



9-10 March, 2016
**AIRLINE E&M:
CHINA & EAST ASIA**

Presented by:

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MRO Forecast and Market Trends





Today's Agenda

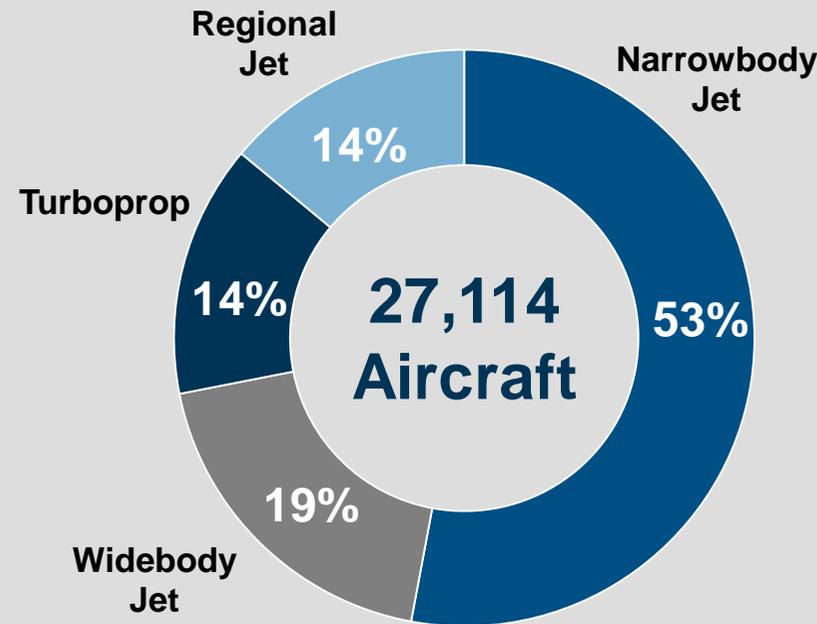
- ⚙️ **MRO Forecast**
- ⚙️ **New Technology Aircraft Impact**
- ⚙️ **Meet the Frackers!**
- ⚙️ **The Next Big Thing...**

MRO Forecast

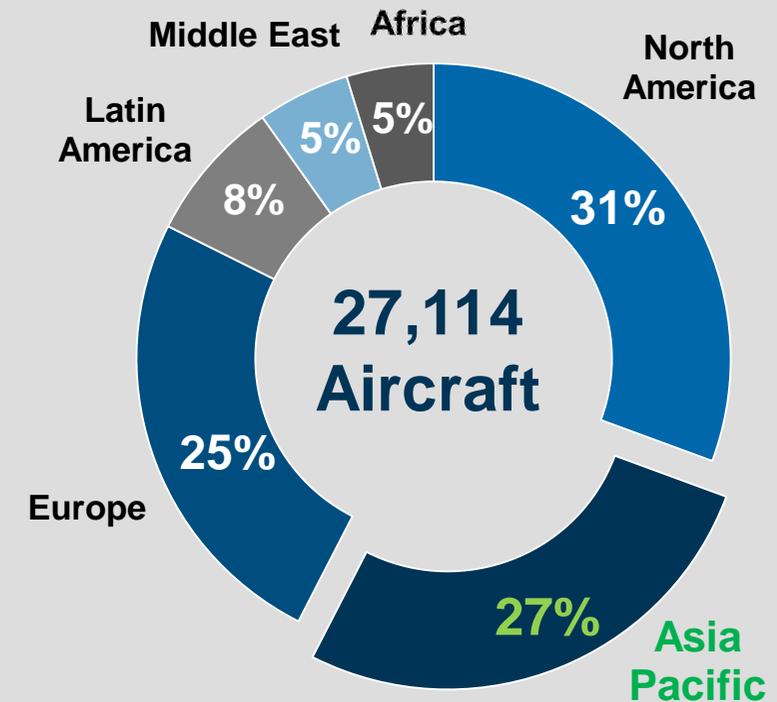


The current commercial air transport fleet consists of over 27K aircraft

2015 Global Commercial Air Transport Fleet



By Aircraft Type

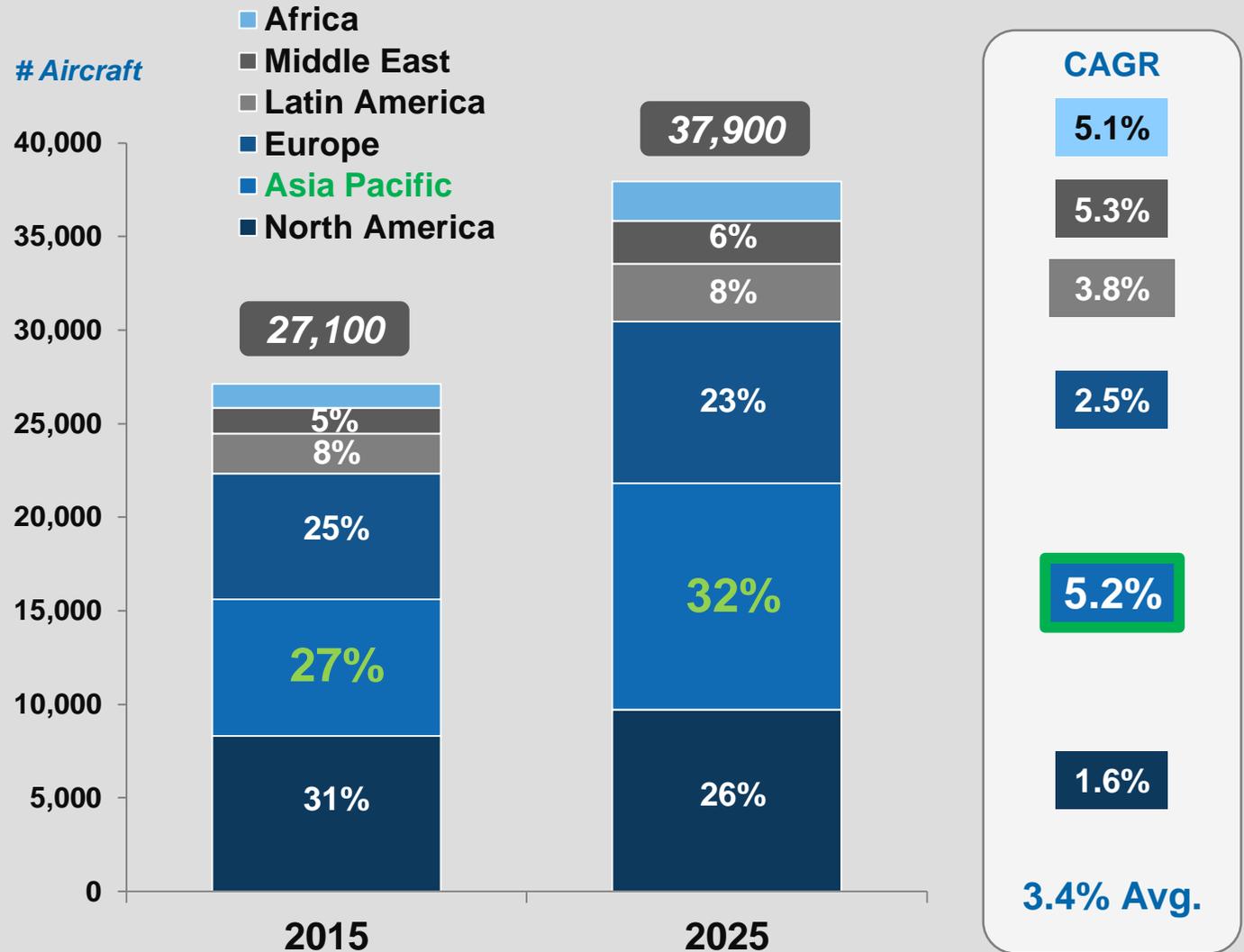


By Global Region

The combination of strong air travel demand and the need to replace ageing aircraft will drive fleet growth at 3.4% annually

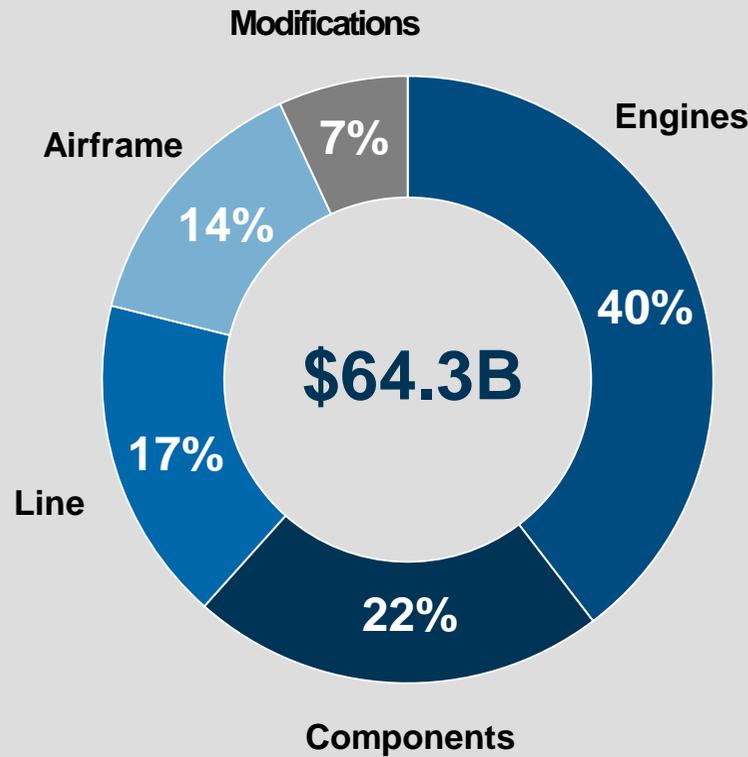
- Air traffic growth of ~4.1%
- Fuel costs in \$55/bbl range
- ~19,600 aircraft deliveries
- ~8,800 aircraft retirements

10 Year Global Air Transport Fleet Growth

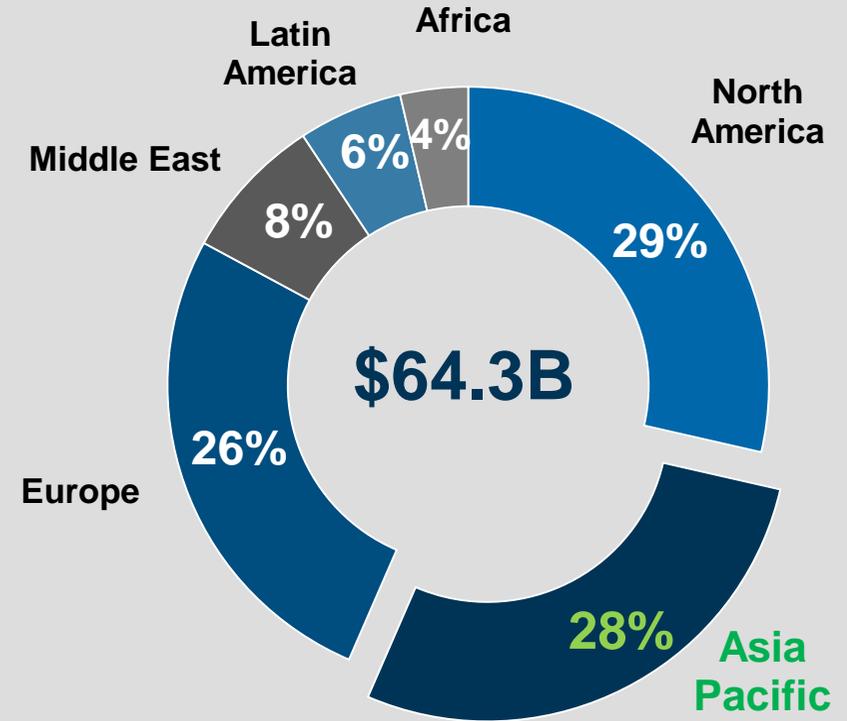


Current air transport MRO demand is \$64.3B; Asia Pacific is now equivalent to North America and Europe

2015 Global MRO Demand



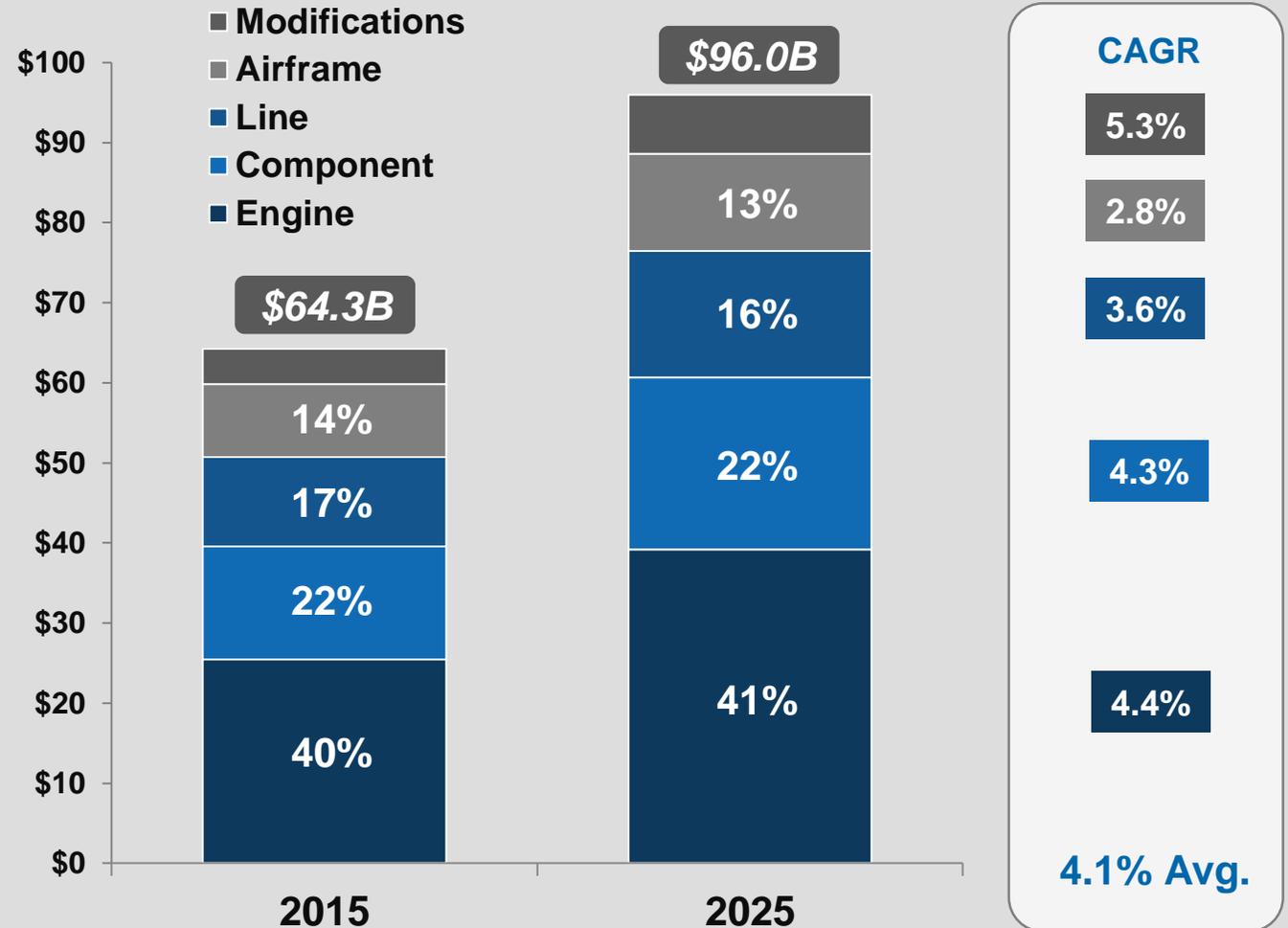
By MRO Segment



By Global Region

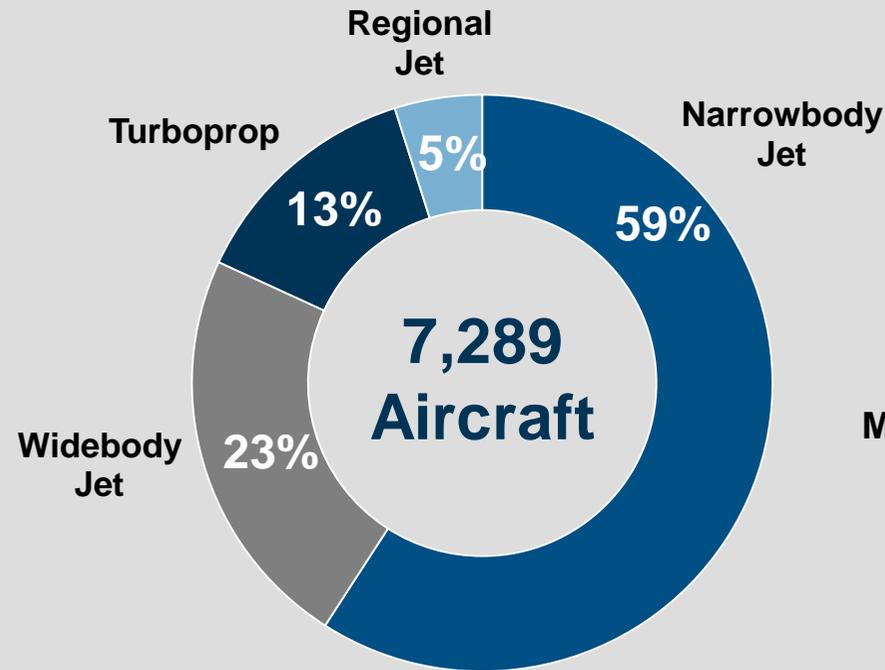
The global MRO market is expected to grow by 4.1% per annum to \$96B by 2025

10 Year Global MRO Demand Growth



The Asia Pacific fleet consists of nearly 7,300 aircraft, with 37% (approx. 2,700 aircraft) in China

2015 Asia Pacific Commercial Air Transport Fleet



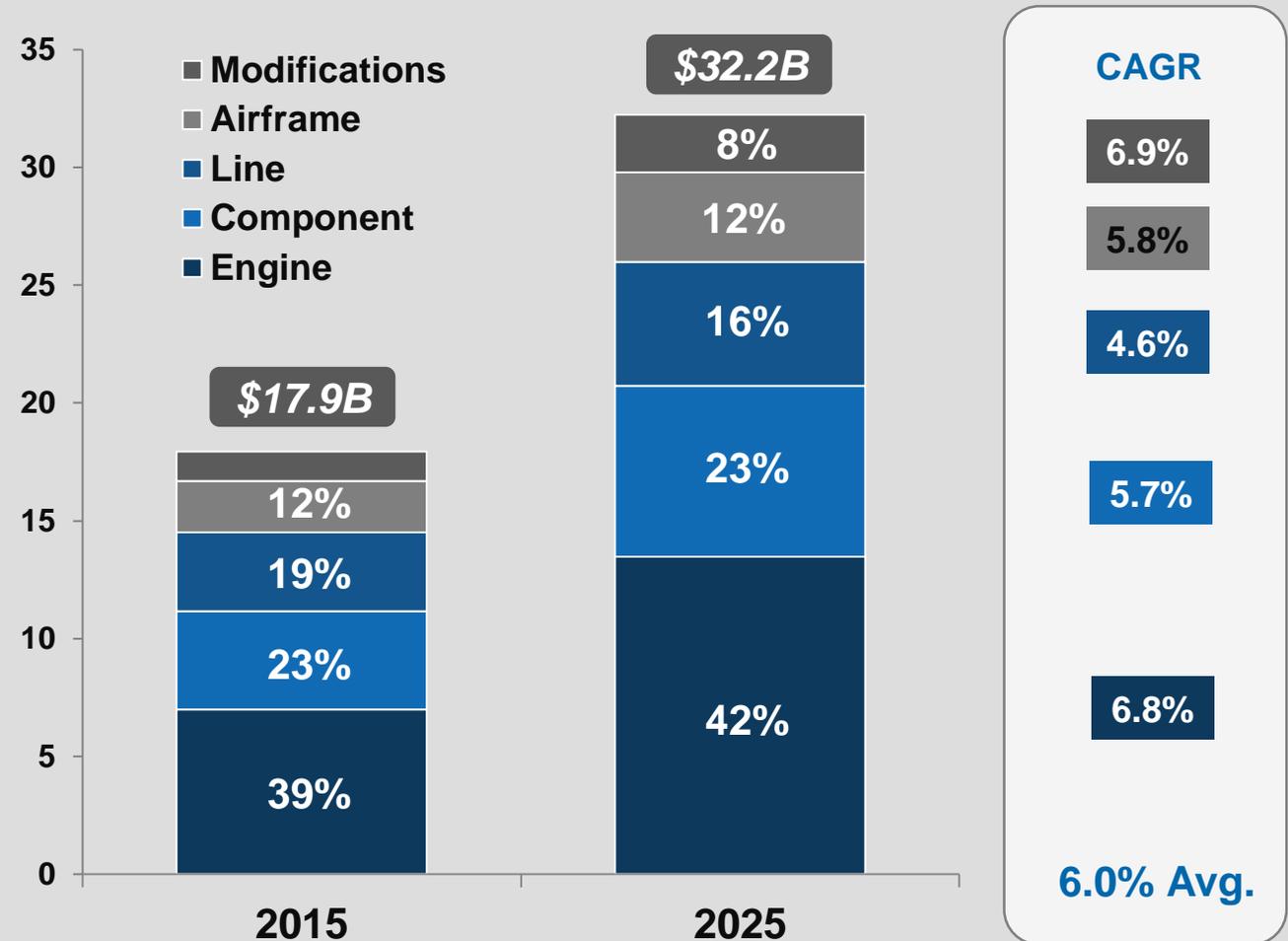
By Aircraft Type



By Country

The Asia Pacific MRO market is expected to nearly double to approx. \$32.2B by 2025, at 6.0% per annum

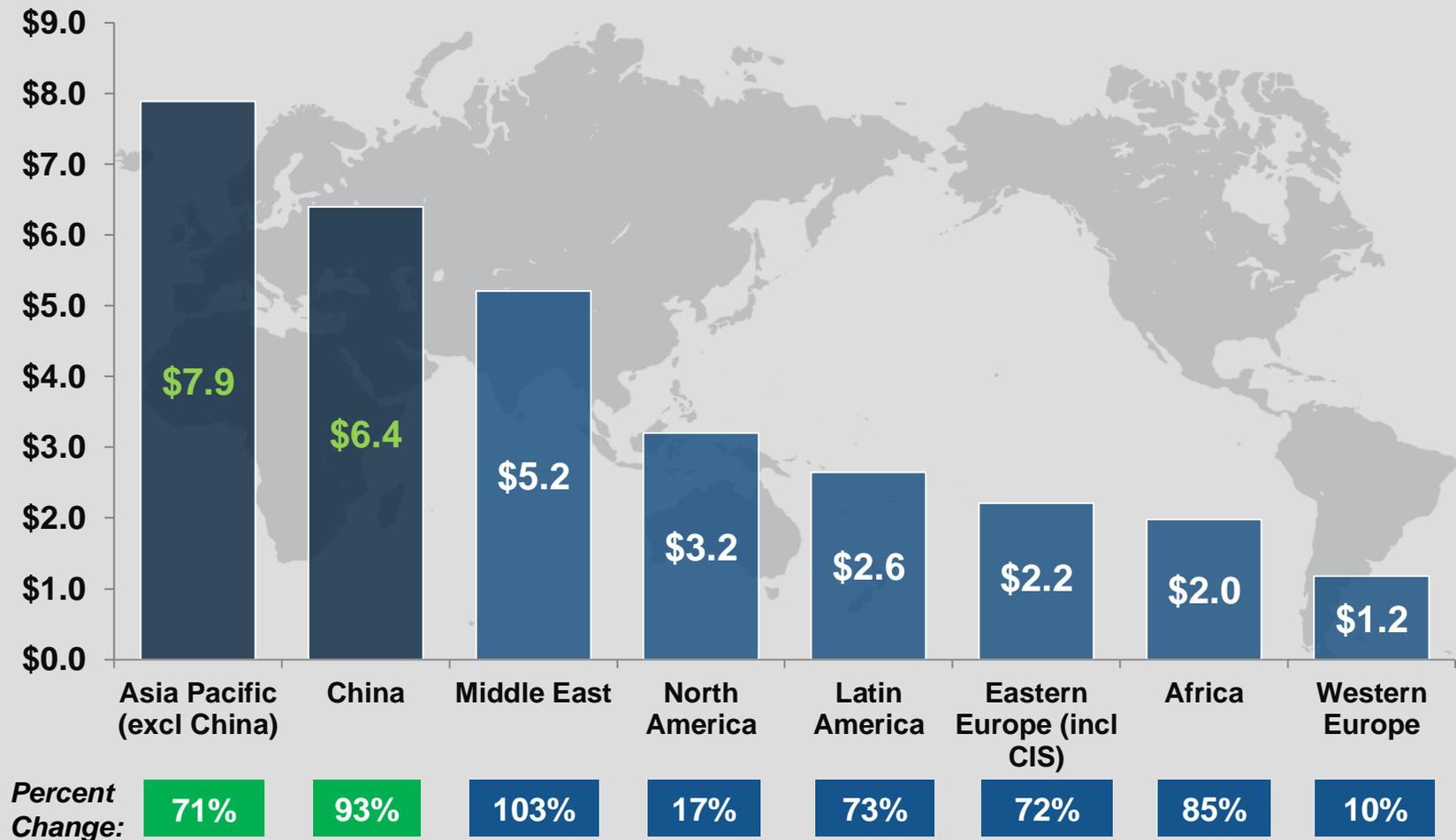
10-Year Asia Pacific MRO Demand Growth



Source: ICF International; Forecast in 2015 \$USD, exclusive of inflation

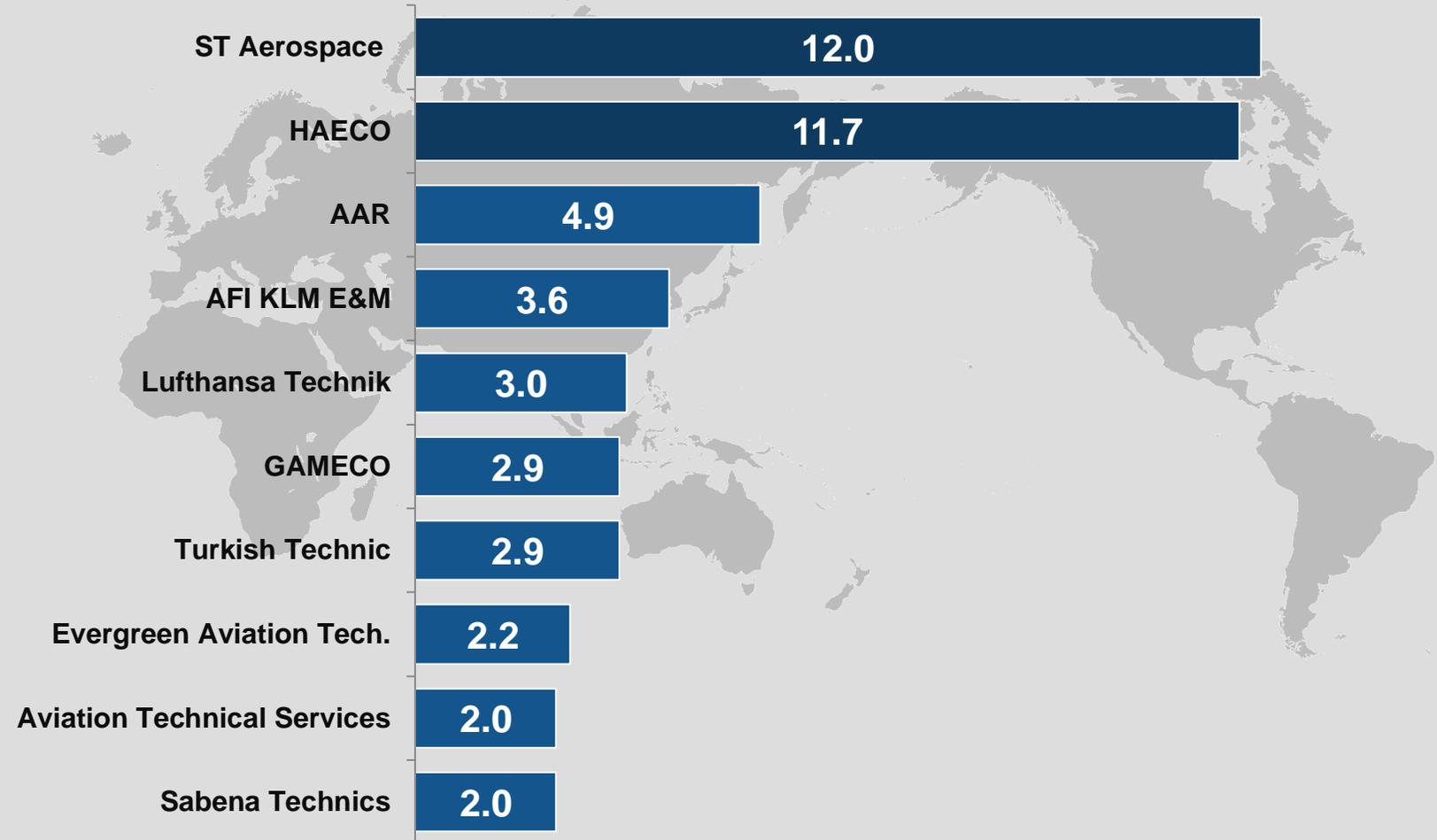
Over the next decade, China and Asia Pacific region will drive absolute MRO spend growth

Difference in MRO Spend, 2025 vs. 2015 – By Global Region
\$ USD Billions



Among the top ten airframe MRO providers, ST Aerospace and HAECO account for 50% of man-hours performed in 2014

2014 Top 10 Airframe MROs by Man-Hours Performed
In Millions

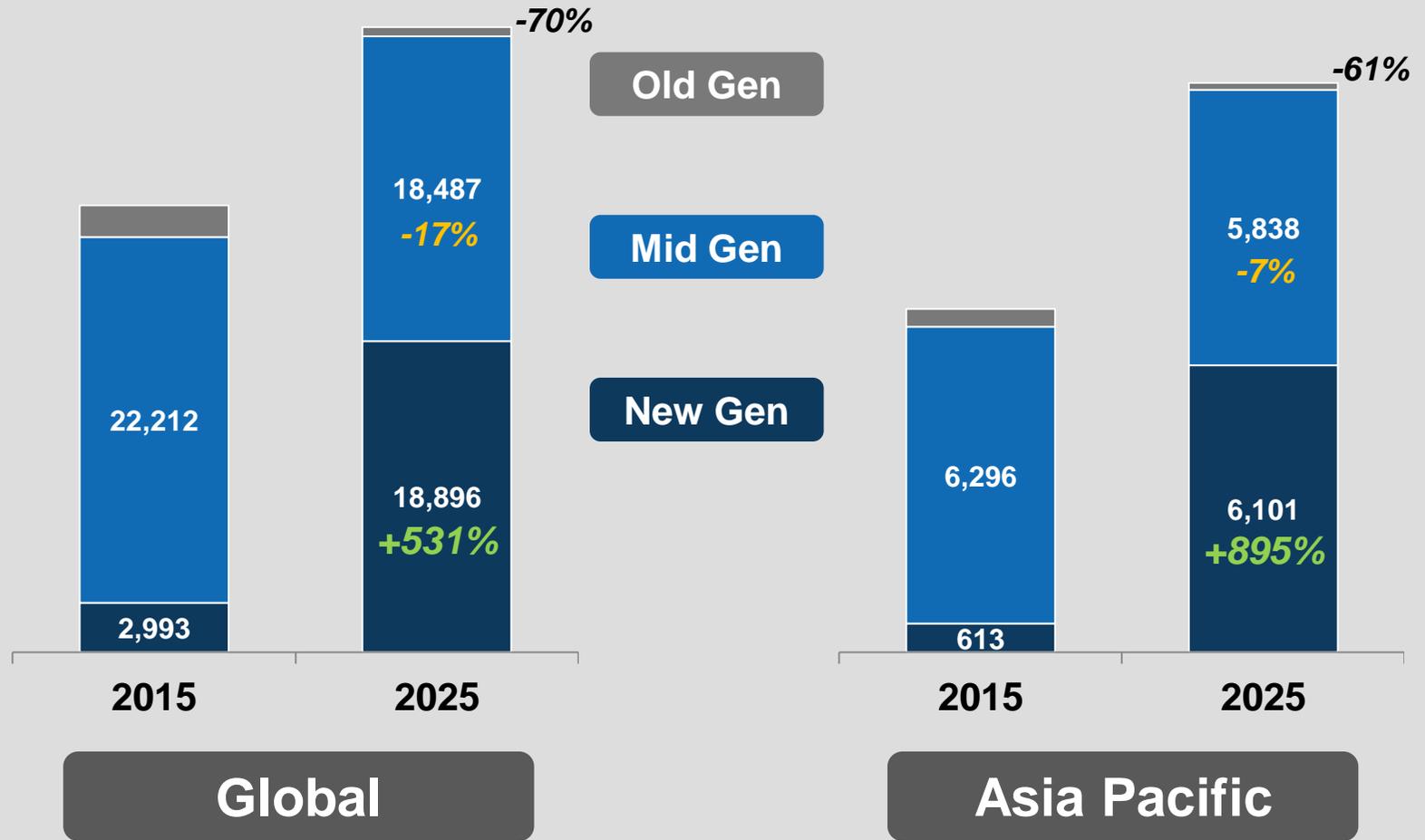


The background of the image is a digital tunnel composed of multiple rows of binary code (0s and 1s). The code is arranged in a perspective that creates a sense of depth, with the lines converging towards a vanishing point in the center. The color palette is a gradient of blues, from a dark, almost black blue on the left to a lighter, cyan blue on the right. The text is overlaid on the left side of the image.

Impact of New Technology Aircraft

In the next decade, the global fleet of new generation aircraft fleet will grow by approx. 531% to nearly 19,000 aircraft

10-Year Fleet Forecast by Aircraft Generation



Source: ICF International

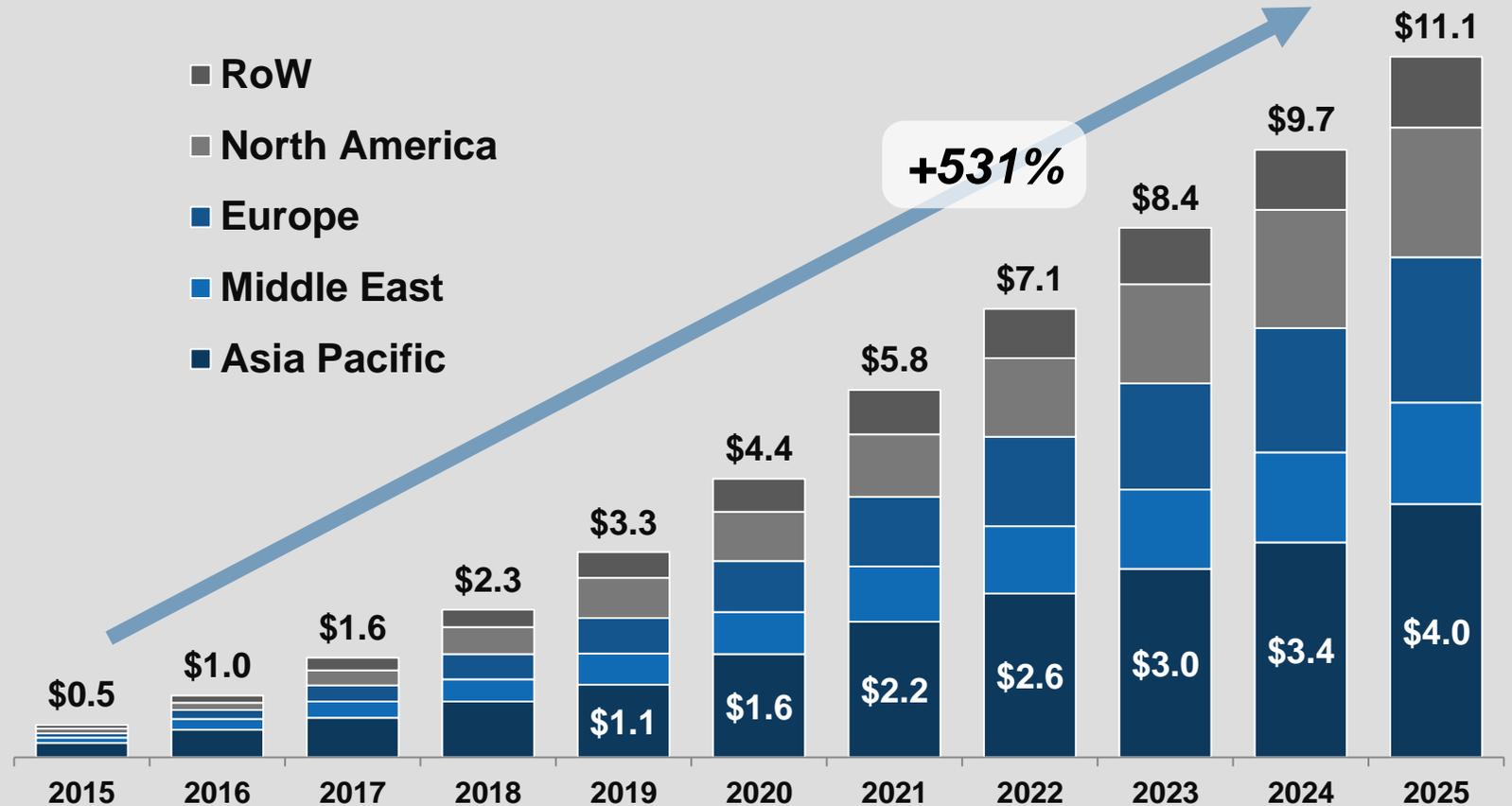
Old Gen: 727, 737 Classic, 747 Classic, DC10, L1011, A300

Mid Gen: 757, 767, 747-400, A320 Family, A330/A340, 737NG, 777, ERJ, CRJ

New Gen: 777X, 787, A350, A330neo, A380, E170/175/190/195, CRJ-7/9/1000, 737MAX, A320neo

Over the next decade, MRO spend on new technology A350 & Boeing 787 aircraft will double every three years

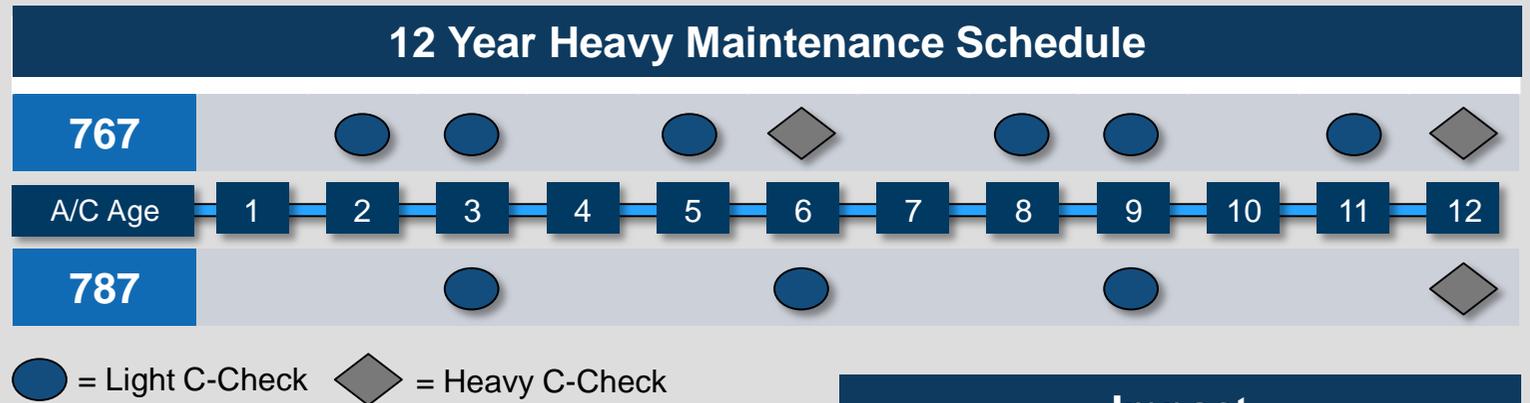
10-Year MRO Spend for New Technology A350 & 787 Aircraft
\$ USD Billions



New technology aircraft challenge traditional MRO sourcing strategies

Return on investment challenges:

- Facilities
- Tooling & Equipment
- Training
- IT Systems



	Impact		
	Volume (C-checks)	Intensity (man-hours)	Days (Hangar)
767	8	95,000	136
787	4	33,000	47

- **Cost Savings:** ~65% fewer routine airframe heavy maintenance man-hours drives an estimated savings of ~\$3.5M
- **Asset Utilization:** ~90 additional available flying days enables increased revenue generation potential

*Based on 4,000 FH/yr utilization

767 C-check = 18mo, 4C = 72mo; 787 C-check = 36mo, 4C = 144mo

Assumed industry standard labor man-hour rate

Aircraft out of Service (AoS) calculated for C/4C/8C checks assuming industry standard MRO hangar productivity

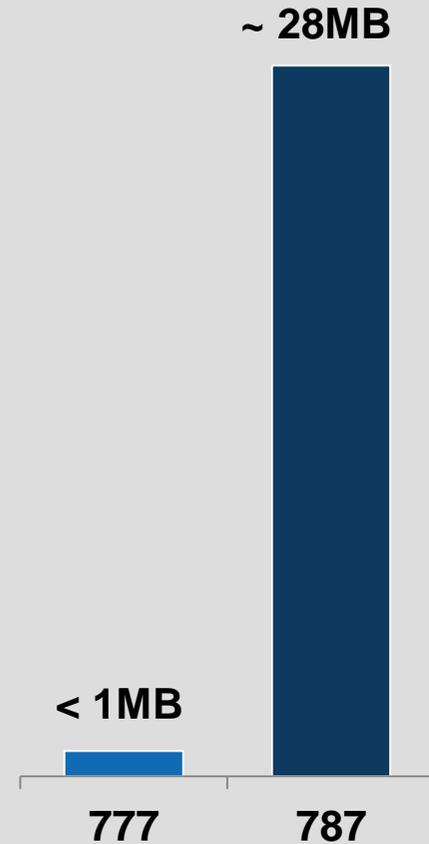
Challenge: How best to realize value from the disparate terabytes of data generated by new technology aircraft

Stakeholder Battle: Who will control and profit from the operating data IP?

- Operators
- Lessors
- OEMs
- MRO Suppliers



Number of AHM Parameters

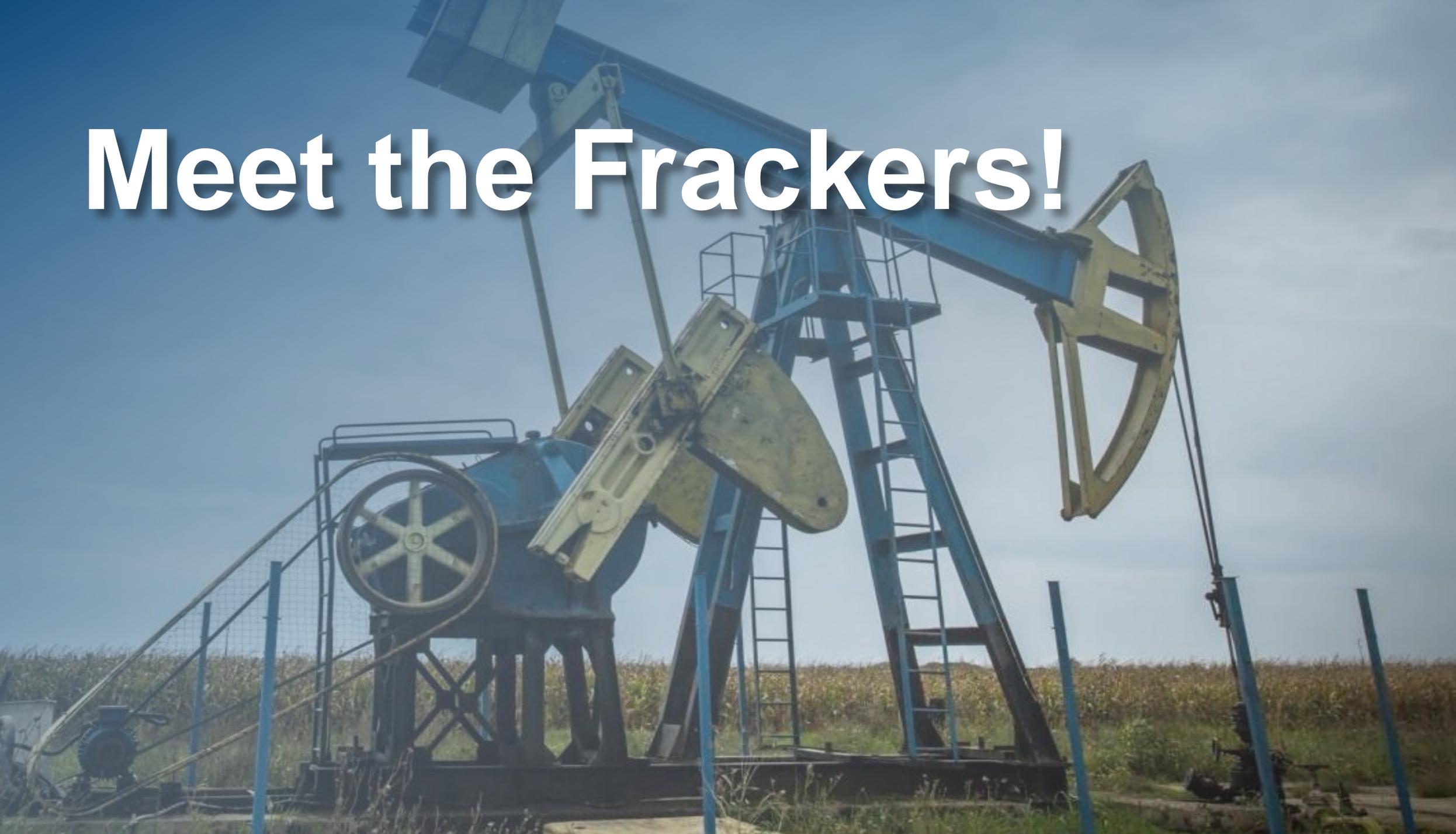


Transmittable Data (MB/Flt)



A/C Data Generated (TB/Year)

Meet the Frackers!



Breakthrough technologies in horizontal drilling and hydraulic fracturing (aka fracking) resulted in a US-led energy revolution

North American crude oil and natural gas production have soared in recent years...

U.S. Crude Oil Production
(Barrels / day)



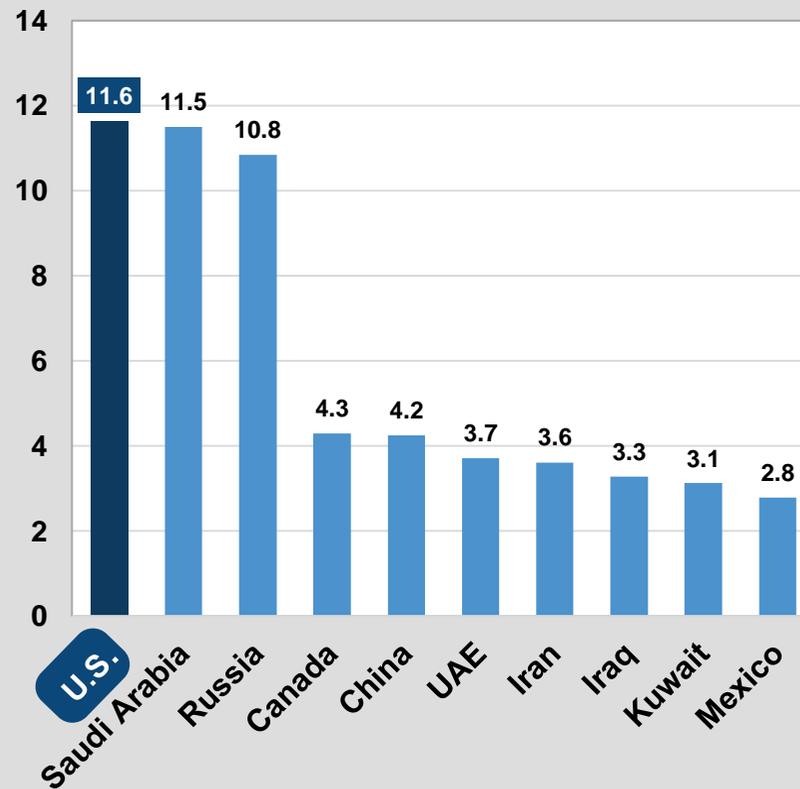
U.S. Natural Gas Production
(Monthly marketed production)



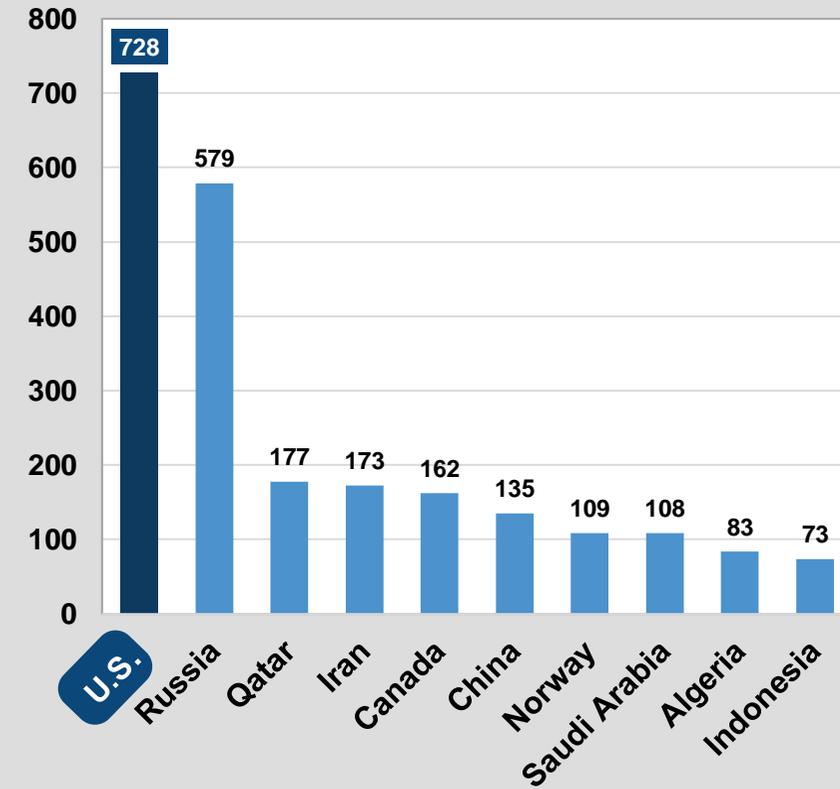
The US energy revolution has completely disrupted the global economic and geopolitical balance of power

...making the U.S. a global powerhouse in energy production

Global Oil Production
(Million barrels / day as of June 2015)



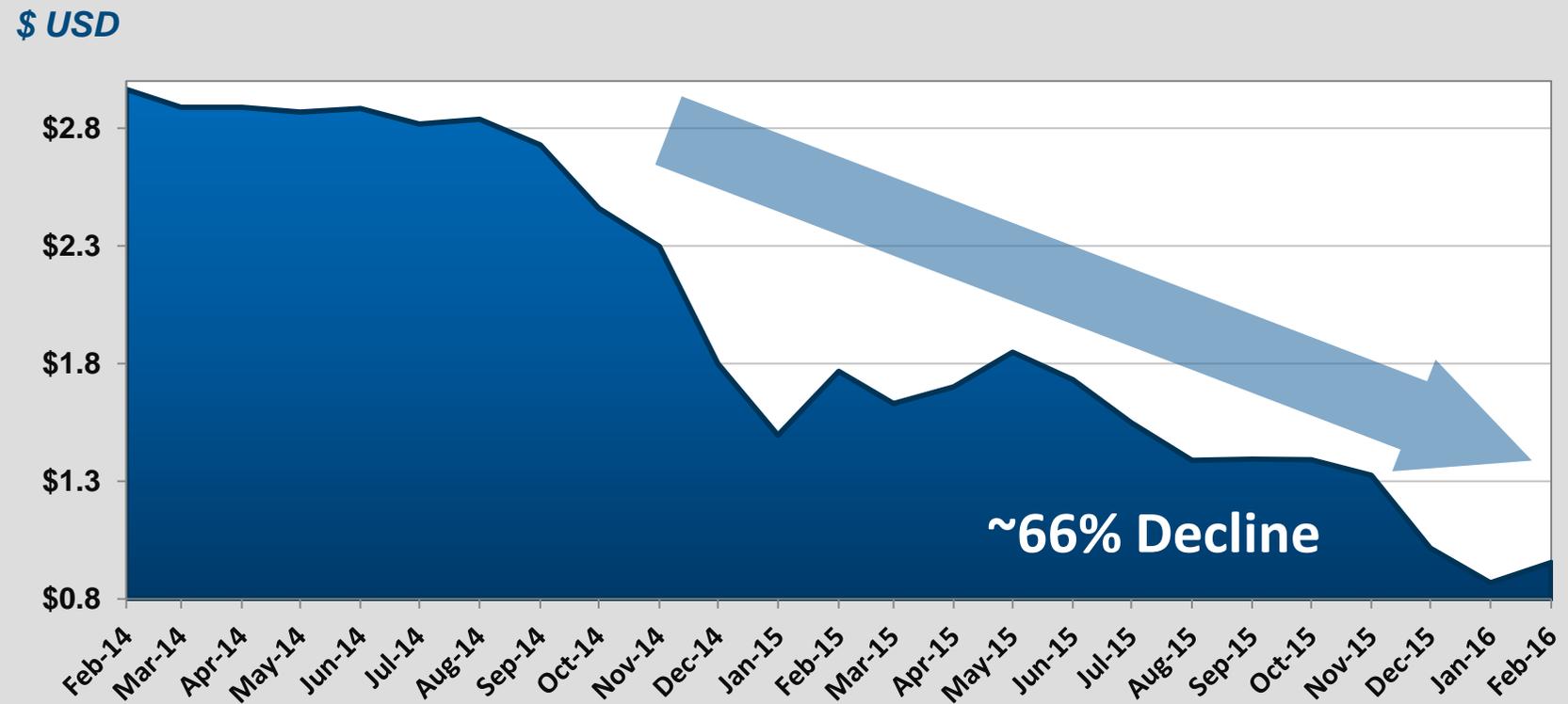
Global Natural Gas Production
(Billions of cubic meters as of June 2015)



Continued low fuel costs will have significant repercussions throughout the aviation & MRO supply chain

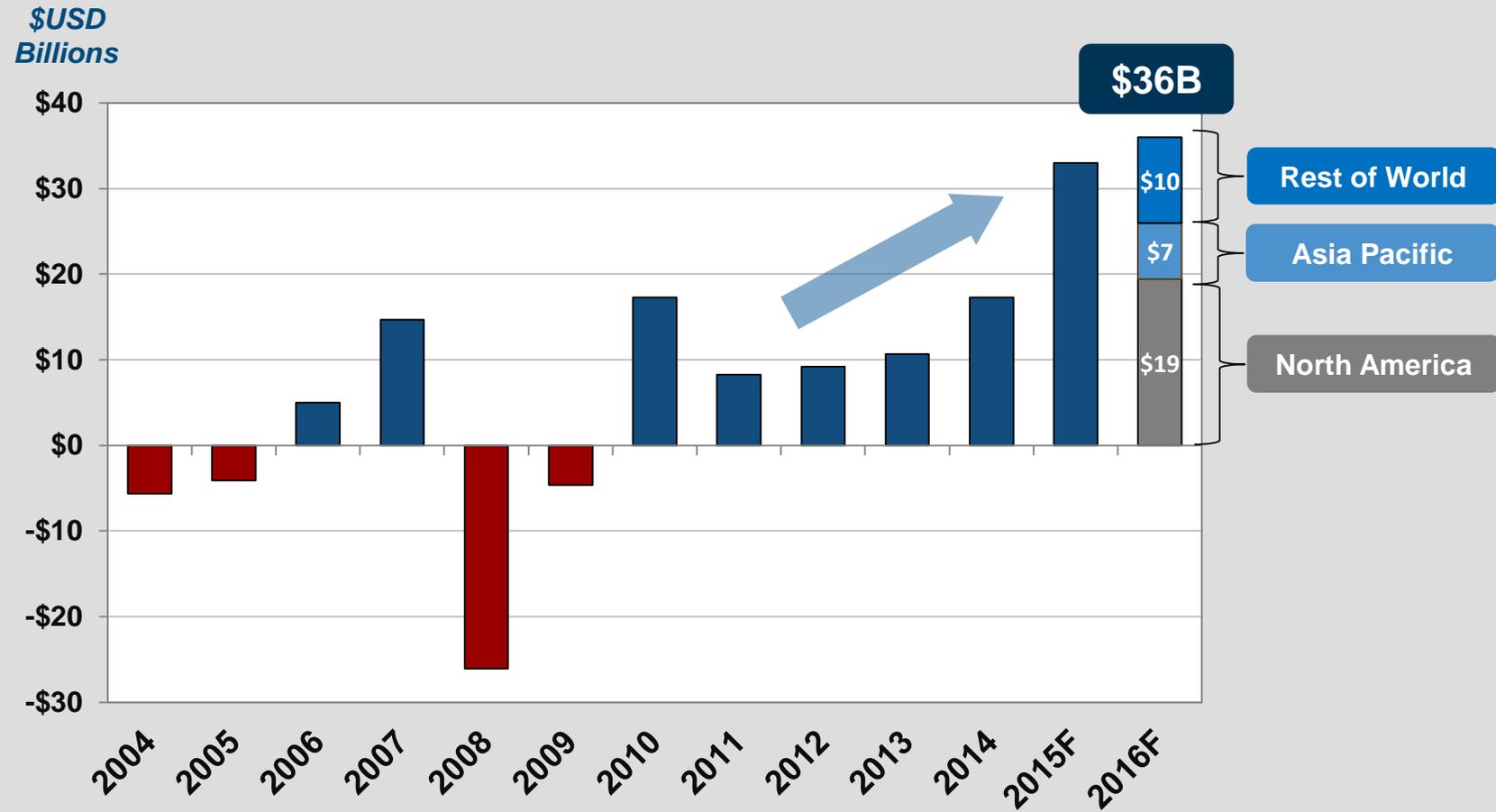
Aviation fuel costs have dropped by approx. 66% during the past 24 months...

U.S. Gulf Coast Jet Fuel Price per Gallon



While Asia Pacific & North American airlines have enjoyed record profitability, other regions continue to struggle

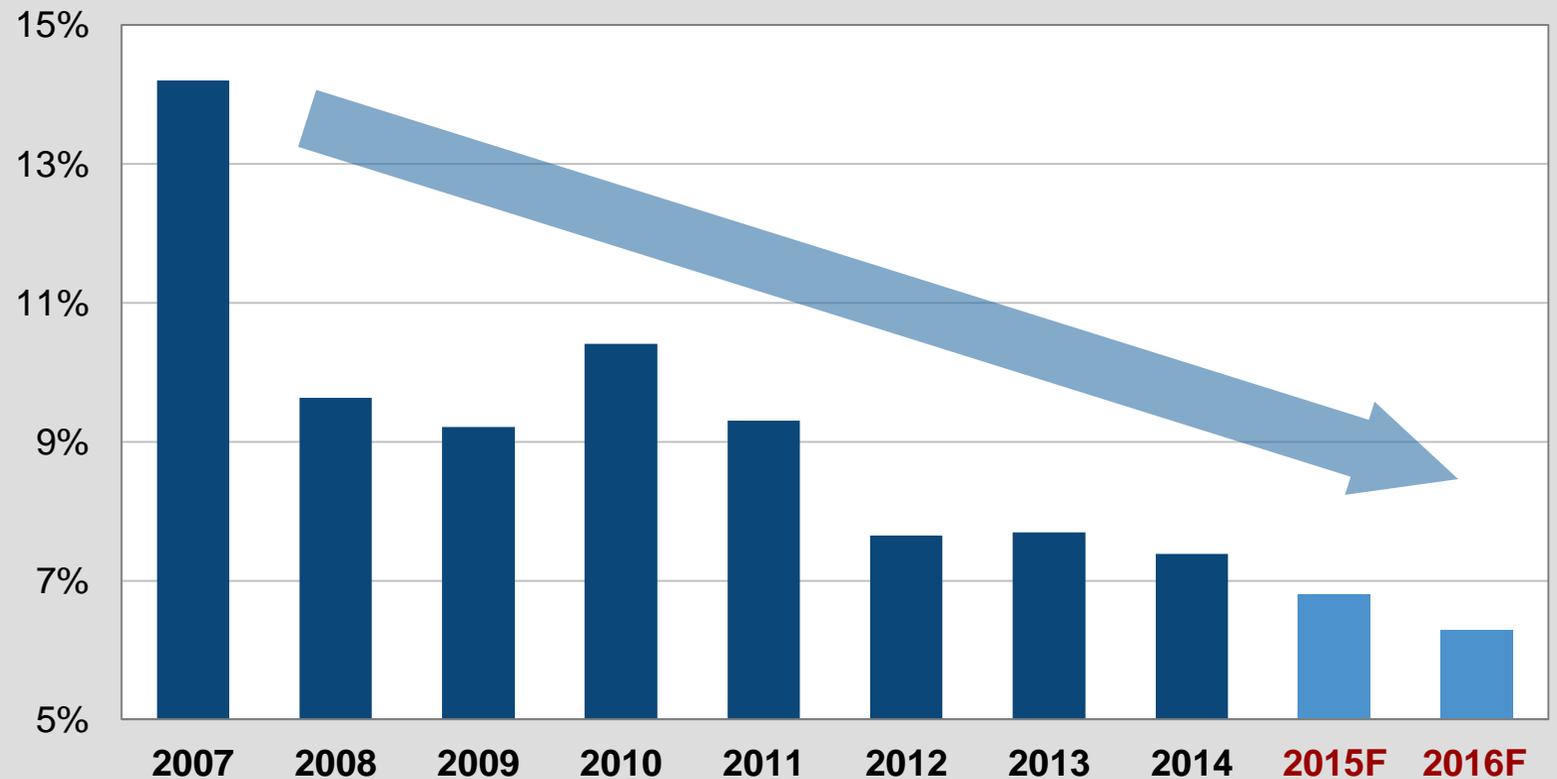
Global Airline Profitability, 2004-2016



China's seemingly insatiable demand for global commodities was a key driver of global economic growth

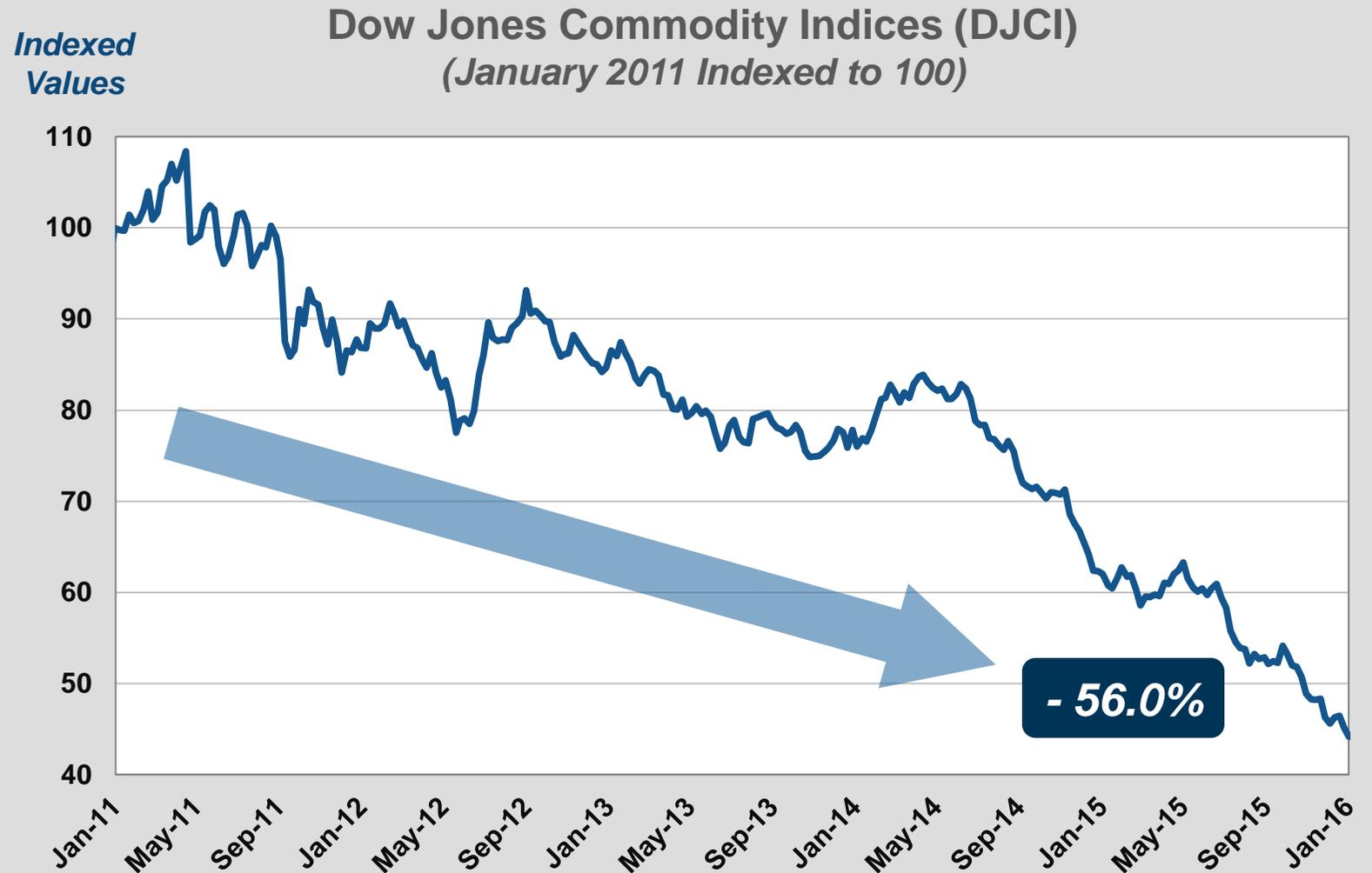
After years of remarkable GDP growth, China's economy has been steadily slowing

China GDP Year-on-Year Growth (%)



The fall in commodity prices have had a dramatic impact of economies dependent on commodity exports

Over the past 5 years, commodity prices have plummeted more than 55%



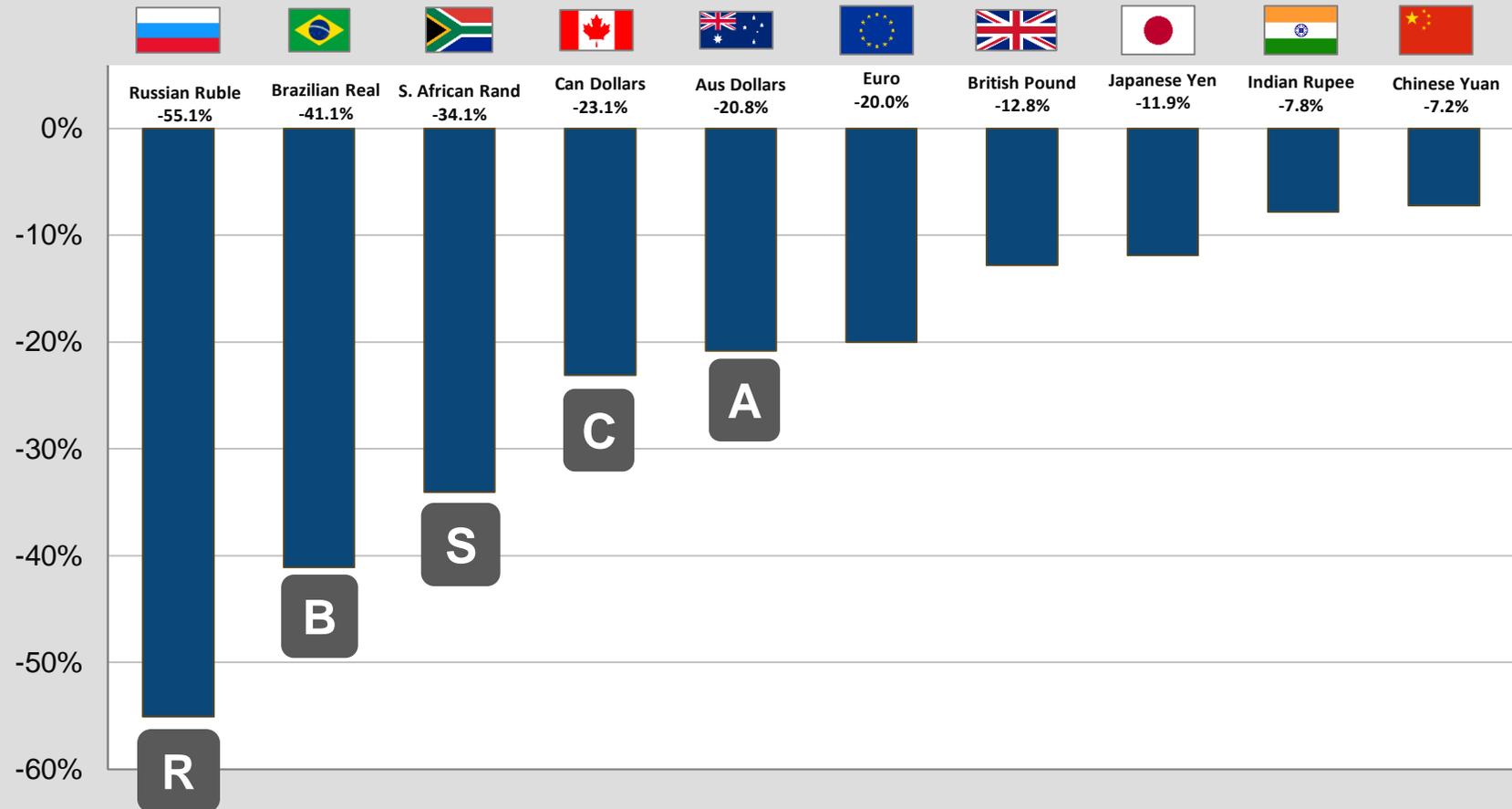
The dramatic increase in oil & gas market supply and reduced demand for commodities has led to a stronger US Dollar

FOREX Impact

- Partially offsets the positive impact of low fuel costs for operators
- Increases the cost of dollar based flight hour agreements (and parts/material in general)
- Cost of labor for in-country MROs is cheaper driving up margins for US dollar based contracts
- Buying/leasing aircraft becomes more expensive

The “CRABS”: Countries with economies that are heavily dependent on commodity exports

Global Currency Exchange Rates vs USD
% Value Change, Jan. 2014 – Jan. 2016



Source: Oanda historical exchange rates, ICF International Analysis

The Next Big Thing...



ICF believes that virtual reality (VR) technology will be as disruptive to MRO training as 3D-printing is to parts manufacturing





In Summary...

- **The Asia Pacific region continues drive global MRO demand growth**
- **The two largest global airframe MRO suppliers are headquartered in the Asia Pacific region**
- **New Technology aircraft are creating both new challenges and opportunities aviation stakeholders**
- **The US energy revolution combined with the economic slowdown in China are having a significant impact commodity export dependent CRABS**
- **Virtual reality has the potential to transform the way technicians are trained**



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THANK YOU!

For questions regarding this presentation, please contact:

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