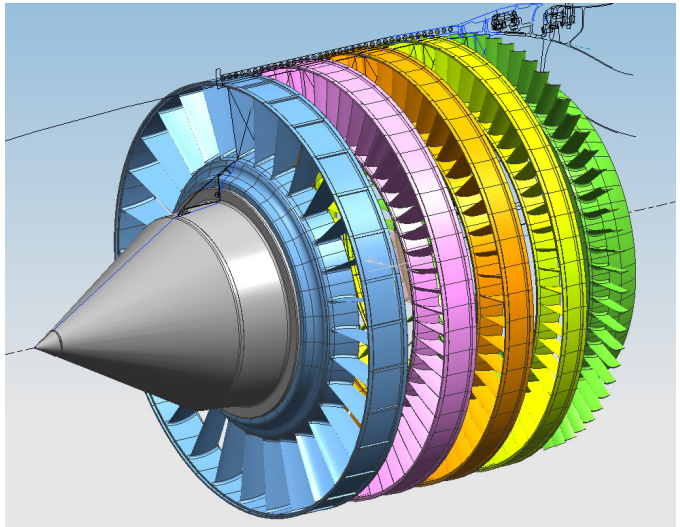
SAGE 3

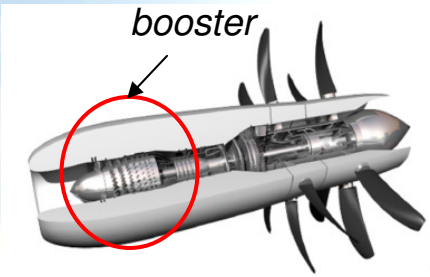


SAGE 4

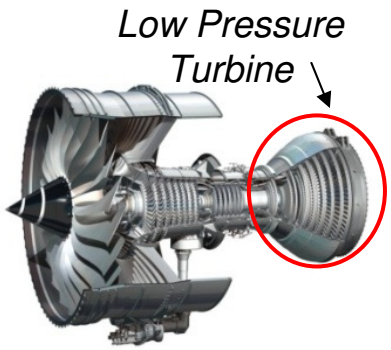
SAGE ITD Associates - ITP

- ITP's contribution in SAGE 1 is design, development and manufacturing of the ORD booster.
- In SAGE3 ITP contributes in technology development for Low Weight Efficient Low Pressure turbines.

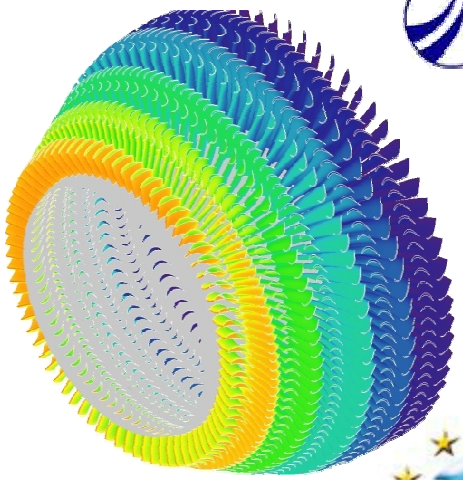




SAGE 1

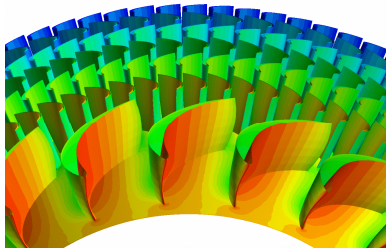


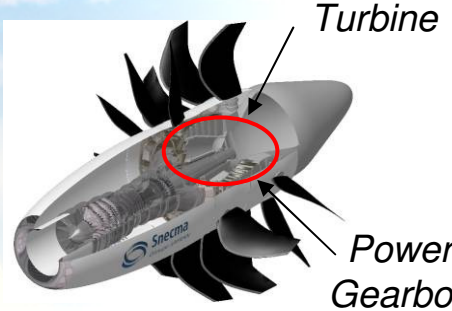
SAGE 3



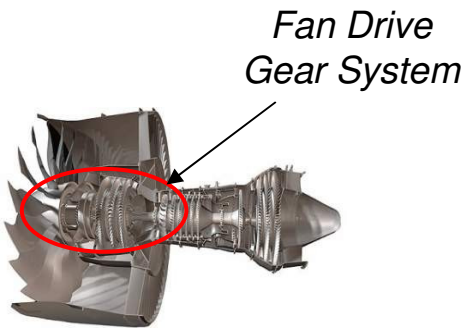
SAGE ITD Associates - AVIO

- 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

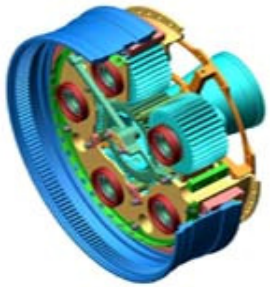




SAGE 2



SAGE 4



SAGE-ITD Call for Proposal Topics Overview

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

Call #3 – 2010 (28.April 2010 – 20.July 2010 (17:00))

- 4 topics
- Total value of topics ~ 12.5 M€

SAGE-ITD Call for Proposal Topics in Call#3 2010

Identification	ITD - AREA - TOPIC	topics	VALUE	MAX FUND
JTI-CS-SAGE	**Clean Sky - Sustainable and Green Engines**	**4**	**12.500.000**	**9.375.000**
JTI-CS-SAGE-01	*Area-01 - Geared Open Rotor*			
JTI-CS-SAGE-02	*Area-02 - Direct Drive Open Rotor*			
JTI-CS-SAGE-03	*Area-03 - Large 3-shaft turbofan*		**10.000.000**	
JTI-CS-2010-3-SAGE-03-002	Aeroengine intake technology development		10.000.000	
JTI-CS-SAGE-04	*Area-04 - Geared Turbofan*			
JTI-CS-SAGE-05	*Area-05 - Turboshaft*		**2.500.000**	
JTI-CS-2010-3-SAGE-05-002	Development of a Wasted Heat Regeneration System (WHRS)		1.200.000	
JTI-CS-2010-3-SAGE-05-003	Development of exhaust noise attenuation technologies		1.100.000	
JTI-CS-2010-3-SAGE-05-004	Development of an advanced system for pollutant measurement		200.000	

Vielen Dank für Ihre Aufmerksamkeit