

GRUPO EMBRAER

Mumbai

# THE CHALLENGES AND OPPORTUNITIES OF BIG DATA ANALYTICS IN AIR TRAFFIC MANAGEMENT

Beijing

Tokya

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Manilla

Singapore

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#### THE CHALLENGES AND OPPORTUNITIES OF BIG DATA ANALYTICS IN AIR TRAFFIC MANAGEMENT

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# AGENDA











# **A Global Picture**

<b>4.1 BILLION</b> <b>PASSENGERS</b> (7.1% increase from 2016)	53 MILLION TONNES OF FREIGHT (4.0% increase from 2015)	<b>35 MILLION</b> SCHEDULED COMMERCIAL FLIGHTS (3.7% increase from 2015)	62.7 MILLION JOBS SUPPORTED		
54,000 ROUTES WORDWIDE (over 2,000 new routes from 2015)	<b>49 BILLION</b> <b>KILOMETRES FLOWN</b> (5.3% increase from 2015)	<b>76 MILLION</b> HOURS FLOWN (5.0% increase from 2015)	<b>3.5 PERCENT</b> OF GDP SUPPORTED		
\$2.7 TRILLION ECONOMIC IMPACT					

INTRODUCTION



# **Growth Of Air Transport**





Total (international and domestic) service

Source: ICAO - Thirteenth Air Navigation Conference, April/2018

INTRODUCTION

## **Aviation's Data Science Revolution**



#### The connected services will revolutionize the entire air transport eco system

This new connectivity and advanced analytics could mean significant savings for airlines.

We estimate that they can save between two percent and **2.5 percent of total global operating costs**, which translates to something between **\$5 billion and \$6 billion annually.** 

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# **ATM Surveillance**

Primary Radar Secondary Radar ADS-B ADS-C MLAT Space based ADS-B

EID	Indicativo	Movimento	
FIX		2016	2017
Amazônica	SBAZ	277.802	280.196
Atlântico <sup>1</sup>	SBAO	41.539	34.816
Brasília	SBBS	512.429	509.396
Curitiba <sup>2</sup>	SBCW	260.123	517.642
Recife	SBRE	301.637	308.664

Source: Anuário Estatístcio de Tráfego Aéreo 2017, DECEA.



**Big Data** 





# How the Big Data can support ATM? ATFM



# Big data will enable aviation to handle the huge surge in demand

Sector Opening Table The Architect integrates big data into operational activity to maintain safety while further improving controller and sector productivity. It is part of the wider ATC2ATM programme, which aims find common ground between to capacity management and air traffic control functions to achieve even greater efficiency

Agência Força Aérea / ©Ten Enilton

# How the Big Data can support ATM?

## **ATFM**

Capacity demand analysis Strategic & Tactical Management Phase Traffic management initiatives (TMIs) Collaborative Decision Making (CDM)



LEVEL/COORDINATE









# How the Big Data can support ATM?

# AMAN / DMAN

- Sequencing
- Operation patterns recognition







Source: SAGITARIO System, Atech



# How the Big Data can support ATM?

ATM APPLICATIONS

#### The FAA Eyes Big Data Possibilities



*Source: Federal Aviation Administration-* THE DATA'S IN THE DETAILS

**Operational Effiency** - "Big data today can help identify operational patterns and help to develop new concepts and methods for looking at how to improve efficiency,"

**Safety** - The FAA's Aviation Safety Information Analysis and Sharing (ASIAS) program aggregates safety data by the terabyte from 185 sources across industry and government.

**Sharing Data and Collaborating** - The FAA's goal going forward is to disseminate information to many hundreds of users through the System Wide Information Management System (SWIM), which facilitates the sharing of data across the agency and with approved partners.

**FAA Data for the Public** - The agency aims to increase and improve the public's access to FAA flight, aeronautical and weather data.



# How the Big Data can support ATM?

ATM APPLICATIONS



#### **AMDAR PROJECT**

Global Aircraft Meteorological DAta Relay (AMDAR) programme was initiated by the World Meteorological Organization (WMO)

Source: WMO / AMDAR

# How the Big Data can support ATM?

WHEATHER PREDICTION

Source: Federal Aviation Administration-FAA (RAPT) / Trajectory Clustering and Classification for Characterization of Air Traffic Flows, Hansman, Jhon and Condé,Mayara – MIT. Weather impact measures – FAA has been used data analytics to predict En-route convective impacts from the Route Availability Planning Tool (RAPT).

**Resource Use Patterns (RUP)** - Detailed RUP characterization enables the quantification of throughput reductions associated with weather impacts at the route level and provides a foundation for the development of predictive airspace capacity models.

## How the Big Data can support ATM?

A-CDM



Source: SmartDataCollective

#### The Dubai International Airport (DXB)

**Increased Efficiency** - Real-time calculations will allow the air traffic control tower to guide airplanes to terminals close to the connecting flights each passenger requires.

**Improved Customer Experience** - Everything's getting smarter, including the boarding passes. Instead of printing everything only in Arabic and English, the analysis of **Big Data** information such as a person's native language will result in better, readable, personalized boarding passes tailored to each individual.

**Cost Reduction** - An increase in customers, plus increased efficiency, plus an improved customer experience means that Dubai's profits will soar. When the statistics are examined a year from now undoubtedly the money saved by not having to reroute passengers and pay for missed flights and hotel stays will be the final proof that **Big Data** *analytics tools are transformative.* 

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# **ICAO STRATEGY**



**CHALLENGES** 



## We need to face....



**Conflict Zones** 



**Global Tracking** 



**Cyber Security** 



Wheater Analisys



UTM



UATM

## **Real Time Big Data**

Real-time big data analytics means that big data is processed as it arrives and either a business user gets consumable insights without exceeding a time period allocated for decision-making or an analytical system triggers an action or a notification.



**CHALLENGES** 

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ATM APPLICATIONS





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# Eurocontrol, Brazil's DECEA Exchange Operational Flight Data for the First Time

The Eurocontrol Network Manager (NM) confirmed in late November the reception and processing of FSA (First System Activation) data from Brazil by its ETFMS (Enhanced Tactical Flow Management System) operational system.



Source: Air Traffic Management Magazine



# **From Local to Global ATFM**





# **FLIGHT PLAN 2030**



# Urban Air Traffic Management

Flight Plan 2030 presents a new paradigm for air traffic management Over the next ten years, the Urban Air Traffic Management vision aims to serve As a gateway to growth for the Urban Air Mobility revolution.



# **Urban Air Mobility will unlock new opportunities**



# Thank You



# How the Big Data can support ATM?



# Data:

- ADS-B messages in SBC-1 format (04/MAR/2015 to 08/APR/2015)
- 1,5 M messages (Total)
- 204 K messages considered in the average trajectory calculation





# **Trajectory from data**



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# **MAR 2015 – Sectors Occupation**











Ocupação da área 10 - ACCBS - 26/09/2015





# MAR 2015 – Heat Map



**OPPORTUNITIES**