# The EASN Association

# A few words about EASN…

## EASN is …

- an **open Association, structuring and representing the European Academia** in Aviation research related issues.
- On 06.05.2008, the EASN Association was established by **22 founding** members, with the support of the European Commission and several University professors throughout Europe. However, the establishment of EASN goes back to 2002 and is based on two subsequent support actions funded by the Commission.

## Long – Term Goal

- To build up an **open, unique European platform** in order to **structure, support and upgrade the research activities of the European Universities** active in **Aviation Research** as well as to facilitate them to respond to their key role in realizing the European Research Area.

## Main features of the EASN Association

- **Self funded** and **self sustainable**
- International **non-for-profit** association
- Coordinated and run by a **board of directors** who are elected by the general assembly **for a 3 year term**.
- The position of a board member is **unsalaried**
- Supported by **EASN-TIS** in all secretarial and administrative aspects
- All steps and actions taken are in accordance with the **statutes of the Association**.

# The role of EASN in the European Research Community

# The role of EASN in the European Research Community

- European universities have a key role in the chain of the European Aeronautics Stakeholders by providing **education of scientists and engineers** as well as generating basic research and **incubating technological innovation** and breakthrough technologies.
- Academic research needs to be driven by "**out of the box**" thinking which leads to fresh ideas and new concepts.
- Especially for the **countries with limited aeronautical industry**, universities are the key players concerning aeronautics related research.

# The role of EASN in the European Research Community

- To **promote, encourage, coordinate and focus joint efforts** between Universities, Research Organizations, Industry and SMEs which are active in Europe in the field of aeronautics.
- To **support innovative research** in general and support European Universities at department and institute level, as well as University research staff to perform aeronautics related research in particular.
- To **support the scientific and technological cooperation** and **human mobility** within the area of its cognitive subject and the organization of and the participation to relative activities.
- To consolidate and express a unique **European Academia voice** on policy related issues and on issues related to the future of Aeronautics research.

# The role of EASN in the European Research Community

- To **disseminate knowledge and technological innovation** and execute dissemination work through its participation either on its own or within the framework of consortia in national or international projects and research programs related to aerospace.
- To act as a **communication platform** between the European Aeronautics Academia and the professional Associations of other stakeholders, governmental and state authorities, such as ASD, EREA, SME's as well as the European Commission, etc.

# EASN is establishing links

# European Aeronautics Science Network

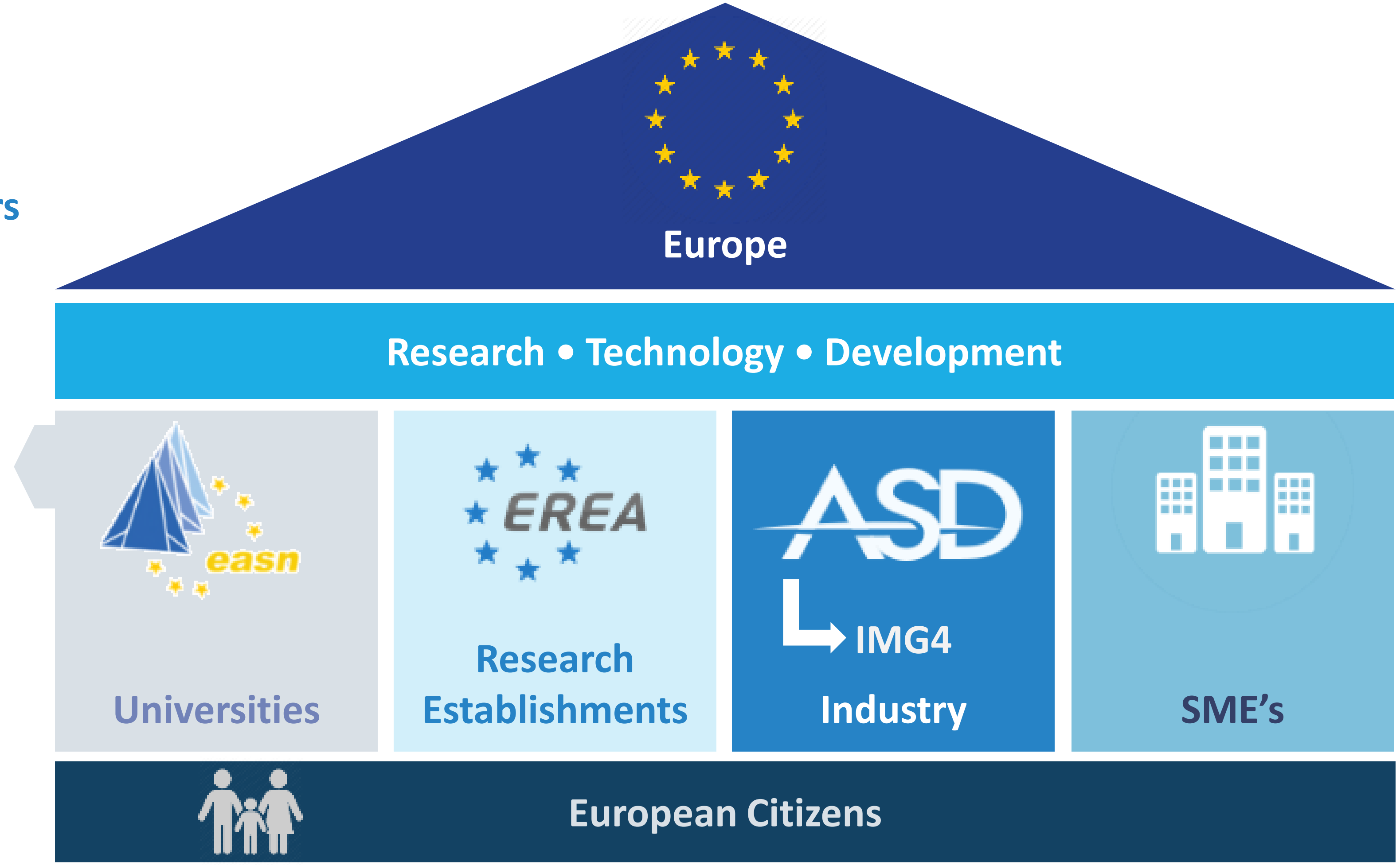
## Establish links

In close cooperation
with all major
European Stakeholders
and the public:
EC
Clean Sky

ACARE

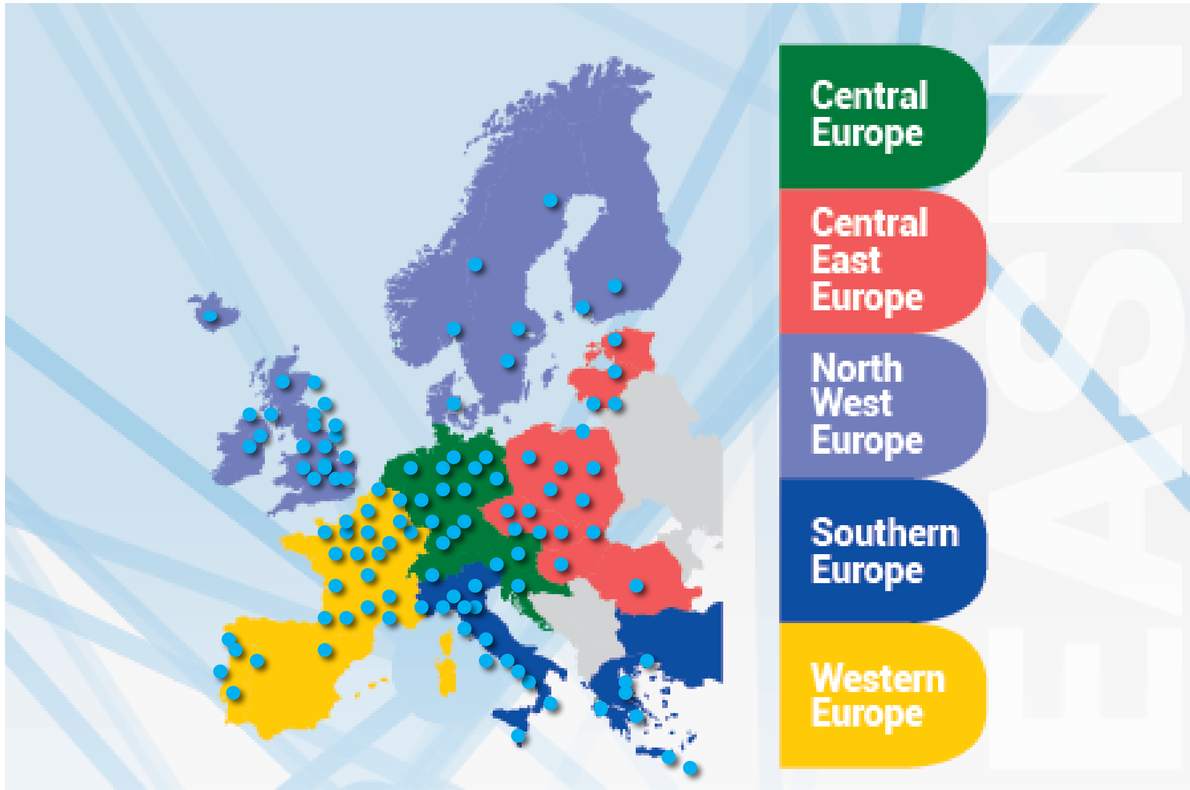
EACP

CEAS



# EASN Structure

## Structuring Academia

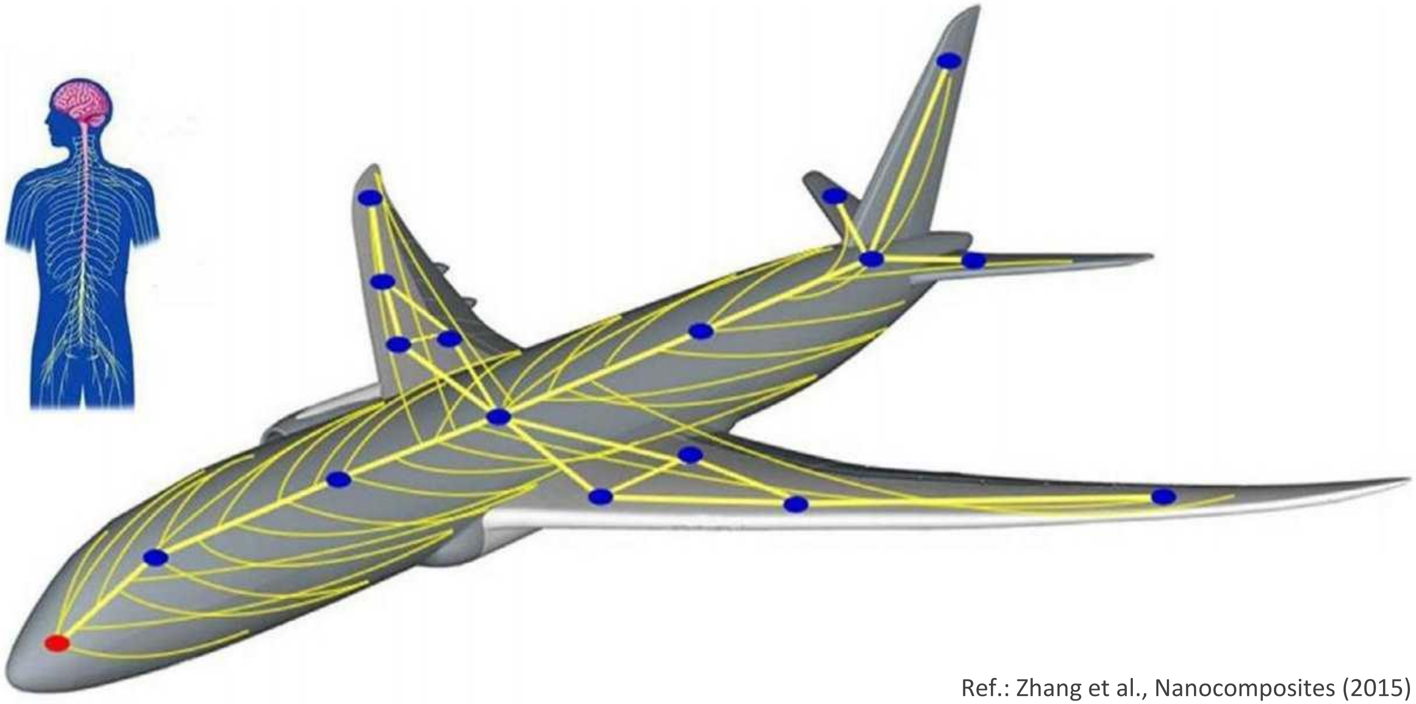
# Create Innovation – Incubate Breakthrough Technologies

The development of innovation and breakthrough technologies represents an indispensable need in order to retain the global leadership and the competitiveness of European Aeronautics and pave the way on achieving the demanding goals of the FlightPath2050 for Aeronautics.

# Research Priorities

## Aerostructures

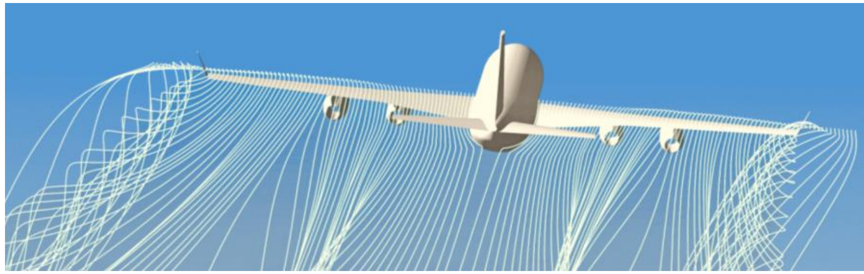
- Advanced Manufacturing Processes & Technologies
- Metallic materials
- Nanocrystalline materials
- Composite Materials
- Structural Analysis & Design
- Smart/ Multifunctional Materials
- Structures Behavior & Material Testing
- Structural Health Monitoring (SHM)



Ref.: Zhang et al., Nanocomposites (2015)

# Research Priorities

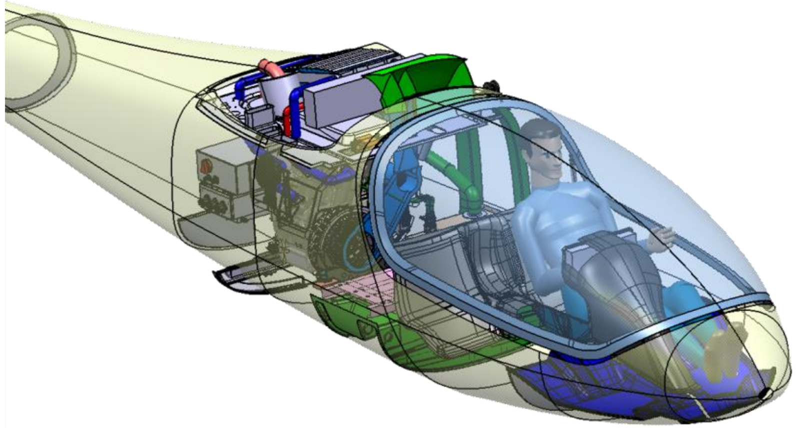
## Flight physics



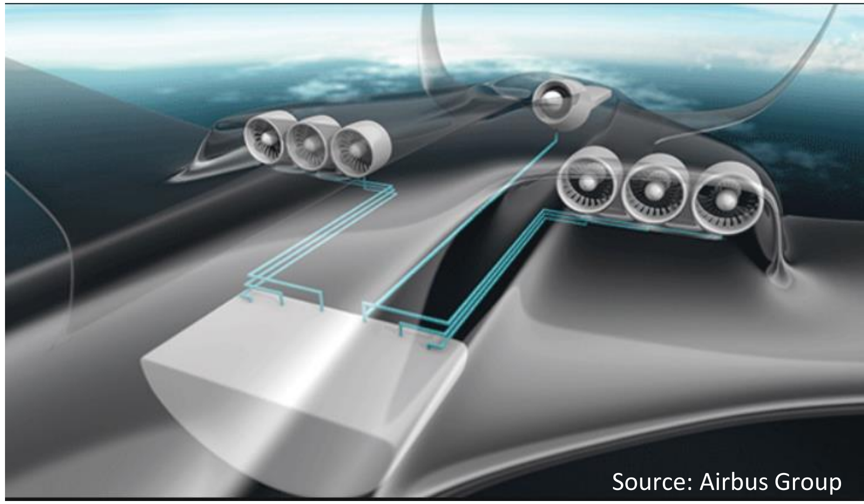
- Integrated wing technologies

## Propulsion

- Distributed propulsion
- Hybrid-electric flight
- Scaled Flight Testing
- Emissions



Source: IFB, University of Stuttgart



Source: Airbus Group

# Research Priorities

## Maintenance, repair and overhaul

- Health and usage monitoring and management
- Integrated sensors and actuators with distributed control and health monitoring

## Innovative concepts & scenarios

- Personal autonomous vehicles
- Air to Air Refueling for Civil Transportation
- Alternative energy sources (batteries, fuel cells, biofuels)
- Personal autonomous vehicles
- Innovation in cargo transport


Source: Airbus Group

# Research Priorities

## Aerostructures

### Advanced Manufacturing Processes & Technologies

- Additive Manufacturing (AM) technologies, fundamental process understanding, structural parts topology and shape optimization.
- 3D free standing metal parts.
- Alternative AM solutions and technologies with a perspective towards aerospace applications, additionally to metal AM (e.g. AM for ceramics, ceramic matrix composites, polymer matrix composites).
- Joining between AM parts and AM parts to other components, using advanced joining techniques.
- Disruptive manufacturing techniques for metallic integral structures.

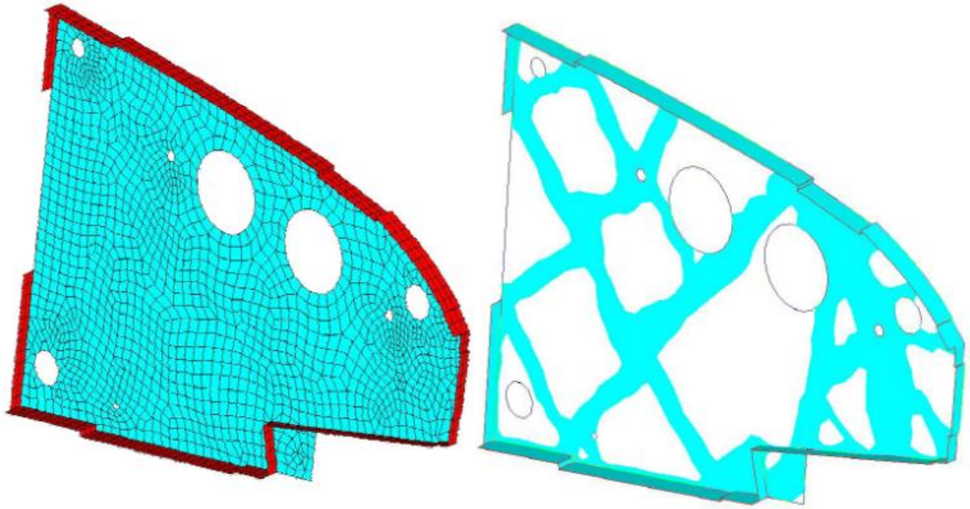
# Topology optimized aircraft parts produced by AM

**Issues to overcome:**

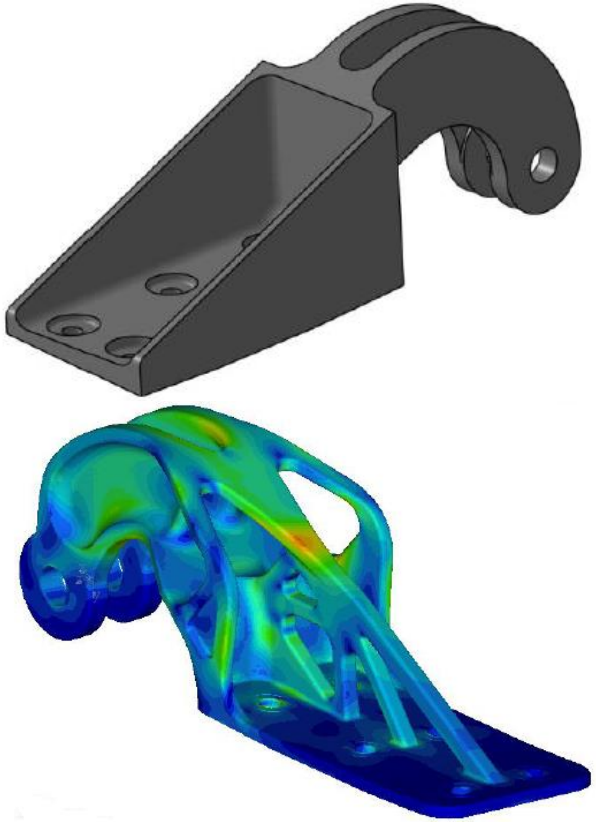
•powder material systems with appropriate properties
• mechanical behaviour (part anisotropy, distortion, fatigue behaviour)
• production time and cost
• NDT methods

**Advantages:**

•complex and demanding components
• optimum material topology i.e. optimum performance
• maximum functionality, load transfer, strength and mechanical behaviour



• the ‘famous’ Airbus A380 LE rib: conventional design (left) and AM future design (right)



• the ‘famous’ Airbus bracket: conventional design (up) and AM future design (below)

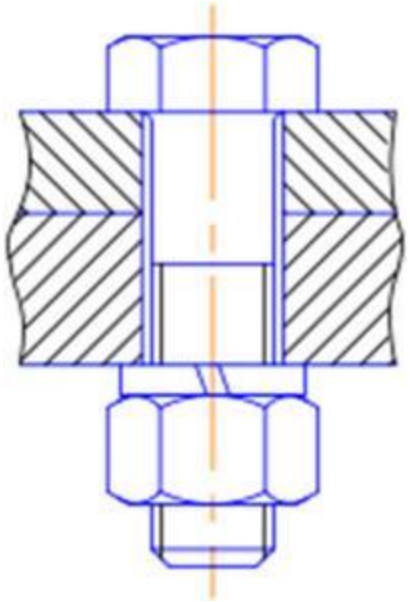
## Metallic materials

- Development of improved metallic airframes based on new aluminum alloys and novel structural concepts.
- Welding of Aluminum alloys and welding of dissimilar alloys; Development of new welding processes and post processes for improved Al alloy welding.
- Increased exploitation of Magnesium Alloys (improving the mechanical properties of aerostructures and reducing corrosion sensitivity).
- Nanocrystalline alloys.
- Treatments and processes for multifunctional surfaces.

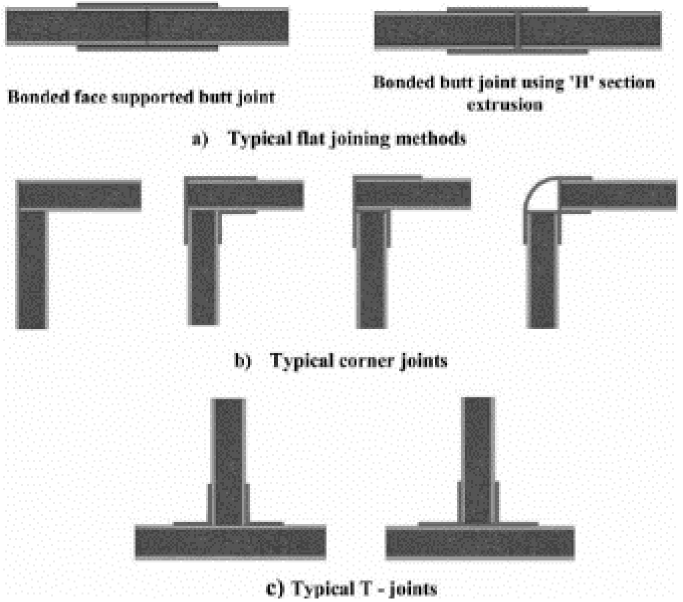
## Composite Materials

- Cost efficient manufacturing techniques for thermoplastic structures.
- Hybrid manufacturing techniques for thermosetting composite structures.
- Recycling of thermosetting composite structures.
- Advanced NDT for composite structures.
- New design of adhesive joints for a reduced influence of environment on durability. Design of alternative design concepts aimed at reducing the decay of the joint properties with time.
- Certification of adhesive bonding (joints and repairs) for primary metallic and composite structural parts (Extended NDT, design of crack arresting features, evaluation of existing standards for mechanical testing ).

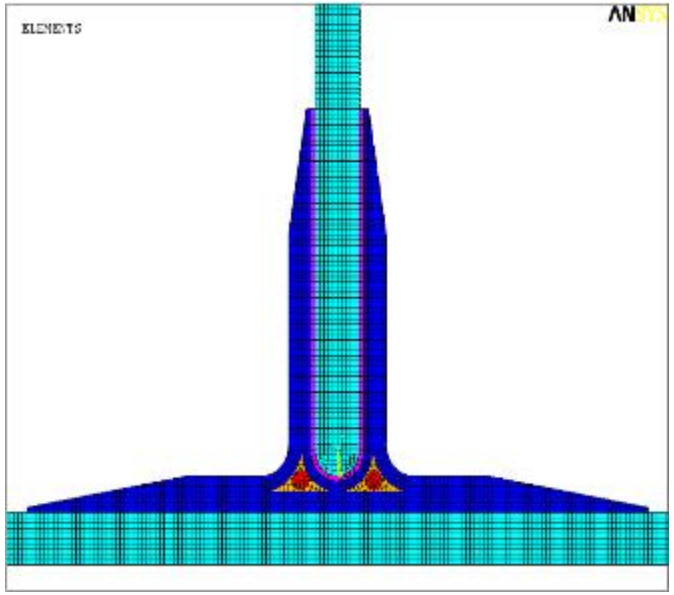
## From bolted joints to adhesive bonding



Bolted joint

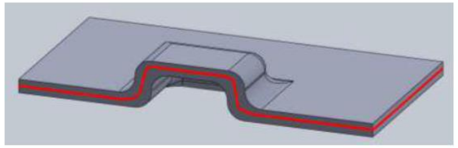



Bonded joint

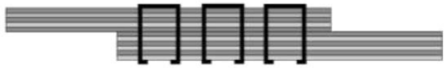



T-shape Bonded joint

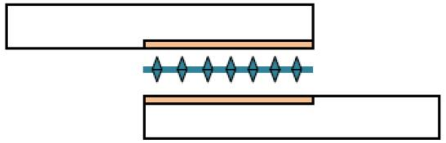
# Bonded joints: Towards certification through crack stopping



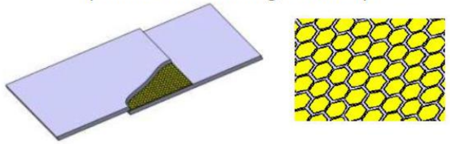
The corrugation principle
(Surface and geometry modification)



Hybrid bonded joint with staples
(Through thickness reinforcements)

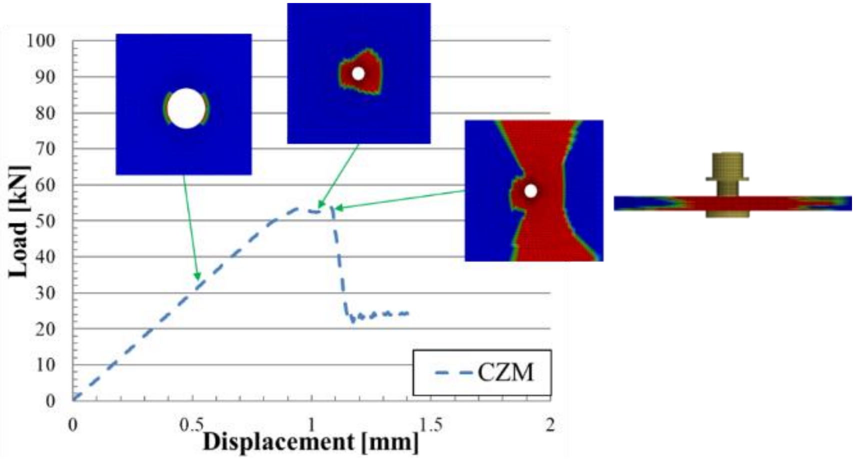


Metallic mesh with surface interfering features
(Surface interfacing features)

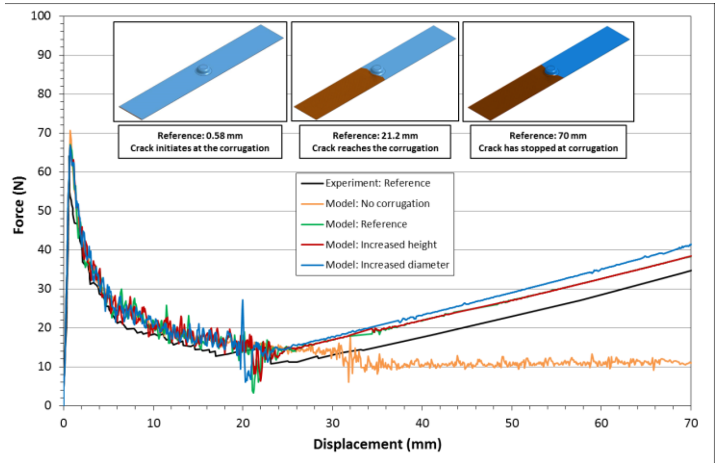


Heterogeneous bondline with separated adhesive areas
(Adhesive bondline architecturing)

Crack stopping using a bolt



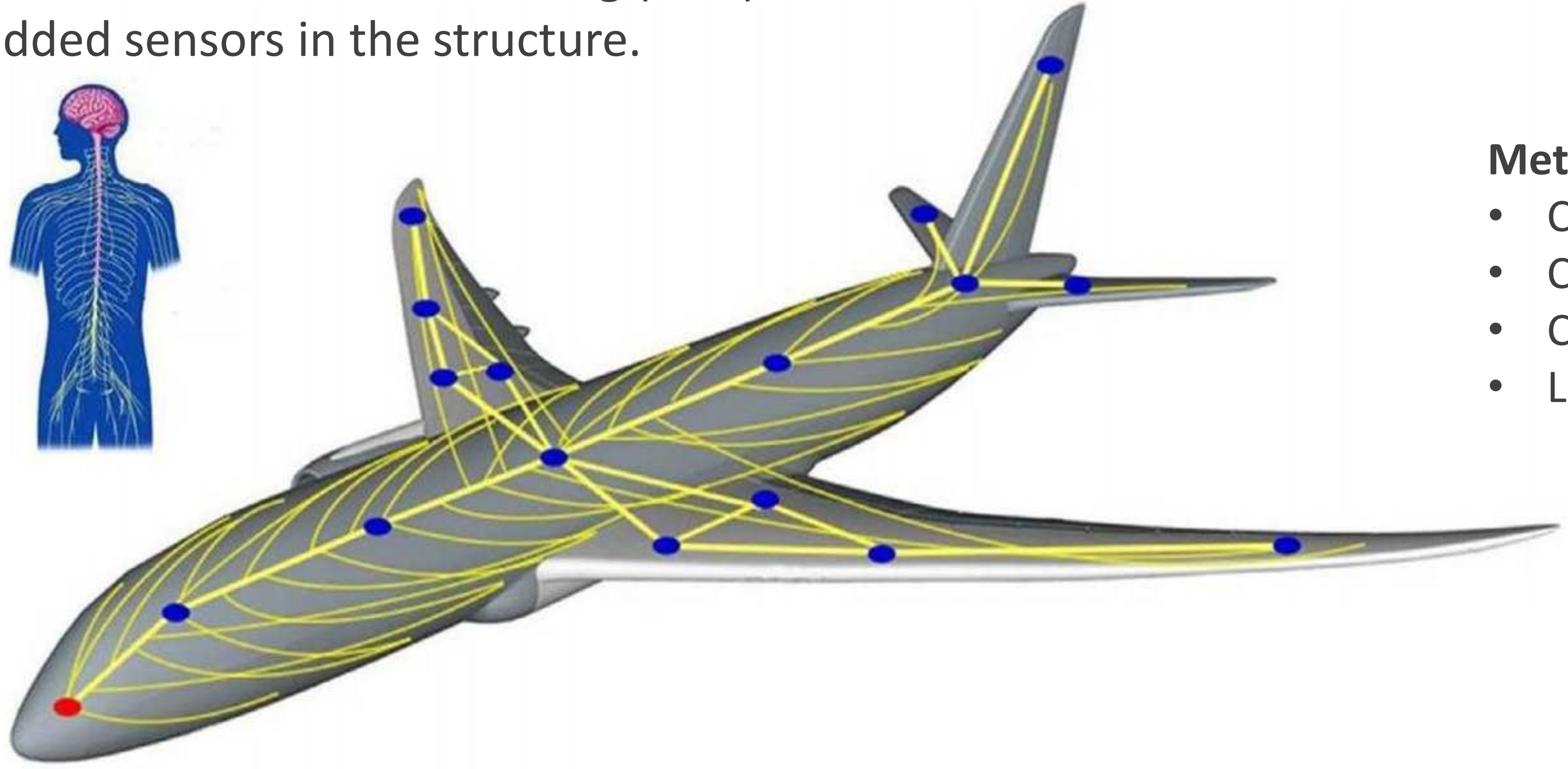

Crack stopping by corrugation




Ref: Tserpes et al., Theoretical and Applied Fracture Mechanics (2016)

## Structural Health Monitoring (SHM)

Innovative Non Destructive Testing (NDT) method with the use of embedded sensors in the structure.



**Metallic structures**
- Cracks
- Crack growth
- Corrosion
- Loads/strains

**Composite structures**
- Impact
- Delaminations
- Debonding
- Loads/strains

Ref.: Zhang et al., Nanocomposites (2015)

# Research Priorities

## Maintenance, repair and overhaul

### Health and usage monitoring and management

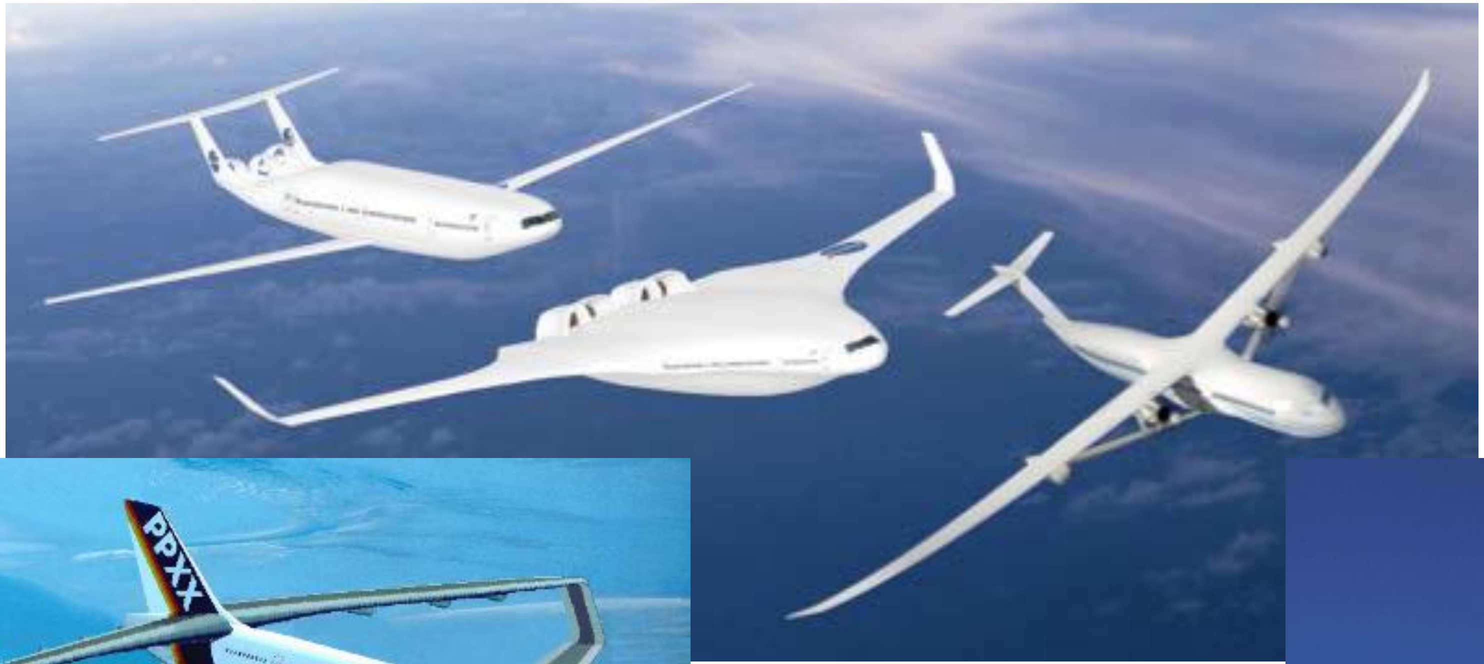
- Focus on alternative concepts for Structural Health Monitoring (SHM).
- Innovative means for detection, prevention, removal of harmful water and the design of affordable design-changes, also with options for retrofit implementations.
- Analysis of big data for predictive maintenance.
- Industry 4.0 for a new concept of maintenance. Automated dent quantification in fuselages.
- Use of drones in all areas of maintenance.
- New solutions for structural repairs, including repair monitoring.

- Repair technologies for Additive, Thermal barrier coating and composites.

## Integrated sensors and actuators with distributed control and health monitoring

- Health monitoring of low- and high- temperature stationary and rotating frames.
- Surfaces with structuring on micro-/nano-scales with/without surface chemistry.
- Advanced shear-pressure sensors.
- Optimization and robust design techniques for health monitoring applications.

## The evolution of aircraft structures strongly depends on unconventional aircraft concepts needs



NASA Double-bubble (left) and hybrid wing body (middle) and high Aspect Ratio Elastic Wing (right) aircraft concepts

Source: NASA.gov


Airbus A30x and Box-plane configuration

Source: Airbus Group

# Develop European Policies

## Participation in policy – related projects

SUNJET

PERSEUS Aerospace

CAPPADOCIA

CATER Coordinating Air transport Time Efficiency research

PromoAir Your future takes off here!

COOPERATEUS

SUNJET

RINGO Research Infrastructures needs.gaps.overlaps

RADIAN

# Dissemination of Knowledge

SARISTU
SMART INTELLIGENT AIRCRAFT STRUCTURES

HAIC
High Altitude Ice Crystals

UNCERTAINTY MANAGEMENT FOR ROBUST INDUSTRIAL DESIGN IN AERONAUTICS
UMRIDA

ComBoNDT

IASS

QUICOM

i-VISION

CORSAIR
COld spray Radical Solutions for Aeronautic Improved Repairs

InLight

EFFICOMP
Efficient Composite Parts Manufacturing
高生産性複合材成形技術

FUCAM
FUTURE CABIN FOR THE ASIAN MARKET

光
HIKARI

ENCOMB

INMA

SARAH
Increased Safety & Robust Certification for ditching of Aircrafts & Helicopters

NHYTE

ICARUS

# EASN Association series of Conferences/Workshops


University of Glasgow

easn

CEAS COUNCIL OF EUROPEAN AEROSPACE SOCIETIES

# 8th EASN-CEAS International Workshop on Manufacturing for Growth and Innovation

4-7 September 2018, Glasgow, UK

# Further information

about EASN and its activities can be found on the EASN website

**www.easn.net**

Scan & Visit

- ✓ All colleagues are cordially invited to join the **EASN Association**.
- ✓ Registration to the EASN database can be made on-line through **the EASN website**.

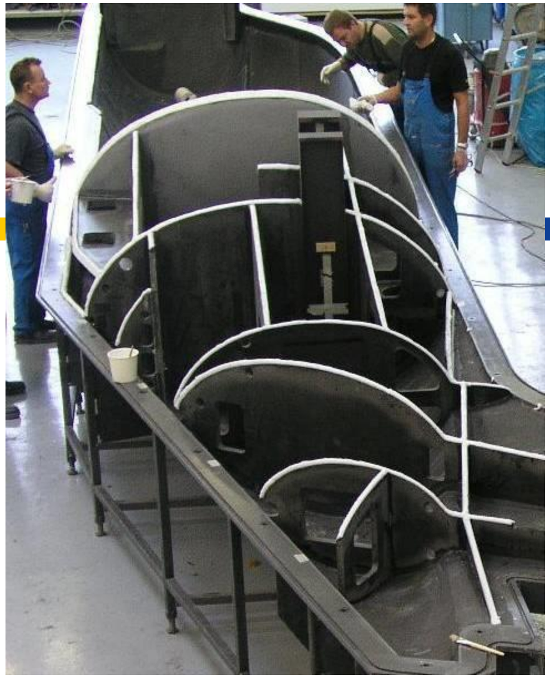
*Thank you !*

# Manufacturing for Growth

## A personal view

Grob Aerospace sp$^{n}$ business jet

# Manufacturing for Growth



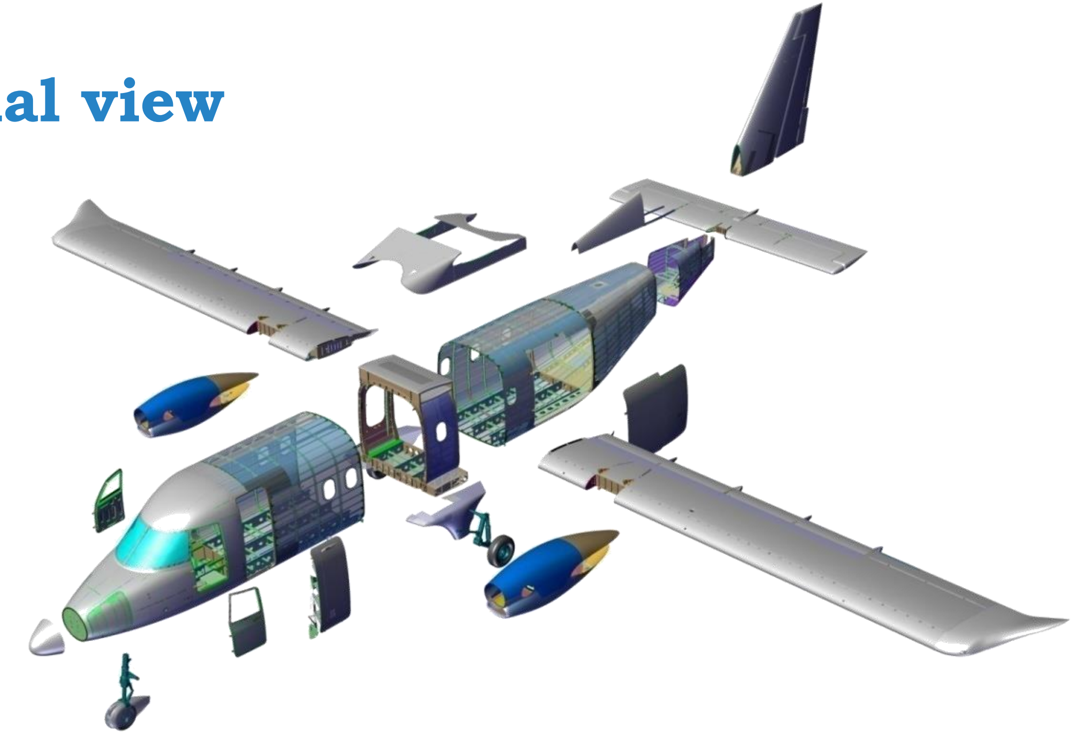
## A personal view

⇨ How to transform this process to series production?

# Manufacturing for Growth

## A personal view

Sky Aircraft Skylander

# Manufacturing for Growth

## A personal view

- ❑ Tooling cost
- ❑ Topology optimized parts / added manufacturing
- ❑ Configuration management
- ❑ Design for testing