

## Aerospace Aftermarket Supply Chains

Most aerospace companies would agree that the majority of their revenues in future years will come from the ‘aftermarket’, i.e. maintenance, repair and overhaul (MR&O) contracts, and spares support and sales. Rolls-Royce estimates that in 2005 approximately 59% of the civil aerospace business profits (£1.8bn) are attributable to ‘service’; including the supply chain. Aftermarket supply chains - which address maintenance, repair and overhaul needs - are characterised by unstable demand and supply. Research performed by other parties has confirmed that:

- 35% of total cost for complex assets is acquisition
- In the US Department of Defence: 30% of the budget is operating and maintaining and 60+% of an aircrafts cost is maintenance

Cranfield School of Management’s Supply Chain Research Centre has researched the design and configuration of aftermarket supply chains. The differences in the key characteristics for production and aftermarket supply chains can be summarised as follows:

<b>Characteristic</b>	<b>Production</b>	<b>Aftermarket</b>
<b>Focus</b>	<i>Cost reduction</i>	<i>Responsiveness</i>
<b>Demand uncertainty</b>	<i>Low</i>	<i>tends to High</i>
<b>Supply uncertainty</b>	<i>Low</i>	<i>tends to High</i>
<b>P:D time</b>	<i>Long</i>	<i>Short</i>
<b>SKU’s</b>	<i>Few</i>	<i>Many</i>
<b>Volume</b>	<i>High</i>	<i>tends to Low</i>
<b>Parts classes</b>	<i>Runners</i>	<i>Runners, Repeaters, Strangers and Aliens</i>
<b>Safety stock level</b>	<i>Low</i>	<i>High</i>
<b>Ordering</b>	<i>Centralised</i>	<i>Decentralised</i>
<b>Order decoupling point</b>	<i>Towards lower tiers</i>	<i>Towards the customer</i>
<b>Control</b>	<i>JIT</i>	<i>Forecast</i>
<b>System</b>	<i>Pull</i>	<i>Push</i>
<b>Margin</b>	<i>Low</i>	<i>High</i>
<b>Priority</b>		<i>???</i>

Research is ongoing with Rolls-Royce as the focal firm, in conjunction with companies from their aftermarket supply chains. Our research has determined that:

- High external entry barriers
  - Not just about price as aerospace products are complex with high levels of knowledge involved.
  - The knowledge needs to be mined over the products lifecycle.
- Significantly higher profit margins
  - Cost of manufacturing equipment is amortised against production units.
- Different rules
  - Not just about price as aftermarket supply chains need to be both responsive and agile.
  - Can necessitate a move from a manufacturing to service orientation or possibly a hybrid as components that are used in production may also be used in the aftermarket due to the long product lifecycle (25+ years).

- Good service becomes a differentiator
  - Companies such as Caterpillar have leveraged their strong service record.
- Difficulty of managing some parts
  - Once production has ceased demand for some components remains high whilst with others it approaches zero.
- Capacity leasing agreements
  - With ‘power by the hour’ the risk of supply chain failure is compounded as the risk for maintaining levels of spares is borne by the provider.

The Supply Chain Research Centre was recently awarded a Knowledge Transfer Partnership (KTP) with a value of £280,000 over two years. KTP's encourage the application of our wealth of knowledge and expertise to business problems. This partnership is with Rolls-Royce Civil Aerospace, and aims to restructure aftermarket supply chains and to model costs. Our project aims to improve service levels to end-customers, and to reduce response times. The project presents a unique opportunity to generate new knowledge in high variety, low volume service settings. The project will take a cross-supply chain approach, allowing solutions to be reached quickly for the benefit of all partners.

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