



## European Mechatronics Meeting 2013

# “Agitateur d’idées mécatroniques”

Presented by

**Thierry Pardessus**

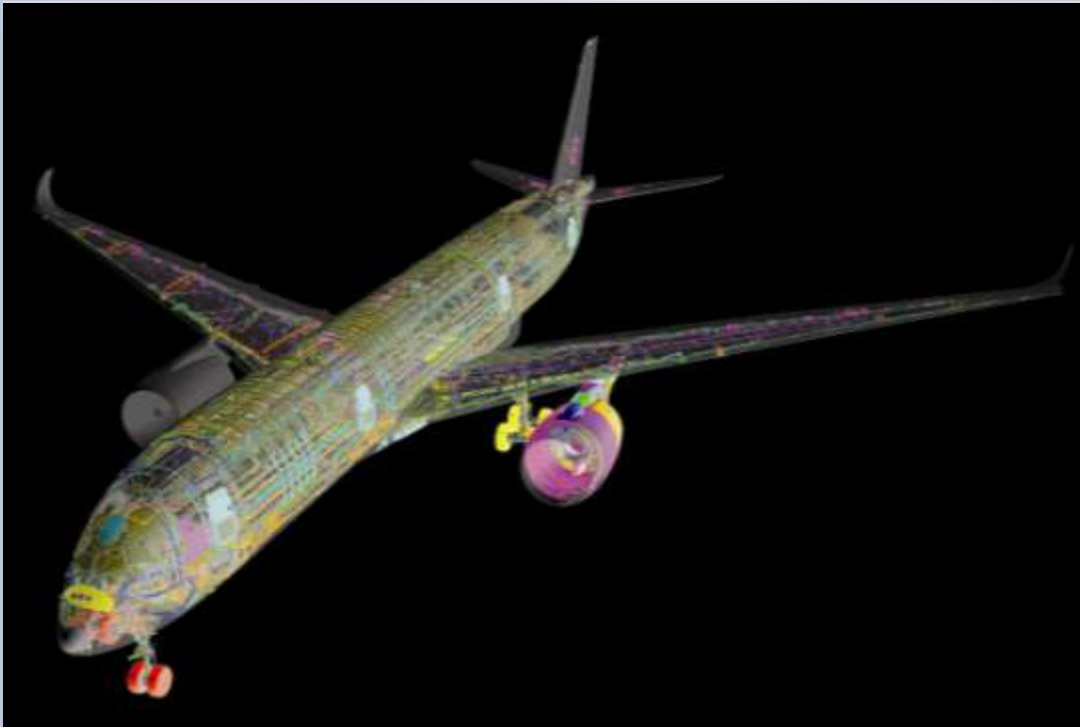
Vice President



*With contributions from Philippe Tatry (Airbus), Sandrine Roques (Airbus)  
and Dr. Bertrand Rives (EADS Innovation Works)*



# Aircraft and Mechatronics



Approx. 30 main architectures:

- On-board power and actuation
- Intelligence

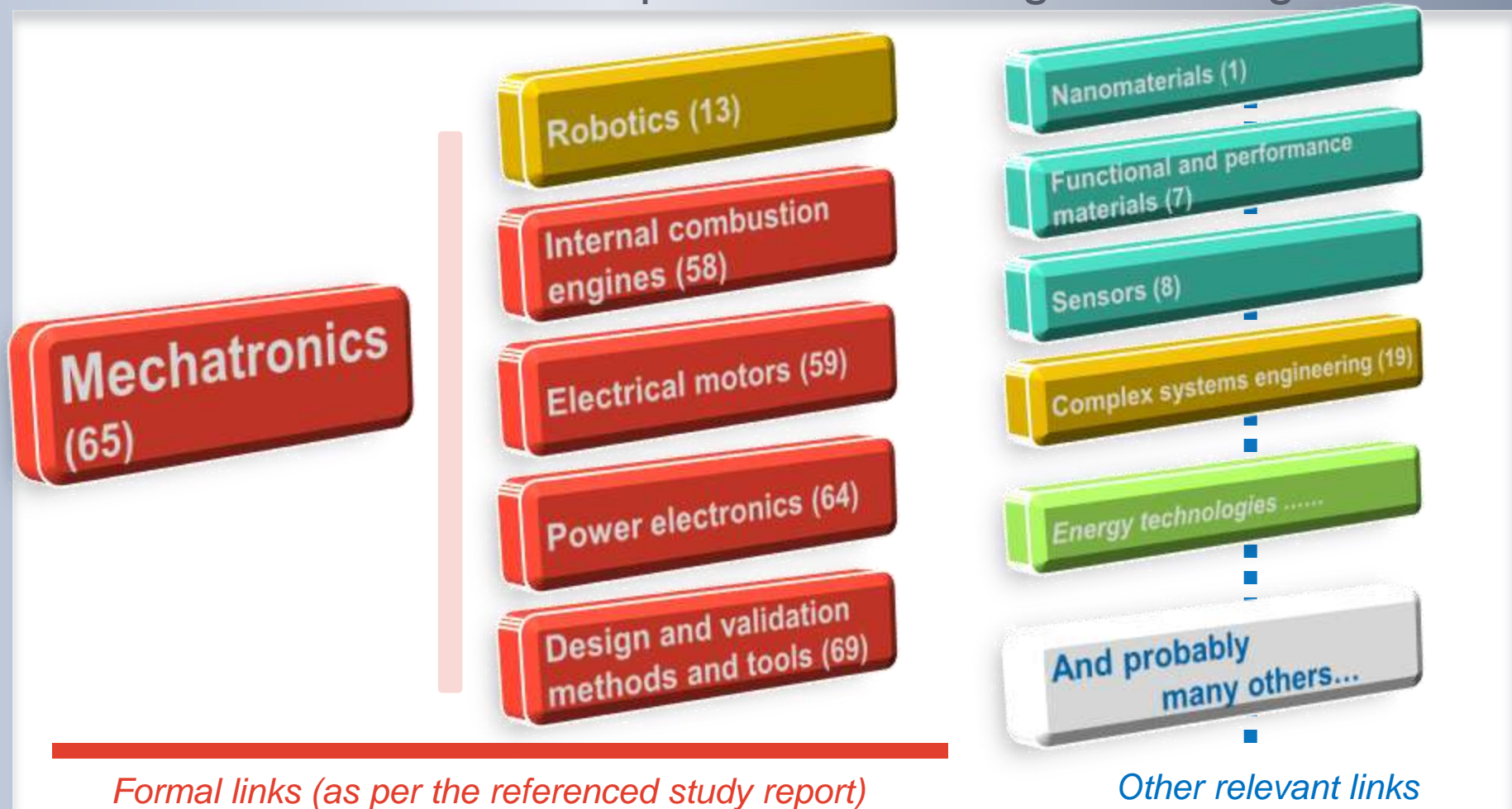


L'Ingénierie Système :  
le point de vue du "Maître de Philosophie" ou  
le besoin d'une pédagogie dédiée ?

**AFIS Conference**  
**Toulouse - May 2006**

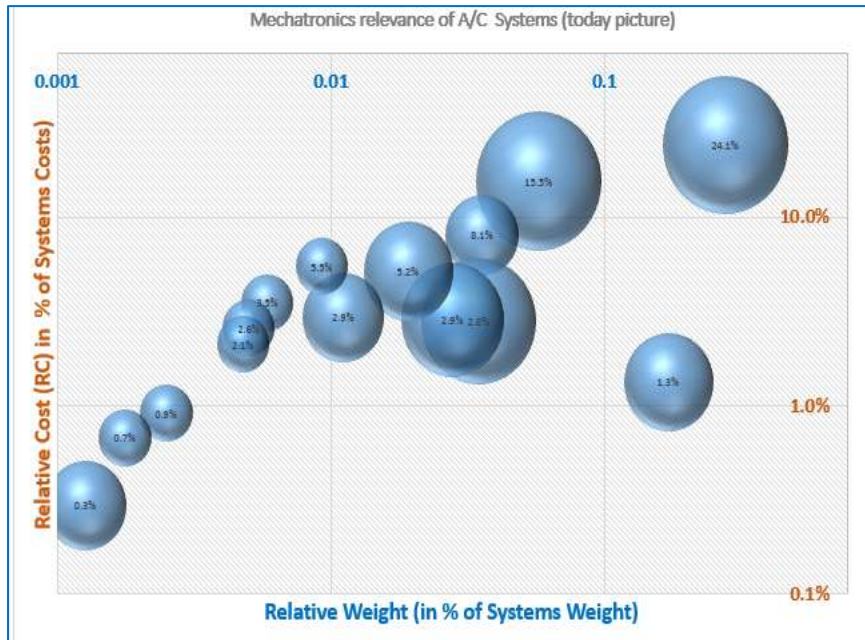
An Aircraft is *per se* a huge  
Mechatronics object, even  
though rarely yet considered  
like that !

# About Technologies: Mechatronics in a broader picture of winning technologies



- Ref. "Technologies clés 2015" - 2010 study, by French Ministère de l'Industrie, de l'Energie et de l'Economie Numérique

# Aircraft and Mechatronics: Where to head the projector ?



*Bubble size = only a principle estimate of the “Mechatronics potential”*

Main “attractors” for mechatronics advances potential:

- Landing Gear system
- Flight Control system
- Equipment and Furnishing
- ...

***Consideration of Systems relative Weight and Recurring Cost in a typical A/C breakdown***

*(on the basis of today’s A/C architectures and solutions)*

# Systems on Aircraft - Operational Environments

➤ Aircraft systems and equipment must be designed and certified against **severe environment** conditions (official document = “DO 160”)

➤ Some typical illustrations / examples :

**Temperature** (-55°C to +70°C)

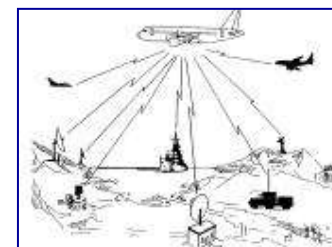
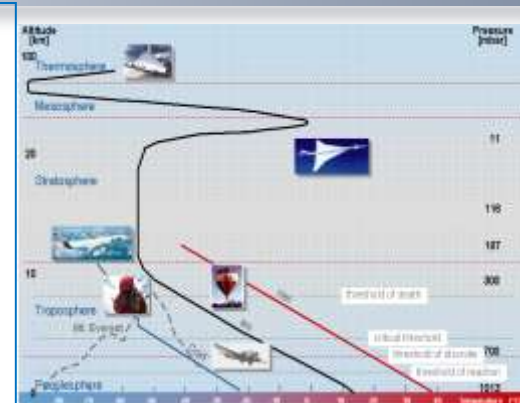
Climatic (temperature, **humidity**, **pressure**)

**Electromagnetic**

- Emitters (internal & external)
- Lightning (direct & indirect effects)
- Electromagnetic compatibility (EMC)  
→ protection, bonding & grounding
- Sensitiveness of advanced electronics to high cruise altitude radiations

**Mechanical**

- Shock, vibrations (envelope specified in Power Spectral Density)
- Acceleration



**Challenge = to design optimized (miniaturized ?) mechatronics solutions where sensors, intelligence and actuators are exposed to those severe operational environment conditions**

# About Technologies

## An illustration: Aircraft Control systems



# About Technologies: Airframe and aerodynamics

- The "Holly Grail" of any Aerodynamicist: **air flow control and fully adapted airframe !**
  - Morphing: → E.g. existing:
    - Variable geometry combat aircraft
    - Hi-Lift devices (Slats ad Flaps)
  - **Which "maximum" level of morphing ? When ?**
  - Targets:
    - A/C performance, comfort

« *The Future by Airbus* »



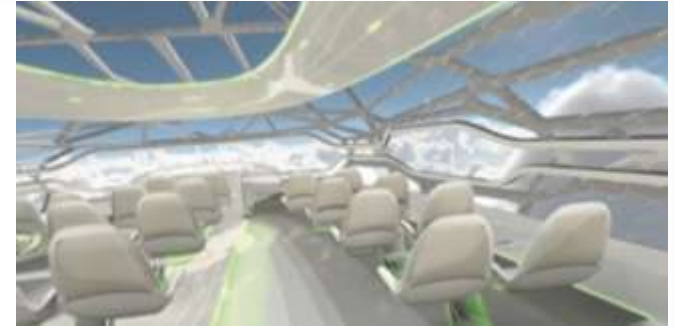
- **What further significant steps in bio-mimicry** could be enabled by mechatronics ?



# About Technologies

## Smart sensing for smart solutions

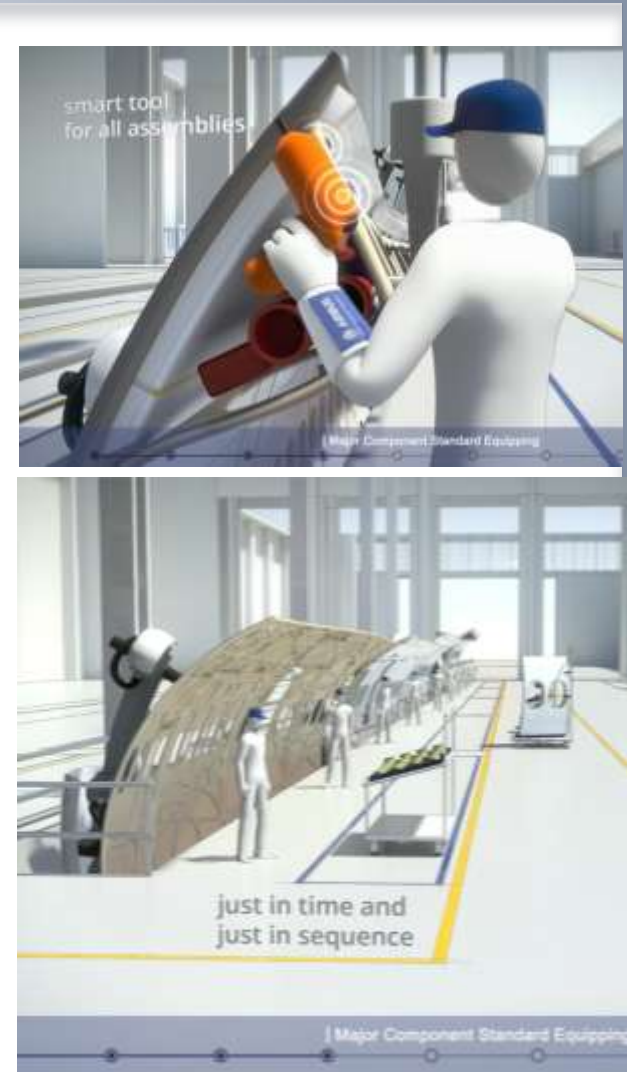
- Why should we stick to discrete sensors and actuators ?
- **→ Towards continuous solutions ?**
  - Cf. Skin, nerves and muscles...
  - ... in association (esp.) to Brain and Heart
- **What performance optimum ?  
New functionalities ?**
- **→ Smart Surfaces**
  - Multi-functional
  - Sensing and Actuating
  - Intelligent,
    - E.g.: Smart surfaces/dynamic liveries for thermal optimization
- **→ Towards “Connected M2M Smart Surfaces”**
  - “Smart Surfaces 3.0” ?**





# About Technologies: Industrial process

- **Industrial processes automation:**
  - **Automated/mechatronics A/C painting process**
    - Real time optimized automated painting: Airframe standard areas + livery decorated areas
    - Localization, thickness/profile measurement, paint/ink application optimization, local environmental control, real time
    - Time saving, quality enhancement
  - **Automated assembly :**
    - Fasteners installation
    - Panels move
  - **Which next degree of mechatronics and automation for the future factory ?**



# About Technologies

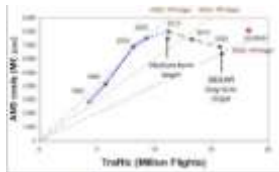
## Air Traffic Management in a Mechatronics perspective

### Air Traffic Management

#### 4D (3D position + time) « contracts »

- Between each A/C and the Air Traffic Control organization
- How ?
  - Sensing A/C position
  - Sensing A/C environment
  - Communication
  - Intelligence (A/C + ATM)
  - Actuation: A/C, fleet

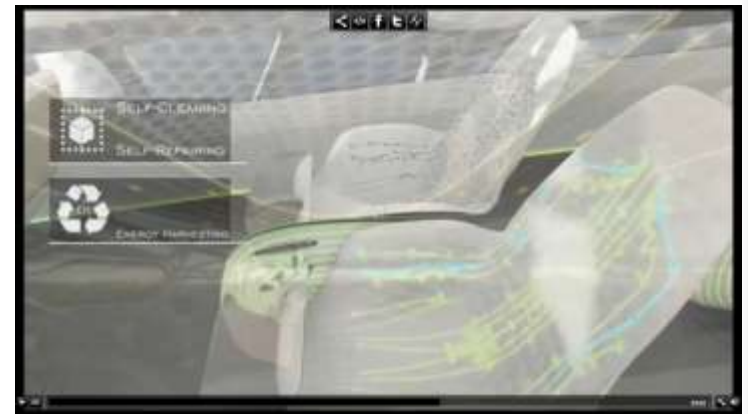
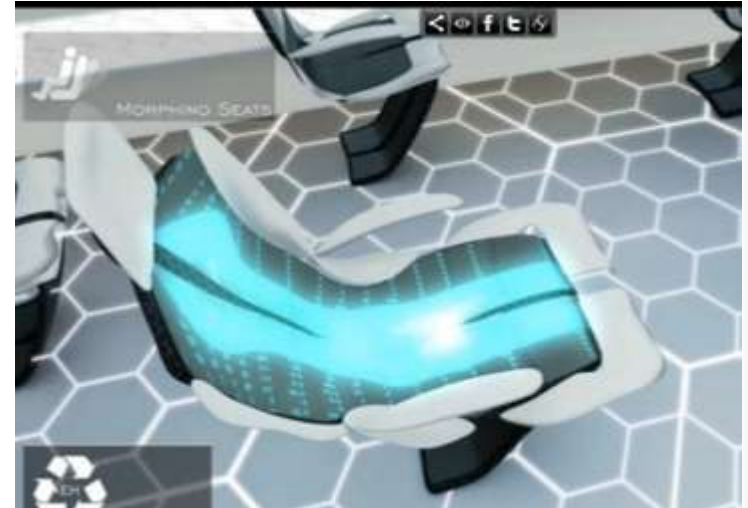
#### « Airbus Smarter Skies Vision »



# About Technologies: Mechatronics for Passenger benefit

- **Advanced comfort solutions**

- Customized onboard services to Passengers at their seat
- E.g.:
  - Adaptive seat morphing
  - Local massage capability
  - Virtual sports...



# About People and Engineering Capabilities

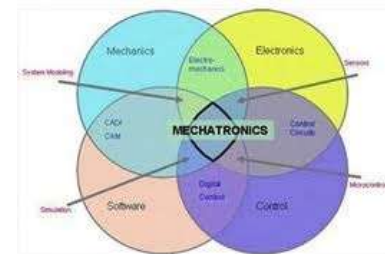
- **Breaking the silos** inside large companies:

- Probably a significant **Change Management dimension**
- → Create and value success stories
- → Create winning superior collective and concrete roadmaps



- Review **academic education programmes** in the view of enhanced Mechatronics features awareness and control:

- Multidisciplinary
- Architecting dimension
- Technology dimension
- Value for usage !



# About the Innovation Ecosystem

- **Boost exchanges and transfers between industrial domains**

- E.g. *via* between clusters, Pôles de Compétitivité, etc.
- Explore beyond established professions
- Shorten the loops between large companies, SMEs, research, education
- → dare triggering and managing some “improbable meetings”

- **Create favourable conditions for enhanced competence/people diffusion and mobility**

- Contests / Prizes ?
- Brief Human Resources teams about Mechatronics ?
- Set-up Houses of Mechatronics to share experience and boost projects (cf. Digital culture) ?
- ...



**The Place To Be !**

# Synthesis

- Mechatronics **must be seen holistically** for aircraft purpose:
  - Passenger
  - Aircraft operation, manufacturing, design for potentially broad range of applications
- **Rigor**:
  - Certification environment (electronics) requirements to be integrated upstream
  - Environmental (“green”) requirements: life cycle analysis and focus in avoiding hazardous materials
- **Selectivity**: appetite for advanced technologies more and more challenged by business and operational reality...
- **A necessary Change dynamic**: to boost Ecosystem and Engineering capabilities enhancement
- **Creativity and innovation**: are necessary !





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