Research in Aviation

31 May 2018, AERO-UA workshop, Kharkov, Ukraine

Prof. Dr.-Ing. Richard Degenhardt
richard.degenhardt@dlr.de

- DLR, Institute of Composite Structures and Adaptive Systems, Germany
- Private University of Applied Sciences Göttingen (PFH), Germany
- University Bremen, Germany
- Publicly certified expert for “Primary structures made of composite materials”

DLR

Short CV

- 1990: Diploma in Engineering
- 1996: PhD in Applied Mechanics
- 1996-2000: Structural engineer in industry
- **2000 – Now: DLR Institute of Composite Structures and Adaptive Systems**
- **2008 – Now: University PFH in Stade**
- **2012 – Now: University Bremen**
- **2008 – Now: Reviewer for European Commission**
- **2017 – Now: Publicly certified expert for "Primary structures made of composite materials"**
- **Publications**: 51 journal papers, 137 conference papers, coauthor of 3 books
- **High-Lights:** Co-ordination of the following EU-projects
  - 2004-2008 (FP6): COCOMAT (Aerospace, 15 partners), www.cocomat.de
  - 2012-2015 (FP7): DESICOS (Space, 12 partners), www.desicos.eu
  - 2012-2014 (FP7): IFARs (Aerospace, Support action, Network of 26 partners), www.ifar.aero, www.ifarlink.aero
  - Representative of DLR in ICARe

Content

- German Aerospace Center (DLR)

- DLR Institute of Composite Structures
- International Forum for Aviation Research (IFAR)
- EU-Project ICARe (International Co-operation in Aviation Research)

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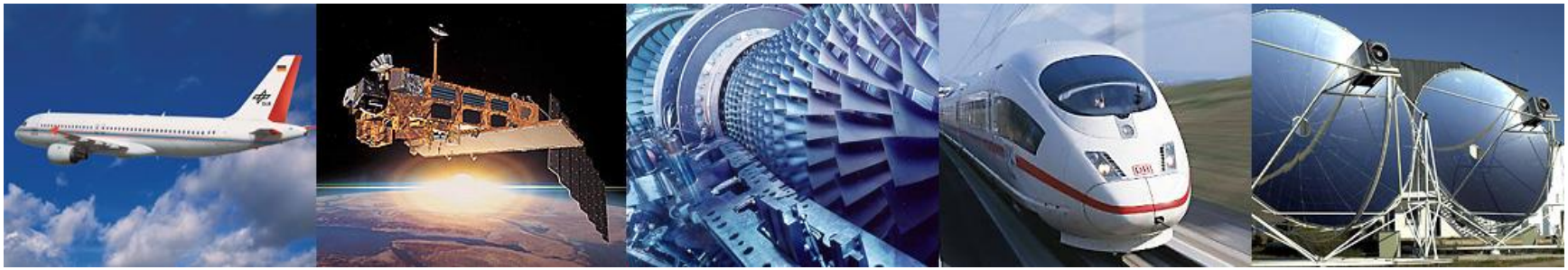
DLR - German Aerospace Center



- Research Institution
- Space Agency
- Project Management Agency

DLR

performs basic research,

develops novel technologies,

builds and operates
large-scale test facilities.

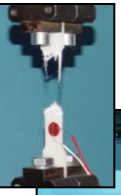
Research Areas

- Aeronautics
- Space
- Transport
- Energy
- Space Agency
- Project Management Agency

Locations and employees

- Approx. 8000 employees
- 40 institutes and facilities
- 20 sites.
- Offices in Brussels, Paris, Tokyo and Washington.

Test Facilities



Material Testing

Tower Simulator

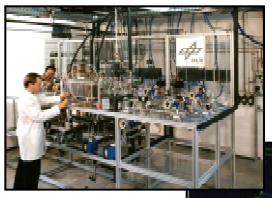
Ground Vibration Testing

Rotor Test Stand

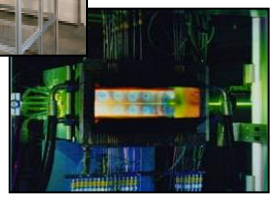
Cockpit Simulator

Test Activities

- Basic Research
- Material Characterization
- System Identification
- Validation of Numerical Tools
- Process Simulation
- Component Testing
- Industrial System Tests



Fuel Cell Laboratory



Experimental Combustor

DLR‘s System Competence, Example: Aircraft

Institute of **Flight Systems**

Institute of **Technical Thermodynamics**

Institute of **Technical Physiks**

Aircraft-systems

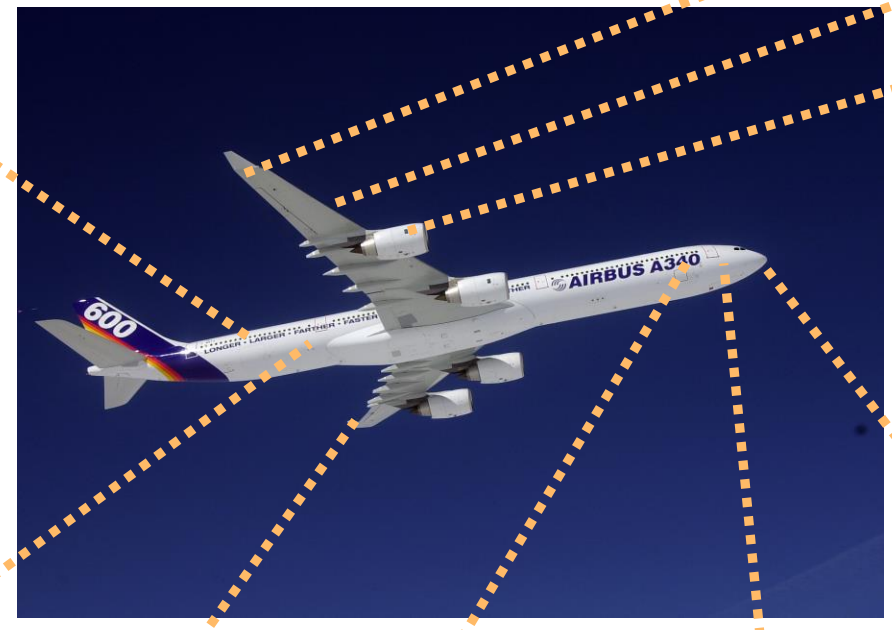
Institute of **Robotics and Mechatronics**

Cluster **Materials and Structures**

Institute of **Composite Structures and Adaptive Systems**

Institute of **Structures and Design**

Institute of **Materials Research**



Cluster **Propulsion and Combustion Technology**

Institute of **Propulsion Technology**

Institute of **Combustion Technology**

Institute of **Communication and Navigation**

Institute of **Aerolasticity**

Institute of **Aerodynamics and Flow Technology**

Institute of **Flight Guidance**

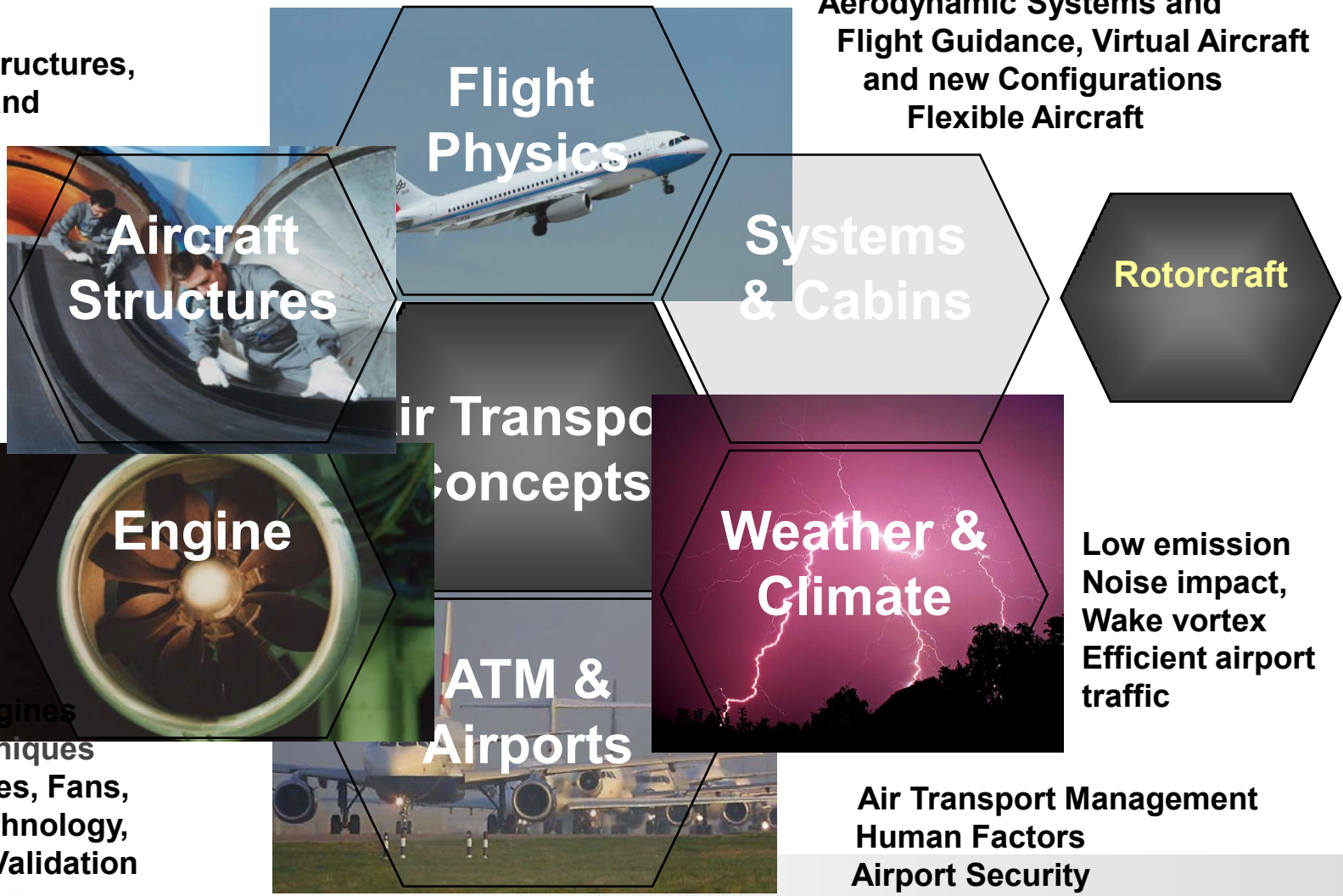
Institute of **Aerospace Medicine**

Flight Departments

Aeronautical Research at the DLR

Materials, Structures, Simulation and Validation

Aerodynamic Systems and Flight Guidance, Virtual Aircraft and new Configurations Flexible Aircraft



Low emission
Noise impact,
Wake vortex
Efficient airport traffic

Virtual Engines
Propulsion Techniques
Turbines, Fans,
Combustion Technology,
Validation

Air Transport Management
Human Factors
Airport Security

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Institute of Composite Structures and Adaptive Systems

Director: Prof. Dr.-Ing. M. Wiedemann

We are experts for the design and realization of innovative lightweight systems.

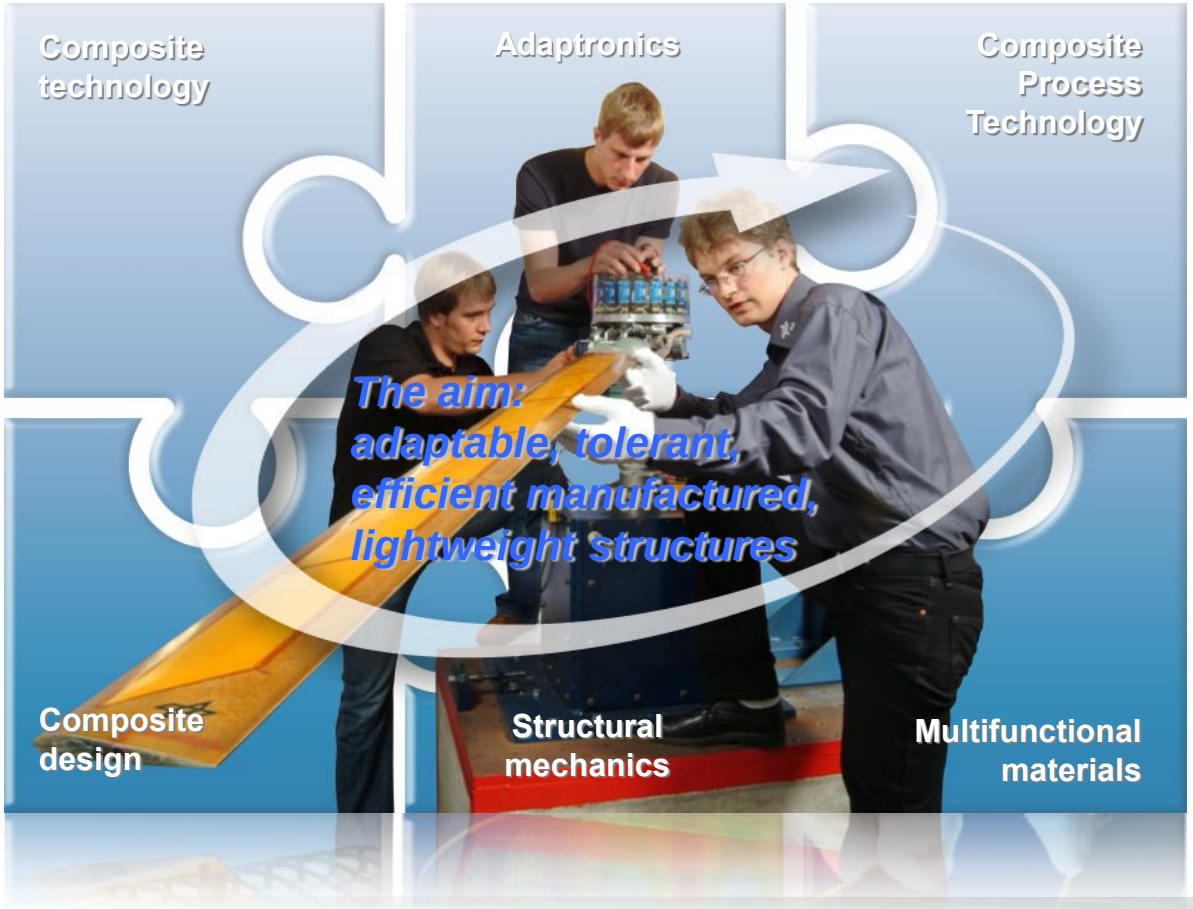
Our research serves the improvement of:

- **Safety**
- **Cost efficiency**
- **Functionality**
- **Comfort**
- **Environmental protection**

Our Professional Competences – Bricks of the **Process Chain of High Performance Lightweight Structures**

We orient ourselves along the entire process chain for building adaptable, efficient manufactured, lightweight structures.

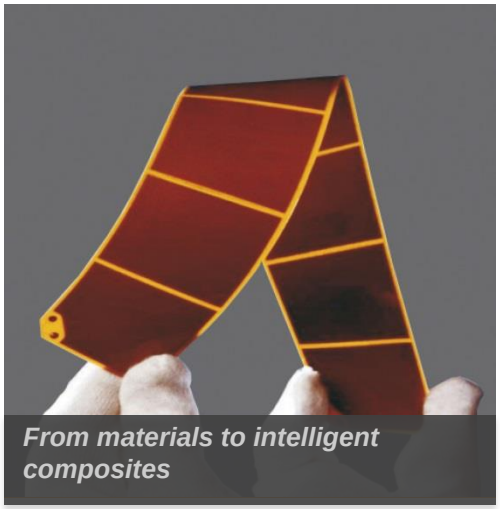
For excellent results in the basic research and industrial application.



Multifunctional Materials

Dr. P. Wierach

We increase the ability of the materials!



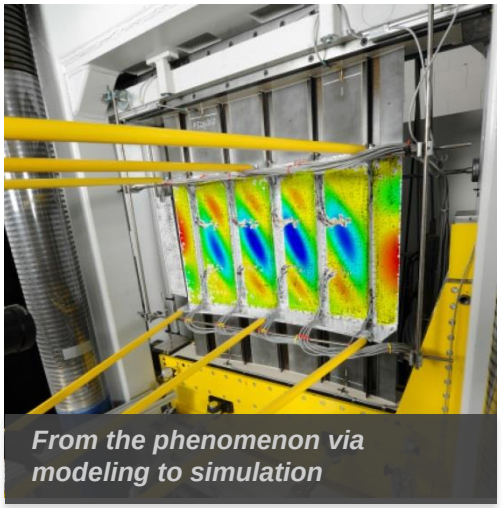
From materials to intelligent composites

- Fiber- and nanocomposites
- Smart materials
- Structural health monitoring
- Material characterization

Structural Mechanics

Dr. T. Wille

With high fidelity to virtual reality for the entire life cycle!



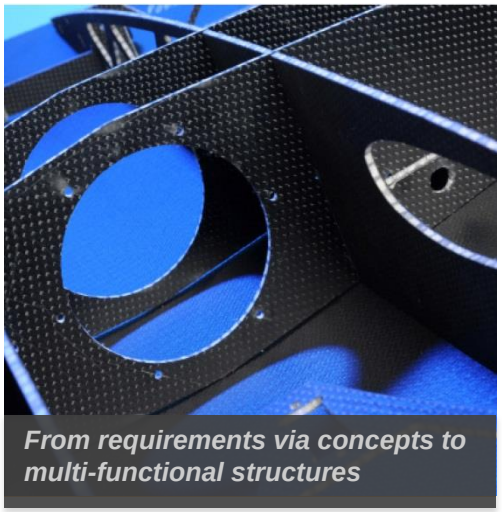
From the phenomenon via modeling to simulation

- Global design methods
- Stability and damage tolerance
- Structural dynamics
- Thermal analysis
- Multi-scale analysis
- Process simulation

Composite Design

Dr. C. Hühne

Our design for your structures!



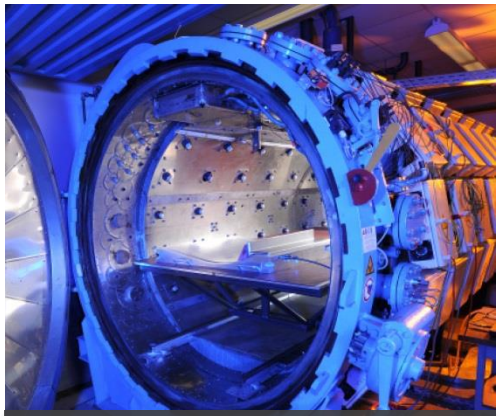
From requirements via concepts to multi-functional structures

- Design and Sizing
- Structure concepts and assessment
- Multi-functional structures
- Shape-variable structures
- Hybrid structures

Composite Technology

Dr. M. Kleineberg

Tailored manufacturing concepts



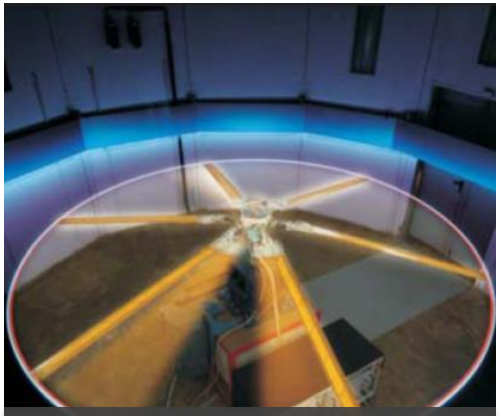
From the idea via processes to prototypes

- New technologies for manufacturing
- Hybrid manufacturing
- Assembly
- Repair
- Process automation

Adaptronics

Dr. H. P. Monner

The adaptronics pioneers in Europe



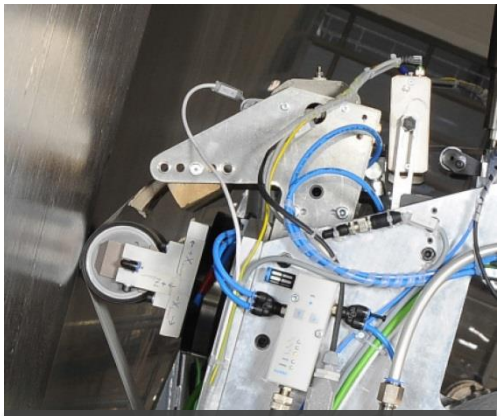
From functional composites to adaptive systems

- Simulation and demonstration of adaptive systems
- Active vibration control
- Active noise control
- Active shape control
- Autarkic systems

Composite Process Technology

Dr. F. Kruse

Research with industrial dimension



For sustainable processes

- Automated FP und TL
- Online QA within autoclaves
- Automated manufacturing for mass-production
- Simulation methods for maximum process reliability and process assessment

Applied Research | Our Foci of Product Oriented Research

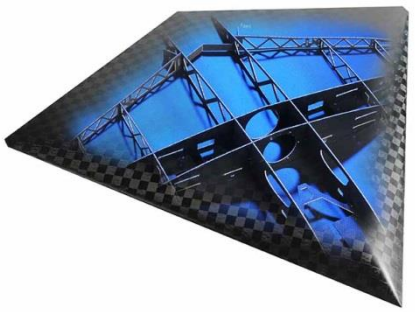
Focus
Fuselage Technologies | Dr. J. Kreikemeier

- Fuselage design
- Large cut-outs
- Manufacturing technologies

Focus
High Lift | Dr. M. Kintscher

- Flexible leading edge
- Morphing of high lift systems
- Structural integration of active flow control

Focus
Special Structures | M. Hanke



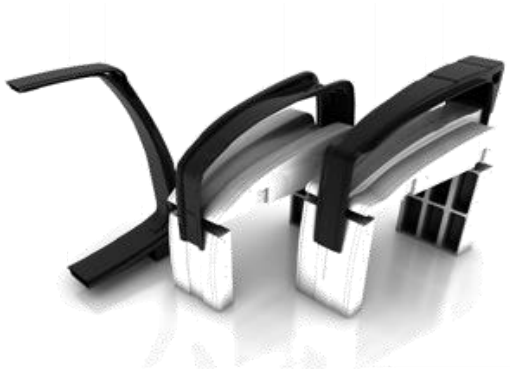
- Savety relevant aeronautic structures and UAVs
- Multifunctional composite structures
- Demonstration of design and technology

Applied Research | Our Foci of Product Oriented Research

Focus
Space | O. Mierheim

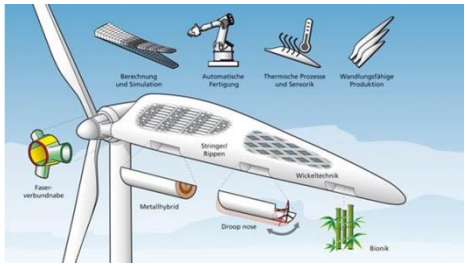
- Lander structures
- Deployable space structures
- Upper stage

Focus
Transport | I. Roese-Koerner



- Next generation train
- Novel vehicle structures

Focus
Windenergy | B. Wieland



- Multidisciplinary design chain
- Quality-controlled production with tolerance management
- Passive and active Smart Blades
- (Partial)Automated Production
- SHM and Loadmonitoring
- Materialdesign, e.g. for radarabsorption

Content

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- International Forum for Aviation Research (IFAR)

- EU-Project ICARe (International Co-operation in Aviation Research)

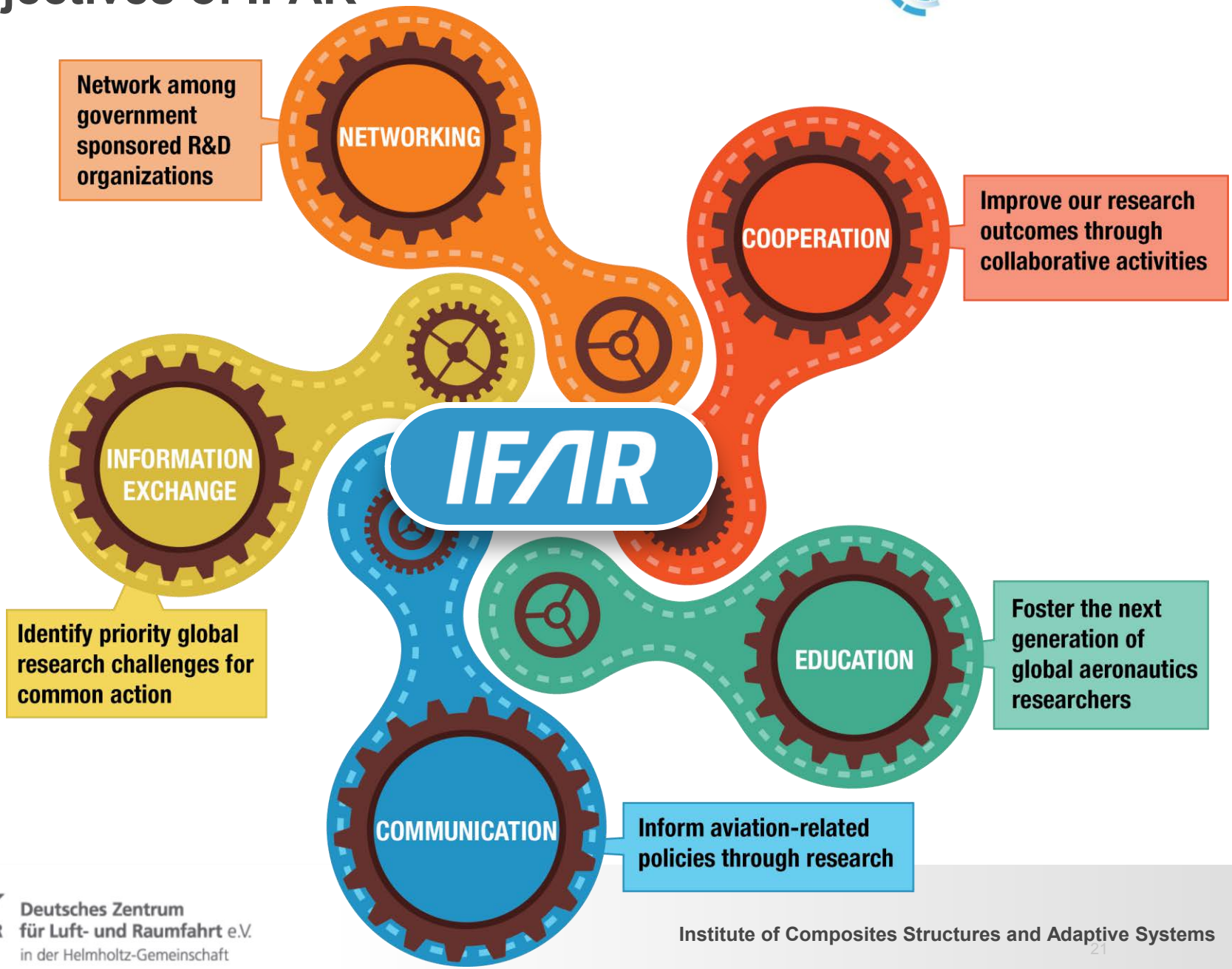
IFAR – International Forum for Aviation Research

Connecting in a globalized world

IFAR | INTERNATIONAL FORUM FOR AVIATION RESEARCH

The International Forum for Aviation Research founded in 2010 is working for a new generation of future air transport and a socially responsible mobility of all our citizens.

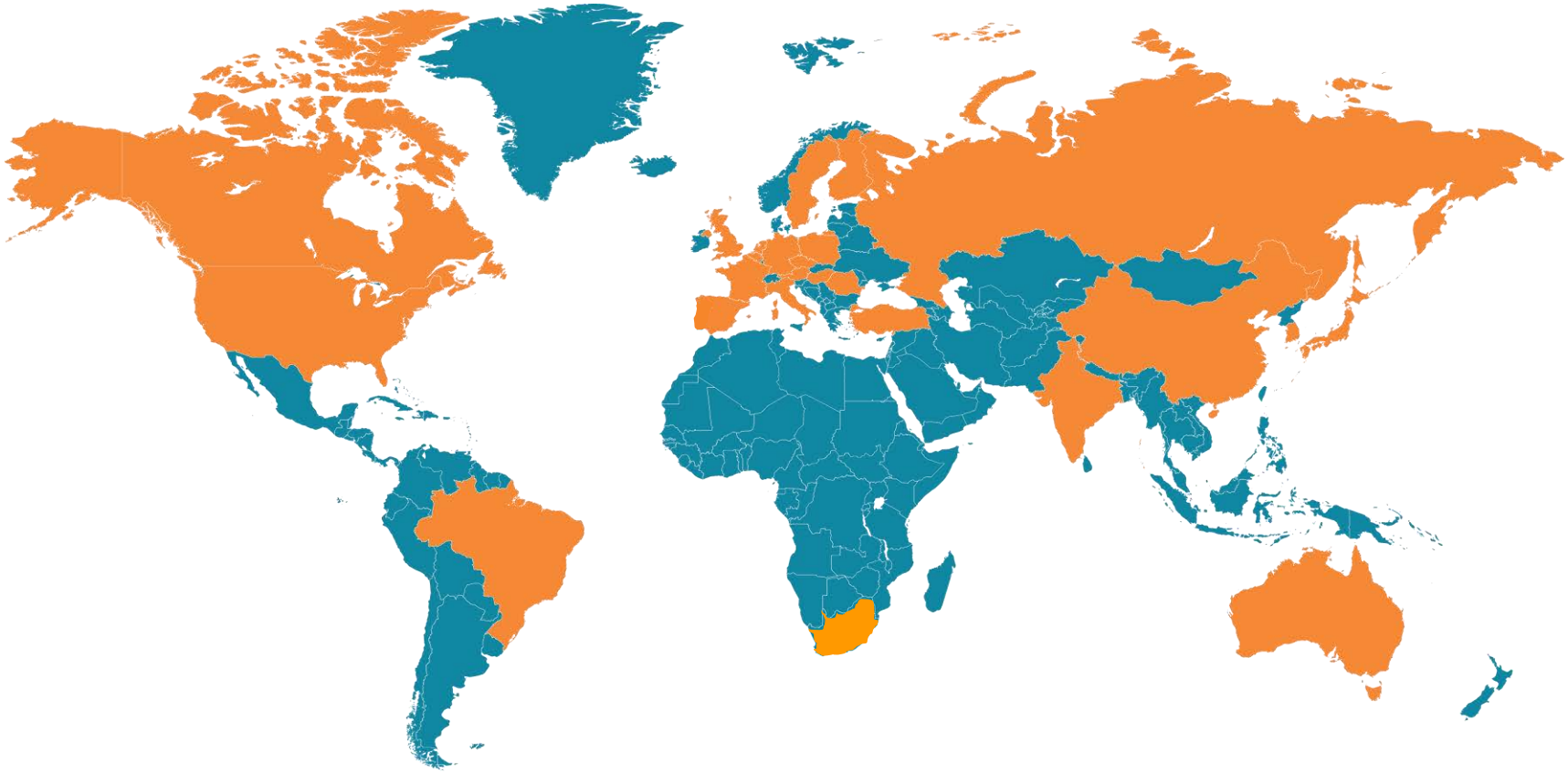
Objectives of IFAR



Statistics of IFAR

Currently 26 aviation research organizations from all over the world are members of IFAR

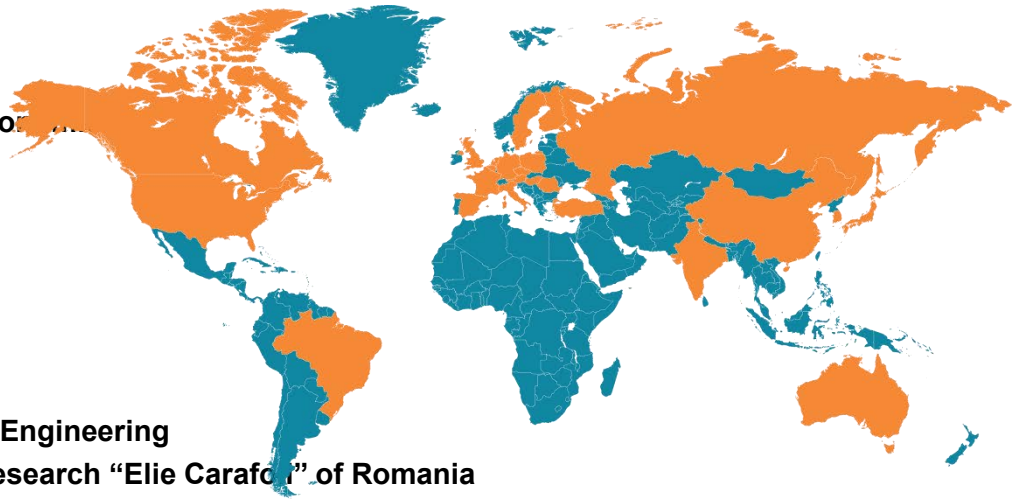
The current members represent more than 35,000 researchers working in aviation



Membership in IFAR is open to national aviation research organizations, including universities active in aviation research, that are (1) non-profit, (2) owned or mainly funded by public governments, and (3) charged by the country or countries in which they are located to conduct such research activities on their behalf. One organization per country is accepted for membership.

IFAR Members

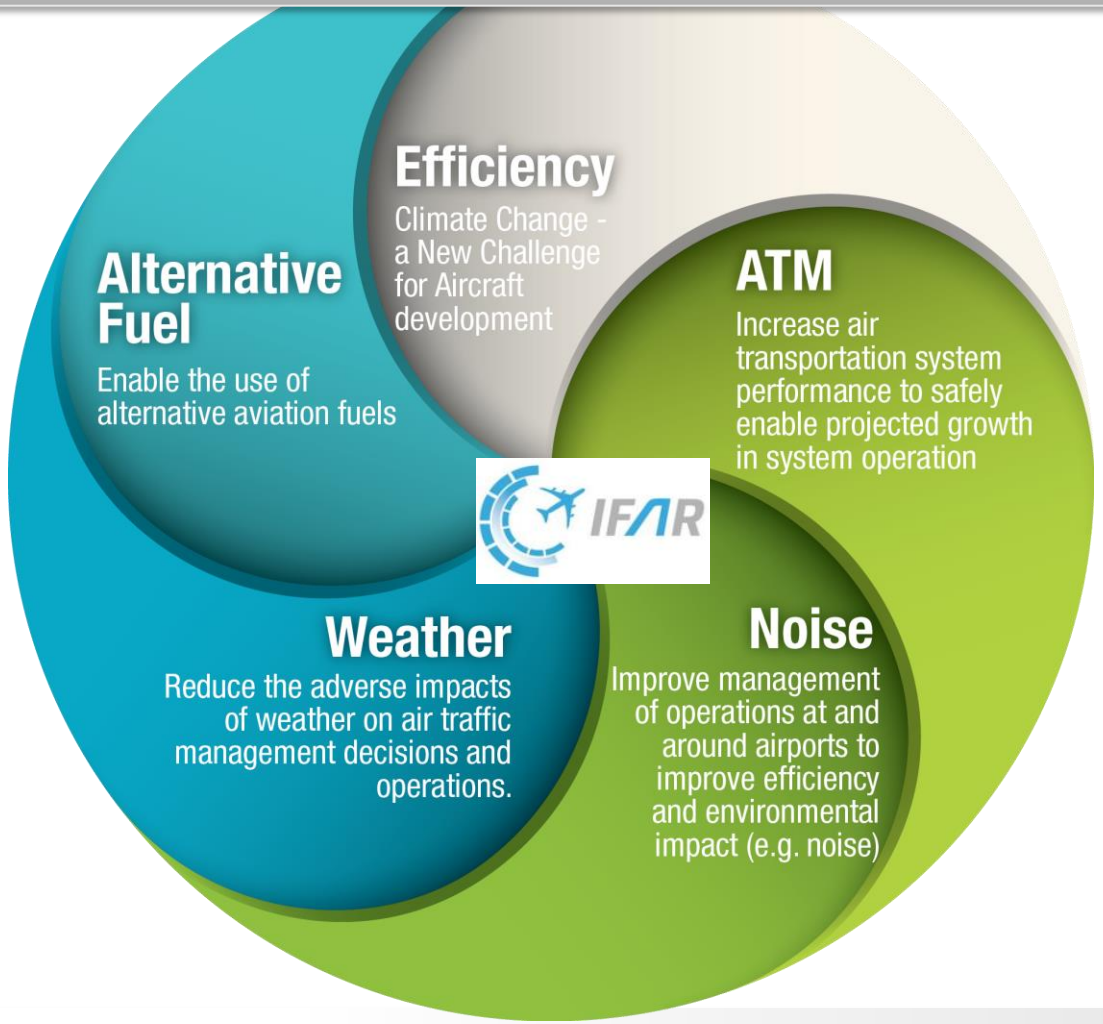
1. Australia, CSIRO – Autonomous Systems Laboratory CSIRO ICT Centre
2. Austria, Vienna University
3. Belgium, von Karman Institute for Fluid Dynamics
4. Brazil, IAE – Institute of Aeronautics and Space
5. Canada, NRC – Aerospace Portfolio
6. China, CAE – Chinese Aeronautical Establishment
7. Czech Republic, VZLU – Aeronautical Research and Test Institute
8. Finland, VTT – Technical Research Centre of Finland
9. France, ONERA – French Aerospace Lab
10. Germany, DLR – German Aerospace Center
11. Hungary, Budapest University of Technology and Eco...
12. India, CSIR-NAL – National Aerospace Laboratories
13. Italy, CIRA – Centro Italiano Ricerche Aerospaziali
14. Japan, JAXA – Aerospace Exploration Agency
15. Korea, KARI – Korea Aerospace Research Institute
16. Netherlands, NLR – Netherlands Aerospace Centre
17. Poland, ILOT – Polish Institute of Aviation
18. Portugal, CEiiA – Centre for Innovation and Creative Engineering
19. Romania, INCAS – National Institute of Aerospace Research “Elie Carafo...” of Romania
20. Russia, TsAGI – Central Aerohydrodynamics Institute of Russia
21. South Africa, CSIR – Council for Scientific and Industrial Research
22. Spain, INTA – National Institute of Aerospace Technology of Spain
23. Sweden, FOI – The Swedish Defence Research Agency
24. Turkey, METU – Middle East Technical University Ankara
25. United Kingdom, ATI – Aerospace Technology Institute
26. USA, NASA – U.S. National Aeronautics and Space Administration



IFAR Focus Areas

IFAR | INTERNATIONAL FORUM FOR AVIATION RESEARCH

Non-competitive aviation R&D related to global technical challenges



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ICARe
International Cooperation in Aviation Research

ICARe Information to EU-project AERO-UA

May 31, 2018

AERO-UA workshop, Kharkov, Ukraine

Richard Degenhardt

DLR Erdyn Engaging Innovation DASSAULT AVIATION Rolls-Royce BAE SYSTEMS Honeywell THE POWER OF CONNECTED THALES

DLR ONERA THE FRENCH AEROSPACE LAB easn aerospace valley EUROCONTROL EASA European Aviation Safety Agency

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 769512

Table of Contents

Summary of the ICARe CSA

Summary of the ICARe CSA

Answer to the call

"H2020 MG 1.5 WP2017: Identification of gaps, barriers and needs in the aviation research" (International cooperation part)

Customer/Purpose/Deliverables:

- Customer: The European Commission (reporting to RTD-H3)

- Deliverables: Recommendations for future International Collaboration in R&T for aviation

Start date: 1 Oct 2017 (Grant Agreement n°769512 signed on 21.09.2017)

Duration: 2.5 years

12 Partners representing Europe Aviation Stakeholders + …

Erdyn, Dassault Aviation, Rolls-Royce, BAe Systems, Honeywell, Thales Avionics, DLR, ONERA, EASN, Aerospace Valley, Eurocontrol, EASA

+ CIMNE (potential new partner) + IATA Major Subcontractor

+ Advisory Board: EU Commission, Airbus, Leonardo, Safran, CleanSky (tbc), SESAR (tbc), Air France/KLM (tbc), ACARE SIB (tbc) …

Summary of the ICARe CSA

21 countries: Australia, Brazil, Canada, China, India, Indonesia, Israel, Japan, Malaysia, Mexico, Qatar, Russia, Serbia, Singapore, South Africa, South Korea, Switzerland, Turkey, Ukraine, United Arab Emirates and USA

And **focused attention** on 5 + one to be selected

Methodology:

- identification of areas of common interest, barriers and solutions for improved international collaboration in the aviation research,
- on a perimeter of 21 countries with a focused attention on Canada, China, Japan, Russia, USA + one to be selected

ICARe Work Breakdown Structure

WP1 Project Management/WP7 Ethics Requirements

Reporting to the EU Commission

WP2 Communication, Dissemination and Networking

Website, media, ..

-> ACARE SRIA Volumes 1 &2
-> ACARE INCO group Strategy report and associated fiches
-> CSAs, RIAS – H2020, FP7, FP6 – Aviation - International collaborattion
-> other CSA MG1.5

WP3 Assessment of past and current Cooperation

Lessons learned

Requirements

WP4 Technology Mapping in Third Countries (21)

Identification of couples « country technology »

WP5 EU-Third Country Open Platforms (6)

identification of win-win opportunities, areas of common interest, barriers and solutions for improved cooperation

WP6 Proposed Collaborations and Final Recommendations

Recommendations

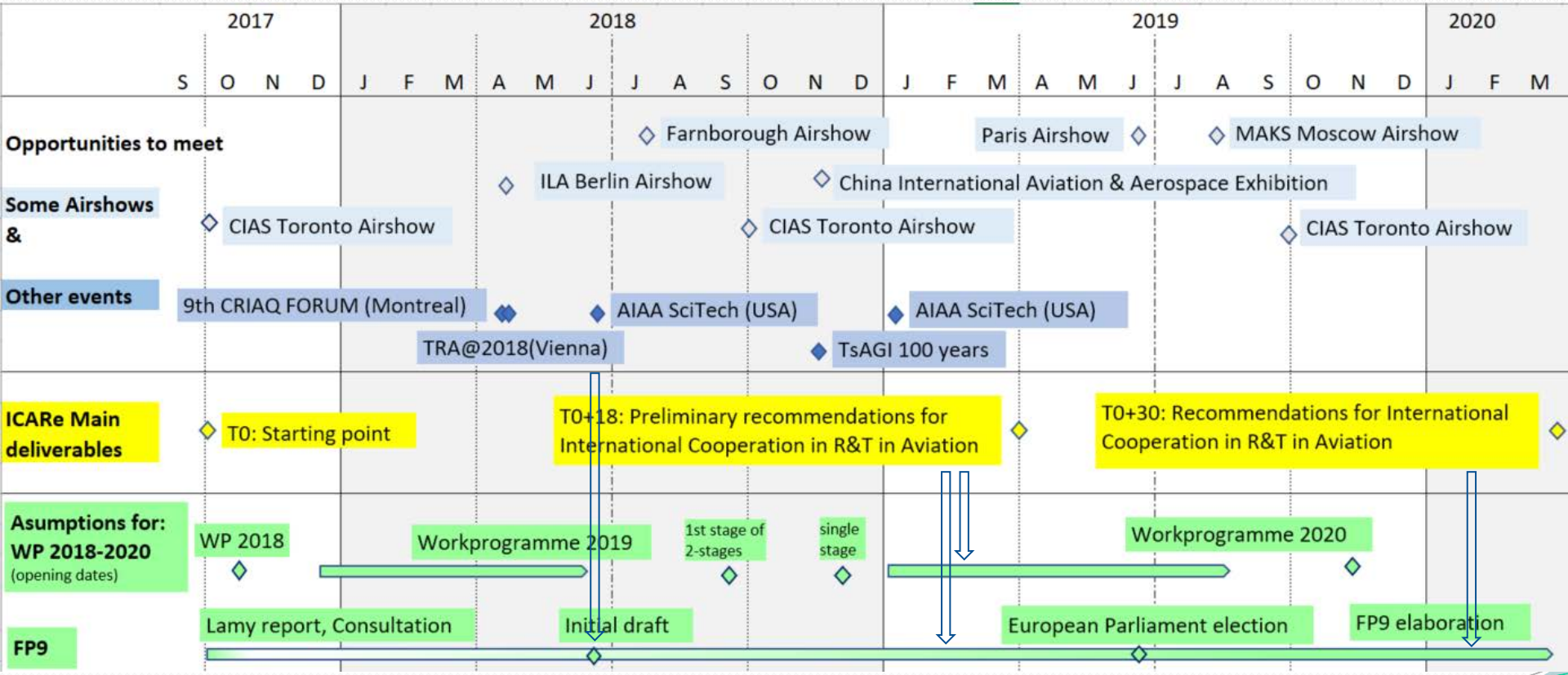
Country profile structure based on:
Ranking procedure

a. Country facts and figures, statistics, with specific respect to Aviation context
b. Trade, IPR, export control or certification issues
c. Funding mechanisms and R&D programmes
d. Main stakeholders / list of potential cooperation partners
e. Past and current cooperation activities
f. SWOT Analysis
g. Conclusions

Main ICARe deliverables and links with..

Links between main deliverables of ICARe and

- **the update of WP2020 and**
- **the preparation of future international collaborations (in the Framework Programme 9 – FP9)**



History / Background

1. ACARE The Advisory Council for Aviation Research & Innovation in Europe in 2000:

Creation of **ACARE**,

Publication of the **Vision for 2020**

Group of Personalities GoP

Vision 2020
January 2001

Le Bourget
Kick-Off
June 2001

"The framework programmes are the key to acquiring the technology required to develop the vision"

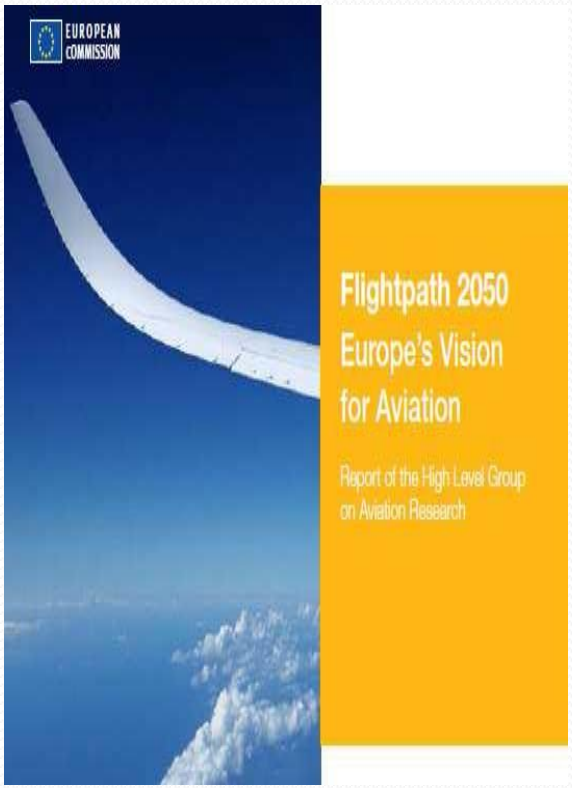
Philippe Busquin

History / Background

In **2010** an update of the ACARE vision

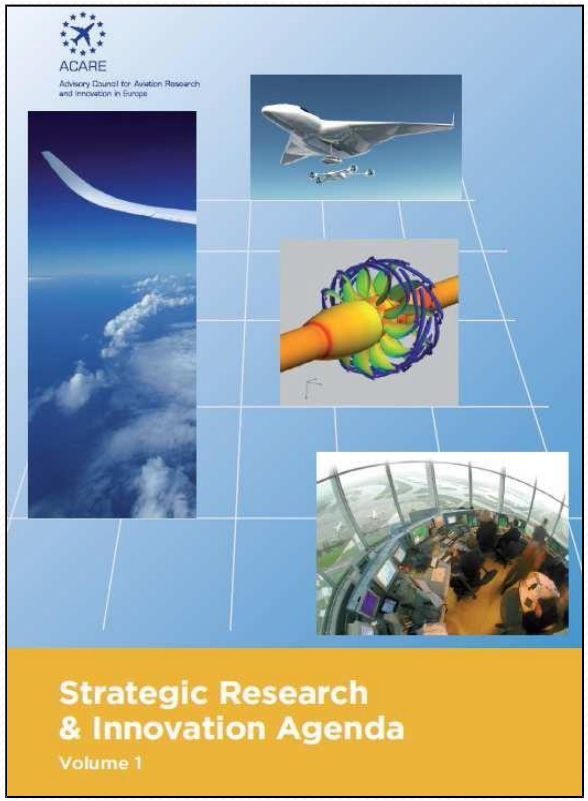
Flightpath 2050

The Vision



SRIA

How to get there



History / Background

-> 5 goals are associated to the vision Flightpath 2050

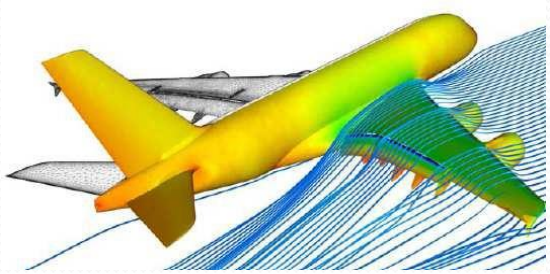
Meeting Societal and Market Needs Maintain

and Extending Industrial Leadership

Protecting the Environment and the Energy Supply

Ensuring Safety and Security

Prioritising Research, Testing Capabilities & Education



Published in 2012

Some goals could be shared with other countries

-> Road map for aviation research, development & innovation, Content aligned to five goals of Flightpath 2050:

2. ACARE INCO (International Cooperation):

-> look for possibilities to develop technologies in the frame of international cooperation

21 countries

a. Country facts and figures, statistics, with specific respect to Aviation context
b. Trade, IPR, export control or certification issues
c. Funding mechanisms and R&D programmes
d. Main stakeholders / list of potential cooperation partner
e. Past and current cooperation activities
f. SWOT Analysis
g. Conclusions

Structure of a country fiche

-> Report in 2015:
Results could be questionable
But a methodology has been developed

ICARe
International Cooperation in Aviation Research

3. Lessons learnt through the experience of past international cooperation in R&T for Aviation in the frame of H2020 (2014-2020), FP7 (2007-2013), FP6 (2000-2006)

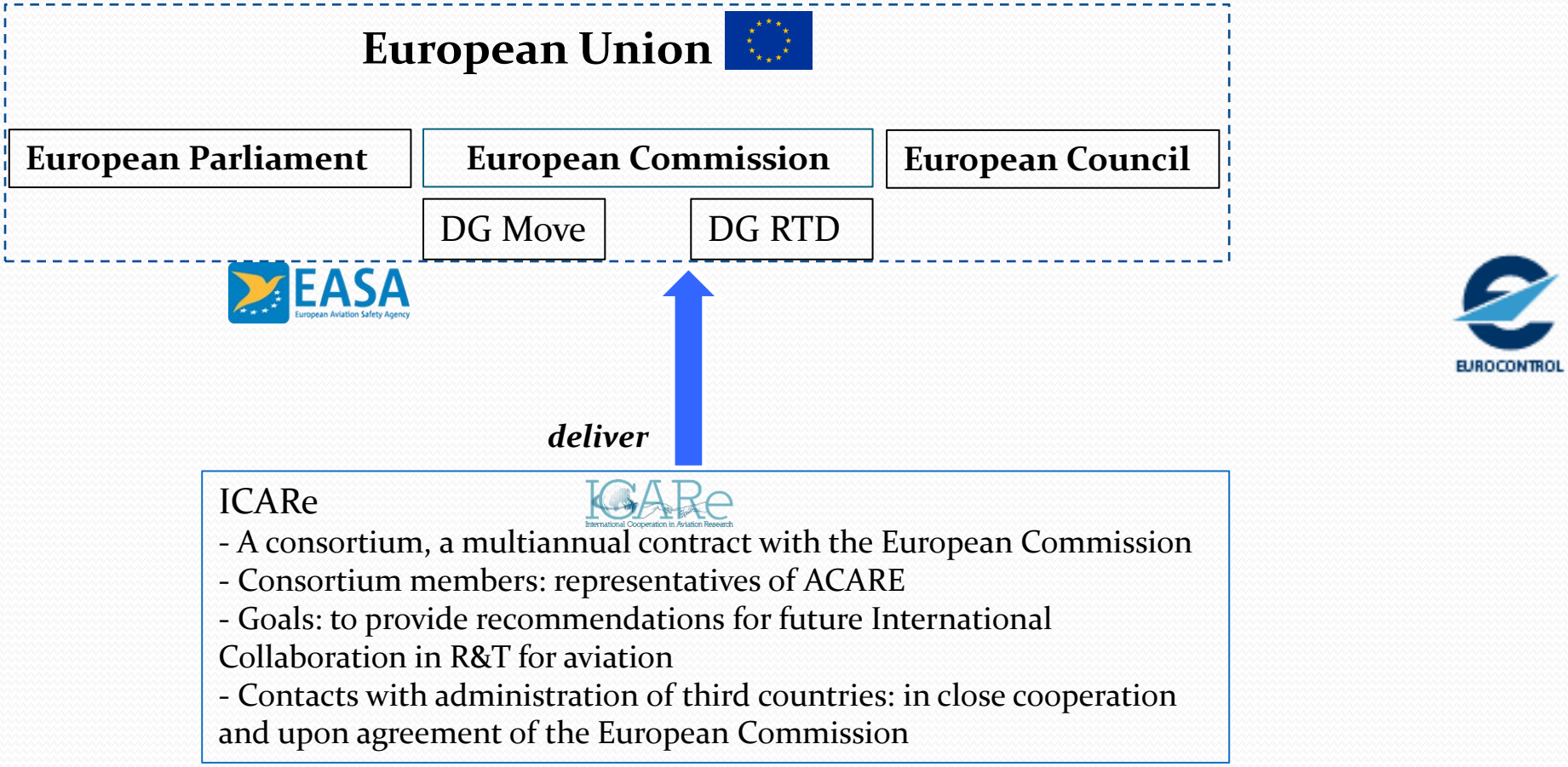
Country	Number of projects (FP7)	Name of projects (FP7)
Argentina	1	COOPAIR-LA
Australia	2	AFDAR ; HAIC
Brazil	5	ADVITAC ; COOPAIR-LA ; IDEALVENT ; NOVEMOR ; X-NOISE EV
Canada	6	ALFA-BIRD ; CANNAPE ; HAIC ; IN-LIGHT ; NIOPLEX ; TOICA
Switzerland	44	ACTUATION2015 ; ADMAP-GAS ; AEROMUCO ; AFLONEXT ; AGEN ; ALASCA ; ALEF ; ASHLEY ; ATAAC ; BOPACS ; CATER ; CERFAC ; COALESCE2 ; COLTS ; CREAM ; DAEDALOS ; DREAM ; E-BREAK ; ENCOMB ; ERICKA ; EVITA ; FAST20XX ; FORUM-AE ; FUTURE ; GLFEM ; IAPETUS ; IMAC-PRO ; INNOVATION PLATFORM ; LAYSA ; MAAXIMUS ; MONITOR ; MYCOPTER ; OPENAIR ; PLASMAERO ; POLARBEAR ; RECREATE ; SADE ; SCARLETT ; SOLAR-JET ; STARGATE ; TAUPE ; TEENI ; UMRIDA ; X-NOISE EV
China	6	MARS ; AEROCHINA2 ; ATAAC ; COLTS ; GRAIN ; GRAIN 2

- An extract of the FP7 list (aero)
- Around 120 international projects in the FP7

4. Experience of the ICARe participants in: ACARE SRIA, ACARE INCO, in CSAs- RIAS (H2020, FP7, FP6 – Aviation Inter. Collaboration), in the other CSA of the MG1.5

Relations ICARE with European Aviation Stakeholders, *"in creation"*

ICARe reports to the European Commission



Actions related to Ukraine

ICARe actions related to Ukraine

Competences in Ukraine

- All future topics of interest for the European Commission are listed in the public ACARE-SRIA list http://www.acare4europe.org/sria .
- In which of those topics Ukraine is competent and active in.

Country fiche for Ukraine

- Write a country fiche for Ukraine.

ICARe Team

ICARe
International Cooperation in Aviation Research

www. icare-h2020.eu

info@icare-project.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 769512.