Aviation Outlook
Growth Opportunities in Asia Abound

Q1 2016
Aerospace & Defense Practice
Frost & Sullivan
Five Big Takeaways

1. **3X Growth of APAC** - APAC is going to be the largest region of operating aircraft fleet by 2034 superseding North America and Europe with triple the volume of aircraft fleet of what it is flying today.

2. **Regional Aircraft Entry** - Regional aircraft (< 150 seater aircraft market) is witnessing many aircraft entries such as ARJ, MRJ, C Series, Regioprop (Indonesia) with very short haul point to point airports to be served.

3. **MRO Operators to adopt to next generation aircraft** - Though MRO markets have witnessed global migration from west to east due to lower costs, new generation aircraft with composite usage will confront MRO operators on a new playing field.

4. **More than 50% of new airport investments in APAC** - Out of 346 new airport developments globally more than half of them are going to be in APAC, which opens huge opportunity for airport support industry.

5. **Aerospace is an early adopter of 3D printing** - Aerospace has been an early adopter of 3D printing with industry primes such as Airbus, GE, Boeing and various government agencies putting active investments.
In the next 15 years, globally we are set to see as many flights are we have witnessed in the last 100 years……
Various drivers have been identified which are key to the global market growth such as growth of global middle class composition followed by aviation mega cities, long haul passenger growth etc.

The global middle class is to double in 2034 in emerging countries. The rise in spending power will see a further growth of tourism. Moreover, with further economic integration and labour mobility the Asian and Latin America region are also to see a consistent growth of travel within and between regions.
Air traffic Overview

Strong growth in “upper middle income group” followed by “lower middle income group” have paved the way for strong passenger numbers with highest growth in APAC and Middle East region.

2015 1st quarter performance by region

North America
- 6.1 million, 0.2 YOY
- 370 million, 3.8% YOY

Europe
- 3.9 million, 0.2% YOY
- 341 million, 5.1% YOY

Middle East
- 0.5 million, 6.9% YOY
- 66 million, 9.2% YOY

Africa
- 1.6 million, 1.5% YOY
- 34 million, 2.3% YOY

APAC
- 3.1 million, 4.9% YOY
- 400 million, 8.5% YOY

2014 number of passengers and 2010-2014 growth rate

Source: Frost & Sullivan Analysis, ACI annual world airport traffic report; 2014 ATRS Global Airport Performance Benchmarking Project. World Bank
Global aircraft fleet dynamics

Globally 38,050 aircraft deliveries are going to be done in 20 years between 2015-2034; majority of which will be in APAC hence MRO markets will shift towards APAC in next 20 years.

Aircraft Fleet Delivery Forecast *

38,050 (~ in 20 years)  
New Aircraft deliveries expected globally between 2015-2034

Source: Boeing Market Outlook 2015, Frost & Sullivan analysis
Global aircraft fleet dynamics

Nearly half of the world's air traffic growth will be driven by travel to, from, or within the Asia-Pacific region in the next 20 years.

**Shift in global fleet market share in next 20 years**

<table>
<thead>
<tr>
<th>Region</th>
<th>2014 Share</th>
<th>2034 Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>31%</td>
<td>22%</td>
</tr>
<tr>
<td>Europe</td>
<td>21%</td>
<td>17%</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>27%</td>
<td>37%</td>
</tr>
<tr>
<td>Latin America</td>
<td>6%</td>
<td>8%</td>
</tr>
<tr>
<td>Middle East</td>
<td>7%</td>
<td>8%</td>
</tr>
<tr>
<td>CIS</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Africa</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>Emerging regions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle East</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latin America</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Global Market Share of Aircraft Operating Fleet by Region (2014-2034)

**Key Insights**

- **Decline of North America**
  - Today North America is still the region with the largest operating fleet which will move to the 2nd spot by 2034.

- **APAC comes to 1st position**
  - Currently APAC is the 2nd largest region of operating fleet with 27% market share which will change to 37% by 2034.

- **Emerging regions (Middle East & Latin America)**
  - Middle East fleet share is growing aggressively by 3 major airlines such as Qatar Airways, Emirates and Etihad.
  - Latin America will grow at a healthy pace of 4.6% CAGR.

*Source: Boeing Market Outlook, Frost & Sullivan analysis*
APAC aircraft fleet dynamics

APAC’s operating fleet stood close to 5,850 by end of 2014 which is expected to add 14,330 new aircraft deliveries to reach the operating fleet size of 16,180 (after retirements) by 2034.

New Aircraft Deliveries (20 yr forecast)

<table>
<thead>
<tr>
<th>Year</th>
<th>Fleet Size</th>
<th>Delivery</th>
<th>Retirements</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>5,850</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015-2034</td>
<td>4,000</td>
<td>14,330</td>
<td></td>
<td>3X</td>
</tr>
<tr>
<td>2034</td>
<td>16,180</td>
<td></td>
<td>4,000</td>
<td></td>
</tr>
</tbody>
</table>

- APAC fleet is estimated to grow at 5.21% CAGR over the period (2015 – 2034) in the next 20 years.
- The fleet size is forecasted to grow to thrice the current fleet size in 20 years time.

New Aircraft Deliveries (20 yr forecast) by type

- Large Wide Body: 1,400
- Medium Wide Body: 1,530
- Small Wide Body: 1,920
- Single Aisle: 10,370
- Regional Jets: 370

- Majority of the addition is in single aisle aircraft across Asia Pacific.
- Markets for wide body are smaller in number but nevertheless prominent in terms of value.

Source: Boeing Market Outlook, Frost & Sullivan analysis
APAC aircraft fleet dynamics

APAC’s operating fleet is estimated to grow x3 the current size with growth expected in almost all aircraft segments apart from large wide body segment such as A380 and B747.

**Aircraft Operating Market Share by aircraft type**

<table>
<thead>
<tr>
<th>Aircraft Type</th>
<th>2034</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional Jets</td>
<td>380</td>
<td>130</td>
</tr>
<tr>
<td>Single Aisle</td>
<td>4,130</td>
<td>11,730</td>
</tr>
<tr>
<td>Small Wide Body</td>
<td>2,270</td>
<td>780</td>
</tr>
<tr>
<td>Medium Wide Body</td>
<td>1,620</td>
<td>530</td>
</tr>
<tr>
<td>Large Wide Body</td>
<td>180</td>
<td>280</td>
</tr>
</tbody>
</table>

**Key Insights**

- Almost all segments expected to grow by 3 times
- Large wide body segment (A380 and B747) is not expected to grow
- Prominent growth is forecasted to be witnessed in Single Aisle
- Intra-Asia Pacific routes are estimated to get thicker over time and hence there is a huge anticipated demand of medium wide body and small wide body aircraft to almost triple of what they stand today in 2014

*Source: Boeing Market Outlook, Frost & Sullivan analysis*
North Asian fleet dynamics

North East Asia has overall smaller market potential compared to South East Asia; Stark difference in fleet composition where North East Asia will have higher % of wide body aircraft and South East Asia will have more of single aisle aircraft

### North East Asia (New Aircraft Deliveries) vs. South East Asia (New Aircraft Deliveries)

**North East Asia**
- Regional Jet, 60: 4.1%
- Single Aisle, 630: 43.4%
- Small Wide Body, 320: 22.1%
- Medium Wide Body, 400: 27.6%
- Large Wide Body, 40: 2.8%

**South East Asia**
- Regional Jet, 90: 2.1%
- Single Aisle, 2860: 76.3%
- Small Wide Body, 510: 15.8%
- Medium Wide Body, 250: 7.2%
- Large Wide Body, 40: 1.5%

- 49.7% concentration of wide body in new aircraft deliveries for North East Asia
- MROs should concentrate on wide body segment in North East Asia

Source: **Boeing Forecast, Frost & Sullivan analysis**

- Single aisle is dominant with 76.3% of all new aircraft deliveries in South East Asia
- Wide body constitutes for only 20.4% of all new deliveries in South East Asia; MROs could focus mainly on single aisle aircraft
Global MRO demand forecast

With increasing labor costs, MRO activities are moving towards low cost nations like Mexico, Brazil, Malaysia, and North Africa. This is particularly seen in labor intensive heavy maintenance checks.
Global MRO demand forecast

A 10 year market sizing which is important to decide investment horizon shows that Asia Pacific region is ripe for investment and amounts to USD $167.2 Billion over next 10 years.

Global MRO Forecast by regions (2015-2024)

<table>
<thead>
<tr>
<th>Region</th>
<th>Market Size</th>
<th>CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>$209.9B</td>
<td>1.03%</td>
</tr>
<tr>
<td>Western Europe</td>
<td>$191.6B</td>
<td>4.02%</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>$167.2B</td>
<td>6.40%</td>
</tr>
<tr>
<td>China</td>
<td>$78.9B</td>
<td>9.00%</td>
</tr>
<tr>
<td>Middle East</td>
<td>$77.9B</td>
<td>7.71%</td>
</tr>
<tr>
<td>Latin America</td>
<td>$51.9B</td>
<td>5.82%</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>$41.6B</td>
<td>3.75%</td>
</tr>
<tr>
<td>Africa</td>
<td>$26.8B</td>
<td>1.45%</td>
</tr>
<tr>
<td>India</td>
<td>$17.0B</td>
<td>13.51%</td>
</tr>
</tbody>
</table>

* 10 year consolidated market size

Source: Aviation Week Database, Frost & Sullivan analysis
Global MRO demand forecast

Asia Pacific will become the second largest region for MRO services by 2024.

- North American market will lose its position to Western Europe over the period and move to the 3rd position by 2024 in terms of MRO spending

Global MRO Forecast by Region (2015-2024)

<table>
<thead>
<tr>
<th>Year</th>
<th>Middle East</th>
<th>Asia Pacific</th>
<th>China</th>
<th>Africa</th>
<th>India</th>
<th>Latin America</th>
<th>North America</th>
<th>Western Europe</th>
<th>Eastern Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>15.8</td>
<td>68.5</td>
<td>19.5</td>
<td>17.0</td>
<td>21.0</td>
<td>21.3</td>
<td>21.4</td>
<td>20.9</td>
<td>22.6</td>
</tr>
<tr>
<td>2016</td>
<td>17.0</td>
<td>72.8</td>
<td>20.3</td>
<td>21.0</td>
<td>21.4</td>
<td>21.8</td>
<td>21.0</td>
<td>20.9</td>
<td>21.4</td>
</tr>
<tr>
<td>2017</td>
<td>17.8</td>
<td>77.3</td>
<td>21.0</td>
<td>21.0</td>
<td>21.4</td>
<td>21.8</td>
<td>21.0</td>
<td>20.9</td>
<td>21.4</td>
</tr>
<tr>
<td>2018</td>
<td>18.6</td>
<td>81.6</td>
<td>21.4</td>
<td>21.3</td>
<td>21.8</td>
<td>21.0</td>
<td>20.9</td>
<td>20.9</td>
<td>21.4</td>
</tr>
<tr>
<td>2019</td>
<td>19.2</td>
<td>85.4</td>
<td>19.5</td>
<td>21.0</td>
<td>21.4</td>
<td>21.0</td>
<td>20.9</td>
<td>20.9</td>
<td>21.4</td>
</tr>
<tr>
<td>2020</td>
<td>19.5</td>
<td>88.7</td>
<td>20.3</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>21.4</td>
</tr>
<tr>
<td>2021</td>
<td>19.9</td>
<td>91.5</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>21.4</td>
</tr>
<tr>
<td>2022</td>
<td>20.9</td>
<td>94.4</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>21.4</td>
</tr>
<tr>
<td>2023</td>
<td>20.9</td>
<td>99.1</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>20.9</td>
<td>21.4</td>
</tr>
<tr>
<td>2024</td>
<td>22.6</td>
<td>103.4</td>
<td>21.4</td>
<td>21.4</td>
<td>21.4</td>
<td>21.4</td>
<td>21.4</td>
<td>21.4</td>
<td>21.4</td>
</tr>
</tbody>
</table>

Key Insights

1. Global MRO Demand
   - Current global MRO spending amounts to USD $68.5 Billion for 2015
   - Global MRO spending will increase at a rate that equals 4.68% CAGR in next years

2. APAC MRO Demand
   - Current APAC MRO spending amounts to USD $12.34 Billion for 2015
   - By the end of 2024 it will become world’s 2nd largest MRO spending market after WE

Source: Aviation Week Database, Frost & Sullivan analysis
Global Airport Business

As of 2015, 741 airport related airport construction investments totaling USD $442 billion were underway globally, the majority of which are either new terminal or new runway projects.

Overview investments by region

<table>
<thead>
<tr>
<th>Region</th>
<th>Terminal expansion</th>
<th>New terminal</th>
<th>Runway extension</th>
<th>New runway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>29</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>107</td>
<td>107</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>57</td>
<td>57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latin America</td>
<td>27</td>
<td>27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle East</td>
<td>98</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>North America</td>
<td>124</td>
<td>124</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Distribution of investments

- New runway: 37%
- Terminal expansion: 17%
- New terminal: 38%
- Runway extension: 8%
Global Airport Business

As of 2015, 346 new airports have been identified as being at various stages of development with a total investment value of USD157 billion between now and 2029.

Number of new airports by region

- Africa: 47
- Asia Pacific: 183
- Europe: 55
- Latin America: 40
- Middle East: 19
- North America: 11

Expected year of completion of airport projects

- 2015: 87
- 2016: 98
- 2017: 88
- 2018: 41
- 2019: 11
- 2020: 20
- 2021: 1
- 2022: 3
- 2023: 1
- 2024: 1
- 2025: 1
- 2026: 2
- 2027: 1
- 2028: 1
- 2029: 1

Number of new airports by country

- China: 57
- India: 46
- Indonesia: 32
- Russia: 26
- Brazil: 19
- Nigeria: 9
- US: 9
- Philippines: 8
- Peru: 5
- Vietnam: 5
- Ghana: 5
- Laos: 5
- Ethiopia: 4
- Nepal: 4
- Greece: 4
- Mexico: 4

Top 3 regions:
- Asia Pacific: 183
- Europe: 55
- Latin America: 40
The consumer and commercial products are expected to account for 28% of 3D printing market by 2020 which is expected to grow at a CAGR of 19.1% between 2009-2025.
Thank You
Frost & Sullivan, the Growth Partnership Company, works in collaboration with clients to leverage visionary innovation that addresses the global challenges and related growth opportunities that will make or break today’s market participants. For more than 50 years, we have been developing growth strategies for the Global 1000, emerging businesses, the public sector and the investment community. Is your organization prepared for the next profound wave of industry convergence, disruptive technologies, increasing competitive intensity, Mega Trends, breakthrough best practices, changing customer dynamics and emerging economies? Contact Us: Start the Discussion

www.frost.com