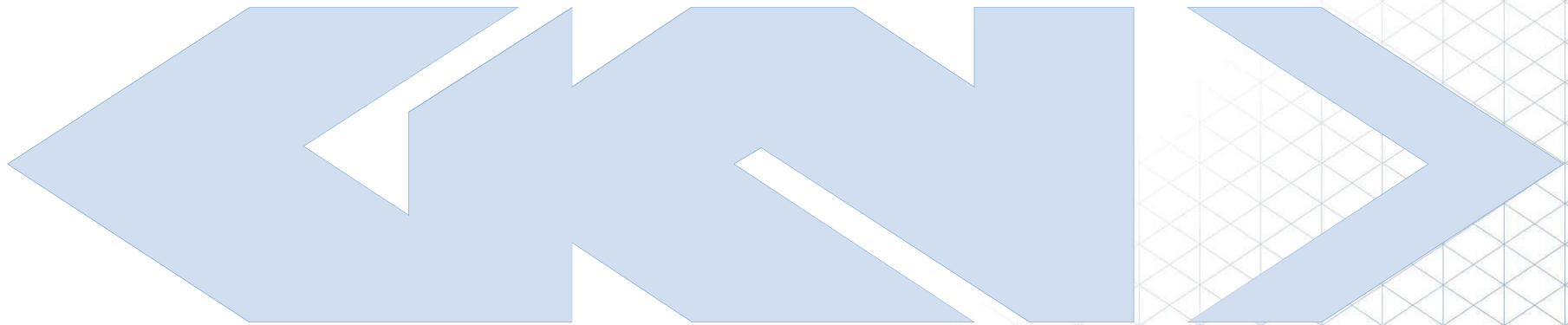


GKN Technology contribution towards sustainable aviation

Aerospace Technology Congress 2019, Stockholm
Henrik Runnemalm, Director Research & Technology



Content

- > GKN Aerospace at a glance
- > Research and Technology strategy
- > Jet Engine propulsion
- > Contributing to lower environmental impact
- > What comes next?





GKN Aerospace: A leading global tier 1 Aerospace supplier

Strong focused businesses, sales £3.53 billion (2018), 18,500 employees.

Aerostructures
£2.2bn



Engine Systems
£1.1bn

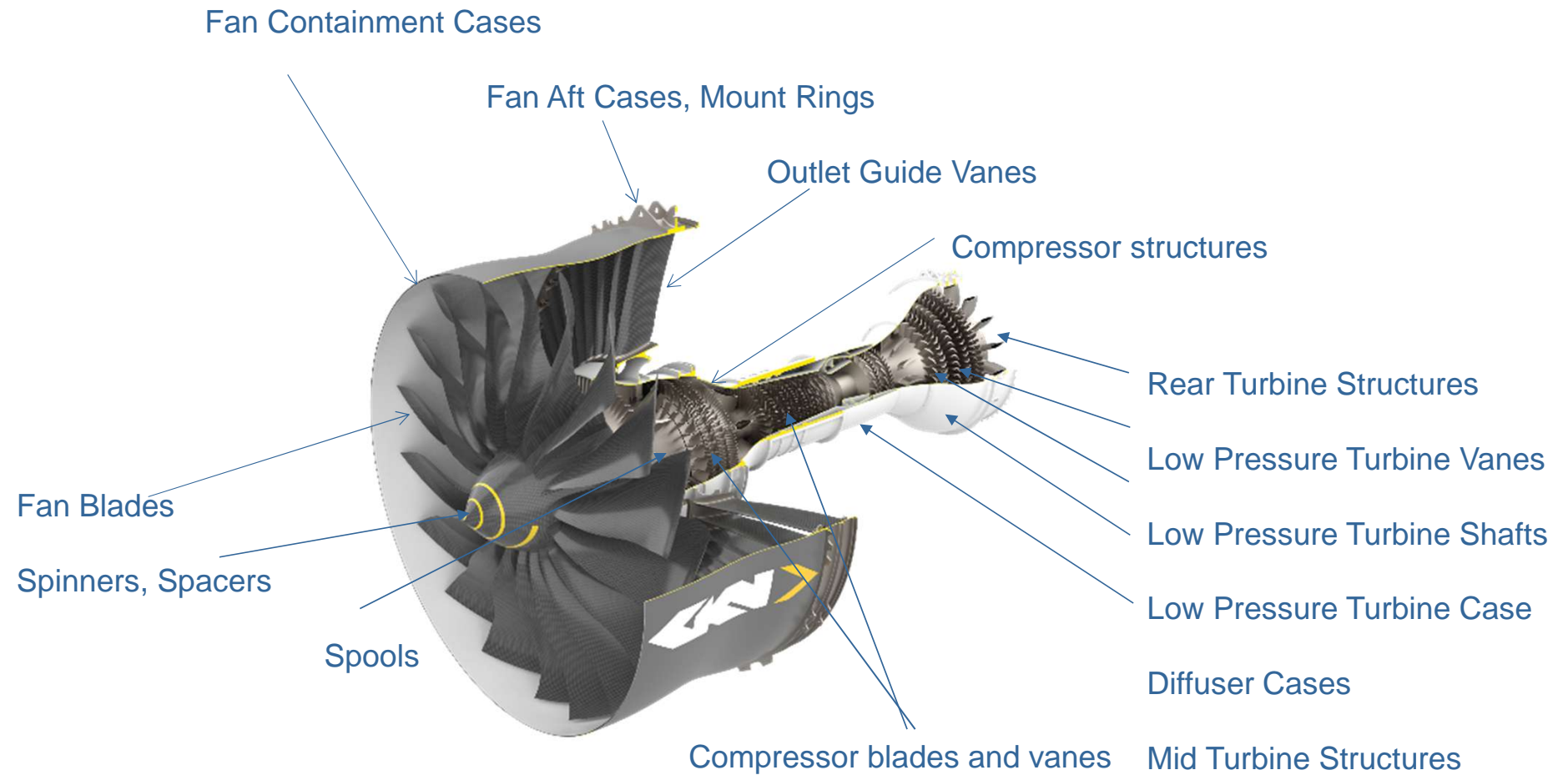


Special Technologies
£0.2bn



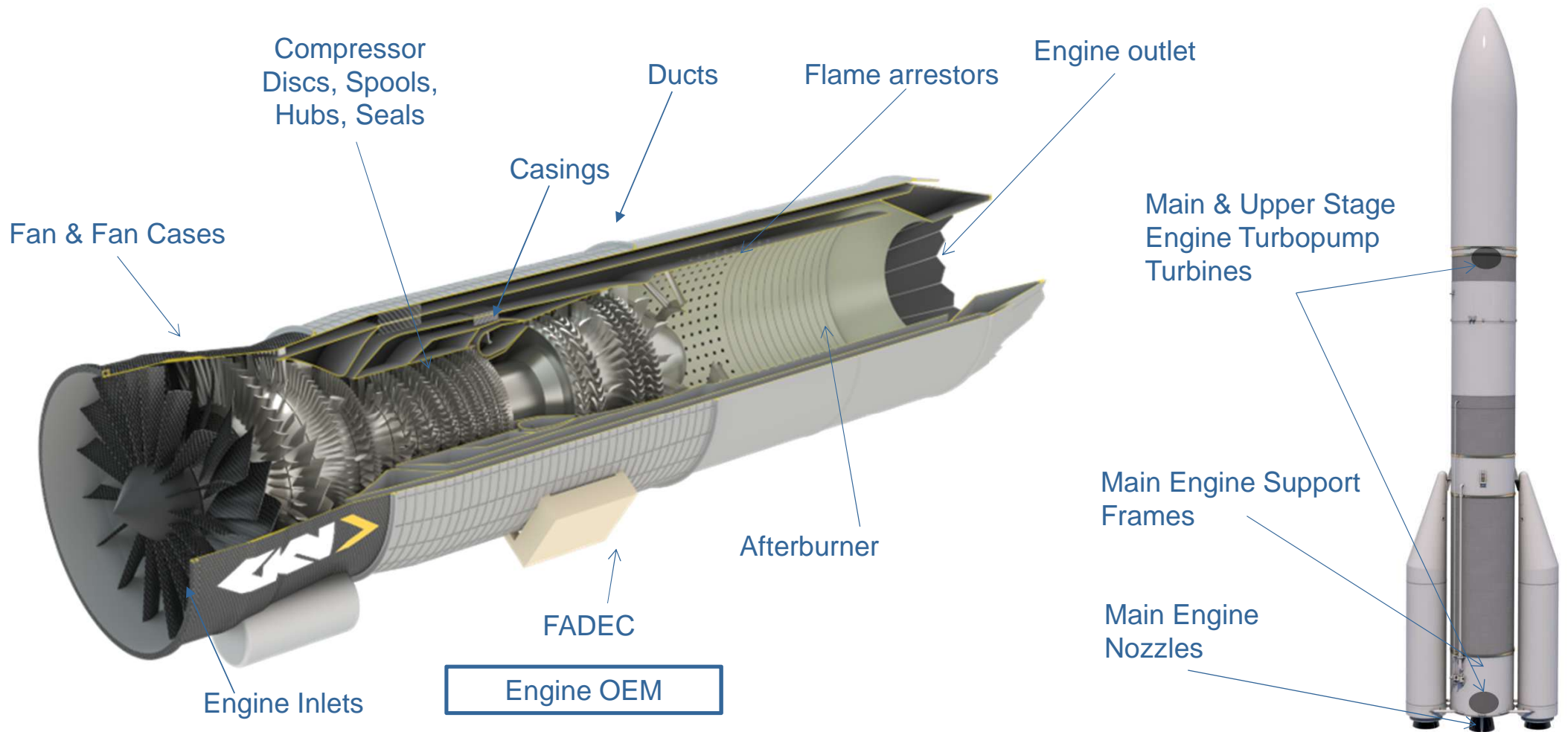


Major Aerospace Engine Products - Commercial Turbofans





Major Aerospace Engine Products - Military and Space



Research and Technology strategy

Product
Application



Development
Programs



TRL 9
VERIFIED
TECHNOLOGY

International
Collaborative
Programs



TRL 6
DEMONSTRATOR

Seeding
Projects

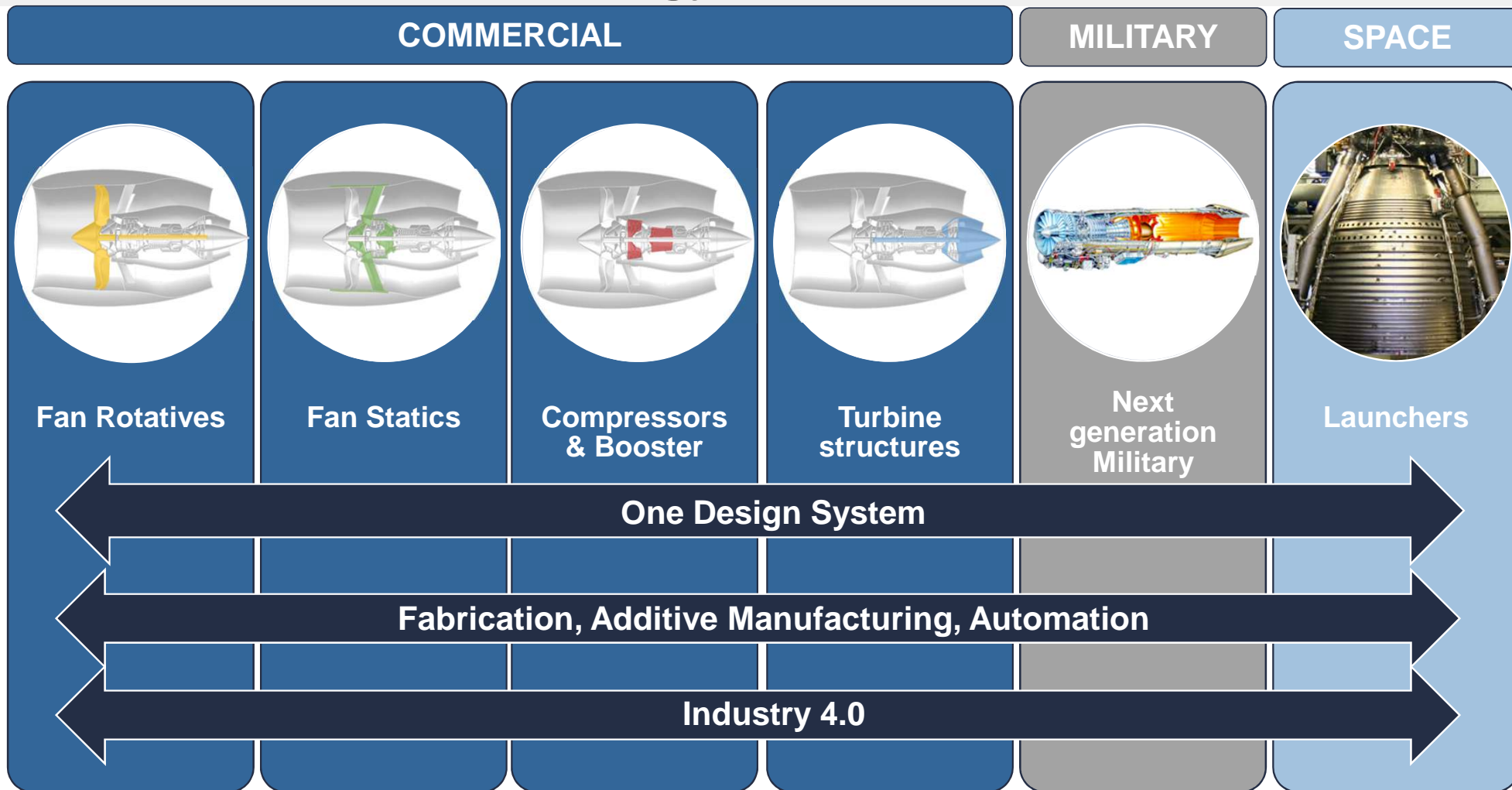


TRL 3
TECHNOLOGY

Time

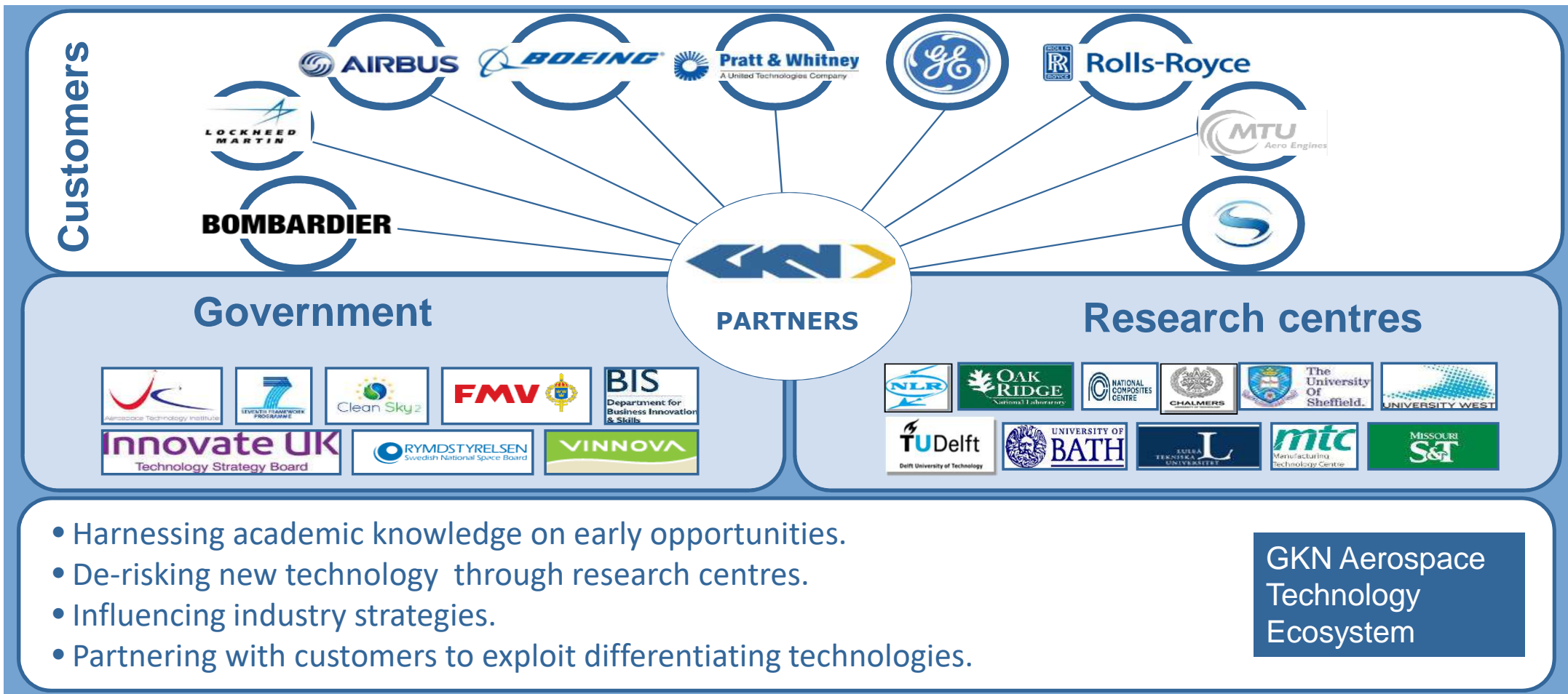


Research and Technology portfolio

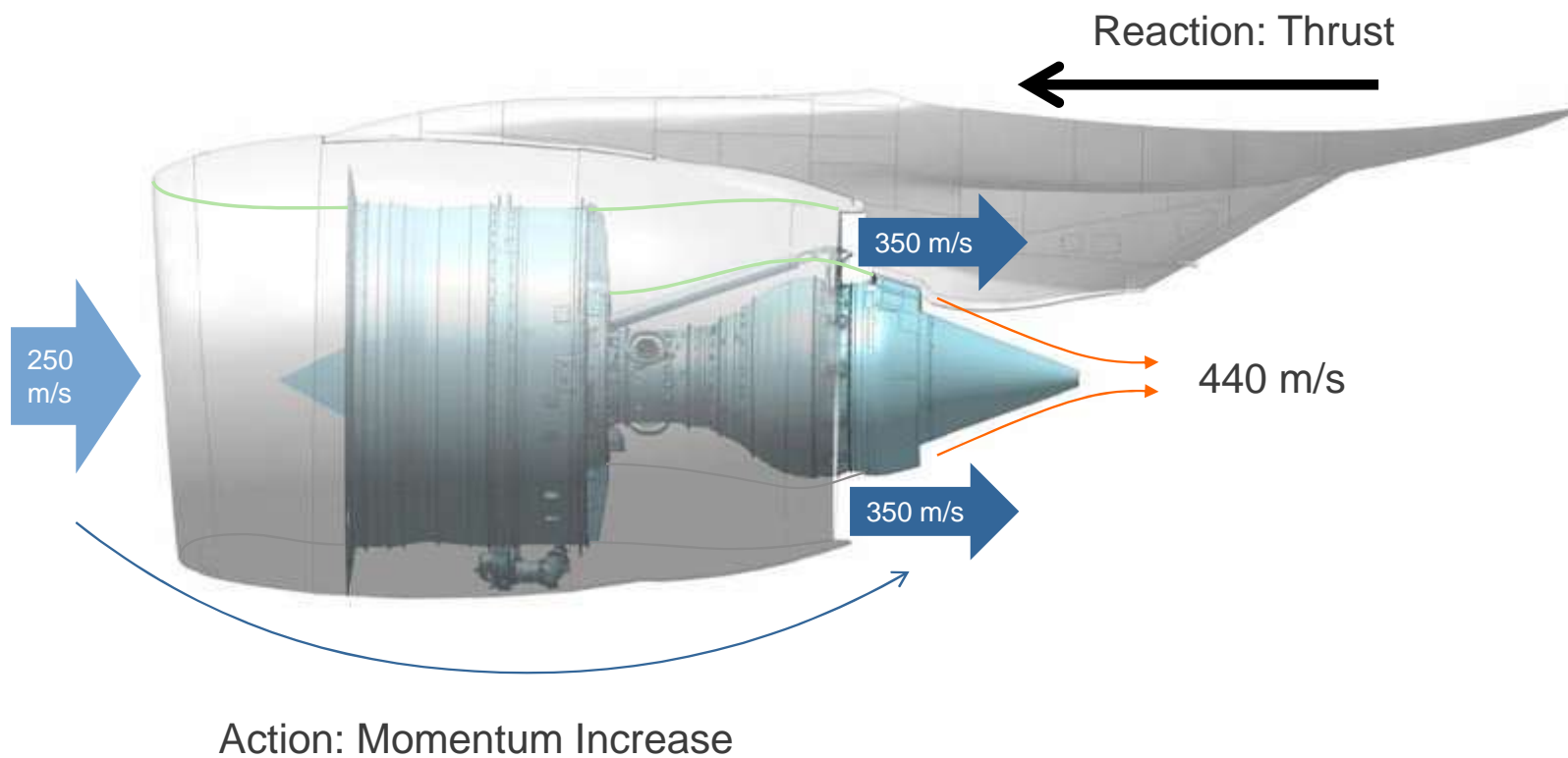




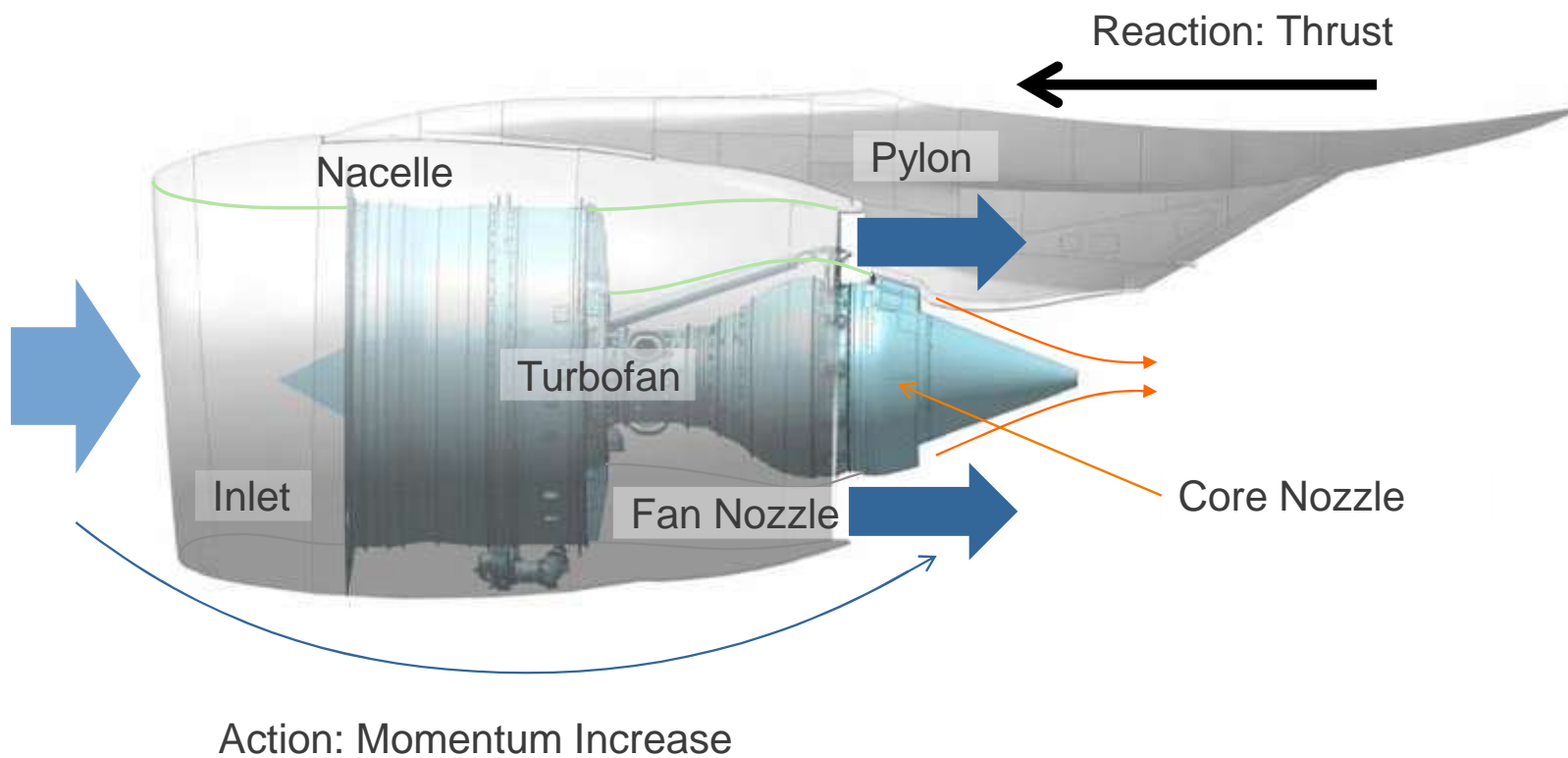
Partnering to Deliver Customer Value



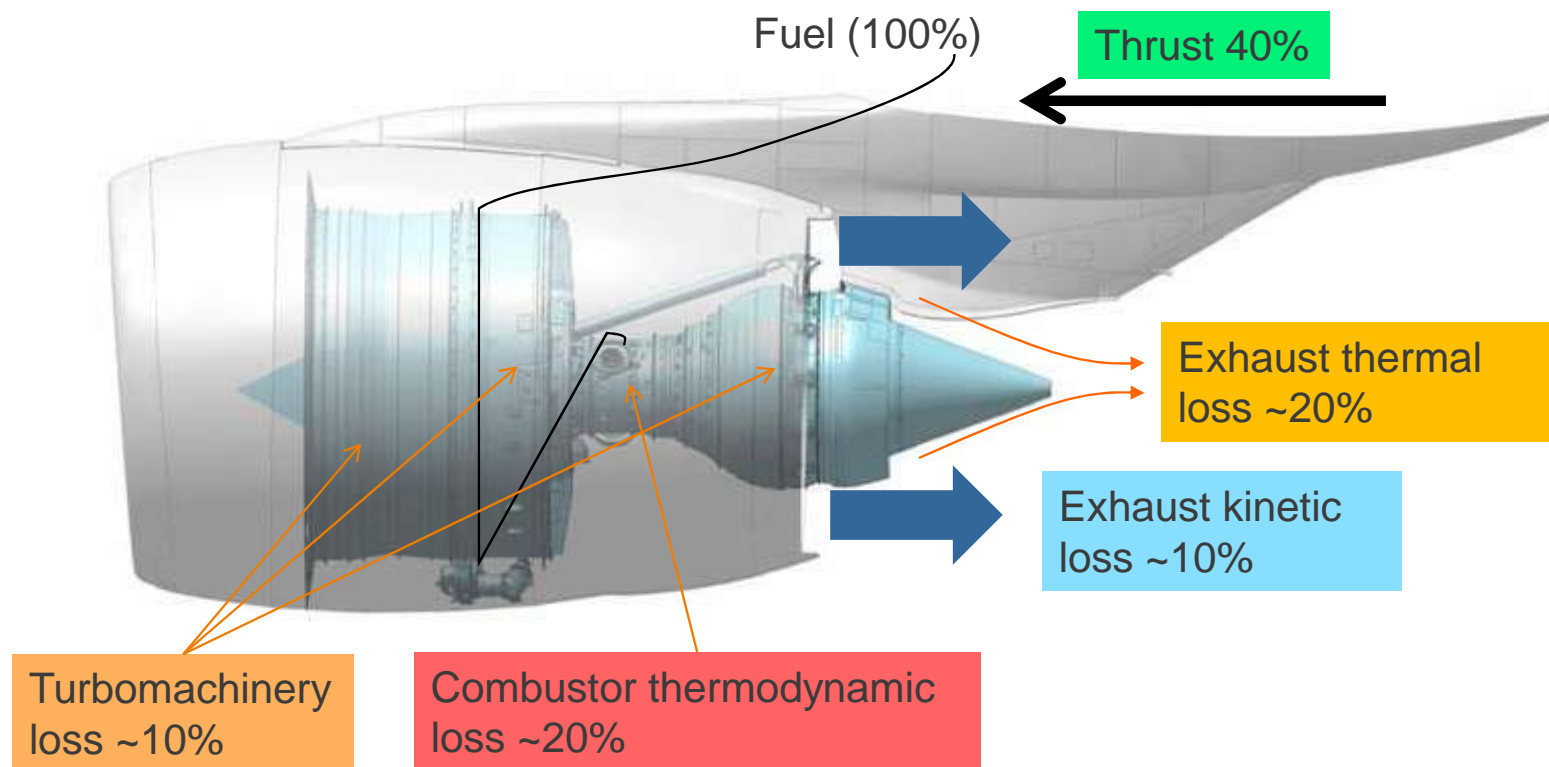
The Turbofan Propulsion System



The Turbofan Propulsion System



The Turbofan Propulsion System



The Turbofan Propulsion System

Is there more to gain?

- > Large step has been taken in propulsive efficiency
 - Larger Fans
- > Thermal efficiency
 - Aero dynamics of compressor and turbines
 - Combustion technology
 - Very dependent on material



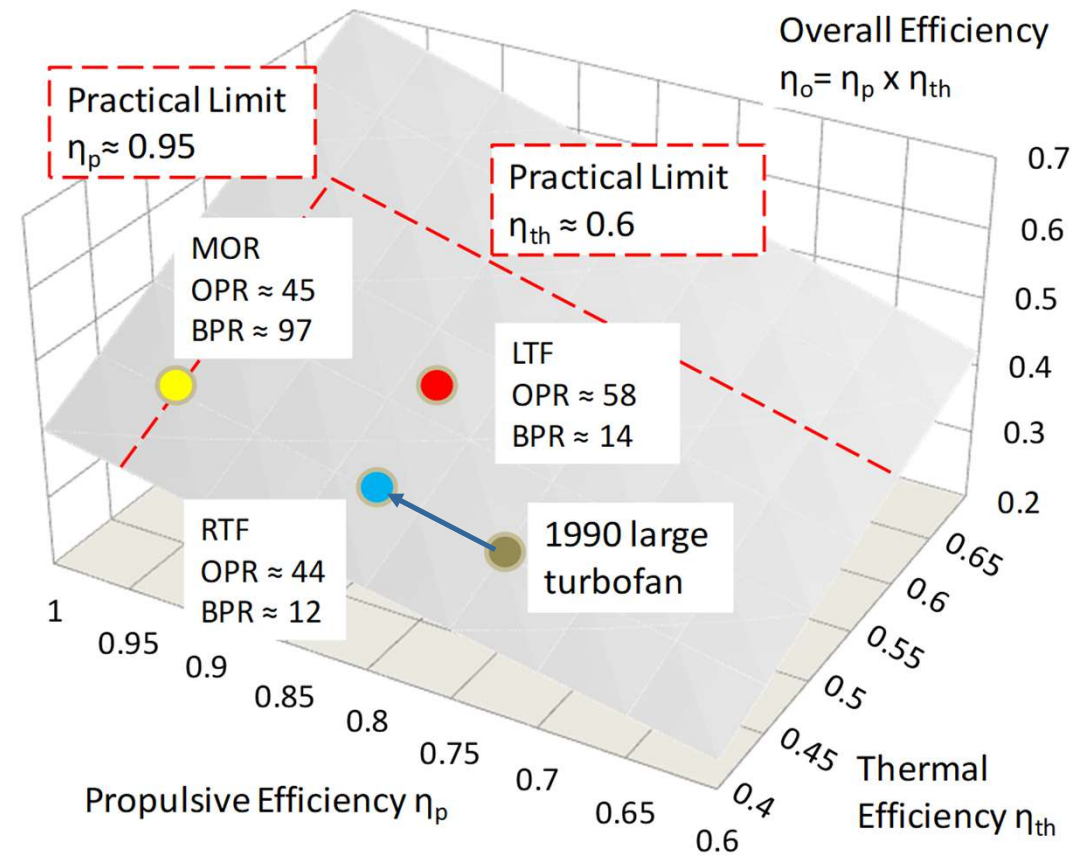
Large turbo Fan
LTF



Geared Turbo Fan
RTF



Mid-size Open Rotor
MOR

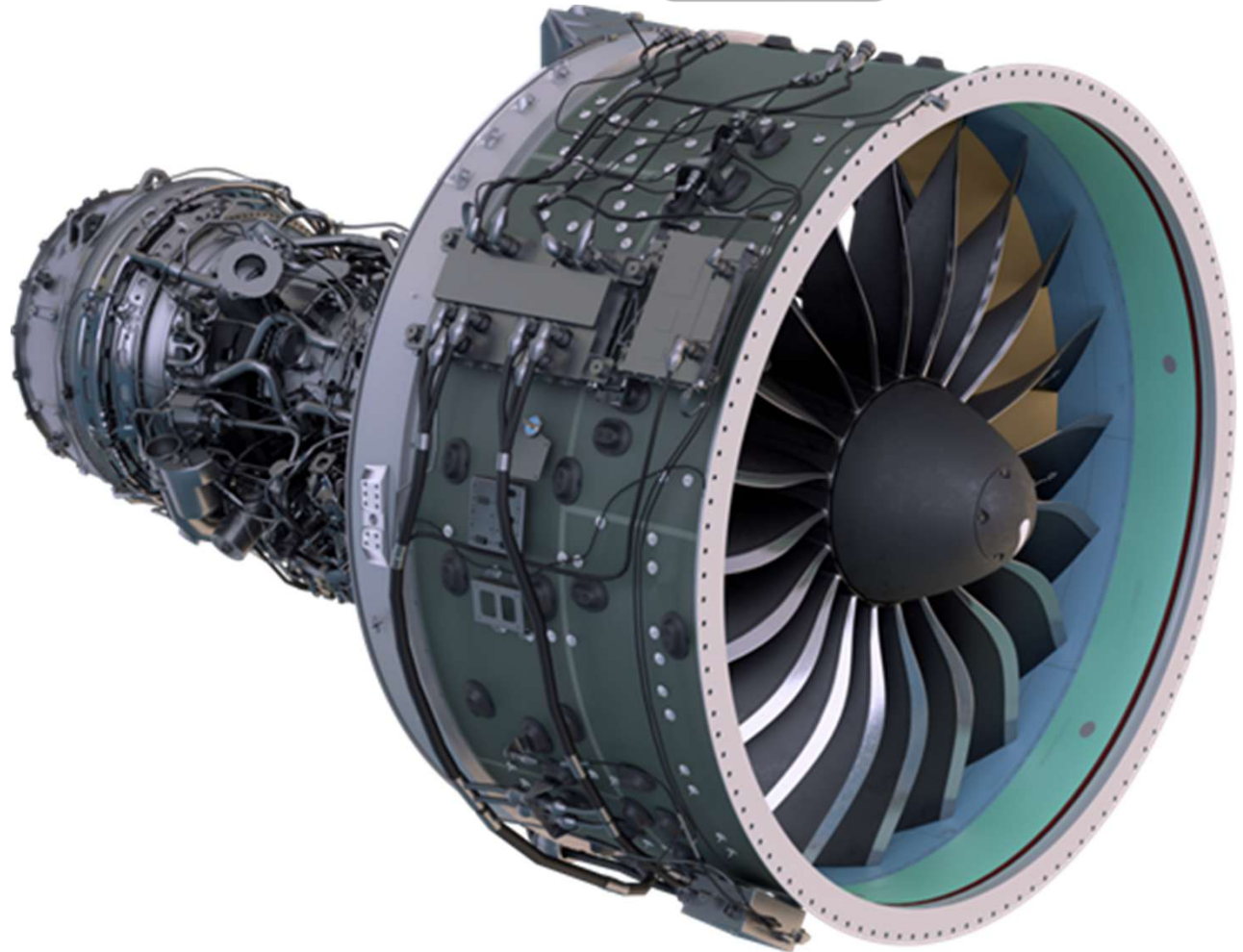


Thermal efficiency

PW1100G

Temperature increase

- > All new engines operates at higher temperature
- > GKN contributes with Novel design solution
 - Less aero dynamic drag
 - Mechanical strength
- > New material introduction
 - +100°C
- > Bi metallic design
 - Combine different material in different areas of the product



Propulsive efficiency

12 to 1 in By pass air to core air

- > Larger engines carries more weight
- > GKN contributes with technology for
 - Carbon composite material
 - Lower number of outlet guide vanes
 - Shorter overall length of engine
- > GKN contributes with design solutions
 - Lower pressure drops in bypass channel
 - Higher strength during impact of foreign objects
 - Noise treatment
 - More functionality integrated in products



Industrial environment

Process Fluids

- > Selecting process fluids that can be recycled
- > Actively working to replace toxic material
- > Safeguard process water

Materials

- > Particles and gases used or produced in our industry
- > Recycling of material and waste

Sustainability



Fan Case – Replacing forging by near net additive parts



- > **Save 600kg titanium**
- > **Save 10kg on product weight**
- > **Less environmental impact**



Studies to develop ultra efficient radical new propulsion systems

Ultra-efficient cores through Constant Volume Combustion (CVC)

- > Composite cycle (four-stroke diesel)
- > Options for constant volume: nutating disc and detonation combustion
- > Double digit fuel burn reduction compared to 2050 reference for all CVC concepts
- > Intercooling show good synergy with all CVC concepts

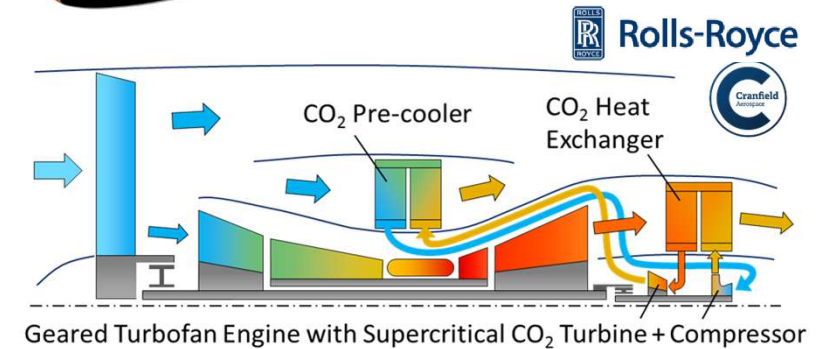
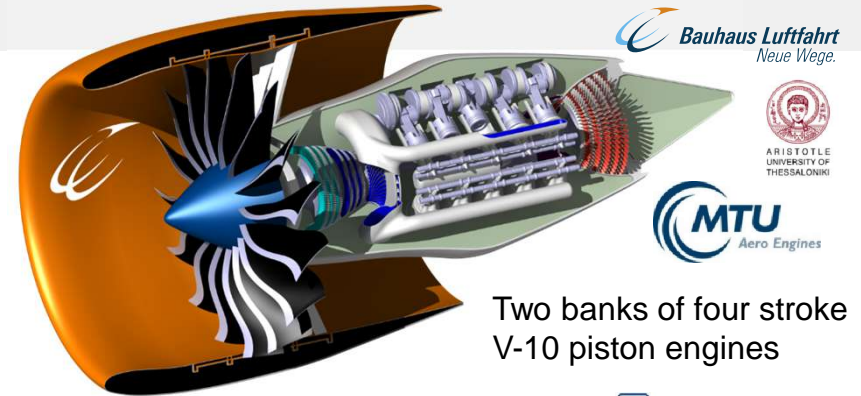
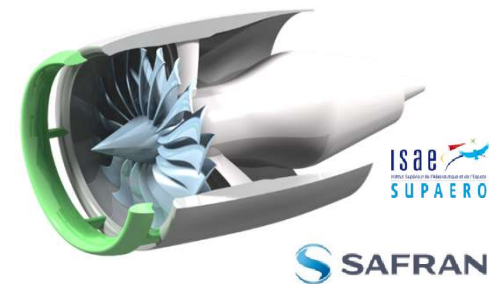
Core heat recovery

- > Supercritical CO₂ cycle

Radical enabling tech. for high efficiency and low noise

- > The Boxprop
- > The slotted nacelle

The Ultimate project was coordinated by Chalmers



Flying with new fuels

Flightpath 2050 very ambitiously targets

- > 75% CO₂ and 90% NO_x emissions reductions*

Liquid hydrogen (LH₂)

- > Is it a feasible fuel for a fully sustainable aviation future?

- ENABLEH2 will mature critical technologies for LH₂ based propulsion
- Targeting zero mission-level CO₂ and ultra-low NO_x emissions, with long term safety and sustainability

safety and sustainability



Thank you for your attention



Source: Airbus