INTERNATIONAL TITANIUM ASSOCIATION 2011
Perspectives and challenges of the Titanium Supply Chain in Airbus

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Air travel remains a growth market

World annual traffic (RPKs - trillions)

- Air traffic has doubled every 15 years
- 20-year world annual traffic growth: 4.8%
- Air traffic will double in the next 15 years
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ICAO total traffic

Airbus General Market Forecast
Market validation

236 firm orders from 18 Customers

All 3 alliances represented

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The A380 network keeps growing
56 A380s delivered, 39 routes, 25 destinations

Additional airline-announced routes for 2011 shown dotted
The A380 expands operations to North America

Making headlines

Summer 2011: 8 new A380 routes to U.S. and Canada

- CDG-SFO 6th June
- FRA-SFO 10th May
- NRT-LAX 1st July
- ICN-LAX 11th October
- ICN-JFK 9th August
- CDG-IAD 6th June
- FRA-MIA 10th June
- Montreal
- New York
- Los Angeles
- San Francisco
- Washington DC
- Miami
- CDG-YUL 22nd April
A320 Family: A totally new context since mid 2009

We never stopped developing the A320 …

• Equipment redesign
• Sharklets ➔ -3.5 % fuel burn
• A320neo ➔ -15 % fuel burn (incl. sharklet)
A320neo market response

More than 1200 commitments!

The most successful Single Aisle strategy on the market
A350 XWB

567 firm orders
35 customers

25 Countries – 3 Alliances – 4 Leasing companies
Use of Titanium on Airbus aircraft

<table>
<thead>
<tr>
<th>Year of Manufacture</th>
<th>Aircraft Type</th>
<th>% Ti</th>
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</thead>
<tbody>
<tr>
<td>1987</td>
<td>A320</td>
<td>6</td>
</tr>
<tr>
<td>2006</td>
<td>A380</td>
<td>10</td>
</tr>
<tr>
<td>2013</td>
<td>A350</td>
<td>15</td>
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A320neo will slightly change the picture (more Titanium in engines and on the pylon)

The use of Titanium is increasing with each aircraft generation
Ramp-up within the Titanium Supply Chain is NOW

- Titanium raw material needs in development phase 2 years before FAL date (going down to 1.5 years in series production)
- Management of changes for development programmes requires flexibility
Volume forecast

+30% in units in 4 years
+60% in revenues

today
EADS Titanium Raw Material Needs

Increase up to 3 X against today needs

FRP

Billet


5th October 2011
EADS Programme Impact

EADS Billet gross demand Evolution 2012-2016

- A350
- SA
- A380
- A400M
- ATR
- EC prog
- F7X
- LR

Trade-off Machining vs. Casting

1. **Titanium ribs machined from plates**
   - **Plate** → **Machining** → **Final part ~ 10% of input weight** → **Swarf ~ 90% of input weight**
   - Most of the material value - key driver for total cost - lost in the value chain!

2. **Titanium ribs casted**
   - **Billet** → **Casting** → **Final part ~ 80% of input weight** → **Swarf ~ 20% of input weight**
   - Longer & less automated process BUT most of material remains in the value chain!

Wrt. titanium trend of price, business case becomes profitable to change manufacturing process from machining to casting

*Source: metalprice.com*
Vertical Integration

- Tier 2: Raw Material provision
- Tier 1: Machining process
- Assembly

- 90% Swarf
- Recycling

Vertically integrated supply chain

- Significant cost reduction (logistics, swarf re-utilisation)
- Streamlined value chain
Conclusion & priorities

- Airbus/EADS will use more Titanium in the future
- Airbus/EADS offer to suppliers 7 years firm production outlook
- Airbus/EADS expect competitive offers (price, quality, flexibility)
- Needs to secure supply chain and OTDQ
- Vertical Integration and casting / machining trade-offs
- Continue to work on R&D for Titanium improved material