A commercial aircraft manufacturer with the two Divisions Defence and Space and Helicopters

134,000+ Total workforce
€1,060 billion Order book
€67 billion Annual revenue
### Passion

Commercial Aircraft’s global workforce is united by a passion for aviation and restless desire to create better ways to fly.

<table>
<thead>
<tr>
<th>Employees</th>
<th>Annual revenue*</th>
<th>Backlog</th>
<th>Operators</th>
</tr>
</thead>
<tbody>
<tr>
<td>54,000</td>
<td>€49.2 billion</td>
<td>6,705</td>
<td>400</td>
</tr>
</tbody>
</table>

Data to end 2016
Aviation in figures

- 3.6 billion Passengers
- 51.2 million Tonnes of freight
- $2.7 trillion Global GDP* annually
- 62.7 million Jobs supported

*GDP: Gross Domestic Product

Source: ATAG 2016
Air Traffic will Double in the Next 15 Years

Air Transport is a Growth Market

60% over the last 10 years

More than double since 2001

Source: ICAO, Airbus GMF 2017

*RPK: Revenue Passenger Kilometres
The Challenge for Aviation: Sustainable Growth

European Union’s Flightpath 2050

-75% CO2
-90% NOx
-65% Noise

Reference year: 2000
History of a Continuous Fuel Burn Reduction

100%

Relative fuel burn per seat

Fuel Burn & CO₂ Reduction

80% per seat since the dawn of the jet age

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History of a Continuous Noise Reduction

Noise Reduction since the dawn of the jet age

75%
Airbus Challenges

Sustainable growth & traffic doubling every 15 years

Commitment to the Flightpath 2050 technology targets

Remain consistently ahead of the competition

Being a game-changer is in Airbus DNA Innovation is key to success!
AIRBUS CHALLENGES

PROPULSION JOURNEY
The Eco-Efficiency & Performance Levers

Aerodynamic  Fuel  Weight  Operations
Road to the Future

Enhance existing platforms & preparing for new configurations

On the track of improving

Through better integration & architecture

Towards new configurations & Urban Air Mobility

Operations

Weight

Fuel

Aerodynamic
On the track of improving

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Aerodynamic
Fuel
Weight
Operations
Towards new configurations & Urban Air Mobility

Road to the Future
Enhance existing platforms & preparing for new configurations

- New engines on existing products
- Advanced composites
- Additive Layer Manufacturing
- Predictive maintenance

Through better integration & architecture

On the track of improving

2050

Operations
Weight
Fuel
Aerodynamic

AIRBUS
New engines on existing products

Benefit from the continuous technology progress
Allow engine configuration changes
Increase aircraft platform capabilities

R&D target
BPR > 15

new technos far beyond

Constantly enhance performance of our flying platforms
Build future & disruptive technologies
The neo story

Aircraft changes mainly contained at engine level

-20% fuel burn per seat

A320, a commercial success!

60% NEO market share

13,000 orders from 300 customers

A321 high demand

-50% Noise & NOx emissions
Lighter & Stronger by Design

Maximise weight reduction & fuel efficiency

Weight

Advanced Composites

 CFRP* Structural Weight

A350XWB
90% of the wet surface is in Carbon

A300
A310/200
A320 / ATR72
A340 / A340-300
A340-600
A380
A400M

0%
10%
20%
30%
40%
50%
60%


*CFRP: Carbon Fiber Reinforced Polymere
Design for Additive Layer Manufacturing

3D-printing: a strong asset for the future

only 5% waste material

up to 50% potential weight saving
Give prior indication of a component/system failure

Thanks to systematic transmission of massive data & data analytics

Allow anticipation & planning of the maintenance

Prevent unexpected failures & operational interruptions

PERFORMANCE  RELIABILITY  SYSTEM INTEGRITY

An Open Digital platform for the aviation industry
Road to the Future

Enhance existing platforms & preparing for new configurations

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- Additive Layer Manufacturing
- Predictive maintenance

On the track of improving

Towards new configurations & Urban Air Mobility

Through better integration & architecture

Operations
Weight
Aerodynamic
Fuel
AIRBUS
On the track of improving...
More Electrical Aircraft

Electrical technologies have to be further explored.

Move from technology bricks development to aircraft architecture & integration.

Architecture & Integration challenges:

- E-ECS: Electrical - Environmental Cabin System
- Propulsion Offtake & Starting
- Ice Protection
- Electrical Network
Optimise cooling architecture & surface cooler integration
Redesign cooling function thanks to heat mutualisation & transportation
Add acoustic attenuation & structural function to surface coolers

Optimize propulsion heat management
to benefit from new propulsion systems
Optimized Operations: 4D trajectory exchange

Enhance ground trajectory prediction

Solve conflicting trajectories upfront

& Reduce traffic congestion

- Time constraint negotiation
- 4D trajectory downlink
- Data link connection

Optimized Operations: 4D trajectory exchange

Enhance ground trajectory prediction

Solve conflicting trajectories upfront

& Reduce traffic congestion
Minimised drag with laminar flow

-5% fuel burn expected

Breakthrough Laminar Aircraft Demonstrator in Europe (BLADE)

2014 – 2015
Wind tunnel tests
Laminar wing & Krueger flap demonstrator

2016
First aircraft parts

2017
Flight tests on Airbus A340

Minimised drag with laminar flow

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Road to the Future

Enhance existing platforms & preparing for new configurations

- More Electrical Aircraft
- Heat management
- Optimized operations
- BLADE
- New engines on existing products
- Advanced composites
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On the track of improving

Towards new configurations & Urban Air Mobility

Through better integration & architecture

Operations

Weight

Fuel

Aerodynamic

2050
Road to the Future

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- Additive Layer Manufacturing
- Predictive maintenance
- Boundary Layer Ingestion
- Open Rotor
- Distributed propulsion
- Hybrid propulsion

Towards new configurations & Urban Air Mobility

Through better integration & architecture

On the track of improving

Aerodynamic
Fuel
Weight
Operations

AIRBUS
Towards new aircraft configurations

Boundary Layer Ingestion

Minimises propulsor effort & reduce total drag

Benefit from slower moving air at the boundary layer

Define optimum inlet distortion & fan reinforcement
Address propulsion integration in unusual location
Analyse & solve integration effects

~10% fuel burn reduction
Open Rotor

- Push propulsive efficiency to the limit
- ~6% Fuel burn saving vs. advanced UHBR
- Lower cruise speed
- Position propulsion system for safety and comfort
- Cost challenge

UHBR: Ultra High Bypass Ratio
Hybrid Electric Propulsion

Explore new configurations

From electrical motoring boost

To full electrical motoring

Develop technology bricks to investigate higher levels hybridation & distributed propulsion

Develop integration technologies and logistic solutions

Define certification basis with authorities
Towards Urban Air Mobility

Airbus is taking a pioneering role in opening the market, while developing and exploring new vehicle concepts, systems and business models.
Conclusion

Fusion of Propulsion System with the Overall Aircraft Design is a must

The engine is the key contributor to Aviation environmental challenges

Will we still need air breathing engines in 2050?

Are you ready for the paradigm shift?
Thank You

Q&A