Titanium Demands and Trends in the Defense Market

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# History of Titanium in Defense

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<thead>
<tr>
<th>Decade</th>
<th>Aircraft/Equipment</th>
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<tbody>
<tr>
<td>1950s</td>
<td>SR-71</td>
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<td>1960s</td>
<td>F-4</td>
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<td>1970s</td>
<td>CH-53K</td>
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<td>1980s</td>
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<td>C-17</td>
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<td>2000s</td>
<td>Howitzer</td>
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<td>2010s</td>
<td>F-35</td>
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<td>2020s</td>
<td>Stilleto</td>
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<td>1950s</td>
<td>A-400M</td>
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**Photos courtesy of DoD**
Global Defense Megatrends

- Defense Budget Growth
- Near-Peer Competition
- Regional Instability
- Persistent Terror Threat
- Growing Trade Tensions
Information obtained from public sources including the US Defense Budgets, SIPRI, ISH Jane’s, Deloitte and NATO Secretary General’s Annual Reports
Global Defense Aircraft Trends

- Next generation fighter aircraft production rates increase
- Legacy fighter aircraft maintain backlogs
- Trainer aircraft demand continues in multiple regions
- Cargo and special purpose remain stable

Source: Forecast International
Top 10 Defense Fixed Wing Aircraft Manufacturers

2019 Estimate of Annual Aircraft Units Produced

Source: Forecast International
Titanium Demand for Fixed Wing Aircraft

2019-2023 CAGR Est. 2.1%

Source: Forecast International

Titanium Trends in the Defense Market
Other Uses for Titanium--Land and Maritime

Ground Vehicles

• Weight challenges in manned vehicle design are unsustainable, driving increased usage of Titanium in ground vehicles

Maritime

• Limited growth from renewed naval construction
• Acquisition cost outweighs life cycle cost savings—initial acquisition cost and reliance on mature ship designs are barriers to Titanium adoption
Titanium Usage Threats and Opportunities

- Additive Manufacturing
- Composites
- New Titanium Alloys
Summary

• Geopolitical uncertainty continues to influence defense spending
• Titanium demand is picking up based on strong defense budgeting around the globe
• Concerns over tariffs and sanctions continue to effect defense buying decisions
• New defense platforms such as the new bomber, trainer and continued demand for fighters is driving year over year growth