An Overview of Taiwanese Aerospace Fastener Development

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Projections for the Global Aerospace Industry

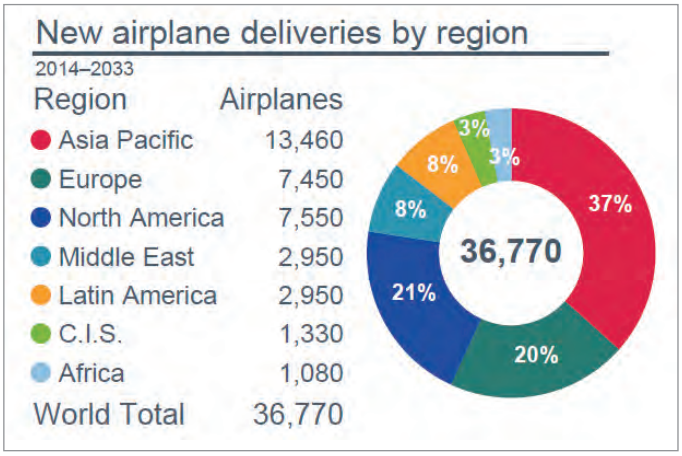
The stable growth in passenger numbers of airlines and shipment volumes continues to boost the demand for aircrafts. According to the "Current Market Outlook 2014-2033" released by Boeing, if the average annual growth rate of the global economy reaches 3.2%, the annual growth rate of airlines passenger numbers can remain at 4.2% and the growth rate of passenger traffic can be 5%, and even the annual growth rate in airfreight will be nearly 5%. In response to the growth in numbers of passengers and airfreight volumes, the demand for Boeing passenger planes and cargo planes will increase from 20,910 units in 2013 to 42,180 units in 2033 (up 21,270 units). Boeing estimates that the demand for new aircrafts from 2014 to 2033 will be 36,770 units with the total market value of USD 5.2 trillion. 40% of the demand is for replacing old planes with new ones while the remaining 60% is for meeting the demand for increasing passenger traffic and airfreight. The largest share is the demand for single-aisle planes (about 25,680 units, representing 70% of the total airplane deliveries). In the following 20 years, the demand for small-to-medium sized airplanes with higher unit prices will reach 7,980 units, with the production value representing over 40% of the total market share. **Table 1** shows Boeing's projections for the global new aircraft demand from 2014 to 2033.

Table 1. Projections of Global New Aircraft Demand from 2014 to 2033

Global New Aircraft Demand from 2014 to 2033		
Airplane Size	Number of New Aircrafts	Production Value (USD 0.1 Billion
Large	620	2,400
Small-to-medium	7,980	23,000
Single aisle	25,680	25,600
Regional	2,490	1,000
Total	36,770	52,000

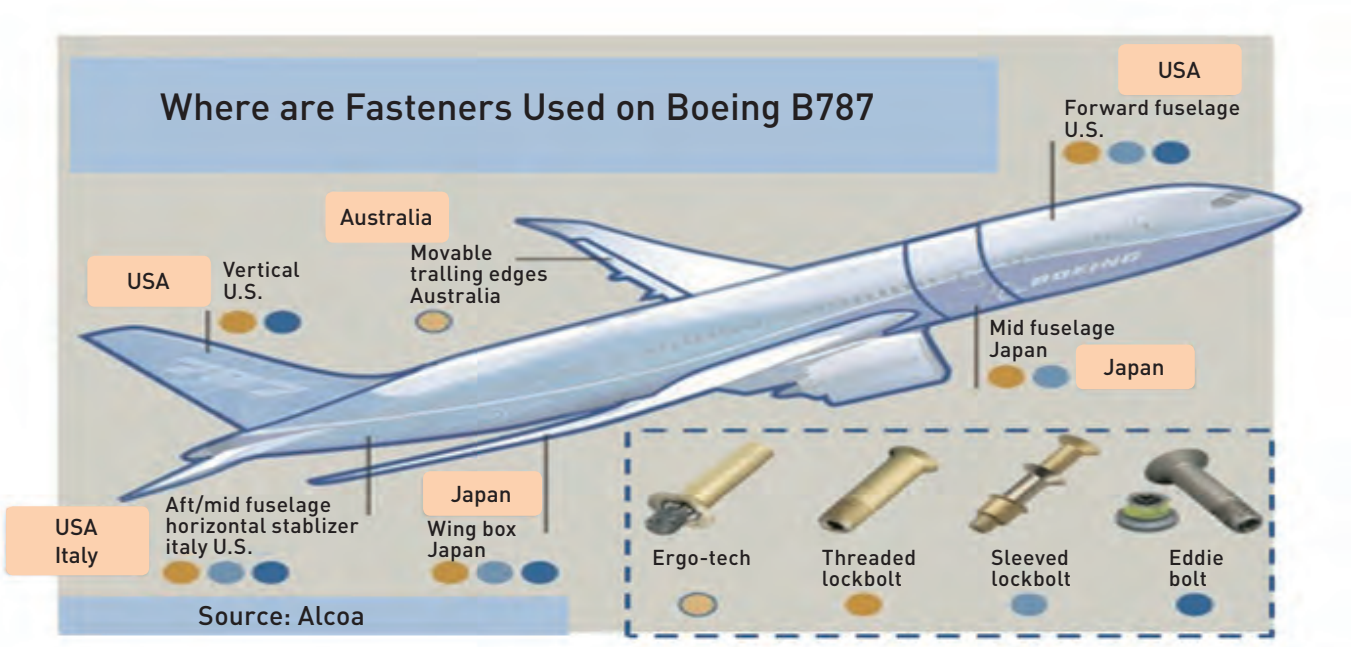
Source: Boeing Current Market Outlook 2014, compiled by MIRDC MII in Sep. 2015

Factors that push the demand for new aircrafts include emerging markets, continuous development of new routes, growing traffic, and more environment-friendly new airplanes to replace old aircraft models. **Pic. 1** reveals Boeing's new airplane deliveries by region in the following 20 years, and Asia Pacific will be the main battlefield with an explosive amount of new airplane demand (13,460 units, 37% of the global new aircraft demand), followed by N. America (21%) and Europe (20%). The top 3 markets share nearly 80% of the global new airplane market.



Pic. 1 Projections for Global New Airplane Demand by Region in 2014~2033
Source: Boeing Current Market Outlook 2014, compiled by MIRDC in Sep. 2015

2009 happened to be the year again for replacing over 10-year-old cars with new ones, so Taiwanese automotive fastener companies can have good development. According to the above mentioned projections for new aircraft demand, in a few years there will be also a similar replacement trend for aircrafts. If Taiwanese fastener companies would like to upgrade themselves from "automotive level" to "aerospace level", they should not miss any chance.

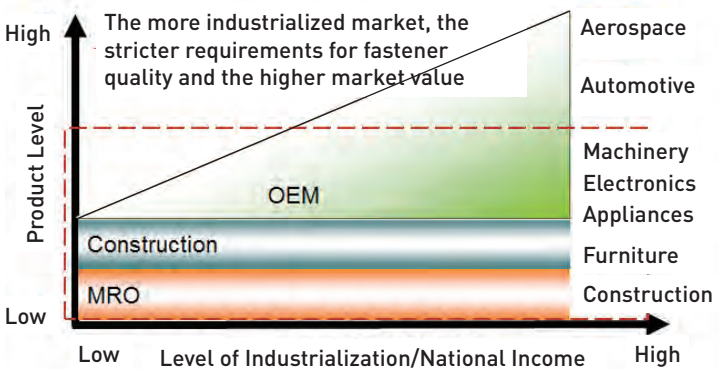


Pic. 2 The Fastener Supply for Boeing B787
Source: Alcoa, compiled by MIRDC MII

The Current Situation and Analysis for Taiwanese Aerospace Fastener Industry

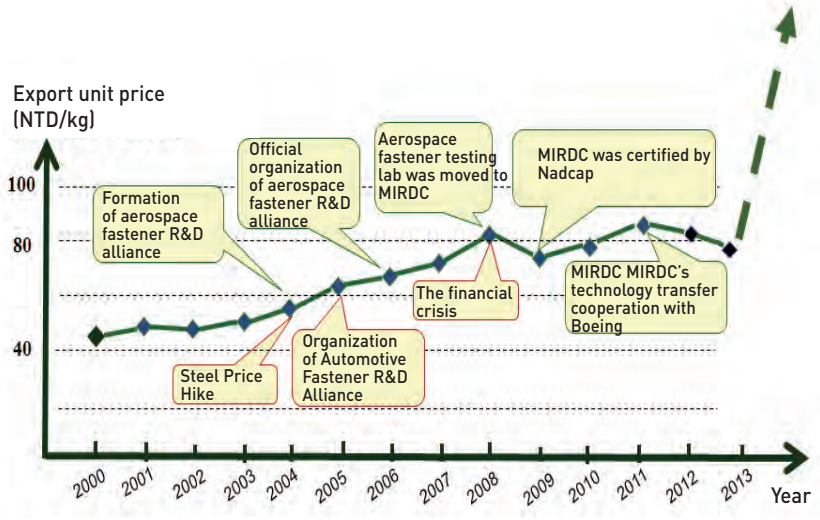
The demand for aircrafts increases the demand for related components. A B767 aircraft will need 1.8 million pieces of fasteners and a B787 aircraft will need nearly 2 million pieces of fasteners. **Pic. 2** shows the current fastener supply for B787. The annual demand for aerospace fasteners is about NTD150 billion, almost the annual total production value of Taiwanese fastener industry, and this demand continues to increase by 5-10%. Leading aircraft manufacturers like Boeing or Airbus continue to relocate production lines to other countries or look for business partners in Asia Pacific. So far, the production value of Taiwanese aerospace fasteners represents only 0.8% of the world total, so it still has a long way for growth to go.

Pic. 3 illustrates the market structure of fastener applications. The more industrialized market, the stricter requirements for fastener quality and the higher market value. In the aspect of applications, the total value of the automotive OEM market demand represents 22% of the entire industrial total (annual growth rate at about 3%), electronics & communication equipment represents 18% (annual growth rate at about 8%), and aerospace fasteners represents 5% (with the highest added value and a stable market without price cutting).



Pic. 3 The Market Structure of Fastener Applications
Source: International Trade Centre, compiled by MIRDC MII

Pic. 4, taking bolts for example, illustrates the development of Taiwanese high value added fasteners. The final goal of industrial upgrade is to strengthen the industry with more energy and help companies increase the added value of their products. Take automotive bolts for example, the average unit price of aftermarket bolts in early years was roughly 80 NTD/kg, almost equivalent to the average unit price of Taiwanese exported fasteners. As for the OEM bolts for car manufacturers, the average unit price was nearly doubled to 150 NTD/kg. Then, the critical automotive components were also developed, the average unit price was even tripled to 250 NTD/kg. The average unit price of aerospace bolts is also expected to reach over 900 NTD/kg. As Taiwanese fastener companies continue to be active in industrial upgrade, their total production value increased from NTD 121.3 billion in 2012 to NTD 138.8 billion in 2014. This value is also expected to reach NTD 150 billion in 2016.



Pic. 4 The Developmental Process of Taiwanese High Value Added Bolts
Source: International Trade Centre, compiled by MIRDC MII

Bottlenecks in Taiwanese Aerospace Fastener Development

Viewing the aerospace industry as a whole, Taiwan faces challenges from low-cost products of other Asian countries, so the competition in export is fierce. Korea even has subsidy policies to help companies win more market share. In the aspect of technology, the supply chain is still not well-organized, lacks energy in some special manufacturing process, and needs to import materials from abroad. In the aspect of labor, the supply of well-trained staff in the industry (especially those specialized in machinery and systematic integration) is insufficient. If the focus on the entire industry is more limited to aerospace fasteners, some other difficulties (in addition to the previously mentioned bottlenecks) including the supply chain that is hard to tap into, the market still under control of European/ U.S. companies, strict requirements for quality and certification for materials/special manufacturing process/quality system can be also observed. For Taiwanese companies, the risk of investing in aerospace fasteners is not only an issue about costs and effects, as when some serious accidient occurs and it later proves to be caused by fasteners, manufacturers will be liable to pay a huge sum of compensation and there should be insurance companies that are willing to accept insurance. However, this is not a common trend in Taiwan, so companies' will to invest will be reduced due to increased financial risks. Moreover, the development of aerospace fasteners will also involve the problems of inspection & certification at customers' side and the advanced joint technology of special alloy materials. As a result, the upgrade of companies to the development of aerospace fasteners is not always an easy way to go. The development of aerospace fasteners in Taiwan can be generally illustrated in **Pic. 5**. on the next page.

Suggestions for Taiwanese Aerospace Fastener Development

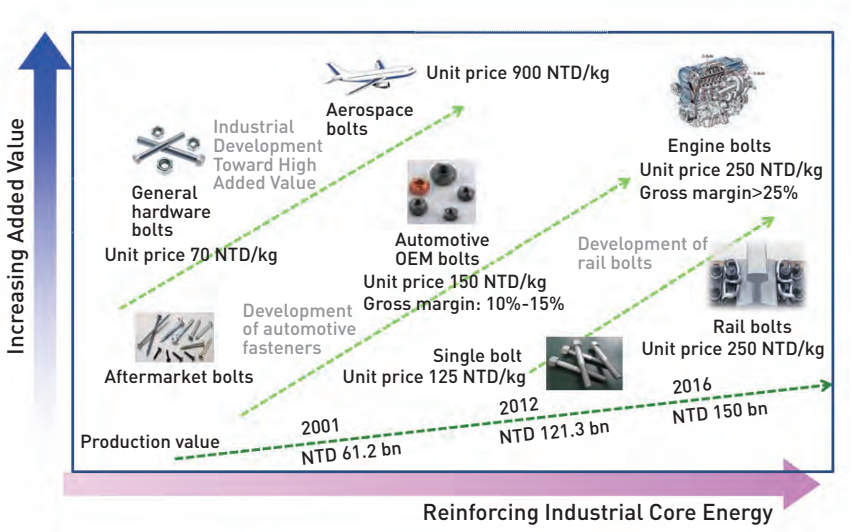
In general, the current development of Taiwanese aerospace fasteners shows 3 major weak points, which include insufficient autonomous material supply, the lack of manufacturing technology and well-trained staff, and incomplete quality certification. Below are suggestions for these 3 points:

For Insufficient Autonomous Material Supply

Based on some safety reasons, materials for aerospace fasteners are even required to have high tensile strength, the ability to withstand high temperature, high anti-fatigue ability, corrosion resistance, and lightweight for improving fuel oil efficiency. Main materials used to manufacture aerospace fasteners are aluminum alloy, high-strength steel, alloy steel, Ni-based alloy, Ti-alloy, etc. Taiwanese GMTC, S-Tech Corp., and China Steel Corp.are only able to supply some of the steel categories, so many other materials have to be imported. In the future Taiwanese suppliers can try to develop alloy steel wires for aerospace fasteners to increase its own material supply capability and they should guide other companies to gain certification for their manufacturing procedures and labs to help Taiwanese fastener manufacturers enter the global supply chain of aerospace fasteners.

For The Lack of Manufacturing Technology and Well-trained Staff

The manufacturing technology of aerospace fasteners must comply with different material and quality requirements, so it needs mold design, forming, threading, heat treating, surface treatment, and testing methods that are different from general industrial or automotive fasteners. Furnaces that aerospace fastener suppliers use to



Pic. 5 The Development of Aerosapce Fasteners in Taiwan
Source: MIRDC

process materials are not even allowed to be used together with materials for different fastener applications, in order to prevent precipitation that can influence the quality of aerosapce fasteners from happening. Taiwanese fastener companies are still not familiar with new materials and manufacturing procedures, so they have to introduce and set up new precision manufacturing facilities and inspection instruments before they can finally meet the requirements of the aerospace industry. I suggest that companies should form an alliance and introduce strategic R&D capital to disperse the risk.

For Incomplete Quality Certification

Certification is an important part the aircraft components suppliers can rely on to win customers' trust. The aerospace industry requires AS 9100, Nadcap, and material certification. However, almost none of Taiwanese companies have been certified by all these 3 certificates. Before entering the supply chain of aerospace fasteners, AS9100 for quality management and Nadcap for special manufacturing procedures (incl. heat treatment, chemical treatment, and non-destructive inspection and material tests) should be both obtained. So far, some fastener companies in Kaohsiung (incl. Ying Ming, Rising Fast Technology (RFT), Anchor Fasteners, Chun Yu, etc.) have been certified by AS9100. In addition, RFT has even passed Nadcap's certification for welding, vacuum heat treatment, non-destructive/fluorescent, and vacuum braze welding. In order to comply with Nadcap's requirements, the expense of a huge sum of certification fee and instrument maintenance & recalibration cost is necessary, though it takes a long period of time to pay off the cost invested in the early phase. As a result, it usually makes investors hesitate and the government should offer more favorable incentives.

Conclusion

"Aerospace fasteners" is a quite closed market. In Taiwan. Only Nafco has officially entered the supply chain of aerospace fasteners and there should not be any other Taiwanese supplier that can enter this supply chain in the short term. Leading fastener suppliers in Southern Taiwan such as Ying Ming, Chun Yu, Jau Yeou, and Anchor Fasteners with ambition recently have been certified by Nadcap. If they can again obtain the certificates from Honeywell and Boeing, they may successfully enter the aerospace fastener market. If they are accepted by Boeing, it will be very possible that they can enter the supply chains of Airbus or other aerosapce fastener suppliers, boosting the development of Taiwanese aerospace fasteners. Going up from the original technical level to another higher level can be considered another business inception for the companies and can be hopes for Taiwanese industrial upgrade. Accordingly, the government, corporations, and companies should coordinate and work with each other and make the most of policies and related tools (even venture fund) to create a new future for aerospace fasteners. ■

References:
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The Current Conditions of Fasteners, Aviation, and Food Industries in 2014