Embraer
Technology Vision

Francisco A. Ferreira Gomes
Technology Development

Embraer at a Glance

We have developed our business in the areas of …

COMMERCIAL AVIATION

EXECUTIVE AVIATION

EMBRAER DEFENSE & SECURITY

Embraer Business Areas

Commercial Aviation

OVER **90** AIRLINES IN MORE THAN **61** COUNTRIES + **1700** AIRCRAFT IN-SERVICE

Executive Jets

MORE THAN **1000** AIRCRAFT IN-SERVICE WORLDWIDE

Defense & Security

OVER **52** ARMED FORCES IN **50** COUNTRIES

Embraer Units – Global Operations


Brazilian Aviation
Industry Origin

Alberto Santos Dumont

Fonte: Favolosi Cappelli

The Brazilian Aviation Industry Origin

1943

After World War II – strategic vision for a national aviation industry

Brazil had a very small industry sector

Air Force Colonel **Casimiro Montenegro** visits Wright Field and **MIT** in 1943

He brings home the dream of creating a Brazilian aviation industry

Our MIT wings are born

1950

1945: Richard H. Smith, MIT professor speech "Brazil, future air power"

1950: he becomes the first ITA dean

ITA – Aeronautical Technology Institute

Brazil launches a national strategic aerospace initiative via the Aeronautics Technical Center (CTA) and the Technological Institute of Aeronautics (ITA).

1946

1950

ITA – Instituto Tecnológico de Aeronáutica

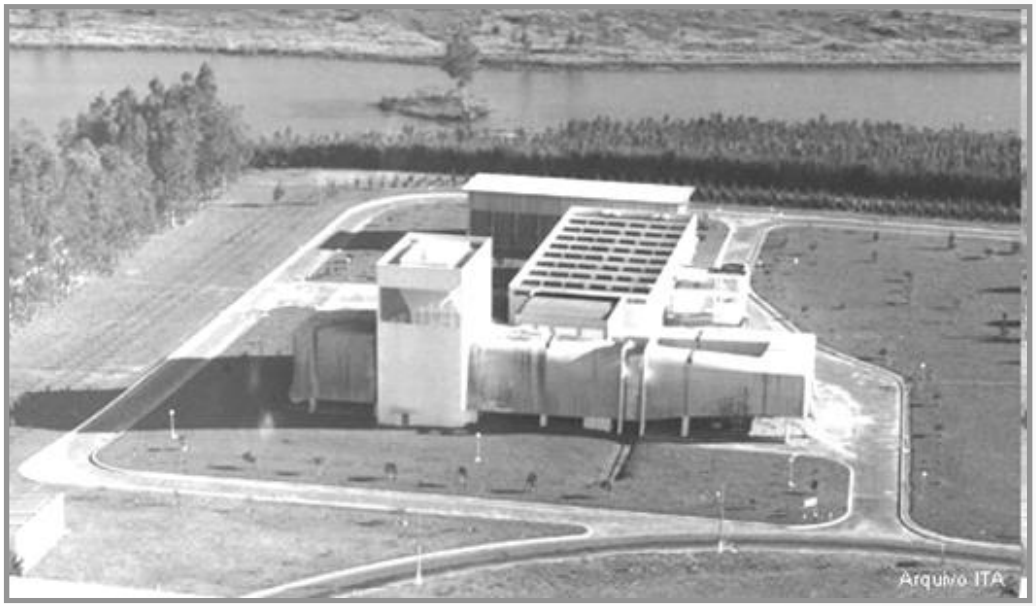
Turma Formandos Engenharia ITA, década 1950

Fonte: Arquivo AEITA

1954

IPD – Instituto de Pesquisa e Desenvolvimento

(Now IAE)



Wind Tunnel, IPD, CTA

Fonte: Arquivo ITA

1954

1969

Federal Government creates Embraer to develop aeronautical engineering and manufacture aircraft in Brazil.

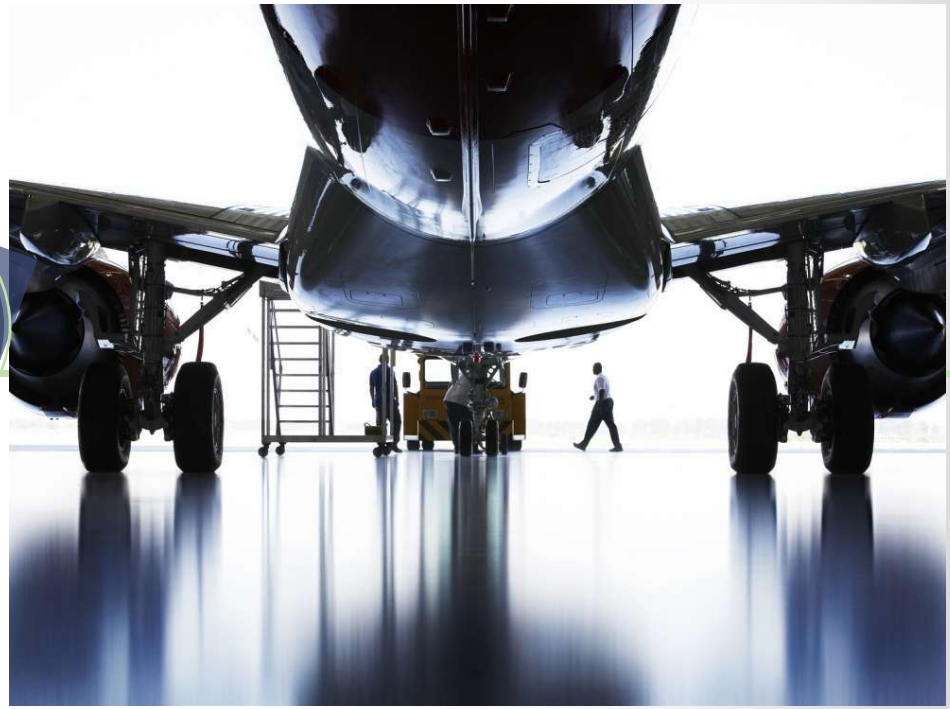
Our History

1969

1st EMBRAER Management Team

Embraer is privatized, fusing **technological** and **industry expertise** with an **entrepreneurial approach.**

1949 1969 1994



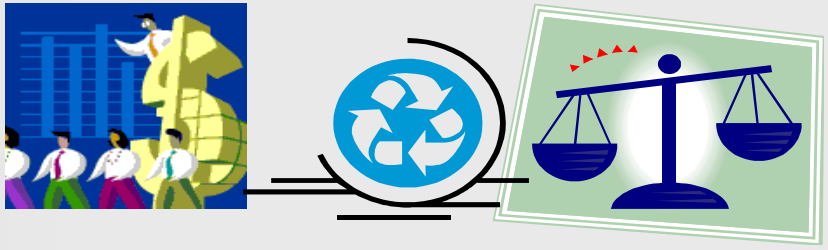
Embraer is one of the world's leading manufacturers of commercial and executive jets, with substantial and growing operations in defense and security.

2016


Aeronautic
Industry Players

Aeronautic Industry Players

External Influencers



- Airworthiness Authorities
- Legislatures
- Financial Markets
- Material Markets
- Fuel Markets

Partners / Suppliers

Manufacturers (OEM)

- Passenger Airlines
- Business & General Aviation
- Cargo Airlines

MRO


Multidisciplinary
technologies


High qualified
manpower

Huge amount of investments


Long maturation time


Low scale production


Global based clients


Small number of OEMs

Characteristics of the Aeronautic Industry (Summary)

- Multidisciplinary technologies
- High qualified manpower
- Huge amount of investments
- Long maturation time
- Relatively low scale production
- Global based clients
- Small number of OEM's


Big
Challenges
for Aviation


• The frequency and impact of severe weather events are increasing and can harm aviation system
lightning strike - antiicing - extreme conditions
Climate changes

- The sustainability trade-off (economic, social, environmental) is becoming more and more relevant in the decision making processes

ENVIROMENT RESPONSABILITY

Connectivity

- The ubiquity of Internet presses for onboard connectivity, bringing challenges to both technology and regulation, with an eye on cybersecurity

Connectivity

Pope Bento XVI
(2005)

Connectivity

Pope Francisco
(2013)

Increase of Violence

- The terrorist threat creates a need for more security policies and procedures that may slow down the airports' operation

POPULATION GROWTH AND AGING

More people want to fly, especially in developing countries, putting more pressure on an already crowded infrastructure

Different cultures have different values which translate into specific preferences for aviation

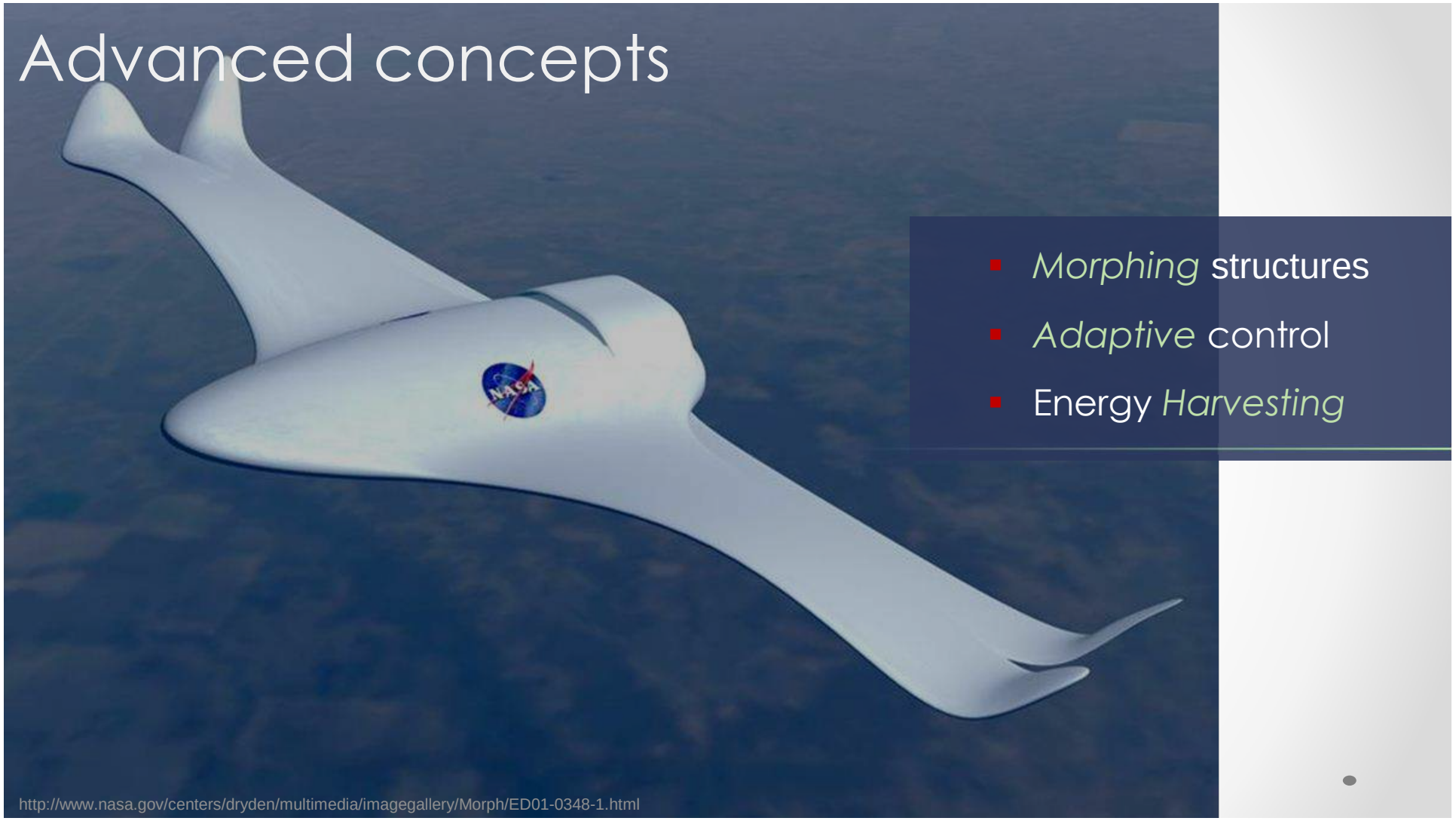
AIRLINE COMPETITION

Aerospace competence, once restricted to a few countries, is spreading

Better performance > lighter aircrafts


No
Technology Trends

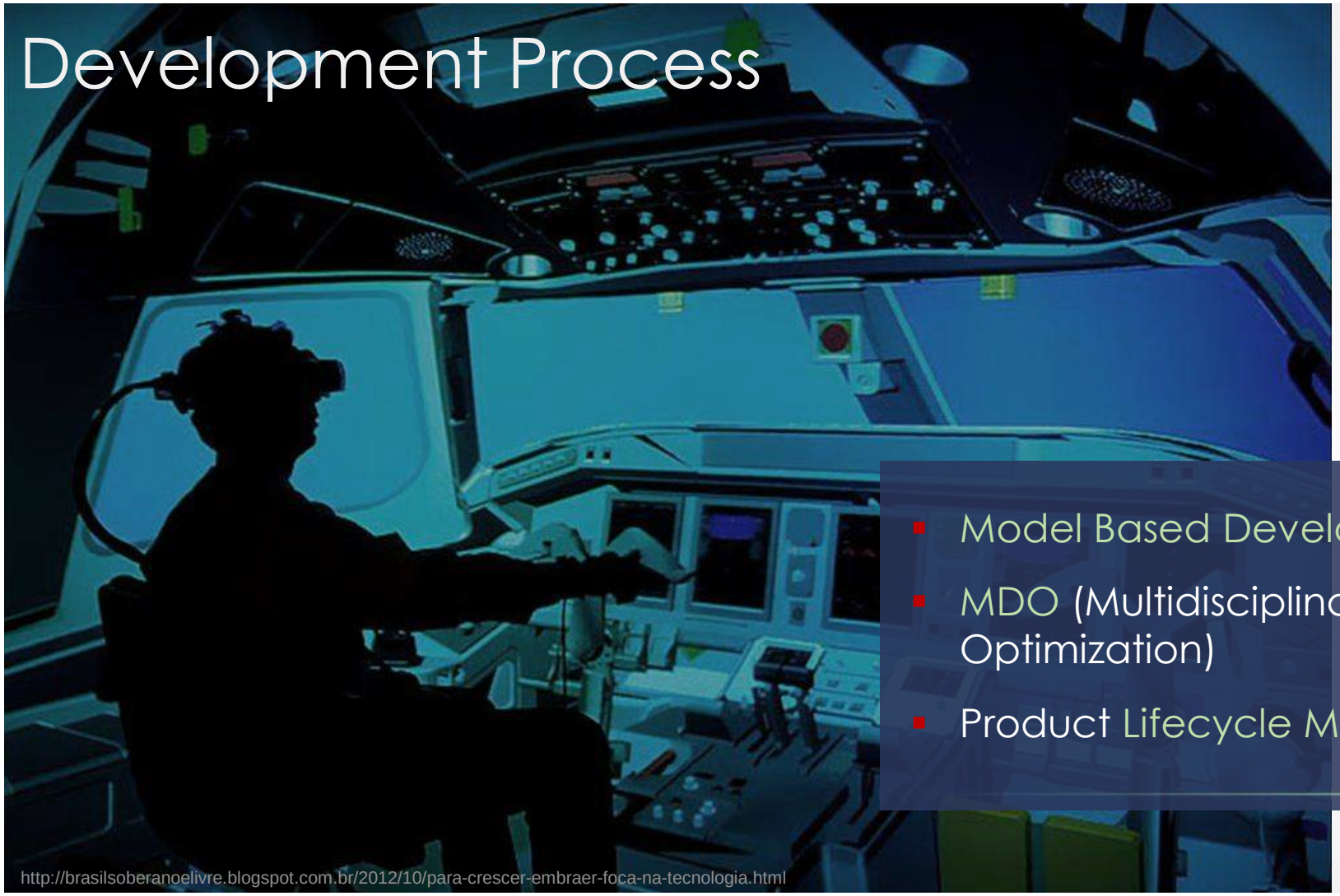
Advanced concepts



- *Morphing* structures
- *Adaptive* control
- Energy *Harvesting*

http://www.nasa.gov/centers/dryden/multimedia/imagegallery/Morph/ED01-0348-1.html

Development Process



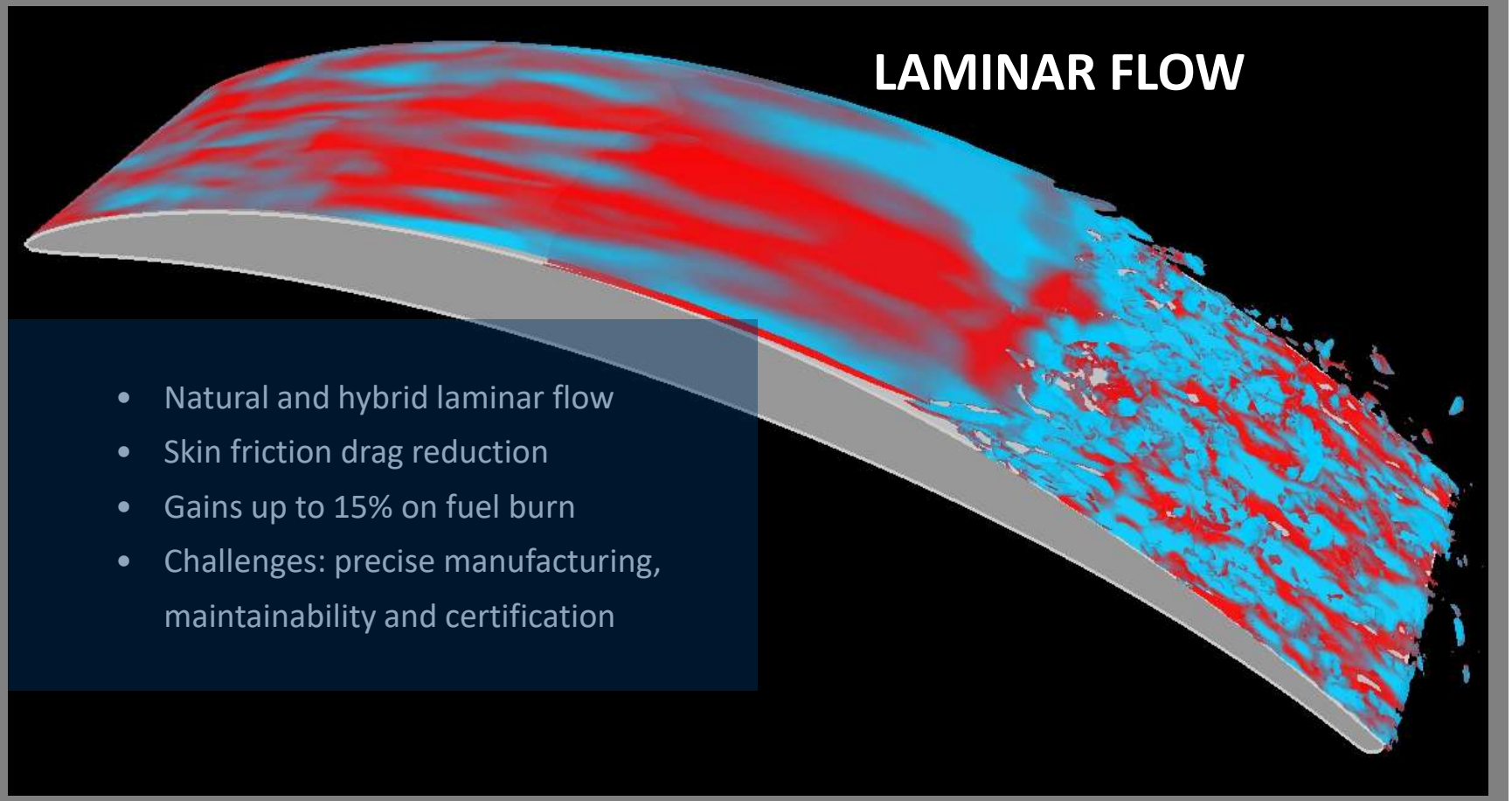
- Model Based Development
- MDO (Multidisciplinary Design Optimization)
- Product Lifecycle Management

http://brasilsoberanoelivre.blogspot.com.br/2012/10/para-crescer-embraer-foca-na-tecnologia.html

Aerodynamic design

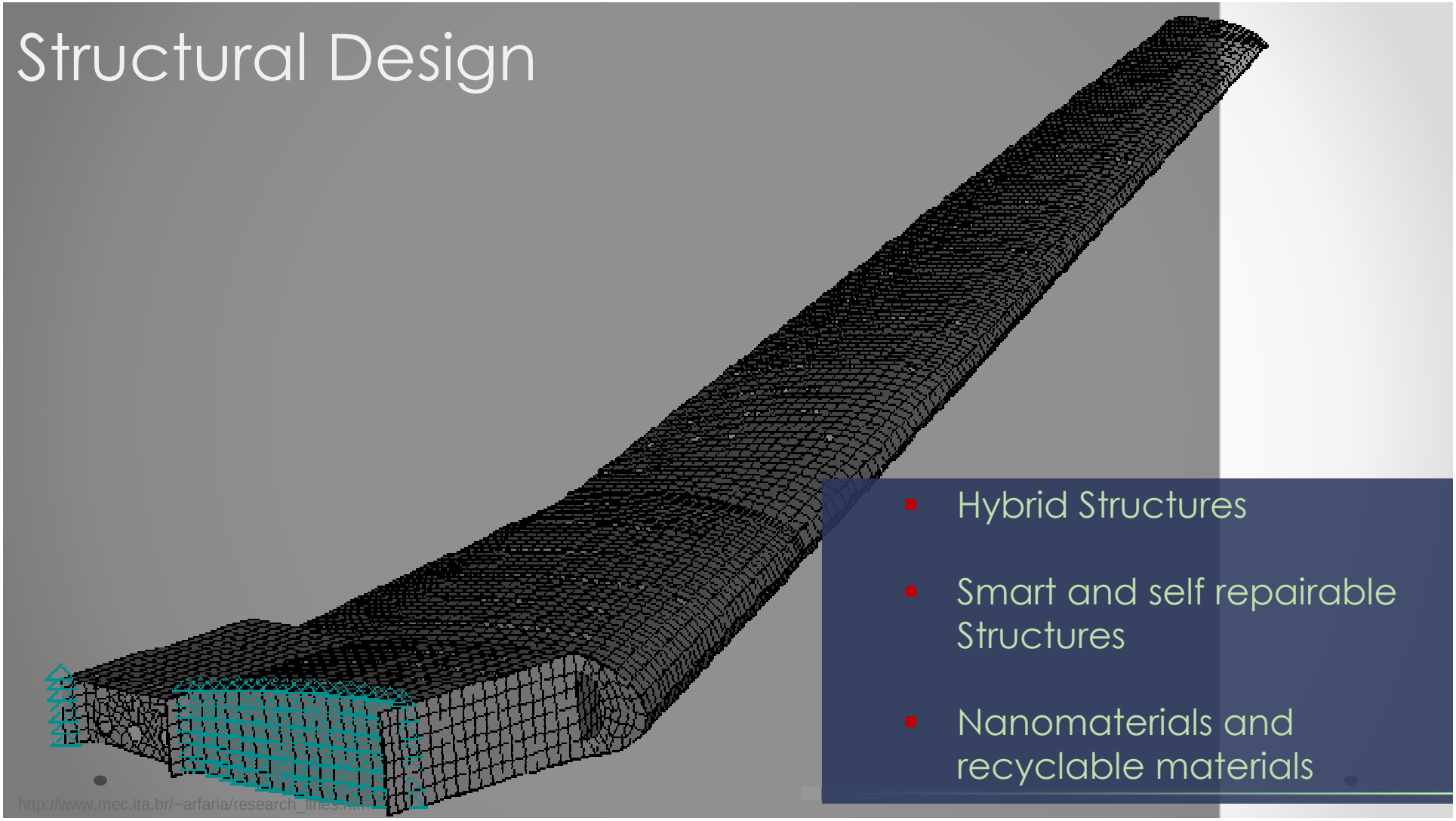
- Flow Control
- New configurations
- Noise Control/Reduction

Fuel Consumption / environment



- Natural and hybrid laminar flow
- Skin friction drag reduction
- Gains up to 15% on fuel burn
- Challenges: precise manufacturing, maintainability and certification

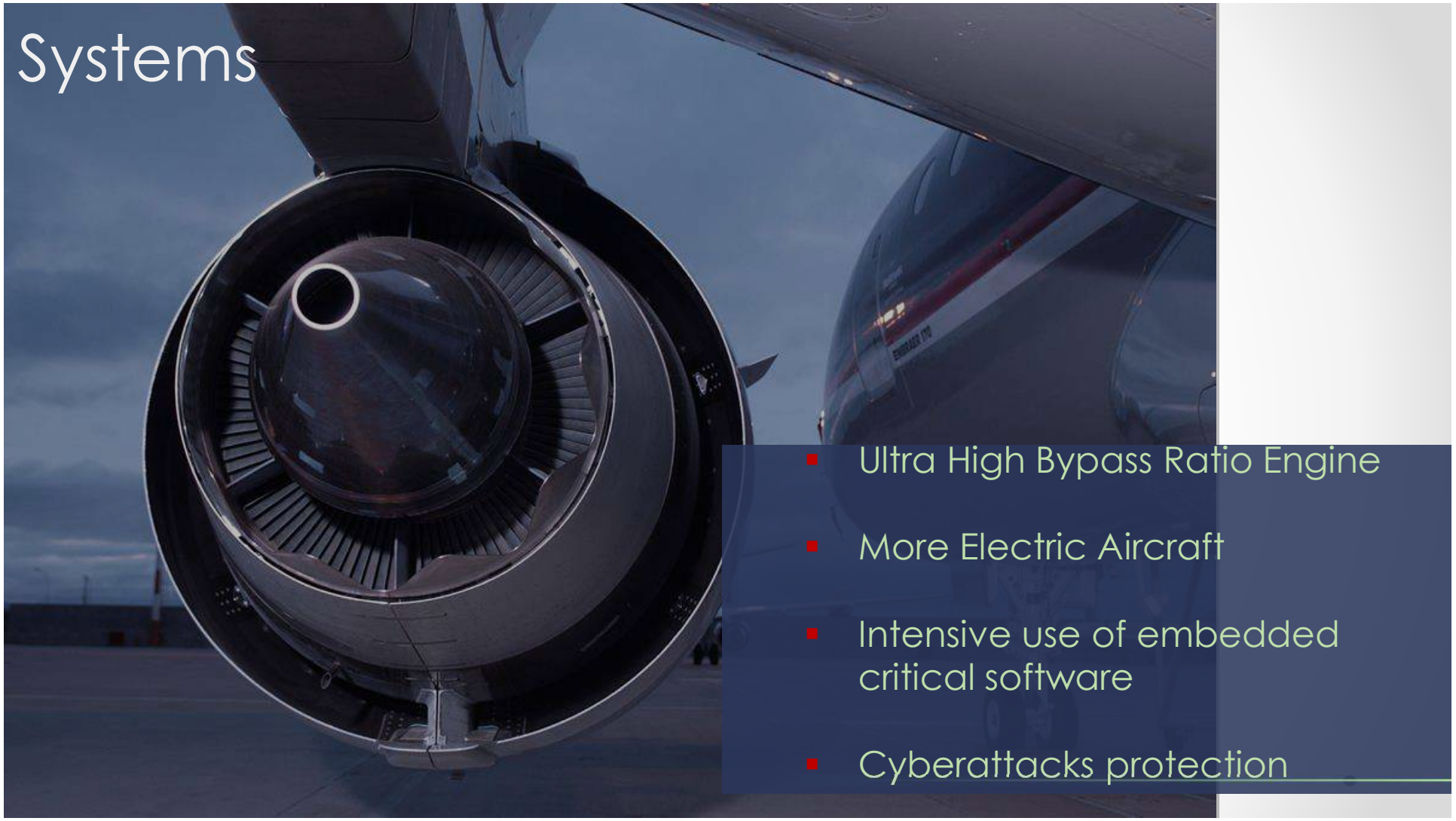
Structural Design



- Hybrid Structures
- Smart and self repairable Structures
- Nanomaterials and recyclable materials

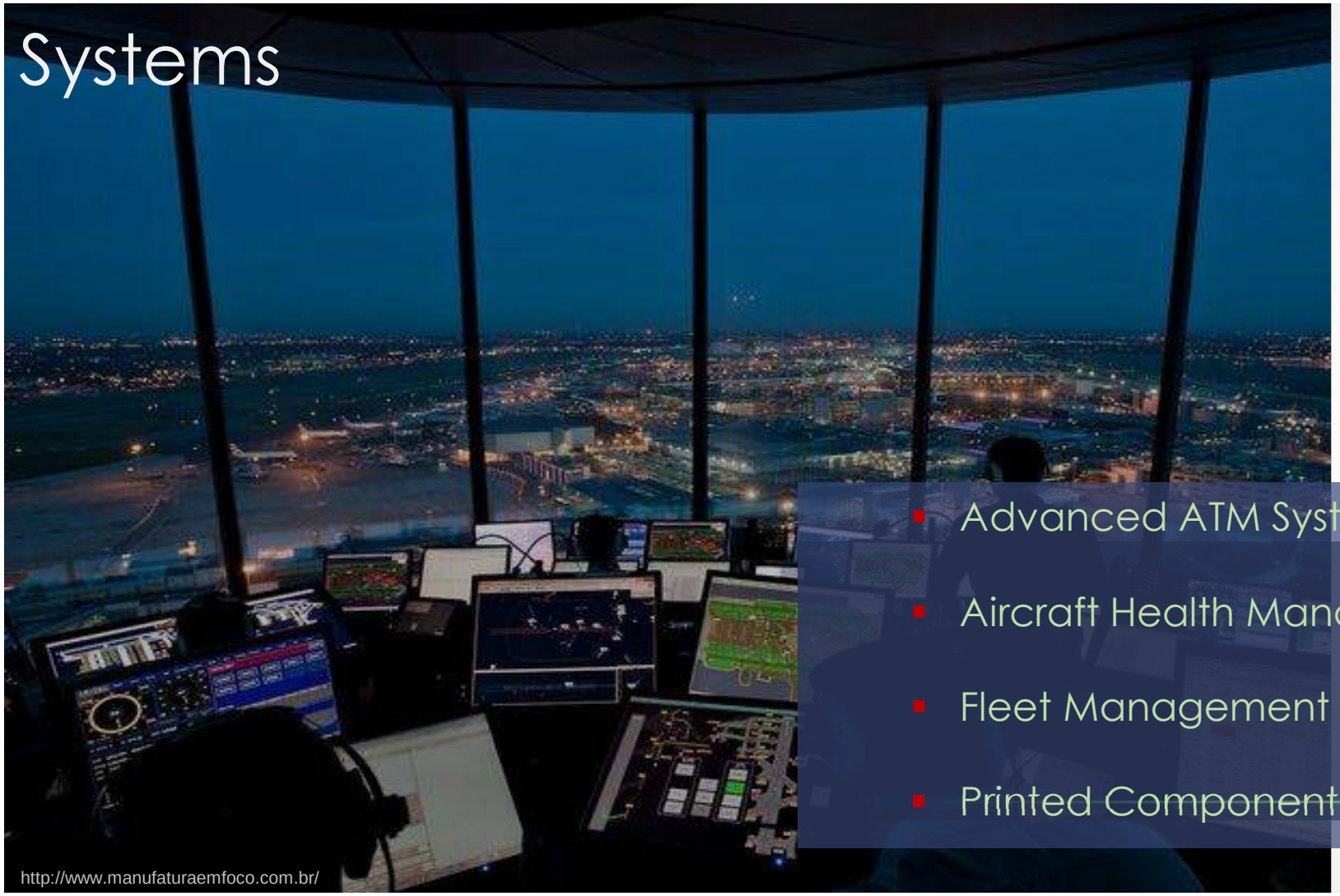
http://www.mec.ita.br/~arfaria/research_lines.html

Systems



- Ultra High Bypass Ratio Engine
- More Electric Aircraft
- Intensive use of embedded critical software
- Cyberattacks protection

Systems



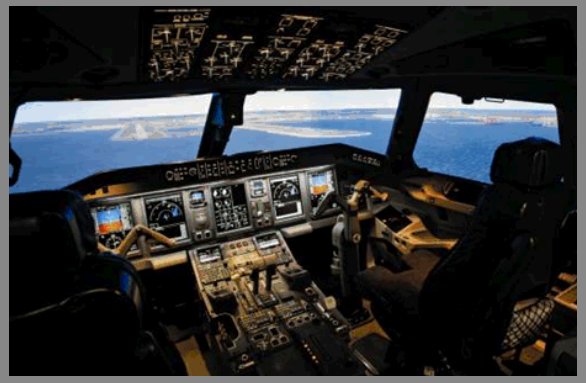
- Advanced ATM Systems
- Aircraft Health Management
- Fleet Management Systems
- Printed Components (3D)

http://www.manufaturaemfoco.com.br/

Leading to a smart integration philosophy

Central Storage Health Monitoring

Data Exchange Interconnected Fleet



Flight Ops

Integrated Fleet Management Center

Confort and onboard Systems

FAST AND RELIABLE CONNECTIVITY	PERSONALIZED ENTERTAINMENT SYSTEM	PRIVACY AND COMFORT	SUSTAINABLE SOLUTIONS	"HANDS-FREE" CONTROLS
CABIN MICROCLIMATES	CABIN CONNECTIVITY	CABIN AIR QUALITY	MEDICAL KITS AND SINGLE-CLASS CABIN	SELF-CLEANING AND ANTI-BACTERIAL MATERIALS

Winner Partnership in Crystal Cabin Award (Visionary Concepts Category)

Confort and onboard Systems

- Privacy and comfort
- Cabin Connectivity
- Personalized entertainment systems
- Cabin Air Quality
- Sustainable Solutions

Manufacture

- Advanced Automation
- Additive Manufacture
- Assembly without gauge
- Precision Manufacture

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C4I2SR

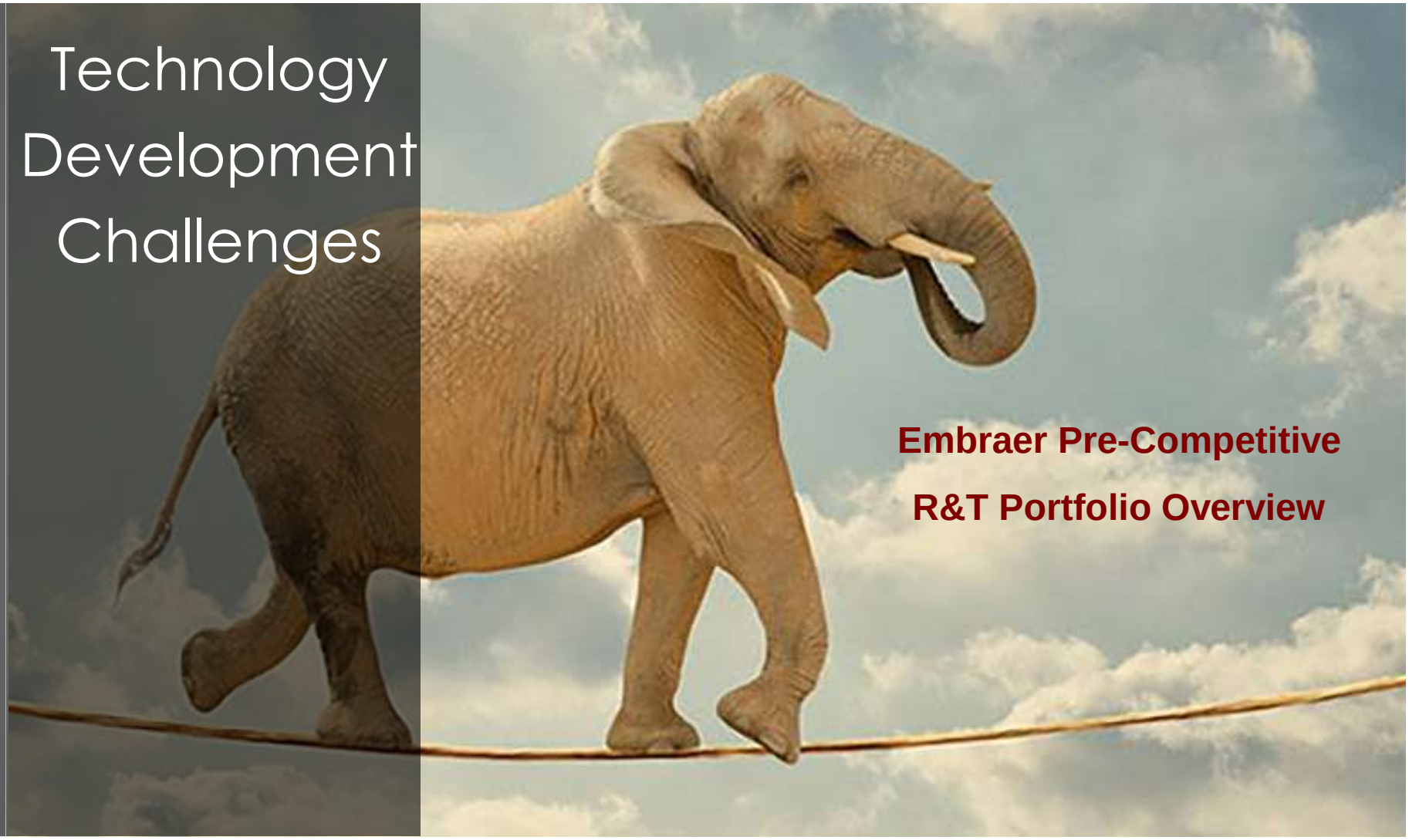
Command
Control
Communication
Computer

Information
Intelligence

Surveillance

Reconnaissenc
e

Technology Development Challenges



Embraer Pre-Competitive

R&T Portfolio Overview

…Technology Challenges

Produto mais competitivo

More Competitive Products

- Lower Fuel Consumption;
- Lower External Noise and Emissions;
- Enhanced Comfort for Passengers;
- Enhanced Mission Performance;
- Lower Property and Operations Costs;
- Enhanced Product Reliability;
- ...

TECHNOLOGY READINESS

Pillar to provide long-term technology readiness aiming competitiveness

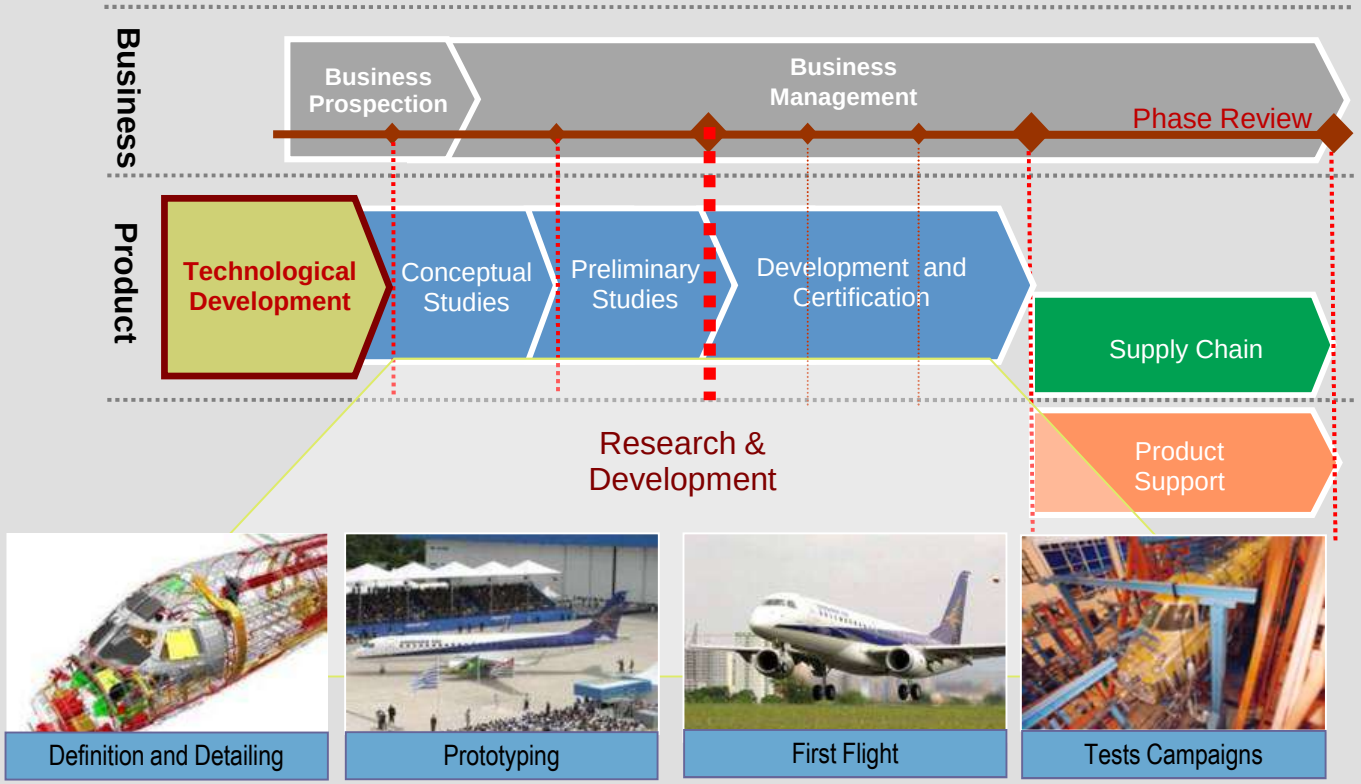
"get ready before it is needed"

Negócio mais competitivo

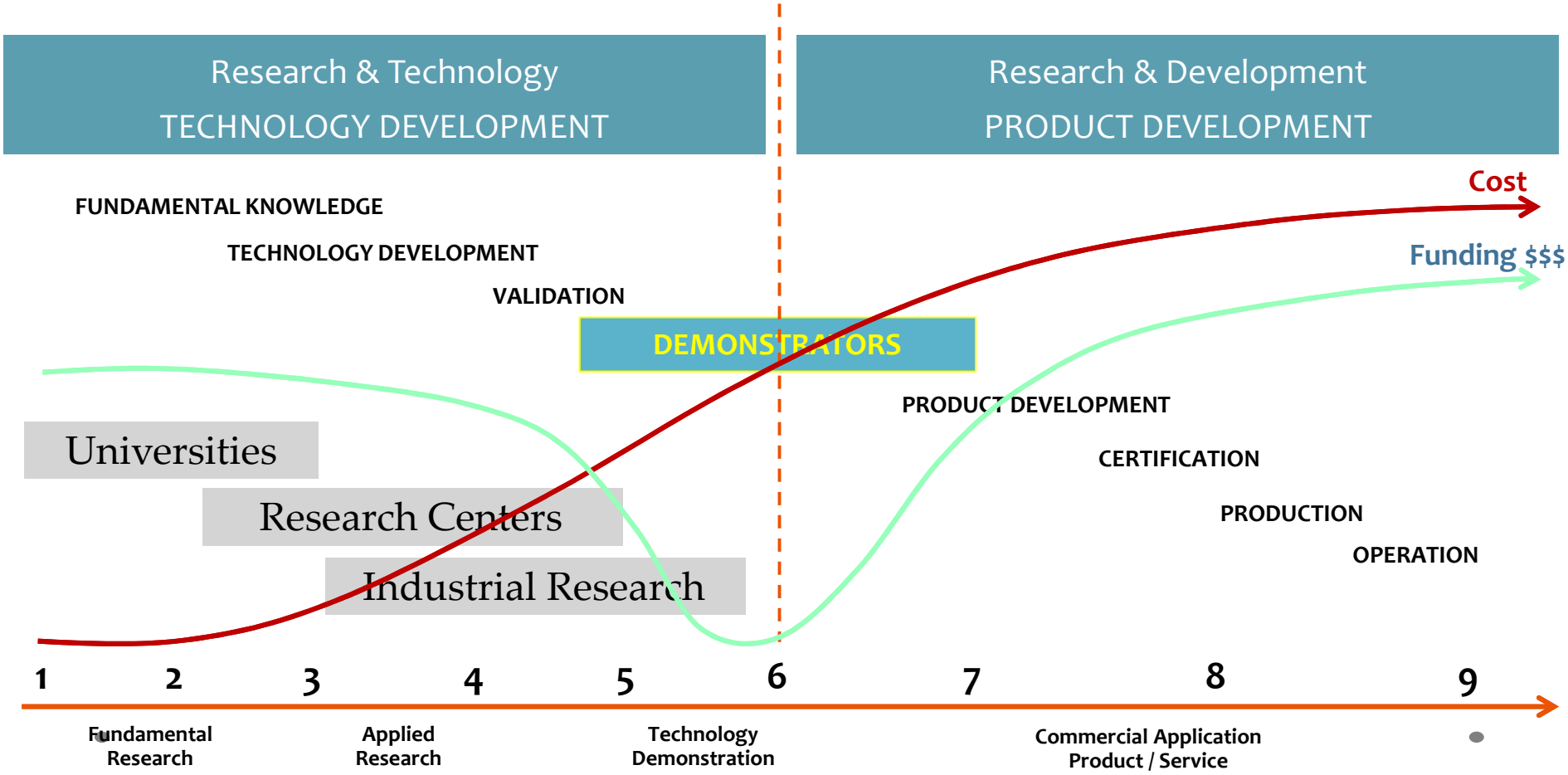
More Efficient Business

- Reduction of the Development Cycle;
- Higher Technological Independence in Complex Systems Integration;
- Higher Product Maturity Through Development and Entrance in Service;
- Lower Response Time;
- ...

Value Added Chain



Technology Development

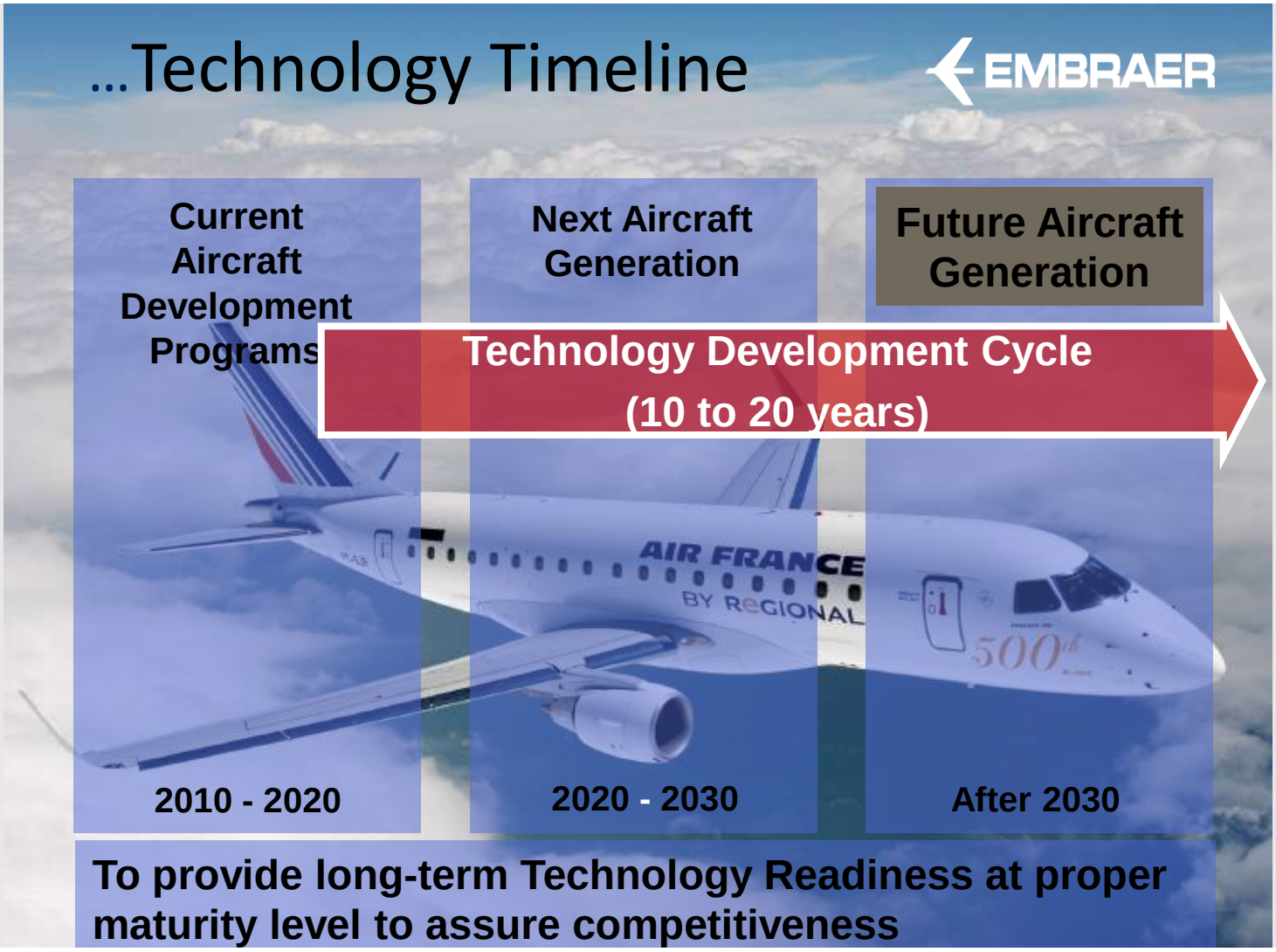


…Technology Timeline

EMBRAER

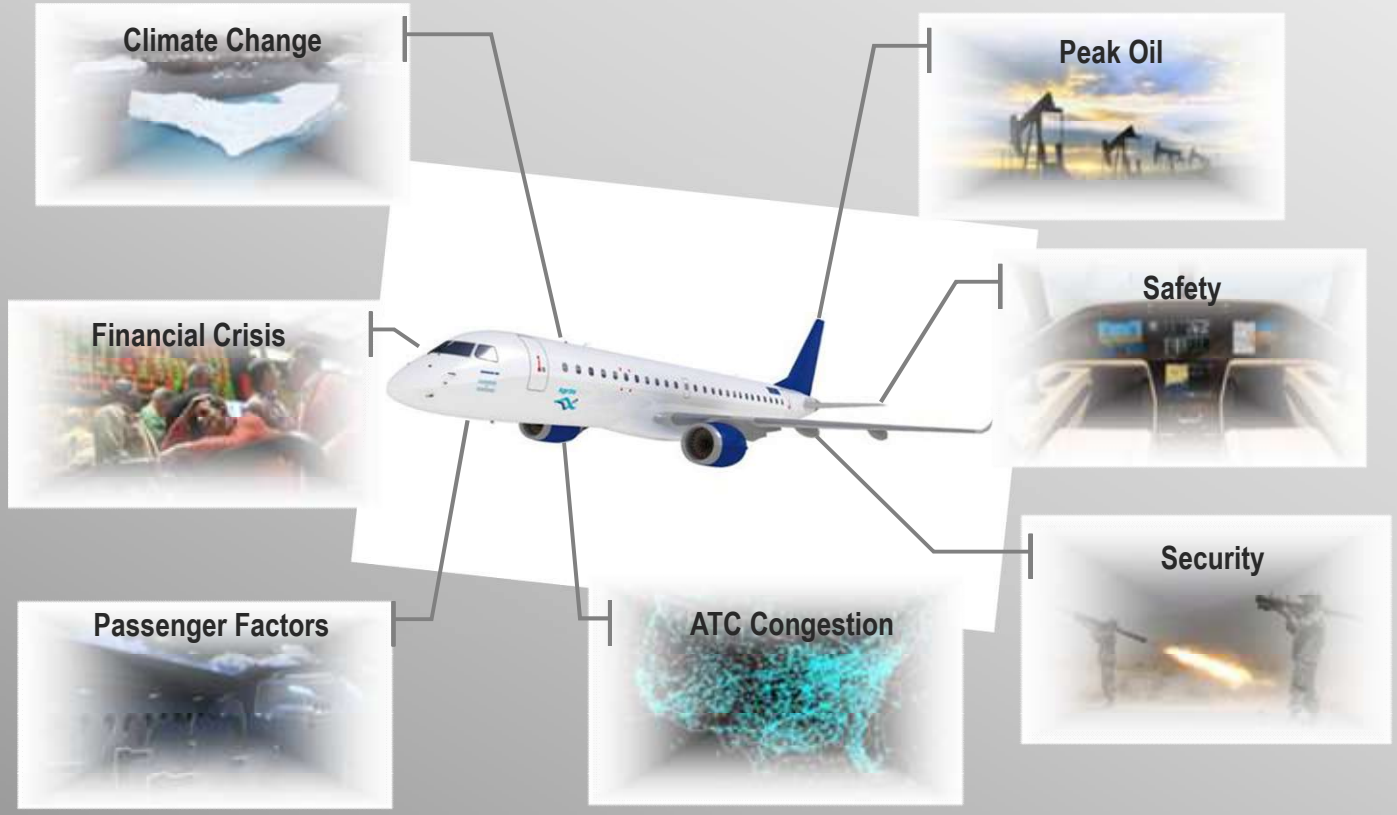
Current Aircraft Development Programs	Next Aircraft Generation	Future Aircraft Generation
2010 - 2020	2020 - 2030	After 2030

Technology Development Cycle (10 to 20 years)



To provide long-term Technology Readiness at proper maturity level to assure competitiveness

Analyzing the Aviation Challenges…



We can establish a Vision of Technological Evolution…

Efficient Energy Management
- New sources
- Integrated management
- Electrical systems with high-reliability

New Aircraft Concept
- New Engines
- New configurations
- Active drag reduction systems
- Advanced materials

Safe operation
- Improved onboard weather systems and tools
- Human-machine integration

Aircraft Life-Cycle Management
- Highly-integrated, multi-disciplinary product
- Lean Development and Manufacture
- Low operational cost through health management system
- Green Life Cycle (manufacture, operation, maintenance and disposal)

Secure Aircraft
- Protection against short range missile attack
- Detection of abnormal trajectory to engage automatic control
- Biometry Systems

Operation in High-density Environment
- Pilot workload management & Single Pilot
- Advance integration with ATC
- 4D Trajectories

Comfort and Onboard Features
- Fast boarding patterns
- New systems and installations
- New displays

EMBRAER IS COMMITED TO EVOLUTION

BIOFUELS

EMBRAER PARTICIPATES IN STRATEGIC PARTNERSHIPS FOCUSED ON RESEARCHING AND DEVELOPING SUSTAINABLE AND ECONOMICALLY VIABLE AVIATION BIOFUELS.

- Partnership with Amyris, GE and Azul Linhas Aéreas.
- Partnership with Boeing and FAPESP.

EMBRAER IS COMMITED TO EVOLUTION

A class of their own

- Fly by wire:
  - safety, docile flight, pax comfort, optimized performance
- More efficient, greener and quieter engines
- Composite materials
- Designed for easy maintenance and high dispatch reliability

Flightglobal Achievement Awards 2010

Innovator of the Year Category

EMBRAER IS COMMITED TO EVOLUTION

A generational step led by new technology

- New Higher Aspect Ratio Wing
- New High By-Pass Ratio Engines
- 4th Generation Full Fly-by-Wire
- Improved Avionics
- Improved Systems Reliability and DMC
- New Interior
- e-Enabled

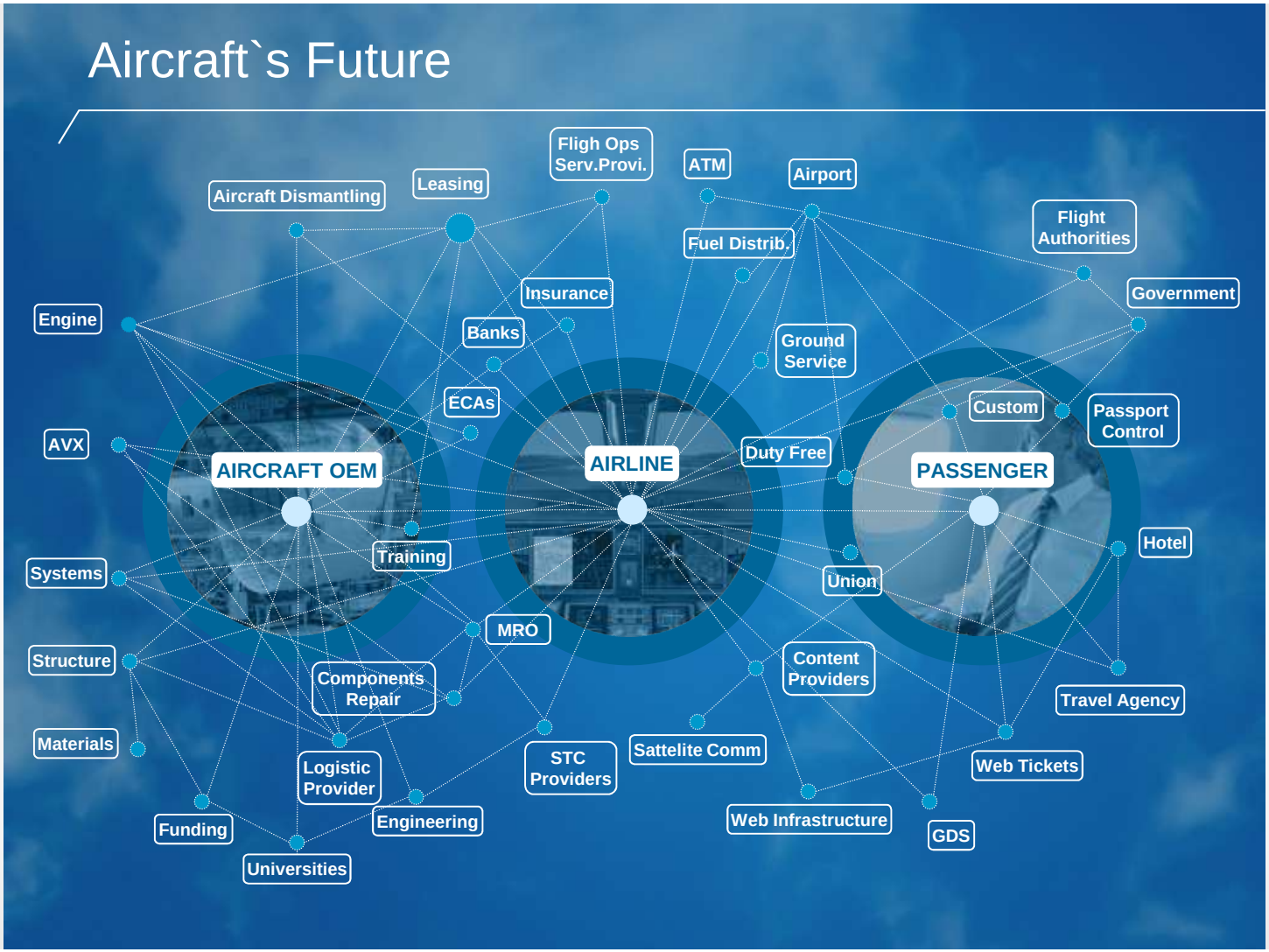
EMBRAER IS COMMITED TO EVOLUTION

Azul more Green

Demo Flight: Rio + 20 Conference, in Jun/12

Biomass: Sugar Cane

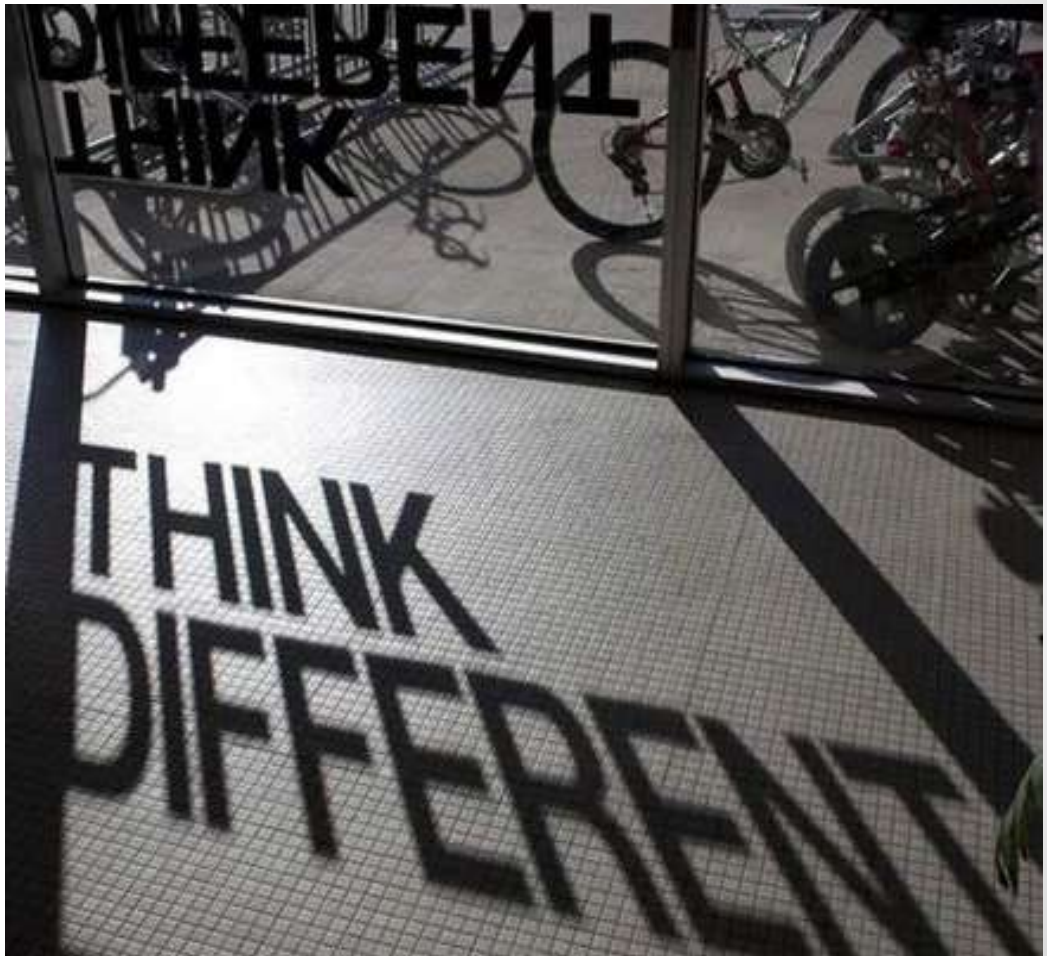
Aircraft`s Future



Final Analysis

- Always evaluate multiple trends

- Focus on the future


THINK
DIFFERENT

- Look for a CLEAR strategy

- More collaborative research must be encouraged to deal with new challenges

Technology Imperative

Collaboration

among companies, research

institutions and governments

Global Cooperation Network

Trustiness

- Failures may represent opportunities


Research and Technology Development
Thanks!
IMPOSSIBLE
“The future is not a gift. It is an achievement!”
Robert F. Kennedy


Thank you
Obrigado!

Global Partners and Suppliers

SAFRAN Technofan Inc.
ZODIAC AEROSPACE
LIEBHERR
AERnnova
Ipeco
senior Aerospace BWT
MICHELIN
SONACA
STG AEROSPACE
LATECOERE
DIEHL Aerospace
Sirio Panel A Finmeccanica Company
Rockwell Collins
Honeywell
CRANE AEROSPACE & ELECTRONICS
ARKWIN
PTI Technologies Inc.
AVTECHTYEE
B/E AEROSPACE
TAT Technologies
EZ AIR
EATON
RITEC
senior Aerospace
Triumph Group, Inc.
MOOG
EMTEQ
Esterline
TACTAIR FLUID CONTROLS INC.
UTC Aerospace Systems
facc

Parceiros e Fornecedores E-Jets E2