

DESARROLLOS TECNOLOGICOS DE AERNNOVA EN COMPOSITES EN CS2, H2020

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San Sebastián

tecnalia **AEMAC** **MS**
MONTAÑAS DE BIZKAIA

**MAT-
COMP**
2017

CONGRESO BIANUAL
“Materiales
Compuestos”

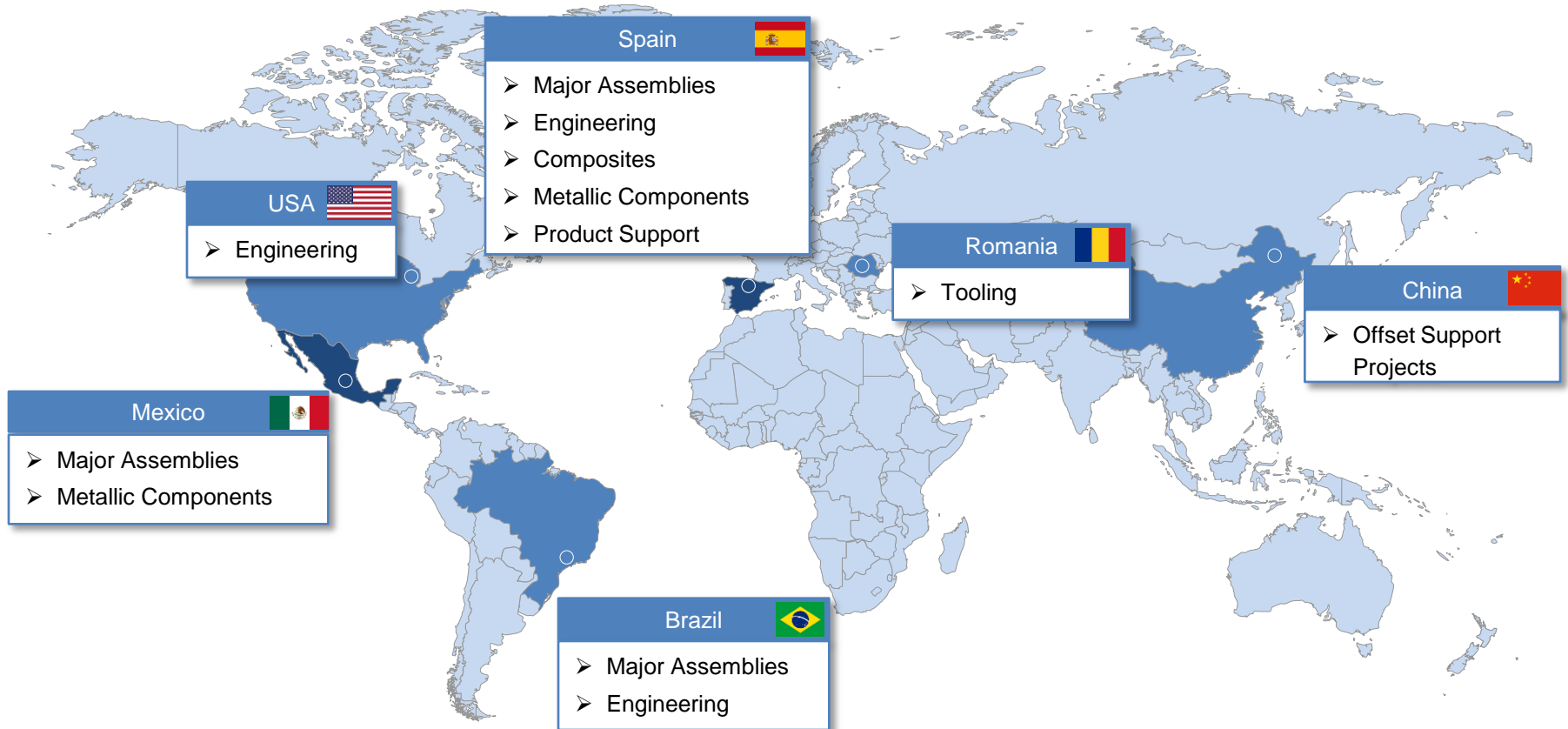
- Aernnova at a Glance
- The need for Clean Sky 2
- Clean Sky 2 overview
- Aernnova R&T and composites
- Aernnova Composites Technology Developments in CS2:
 - CS2 ITD AIRFRAME
 - CS2 LPA REAREND
 - CS2 LPA HLFC HTP AND WING
- Aernnova Collaboration Opportunities in R&T
- Conclusions

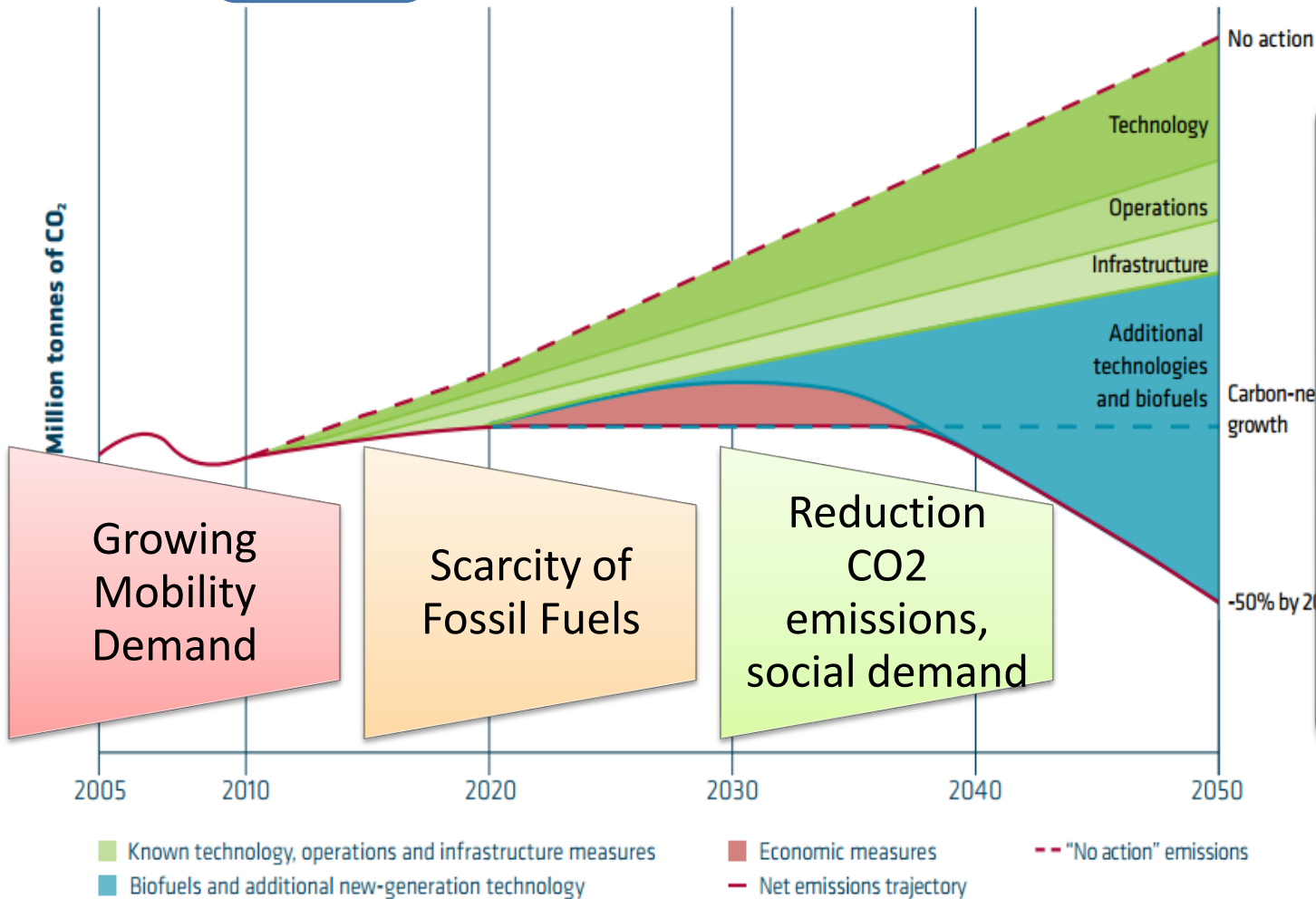
AERNNOVA is a World-Class Supplier of Integrated Aerostructures, Components and Engineering Services through Four Business Segments

- 100% Private Company
 - + 650 Million € Rev
 - + 4600 Employees
 - 7 Countries
 - 19 Locations
 - + 18 Customers
- Not included BREK Acquisition



Headquartered in Spain, Aernnova has expanded its presence globally through its Manufacturing and Engineering Centers in Europe, America and Asia

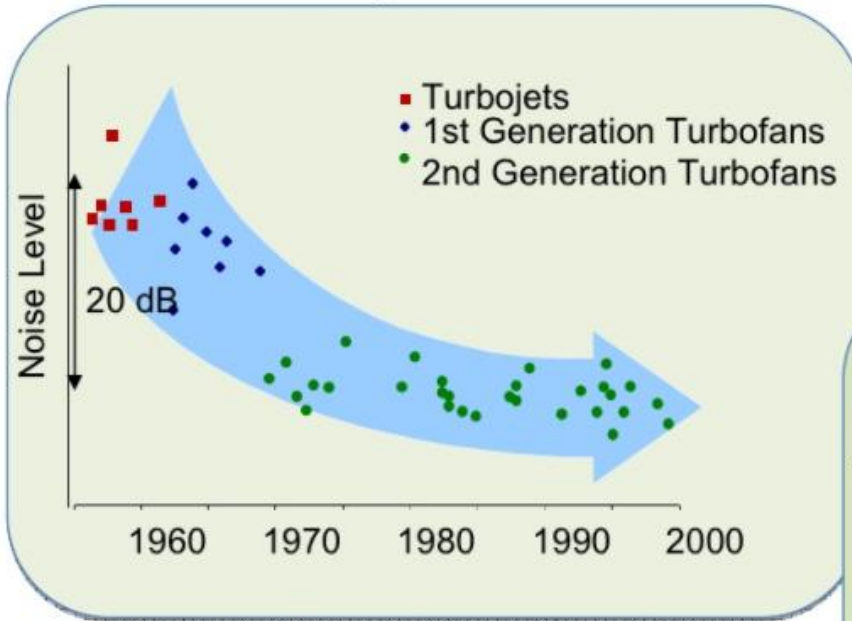




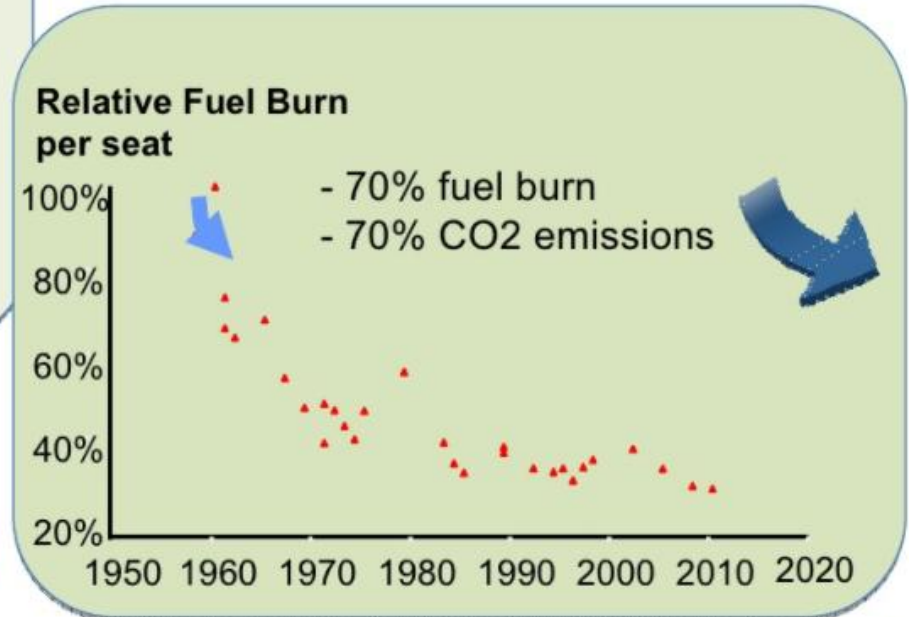
Strong economical pull to develop technologies that make aviation cheaper, scalable, sustainable and carbon-neutral

Air Traffic Action Group, "A sustainable flightpath to reduce emissions. UNFCCC Climate Talks, Doha," Nov. 2012.

In the last 40 years, commercial aviation industry has achieved:



20dB less noise



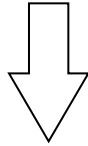
70% less fuel

Technology Driven achievements!

Vision 2050

Responding to society's needs

Securing global leadership for Europe



Five Objectives of the Strategic Research & Innovation Agenda

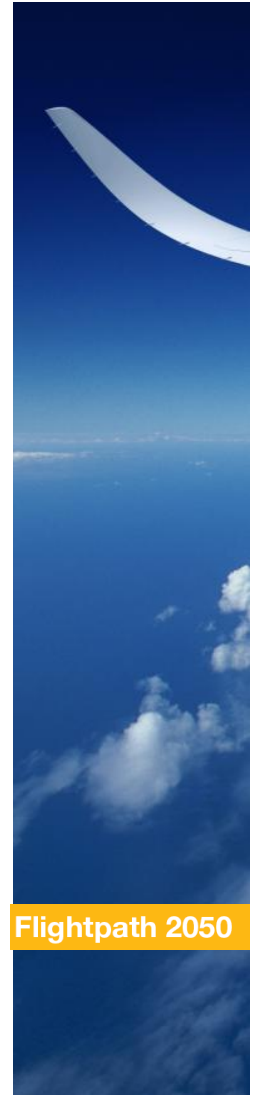
Meeting Societal and Market Needs

Maintaining and Extending Industrial Leadership

Protecting the Environment and the Energy Supply

Ensuring Safety and Security

Prioritising Research, Testing Capabilities & Education



Flightpath 2050



Meeting Societal & Market Needs

European citizens are able to make informed mobility choices

90% of travellers within Europe are able to complete their journey, door-to-door within 4 hrs.

Flights arrive within 1 minute of the planned arrival time

An air traffic management system is capable of handling 25 million flights a year in Europe

A coherent ground infrastructure is developed

Maintaining & Extending Industrial Leadership

The whole European Aviation industry is strongly competitive

Europe maintains leading edge design, manufacturing and system integration capabilities and jobs

Streamlined systems engineering, design, manufacturing, certification and upgrade processes have addressed complexity and decreased development costs.

MAIN CONCLUSIONS OF ACARE WG2

- **New technologies, new vehicles**
- **Efficient development and manufacturing process**
- **Investment in Research and Innovation**
- **Fair, balanced set of global regulations and standards**
- **Innovative business models, regulations and incentives**
- **Efficient certification of aviation products**





Protecting the Environment and the Energy Supply

In 2050 technologies and procedures available allow

- 75% reduction in CO2 emissions per passenger kilometre,
- 90% reduction in NOx emissions, and
- 65% reduction in perceived noise emission of flying aircraft

relative to the capabilities in 2000.

Aircraft movements are emission-free when taxiing.

Air vehicles are designed and manufactured to be recyclable.

Europe is established as a centre of excellence on sustainable alternative f

Europe is at the forefront of atmospheric research



Ensuring Safety and Security

The European air transport system has less than one accident per ten million commercial aircraft flights. (- 80% for specific operations, reference: 2000)

Weather and other hazards are precisely evaluated and mitigated.

Seamless operations through fully interoperable and networked systems (incl. manned and unmanned vehicles)

Efficient boarding and security checks allow seamless security

Air vehicles are resilient by design to security threats

The air transport system has a fully secured global high bandwidth data network, hardened and resilient by design.

Prioritising Research, Testing Capabilities and Education

European research and innovation strategies are jointly defined by all stakeholders

A network of multi-disciplinary technology clusters are created

Strategic European aerospace test, simulation and development facilities are identified, maintained and continuously developed

Students are attracted to careers in aviation. Courses offered by European Universities closely match the needs of the Aviation Industry



CPW1:
* HLFC HTP
* REAREND (with FIDAMC)

CPW4 (under negotiation)
* HLFC WING (DLR, Onera, SONACA)

Vehicle IADPs

Fast Rotorcraft
Augusta
Westland Airbus
Helicopter

Large Passenger Aircraft
Airbus

Regional Aircraft
Alenia
Aermacchi

Eco-Design
Fraunhofer Gesellschaft

Large Systems ITDs

Airframe ITD
Dassault – EADS-CASA – Saab

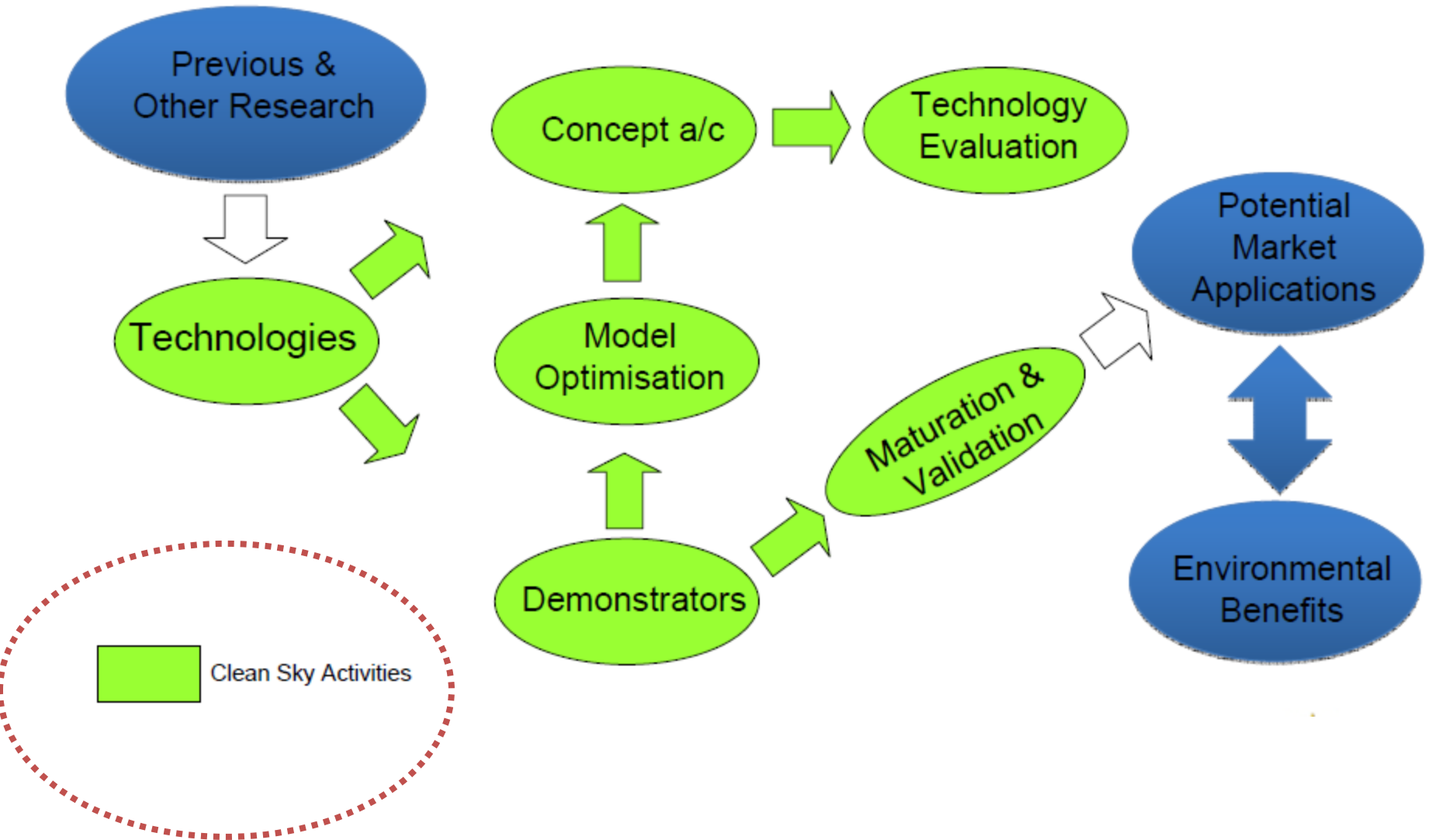
Engines ITD
Safran – Rolls-Royce – MTU

Systems ITD
Thales – Liebherr

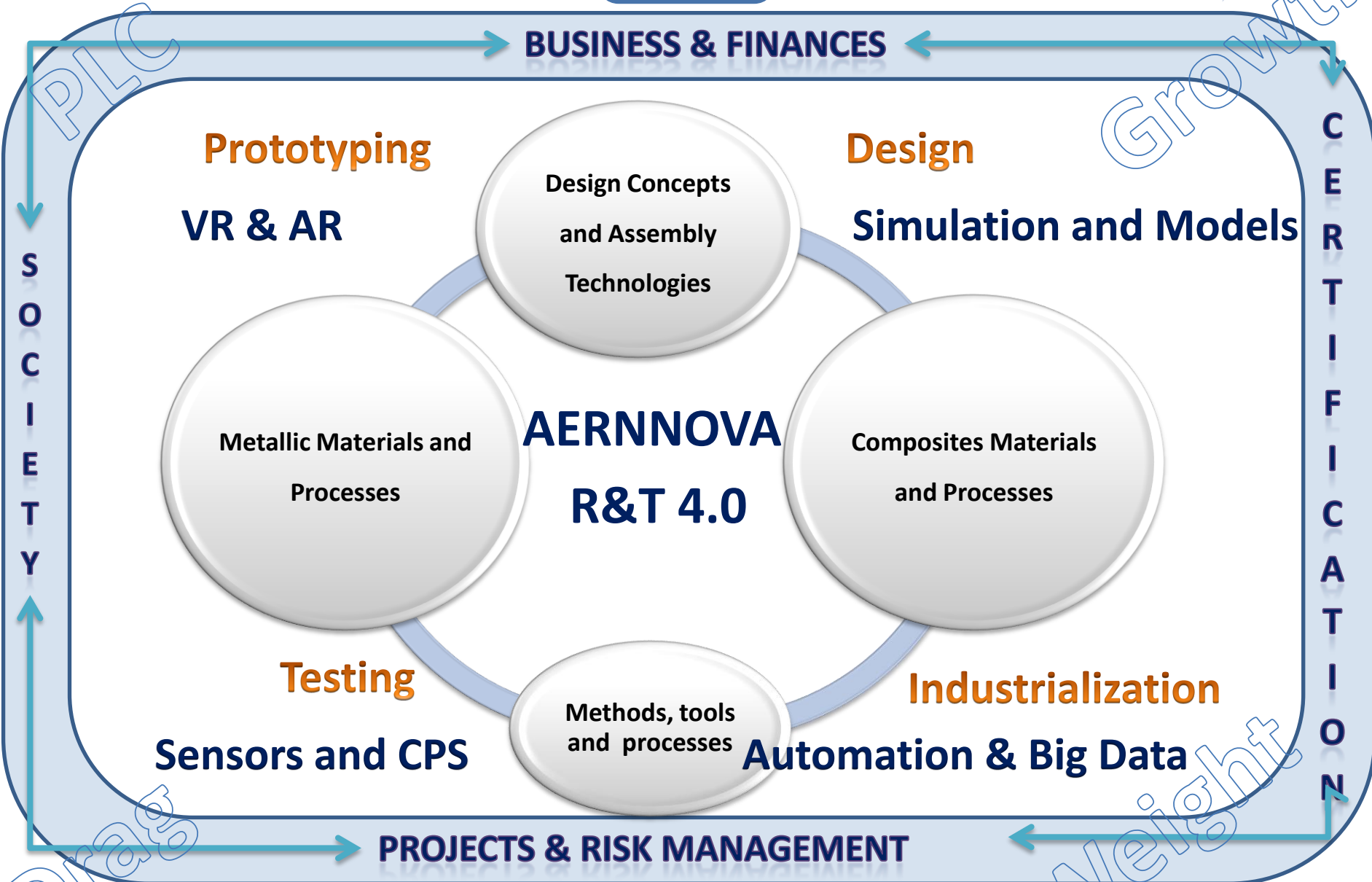
Small Air Transport
Evektor – Piaggio

Technology Evaluator (TE)
German Aerospace Center (DLR)

CPW1:
* OUTCOME (with TECNALIA+ FIDAMC+ CATEC+ CTA+ CT Ingenieros)



- Runtime of ~10years with focus on medium to high TRL (3 to 6 typ.) R&T and large scale, complex ground and flight demonstrators
- Very large funding and gross budget volume
- Overlapping schedule of project planning, operational start, definition and accession of Core Partners and Partners through open calls
- Subsequent, separated contracts (GAMs) paralleled by associated activities in GAPs
- Aernnova, was selected Core Partner- member- in wave 1 and since then, we can launch CFP
- The overall potential perimeter of Aernnova engagement in Clean Sky2 is close to 70 M€

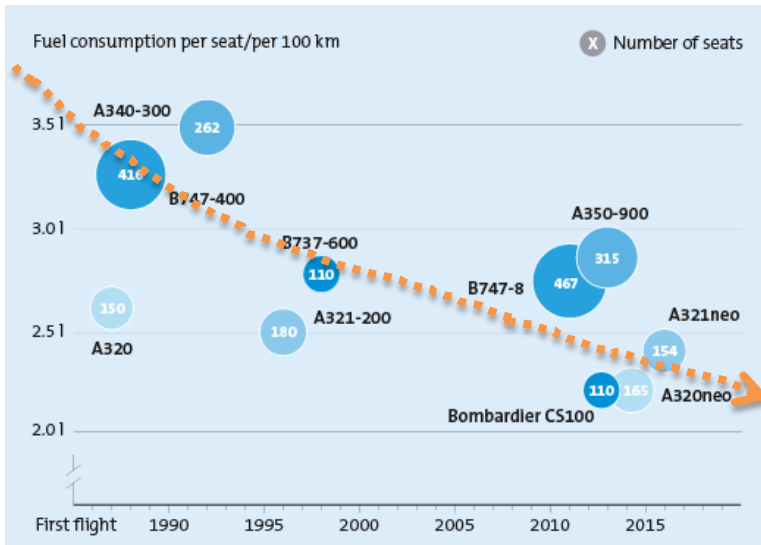


Why aeronautic design is all about weight, drag and engines continuous improvements?

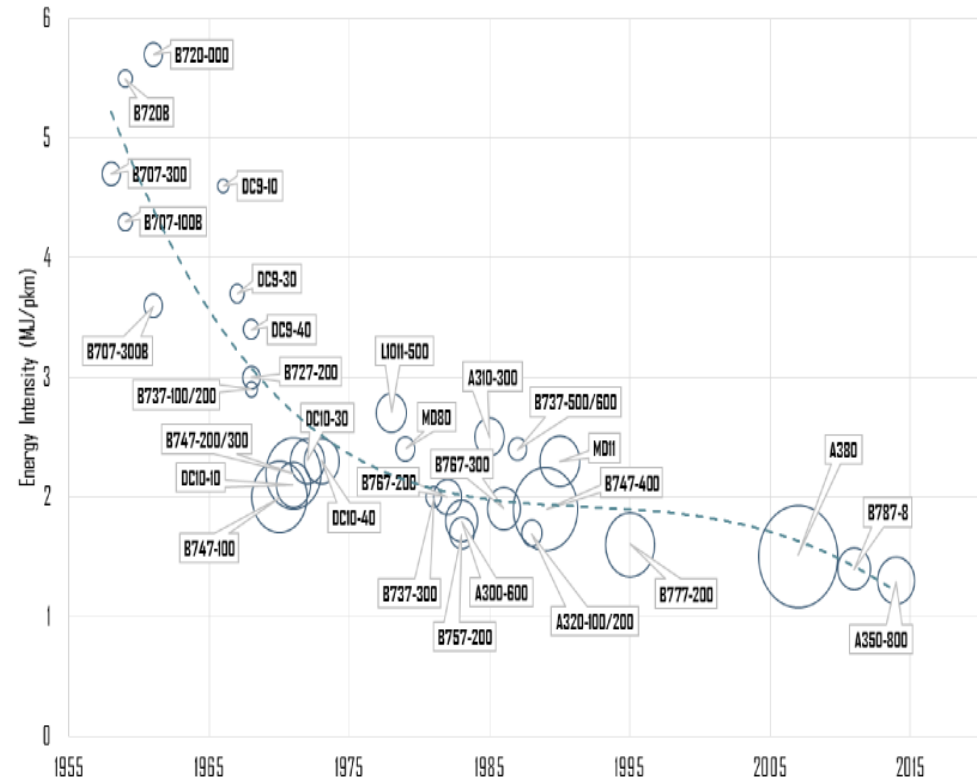
The Breguet equation- simplification for constant speed and aero efficiency

$$\text{Range} = u_o \frac{L}{D} \text{Isp} \ln \frac{W_{\text{initial}}}{W_{\text{final}}}$$

Fluids (Aero) Propulsion Structures + Materials



Ref. BDL Climate Protection Report 2016

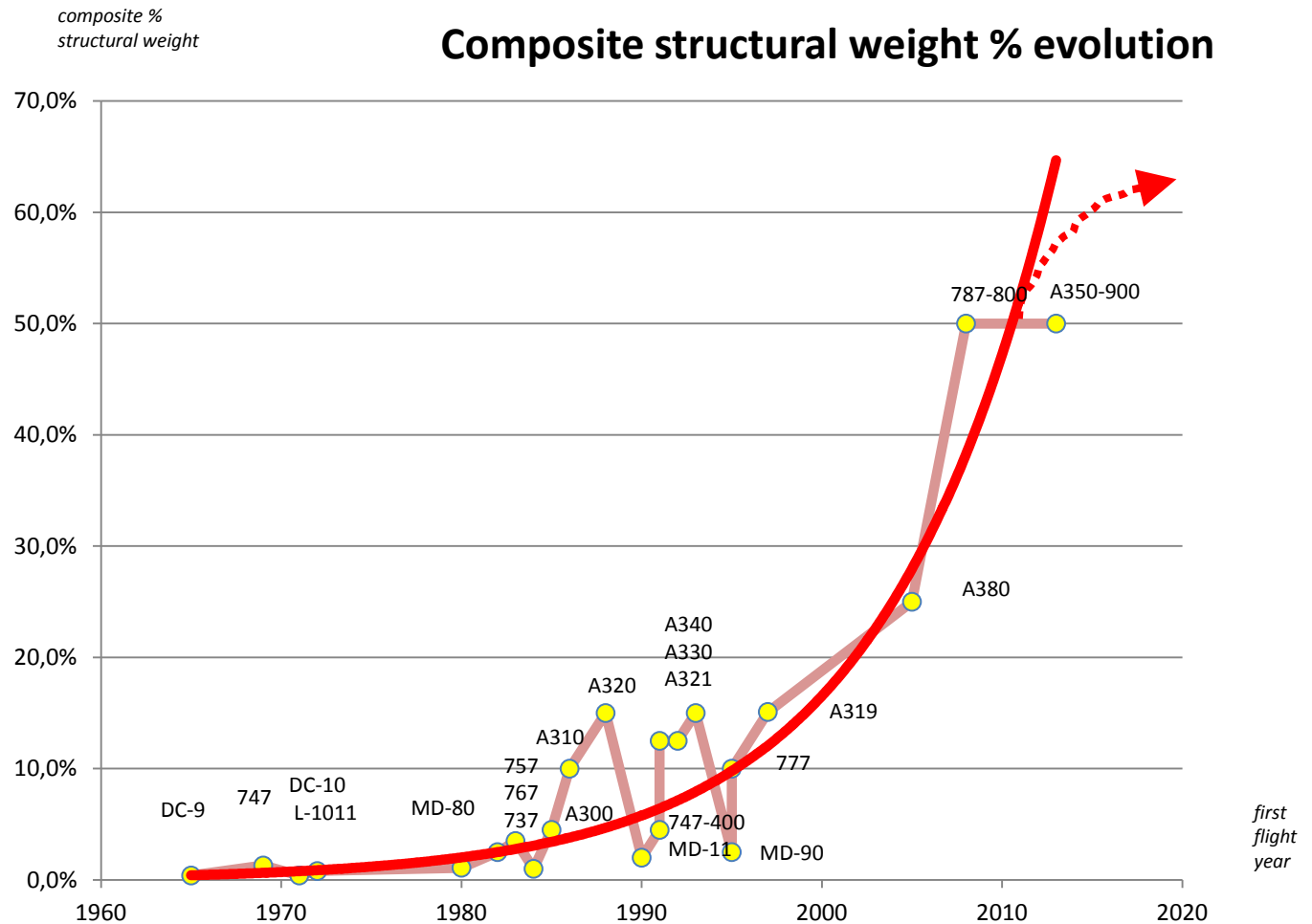


Adapted from International Energy Agency/ OECD Transport, Energy and CO2 report 2009

Composites

Evolution

Utilization in civil aeronautics



Propiedades más relevantes de los materiales compuestos

- Más resistencia y rigidez específica que los metales
- Posibilidad de adecuar la resistencia y rigidez, ingenierizando los apilados, a las necesidades, en términos de cargas internas, de cada parte de la pieza
 - Complejidad de analizar todos sus modos de fallo y su acoplamiento con producción y vida en servicio
- Capacidad para funcionar a temperaturas de operación media y máximas altas
 - Depende de temperatura de transición vítrea de la resina
 - resina Epoxy hasta 120 ° C Bismilamide 180 ° C
- Resistente a la corrosión. Inerte en los ambientes más corrosivos
- Aislamiento eléctrico y posibilidad de customizar propiedades en función del dopaje que se haga a la resina:
 - es posible hacer materiales compuestos conductora o no según sea necesario;
 - Customización de respuestas a frecuencias del espectro de radiación
- Los materiales compuestos habilitan geometrías complejas, integración de partes, mutimaterial, sensórica y diferentes acabados superficiales
- Customización de la respuesta en frecuencia
- Durabilidad con ciertos añadidos en el caso de desgaste por contacto y resistencia a la erosión
- No presentan fatiga, siempre que estén bien diseñados, incluso en entornos agresivos
- Fragilidad y en general mal comportamiento frente a impactos

500 Aircraft per year

Next

Generation

Composite

Airframe:

Challenges for

Industrialization

- 500 Fuselages and Vertical Tail Planes
 - 50.000 frames
 - 150.000 stringers
- 1.000 Wings and Horizontal Tail Planes

Challenges

- Cost Efficiency
- Production Quality and Reliability
- Steep Ramp ups and changing rates
- Integration to reduce High Part Counts

**Composite
Manufacturing
Processes
Technologies:
challenging and Lay
– Up
with Automation
... but not only →
Aernnova
Composites 4.0**



Aernnova Composites 4.0

Today

Material
Characterization

Design,
concurrent
engineering

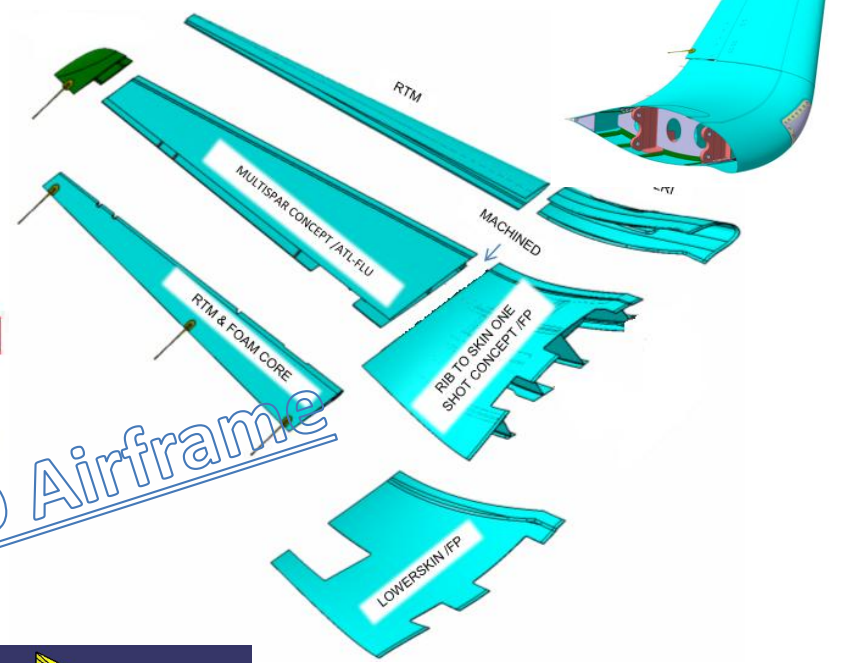
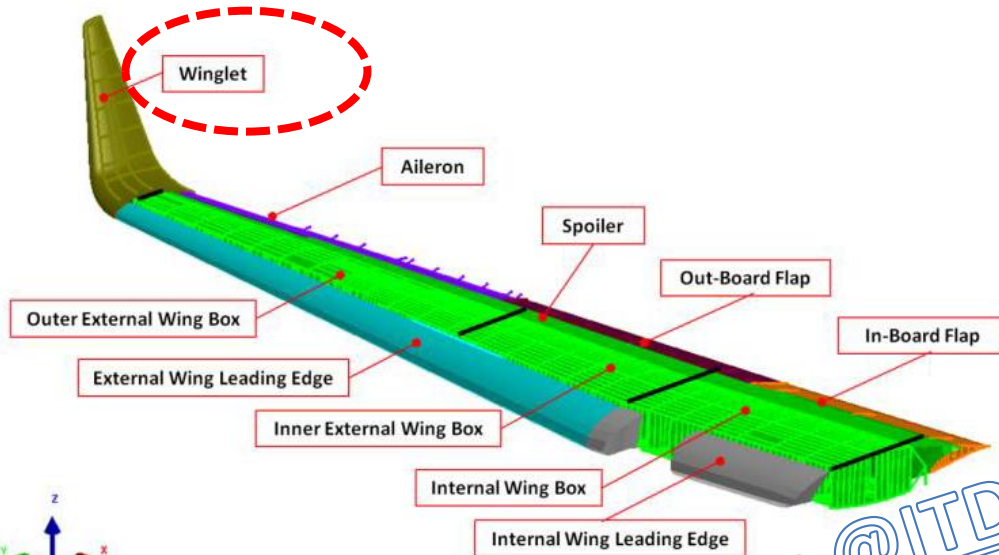
**Manufacturing
Demonstrators**

Automated
Production

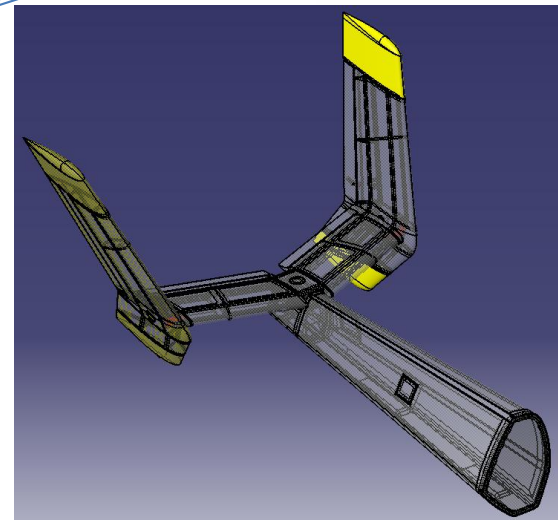
Tomorrow

**Full Concurrent Engineering including
robotics, interconnection, inspection...**

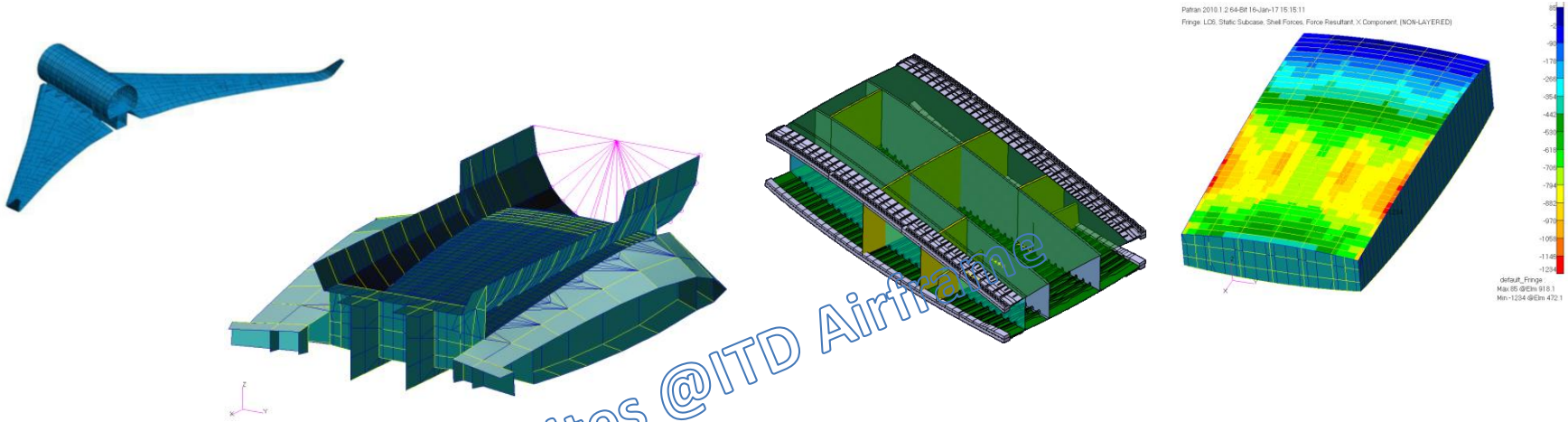
Aernnova Composites Technology Developments in CS2:



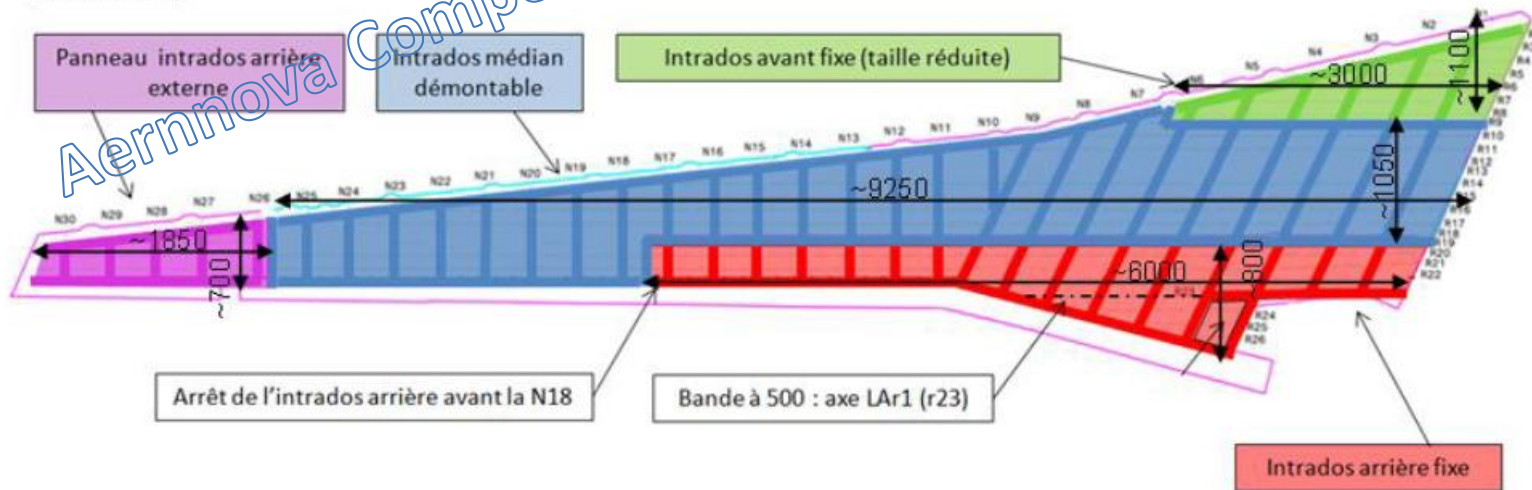
Aernnova Composites @ITD Airframe



CFP: LOIRE TECH
... more to come

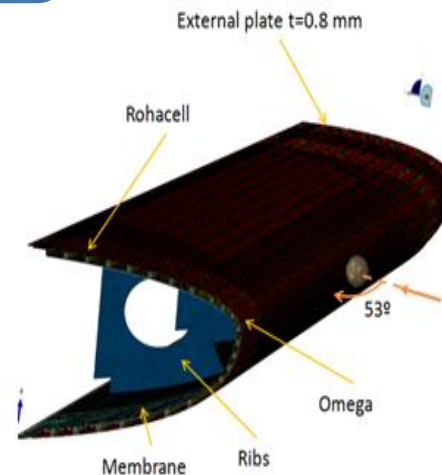
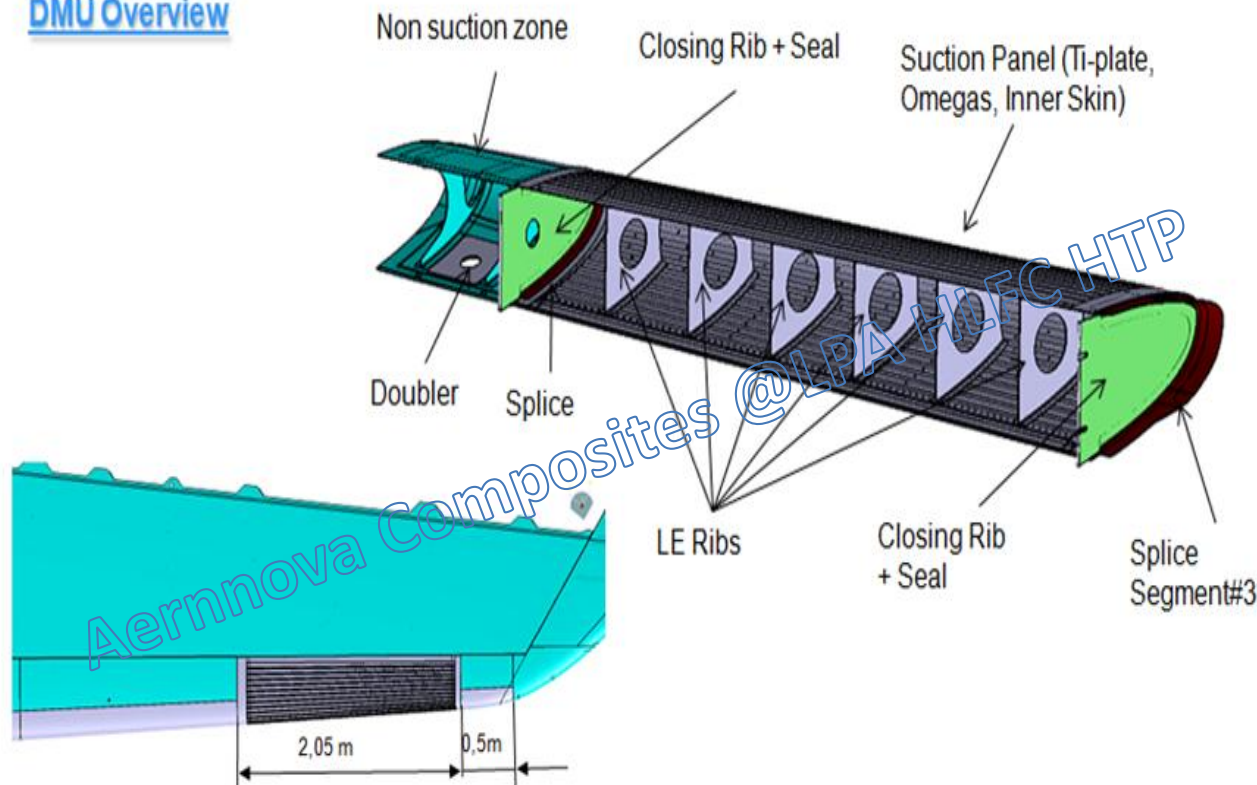


Intrados :

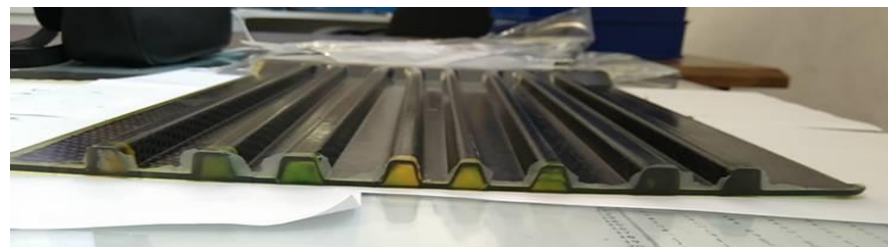
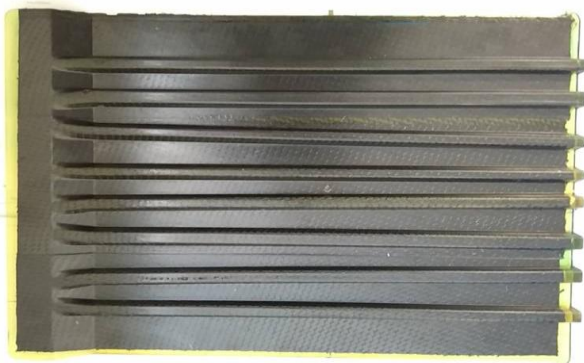


CFP to come for tooling

DMU Overview



CFP:
TEKNIKER + BIAS
COEXPAIR
TU DELFT



CFRP: AITIIP

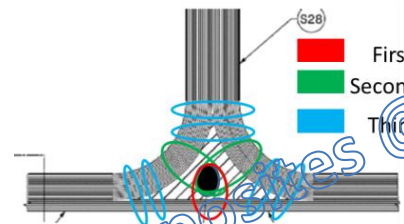
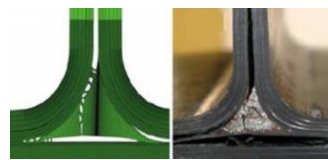
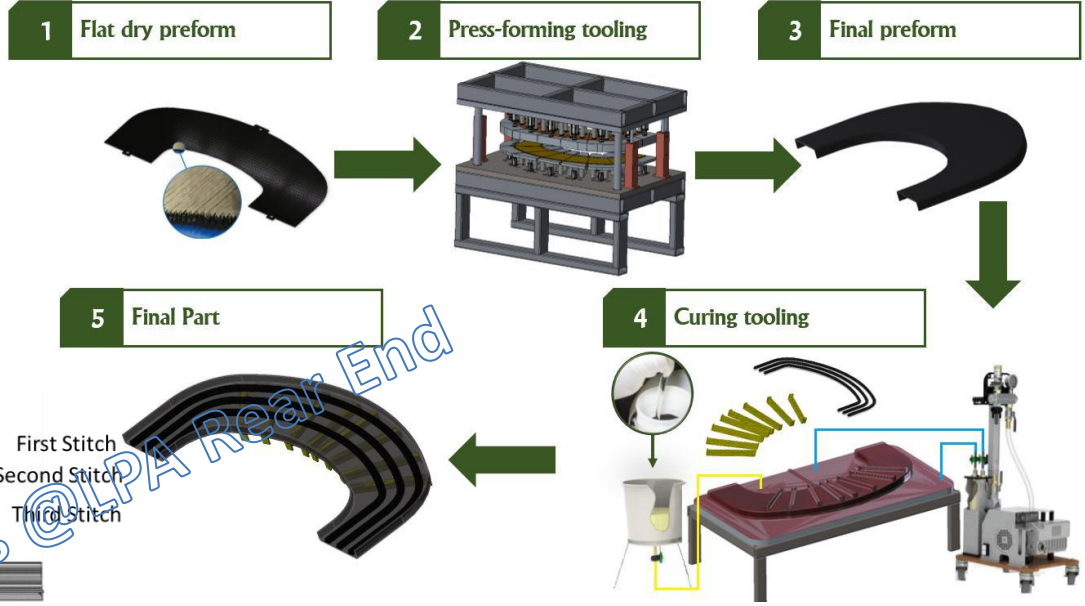
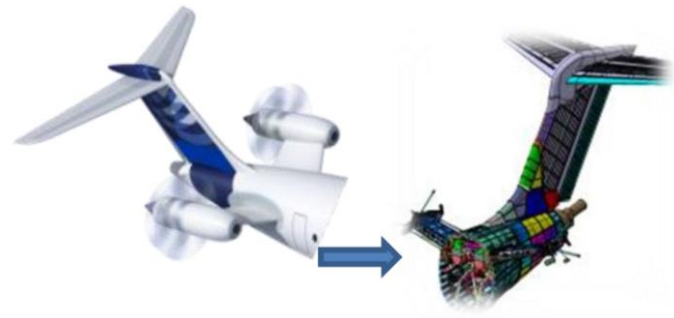


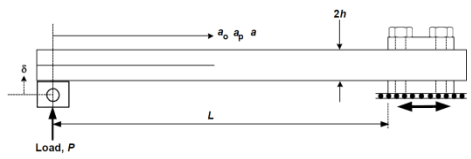
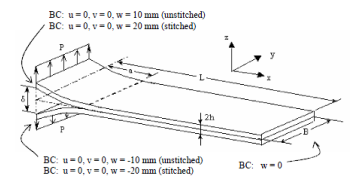
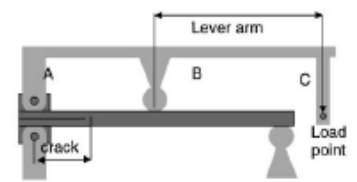
Fig. 3 - Definición de la geometría - Laminado

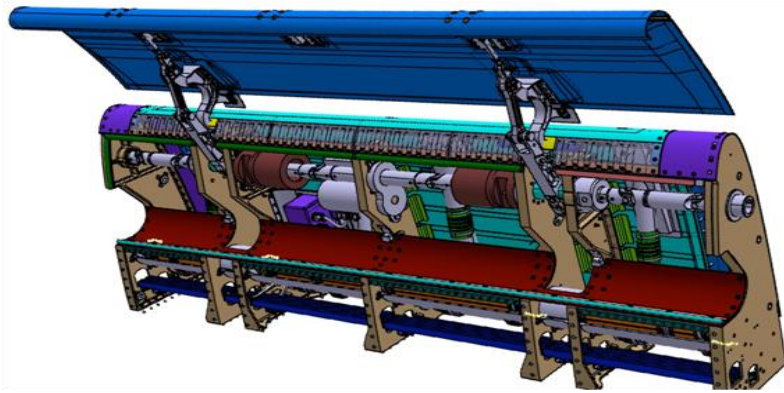
Config. 2 +GUSSET

- Location where the clip is needed
- Location where the clip may be needed

Potential area for stitching

Potential area for stitching





EU FP7 projects
 AFLoNext, MAAXIMUS,
 LoCoMACHS)



Manufacturing methods,
 Wing Parts Production,
 Wing Box Assembly



LE Segment for a HLFC HTP

CS2 LPA IADP
 (ECHO, HLFC HTP)

Integrated WIPS, high
 performance Krueger



EU FP7 projects
 (AFLoNext, DesireH)

HLFC-Win
 Large Scale GBD of
 a fully integrated
 HLFC wing

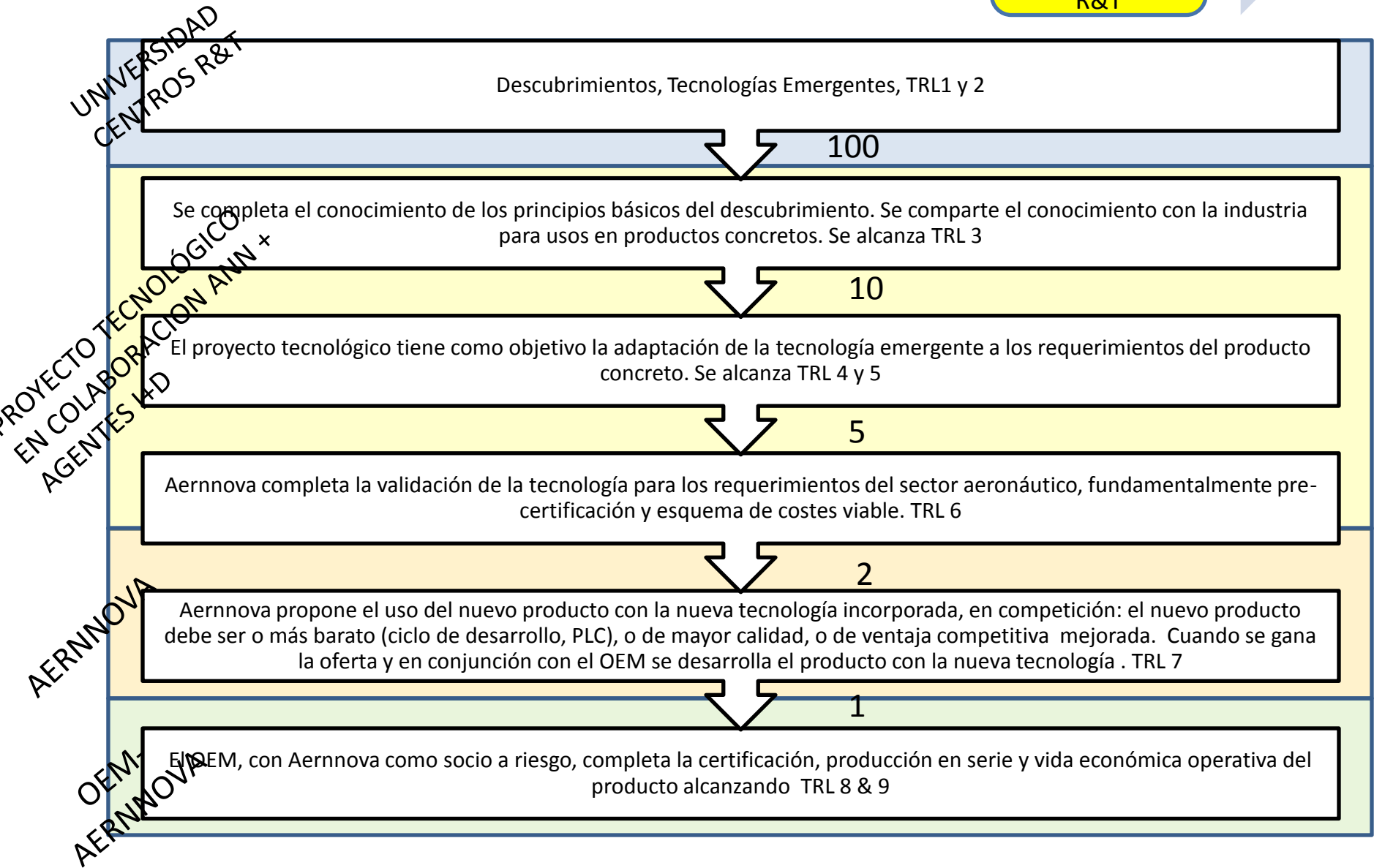
Manufacturing, Process, WIPS design, Krueger
 design & kinematics



National projects (Germany, Belgium, France, Spain)

CFP to come for manufacturing
 some parts

Aernnova Composites @LPA HLFC-WING (under negotiation)



- En **Universidades y centros tecnológicos** buscamos investigación y capacidades de simulación numérica, modelos numéricos, ensayos, pruebas, prototipos...
- En **empresas, PYMES**: cualificación EN 9100 o en vías de conseguirla, capacidad de diseñar y/ o fabricar utillaje aeronáutico, modelización sólidos en 3D
- Visitar página clean sky para ver CFP abiertas:
<http://www.cleansky.eu/content/page/calls>
- Cualificaciones y homologaciones del sector: ISO 9001, EN 9100 y procesos según se requiera
- Trabajan en equipo y de forma abierta con nosotros. El diálogo es a dos bandas
- Aceptan los compromisos de coste, calidad y plazo de los elementos bajo su alcance
- Comparten las acciones específicas que Aernnova demanda en cada momento, en particular conseguir y mantener todas las operaciones según la metodología Lean de Aernnova
- Aceptan y comparten los principios de mejora continua según el Plan de calidad de Aernnova
- Compromiso con el mantenimiento de la competitividad a corto y largo plazo, pudiendo invertir en desarrollo tecnológico en las áreas que así lo requieran

- Hay motivos para seguir estudiando e investigando en materiales compuestos
- Aernnova en CS2 está desarrollando algunas de las líneas más punteras a nivel mundial en nuevas soluciones basada en material compuesto
- En la industria tenemos retos para inspirar nuevas líneas de desarrollo tecnológico
- Aernnova es un socio industrial con el que ejecutar proyectos de desarrollo tecnológico con experiencia en la coordinación y gestión de grandes proyectos, como Clean Sky, y abiertos para colaboraciones.

miguelangel.castillo@aernnova.com

Gracias por su atención

Many Thanks for your attention!

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