Aerospace - Executive Summary

The Aerospace industry is critical to India's strategic and economic interests and is characterized by high growth potential. Although Indian aerospace industry is in nascent stage contributing to mere 0.25% to the global industry, it has shown tremendous growth over the years growing at nearly 20% per year since 2004. India's total exports for the sector stood at US$ 1.5 billion in 2010, out of which more than 96% of the contribution was from aircraft parts.

Aerospace industry have six core manufacturing processes: Design Engineering; Component Manufacturing (Tier -3) like castings, forgings, sheet metal components, power & electronic components etc.; Component Manufacturing (Tier-2) like hydraulic systems, electrical systems and avionic & flight components; Subsystem Manufacturing; Aircraft Assembly; and MRO. Considering the strategic nature of the sector, and India's miniscule contribution to global aerospace sector, it is imperative that impetus needs to be given to entire value chain to increase the competitiveness of Indian aerospace sector.

The U.S. is the world leader in aerospace exports contributing to 36% to global exports of US$ 221 billion in 2010. France & Germany are the other competitive countries, serving some of the major import markets like U.K., Spain and Ireland. France contributed of around 21% to world exports in 2010[1]. Of late China has also been fast catching up with top global aerospace OEMs shifting their base in China. China has seen tremendous growth in exports having an export CAGR of around 12% for the last 5 years from period 2005-10. However, the production is growing at much higher rate than the exports due to high domestic consumption. India, in-spite of showing phenomenal growth in the aerospace sector (having export CAGR of almost 90% for a period of 5 years from 2005-10); had very miniscule contribution in world exports in 2010. India contributed to meagre 0.7% to the world aerospace exports in 2010.

China's aerospace industry has been benefited from the focused approach of the government over the last two decades. During this period, the industry has witnessed several structural changes led by the government to consolidate the country's capabilities in military as well as commercial aerospace. China has also centralized its aerospace activities under one ministry at the Government level. The Chinese government has made huge investments in research and development and in creating a supportive environment, through introduction of large amount of foreign equipment at major institutes, design offices, and universities and colleges. Further, tie-ups and joint ventures with foreign aerospace manufacturers has helped China in keeping high quality standards and receiving international certifications for processes and parts, which is a key to maintaining global competitiveness for higher exports.

The US's aerospace industry is the largest in the world and is a leading exporter of civil aircrafts and aerospace components. Since the 1970s, USA has negotiated and entered into a number of major international agreements that have significantly liberalized trade of civil aircraft products and reduced government intervention in the civil aerospace market. The aerospace market in the US has been successful in attracting foreign firms because it is the largest in the world & has a skilled workforce and strong support at the local and national level for policy and promotion.

A comparative assessment of Indian aerospace industry vis-à-vis that of competing countries points out to the following key points:

[1] International Trade Centre Trade Statistics, D&B Analysis

1. ***Huge government investments have boosted industry growth in competing countries***

The aerospace industry is highly capital intensive and requires huge investments at the growth phase as well as during regular intervals in order to maintain the planned growth rate. The Chinese government has made huge investments in research and development and in creating a supportive environment, through introduction of large amount of foreign equipment at major institutes, design offices, and universities and colleges (Civil Aviation University of China), and increased joint R&D activities by the Chinese Aeronautical Establishment with several foreign organisations from France, Germany, Italy and others. The United States government focuses on aerospace R&D by making investments in development of long-term breakthrough technologies that benefit the public. U.S. government-funded civil aeronautical basic research programs are open to foreign firms and the results generally are broadly available to the U.S. and foreign competitors.

2. ***Modern technology gives a competitive edge to competing countries vis-à-vis India***

Indian aerospace industry lacks in latest technology across the design lifecycle, which is a major obstacle in its growth and development. The FDI restrictions do not allow foreign companies a majority control in Indian entities, due to which they are reluctant to transfer state-of-the-art technologies and have given licenses only for older technologies. In case of Tier-3 suppliers especially, which are generally small family-owned businesses in US and Europe, there is little incentive to transfer know how or invest in local Indian companies.

On the other hand, Chinese government has tried to leverage large commercial aircraft purchases in exchange for arrangements leading to technology transfer with a view to modernise its aerospace industry. China's aerospace industry began with production of military aircrafts way back in 1950s and though China did not have access to western technology and design/ development capabilities at that time, it build up its technology base through in-house R&D and reverse engineering of foreign products.

3. ***Lack of international certifications deters growth of aerospace industry in India***

Tie-ups and joint ventures with foreign aerospace manufacturers has helped China in keeping high quality standards and receiving international certifications for processes and parts, which is a key to maintaining global competitiveness for higher exports. However, Indian suppliers have faced difficulties in getting international airworthiness certifications and often the international airworthiness approvals for parts manufactured in India takes too long as approvals are not done within the country. The delay in approvals often leads to high costs for OEMs, which deters the outsourcing of components to Indian suppliers.

4. ***R&D has been a key to aerospace development in major countries***

Research and Development have been at the forefront in aerospace industry in most leading countries. The US government has provided significant funding for aerospace R&D and so have European countries like Germany and France. The German Aerospace Center (DLR) is directly involved in research projects and runs the expensive research facilities that are indispensable for advanced R&D activities. Apart from these, the universities and research institutions foster industry-specific innovation and house more than 700 aerospace scientists.

In India too, there are numerous government research institutes and organisations that carry out intensive research and development for the aerospace sector, namely Hindustan Aeronautics Limited (HAL), Defence Research and Development Organisation (DRDO), National Aerospace Laboratories (NAL), ISRO, etc. However, the progress on R&D front has been relatively slow and there is lack of private sector participation.

5. Costs and availability of critical input material- raw material, manpower and technology

A major disadvantage that India faces in the context of aerospace manufacturing is the availability of appropriate grade raw materials, whether it is metals like aluminium and titanium or plastics and composites. In the absence of the availability of such critical raw materials, the sector is dependent on imports. On the other hand, China has developed a complete ecosystem around the global OEM's in aerospace and has a fully developed raw-material and component industry for the aerospace assembly.

6. Quality certifications are key to increase export competitiveness

India is at a very disadvantageous position in global market as compared to countries like U.S., France & China when it comes to quality certifications like AS9100. AS9100 is a widely adopted and standardized quality management system for the aerospace industry. It was released in October, 1999, by the Society of Automotive Engineers and the European Association of Aerospace Industries. AS9100 replaces the earlier AS9000 and fully incorporates the entirety of the current version of ISO 9000, while adding additional requirements relating to quality and safety. Major aerospace manufacturers and suppliers worldwide require compliance and/or registration to AS9100 as a condition of doing business with them. Quality assurance and reliability are essential in aerospace technologies due to stringent requirements of weight-to-strength considerations and the need for highly reliable systems. The industry works on a zero defect target. While Indian manufacturing has improved significantly in quality control, a mature supplier base is still developing in India and the inability of smaller suppliers to keep abreast with the rising quality issues could become a problem for the Indian aerospace companies.

Based on analysis of the current status and international norms & standards, the gaps & issues in the Indian aerospace industry can be summarised as following:

S.No.	Areas	Issues
1	Scalability	Diffused nature of the Indian aerospace industry with all the big players being PSUs. All the small firms are mainly into manufacturing of tier-3 components.
		Indian aerospace industry lacks in latest technology across the design lifecycle, which is a major obstacle in its growth and development.
		Lack of international certifications deters growth of aerospace industry in India
		FDI restrictions do not allow foreign companies a majority control in Indian entities, due to which they are reluctant to transfer state-of-the-art technologies and have given licenses only for older technologies.
2	Cost Efficiency	Unavailability of critical raw materials such as aluminium, titanium, plastics etc. makes the sector dependent on imports.
		Higher costs incurred in getting certifications for processes and parts manufactured in India
3	Productivity Optimization	International airworthiness approvals for parts manufactured in India takes very long time as approvals are not done within the country. The delay in approvals often leads to high costs for OEMs, which deters the outsourcing of components to Indian suppliers.
		Less productivity in production planning, supply chain management, quality and maintenance.
4	Quality Excellence	Lack of private sector participation from domestic as well as foreign players in research and development activities in aerospace sector
		Inability of smaller suppliers to keep abreast with the rising quality issues

		Shortage of efficient and skilled manpower with expertise in Boeing and airbus related work
5	Sustainability	Lack of awareness of global standards for among Indian SMEs
		Lack of joint R&D activities with foreign partners.

The analysis of various facets of the global and the Indian aerospace industry shows that India needs to look at multiple interventions including in the areas of Regulatory framework, Investment policies, Trade policies, Fiscal policies, Infrastructure, R&D, Skill, Financing, Process, Collaboration and Technology. These interventions have been detailed in the main report.

However, recommendations only related to technology and research & development have been detailed which could form part of several schemes undertaken by Department of Science & Industrial Research in this section.

Intervention 1 : Focused scheme to improve raw-material competitiveness	
S.No.	**Tasks**
1	Focused scheme to induce indigenous production of critical raw-materials like high quality aluminum, titanium etc. Cluster based development approach needs to be followed for the same. Some of the steps that may be adopted are: • Compile a list of critical raw-materials which have enough demand in India but very limited domestic production to match the demand. • Identify international companies present in the above product categories and encourage these companies to collaborate with Indian counterparts to create manufacturing facilities in India. • Create a centralized fund which could be utilized for acquisition of international companies/assets operating in various raw-material categories. For the same designate an implementing agency to invite shortlist and grant the funding to the domestic companies.
Intervention 2 : Foster R&D and encourage more participation from private players	
S.No.	**Tasks**
2	Creation of innovation centres for conducting collaborative research on pay-per-use model. This may be done on PPP model with investments shared between government and private players. Some of the facilities that should be created are: • CAD/CAE/CAM tools • Testing chambers • Laboratories like wind tunnels and lightning strike facilities. • Simulation environments etc. • Incubation centres for providing supportive framework for the researcher that enables him to turn a technological idea that has an economical-marketing potential into a product of interest for investors
Intervention 3 : Provide database & technology support to domestic firms	
S.No.	**Tasks**
3	Provide database & technology support to domestic firms in the following areas: • Quality standards followed globally for various components & products in India. • Technology- and innovation-related international journals from major publishers. • Country wise/OEM wise SOPs for testing the products. This will include testing labs availability and tests conducted by them, fees for conducting the tests etc. • Database of industry experts (either retired or from the industry) who can be contacted by SME's for any kind of technical support required. For the same, profiles of the experts need to be invited and kept in a repository. On receipt of any request from the industry, communication can be sent to the relevant experts and the interested one's can then be suggested to the requestor.

The interventions mentioned above are further prioritized on the basis of their role in fulfilling various objectives* of the Government of India for the growth of the manufacturing sector. Each intervention is tagged with the objective that it may help achieve. The intervention impacting maximum number of objectives has been prioritized for implementation.

*These objectives have been picked up from "PM's Group Report on Measures for Ensuring Sustained Growth of The Manufacturing Sector", "National Manufacturing Policy 2006" and "National Manufacturing Policy 2011".

Intervention	Government Objectives				
	Employment	**Building Strong Capacity & Scale**	**Local Value Addition**	**Technology Adoption**	**Skill Development**
Focused scheme to improve raw-material competitiveness	✔	✔	✔	✔	✔
Foster R&D and encourage more participation from private players			✔	✔	✔
Database & technology support to domestic firms			✔	✔	✔

Decide with Confidence

Aerospace: Framework for Global Competitiveness & Promotion of Innovation

Knowledge Creation & Commercialization

- Focused scheme needs to be formulated for setting up aerospace economic zone in the country
- Invite component manufacturers, aero-structure engineers and assemblers etc. to set up units in the cluster.
- Focused scheme to induce indigenous production of critical raw-materials like high quality aluminium, titanium etc.
- Launch a national level scheme to encourage both academia & industry to target efforts in R&D.
- Provide incentives for foreign players who are ready for technology transfer to Indian players.

Inclusive Innovation

- Focused scheme for creating awareness among SME's for quality standards followed for various components & products in India and by global OEMs

Knowledge Diffusion & Absorption

- Creation of innovation centers for conducting collaborative research on pay-per-use model. This need to be done on PPP model with investments shared between central government, state government and private players.
- Launch a scheme to set up Joint testing and certification facilities for certification of Indian manufactured components and parts exported internationally.
- Provide database & technology support to domestic firms

Support Mechanisms

Skill

- Database & technology support to domestic firms providing access to : global quality standards, technology journals, testing infrastructure etc.
- Awareness of global standards

Policy

- Formulation of National Aerospace Policy.
- Integration of existing stand-alone policies
- Direct as well as indirect subsidy schemes for players in aerospace economic zones
- Reduced excise duty on the identified materials to encourage indigenous raw-materials

R&D

- Scheme for participation of private players in R&D
- Provision for funding up-gradation of R&D labs in the private and government sector
- Incentive scheme to reward any breakthroughs in new product development

Infrastructure

- Aerospace economic zones.
- Joint testing & certification facilities
- R&D innovation centers
- Incubation centers

Collaboration

- Collaboration for certification labs
- Collaboration for domestic raw-material manufacturing
- Collaboration for R&D