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Raytheon

Customer Success Is Our Mission

SESAR & NextGen: Transforming Global Air Traffic Management

IEA Conference 2013, London

Steve Winter
Engineering Fellow
March 5, 2013

steve.winter@raytheon.com

Raytheon Company

- Raytheon, based in Massachusetts, USA, is a major international defence, aerospace, and government technology solutions provider
- Its *AutoTrac*™ Air Traffic Control systems are used in more than 50 countries
- The STARS terminal automation system for the FAA is the world's largest ATC program
- Raytheon is also a leading provider of civil and military air surveillance solutions
- Raytheon is providing engineering services to the FAA as part of NextGen
- Raytheon (through TRS) is an Associate Partner of the SESAR JU

Presentation

- “A Global Crisis in Aviation”
- Why this all matters to all of us
- You may be confused…
- SESAR and NextGen Vision
- A Disconnect
- The Role of Enterprise Architecture
- Dimensions of the Problem
- “Crisis, Which Crisis?”
- Where do we go from here?
- “Show me the Money”
- Information
- Conclusions

"A Global Crisis in Aviation"

- We have been told there is a global crisis in aviation
  - Sustainability
  - Cost and Efficiency
  - Growth
  - Maintaining Safety

- This crisis affects all aviation stakeholders
  - Civil and Military Aircraft Operators
  - Manufacturers
  - Air Navigation Service Providers
  - National and International Aviation Regulators
  - Government
  - Airport Operators
  - Freight Customers
  - Passengers!

- The crisis has been brewing for over a decade

Why all this matters

- Aviation has a significant global impact
  - Nearly 5% of US GDP (IATA)
  - Nearly 3% of European GDP ($485 billion) (ATAG)
  - 3.5% of the Gross World Product supported, $2.2 trillion (ATAG)
  - 56.6 million jobs worldwide (IATA)
  - 2.8 billion passengers worldwide (IATA)
  - 35% of world trade by value (ATAG)
  - 2% of Global CO_2 emissions (ATAG)

- Failure to address the crisis could inhibit future growth and profitability of aviation, which would affect:
  - Long-term global economic growth,
  - Recovery from the current recession,
  - Environmental sustainability of aviation
  - Improvements in global aviation safety

You May Be Confused…

- Isn't the aviation industry already in crisis?
  - A crisis of survival
  - A crisis of profitability, caused by:
    - A spike in fuel prices
    - Increased aviation taxes
    - A collapse in demand caused by the Global Recession

- The industry has responded by:
  - Consolidation (e.g., American/US Airways merger)
  - Elimination of non-profitable routes
  - Mothballing of excess and inefficient aircraft

(Wikipedia)

Short Term *vs.* Long Term

- Just as in the global economy, there is a short-term crisis and a separate long-term “crisis”
- They may require different solutions
  - Tactical *vs.* Strategic
- The industry has to survive the short-term crisis
- This presentation concentrates on the long-term “crisis”

Industry & Government Responses

- A number of initiatives have been created to address the long term:
  - ICAO Global Navigation Plan and Aviation System Block Upgrades (ASBUs)
  - US Next Generation Air Transportation System (NextGen)
  - Single European Sky (SES) and Single European Sky ATM Research (SESAR)
  - Seamless Asian Sky (in early stages)

ICAO ASBUs Overview

- A 4-Step Plan for achieving Global Harmonization:
  - Step 1: Create Global Harmonization Agenda
  - Step 2: Define interoperable Block Upgrades
  - Step 3: Rollout Plan for feedback (2011)
  - Step 4: International Agreement at 12th Air Navigation Conference (Nov 2012)
- 4 Blocks planned

• Block 0 (now)	• Block 2 (2023)
• Block 1 (2018)	• Block 3 (2028+)

- Blocks are made of Modules in four Performance Improvement Areas:
  - Airport Operations
  - Globally Interoperable Systems & Data
  - Optimum Capacity and Flexible Flights
  - Efficient Flight Path

SESAR & NextGen Vision

Satellite-based navigation

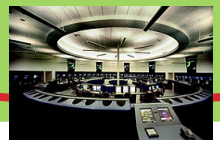
Advanced autonomous precision navigation
Peer-to-peer surveillance
Self-separation

Trajectory-Based Operations

Analog voice
Digital data communications
Automatic Dependent Surveillance

Strategic Plan

Integrated Ground Digital Information Infrastructure (SWIM)



A Disconnect

- However, there is a disconnect between this technological vision and the future reality:
  - How does the industry get there?
  - How is the vision to be implemented?
  - What problems is its realization intended to solve?

- This is where we come in…

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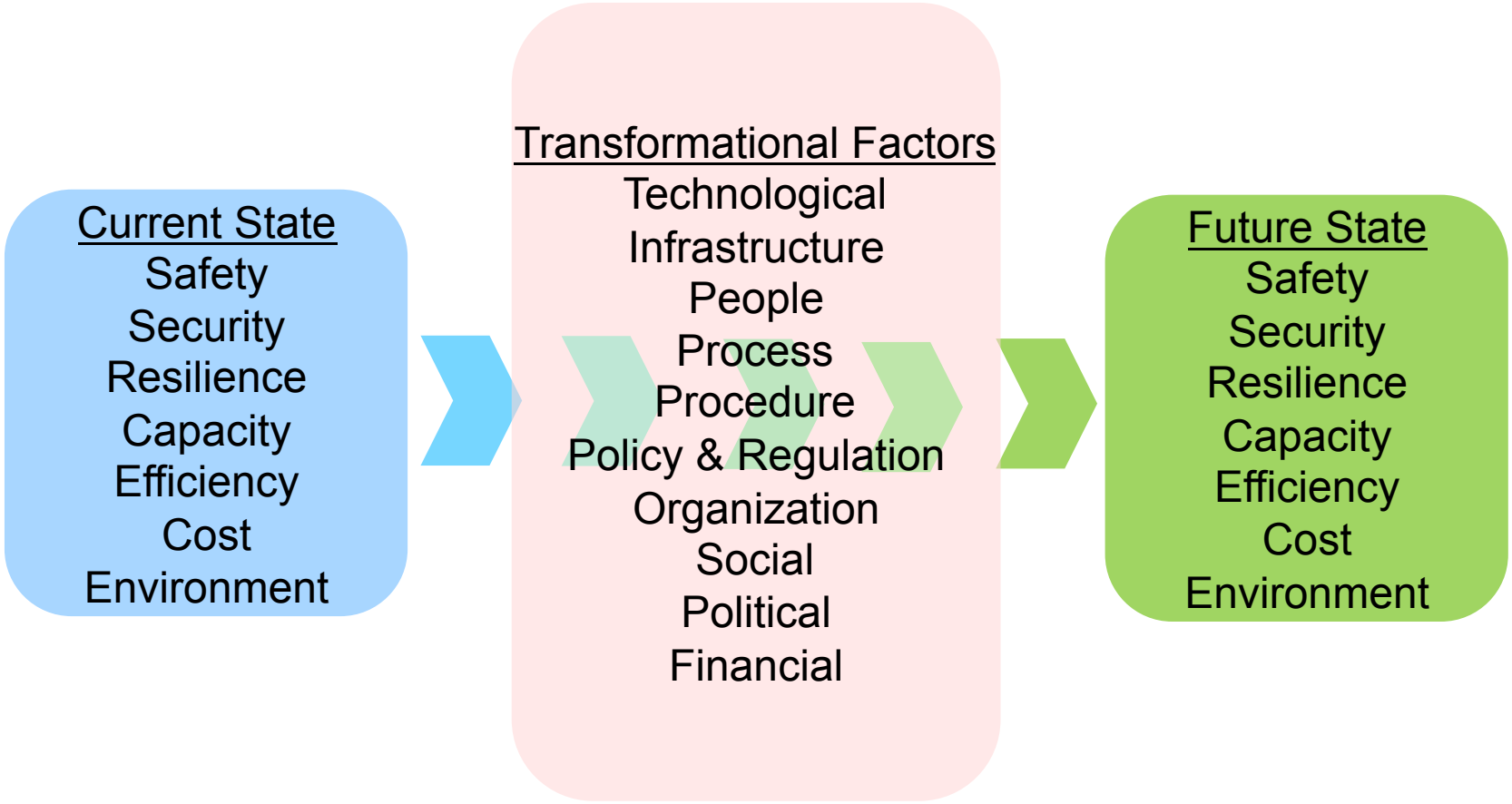
Dimensions of the Problem



There's a lot more to this than technology alone!

An Example

- The transformation of the 80 Air Traffic Control Centres in Europe is a massive undertaking
- As Frank Brenner, Director General of Eurocontrol pointed out in Madrid last month, the money isn't there to transform all of them
- The solution is to look at ways of consolidating facilities, new financing models, reducing costs, etc.
- Which are affected by many of the Transformational Factors

The Role of Enterprise Architecture

- Aviation is a huge, complex, highly-integrated, global enterprise
- Random, technology-focused, initiatives will fail to deliver the needed improvements
- A coherent, holistic approach is necessary…

…Enterprise Architecture

- As with most things, we have to start at the beginning with

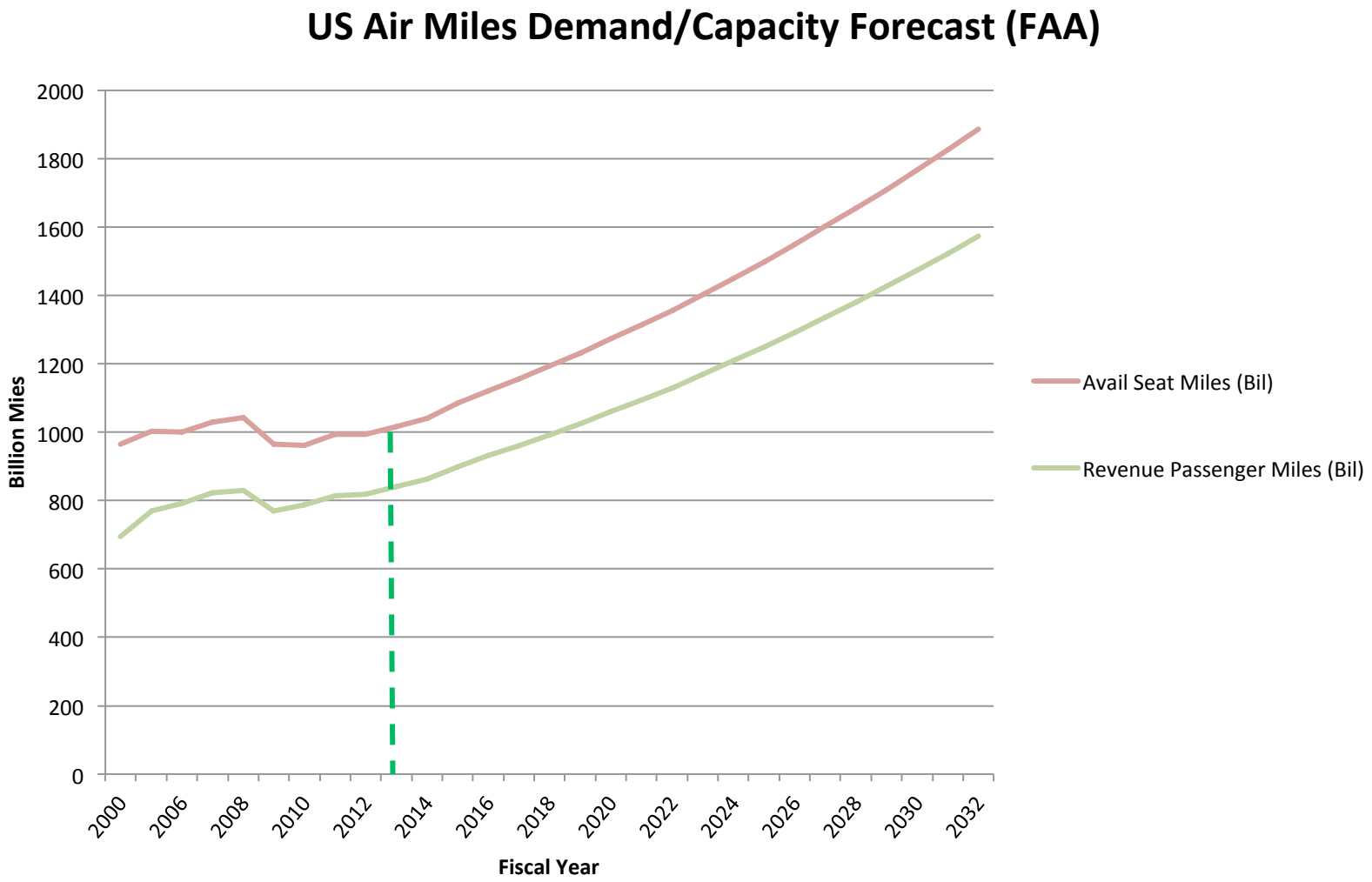
"Why?"

"Crisis, Which Crisis"?

- Is it a Demand *vs*. Capacity crisis?
- Is it a Cost crisis?
- Is it an Environmental crisis?
- Is it a Safety Crisis?
- Is it Something Else?
- Is it *really* a crisis?

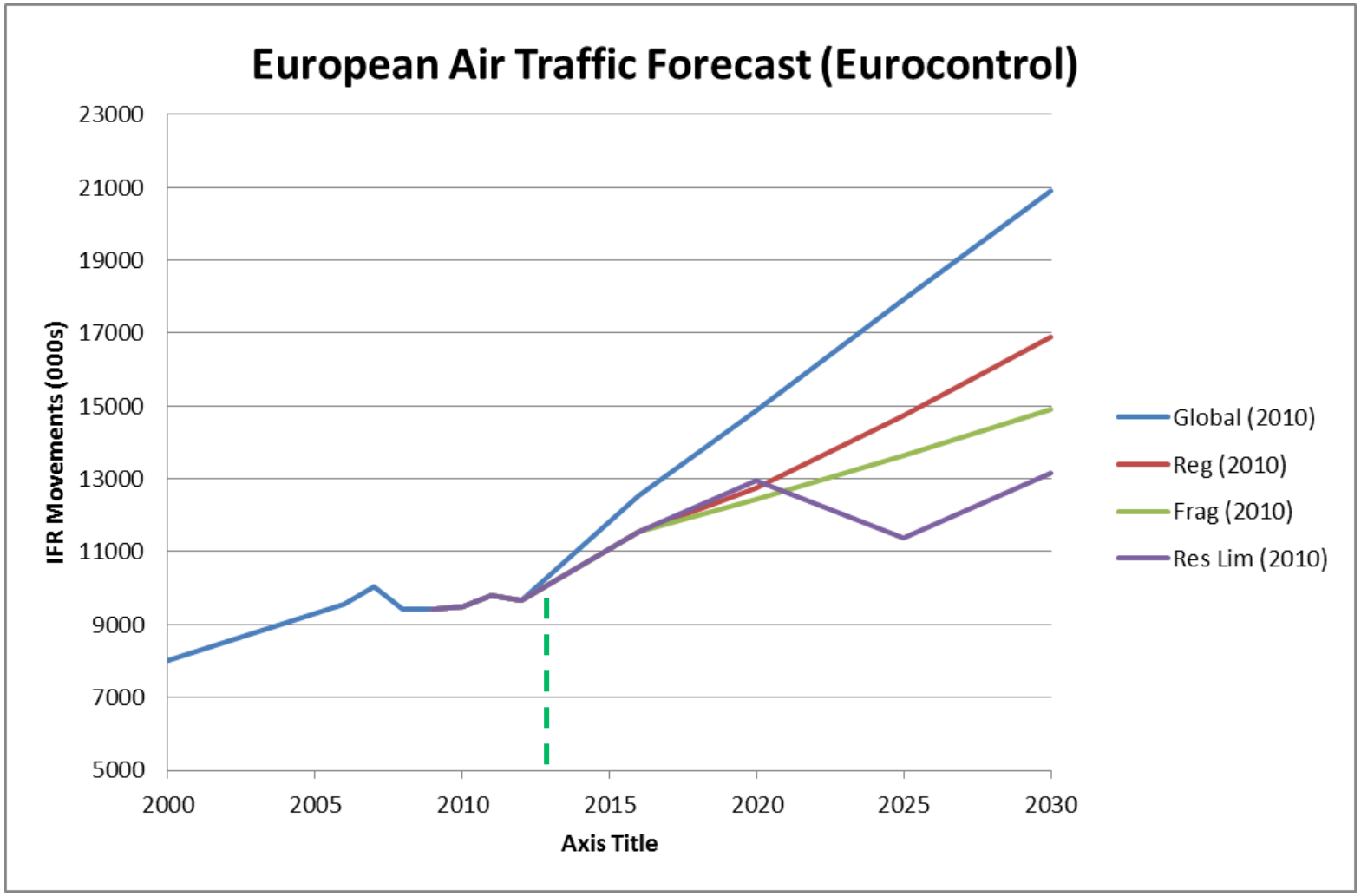
- Let's take a look

The Demand/Capacity Perspective (US)



Source: FAA Aerospace Forecast

The Demand/Capacity Perspective (Europe)



Source: Eurocontrol Forecasts

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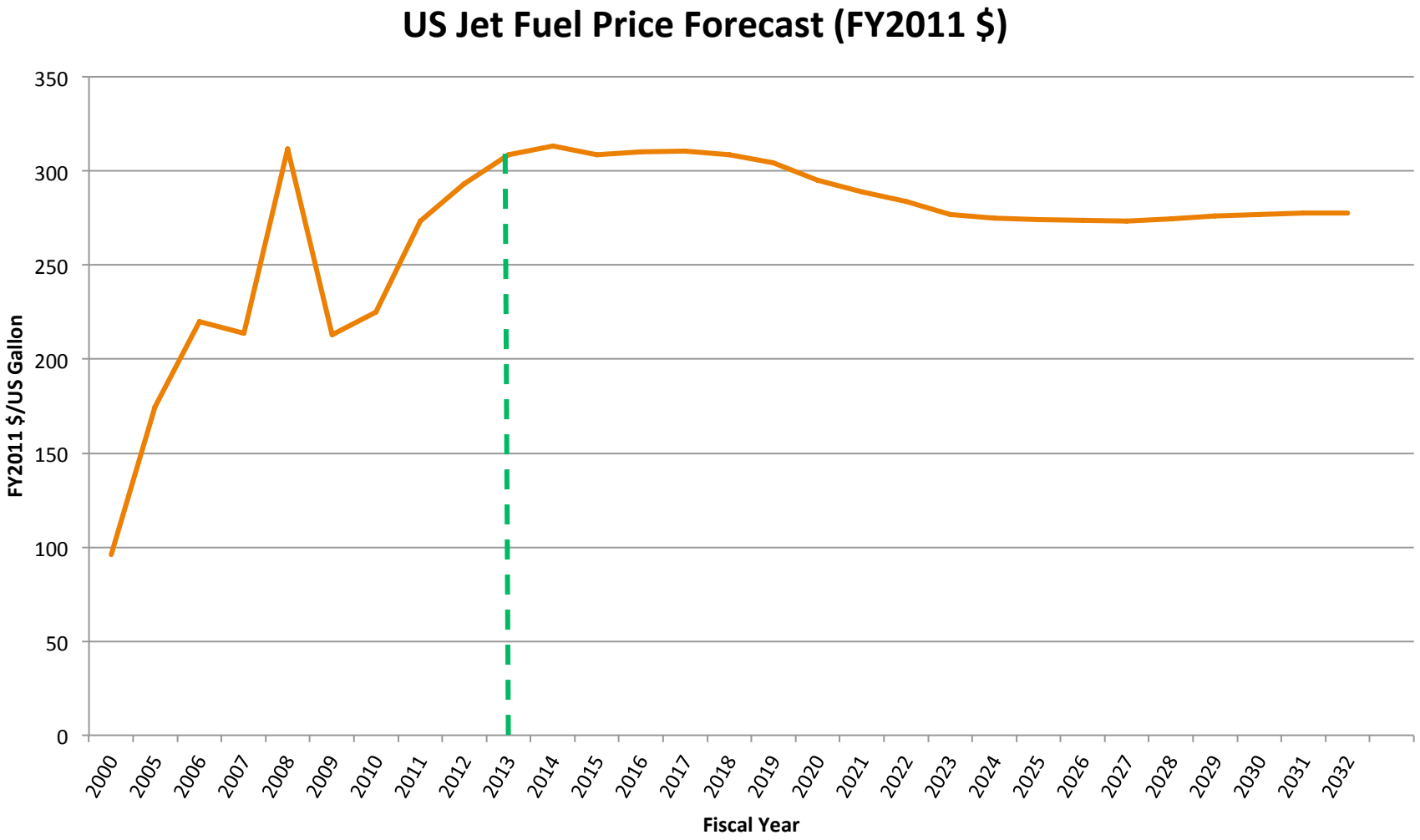
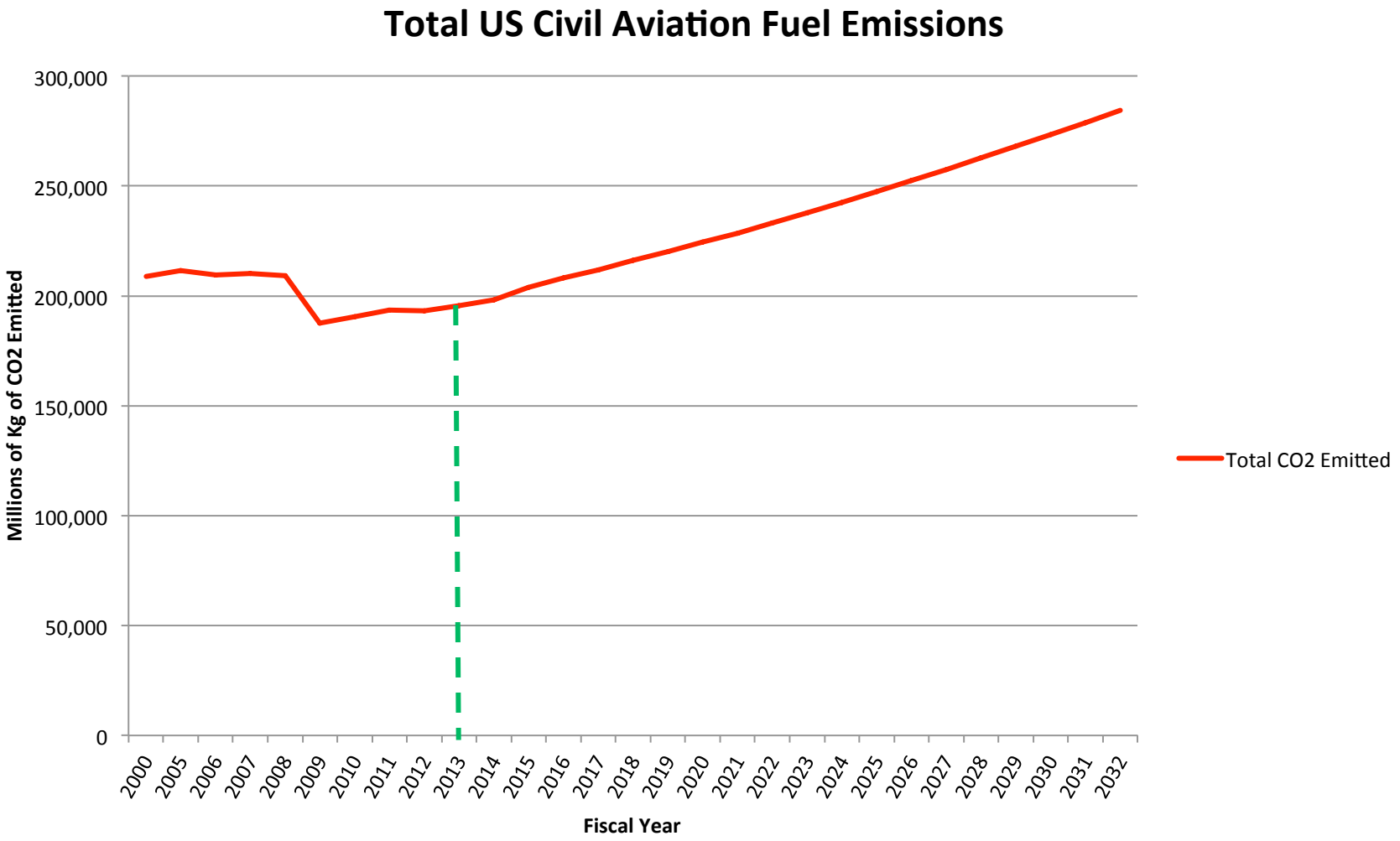
The Cost Perspective



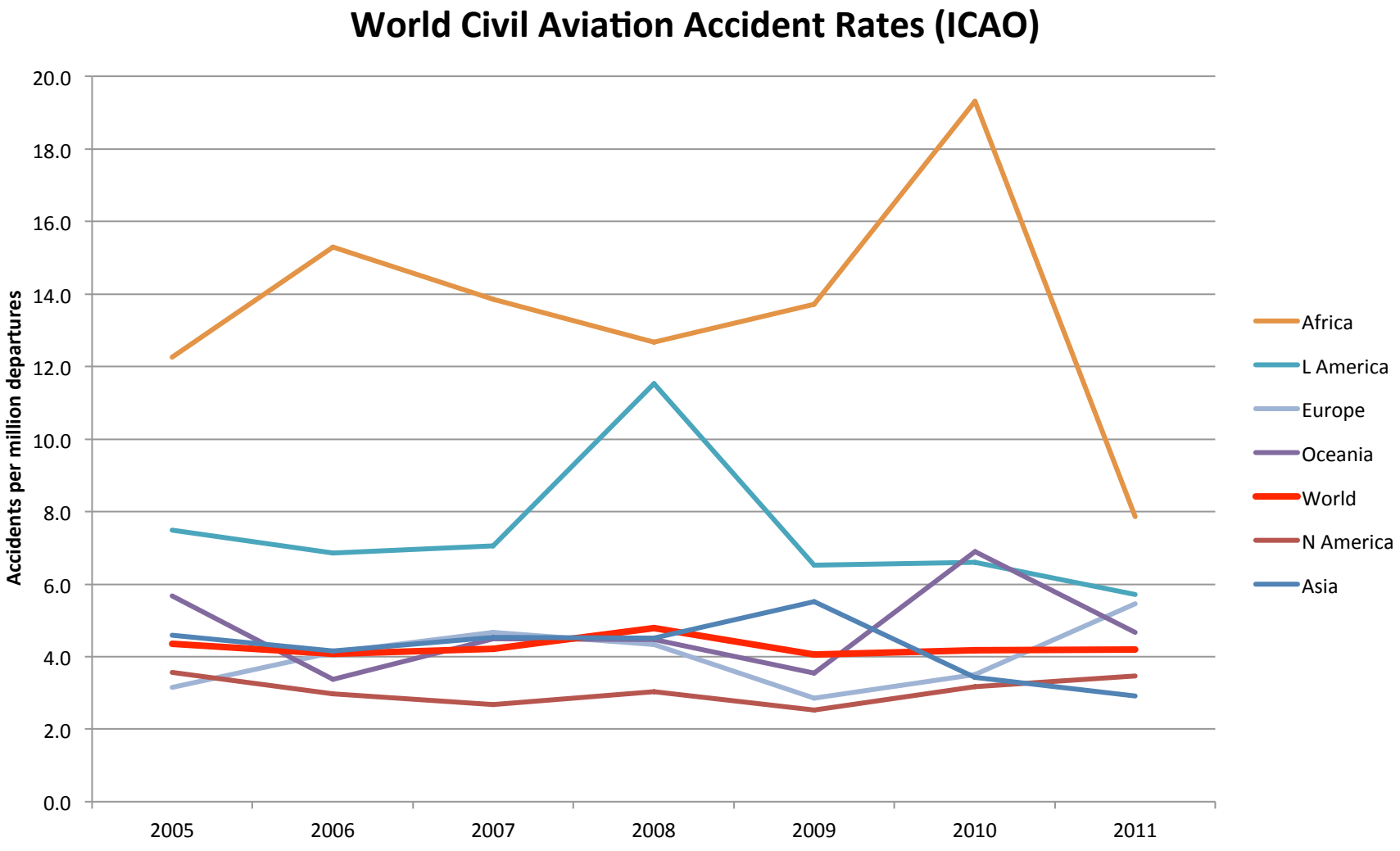
Source: FAA Aerospace Forecast

The Environmental Perspective



Source: FAA Aerospace Forecast

The Safety Perspective



Source: Author Analysis of ICAO data

The "Crisis": Summary

- So it's pretty clear from the above that:
  - There is a long-term issue of demand/capacity growth
  - There is no long-term cost crisis (provided fuel prices only increase in line with inflation)
  - There is a long-term environmental sustainability issue, caused by growth in demand
  - There is no specific safety crisis (though there is always room for improvement)
- From an ATM perspective this means:
  - The industry needs to find ways to manage increased demand efficiently, while maintaining current levels of safety
  - Flight efficiency needs to be improved by average of at least 3.5% *per annum* to maintain or reduce current emission levels.
    - This will be principally the responsibility of aircraft manufacturers and operators
    - Government *may* have a role in regulating the use of older, less efficient aircraft
    - ATM can only make a minor contribution to this (6-12% total maximum)

Security

- The *Physical* Security of aviation has received much attention since 9/11
- However, aviation *Cyber* Security is still quite immature:
  - Dependencies on open networks
  - Use of unencrypted protocols for sensitive information
  - Vulnerability to attack (e.g., DoS)
  - Traditional Reliance on Physical Security to provide Cyber Security
- This is not a satisfactory situation
- Recent information (*e.g.,* President Obama State of the Union speech, Mandiant report) indicates there is a substantial, emerging threat against public infrastructure, including ATC
- Substantial improvements in Cyber Security need to be part of the transformation

Where Do We Go from Here?

- We need to understand the REAL issues
  - It's about Change, People, and Money
- We need to focus on the critical questions:
  - How are we going to ensure cyber-security for the network?
  - How are we going to consolidate facilities, potentially across national boundaries?
  - How are we going to ensure adequate and sustained funding for the transformation?
  - How will the industry remain profitable in the future?
  - How will we make aviation environmentally sustainable despite its growth?
  - How are people going to be able to adapt to change?
- We need to ensure that technology is not the tail wagging the dog
  - Is ADS-B really an appropriate surveillance solution?
  - Is <32 kbps adequate for aircraft-ground communications?
  - Do we need a backup navigation capability to GPS?
  - Is consolidation really the answer?

"Show Me the Money"

- All of this change depends vitally on adequate and sustained funding
  - But where is the money going to come from
- Europe does not yet have a plan for funding SESAR implementation
- US NextGen funding continues to be a political football, subject to fits and starts
- It may be time to look at different funding models:
  - Public-Private Initiatives
  - EC to divert part of European ATS revenue stream, managed by EuroControl

Information

- However, there is one technological concept that stands out:
  - The concept of shared, distributed information services
- Sharing of information is vital to the ability of diverse stakeholders to collaborate across large areas
- The concept is known as System Wide Information Management, or SWIM, as recently demonstrated at the World ATM Congress in Madrid
- But to turn SWIM into an fully-operational reality will require a paradigm shift from today's "siloed" Functional Architecture to an Information-centric Architecture, or SOA, on a local, regional, and global scale.

Conclusions

- Global aviation faces large challenges to create an efficient, safe, secure, environmentally-sustainable, future
- We're not yet in a long-term crisis, but the industry needs to take action now to avoid the situation becoming one
- The main progress to date has been technological
- However, political, organizational, financial, social, and other factors will outweigh technology
- To address this will require a global commitment to coherent, holistic, solutions, combined with local action
  - "*Think Globally, Act Locally*"
- Used correctly, Enterprise Architecture is a key tool to achieve this.
- Improvements in Cyber Security are a critical part of the transformation
- The SWIM concept is critical to the future of aviation

Any Questions?

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