



Alenia Aeronautica

Technologies applied in R&D

Napoli 25 Maggio 2011

N. Cauceglia - CTO

- Mission, Centers of Excellence & Network
- Main Programs
- Market Drivers & Challenges
- Research & Innovation Network and main Research Project
- Laboratories & Test Facilities
- Relationships with Academic Institutions
- B787 overview and Composite experience

THE MISSION

MISSION/ ROLE

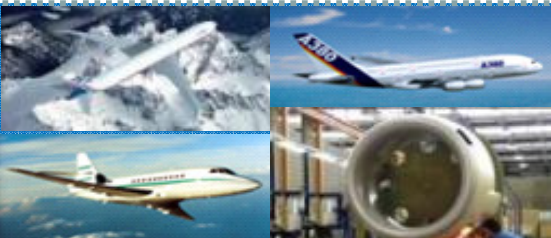
CORE TECHNOLOGIES

TEST FACILITIES

**System
Integrator**



**Independent
Prime**



PROCESS TECHNOLOGIES

Air Vehicle Engineering

General Systems

Avionic & Weapon Integr.

UAS Sys. Integr.

Low Observability

System Processes

Flight Test Centre

Demonstrators

Rigs

Simulator

Skylight Simulator

Anecoic Chamber

Structural Processes

Composite/Metal

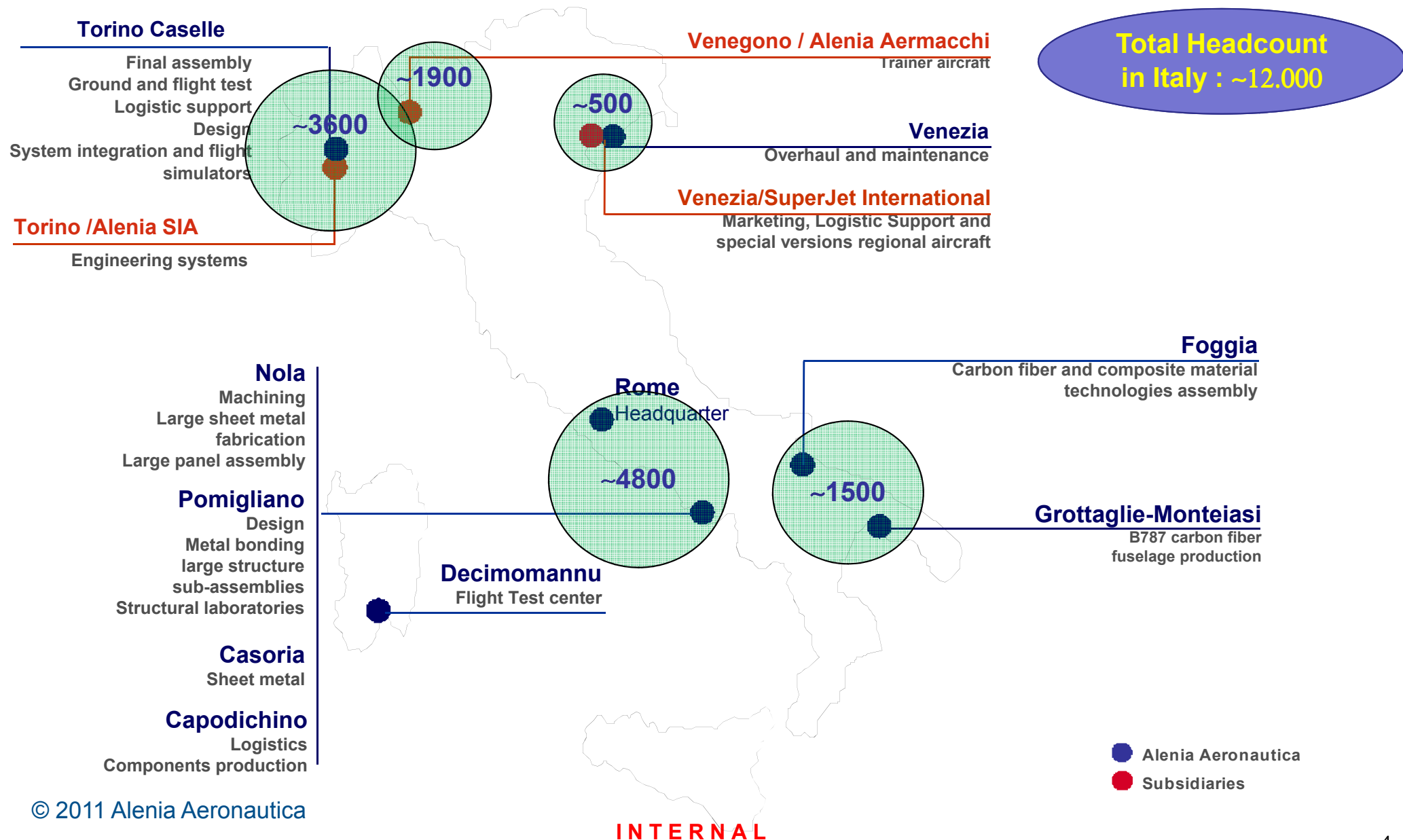
Innov. Concepts/ Materials

Manufacturing Processes

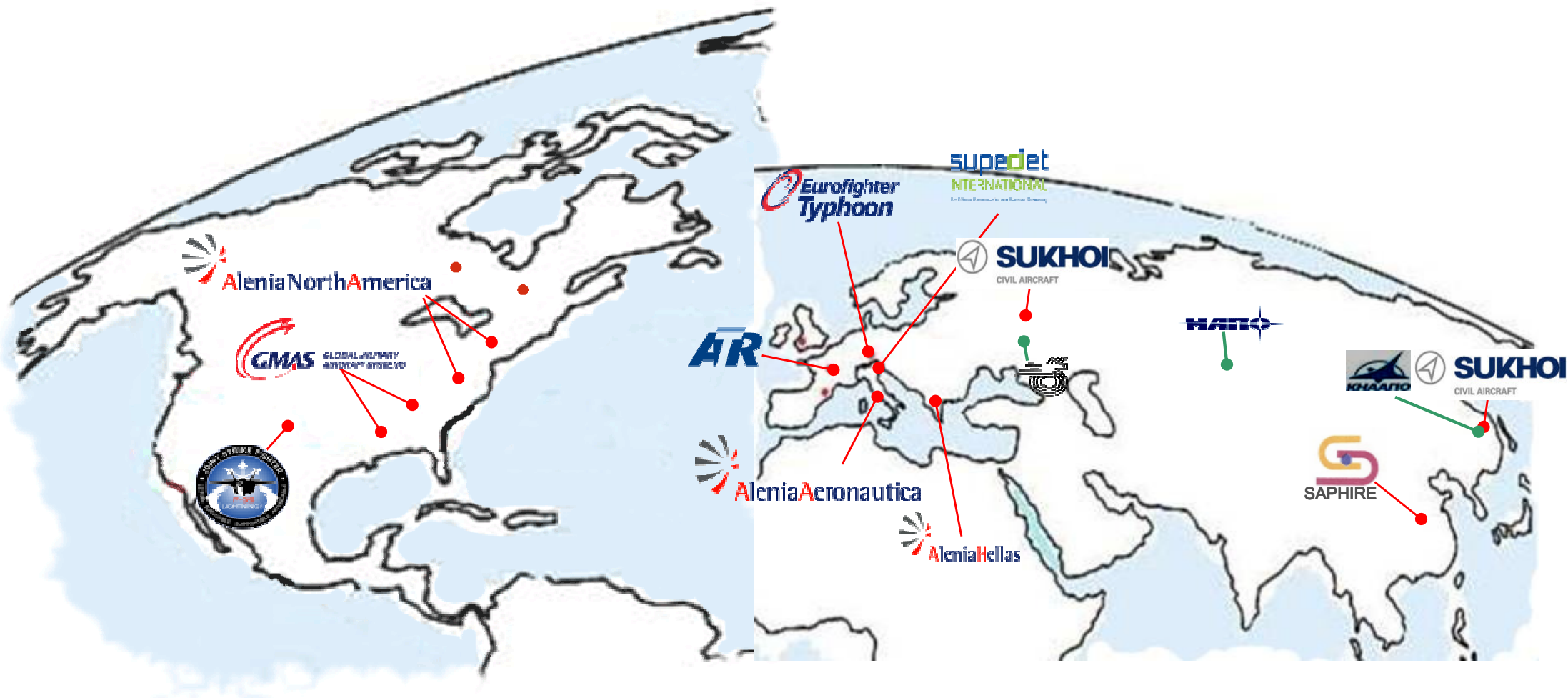
**Structural, systems
and material
laboratories**



CENTRES OF EXCELLENCE IN ITALY



Alenia main subsidiaries, main consortia, JVs and program suppliers



- Subsidiaries, JVs, Consortia
- Superjet 100 Program suppliers

MAIN INDUSTRIAL LINKS

Military Programs

BAE Systems

Eurofighter
Tornado

Boeing

767 Tanker

Dassault

Neuron

EADS

Eurofighter
Tornado

L-3 Communications

C-27J (JCA Program)

Lockheed Martin

F35-JSF
C-130J

Embraer

AMX



Commercial Programs

Airbus

A380
A340
A330
A321

Boeing

787
767
777

Bombardier
CSeries

Dassault

Falcon 2000 EX
Falcon 900 EX

EADS

ATR42/72

Sukhoi

Sukhoi Superjet family

AERONAUTIC PROGRAMS

Military Airlifters



Regional Aircraft



Mission Systems



Aerostructures



Trainer Aircraft



Defense and Surveillance Aircraft



UAV



Technology Roadmap

Transport

Aerostructures

Trainer

UAV

Processes

Aerospace & Defence Market: innovation drivers



- Low Cost Communication
- Low Cost Countries
- Technology as offset

Globalization

New Comers

**Economic Crisis & Oil
Price growth**

R&D Cost

Public/Private Funding

- Less Military Expenses
- Airline crisis
- Growing Operative Costs



- Russia & Asia Growth
- Brazil Growth

- Fast Technology Evolution
- Huge R&D Investment
- Strategic alliances required



THE CHALLENGE OF DESIGN DEPARTMENT

- MULTICULTURAL ENVIRONMENT
- NEW PARTNERSHIPS IN NEW COUNTRIES
- STRONGLY COMPETITIVE CIVIL A/C MARKET
- INTELLECTUAL PROPERTY AS A STRATEGIC ASSET



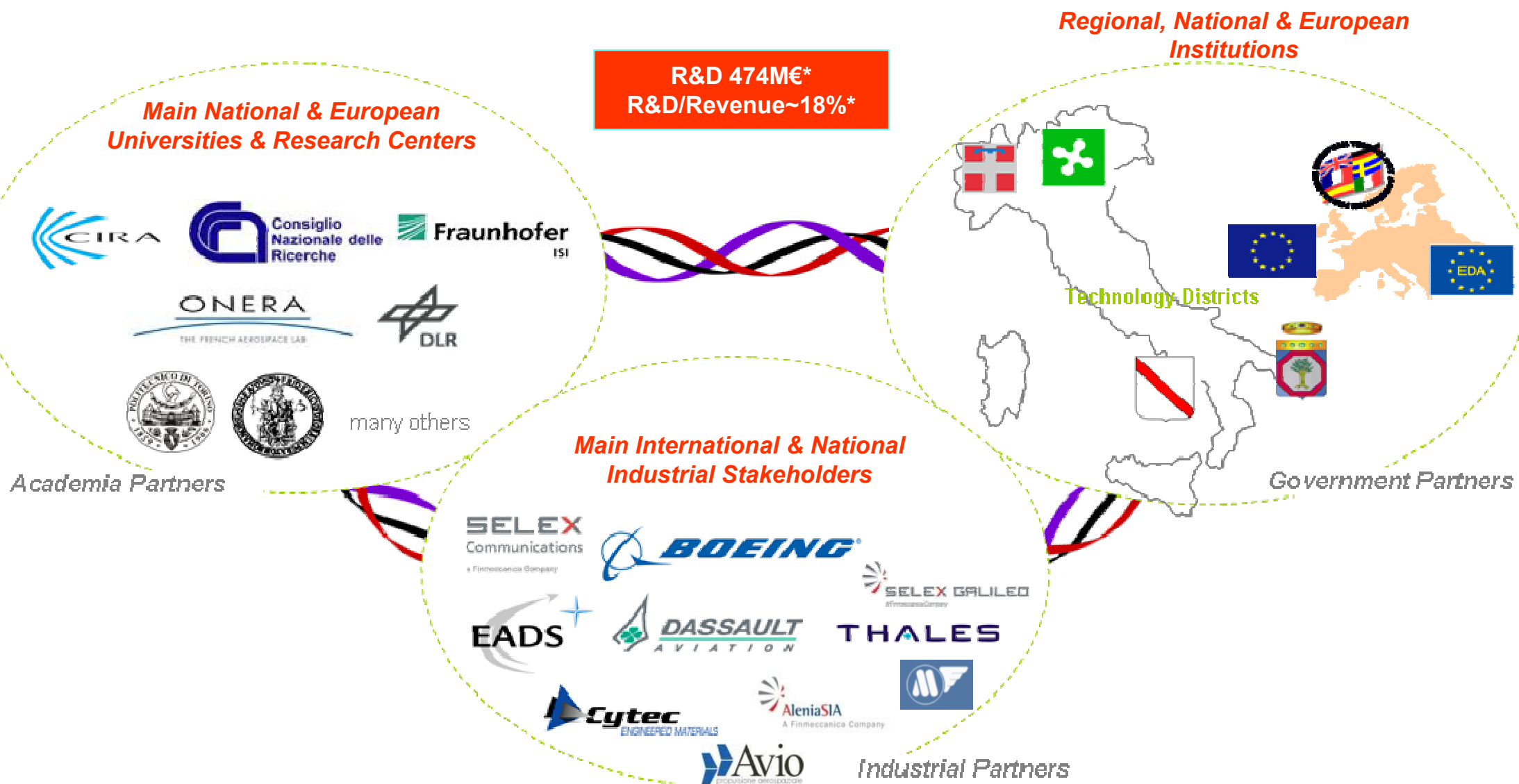
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ONLY ONE ANSWER :

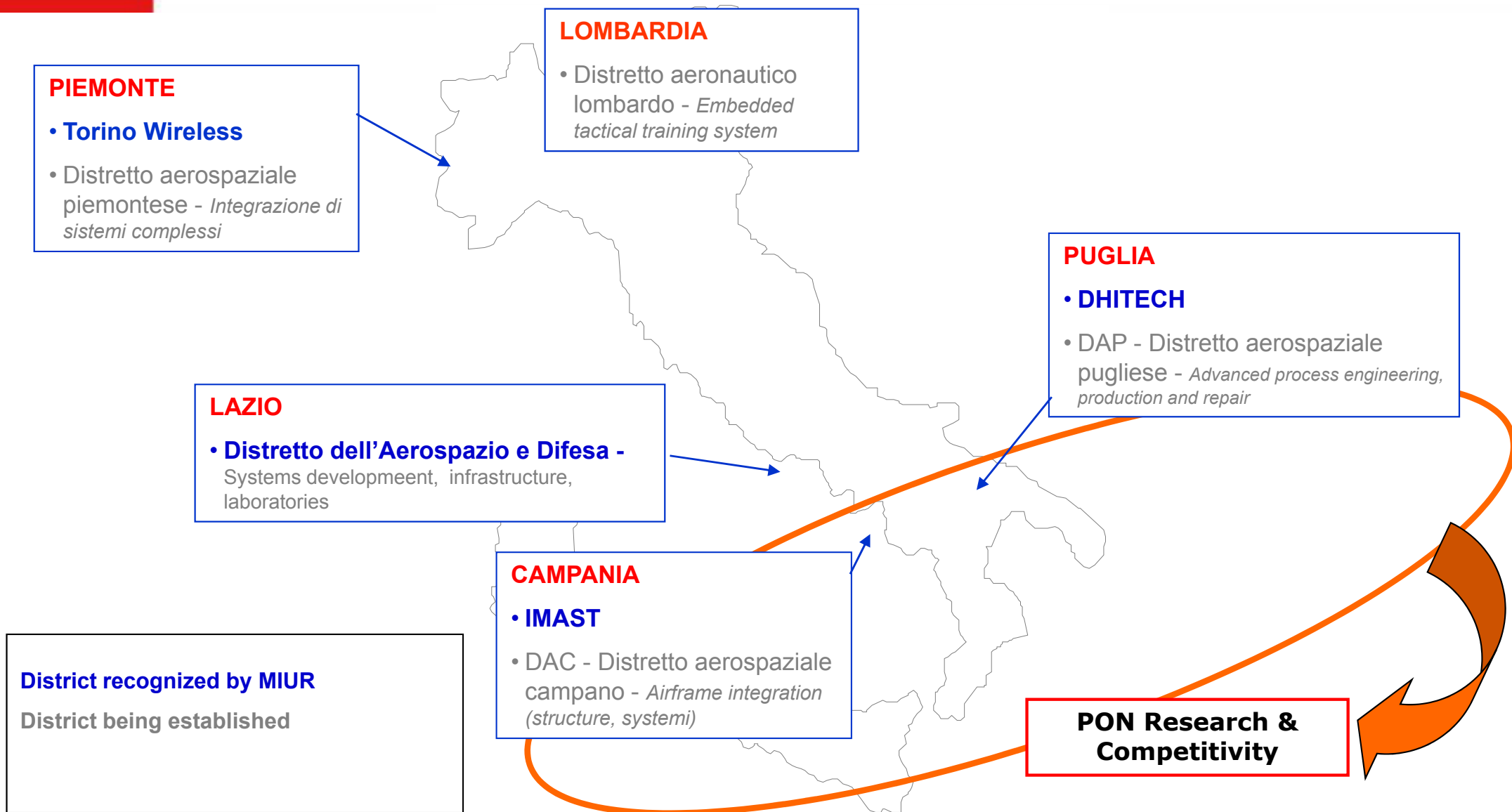
- *MORE RESEARCH*
- *MORE INNOVATION*
- *MORE DEVELOPMENT*

INTERNAL

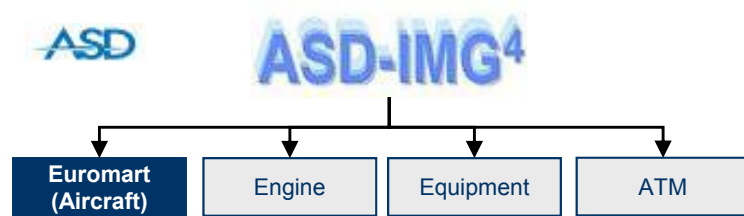
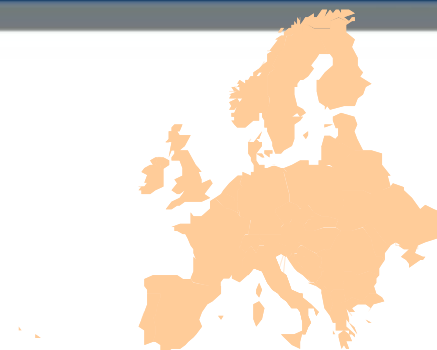
GROWING BY SHARING: RESEARCH & INNOVATION TRIPLE HELIX



National role: Technology Districts Network



Alenia and European Research



**EDA
Working Groups**

**ETAP Industrial Steering
Committee**

Industrial Management Groups



Civil & Military Funders



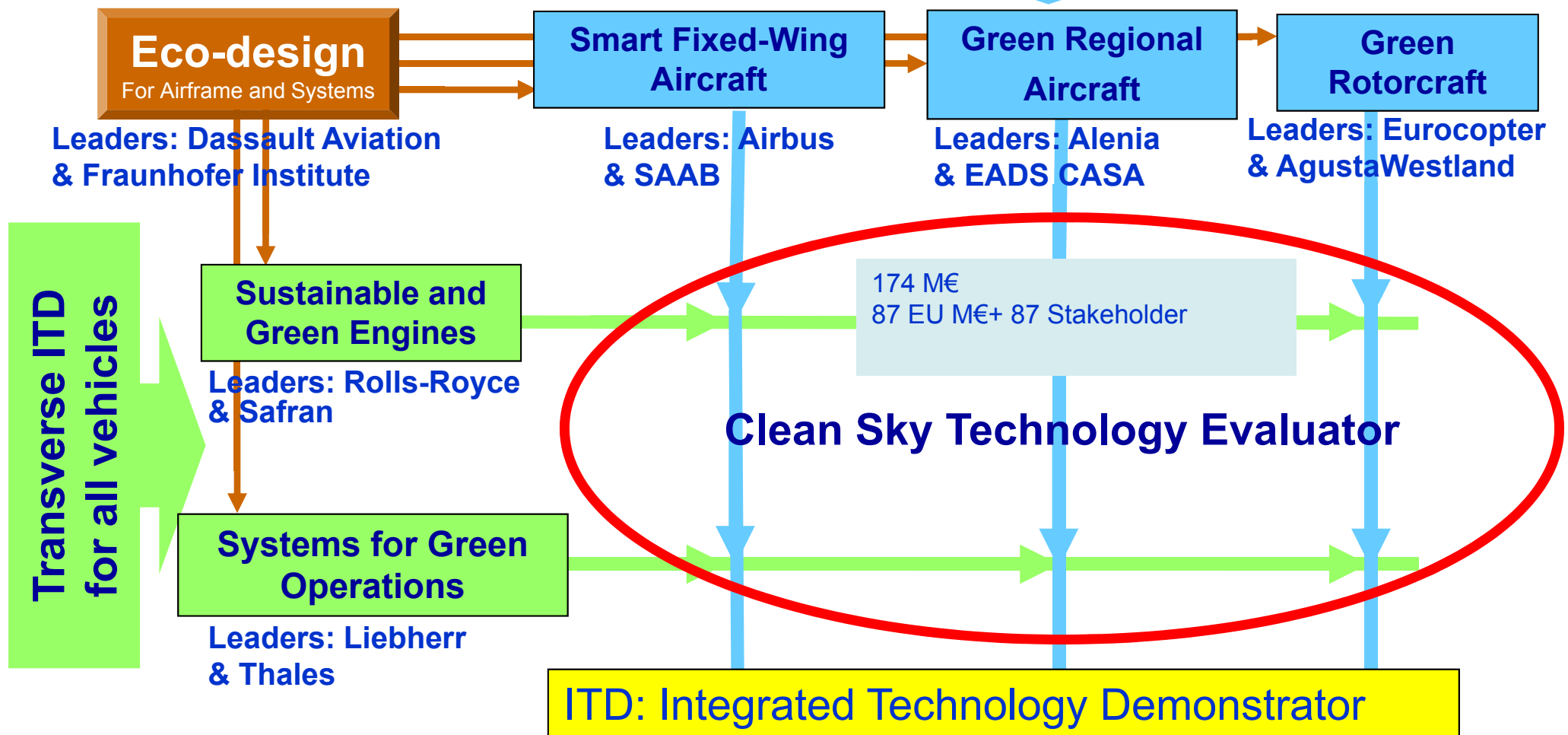
MIDCAS

**ETAP GSS
ETAP TDP 4.5**

European Projects

1600 M€
800 EU + 800 Stakeholder

Vehicle ITD



Green Regional Aircraft – Participants

❖ AIR GREEN Cluster

- with following members:
 - Piaggio, Italy, single-voice Cluster's representative
 - Polo delle S&T, Univ. Naples, Italy
 - Centro Sviluppo Materiali (CSM), Italy
 - IMAST, Italy (technological district)
 - FoxBit, Italy
 - Sicamb, Italy
 - Politech. Turin, Italy
 - Univ. Bologna/Forlì, Italy
 - Univ. Pisa, Italy



❖ ATR



❖ CIRA PLUS Cluster

- with following members:
 - CIRA, Italy, single voice Cluster's representative
 - Dema, Italy
 - Aerosoft, Italy
 - INCAS, Romania
 - Elsis, Lithuania



A sizeable amount of activities are reserved to Call for Proposals open to European Institutions and Industry: **we expect to reach about 53 additional partners**

❖ HELLENIC AEROSPACE INDUSTRY

❖ ONERA



For end of this year, we foresee about 85 participants involved in GRA!!

Green Regional Aircraft – 5 Technological Domains

Innovative structures (Low Weight Configuration)

- ✓ multifunctional composites
- ✓ advanced metallic materials
- ✓ Structure health monitoring

Advanced aerodynamics (Low Noise Configuration)

- ✓ Lower Fuel Consumption
- ✓ Better climb performance
- ✓ Lower Airframe noise from high lift devices and landing gear

Innovative systems (All Electrical Aircraft)

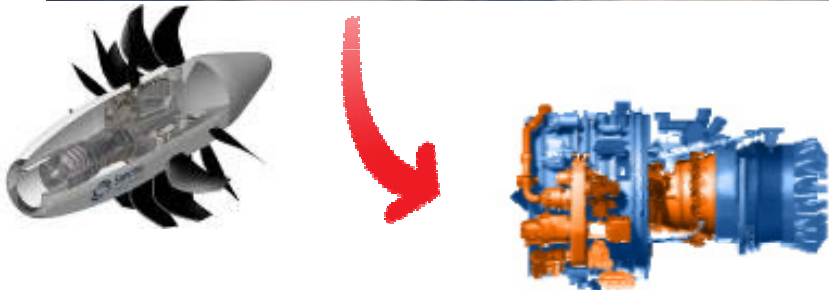
- ✓ Bleed less architectures
- ✓ Limited hydraulics
- ✓ Energy management

New aircraft configurations (NC)

- ✓ Advanced turboprops
- ✓ Open rotors
- ✓ Advanced turbofan

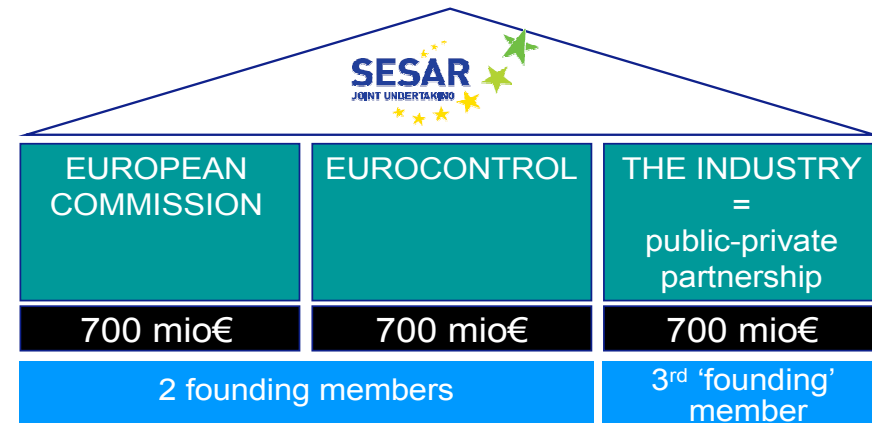
Evaluation of new avionics architecture in MTM domain for

- ✓ Fuel & noise reduction
- ✓ Upgraded capabilities for MTM
- ✓ Lower Maintenance costs

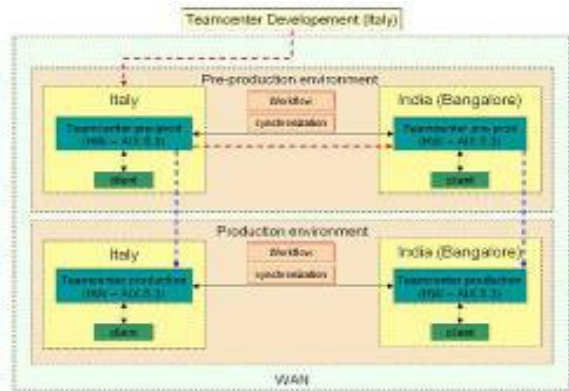


SESAR (Single European Sky ATM Research)

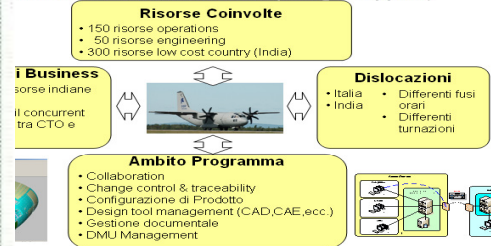
- Present ATM system is characterized by :
 - Fragmentation of airspace,
 - Obsolescence of present ground and on-board systems
 - Low usage of airspace resources
- SESAR objectives :
 - To triple the **airspace capacity**
 - To reduce **ATM costs** by 50%
 - To increase **safety** by a factor 10
 - To reduce **environmental impact of single flight** by 10%
- In three Phases :
 - Definition (2004-2008) : to define new operative concepts and new R&D requirements (*activity completed*)
 - Development (2008-2013) : research & development of new systems & standards by a common organization , the **SESAR Joint Undertaking** (*in progress*)
 - Deployment (2014-2020): introduction in service of new systems, procedures & standards (*definition phase*)



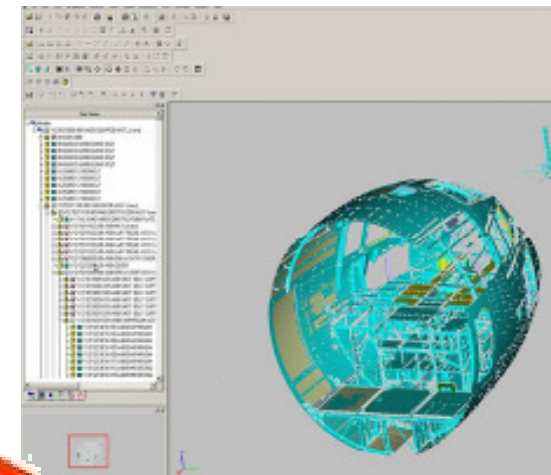
Extended Enterprise - Collaboration



Realizzazione efficace in azienda di un business model di extended enterprise", con l'utilizzo da Aprile 2007 della collaborazione con HCL in India (Design Supplier)



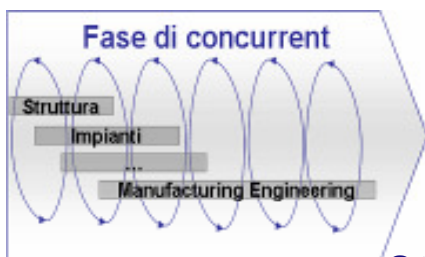
Digital data



Multidisciplinary optimisation

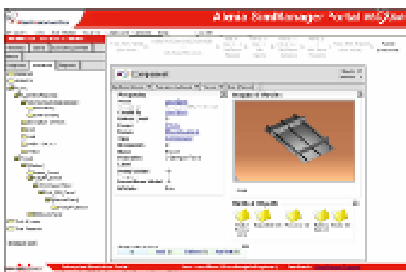


Concurrence



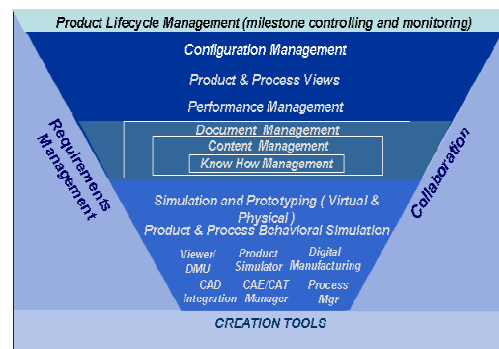
Knowledge Management

Standard methodologies And process

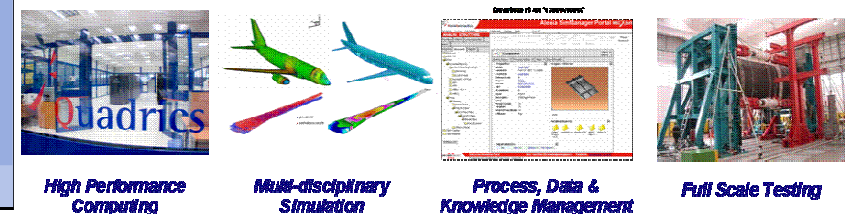
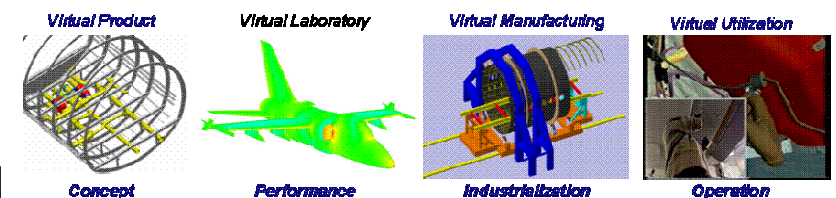


AleniaAeronautica		AliaNET	Customer of the AliaNET
CAD Model Process		Customer A	Customer A
		Version 1.0	Nov 2011/2008
PROGETTO: Progetto AliaNET			
DOCUMENTO: CAD Model Process			
FIRME			
PREPARATO DA:	Verifica/Valida:	Modificato:	Firma
AliaNET - VPS	A. Bazzani		
CONTROLLATO DA:	CTO	R. Bernini	
AliaNET - Capito Capito			
AliaNET - VPS	V. Bazzani		
APPROVATO DA:	AliaNET - CTO	M. Bazzani	
AliaNET - CTO			

Product Lifecycle Management



Life Cycle Virtual prototyping



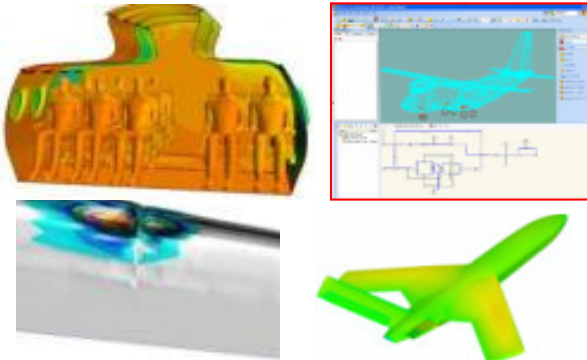
Virtual & Physical Prototyping & Simulation in Programs and Research

Virtual Product



Concept

Virtual Testing



Performance & Validation

Virtual Manufacturing

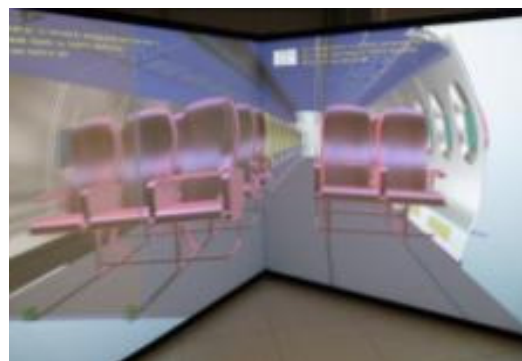


Industrialization

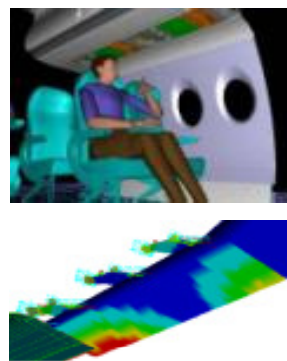
Virtual Utilization



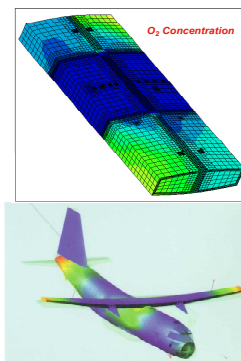
Operation



Virtual Product Navigation
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Multi-disciplinary
Integration



INTERNAL



Process, Data &
Knowledge Management



Full Scale Testing

Innovation through Hardware

- Ideas are not enough
- State of the art labs in relevant areas
- Skylight simulator
- Anechoic Screened chamber
- HIRF
- Structural Test lab
- The Flight Test Center



STRUCTURAL LABORATORY



B787 Horizontal - Stabilizer

MATERIAL & PROCESS LABORATORY



Mechanical Lab
Material Test
Machines



Chemical Lab

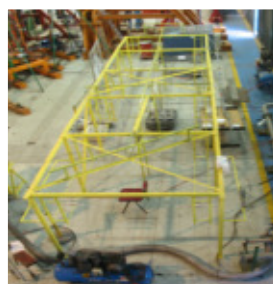
SYSTEM & ACOUSTIC LABORATORY



Acoustic Lab



Electric/Electronic Lab



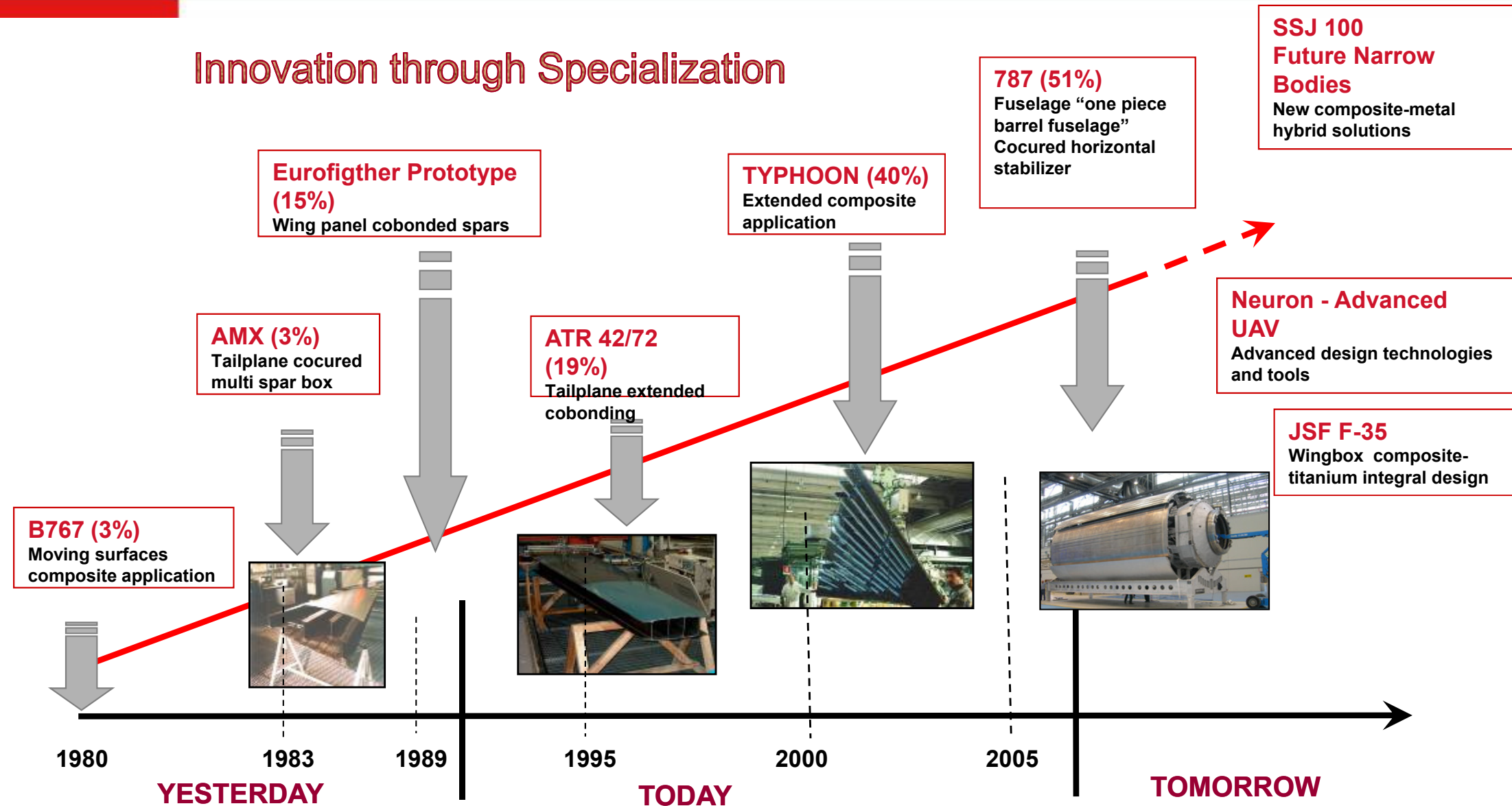
Fluid-dynamic lab



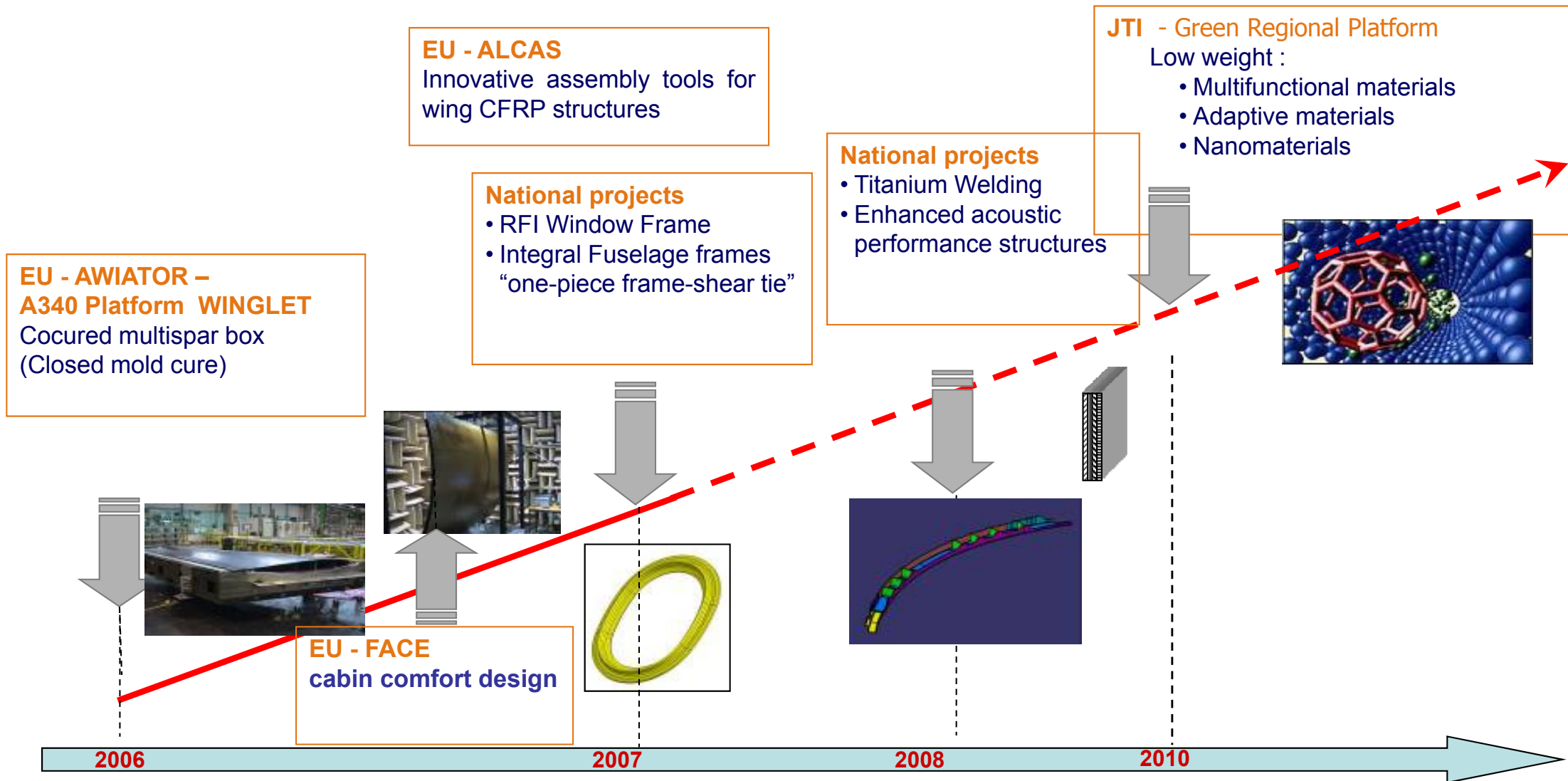
Microscopy & Failure
Analysis Lab

Alenia Aeronautica from 767 to 787 Leadership in Composite Technology

Innovation through Specialization



Aerostructures: Examples of Composite Structures Research



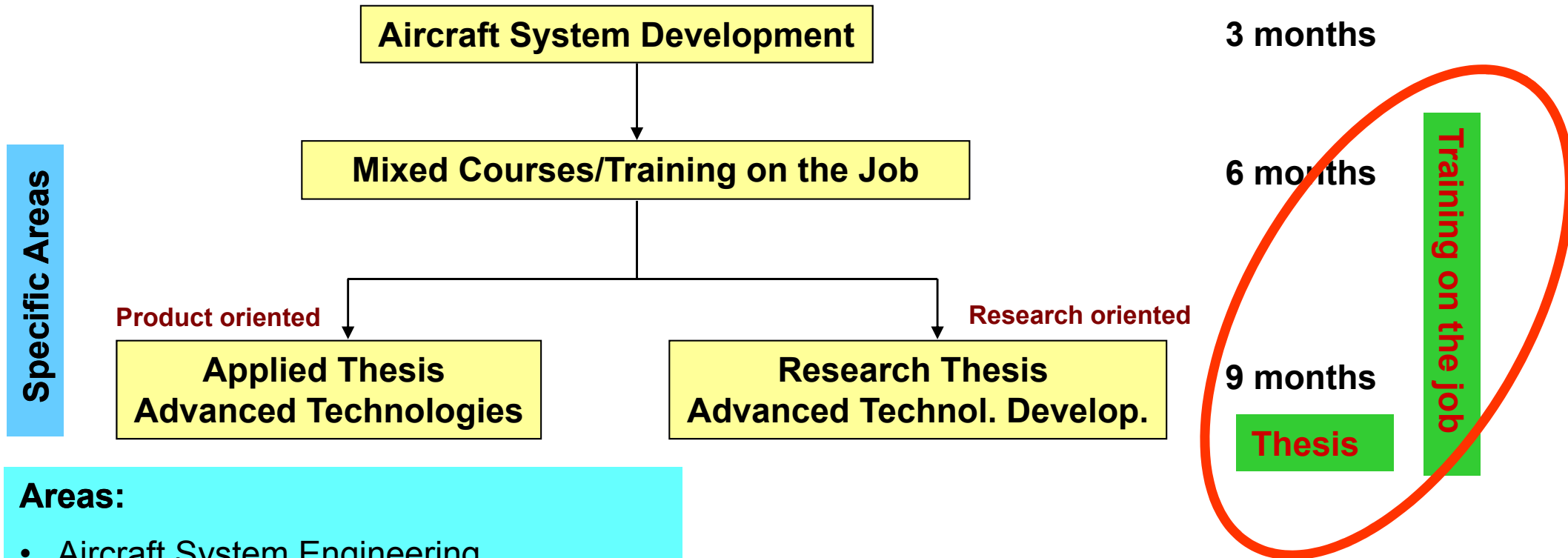
Since 2005 Alenia Aeronautica has launched educational programs in close collaboration with local Scientific Faculties and Polytechnics

Examples of these educational programs are the following :

- **Advanced Training ENgineers Aeronautics (ATENA – 2005-2007 – dedicated to Greek students – advanced aeronautic education by Turin Polytechnic' Profess mixed with training on the job at Alenia premises)** 
- **Master Of Science in Aeronautics for the International Community (MOSAIC 2008-2010 – dedicated to Turkish, Lithuanian, Bulgarian, Greek, Romanian students – continuation of ATENA scheme)**
- **AEROTECH (1st edition 2006-2007 – dedicated to post-graduated engineers – in partnership with ATR Toulouse (France), Cira, SAM Consortium, Magnaghi, Officine Aeronavali, OMASUD, Piaggio Aereo Industries, Sintart, Tecnam, Vulcanair and with Dipartimento di Progettazione Aeronautica (DPA), Università degli Studi di Napoli Federico II, Consorzio Eubeo (Consorzio Universitario per l'Innovazione), Regione Campania, Unione Industriali di Napoli** 
- **INDUSTRIAL PhD Program (2010-on – dedicated to Italian post-graduated students)**

MOSAIC :

Post Graduated **M**aster **O**f **S**cience in **A**eronautics for the **I**nternational **C**ommunity

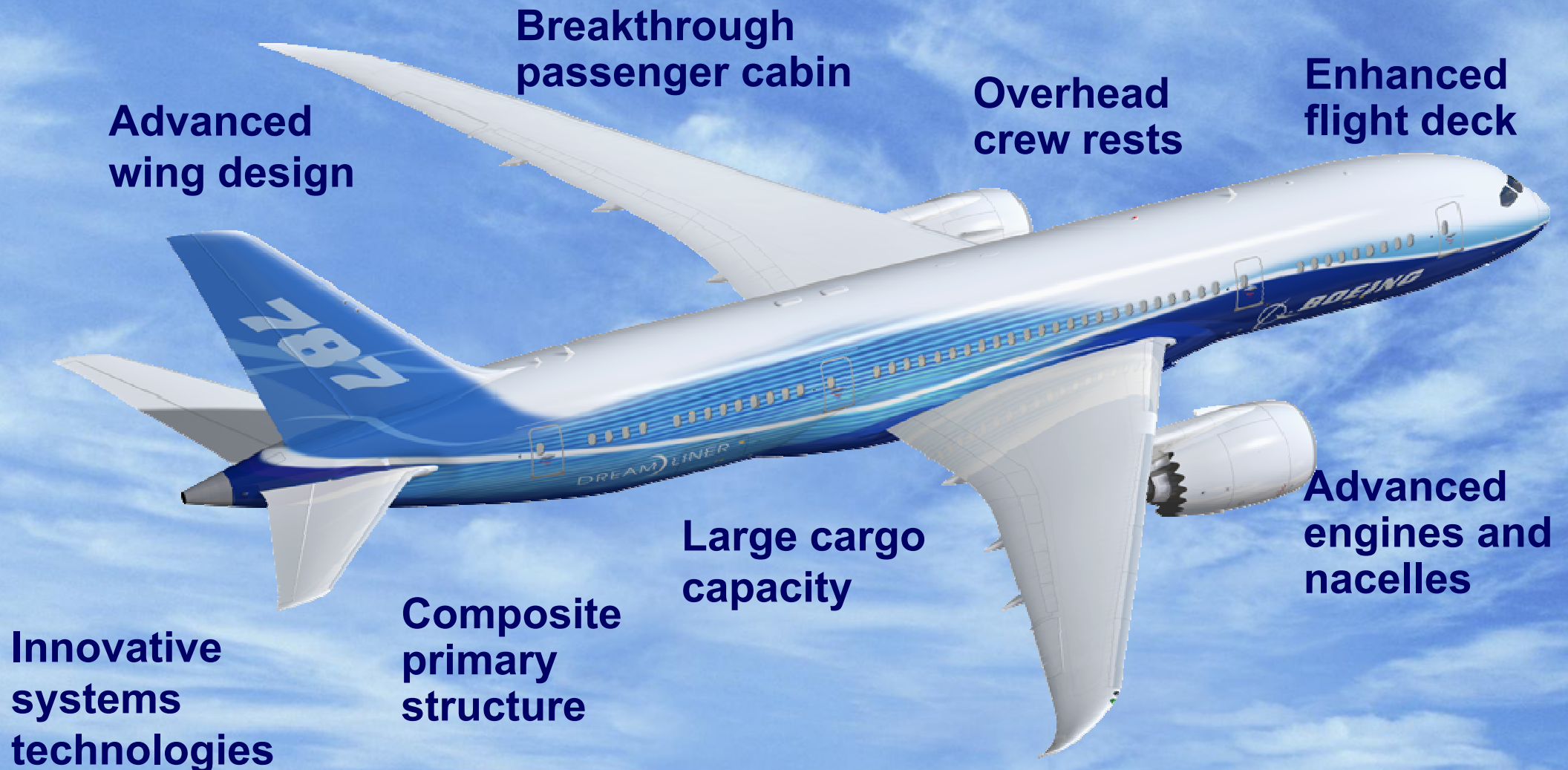


Areas:

- Aircraft System Engineering
- Advanced Materials & Manufacturing
- Virtual Reality, Simulation and Training
- Logistic support and maintenance

- **For Professors :**
 - initial possibility to provide lectures and seminars and in future be part of the consortium for the International Master hosting courses etc.
- **For students and Professors :**
 - opportunity to visit Italian Universities/Research centres/ Industries, gain knowledge, establish new links, be part in network (concerted action) participate in common research projects (for instance within European Framework Programs)
- **For students:**
 - high level education also suitable for those willing to continue academic career (ex. PhD)
- **Student education tailored also on industrial needs**
 - (Master different orientations)

B787-8 Design Features



Advanced Systems Technologies Provide Value



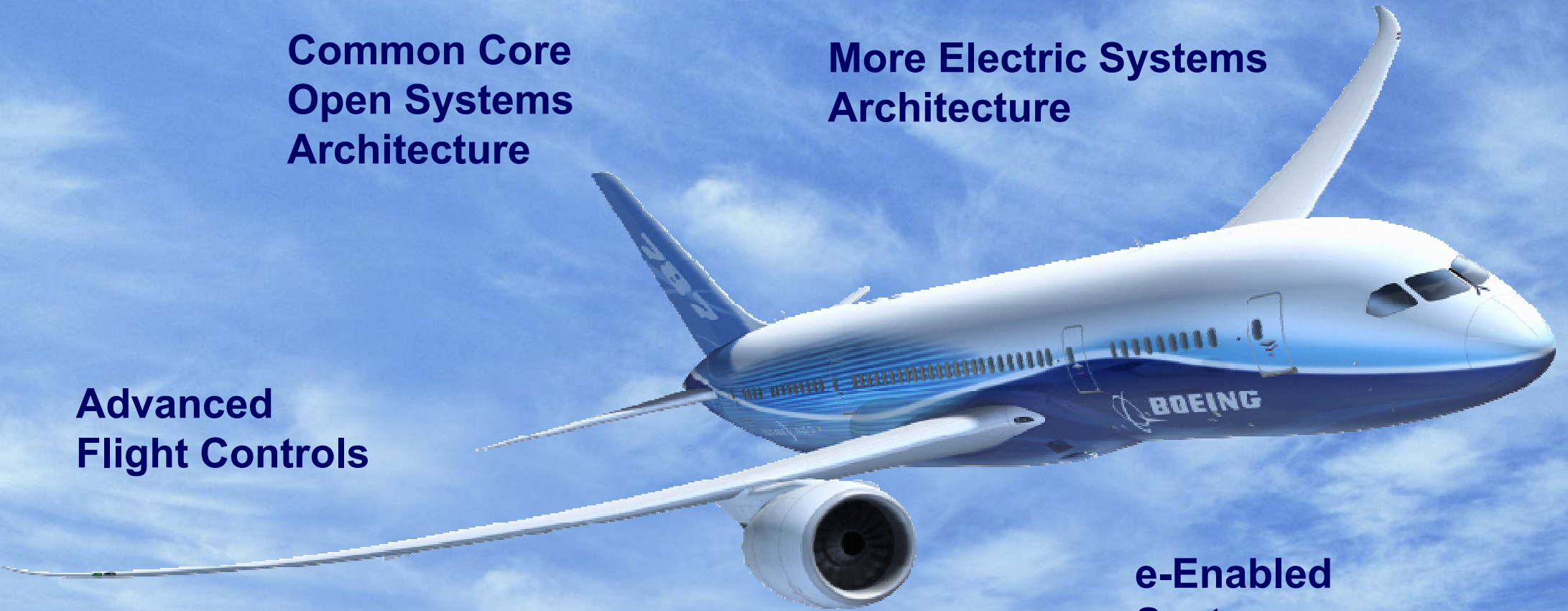
**Common Core
Open Systems
Architecture**

**More Electric Systems
Architecture**

**Advanced
Flight Controls**

**e-Enabled
Systems**

**Integrated
Health
Management**

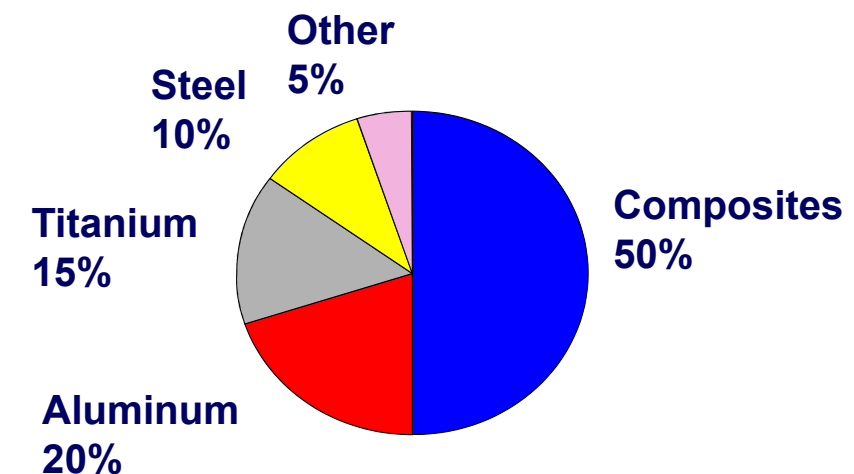
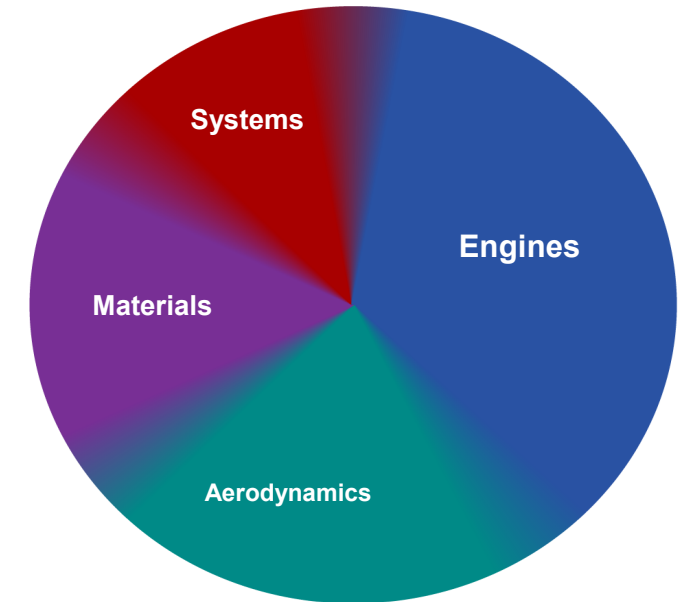


Composites Serve as Primary Structural Material



- Carbon laminate
- Carbon sandwich
- Other composites
- Aluminum
- Titanium
- Titanium/steel/aluminum

Efficiency Contribution



Boeing 787 - The First “Plastic” Airplane

For the first time in aviation history, composites will be applied to every primary structure of an airliner

Composites: lighter, no fatigue or corrosion

Complete, large sections cocured together (One Piece Barrel) gives fewer joints, fewer parts, simple assembly, lower weight

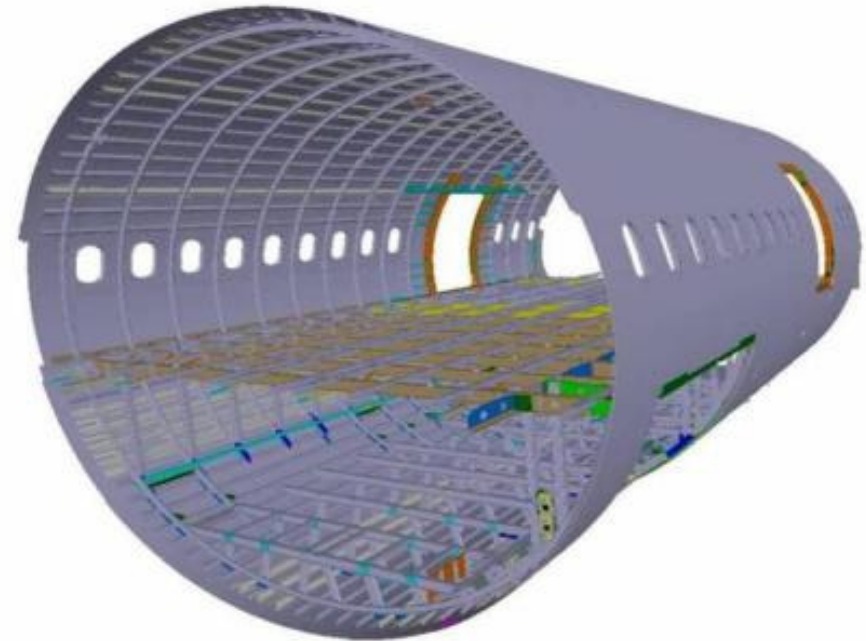


Benchmark for future airliner development:

- 20% lower Direct Operating Costs
- Savings from aerodynamics, materials and systems, engines and their synergies

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Innovation through technology jumps



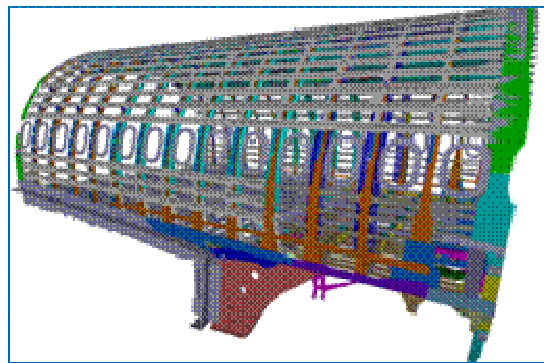
Alenia Aeronautica is Boeing 787 Risk-sharing partner

- **About 15% of airframe**
- **Proprietary processes**
- **New plants in Italy and USA**

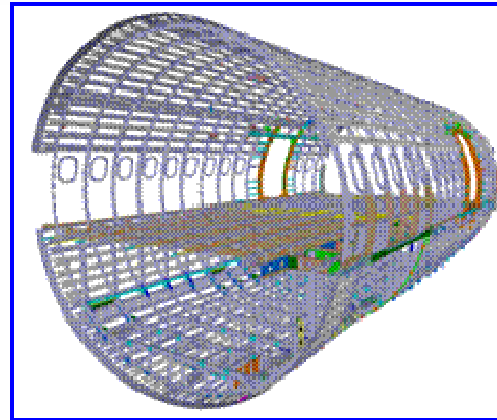
Structure Design and Technologies

787 Program Experience

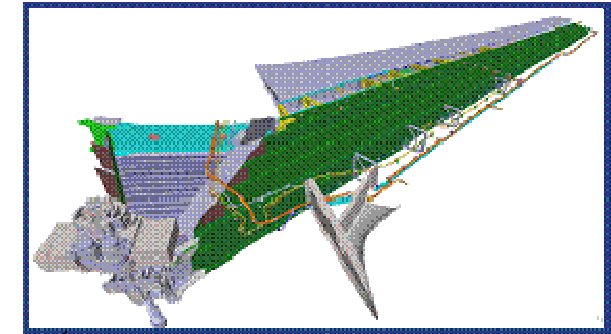
787 Alenia Work Packages



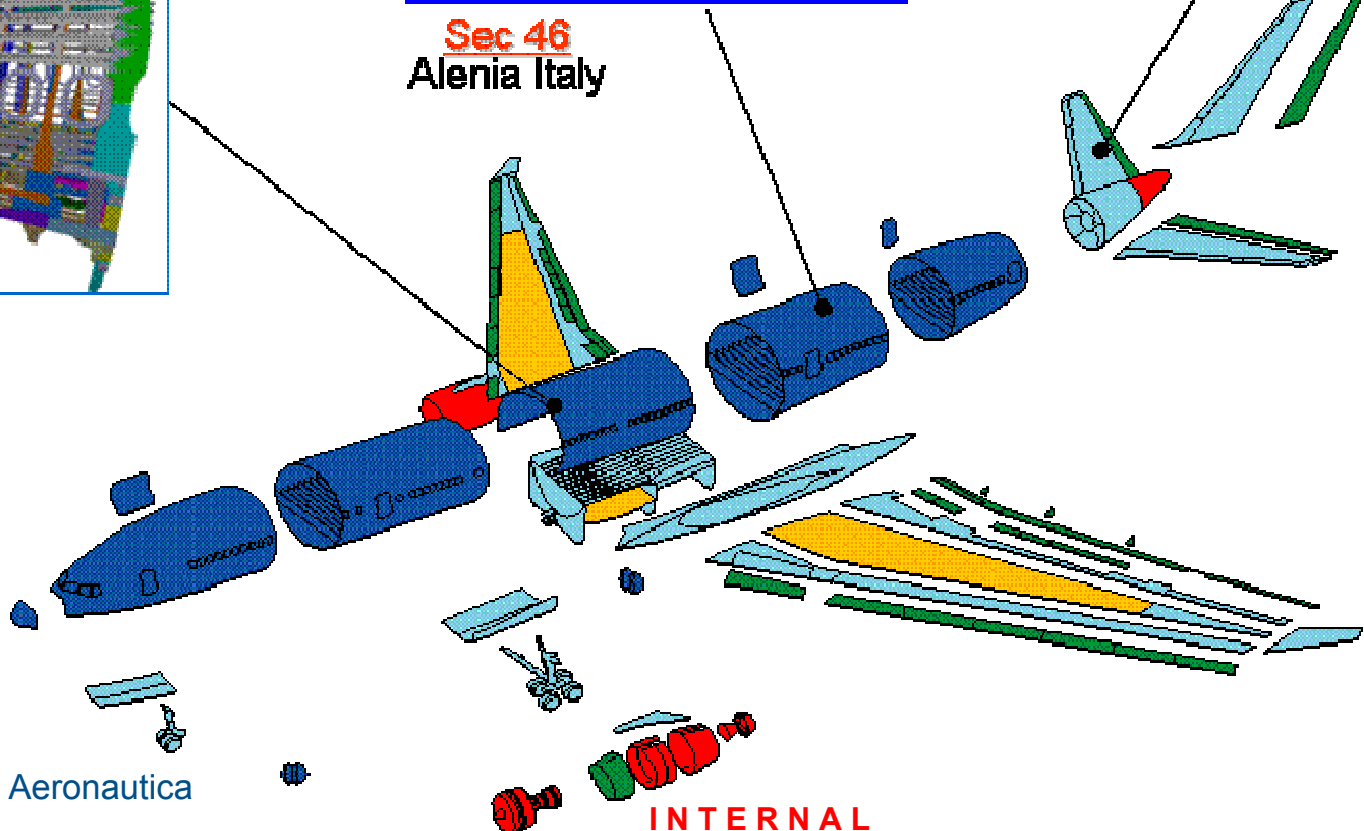
Sec 44
Alenia Italy



Sec 46
Alenia Italy



Horizontal stabilizer
Alenia Italy

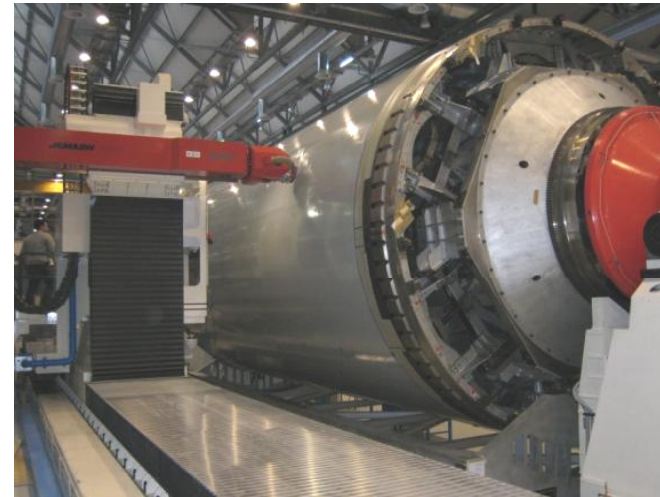


INTERNAL

Boeing 787 One Piece Barrel



Skin Lay Up



Trim & Drill

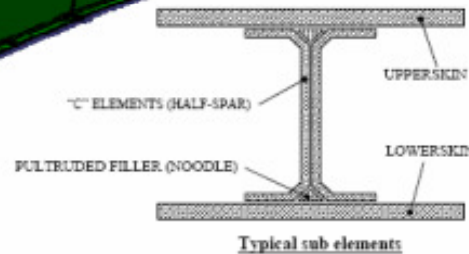
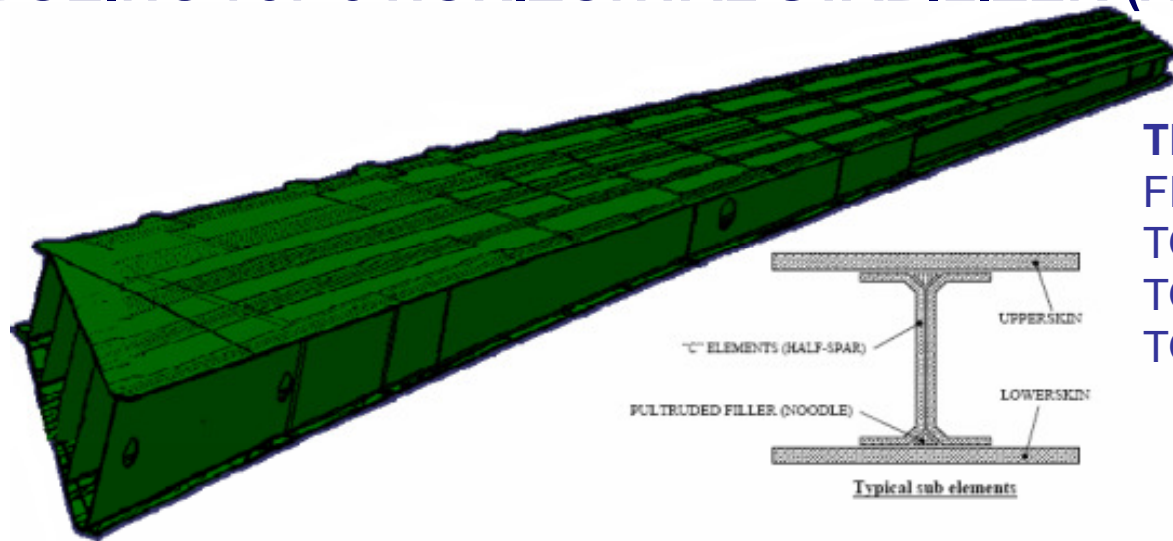


Extraction

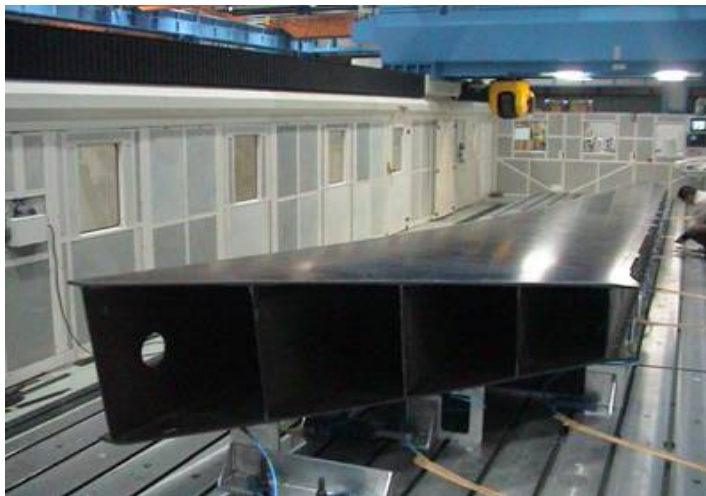


Cleaning & Preparation

BOEING 787-8 HORIZONTAL STABILIZER (Alenia Patented Technology based)



TECHNOLOGY SCALE-UP:
FROM FEASIBILITY SPECIMEN (1983)
TO AMX STABILIZER & VERTICAL FIN (1986)
TO ATR 42/72 STABILIZER (1995),
TO 787 STABILIZER DEMONSTRATOR (2006)





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