Titanium in Military Airframes

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GO ARMY!
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History of GKN Plc in Short

- The story of GKN began in 1759 when the Dowlais Iron Company was set up in the village of Dowlais in South Wales, John Guest was appointed as manager of Dowlais.

- The current company, GKN plc, was incorporated as Guest, Keen and Co Limited on 9th July 1900 on the merger of the Dowlais Iron Company with Arthur Keen's Patent Nut and Bolt Company.

- In 1902 the Company acquired Nettlefolds Limited, one of the world's leading manufacturers of screws and fasteners.

- Over the years the Company transitioned out of the Iron and Fastener businesses and into Marine, Aircraft and Automotive production.
Titanium in Military Airframe Production

- Focus on Major Platforms using Titanium in Airframes
- Global Military Airframe Production
- Titanium Demand in Airframe Production
- Growth in Titanium content not restricted to the commercial sector
- Effect on Titanium Demand with Sustained Legacy Program Production
- Downstream process capacity concerns
Global Airframe Production

Total Military Airframe Production will grow to 37% of Global Airframe Production by 2015, up from current 28%.

Market Drivers are JSF and Russia.

Russia will double military aircraft production by 2025 (source: RIA Novosti, 11 Aug 07).

Sources: Teal Group, Airline Monitor, GKN
Military Airframe% of Global Titanium Demand

The Market Share of Titanium for Military Airframe Production will increase to 29% in 2015, up from 20% in 2007.
Titanium Content Growth in Fighters

Next Generation Aircraft will contain a higher Titanium content than legacy platforms.
Projected Increased in Titanium Demand

Within the Military sector the increased content of Titanium in future platforms and expected higher build rates, demand for Titanium is anticipated to double by 2015.
Titanium in Military Airframe Production

- Main drivers in the forecasted demand are the F18, JSF, A400M, Russian platforms

Percentage of Military Transport and Fighter Airframe Titanium Demand

- JSF + Russian = 80%
- All Others = 20%

Photos courtesy of Aviation Link
Effect of Sustained Legacy Production

What happens if production of existing platforms is extended beyond current forecast models?

Impact on Military Airframe Titanium Demand with Sustained Legacy Production

- JSF + Russian = 65%
- All Others = 35%

Photos courtesy of Aviation Link
Total Military Airframe Production would be expected to grow to 41% by 2015, a 13% increase or 4% higher than without sustained production.
Titanium demand in Military Airframe Production would be expected to grow to 32% by 2015, or 3% higher than without sustained production.
Where Does the Metal Go?

- With the forecasted growth of Titanium Mill Production there must be corresponding growth in processing the material.

- Areas of Capacity Concern:
  - Forging
  - Casting
  - Forming
  - Machining

- The following slides review Machining Capacity
Titanium Machining Capacity

- Titanium Mill Products are not fly away products
- Most Products will be processed by Machining Companies
- The Products are generally Forgings, Plate or Bar Products
- Assuming the Product distribution of:

![Aerospace Titanium Product Distribution Pie Chart](chart-image-url)
## Titanium Machining Capacity

### Machining Capacity Requirement Calculation

<table>
<thead>
<tr>
<th>Year</th>
<th>Military Only</th>
<th></th>
<th>Military and Commercial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assumed Pounds to Aerospace Sector</td>
<td>10,000,000</td>
<td>20,000,000</td>
<td>50,000,000</td>
</tr>
<tr>
<td>10% of Volume Produced as Sheet</td>
<td>(1,000,000)</td>
<td>(3,000,000)</td>
<td>(7,500,000)</td>
</tr>
<tr>
<td>15% of Volume to Casting/Extrusion/Others Products</td>
<td>(1,500,000)</td>
<td>(2,000,000)</td>
<td>(5,000,000)</td>
</tr>
<tr>
<td>75 % to Machining Companies</td>
<td>7,500,000</td>
<td>15,000,000</td>
<td>37,500,000</td>
</tr>
<tr>
<td>8:1 Buy to Fly Ratio</td>
<td>6,000,000</td>
<td>12,000,000</td>
<td>30,000,000</td>
</tr>
<tr>
<td>Equivalent cubic inches (.163 density)</td>
<td>36,809,816</td>
<td>73,619,632</td>
<td>184,049,080</td>
</tr>
<tr>
<td>Machining Hours at 60 cubic inches per hour removal rate (1 cu in/min)</td>
<td>306,748</td>
<td>613,497</td>
<td>1,533,742</td>
</tr>
<tr>
<td>Annual Hours Available per Machining spindle (90% of 365 x 7)</td>
<td>2,300</td>
<td>2,300</td>
<td>2,300</td>
</tr>
<tr>
<td>Machine Tool Utilization 80%</td>
<td>1,840</td>
<td>1,840</td>
<td>1,840</td>
</tr>
<tr>
<td>Spindles Needed in a Year</td>
<td>167</td>
<td>333</td>
<td>834</td>
</tr>
</tbody>
</table>

**Required growth in Machining Capacity**

<table>
<thead>
<tr>
<th>Military Only</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Military and Commercial</td>
<td>40%</td>
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</tbody>
</table>
Titanium Machining Capacity

2015 - Machining Capacity Sensitivity Analysis

- 40% Growth, 20% Sheet, 20% C/E/O, 1 cu. in/min
- 40% Growth, 10% Sheet, 5% C/E/O, 2 cu. in/min
- 15% Growth, 10% Sheet, 5% C/E/O, 1 cu. in/min
- 10% Growth, 20% Sheet, 20% C/E/O, 2 cu. in/min

Number of Machining Spindles

28%, 24%, 18%, 11%
In Summary

- A minimum of 11% growth of hard metal machining capacity is required by 2015.
- Most likely scenario is 28% growth required.
- Major Capital Investment in processing the forecasted Titanium Production is required to meet OEM build rates.
- Competing Capital Issues
  - These capital funds will be distributed between similar demand forecasts for Aluminum.
  - Aluminum High Speed machines are not suitable for Titanium machining
Thank You