Bigger, Faster, Greener, Cheaper?
Developing the Airbus response to the European Vision 2020 demands

Content

1. ACARE Vision 2020
2. Design drivers for aircraft technology
3. Airbus’ future capability development
4. The European aeronautics research network
5. Fascination aeronautics
6. Conclusion
Evolution or Revolution?

The age of sustainable growth

European Aeronautics - Vision 2020

Challenges and associated goals

- Quality and Affordability
  - Reduced passenger charges
  - Increased passenger choice
  - Transformed freight operations
  - Reduced time to market by 50%

- The environment
  - Reduction of CO2 by 50%
  - Reduction of NOx by 80%
  - Reduction of external noise by 50%
  - Substantial progress towards ‘Green MMD’

- Safety
  - Reduction of accidents rate by 80%
  - Drastic reduction in human error and its consequences

- The Efficiency of the Air Transport System
  - 3X capacity increase
  - 99% of flights within 15' of schedule
  - Less than 15' in airport before short flights

- Security
  - Airborne - zero hazard from hostile action
  - Airport - zero access by unauthorised persons or products
  - Air navigation - No misuse. Safe control of hijacked aircraft

addresses the full scope of customer expectations
How will Airbus implement the vision?

- **Cheaper and passenger friendly air travel**
  - Lower cost
  - Cabin design

- **Reduction of atmospheric emissions**
  - Aerodynamic drag reduction
  - Pylon, Engine integration

- **Reduction of noise**
  - High lift noise
  - Landing gear noise

- **Enhanced safety and security**
  - Airframe noise
  - Passive protection means

- **Increased capacity and reduction of delays**
  - Reduce delays

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Technology as a driver for Airbus
Examples of successful technology implementation

A300  A310  A320  A340-356  A380
- Twin-engine, twin-aisle a/c
- CFRP vertical fin
- 2 man-cockpit
- Sidestick controller
- All new advanced technology wing
- CFRP centre wing box
- Variable Frequency generator

1970  1980  1990  20
- A300B2
- A310-200
- A320-200
- A340-300
- A340-600
- A380

Means for evolutionary progress

- Drag Reduction
- Weight Reduction
- SFC
- Emissions
- Safety & Security
- Cost Reduction
- Noise
- Comfort & Convenience

Classical Priorities for R&T Activities

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Dieter Schmitt - Airbus
Drivers for aircraft design

Conventional, classical configuration

- further
- bigger
- faster
- cheaper
- greener
Design driver “further”
Long Range Aircraft development vs Time

Drivers for aircraft design

- further
- bigger
- faster
- cheaper
- greener

Conventional classical configuration

Range as design driver is reaching natural limit
Design driver “bigger”
The A380

Setting the standards for high capacity aircraft for the next decades

Drivers for aircraft design
- further
- bigger
- faster
- cheaper
- greener
Design driver “faster”

Drivers for aircraft design

- further
- bigger
- faster
- cheaper
- greener

Conventional classical configuration
Understand the challenges of the future

- Which aircraft will answer the multiple challenges of sustainable growth for the 21\textsuperscript{st} century?
- Which aircraft configurations, evolutionary or revolutionary, will offer the opportunities to provide answers to customer expectations?
- Which selection of concepts and technologies should be explored in order to push further current state of the art?

from Vision 2020 to Innovative Capability Development

Rationalise future challenges

Modelling of the world context will provide insight and rationale to prioritise the different concepts for the benefit of the end customer as well as for the aircraft manufacturer.
Understand the challenges

SAFETY and SECURITY

**MARKET REQUIREMENTS**
1. High Productivity
2. Low cost of operation
3. Superior reliability/maintainability
4. Comfort / health driven cabin design
5. Low cost of acquisition / high residual value
6. High flexibility/updatability
7. Family Concept design
8. Market specialisation

**ENVIRONMENTAL PRESSURE**
9. Low noise
10. Reduced emissions
11. Low manufacturing and life cycle impact

**INTEGRATION IN THE SYSTEM**
12. Solution to airport congestion
13. Good airport compatibility
14. Exploiting new ATM opportunities

Key driving requirements for the future air transport system have been captured and analysed

Think out of the box

Future capabilities: driven by a family of concepts tailored to fit specific sets of requirements

The idea is to select concepts to explore the most relevant capabilities and meet the widest range of challenges

Important: these are not intended to be future Airbus products but extreme configurations to develop our capabilities
Environmentally friendly

• **What do we mean with „green“ aircraft?**

  ‣ Just following a green trend?  No
  ‣ Constant effort to reduce fuel consumption?  Yes
  ‣ Further reduction of noise around airports?  Yes
  ‣ Improve production processes to comply with EN9100?  Yes
  ‣ Improve image of aeronautics compared to road and rail?  Yes

**What are the characteristics of a „green“ aircraft?**
The “proactive” green aircraft – design drivers

Concept to drive R&T

- Reduce noise
- Environmental friendly manufacturing
- Reduce fuel burn
- Reduce emissions

Giving minimum affordable impact of aviation operations and manufacturing on the environment

The “proactive” green aircraft – solutions and technologies

Jet noise shielding studies and test in acoustic wind tunnel

- Systems analysis
- Concept to drive R&T
- Engine / airframe integration
- New architectures (contra fan, gearbox)
- Fuel efficient, quiet, clean engines
- High aspect ratio, low swept wing
Cheaper, what does it mean?

- **Improvements in economics has always been a challenge for aircraft manufacturers**

- **What is new?**

- Growing market and increasing segmentation opens niches
  - Fulfil *passenger* expectations between 2 extremes:
    - Transport between A and B at minimum cost
    - Travel from home to destination with optimum services
  - Meet *Airlines* needs
    - Low cost carriers
    - Regional airlines
    - National airlines
    - World standard setting airlines
    - Business airlines

- The *Manufacturers* task is to provide a family of aircraft to satisfy the demands of all airlines

**The approach to „Low Cost Design“ of a new aircraft is a complex challenge**

The “Money Booster” – design drivers

- **Low manufacturing cost**
- **Versatility in operation**
- **Simple and robust design**
- **Maintenace free aircraft**
- **Minimum number of parts**

Putting maximum emphasis on return of investment over life cycle of the aircraft
The “Money Booster” – solutions and technologies

- V-Tail wind tunnel tests
- Lattice structure study
- Simpler flap study
- Integrated diagnostics and prognostics
- Low cost, low weight metallic fuselage
- Flexible cargo & cabin operations
- Simple architectures

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Leading role of Airbus as R&T architect in Europe

Airbus relevant stakeholders in ACARE

- European member states
- European Commission
- National authorities
- Airlines
- Airports
- Research centres
- Universities
- SME Supply chain
- Main suppliers
- ATM
- National authorities
- Airports
- Research centres
- Universities
- SME Supply chain
- Main suppliers
- ATM

Strategic Research Agenda SRA2

5 High level target concepts for Air Transport Systems:

- Ultra cost-efficient
- Ultra time efficient
- Ultra green
- Ultrasound
- Highly customized
Ways to manage R&T in the aeronautics industry

**Way 1:**
R&T is investment in the future
› Own and protect it!

**Way 2:**
Concentrate R&T on essential domains
› Define with partners common R&T projects
Ways to manage R&T in the aeronautics industry

Way 3:
Keep role as aircraft architect and guide your partners
- R&T is based on overall aircraft design capabilities as architect/integrator
- Maintain and support a network of competent/preferred suppliers

Partner involvement in the R&T process

Global R&T activities  AIRBUS R&T activities (incl. external partners)

Technology maturity
- Research Labs: Applied Research
- Universities: Basic Research
- Technology readiness: Validation for specific Components
- R&T Budget per Technology
The TANGO project

- TANGO = Technology Application to the Near-Term Business Goals and Objectives
- Goal: integration of innovative technologies, specific targets for wing and fuselage:
  - 20% weight and 20% cost reduction
- Involves 34 partners in 12 countries

CFRP centre wing box

CFRP fuselage

CFRP lateral wingbox (with metallic joint)

Metallic fuselage

Partner involvement in the R&T process

Cooperation with Universities:
- Basic Research
- Branch on individual performance
- Focus on upstream R&T
- Innovative ideas
- However, short term benefit for industry less evident

Research Labs: Applied Research

Global R&T activities

AIRBUS R&T activities (incl. external partners)

Technology maturity

R&T Budget per Technology

Industry: Validation for specific Components

Universities:

Technology readiness
The VELA project

- VELA = Very Large and Efficient Aircraft
- Goal: Acquiring appropriate knowledge of flying wing design across the main disciplines
- Involves 16 partners from industry and research centres of 8 nations

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Successful Innovation

education systems of excellence

young, talented people

Momentum of Innovation

education

research

training / career opportunities

Attractive business domains with growth potential:
• pharmaceutical
• bio-technology
• air transport
• IT/electronics
• finance/consulting
• automotive
• …

Fascination Aeronautics
Fascinating concepts

Evolution or Revolution?

Air Transport Effectiveness  The age of sustainable growth

The pioneering age

The commercial age

1900's 1950's 2000's 2050's
Conclusion

• Evolution or Revolution?
  › New aircraft programs involve high capital expenditure and risk
    – Evolutionary development may look most probable
  › However:
    – Innovation has been and will be mandatory for the future
    – Innovation needs the best brains and young talents
    – Fascination for Aeronautics is key motivator for young and experienced engineers
    – Exploring new ideas, concepts and dreams is and has to be a constant challenge
    – Well trained and motivated young engineers are the base for future success of this industry

Joint effort from industry, research centers and universities to develop innovative concepts and dreams

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24th ICAS congress Yokohama