



# SAGE

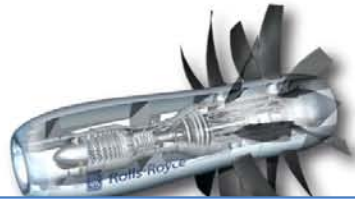
## Call #11 Call for Proposal Info Day

Brussels, 20<sup>th</sup> January 2012

*GOULAIN Michel*

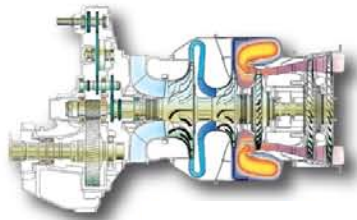
*SAGE Project Officer*

[www.cleansky.eu](http://www.cleansky.eu)



Geared pusher counter rotating open rotor

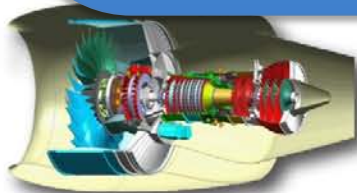
Advanced Turboshaft



Geared drive counter rotating open rotor

## And now, one more WP, SAGE 6 for the Lean Burn

Advanced Geared Turbofan



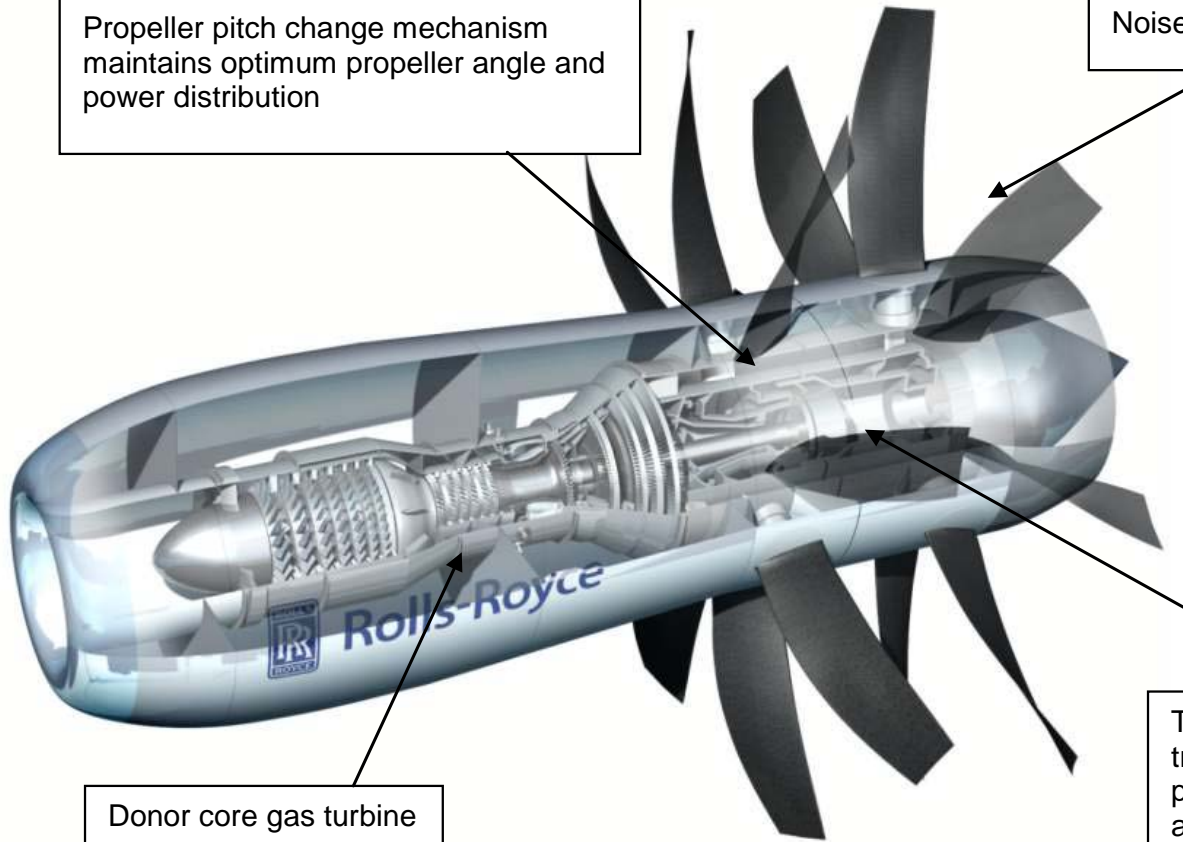
Advanced Large 3 shaft Turbofan

# SAGE 1 technologies

## CROR Technology

Propeller pitch change mechanism maintains optimum propeller angle and power distribution

Contra rotating propellers  
Noise optimised configuration



Donor core gas turbine

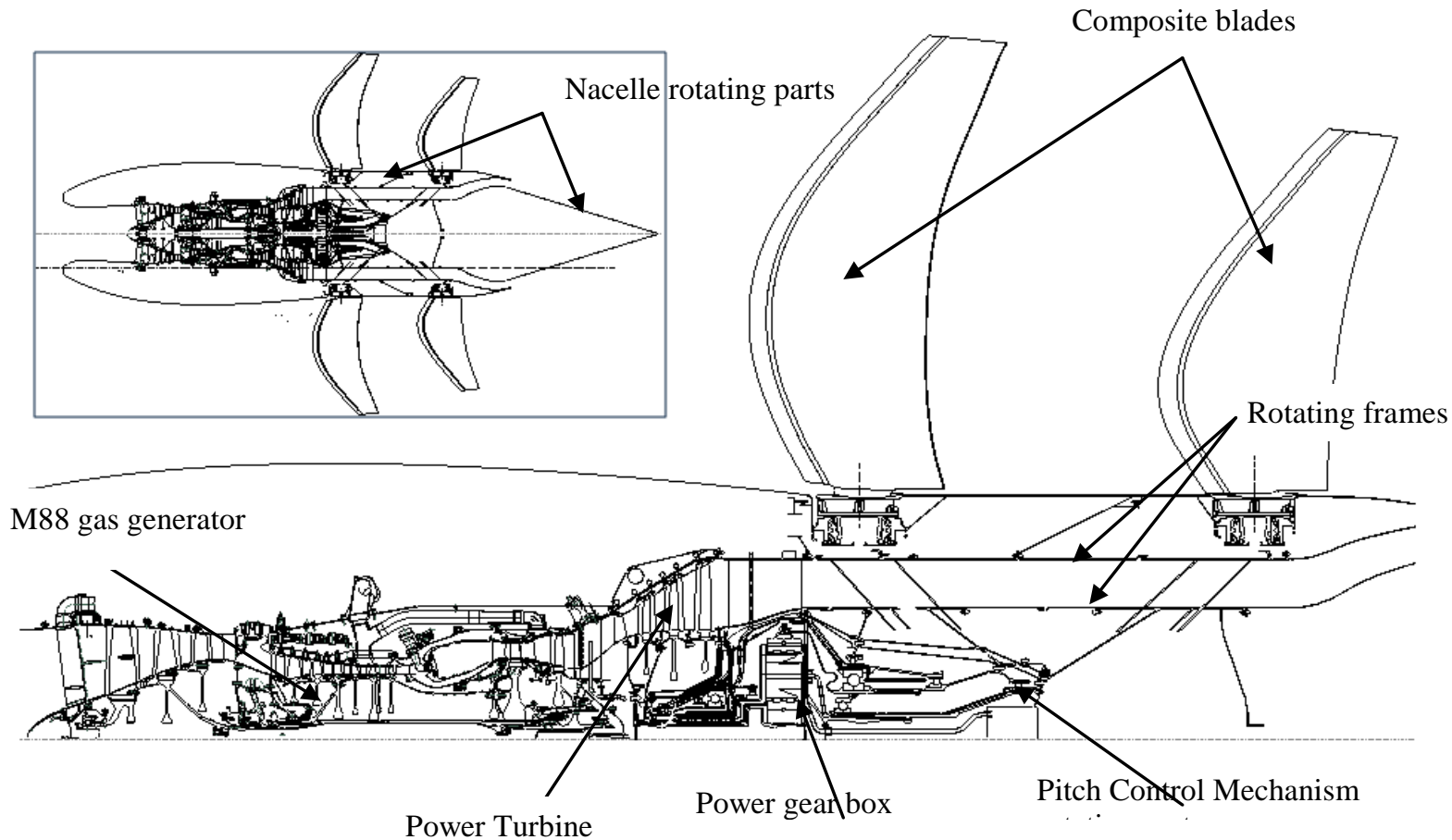
Transmissions system transfers energy from free power turbine to contra-rotating assemblies



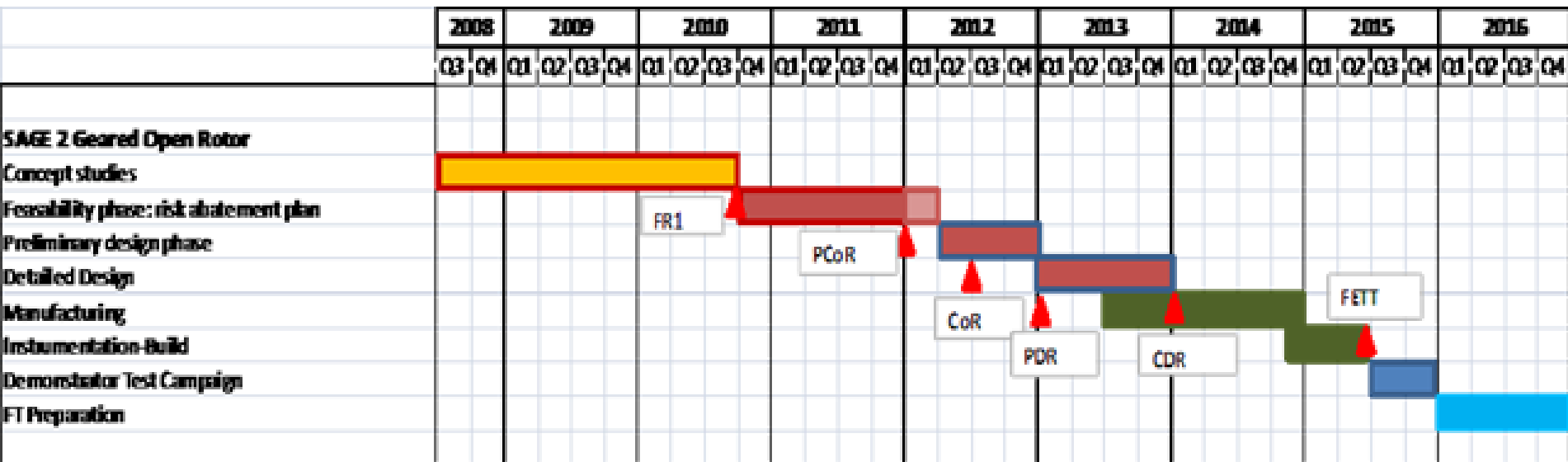


# SAGE 2

## 0.1 DEMONSTRATOR OVERVIEW

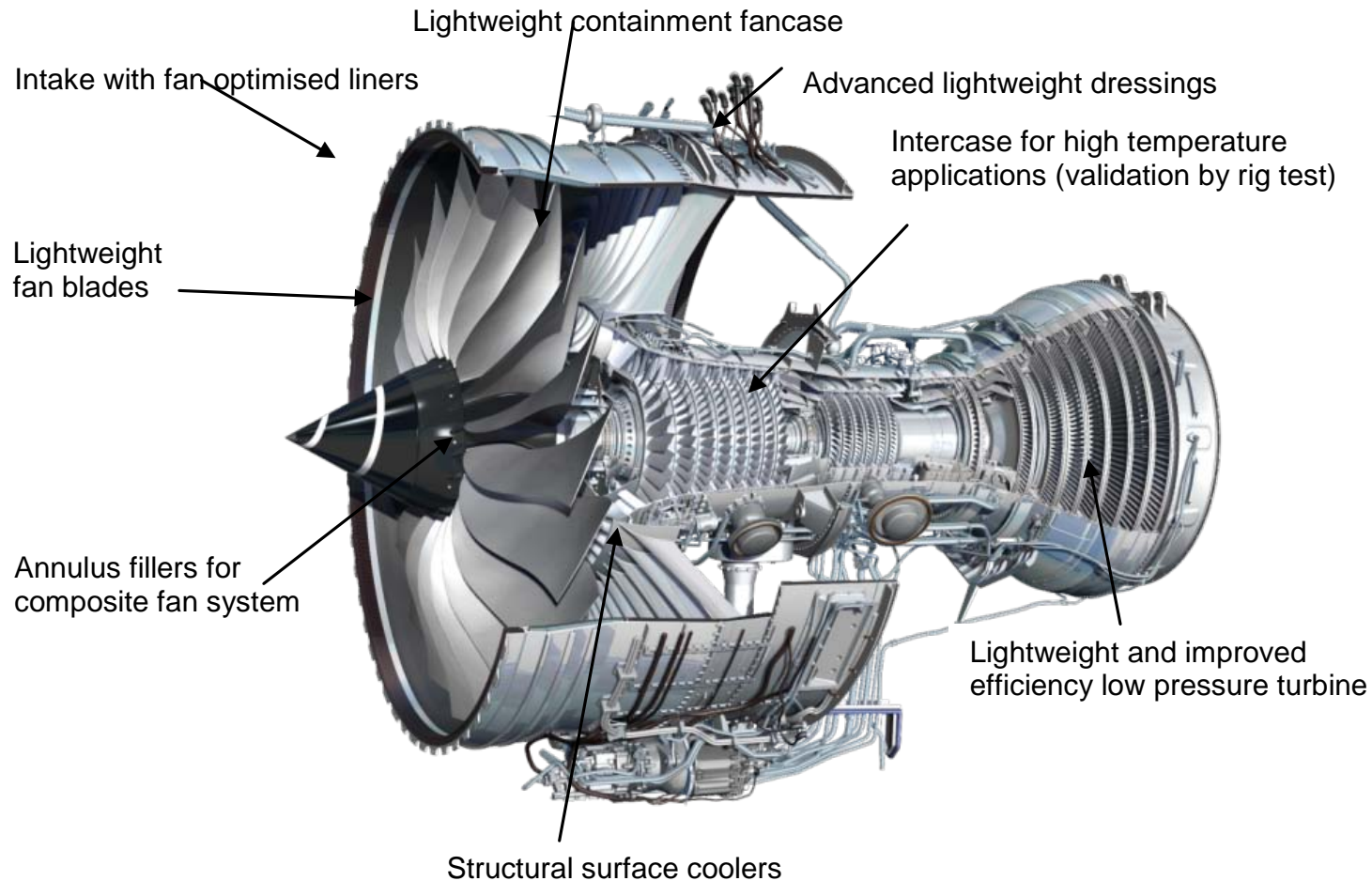


# SAGE 2 planning

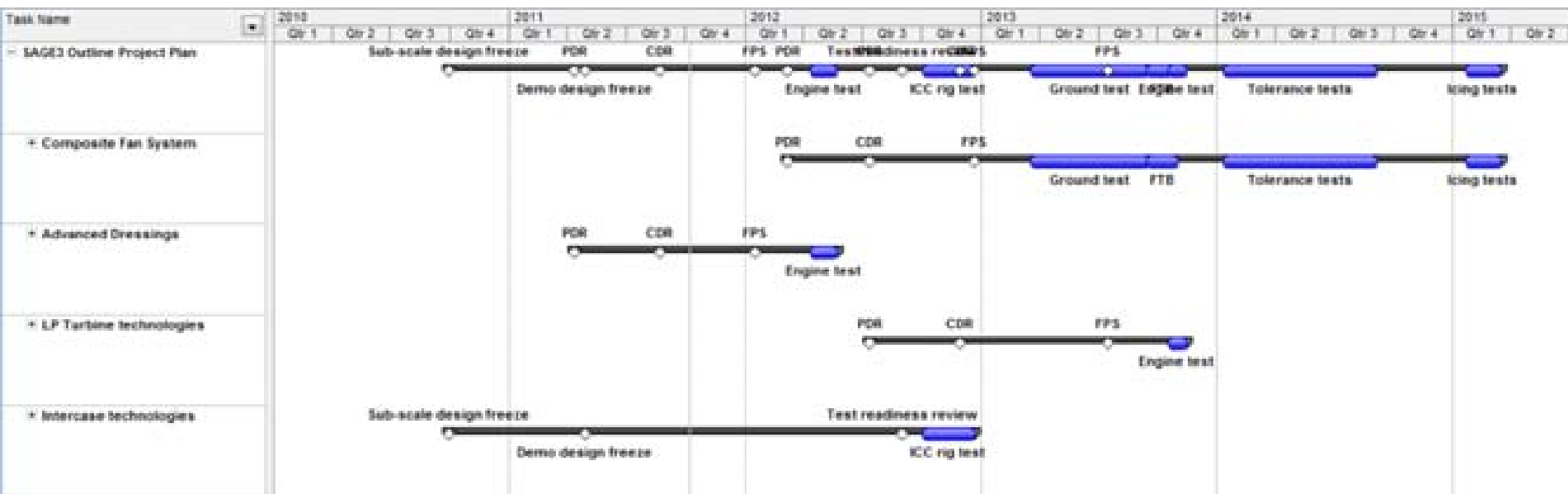


# SAGE 3

## 0.1 DEMONSTRATOR OVERVIEW



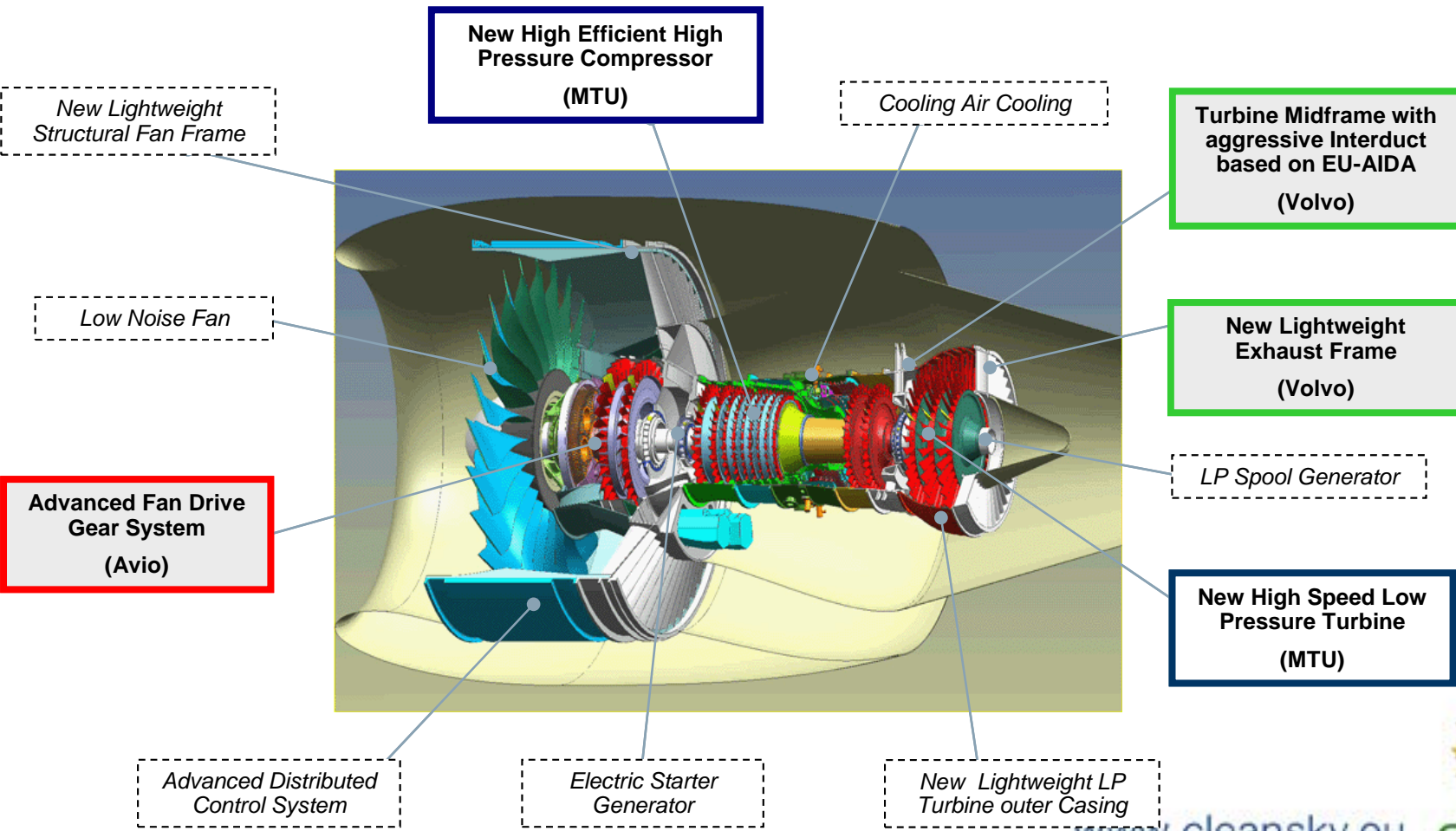
# SAGE 3 planning



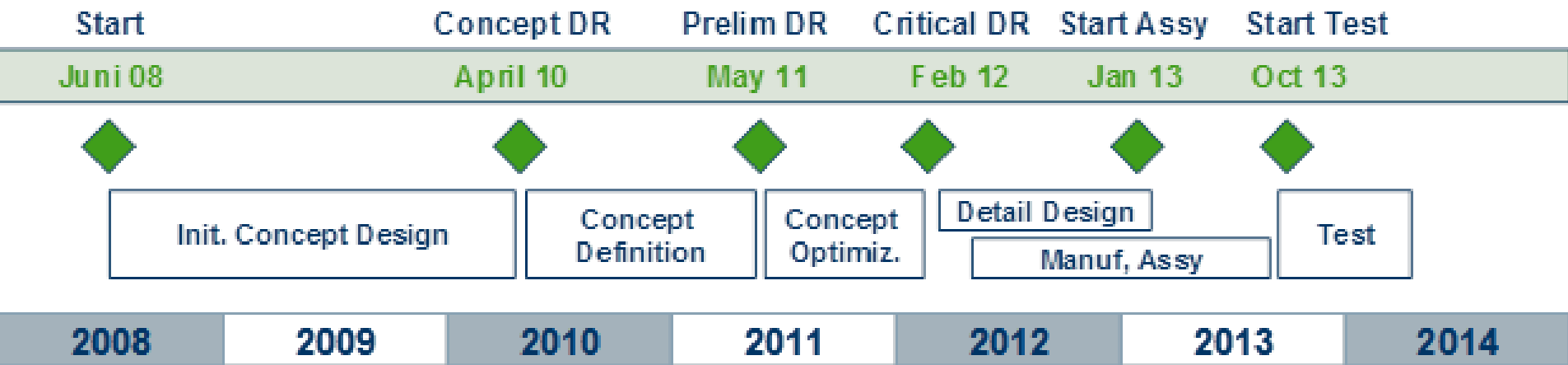
# SAGE 4



## 0.1 DEMONSTRATOR OVERVIEW

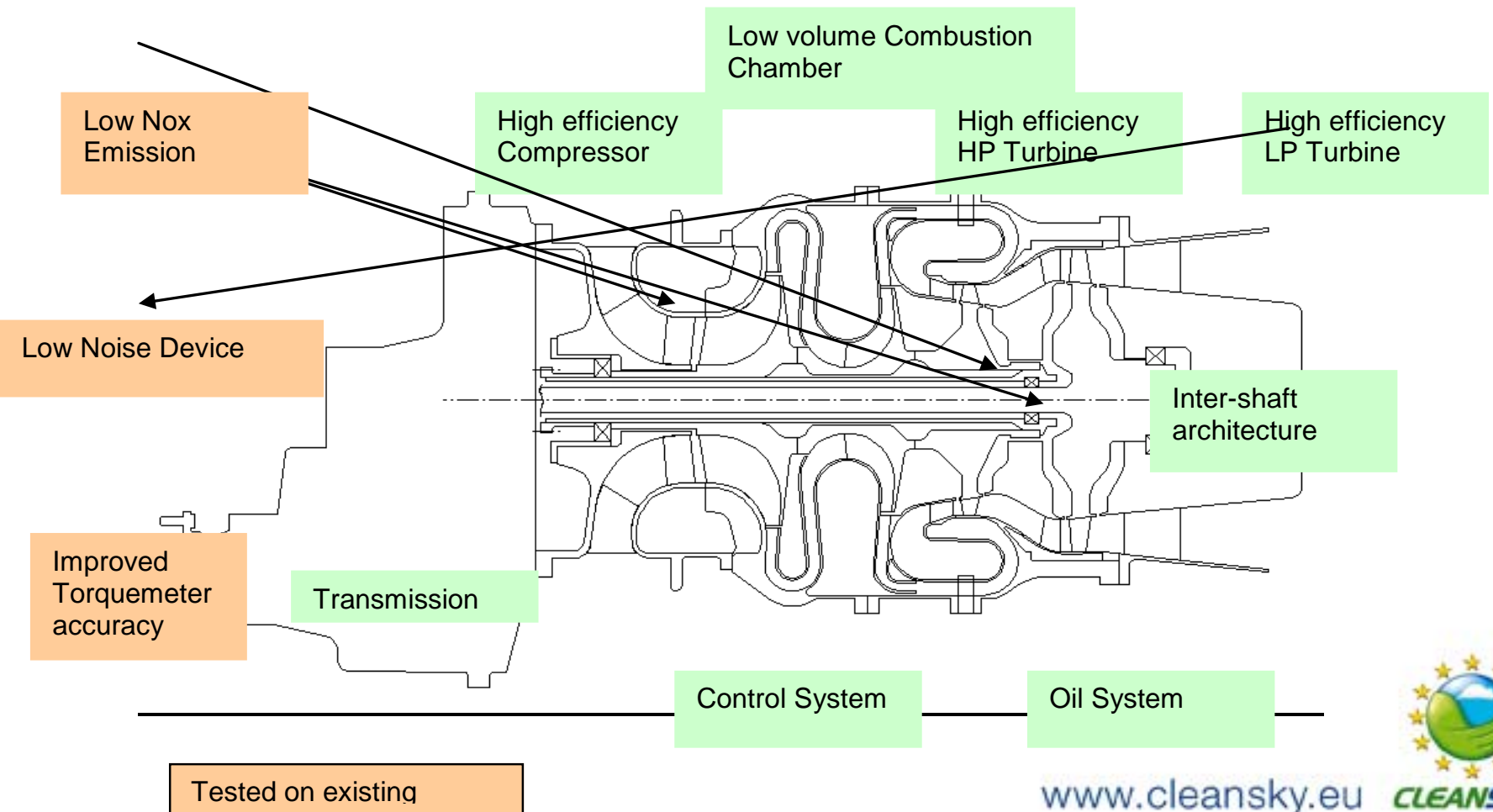


# SAGE 4 planning

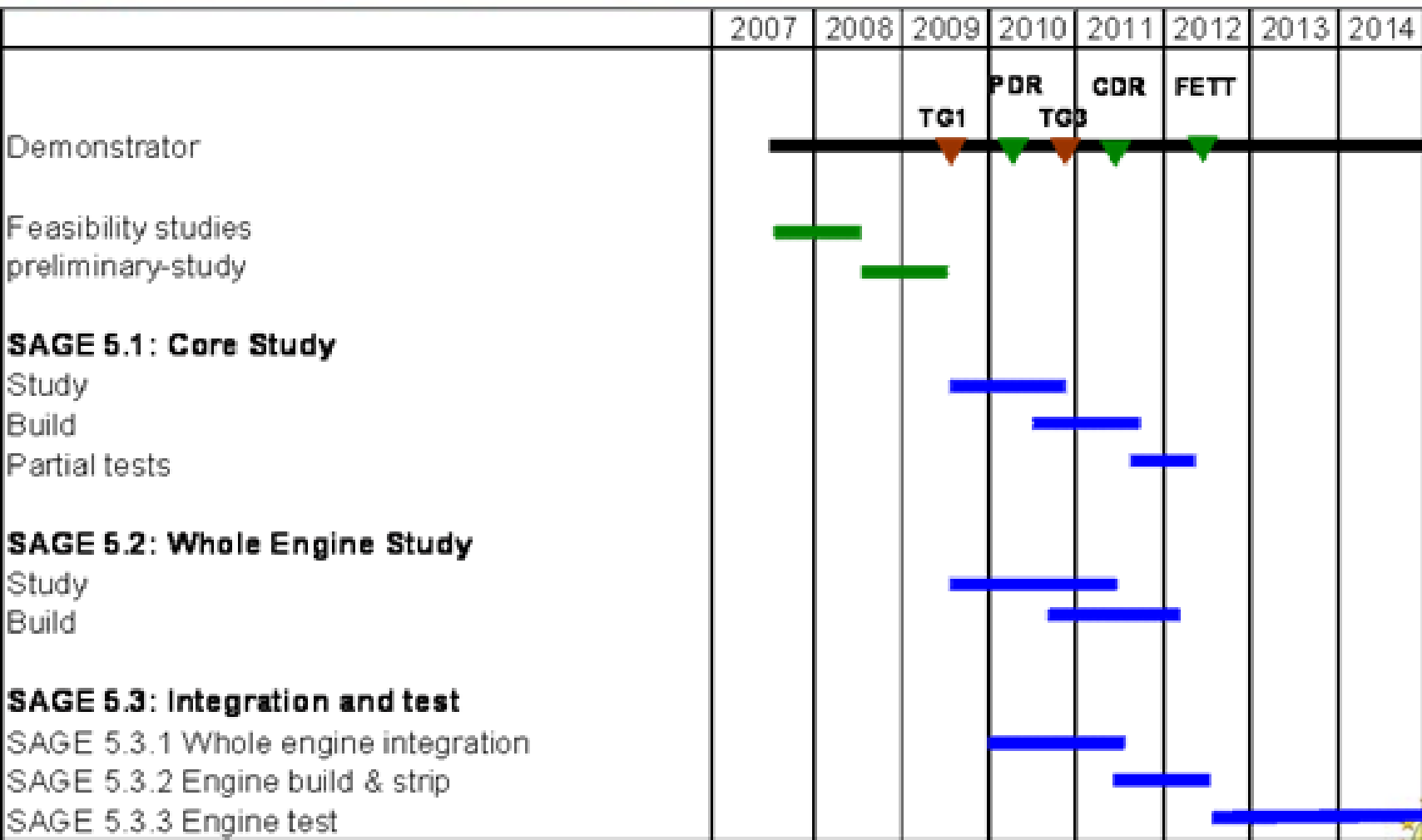


# SAGE 5

## 0.1 DEMONSTRATOR OVERVIEW



# SAGE 5 planning



# SAGE 6

## Lean Burn Demonstrator

### EEC & EMU

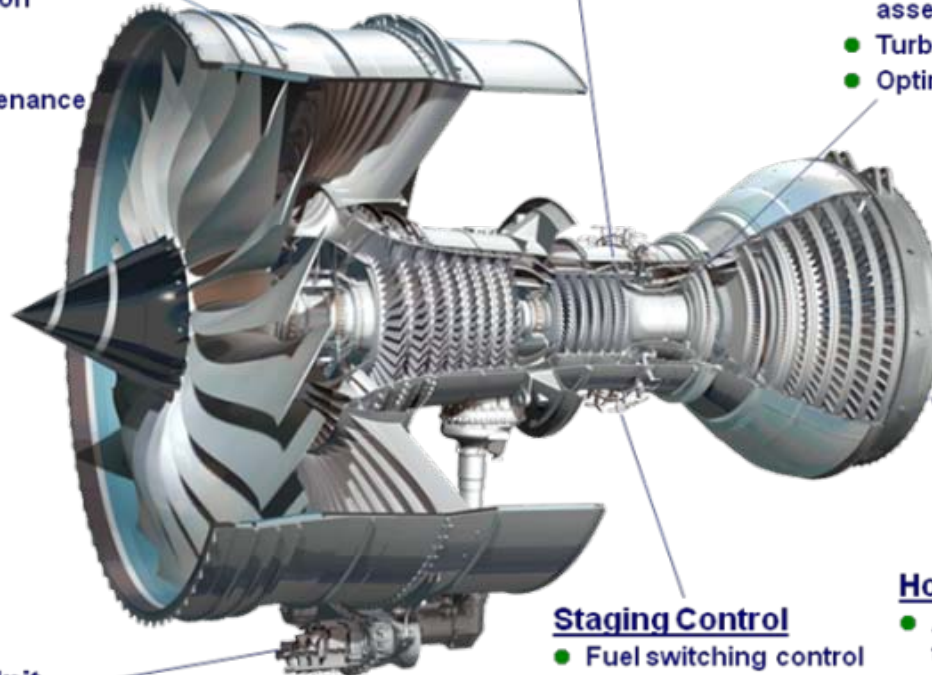
- System Safety Functions
- Lean Burn control laws
- Fuel staging system drives
- Dedicated rumble detection
- Staging system fault accommodation
- System health and maintenance monitoring and reporting

### Combustion

- Internally staged fuel spray nozzles (Pilot & Main)
- Tiled combustor (symmetric, canted)

### Turbine Interface

- Performance assessment
- Turbine design rules
- Optimised cooling



### Lean Burn Staging Unit

- Fuel staging and splitting
- Lean blow out protection

### Staging Control

- Fuel switching control
- Fuel Supply system

### Hot Exhaust

- Advanced noise treatment



# Topic list

| <b>JTI-CS-SAGE</b>        | <b>Clean Sky - Sustainable and Green Engines</b>   | <b>16,150,000</b> |
|---------------------------|--|-------------------|
| <i>JTI-CS-SAGE-01</i>     | <i>Area-01 - Open Rotor Demo 1</i>   |                   |
| <i>JTI-CS-SAGE-02</i>     | <i>Area-02 - Open Rotor Demo 2</i>   | <b>13,150,000</b> |
| JTI-CS-2012-1-SAGE-02-011 | Pitch Change Mechanism development, test and supply for engine demonstrator  | 7,000,000         |
| JTI-CS-2012-1-SAGE-02-012 | Optimal High Lift Turbine Blade Aero-Mechanical Design   | 850,000           |
| JTI-CS-2012-1-SAGE-02-013 | Advanced Non Destructive Testing methods and equipment development for fabricated structures.                                | 500,000           |
| JTI-CS-2012-1-SAGE-02-014 | Enhanced material and lifing model including sustained peak Low Cycle Fatigue  | 900,000           |
| JTI-CS-2012-1-SAGE-02-015 | Advanced electrical machine manufacturing process implementation and tuning based on composite material process technologies | 200,000           |
| JTI-CS-2012-1-SAGE-02-016 | Study and durability of electrical insulating material in aircraft engine chemical environment                               | 200,000           |
| JTI-CS-2012-1-SAGE-02-017 | Variable thickness lamination machine-tool design and manufacturing  | 500,000           |
| JTI-CS-2012-1-SAGE-02-018 | Engine Mounting System and Engine In-flight Balancing System   | 3,000,000         |
| <i>JTI-CS-SAGE-03</i>     | <i>Area-03 - Large 3-shaft turbofan</i>  | <b>2,600,000</b>  |
| JTI-CS-2012-1-SAGE-03-012 | Non-metallic Pipes for Aero engine Dressings   | 1,800,000         |
| JTI-CS-2012-1-SAGE-03-013 | Extended operation temperature range for compressor structure materials  | 800,000           |
| <i>JTI-CS-SAGE-04</i>     | <i>Area-04 - Geared Turbofan</i>   |                   |
| <i>JTI-CS-SAGE-05</i>     | <i>Area-05 - Turboshaft</i>  | <b>400,000</b>    |
| JTI-CS-2012-1-SAGE-05-016 | Telemetric System Acquisition in harsh Environment   | 400,000           |



# Potential topics for 2012 calls

|  |
|--|
| Rotating Nozzle design   |
| Analytical simulation and validation of complete manufacturing chain for fabricated structures |
| Ferrite forming process adaptation and tuning for high T°C and high vibrations applications    |
| Light weight and complex shape magnetic core design and manufacturing                          |
| Propeller blades de icing technology development.  |
| Rotating cowls manufacturing   |
| Seamless Nozzle Manufacture  |
| High temperature resin Systems for RTM   |
| Erosion coatings for composite applications  |
| Ring rolled IN718 forging  |
| Development & Manufacture of CMC segment with containment function                             |
| Physically based microstructure sim-tool DSLM parts  |
| PECM machine tool technology for IBRs  |
| Development of an Advanced Coating for Turbine parts   |
| (1) Combustor-Turbine-Interaction Investigation by CFD and Experiment                          |



# Thanks for listening

