Over the last three decades, China’s manufacturing industry has become increasingly competitive and is expanding rapidly. However, the majority of this manufacturing is resource intensive and normally falls within the middle and lower end of the value chain. As a result, China now faces environmental challenges and resource shortages and has responded by seeking to move away from resource-intensive manufacturing.
The aerospace, automotive and shipbuilding industries are three of the areas where wide-scale industrial upgrading is taking place in China:

- A large amount of expenditure has gone into R&D in the commercial aircraft industry. This is intended to make it more efficient and less resource intensive. It will also produce a knock-on effect on related industries such as machinery, electronics, metallurgy, chemical, material, energy and information technology. The Chinese government hopes that the initiative will drive related industries to improve both technology and cost-effectiveness levels.

- In 2004, the Chinese government formulated its latest policies regarding auto manufacturing to put more emphasis on technological upgrading and energy efficiency.

- The Chinese government is also keen to advance the marine engineering industries to improve local technological capabilities.

Developments across the aerospace, automobile manufacturing and shipbuilding industries are creating significant business opportunities for UK engineering companies.

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**UK CAPABILITIES AND THE CHINA MARKET**

UK engineering companies are marketing their products and services across a wide range of sectors in China. Key sectors for UK firms are aerospace, automotive, shipbuilding (marine engineering), construction, oil and gas, and power generation. Large UK companies, like Rolls-Royce, Lloyds Register, Holset, Arup, British Gas and Delta Control, are highly regarded in China for their cutting-edge technologies in their fields. These firms are active across a broad range of advanced engineering sectors, from turbine technology to coal gasification.

### China’s Requirements

<table>
<thead>
<tr>
<th>China’s Requirements</th>
<th>UK Capability</th>
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<tbody>
<tr>
<td>A large and fast-growing aircraft manufacturing market: China’s large commercial aircraft project began in May 2008 (see below). Boeing predicts that by 2020 demand in China for new passenger aircraft will be in excess of 2,600.</td>
<td>The UK is at the forefront of many advanced engineering sub-sectors, including design, software, airframe manufacturing (advanced materials and CNC machine tools), airborne equipment (instrumentation and advanced control systems) and supply chain management.</td>
</tr>
<tr>
<td>China has the second largest and most dynamic automotive manufacturing market in the world. By 2010, its auto output will reach 10 million units per year.</td>
<td>Model designs, rapid prototyping services, metallurgical processes, bespoke machines, automation, key components manufacture (gear boxes, airbag apparatus, driving axles and shock absorbers), project management, technical consultancy and training.</td>
</tr>
<tr>
<td>China has the third-largest shipbuilding market in the world. In 2006, its shipbuilding output reached 14.5 million deadweight tonnes, accounting for 19 per cent of the global shipbuilding market.</td>
<td>Design, software, advanced steel making, key components (i.e. diesel engines, power generators, transmission systems, propellers, blades and instrumentation) and training.</td>
</tr>
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| 3. Source: China Association of the National Shipbuilding Industry |

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The cities identified as having potential in advanced engineering sectors, namely Dalian, Harbin, Suzhou, Xi’an, Chengdu, Hangzhou, Qingdao, Shenyang, Tianjin and Wuxi, have established industrial clusters in automotive, components, aircraft and shipbuilding. The exception is Daqing, which instead has strength in oil drilling, petrochemical equipment and instrumentation.

Aircraft Manufacturing
The Chinese government has launched a large aircraft development programme (see box below), which is divided between Shanghai and Xi’an. Shanghai is designated as the research, development and manufacturing centre for large commercial aircraft in China, while Xi’an is dedicated to military aircraft. A government target is to build up the nation’s capabilities in large commercial aircraft manufacture by 2020.

In addition, Harbin (medium-size airliners and helicopters), Shenyang (“fighter jets”), Tianjin (Airbus assembly) and Chengdu (“fighter jets”) are also well-known clusters for aircraft manufacture.

Highlighted opportunities for UK companies in aircraft manufacturing include:
- Software for design, aviation control systems, production planning, supply chain management, testing and simulation
- Manufacturing technologies for world-class aero-engines.

China’s Commercial Aircraft Programme
The aerospace sector is split into military and commercial segments. Currently, two state-owned companies, AVIC I and AVIC II, control both military and commercial aircraft manufacturing. International companies find it difficult to operate in this opaque market.

On the other hand, the government is nurturing a separate commercial aircraft industry, which is to be driven by market forces. As a result, in May 2008, China Commercial Aircraft Co Ltd was formed to develop and manufacture large commercial aircraft. This is intended to bring about greater competition in the market and may create business opportunities for UK companies.

Manufacturing technologies
Chinese manufacturers are looking to upgrade their facilities with world-class technologies. Particular areas of interest include: robotics, automation, metrology, CAD/CAM/CAE, high precision machine tools, system integration and supply chain management.

Design consultancy
This area includes design, adaptation of existing technologies to the local environment, rapid prototyping, “concept to manufacture”, as well as research and development-based project management. To upgrade technologies, Chinese manufacturers are increasingly undertaking their own R&D and thus there is a growing demand for technical consultancy.

Advanced materials
As China’s manufacturing is moving up the value chain, demand is rising for advanced materials such as composites, ceramics, nano-materials, advanced metals and related technologies.

Energy/environmental technologies
There is also a movement towards technologies which optimise energy usage and which are environmentally friendly, e.g. hybrid electric vehicles and coal gasification.

Many areas of advanced engineering-based manufacturing are considered too technology intensive and investments in these areas are therefore encouraged by the Chinese government. Nonetheless, UK companies should be aware of intellectual property right (IPR) issues, as counterfeiting and piracy continue to be significant challenges in China. For IPR protection, international companies typically keep their core research and development overseas, while running manufacturing operations in China.

The business opportunities which run across aerospace, auto manufacturing and shipbuilding in China can be summarised as follows:
Aircraft Components
Partly because of their proximity to Shanghai, the cities of Hangzhou, Suzhou and Wuxi have become specialist clusters for aircraft component manufacturing. In the component manufacturing markets, the key opportunities for UK companies are:
- Foundry and casting technologies
- High-precision machining
- CNC machine tools
- Testing facilities and technologies
- Quality control and audits
- Consultants
- Training

Automotive Manufacturing
Changchun and Wuhan are the oldest automotive manufacturing centres in China and were once based on technology from the former USSR. Post 2000, Changchun has outperformed Wuhan in considerably upgrading its technologies by attracting substantial FDI inflows in the sector, although Wuhan is now catching up in this regard. Changchun and Shanghai are close rivals in the automotive manufacturing sector. Shenyang and Tianjin are also emerging as important auto manufacturing centres.

Highlighted opportunities for UK companies are:
- Model design and development - technical consultancy and rapid prototyping services
- Steel-making technologies (for car bodies) - provision of technical services and bespoke equipment
- Metal fabricating technologies
- High-quality engine manufacturing - adaptation of existing Western technologies to the Chinese environment
- New energy-based engine development (i.e. hybrid electric engines).
- Technical training for Chinese engineers and managers.

Automotive Components
Shanghai's success in the automotive industry is due in part to outperforming the auto component capabilities of nearby cities such as Hangzhou, Suzhou and Wuxi. These cities are well-known clusters for international and domestic auto component manufacturers. For instance, Holset (the UK turbocharger manufacturer) runs a successful operation in Wuxi. International companies normally dominate the supply of higher-end products, while domestic manufacturers occupy the lower to middle end of the market. Consequently, the more cost-effective and higher-quality component supply in these regional cities in turn helps Shanghai outperform other Chinese automobile manufacturing centres.

Opportunities for UK companies include:
- Auto mechanical and electronic component manufacturing
- Manufacturing technologies, including foundry, casting and plastic-moulding technologies; high-precision cutting, lathing and machining; and finishing treatments.

In terms of outward investment in this sector, a number of Chinese component companies are keen to become OEMs for international brands. In order to win approvals, an increasing number of them are operating their research and development facilities in the USA or Europe to help them respond promptly to customers’ needs. The UK has advantages in research infrastructure, talent pools and easy access to major European markets and is an attractive choice for Chinese investors.

Shipbuilding
The shipbuilding market is grouped into military and commercial categories. At present, two state-owned firms, China Shipbuilding Industry Corporation (CSIC) and China State Shipbuilding Corporation (CSSC), dominate in the military sector. International companies are required to enter into joint venture partnerships with Chinese firms in shipbuilding. In addition, foreign investors are not allowed to own more than 49 per cent of the joint venture company. However, international shipbuilders can choose joint venture partners outside of CSSC or CSIC. This liberalisation allows joint ventures, as independent shipbuilders, to compete with the two bodies.

According to the China Association of the National Shipbuilding Industry, independent shipbuilders make up 33 per cent of the Chinesemarket while CSSC and CSIC control the remainder.

Shanghai, Dalian and Qingdao are the oldest and largest shipbuilding centres in China. CSIC controls the majority of shipbuilding assets in Dalian and Qingdao, while CSSC dominates in Shanghai.

Nantong is an emerging centre for shipbuilding, where China’s largest independent shipbuilder, Nantong COSCO KHI Shipping Engineering Ltd (NACKS), is based. NACKS is a joint venture between COSCO (China’s largest sea carrier) and KHI (a Japanese shipbuilder).

Although the government is encouraging localised manufacturing of “key” components, the industry still relies on imports of certain components and technologies. This gives rise to a number of opportunities for UK companies in the following areas:
- The provision of world-class manufacturing technologies, such as joining technologies (welding)
- Marketing opportunities for “key” components, such as high-powered, low-speed, diesel engines (HPLSE), crankshafts and other components for HPLSE, marine navigation systems and marine automatic systems
- Local manufacturing of “key” components.