Performance Based Navigation
New Era in Precision Navigation

Honeywell

Growth Forecast

- **International Air Transport Association** (IATA) released industry traffic forecast showing that airlines expect to welcome some **3.6 billion passengers** in 2016.
  - That's about 800 million more than the 2.8 billion passengers carried by airlines for a compound annual growth rate (CAGR) of 5.3%

- **Asia-Pacific** passenger traffic is forecast to grow at **6.7% CAGR.** Passenger growth within the Asia-Pacific region (domestic and international) is expected to add around 380 million passengers over the forecast period.

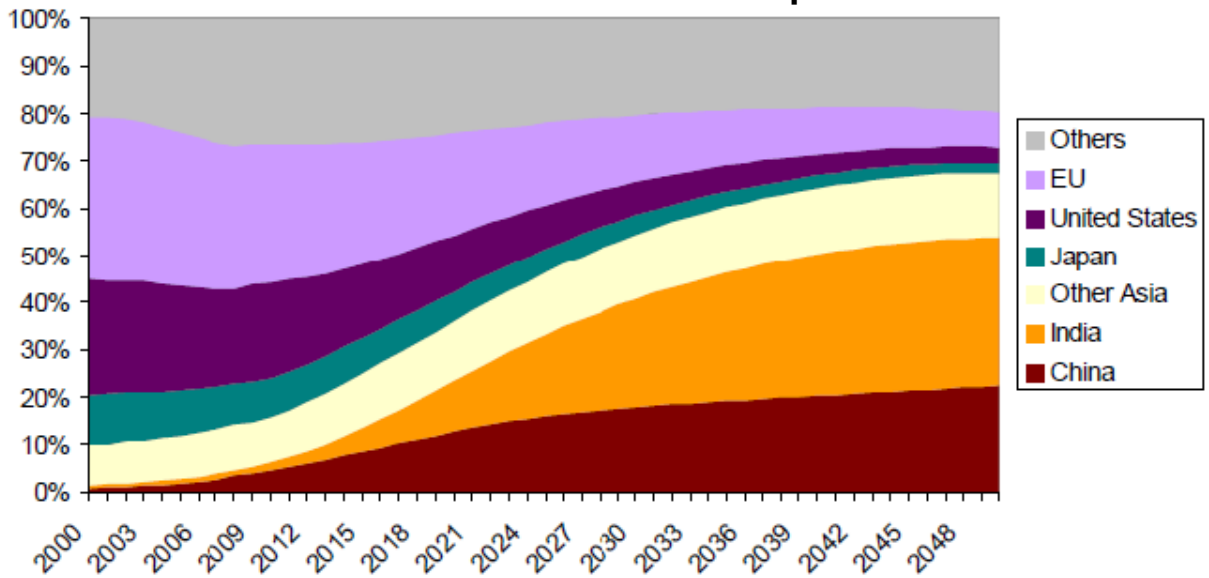
- The Asia-Pacific region already accounts for **34% of passenger traffic** worldwide, ahead of both Europe and North America (27% each), led by dynamic growth in the major emerging economies.

- **Makes the APAC region the largest regional market for air transport (ahead of North America and Europe which each represent 21%).**

Market Drivers: Emerging Middle Class

- **Rapidly Expanding Middle Class – Driven by Emerging Markets**
  - Global middle class is expected to grow from under 2 billion consumers today to nearly 5 billion within two decades
- **Heavy Investment in Airport Infrastructure in Emerging Regions**
  - *"Asia Pacific region to develop 350 new airports over a decade, with more than USD $100B in investments"*, (Frost & Sullivan, 12 Nov 2010)
    - *Over 55 new airports in China by 2020* – CAAC 12th annual plan

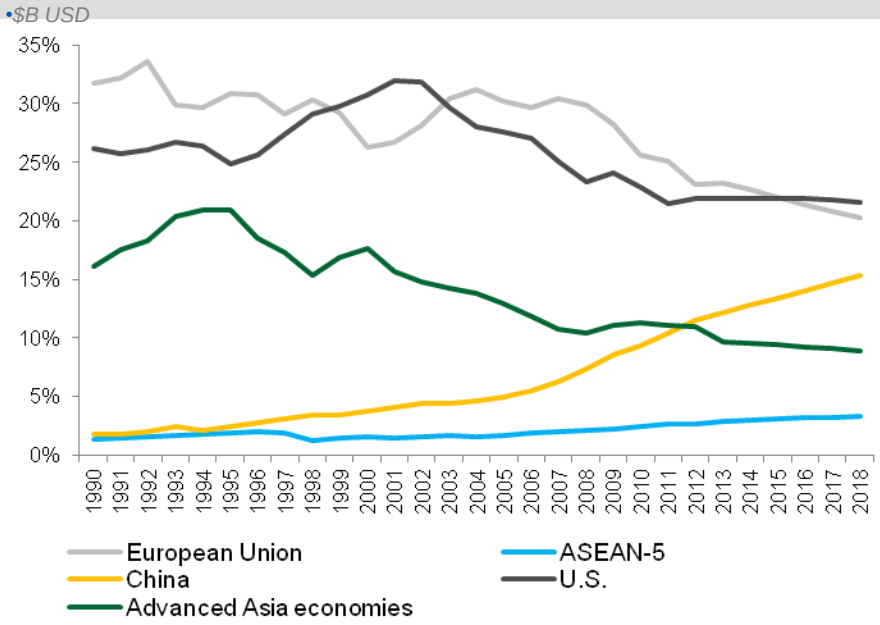
•Share of Global Middle Class Consumption[1]



•Rapidly Expanding Middle Class Driving Need to Accommodate Increased Air Transportation in Emerging Regions

APAC Macro Environment

World GDP Distribution

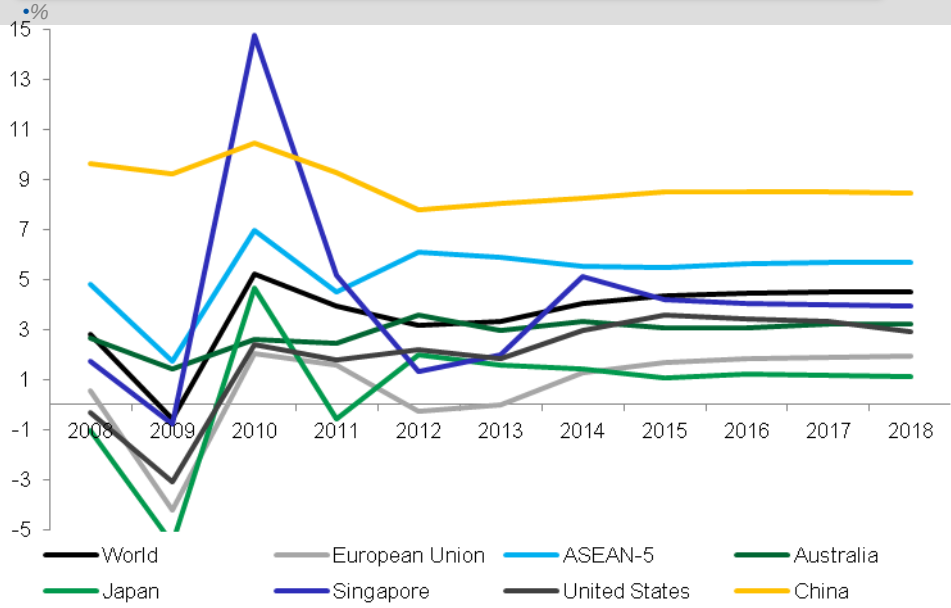


- China will account for 15.2% of world GDP in 2018
- Developed Asia economies* account for 8.9% of world GDP
- ASEAN economies have become increasingly competitive

Source: IMF

** Japan, South Korea, Taiwan, Singapore*

Asia County Real GDP Growth

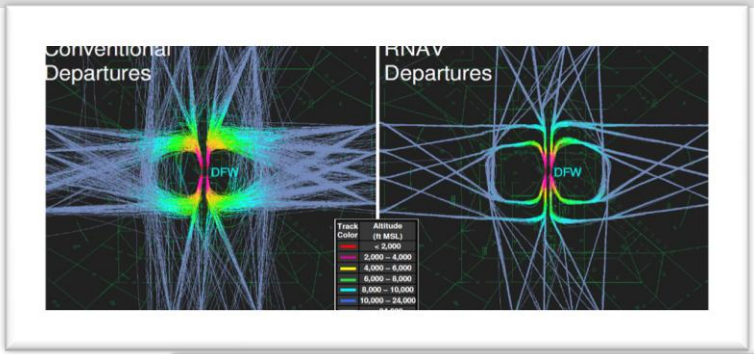


- China: continued robust domestic demand in both consumption and investment; renewed external demand
- ASEAN-5 economies growth remains strong above 5%
- Stabilize of Japan, Singapore and Australia economy

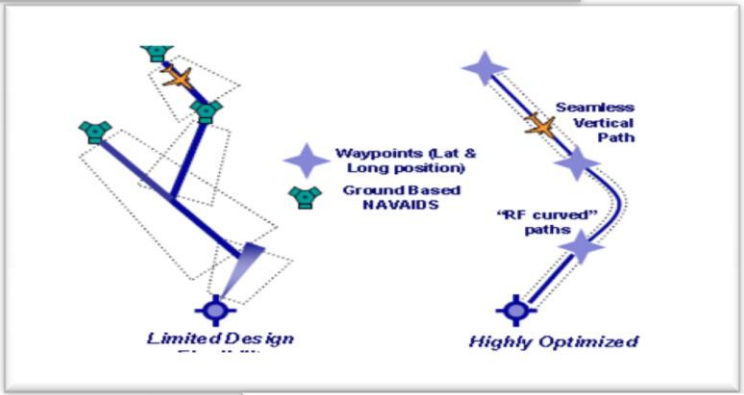
Growing Impact of APAC Economies

PBN Provides Value in All Phases of Flight

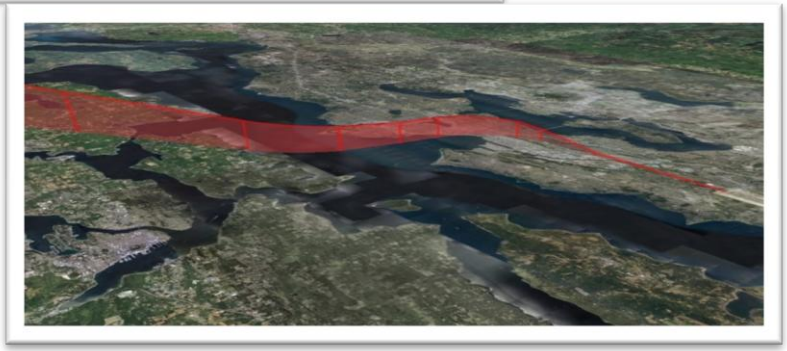
- Departure



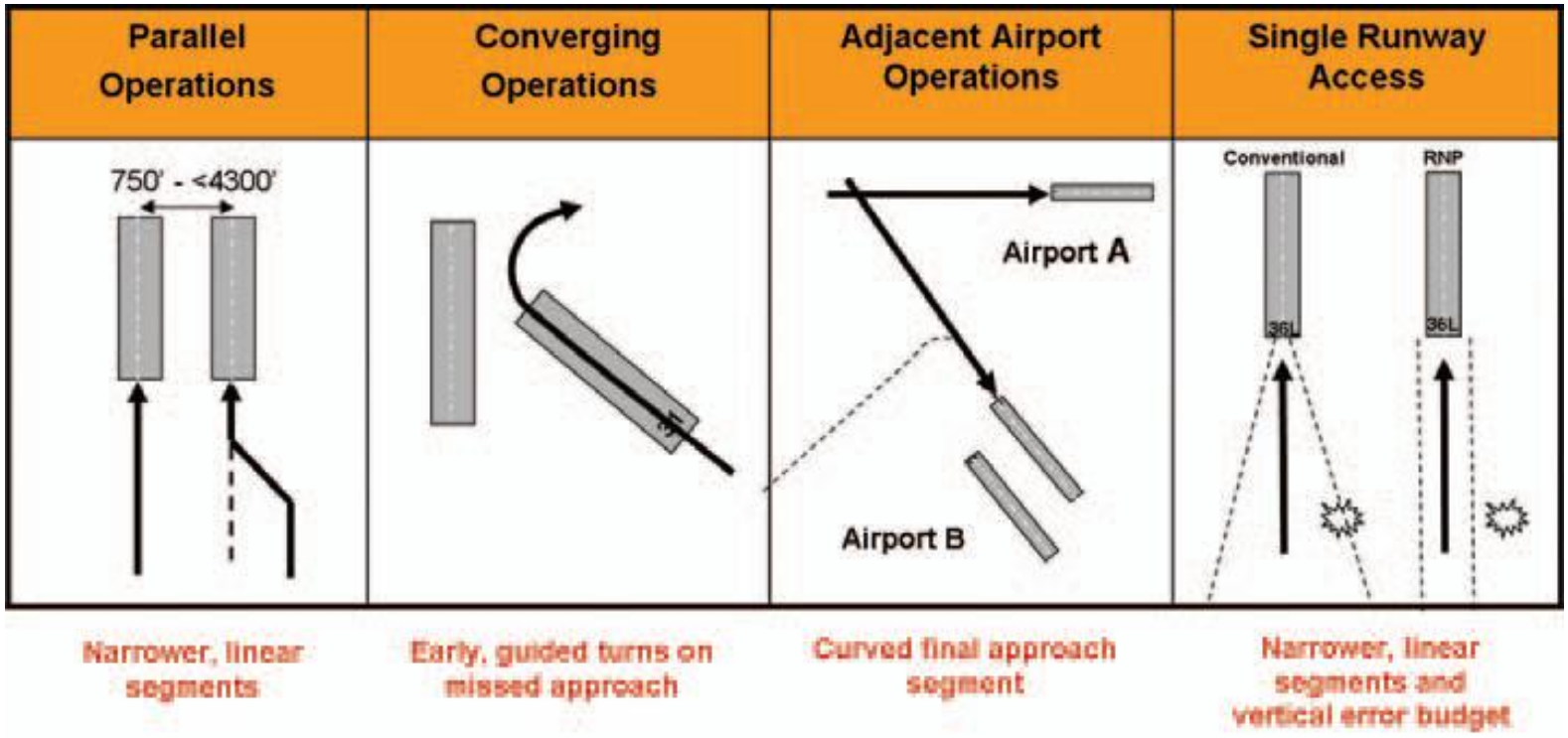
- En-route



- Arrival



PBN Facilitates Accuracy, Safety, & Capacity



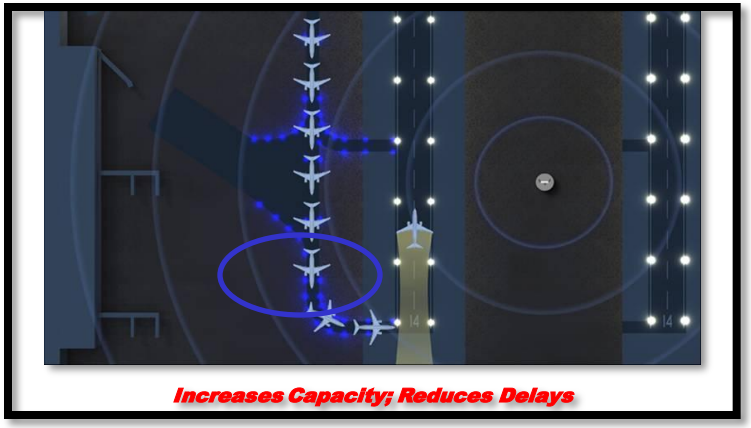
Air Traffic Environment of the future

- All Stakeholders (Airports/Airlines/ANSPs) should not view this from their singular perspective
- Must Take an Enterprise approach; viewing Air Traffic management into and out of an airspace/airports like a Manufacturing Process
- Work to implement technologies across the entire process to:
    1. Facilitate change
    2. Provide Increased efficiencies and safety
    3. Act in synergy with each other
- Replace Man-Man operations with Man-Machine automated operations
- For example:
    - Increase approach capacity using PBN coupled with GBAS

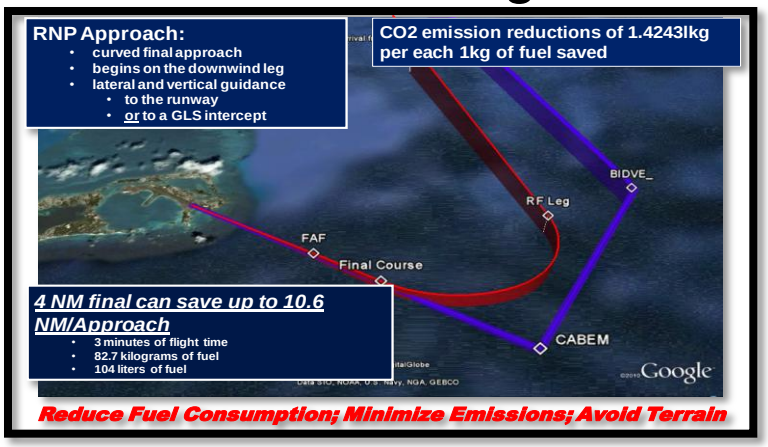
GBAS – Enhanced ATM Capabilities

•Flexible, Digital Approach Paths

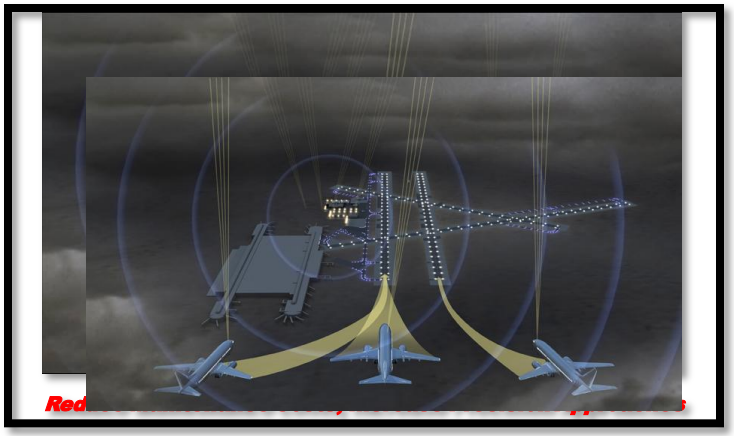
•Requires No "Clear Zones"



•Enables Efficient Flight Path



•Serves All Runway Ends



•*Increased Capacity; Reduced Noise; Reduced Track Miles; Reduced Operating Costs*

Shanghai Pudong Flight Trials

- 29 April 2015 China Eastern & Shandong Airlines successfully flew the most Complex PBN to GLS procedures to date
  - Flew RF Curved Path to 2.5 and 4.0 NM Finals
  - Flew 2.8-3.2 Degrees Variable Glidepaths
  - Flew Displaced Threshold Operations

First PBN to GLS Landing in China

- **Increase safety and efficiency, and ease the challenges of China's growing air traffic**

- Help to reduce air traffic congestion and increases airport throughput

- Requires less track miles, reducing fuel burn and carbon emissions

- Minimize aircraft noise levels and footprint

- Significant savings on annual maintenance and re-calibration

- **5 aviation "firsts" which are noteworthy**

✓First flight in APAC outside of Australia

✓First GBAS flight by A320&B737 airline/line crew into major commercial airport

✓First curved path RNP into GLS final by any airline/line crew into major commercial airport

✓First variable glide path (2.8 & 3.2deg) GBAS landing in non-test aircraft

✓First displaced thresh hold (1075M) landing in non-test aircraft

Potential Savings

- Shanghai Pudong Aircraft Movements in 2014 = 402,105
- Cost of Jet Fuel = $1.87/gal (source:
- CO2 directly created per kg of Jet Fuel Burned = 3.15 (source:
- 1 liter of Jet-A Fuel = .81kg (source:
- Track Miles Saved in Pudong Demonstrations = 34.9 maximum
- Fuel Savings per Track-mile not flown (narrow body aircraft) = 9.81 liters/mi
- Per Arrival Fuel savings for 34.9 track miles eliminated = 34.9 * 9.81 = 342.369 liters = 90.44 gal * $1.87/gal = $169.12 per arrival
- Carbon Saved per Arrival = 9.81 liters * 34.9 * 3.15 = 1078 kg of CO2

If 25% of arrivals used this combined approach, the annual value of fuel saved would equal more than $15,000,000 USD.

Wrap Up…Questions and Answers

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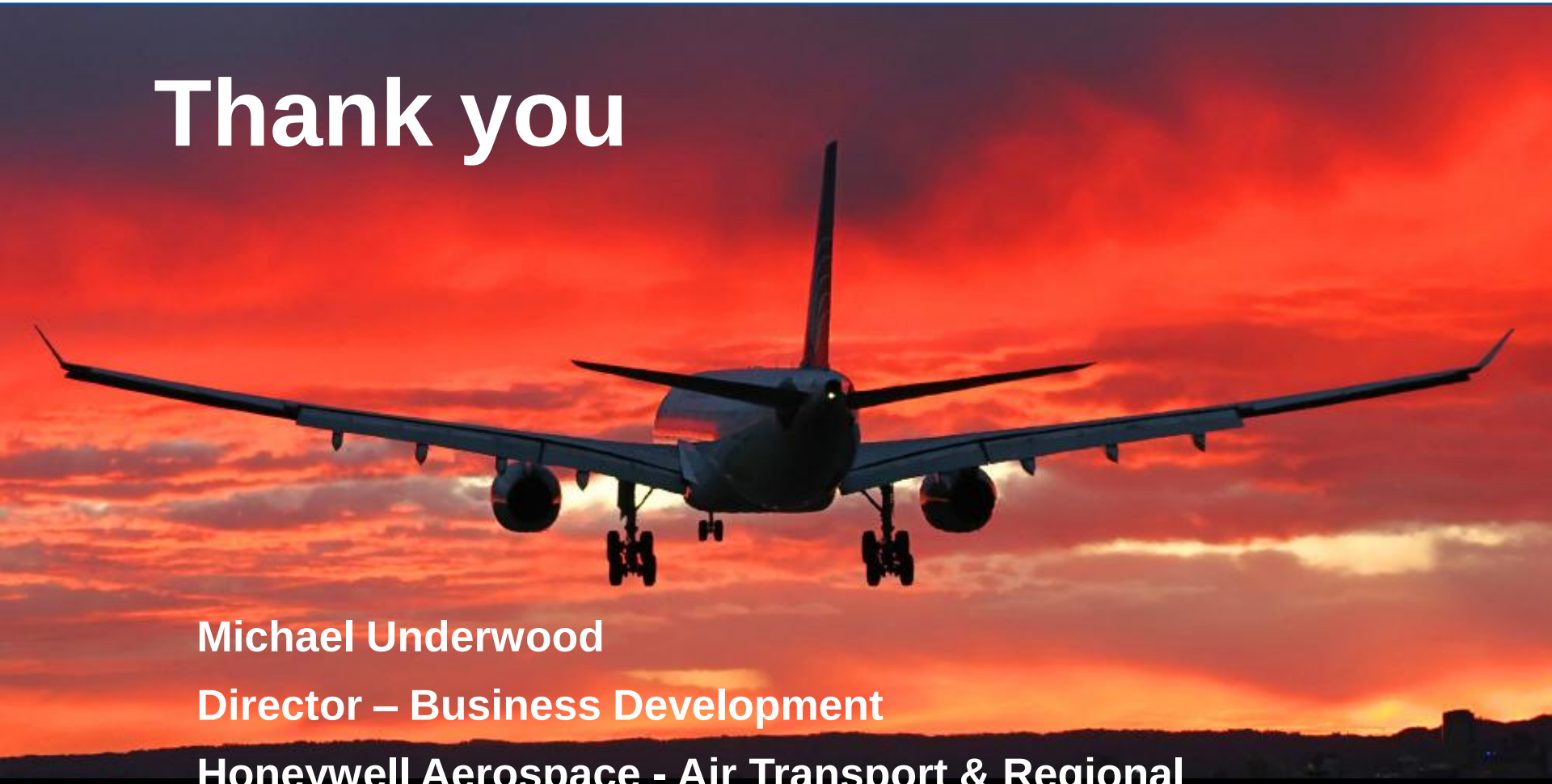
Thank you



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