Aviation Data Symposium

15–16 November 2017

Miami, USA

Safety and Operations

Thank you to our Sponsor

Deloitte.

Opening Remarks
&
Objectives

The Benefits and Challenges of Global Information Sharing and Exchange Networks

Moderator

- **Olena Vasylchenko**, Head, Centers of Excellence ITS, IATA

Panelists

- **Al Madar**, Managing Director, Operation Safety, American Airlines
- **Rodolfo Quevedo** , Director, Safety, IATA

Partnership for Safety

Al Madar

Managing Director, Operation Safety

American Airlines

Partnership for Safety

COMMERCIAL AVIATION SAFETY TEAM (CAST)

AVIATION SAFETY ANALYSIS AND SHARING (ASIAS)

Safety Life Cycle

CAST Goal

- CAST came together in 1997 to form an unprecedented Industry-Government partnership…
  - Voluntary commitments, Consensus decision-making, Data-driven risk management, Implementation-focused.
  - Goal:

Original *Reduce the US commercial aviation fatal accident rate by 2007.* 83%

New *Reduce the U.S. commercial aviation fatality risk by at least 50 percent from 2010 to 2025.*

Predicted vs. Actual Part 121 Onboard Fatalities

A history of continuous improvement

- From 1997 to 2007, CAST leveraged accident data
- With so few accidents and no “common causes,” we needed more data points in order to move from a reactive to a predictive approach.
- Led to the establishment of ASIAS in 2007

What is ASIAS?

- *A collaborative Government-Industry initiative on safety data analysis & sharing*
- *A risk-based approach to aviation safety, identifying & understanding risks before accidents or incidents occur*
- *Timely mitigation & prevention*

ASIAS Is Governed by Formal Principles

Data used solely for advancement of safety

Voluntary submission of safety-sensitive data

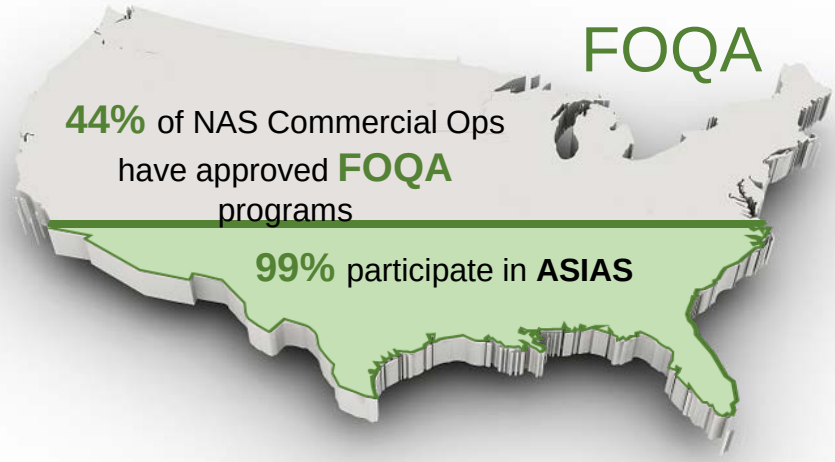
Carrier/OEM/MRO data are de-identified

Transparency – knowledge of how data are used

Procedures & policies established through collaborative governance

Analyses approved by an ASIAS Executive Board

ASIAS Participation: FOQA & ASAP



FOQA Records in ASIAS
(3 years of data)

16.1 M Commercial
+ **35 K General Aviation**

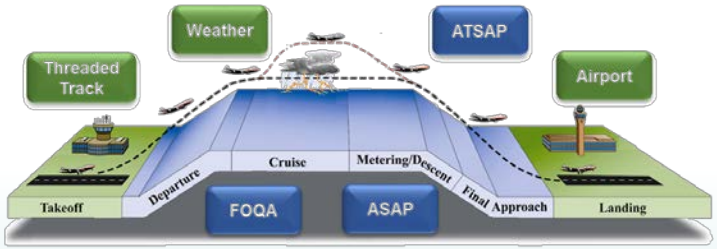
ASAP Records in ASIAS
(3 years of data)

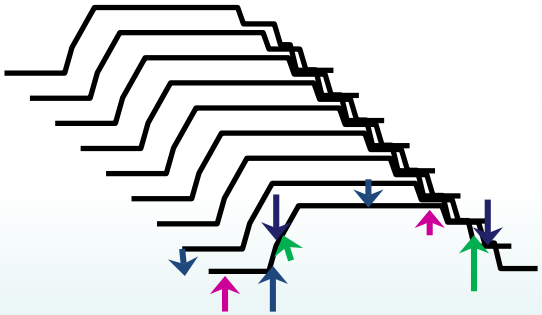
188 K Commercial
+ **18 K General Aviation**

CAST / ASIAS Safety Studies

- Takeoff Misconfiguration
- Runway Excursions (RE)
- RNAV Departures and STAR Operations
- Airplane State Awareness (ASA)
- Traffic Collision Avoidance System (TCAS)
- Terrain Awareness Warning System (TAWS)

2017 and beyond--Fusion is the next step in continuous improvement of the CAST / ASIAS process





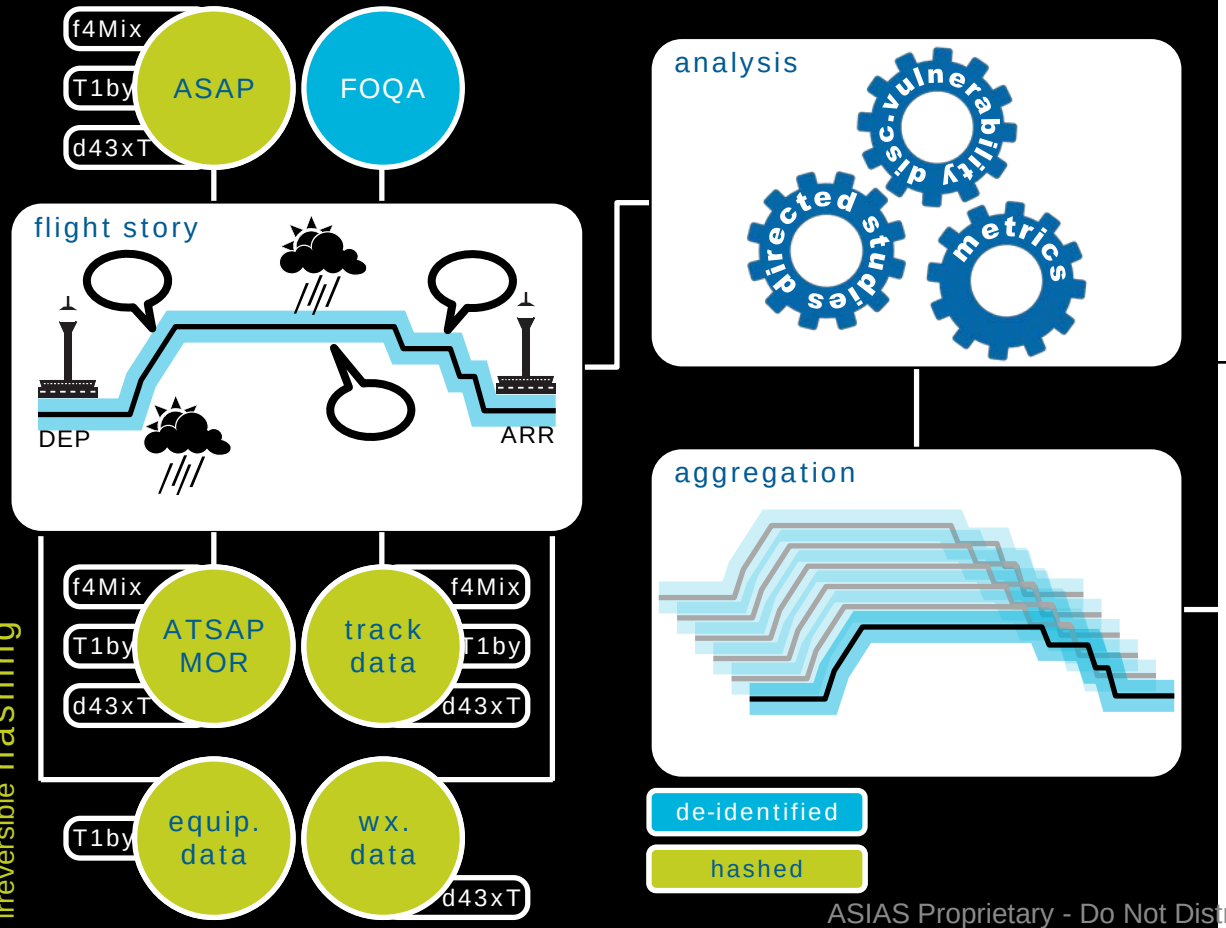
insight **about safety issue**

numerous data sources = greater insight into the safety issue

deeper understanding of underlying contributing factors

better informed = develop more effective mitigations

rigorous identity protections are applied



irreversible de-identification of data conducted within 24 hours

all processing & analysis conducted in secure environment per ASIAS governance

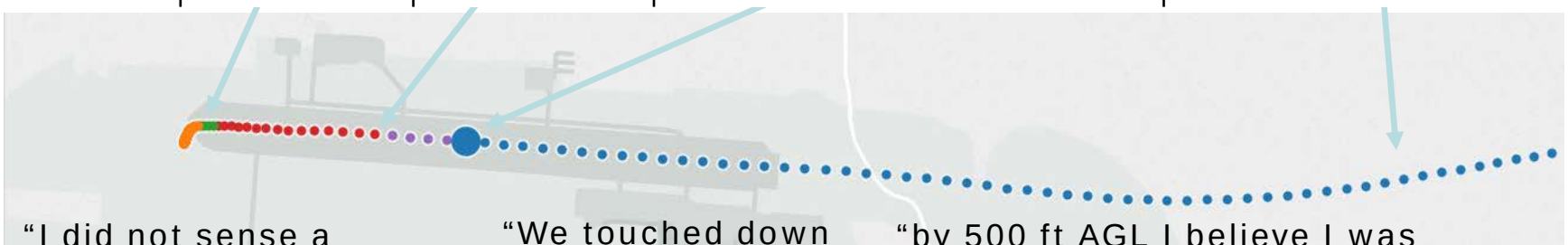
results de-identified & aggregated per ASIAS governance

ASIAS RESULTS

fusion provides enhanced insight – runway excursion example

FLIGHT PARAMETERS FROM FOQA

	runway remaining @ 50 knots	thrust reverser deployed	touchdown point | groundspeed	approach centerline capture
EXAMPLE FLIGHT	251’	+4 seconds	53% of runway | 163 knots	1.5 NM from threshold
AVERAGE	2400’	+3 seconds	23% of runway | 143 knots	2.7 NM from threshold



“I did not sense a significant braking action taking place”

“We touched down beyond the landing area”

“by 500 ft AGL I believe I was stabilized on speed, on glideslope and on course”

WEATHER INFORMATION FROM ASOS

ASOS report offset	headwind (knots)	crosswind (knots)	wind gust (knots)	precip. within 1 hour (in)	visibility (Mi)	ceiling (ft)	sigweather
2	-6.6	-14.6	24	0.04	7	9500	-RA

Summary
CAST / ASIAS

- Success is the result of 20 years of an unprecedented Government / Industry partnership
- Leverage “big data” to reduce risk within the National Airspace System
- Drive future safety improvements through further data enhancements/analysis and even greater collaboration/trust

IATA Safety Information Exchange Program

Rodolfo Quevedo

Director, Safety

IATA

IATA Safety Information Exchange Program

Supported by IATA Safety/GADM

IATA Safety Data Programs

↗ Goal

- To support a proactive data-driven approach leading to the identification, analysis and mitigation of aviation risks

GADM Portfolio

Flight Data Analysis Service

Individualized Airline Service

Accident

Database of commercial aviation accidents

Data used to create the IATA Safety Report

FDX

Database of FDA and FOQA type events

GDDB

Database of ground damage incident reports

STEADES

Database of airline incident reports

Global Data Exchange Programs

Audit Data

Database of audit findings from IOSA and ISAGO audits

How has GADM been used?

Support to National and International Safety Teams

↗ CAST

- ASIAS data sharing program
- MoU since 2013
- Share the INFORMATION not DATA
- Alignment of metrics

↗ ICAO

- Regional Aviation Safety Groups

↗ BAST

- Brazilian Aviation Safety Team
- Data provided for quarterly meetings

Challenges

- Data collection – harmonization across global community
- Data de-identification vs information analysis and sharing
- Safety information protection – application of governance protocols to avoid misuse
- Industry concerns regarding the scope and use of Safety Information
  - Mandatory versus Voluntary
  - Use of highly sensitive data
  - Safety versus Compliance

Safety Information Exchange Program

- States must manage the safety performance of its aviation system
  - Requires safety management inputs by both the State and Service Providers
- States have recognized the value of using this aggregated, de-identified Operator information to support State safety activities
  - All safety data and safety information deemed relevant by a State is in scope for a IATA Safety Information Exchange Program

IATA Program

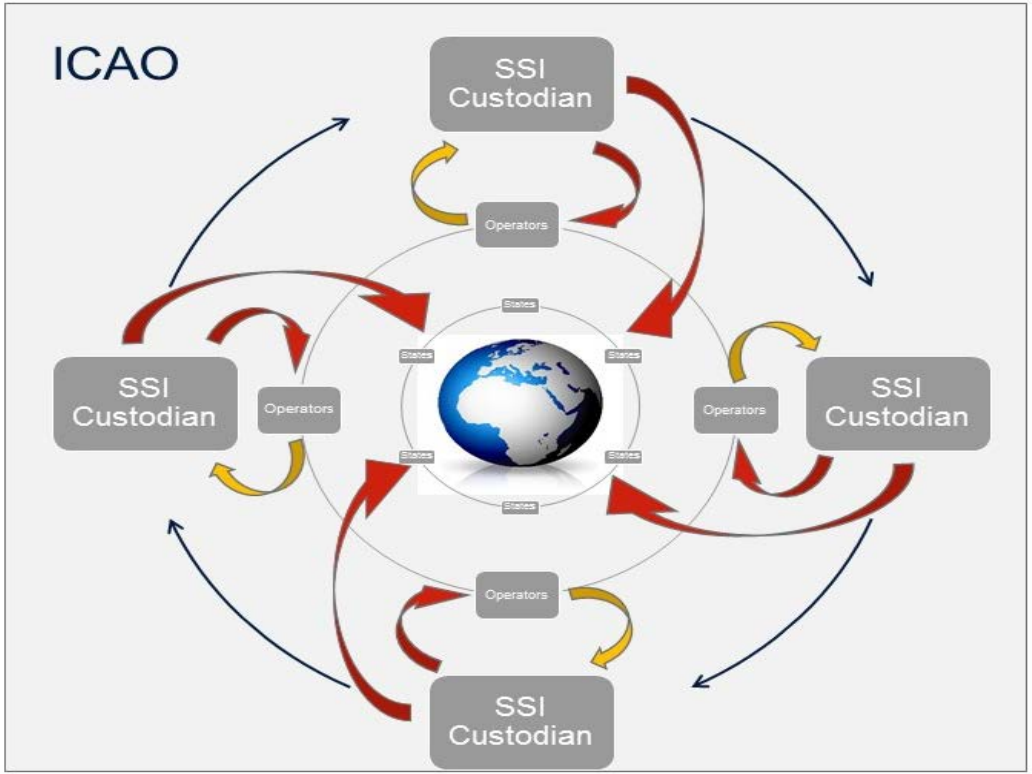
- Industry / State collaboration to develop Safety Information Exchange and analysis
  - ICAO Assembly A39-WP/117
- Models would:
  - Meet the needs of an SSP to manage safety at the State level
  - Address Industry concerns
  - Adhere to Annex 19 protection principles
  - Streamline global safety-sharing channels for and harmonize metrics

Collaborative Approach to Safety Management

↗ IATA Safety Information Exchange Program

- Enables States access to de-identified aggregate Safety information collected by IATA
- Supports both State and Regional Safety Oversight Organization (RSOOs) Safety Management activities
- Also supports the ICAO Global Aviation Safety Plan (GASP) objectives and the work of the Regional Aviation Safety Groups (RASGs)

Safety Information Exchange Model



Collaborative Approach to Safety Management

- Establishment of a “Collaborative Safety Team”
  - Mechanism for safety information sharing and exchange to identify top safety risks, and develop mitigation strategies to improve the safety performance of the respective State aviation system
  - Team includes representation from the State and aviation system Service Providers
  - Team establishes the protocols for the Safety Information Exchange (SIE)
  - Frequency of the meeting based on the need and desire of the State and participating Service Providers

Collaborative Approach to Safety Management

↗ IATA as Custodian

- Assures the protections of the safety data and safety information from Operators are applied consistently and in accordance with A19 provisions and the respective program governance
- Integrates the various safety data sources
- Provides de-identified aggregate information to the respective State or RSOO

Overview

The FDX analysis pages enable querying of event occurrences through a much larger data set than that of your own. Contributors' data is processed using a single platform into a single database to ensure consistency of analysis. FDX members benefit from free access to this innovative tool to identify systemic issues and benchmarking. Data is always de-identified and updated on a regular basis. Users can drill down several layers of data from flights to event categories, regions and airports.
For more information on how to participate, access the GADM Site.


Data Submission


Misconfigured Takeoff


TCAS


LOC-I


TAWS


Runway Approach & Landing

Latest update

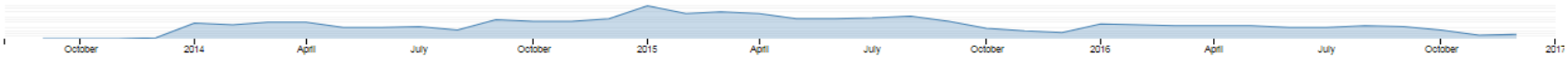
2017-03-30: Updates and improvements.
2017-03-16: Initial release.

Definitions

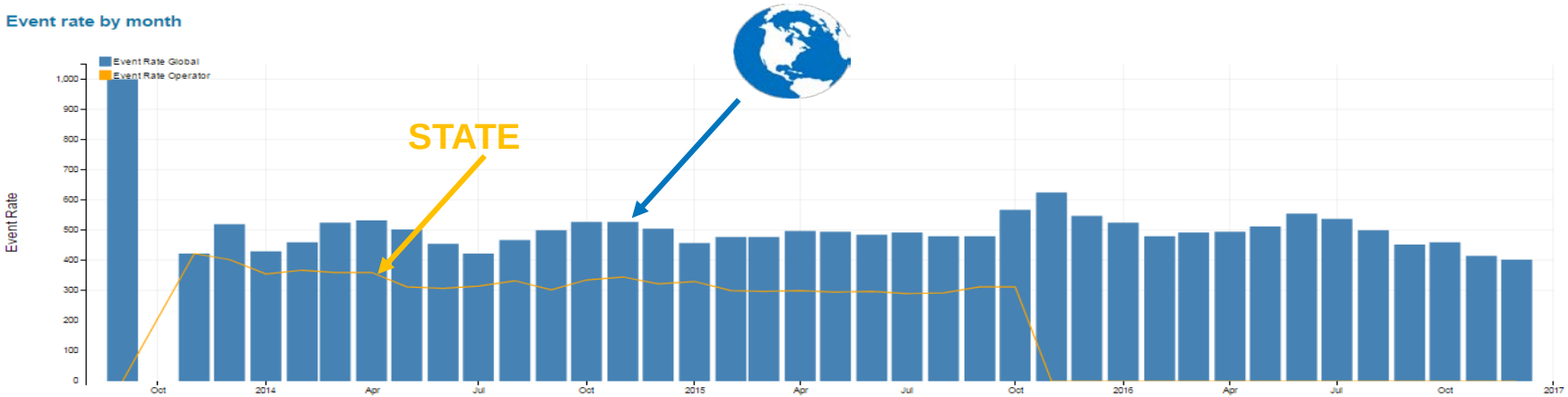
- Rule of Three
- Event Rates
- IATA Region of Operator
- Flight Date

Runway Approach & Landing

The Approach and Landing Accident Reduction page contains metrics on go-around, long landing, tailwind, stopping distance events and other KPVs. Currently displaying all event levels.

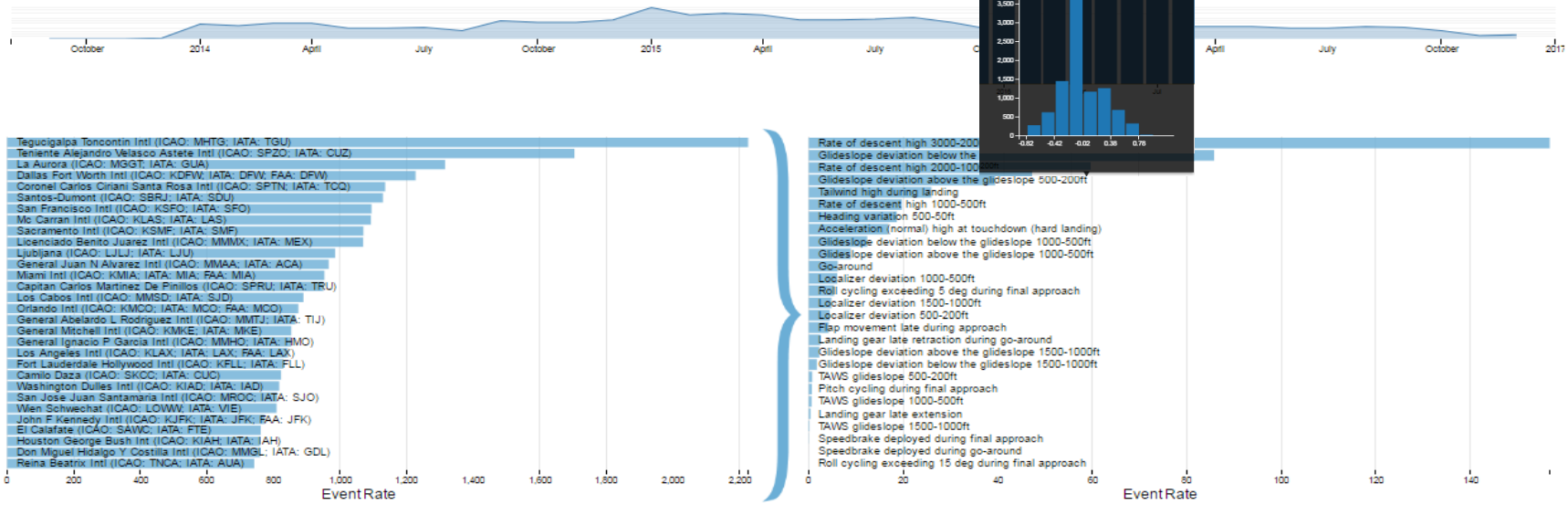


Event rate by month

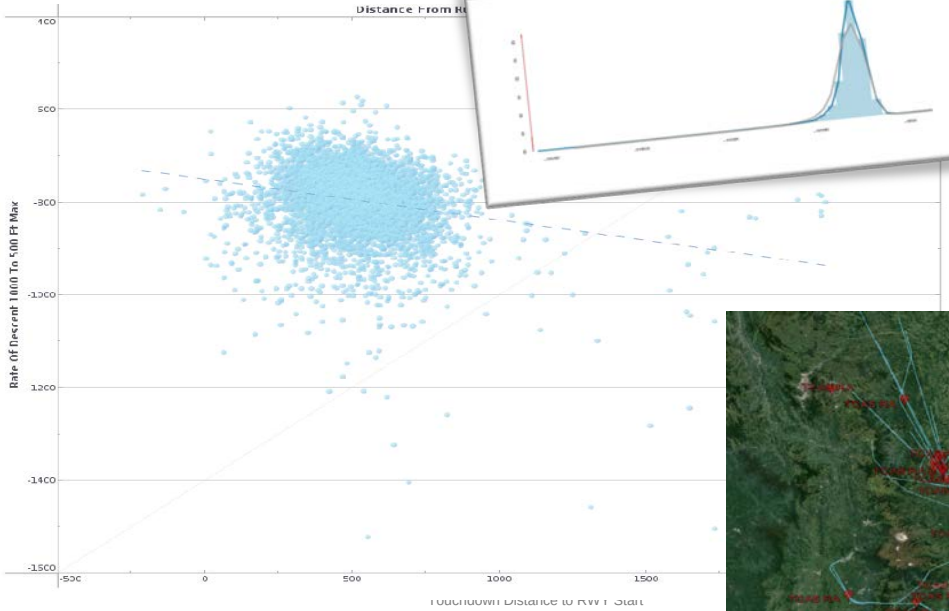


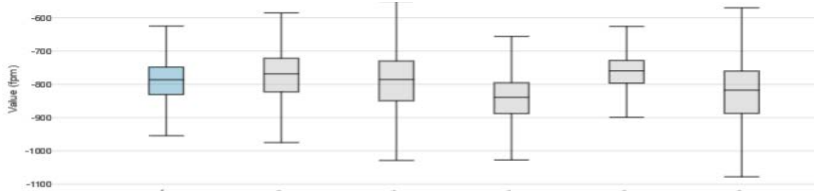
Runway Approach & Landing

The Approach and Landing Accident Reduction page contains metrics on go-around, long landing, tailwind, stopping distance events and other KPVs [illegible] levels.

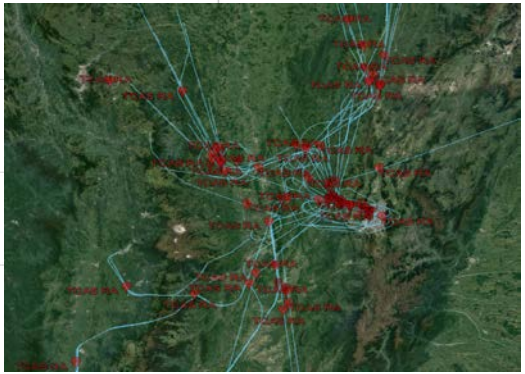


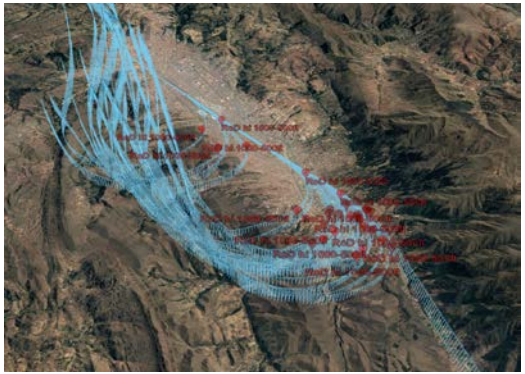
In-Depth Studies





Minimum:	-2524	-1685	-1772	-2327	-1984	-1970
Average:	-796	-777	-799	-847	-768	-834
Maximum:	-40	-585	-378	-11	-1	0
Std Dev:	76	82	102	84	65	143
Range:	2484	1100	1394	2316	1984	1970
Count:	1000's	1000's	1000's	1000's	1000's	1000's






COLLABORATION
That's why it's important

Information Sharing and Exchange Networks - A Participants View

Pablo Hernández-Coronado Quintero

Director of Safety Analysis & QM, Spanish Aviation Safety and Security Agency (AESA)

case study

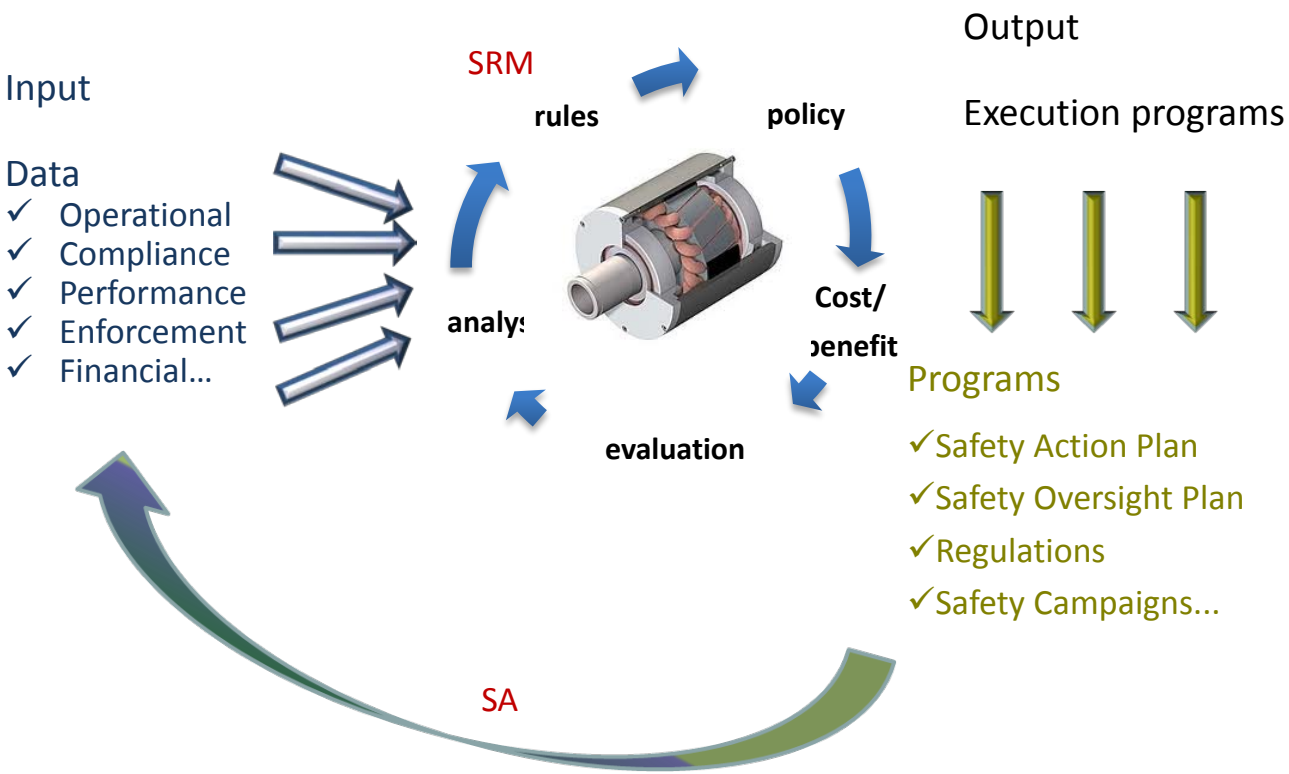
Pablo Hernández-Coronado Quintero
Director of Safety Analysis and Quality Management
AESA

Código de Plantilla: F-DEA-CDO-08 2.0

- SSP
- RIMAS
- Participation on Data4Safety
- SafeClouds

SSP

STATE SAFETY PROGRAMME



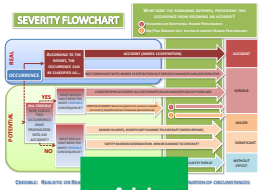
OCCURRENCE REPORTING

PRELIMINARY ANALYSIS

HIGH SEVERITY

- Information gathering
- Deeper analysis
- Formal Investigation?

AFTER THE ANALYSIS



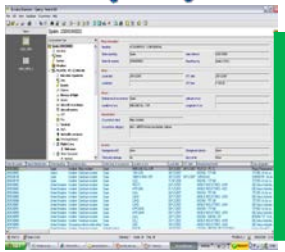
ALL

ECCAIRS: UPDATED WITH RESULTS

Safety Risk assessment for an event

RAT >< ARMS >< Bow-Tie

ECCAIRS



READY FOR ANALYSIS

Safety risk assessment methodology for aggregate data

AGGREGATE DATA ANALYSIS

SPECIAL EVENTS

MAJOR RISK CONCERN

SAFETY PERFORMANCE INDICATORS

Parameters to monitor SMS safety performance

Agreed with service providers

Although,… mandatory by Law 1/2011 of 4th March 2011

Monthly provided via Internet secure access

(login & password required)

And,…

service providers take advantage of AESA's safety data

CAT OPERATORS' SPIs

Exposure Data

- Flight hours per air fleet & month
- Nº of take-offs per air fleet & month
- Daily use per air fleet (flight hours)

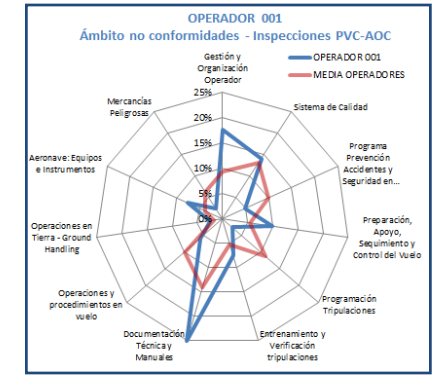
Maintenance Data

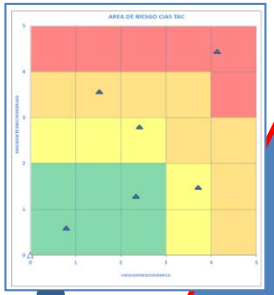
- PIREPs per 100 TOs
- Deferred Maintenance Items per month & aircraft
- In Flight Shut Downs (IFSD) per 1000 engine operating hours
- IFTB (In-Flight Turn Back) & Diversions due to Technical Reasons per 100 TOs
- Delays or Cancelled flights due to Technical Reasons per 100 TOs
- Rejected take offs due to Technical Reasons per 100 TOs

Operational Data

- Unstable approaches per every 100 reviewed flights
- GPWS & EGPWS warnings per 100 TOs
- Missed approaches or "GO-AROUNDs" per 100 TOs
- Technical crew duty period exceeded per month

SAFETY RISK ANALYSIS





Aviation System

Sector

Corporate

Safety Cloud

RISK BASED OVERSIGHT

❑ SAFETY INFORMATION AND DATA SOURCES

Risk Exposure

- Category A and B operators
- ANSPs and industry: i.e. No. of operations, flight hours, passengers
- Registered air fleet

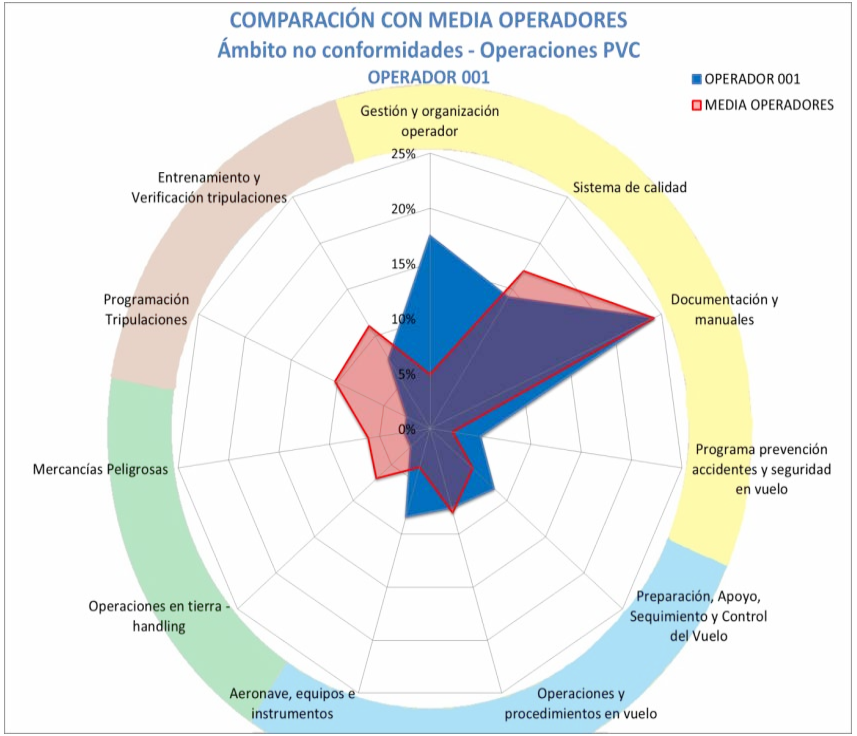
Compliance

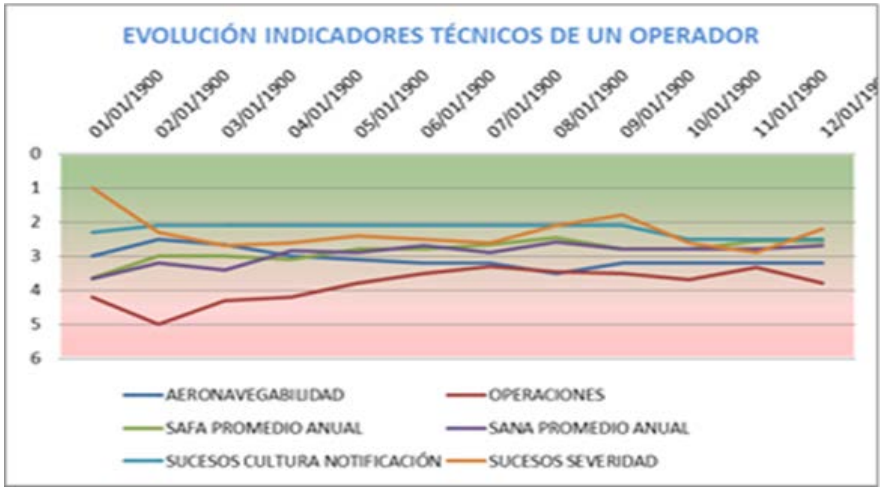
- AESA's safety oversight findings: OPS, AIW
- SAFA & SANA reports: ramp inspections
- Enforcement procedures (qualitative analysis)
- Pax. claims (qualitative analysis)

Performance

- Occurrence Reporting System; MOR & VOR
- Financial information
- SPIs
- SMS

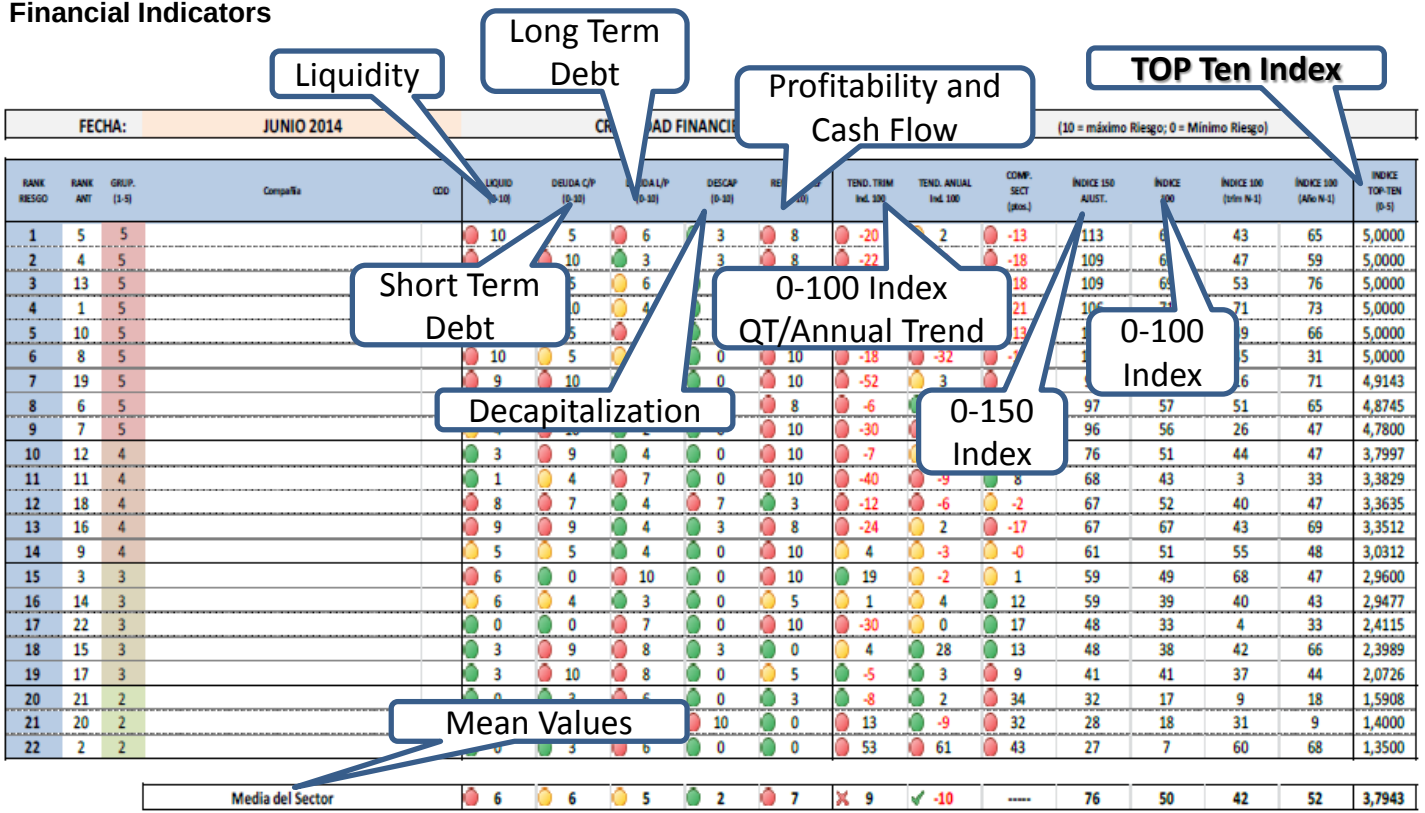
❑ CORPORATE LEVEL: SAFETY DNA





RISK BASED OVERSIGHT

Financial Indicators

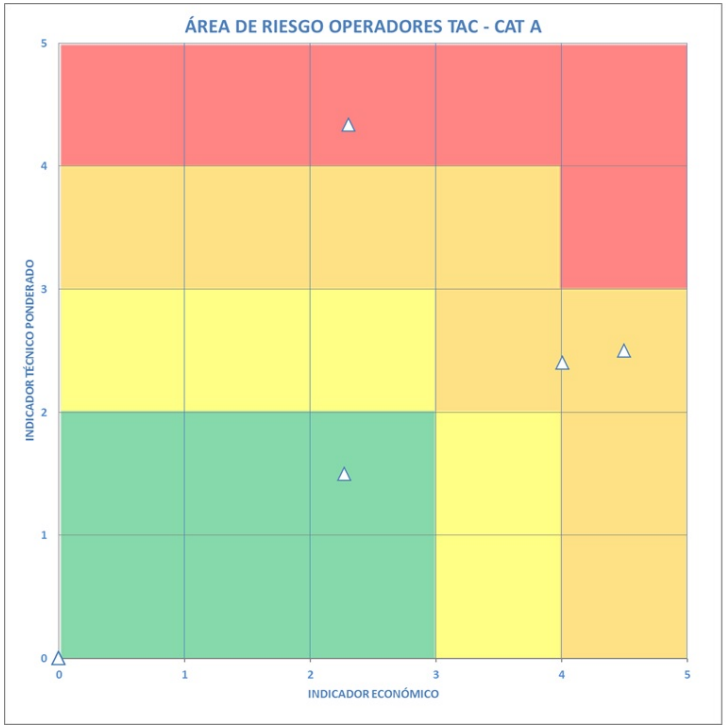


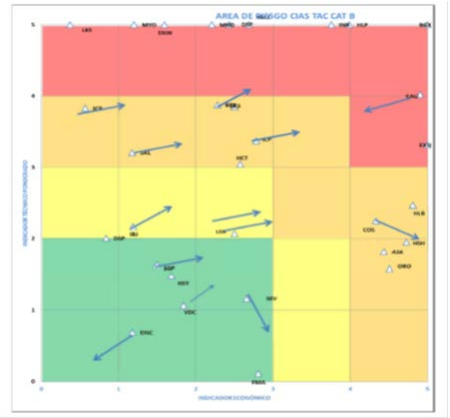
FECHA: JUNIO 2014 — CR…AD FINANCIE… — (10 = máximo Riesgo; 0 = Mínimo Riesgo)

RANK RIESGO	RANK ANT	GRUP. (1-5)	Compañía	CDD	LIQUID (0-10)	DEUDA C/P (0-10)	DEUDA L/P (0-10)	DESCAP (0-10)	RE… (0-10)	TEND. TRIM Ind. 100	TEND. ANUAL Ind. 100	COMP. SECT (ptos.)	ÍNDICE 150 AJUST.	ÍNDICE 100	ÍNDICE 100 (trim N-1)	ÍNDICE 100 (Año N-1)	INDICE TOP-TEN (0-5)
1	5	5			10	5	6	3	8	-20	2	-13	113		43	65	5,0000
2	4	5				10	3	3	8	-22		-18	109		47	59	5,0000
3	13	5				6	6					18	109		53	76	5,0000
4	1	5				10	4					21	106		71	73	5,0000
5	10	5				6						13	1…		9	66	5,0000
6	8	5			10	5		0	10	-18	-32		1…		5	31	5,0000
7	19	5			9	10		0	10	-52	3		9…		6	71	4,9143
8	6	5							8	-6			97	57	51	65	4,8745
9	7	5							10	-30			96	56	26	47	4,7800
10	12	4			3	9	4	0	10	-7			76	51	44	47	3,7997
11	11	4			1	4	7	0	10	-40	-9	8	68	43	3	33	3,3829
12	18	4			8	7	4	7	3	-12	-6	-2	67	52	40	47	3,3635
13	16	4			9	9	4	3	8	-24	2	-17	67	67	43	69	3,3512
14	9	4			5	5	4	0	10	4	-3	-0	61	51	55	48	3,0312
15	3	3			6	0	10	0	10	19	-2	1	59	49	68	47	2,9600
16	14	3			6	4	3	0	5	1	4	12	59	39	40	43	2,9477
17	22	3			0	0	7	0	10	-30	0	17	48	33	4	33	2,4115
18	15	3			3	9	8	3	0	4	28	13	48	38	42	66	2,3989
19	17	3			3	10	8	0	5	-5	3	9	41	41	37	44	2,0726
20	21	2						0	3	-8	2	34	32	17	9	18	1,5908
21	20	2						10	0	13	-9	32	28	18	31	9	1,4000
22	2	2					6	0	0	53	61	43	27	7	60	68	1,3500
			Media del Sector		6	6	5	2	7	9	-10	-----	76	50	42	52	3,7943

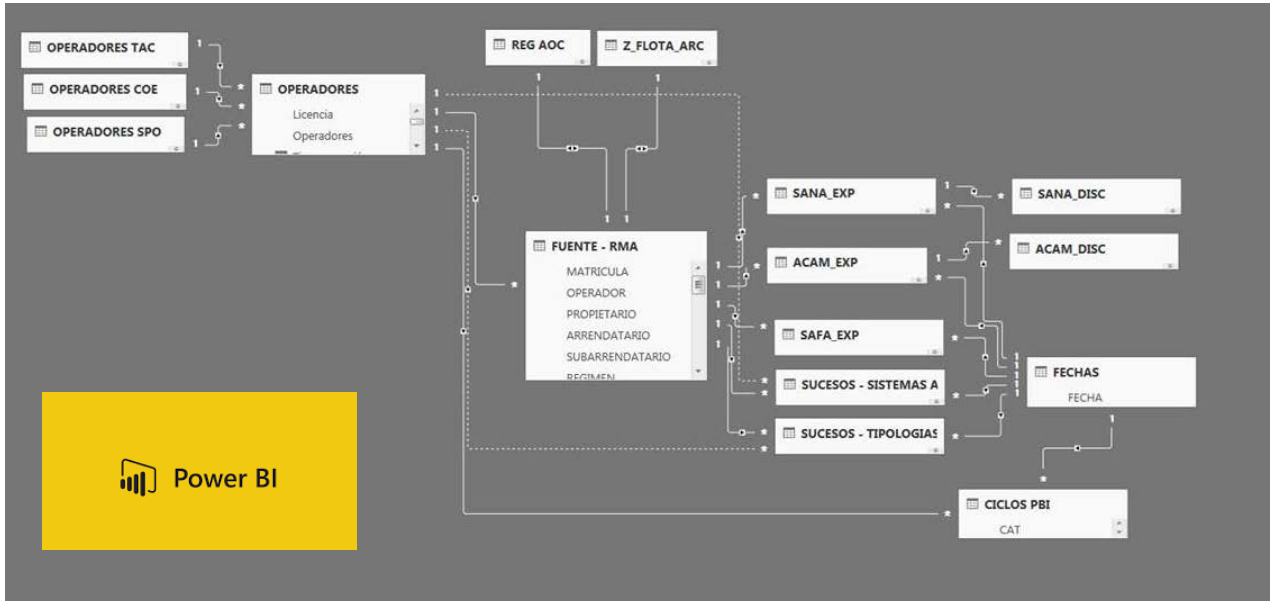
RISK BASED OVERSIGHT

❑ SECTOR LEVEL





RISK BASED OVERSIGHT



RISK BASED OVERSIGHT

ANÁLISIS DE LA FLOTA DE OPERADORES TAC

CATEGORÍA

Nº AERONAVES RMA	Nº AERONAVES AOC	Nº AERONAVES ARC	ANTIGÜEDAD MEDIA
38	35	38	6,97

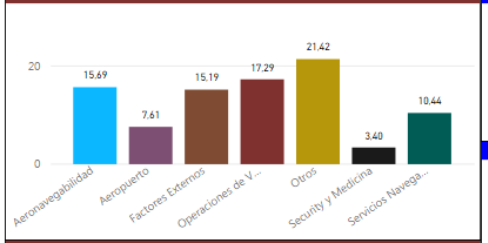
PERIODO ANÁLISIS

Last 4 Years

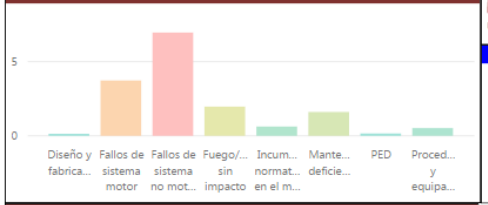
24/10/2013 - 23/10/2017

REG	MODEL	AOC	ARC	EDAD	ACAM	SANA	SAFA	TASA SUCESOS
	737-800		En vigor	15,00		1,08	1,40	8,09
	737-800		En vigor	13,00	1,00	2,25	0,00	6,21
	737-800		En vigor	15,00		1,13	1,04	5,79
	A330-202		En vigor	9,00			2,00	5,75
	737-800		En vigor	5,00			0,80	5,65
	A330-202		En vigor	10,00	5,00			5,41
	737-800		En vigor	4,00		1,50	0,00	5,12
	A330-343		En vigor	7,00				4,79
	737-800		En vigor	12,00		0,00		4,74
	A330-243		En vigor	14,00			4,00	4,23
	A330-200		En vigor	15,00				3,74
	A330-202		A pun...	9,00	0,00			3,19
	A330-202		En vigor	11,00			0,00	2,81
	737-800		En vigor	4,00		2,00	0,75	2,51
	A330-202		En vigor	11,00		2,00		1,96
	737-800		En vigor	12,00		0,25	0,00	1,83
	A330-202		En vigor	11,00	2,00	1,00		1,81
	737-800		En vigor	15,00		0,88	1,88	1,80
	737-800		En vigor	11,00			0,00	1,74

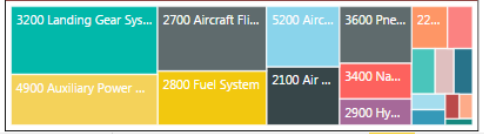
SUCESOS DE LA FLOTA - GRUPO



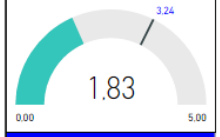
SUCESOS DE LA FLOTA - AERONAVEGABILIDAD



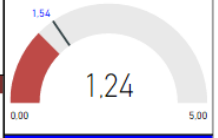
SUCESOS - SISTEMAS ATA



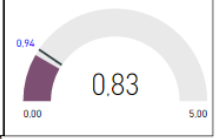
INDICADOR ACAM



INDICADOR SANA

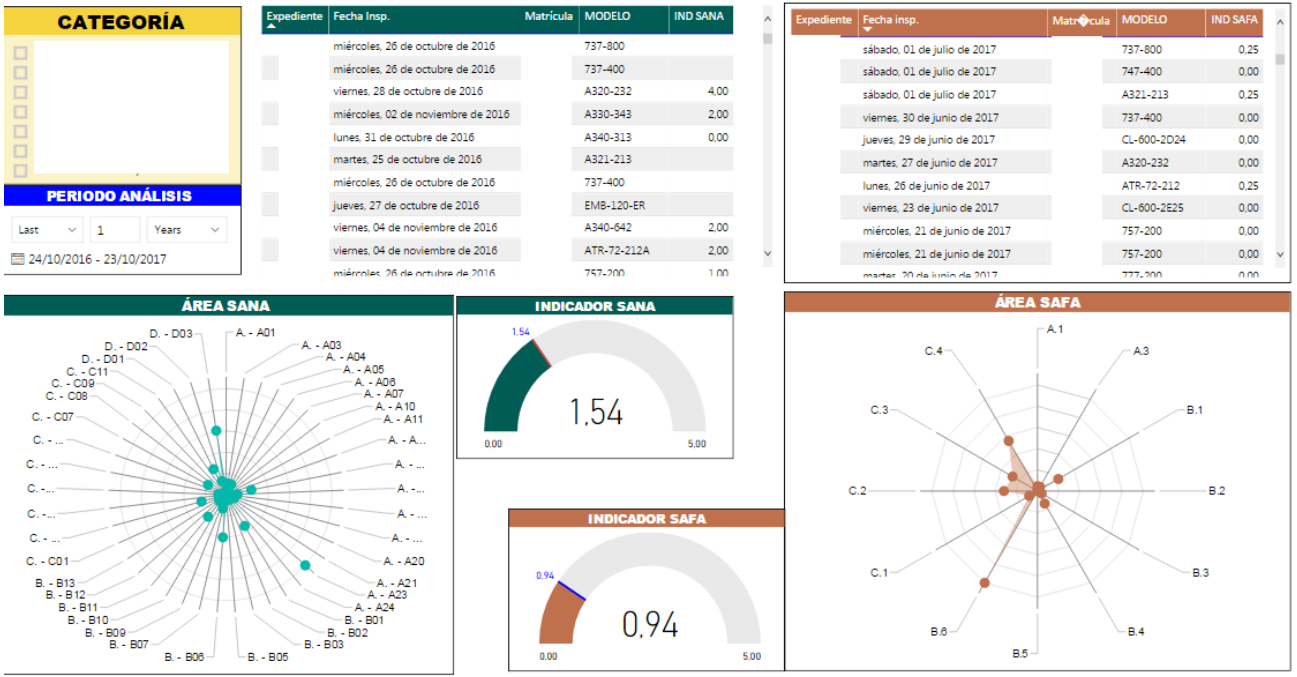


INDICADOR SAFA



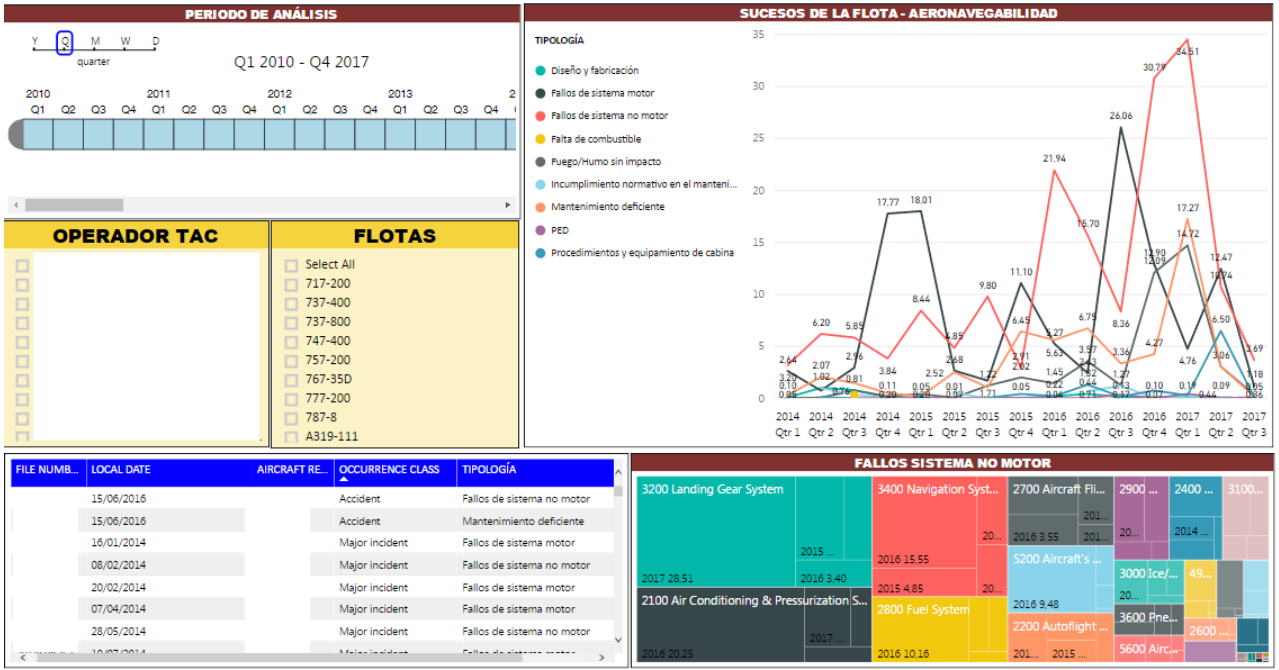
RISK BASED OVERSIGHT

RESULTADO INSPECCIONES EN RAMPA



RISK BASED OVERSIGHT

SUCESOS DE LA FLOTA -AERONAVEGABILIDAD



RIMAS

- Aviation System Level -

RIMAS: RISK MANAGEMENT IN AVIATION SAFETY
- A Framework and Architecture -

- A comprehensive coherent methodology for aviation safety risk management at state level
- Beyond risk matrices towards coherent development of SSPs

Key issues/steps:

1. Meaningfully exploring aviation safety databases
2. Building forecasting models for: operations, occurrences, severities
3. Assessing multiple consequences: deaths, injuries, delays, cancellations, maintenance and repair operations, image loss,…
4. Building risk maps (and matrices): Safety Risk Picture
5. Optimal assessment of aviation safety resources

RIMAS: RISK MANAGEMENT IN AVIATION SAFETY

- **MOR. 88 types of occurrences. Registered in ECCAIRS.**
- **Other databases: ASN, Eurocontrol (CFMU), ESTOP,…**
- **5 severity degrees (ICAO and EUROCONTROL): Minor, Significant, Major, Serious, Accident**
- **4 types of aircrafts T1, T2, T3, T4 (No. of passengers)**

✓ **Flight operations**
- **Hard landing,…**

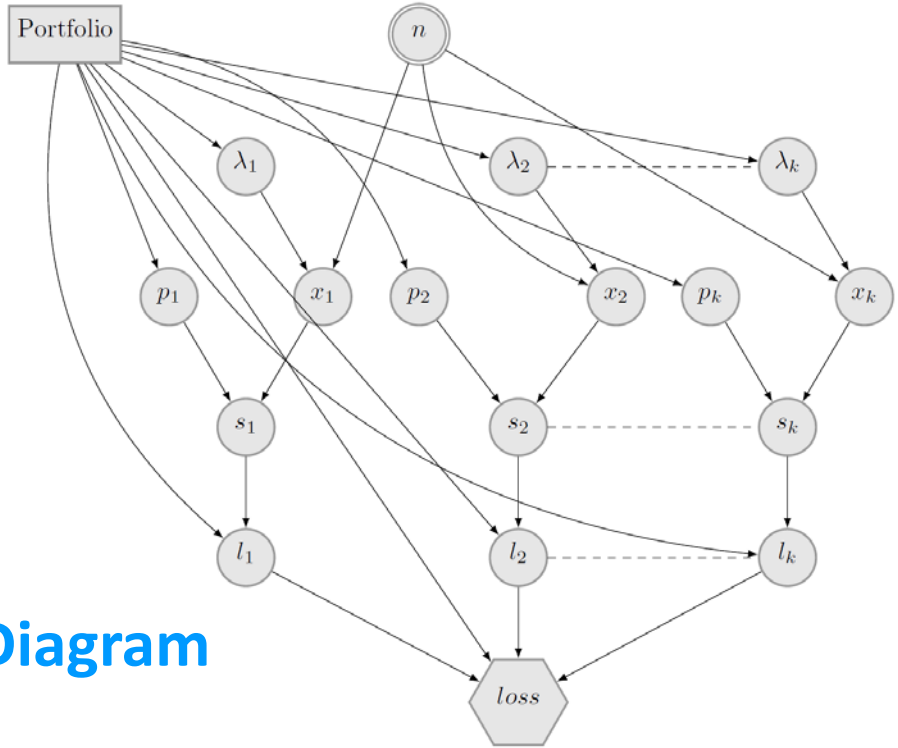
✓ **Navigation services**
- **ACAS warnings,…**

✓ **Airworthiness**
- **Engine failure,…**

✓ **Airport**
- **Impact with vehicle,…**

✓ **External factors**
- **Bird strikes,…**

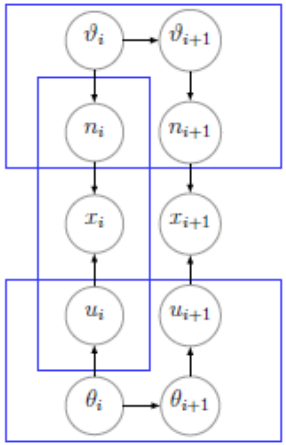
RESOURCE ALLOCATION



Influence Diagram

PREDICTING THE NUMBER OF OCCURRENCES

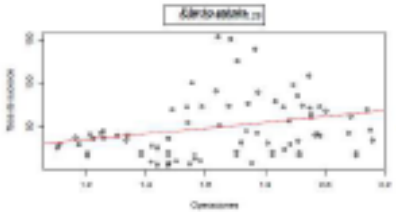
- **ID DLM+POISSON+(EXP)DLM**



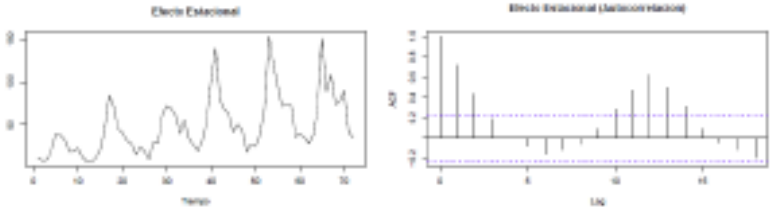
- **Model**

$$
\begin{cases}
\begin{cases}
\begin{cases}
n_i = H_i\vartheta_i + z_i, z_i \sim N(0, \Sigma_i) \\
\vartheta_i = J_i\vartheta_{i-1} + \xi_i, \xi_i \sim N(0, S_i)
\end{cases} \\
\vartheta_0 \sim N(\eta_0, S_0)
\end{cases} \\
x_i|\lambda_i, n_i \sim Po(\lambda_i n_i) \\
\lambda_i = \exp(u_i) \\
\begin{cases}
\begin{cases}
u_i = F_i\theta_i + v_i, v_i \sim N(0, V_i) \\
\theta_i = G_i\theta_{i-1} + w_i, w_i \sim N(0, W_i)
\end{cases} \\
\theta_0 \sim N(\mu_0, W_0),
\end{cases}
\end{cases}
$$

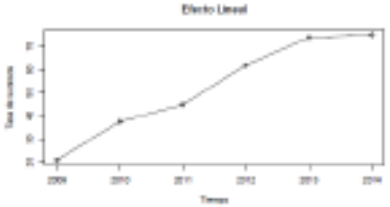
FEATURES FACED IN (POISSON) INCIDENT RATES



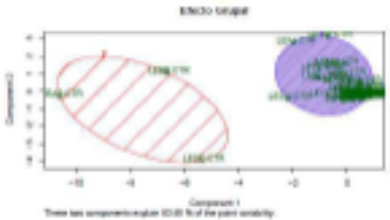
(a)Stress



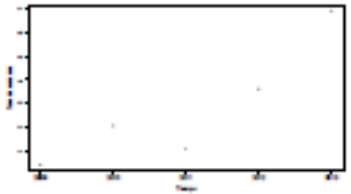
(b)Seasonal



(c)Linear



(d)Group



(e)Underreporting

PREDICTING OCCURRENCE SEVERITIES

- We must also predict the corresponding occurrence classes (severities)

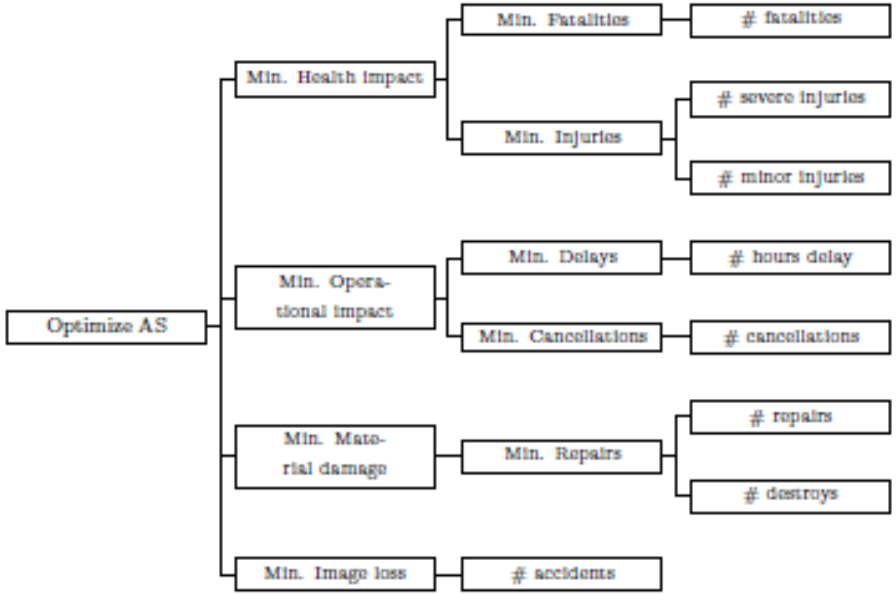
- **Model**

- assuming that the data D_t available until the beginning of the t-th period are $((s^1_1, s^2_1, \ldots, s^5_1), \ldots, (s^1_{t-1}, s^2_{t-1}, \ldots, s^5_{t-1}))$, and where s_i^j represents the number of occurrences of class i, i ϵ {1, 2, 3, 4, 5}, in period j, j ϵ {1, . . . , t−1}:

$$p|D_t \sim \mathcal{D}ir\left(\alpha_1 + \sum_{i=1}^{t-1} s_i^1, \ldots, \alpha_5 + \sum_{i=1}^{t-1} s_i^5\right)$$

❑ PREDICTING INCIDENT CONSEQUENCES

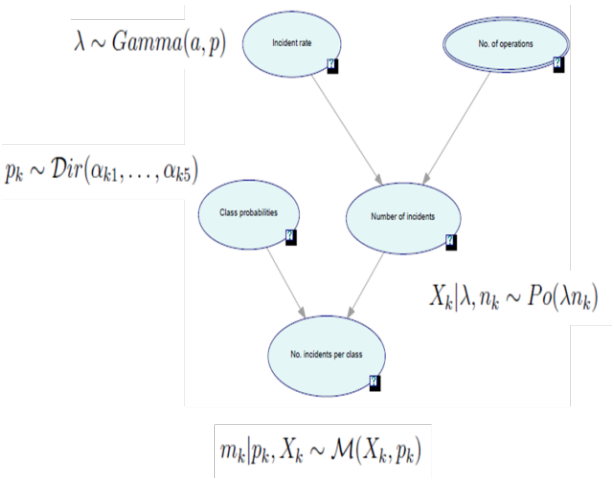
✈ Multiattribute utility function

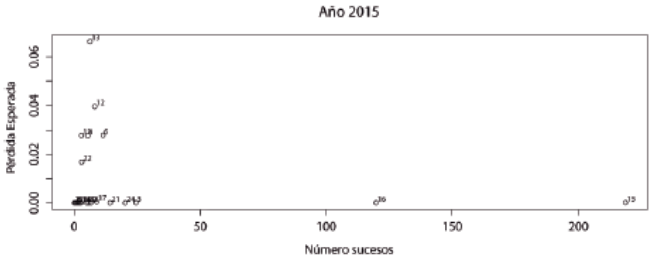


RISK MAPPING

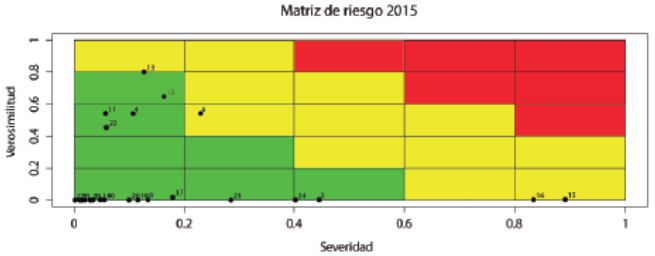
- **Mapping (forecasted) incident numbers vs (forecasted) incident costs (expected, boxplots)**

Less but more expensive	More and more expensive
Less and less expensive	More but less expensive



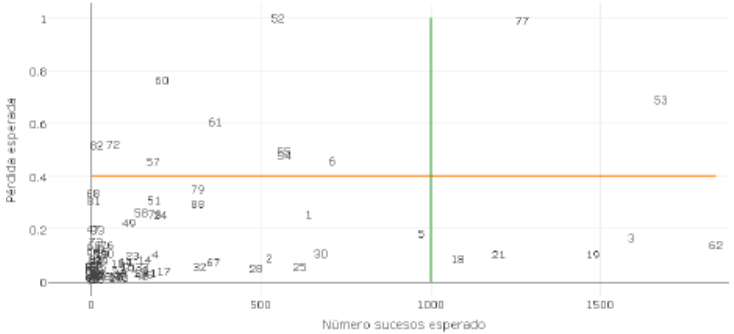


(a)



(b)

USES: SCREENING



Anti-Pareto	Más costosos	Más frecuentes	Empeora	Emergentes
(52)	(6)	(3)	(19)	(60)
	(52)	(18)		
(53)	(53)	(19)	(62)	
(62)	(54)	(21)		
(77)	(55)	(53)	(77)	
	(57)	(62)		
	(60)	(77)		
	(61)			
	(72)			
	(77)			
	(82)			

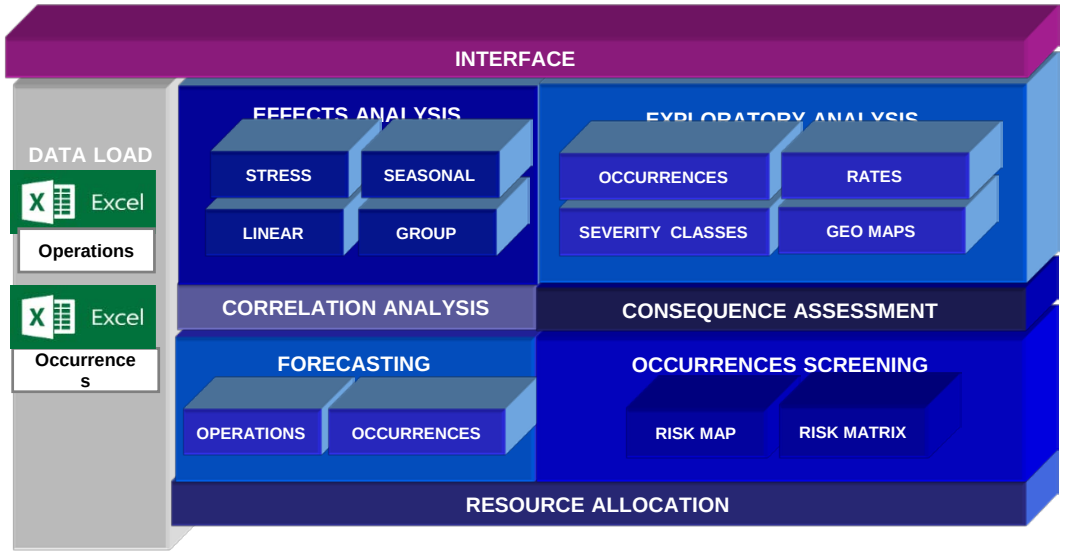
	Suceso	Ref.	ADREP
1	Presencia de obstáculos / FOD	123	ADRM
2	Láser	-	-
3	Golpes de aves	651	BIRD
4	Incursión aeronave en otras superficies	321-1	RI-VA(P)
5	Fallos de sistema motor	441	SCF-PP
6	Fallos de sistema NO motor	431	SCF-NP
7	Turbulencias meteorológicas	621	TURB
8	Vientos	622	OTHR
9	Colisión con aves	651	BIRD
10	Toma de tierra dura, pesada, rápida o larga	231	ARC
11	Manejo de la aeronave	2121	OTHR
12	Cizalladura	612	WSTRW
13	Cizalladura en cabeceras	-	-
14	Fallos técnicos sin identificar	451	OTHR
15	Otras condiciones meteorológicas	641	OTHR/UIMC
16	Pérdida de control en vuelo	282	LOC-I

RIMAS: THE ARCHITECTURE

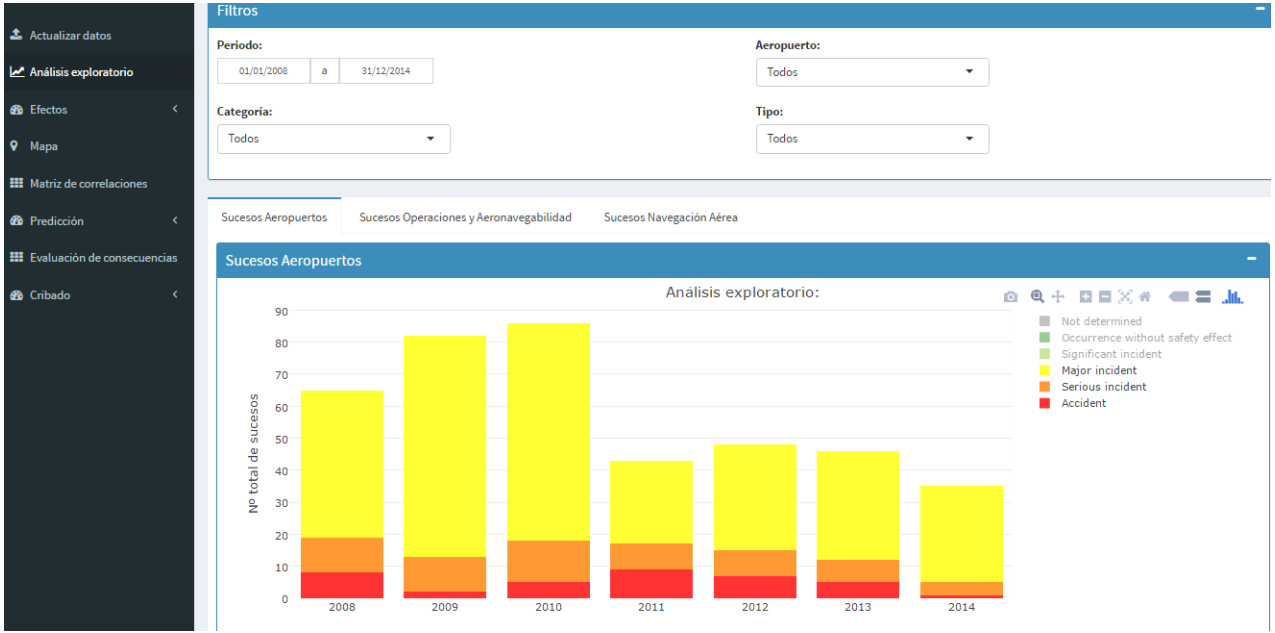
Based on R! and ECCAIRS (and other aviation safety databases), it supports building:

- Forecasting models for numbers of 88 types of occurrences (including number of operations)
- Forecasting models for occurrence severity classes (1 to 5)
- Forecasting models for occurrence consequences (deaths, delays,…)
- A multiattribute utility function to assess such consequences
- Risk maps (and risk matrices)
- Screening of occurrences
- Optimal assignment of resources to reduce and mitigate aviation safety risks
- Displaying all types of graphs to build aviation safety reports

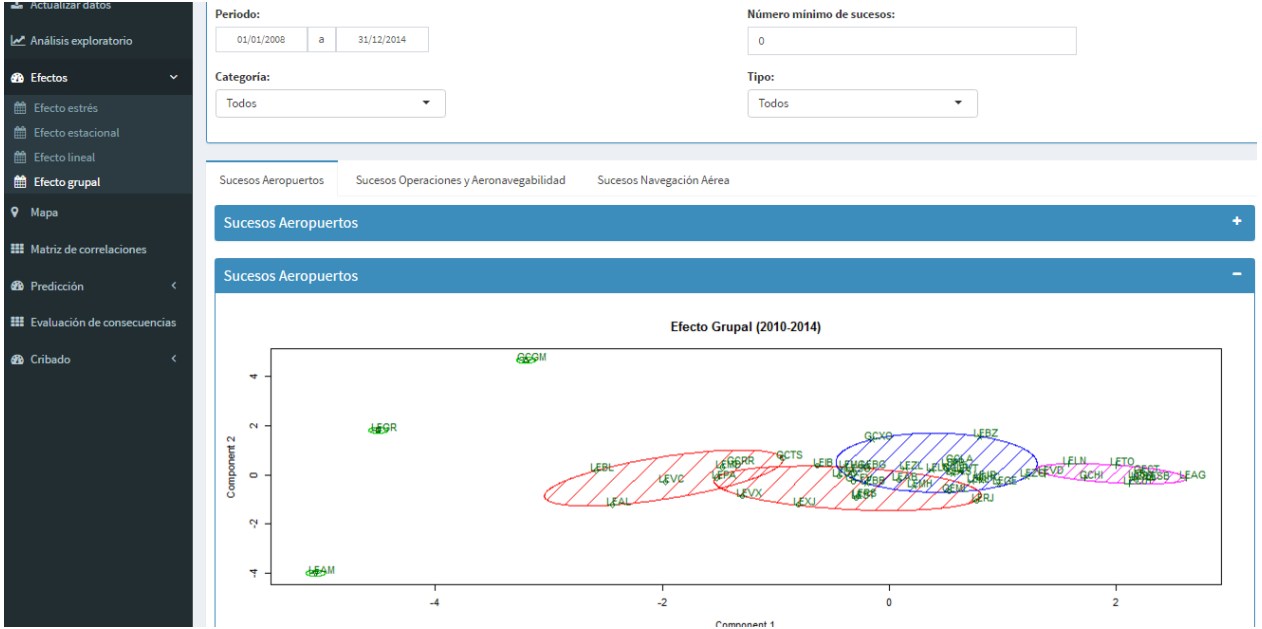
RIMAS: THE ARCHITECTURE



EXPLORATORY ANALYSIS

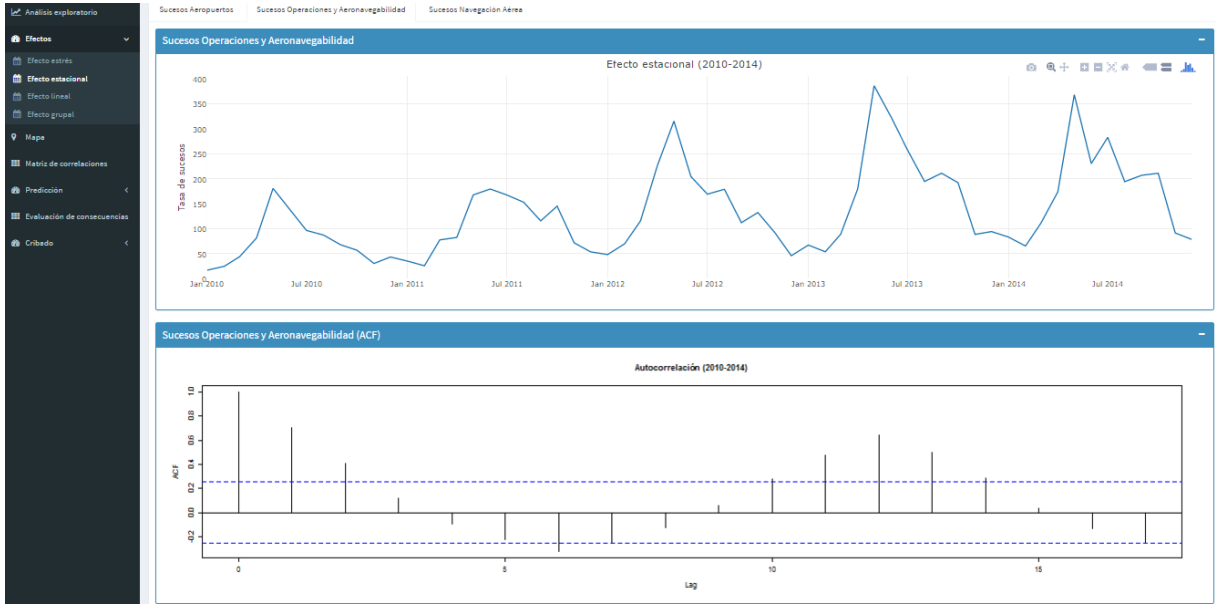


EFFECT ANALYSIS: GROUP

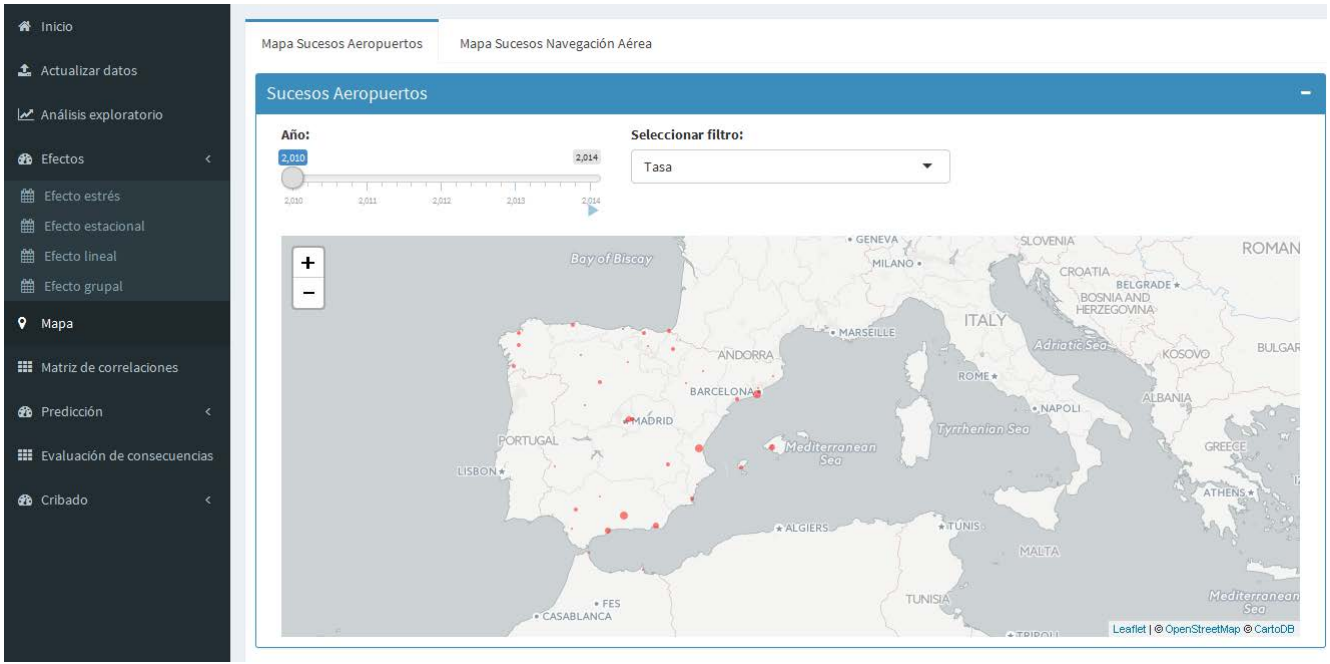


Código de Plantilla: F-DEA-CDO-08.2.0

EFFECT ANALYSIS: SEASONAL

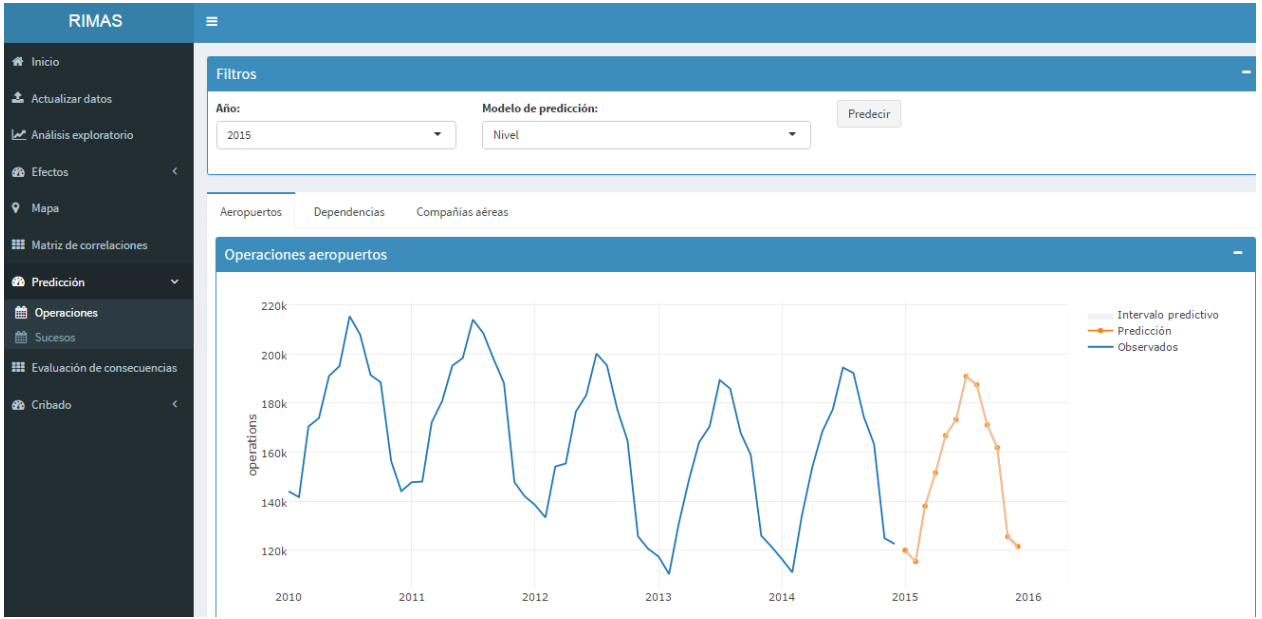


GEO MAPS



CORRELATIONS MATRIX

OPERATIONS FORECASTING



RISK MAPS

Participation on Data4Safety

Our View

D4S is a **data collection and analysis programme** that will support the goal to ensure the and environmental protection for the European aviation **highest common level of safety** system

Why? AESA's **strategic interest** in leading big data projects

Contribution?

- **previous experience** in national and international projects
- **highly qualified team** of safety analysts

Main problems… **protection** and **use** of safety **information**

Expected achievements… **safety improvements** under **SSP** and **EPAS**

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO
AESA AGENCIA ESTATAL DE SEGURIDAD AÉREA
The Project is funded by the European Union

Started in October 2016

1 The Project

Applied research - laboratory validation

Data management, infrastructure, data protection,
data mining tools, visualisation

Aviation safety knowledge discovery

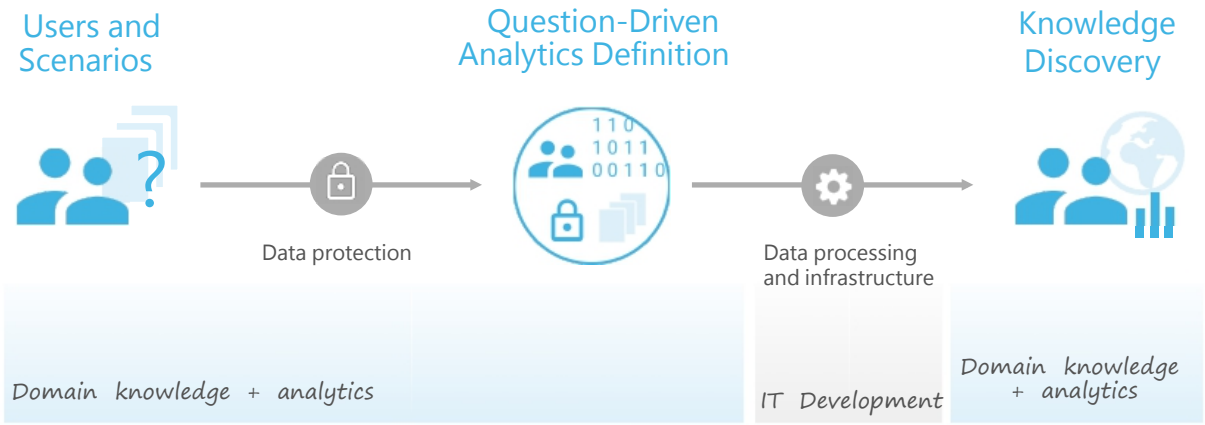
Systematic identification of hazards

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO
AESA AGENCIA ESTATAL DE SEGURIDAD AÉREA
The Project is funded by the European Union

2 The team

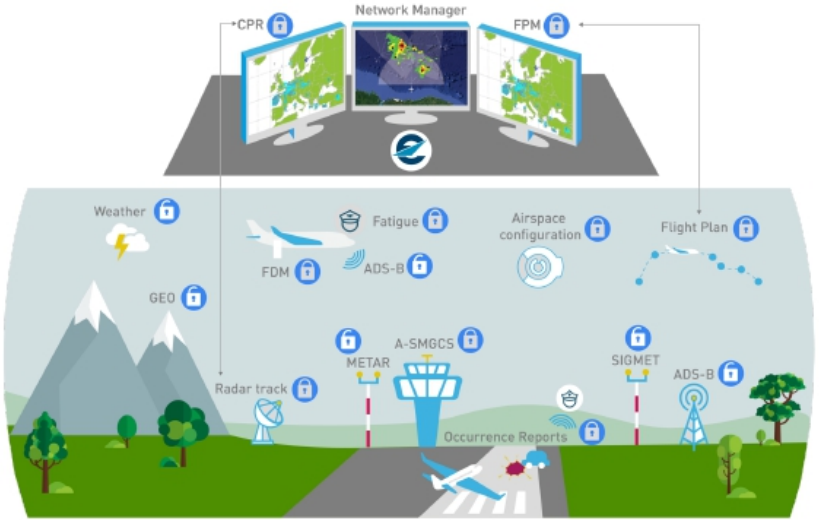
2 The Team

The user role in the Big data process



3 The data

14 Data Sources identified and documented



- Description
- Structure and size
- Data Items description
- Range of available data
- Delivery procedure (when and how)
- Technical limitations

Open data

Proprietary data - Data Protection Agreements signed+technical procedures

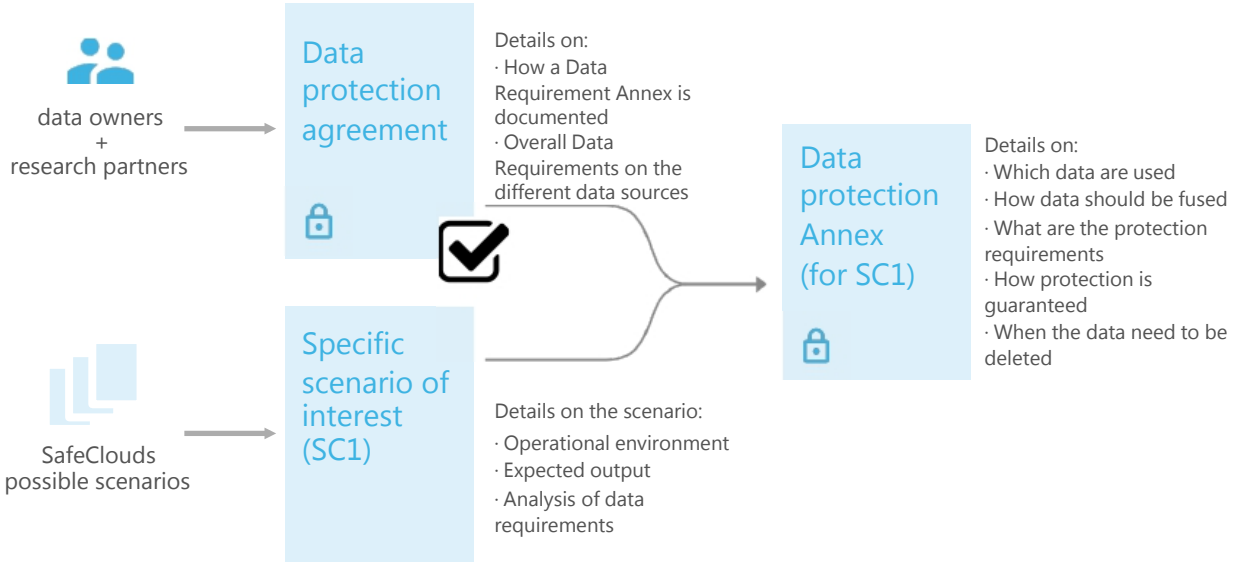
4 Data protection

Basic procedures in the Consortium Agreement

- Any dataset provided to the project treated with **maximum confidentiality**
- SafeClouds **will not publish datasets** by any means, paper or electronically
- SafeClouds **will not publish details of a concrete safety event**
- All **publications** to be **approved by the data owners**

4 Data Protection

Data Protection Annex - legal agreement



4 Data Protection

Data Protection Annex - technological procedures

The Smart Data Fusion algorithm allows fusion/identification of datasets without private data leaving the private environment.

This is performed storing randomized hashes as references in the shared environment and encrypted values and seeds on the private environment, i.e. hash key bank.

4 Data Protection

Additional Data protection mechanisms

System monitoring

- A **user hierarchy** defines roles and limits data access.
- User actions are **continuously monitored** and logged.
- Any **suspicious behaviour** will trigger a series of **alarms**

5 Scenarios

Input from SafeClouds partners

5 Scenarios

Use Cases

Operational + mathematical description (**metric**)

Data supporting the use cases

Data **Protection** requirements (legal +technical)

Analytics supporting the use cases

Details on how to **embed the analytics** in the operations

User experience and visualisation requirements

5 Scenarios

Use Cases - CFIT

Metric
Data needed and elements

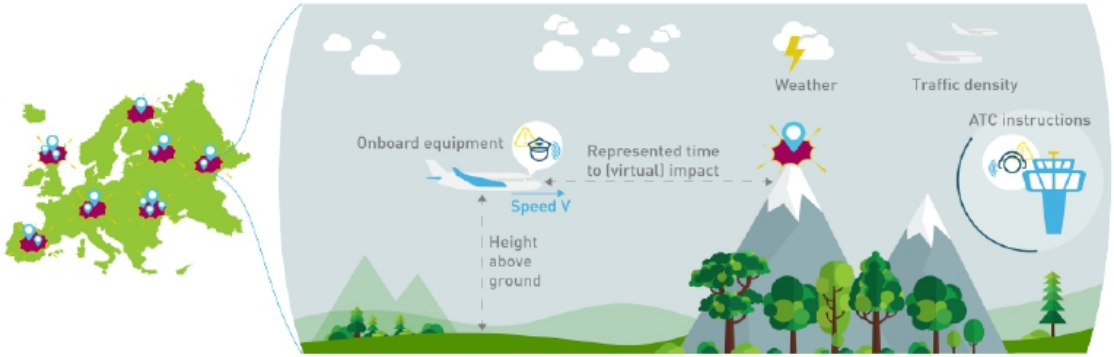


Figure 3.4/7: Concept Graphic for CFIT Use Cases

CFIT-1: Hotspot Detection

CFIT-2: Identifying unreported situations of Aircraft Flying Below Minima

5 Scenarios

Use Cases - Runway utilization

Metric
Data needed and elements

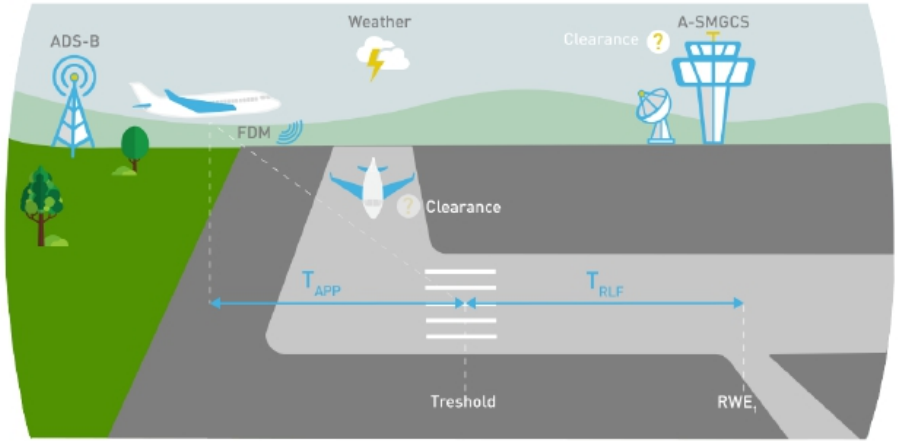


Figure 3.3.1/6: Concept Graphic for Use Case RU-1

RU-1: Runway usage prediction:

a) runway vacate

b) distance to threshold

5 Scenarios

Use Cases - Unstable Approach

Metric
Data needed and elements

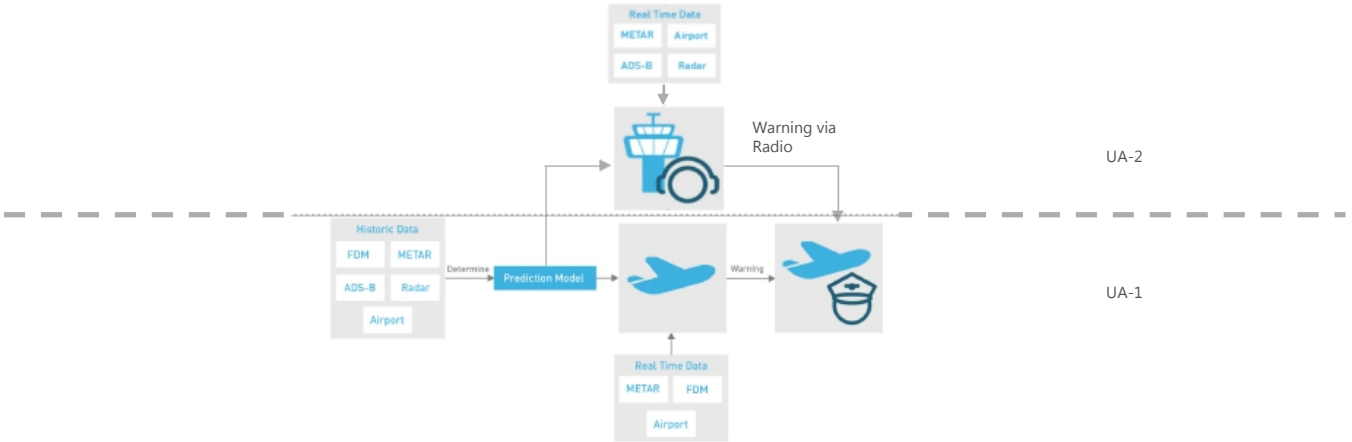


Figure 3.2.3/4: Concept Graphic for Use Case UA-1

UA-1: Prediction of UA due to data theoretically available on board an aircraft in real time

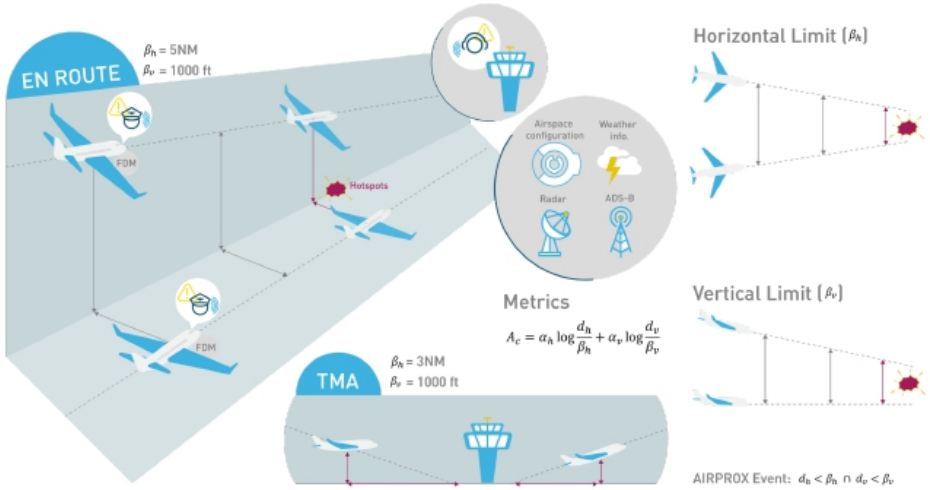
UA-2: Prediction of UA due to data theoretically available to ATC in real time

UA-3: Blind Benchmarking

5 Scenarios

Use Cases - AIRPROX

Metric
Data needed and elements



AIRPROX-1:Detection and characterisation of hotspots in En-Route environment

AIRPROX-2: Detection and characterisation of hotspots in TMA environment

6 User-driven analytics

User + Questions	Outcomes	Methodologies, technologies
What happened? What's happening? Descriptive analysis	Well-defined case studies, opportunities and challenges	· Clustering · Link prediction · Co-occurrence grouping · Profiling · Similarity matching
What will happen? Predictive analysis	Accurate projections of future states	· Parametric modelling · Methods to avoid overfitting · Similarity networks and clusters · Supervised / unsupervised segmentation
What should we do? Prescriptive analysis	Best-possible decisions	· Optimization · Simulation · Decision modelling · Causality modelling

7 Supporting infrastructure

Your SafeClouds remote

Data de-identified

Analysts controlled/secure access

No local copies of data

No data fusion among airlines - unless agreed

Your SafeClouds local

Data semi-identified for data fusion (e.g. meteo)

No Data Analyst access

Data Protection team remote access

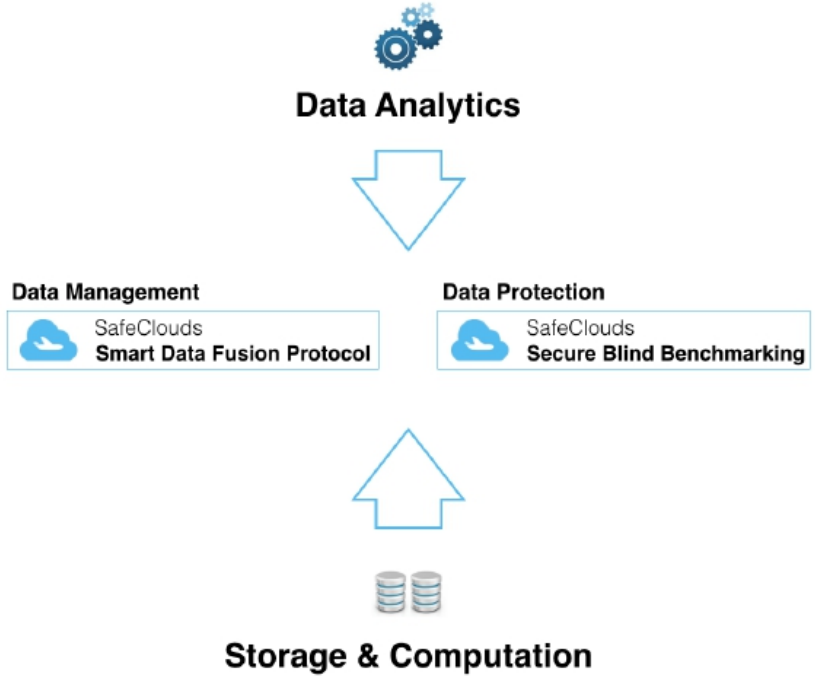
Your own systems

Data identified

No SafeClouds access

7 Supporting infrastructure

Integration infrastructure-analytics

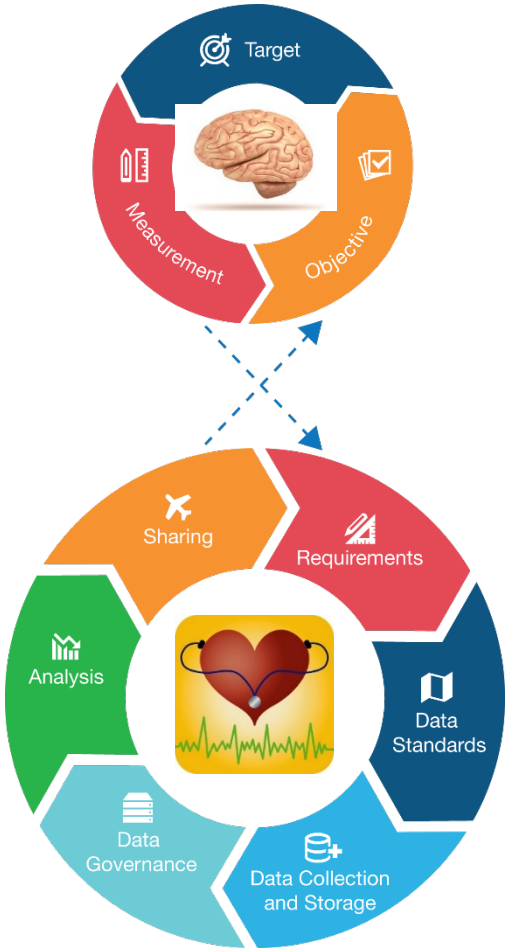


SUMMARY and DISCUSSION

SUMMARY and DISCUSSION

- Safety data: the system's blood
- Safety data & sources protection: key SSP/SMS
- Safety risk management is pervaded by simplistic methods based on risk matrices

WITHOUT APPROPRIATE DATA PROTECTION…
NO EFFECTIVE SSP/SMS



Thank you very much

END OF THE PRESENTATION

AVIATION DATA SYMPOSIUM

case study

www.seguridadaerea.gob.es

Networking Coffee Break

Thank you to our Sponsor

mcmillan

Virtual Reality – How VR will Shape Aviation Training

- April Slovensky
  Deloitte
- Frederic Leger
  Director, Airport, Passenger, Cargo and Security, Products, IATA

Digital Reality

April Slovensky

Deloitte

Deloitte.
Digital

IATA

NOV | 2017

Digital Reality

DIGITAL REALITY

Virtual Reality

CREATES A DIGITAL ENVIRONMENT
that replaces the user's real-world environment

360° Video

A NEW PERSPECTIVE
Allowing users to look every direction

Augmented Reality

OVERLAYS DIGITALLY-CREATED CONTENT
into the user's real-world environment

Solves real-world business problems and creates new sources of competitive advantage.

Immersive

MULTISENSORY, DIGITAL EXPERIENCE
Delivered through any of these technologies

Mixed Reality

BLENDS DIGITAL CONTENT INTO REAL-WORLD
both environments can coexist and interact

Based on Consumer Technology Association Definitions, 2016

Data is the key to delivering digital realities

Think	Connect	Know	Learn	Explore	Play
Evaluate solutions, identify starting points, pivot based on learnings	Connect people remotely, communicate via “See what I see” and interact with the same information	Augment data and resources to give team members a new way to do their jobs	Immerse in training, analytics, and research, lowering time, risk & cost required	Bring consumers on a journey of exploration across time and geography	Deliver digital reality experiences through content creation, enablement and consumption

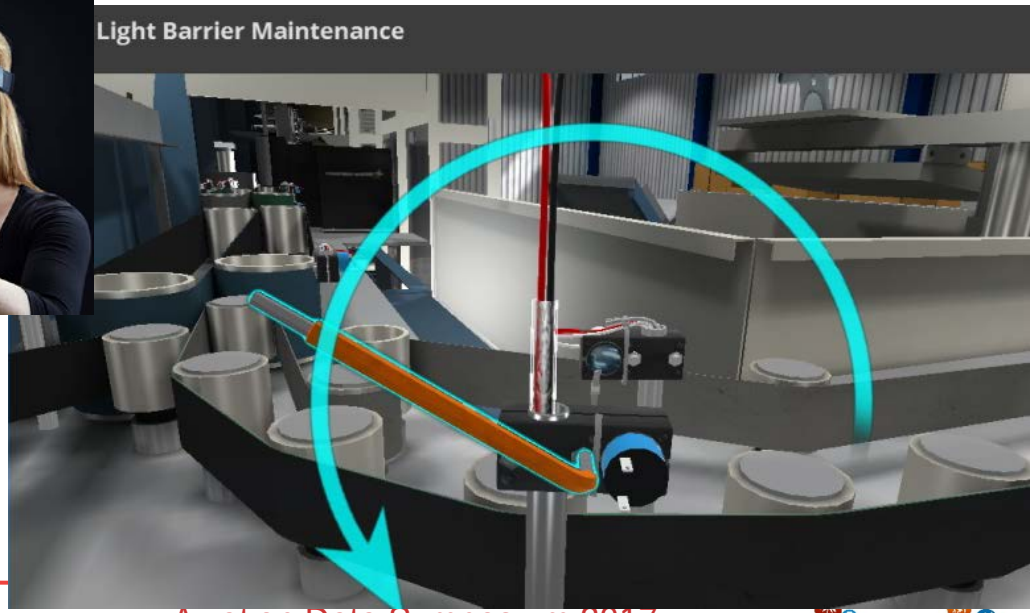
Identify ~ Capture ~ Cleanse ~ Translate

Immersive training for key use cases in a curriculum

Train a workforce for mission-critical, high cost, complex scenarios by creating an interactive, scalable, experiential reality

Virtual Reality Capabilities

- Scalable Low-Cost Training Simulations
- Experiential Learning Environment
- Instant Best Practice Sharing

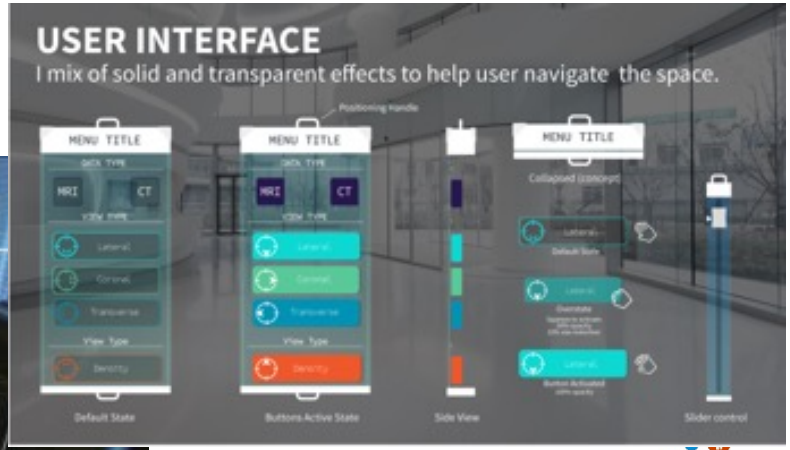


Real-time support and quality built into task execution

Provide workers hands-free access to issue resolution as well as on-demand global expertise with SME's using see-what-I-see technology

Augmented Reality (AR) Solutions Capabilities

- Hands-Free Remote Assistance
- See-What-I-See Guidance
- Automatic Visual Task Assistance



Alter your Reality

1 **Think.** Leverage early adoption, strategic decisions and high priority areas.

2 **Connect.** Use your ecosystem to collaborate.

3 **Know.** Embed learning into the operational activities.

4 **Explore.** Shift the thinking about new ways to create a learning environment.

5 **Consume.** Transform data into content users understand and consume.

RampVR:
Virtual Reality in Aviation

Frederic Leger

Director, Airport, Passenger, Cargo & Security Products

IATA


RAMPVR
VIVE
SONY

IATA Training in 2016

- **100,000+** professionals trained in 2016


In company


Classroom

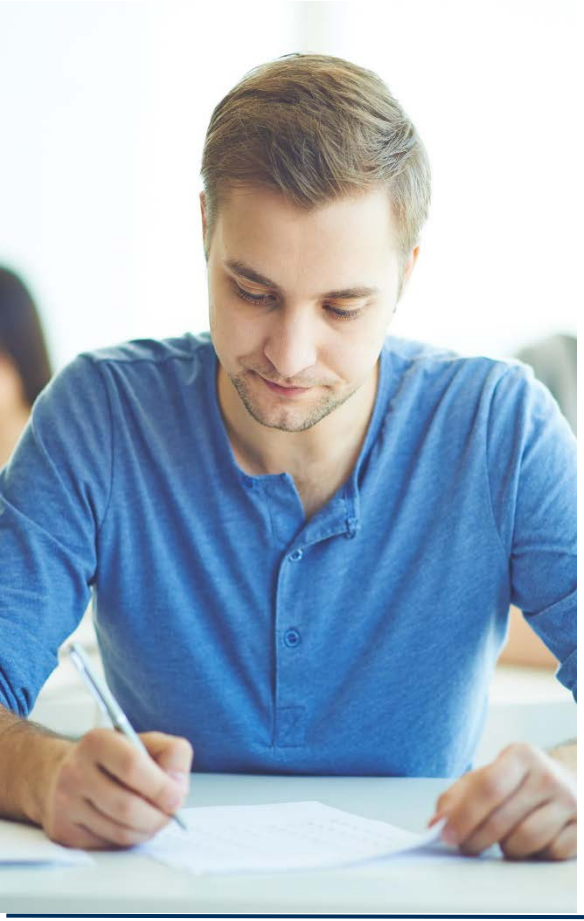

Virtual


Online


E-book

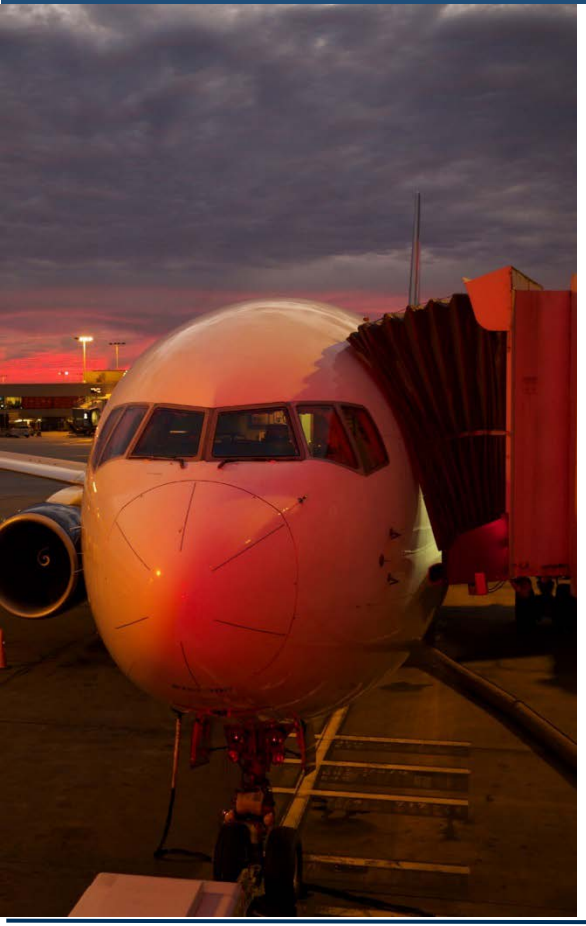

Printed

- **20+** IATA Training Centers
- IATA training offered in **90+** countries
- Our students come from **190+** countries
  - Students represent **2,000+** organizations & government authorities



Current operational training is good, but...

- Not evolved and remains “passive”
- Subject to capacity and availability limitations
- Not benefiting from state of the art and most advanced technology
- Knowledge retention rate could be improved
- Examination remains very theoretical vs. operational



Consultation helped us improve effectiveness of existing training

- Consulted with airlines, airports and ground service providers to understand training needs and pain points
- Common thread: *“need for live, practical, on-the-ground experience while minimizing ramp access”*
- Common need: *“immersion in a close-to-reality environment, simulating live operations, enhancing knowledge retention”*

Virtual reality addresses limitations of training

- Immersion in a fully interactive, realistic 3D environment
- Full compliance with industry standards, e.g. Airport Handling Manual (AHM) and IATA Ground Operations Manual (IGOM)
- Accessible anytime
- Easy to set-up and use

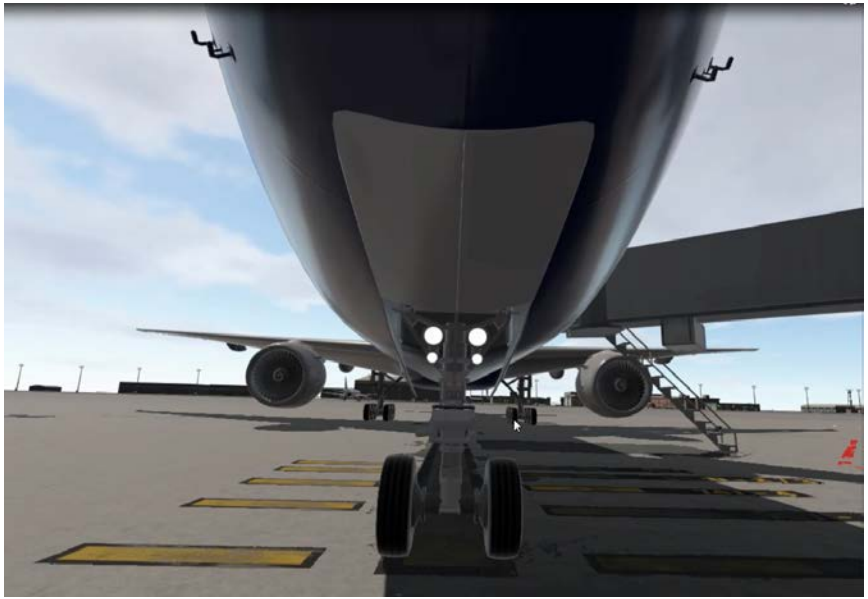
Making RampVR™ simple to use was key in adoption

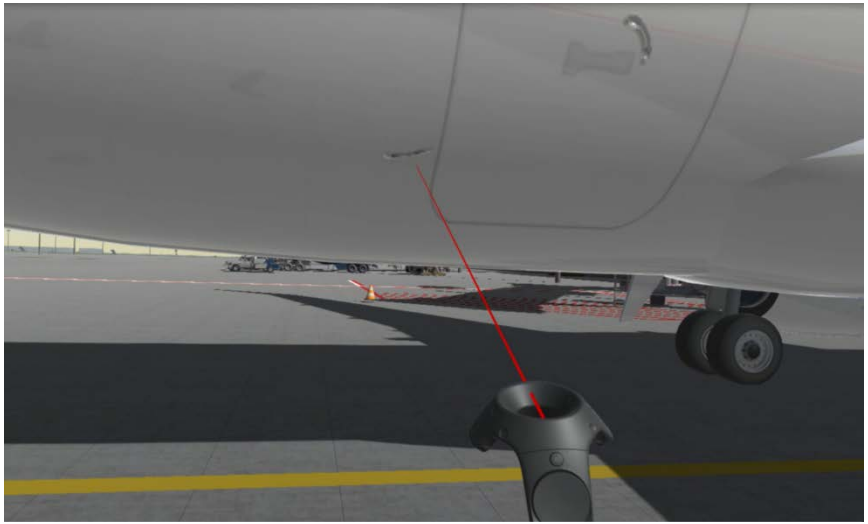
- A plug-and-play system with an intuitive user interface
- Simple setup in any 3x3 meter space with straightforward wire connections
- Quick change between users for time-constrained training sessions
- Easy web download of new VR modules or updated versions of existing modules

We currently offer 2 training modules

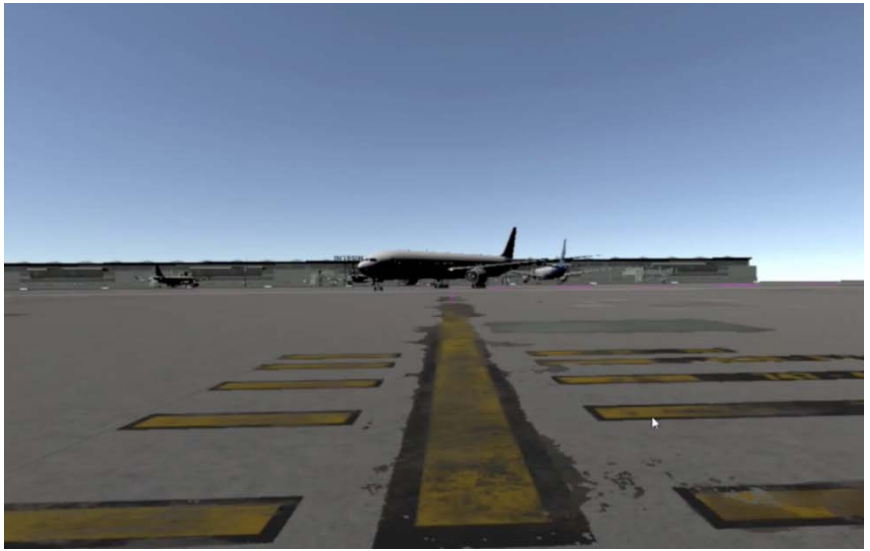
- **Aircraft Turnaround Inspection** – Review of procedures to be performed by ramp handlers/supervisors in the safety inspection of the apron prior to an aircraft's arrival as well as damage inspection of the arriving aircraft prior to docking of equipment.

- **Marshalling** – Using IATA Marshalling Signals to train and evaluate aircraft marshallers to guide an aircraft safely to its final parking position.

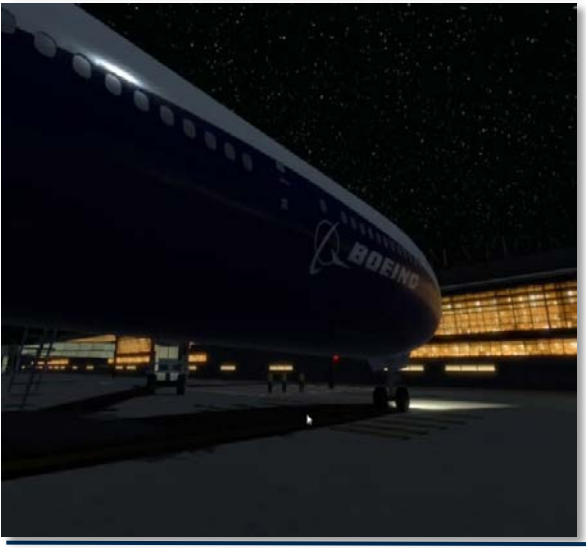




Turnaround Inspections

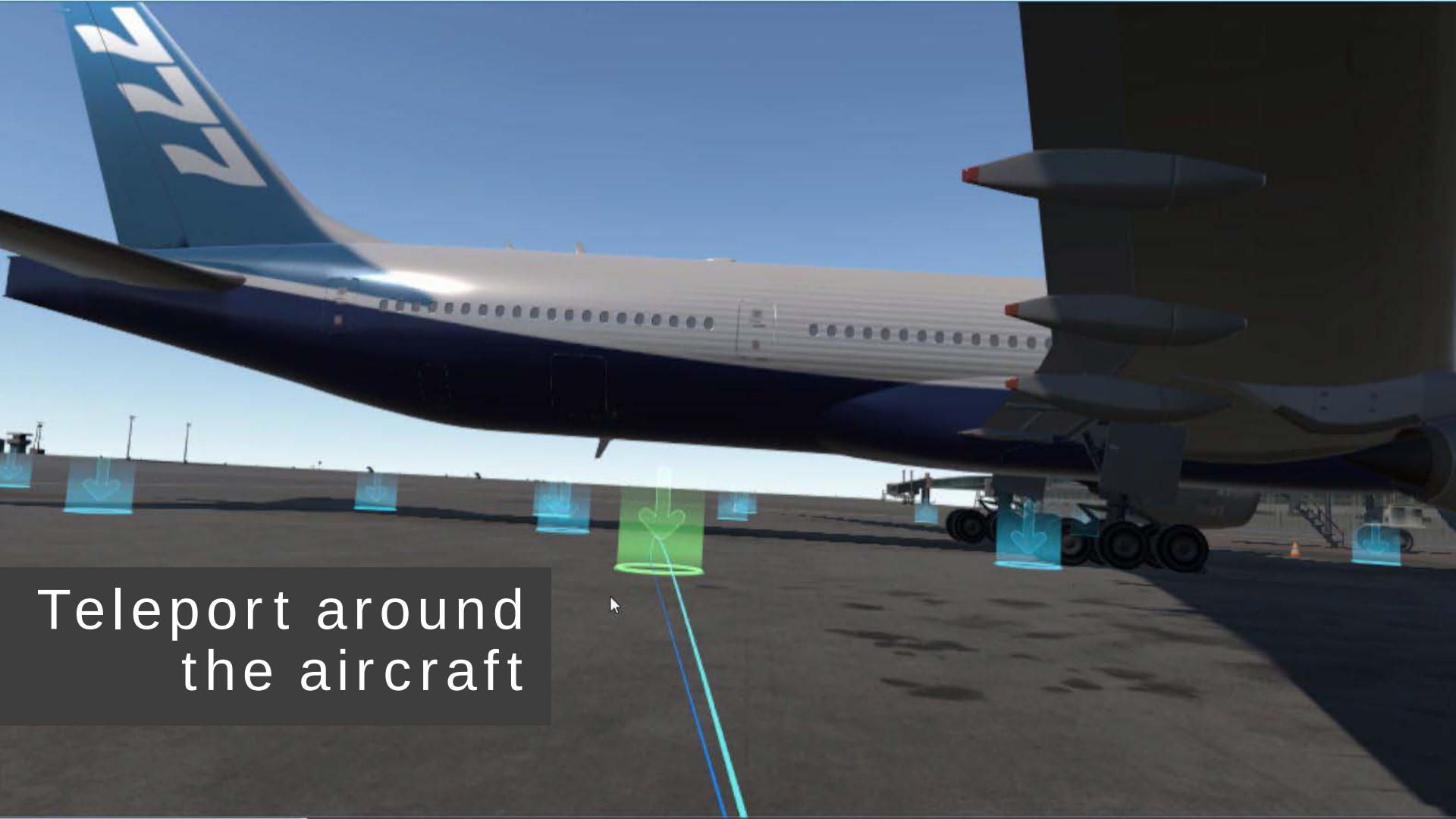


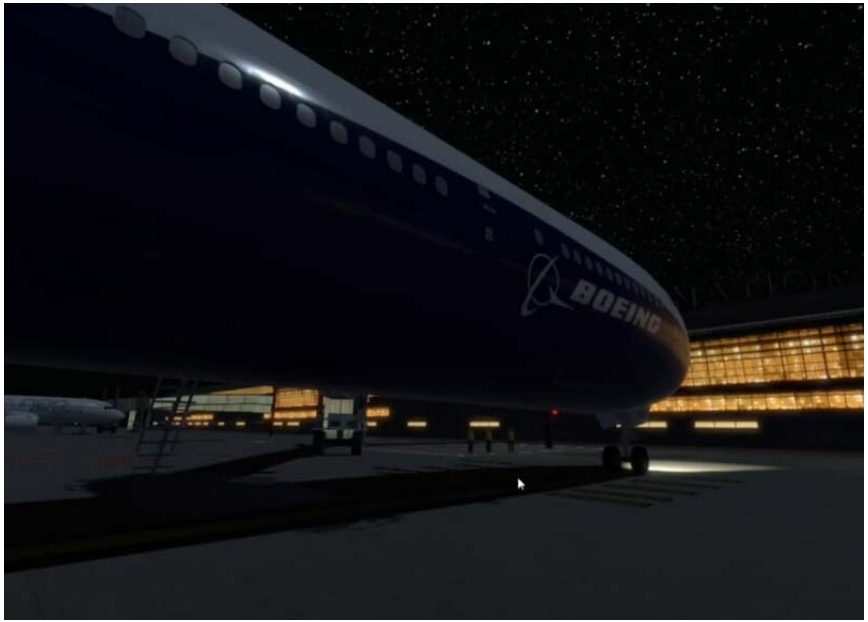
Marshalling



RampVR™ experience

- Be reminded on key principles of training while “on” the ground
- Spot common errors experienced in operations that the system will randomly inject
- Experience infrequent errors to familiarize with unusual situations
- Choose from multiple aircraft categories and “teleport” where needed to conduct the inspections
- Simulate day and night operations in combination with clear and low visibility
- Check score to ensure the inspection or marshalling has been successfully performed


Teleport around
the aircraft



Simulate day and night

Simulate issues

Record results

Benefits of virtual reality training

- Practical training in a safe and immersive environment
- Access aircraft and apron anytime, anywhere
- Replicate incidents and issues infrequently seen in operations
- Expose trainees to different lighting and weather conditions
- Improve knowledge retention and staff engagement
- Comply with IATA standards
- Easy set-up, usage and download of new version and modules

Distributing virtual reality training

1	2	3
Training at IATA Training Centers	Training in Customers' Premises	Company Purchases RampVR

What is included in the RampVR solution?

- The RampVR kit includes:
  - High-spec PC
  - HTC Vive
  - Headphones
  - Setup equipment (tripods, wires, etc)
  - VR training modules
- Other services:
  - Easy download of new or updated modules
  - On-site setup and user familiarization
  - Customer support

Future IATA VR Modules

Cargo
ULD build up, Dangerous Goods

Security
Cabin Security

Ground Ops
Aircraft loading

Passenger Experience
Inflight Experience

Other IATA VR/AR Activities

- Aviation AR/VR Ecosystem
- VR User Group
- AR/VR Events
- AR/VR Strategic Partnership Program

SAVE THE DATE

Air Transport Virtual & Augmented Reality Conference

15-16 May 2018
Geneva

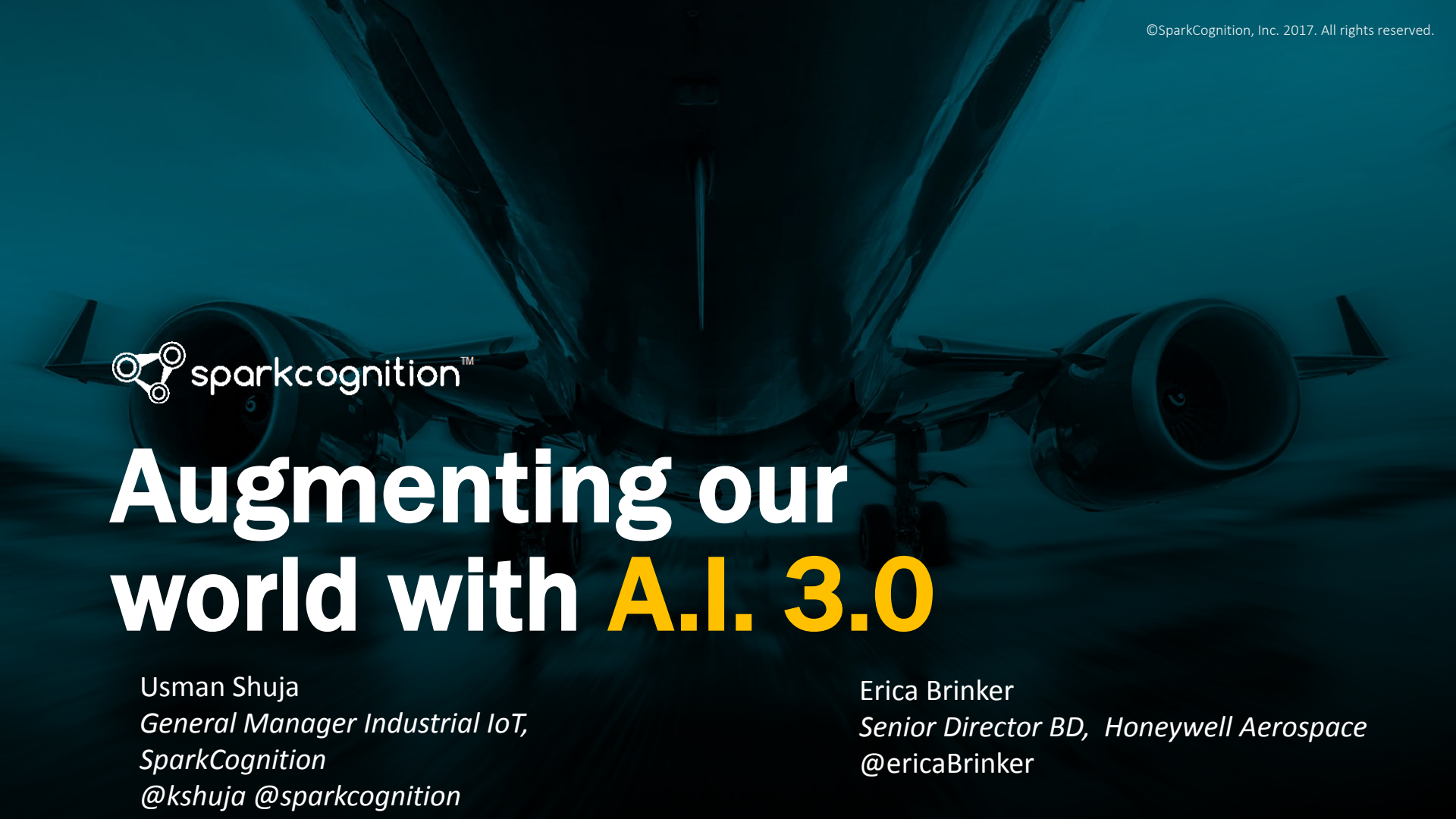
More information at:

rampvr@iata.org

www.iata.org/rampvr

Machine Learning – The Future of Aviation Data and Information

- Usman Shuja
  General Manager, Industrial IoT, Spark Cognition
- Erica Brinker
  Senior Director, Business Development, Honeywell Aerospace



sparkcognition™

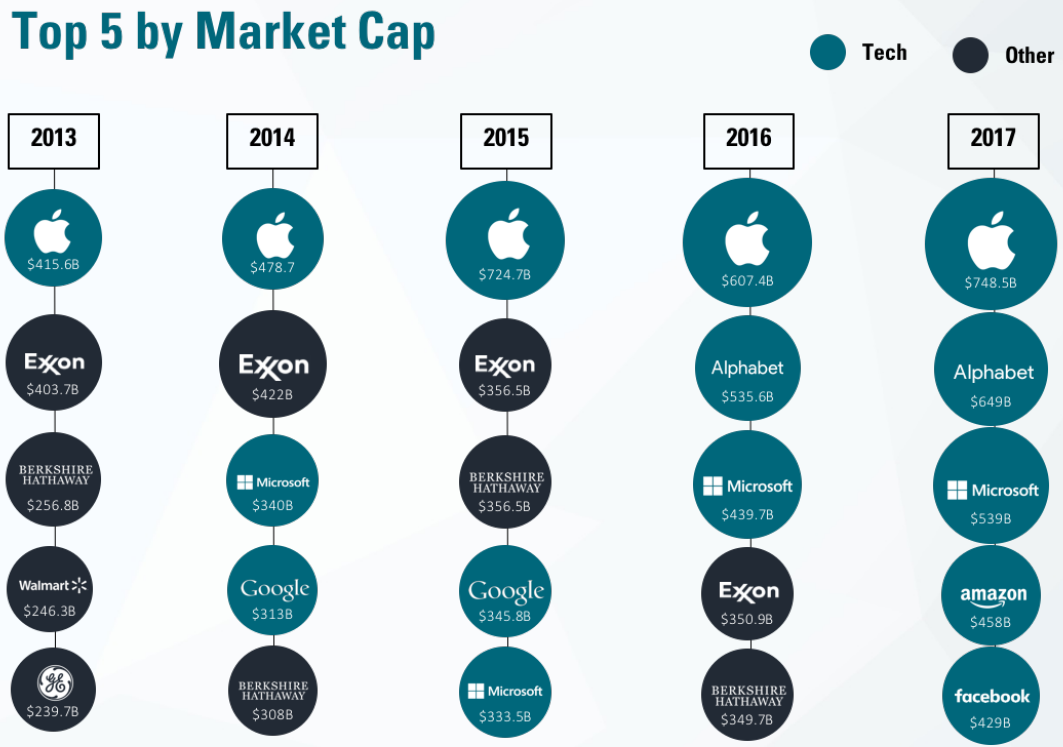
Augmenting our world with A.I. 3.0

Usman Shuja
General Manager Industrial IoT, SparkCognition
@kshuja @sparkcognition

Erica Brinker
Senior Director BD, Honeywell Aerospace
@ericaBrinker

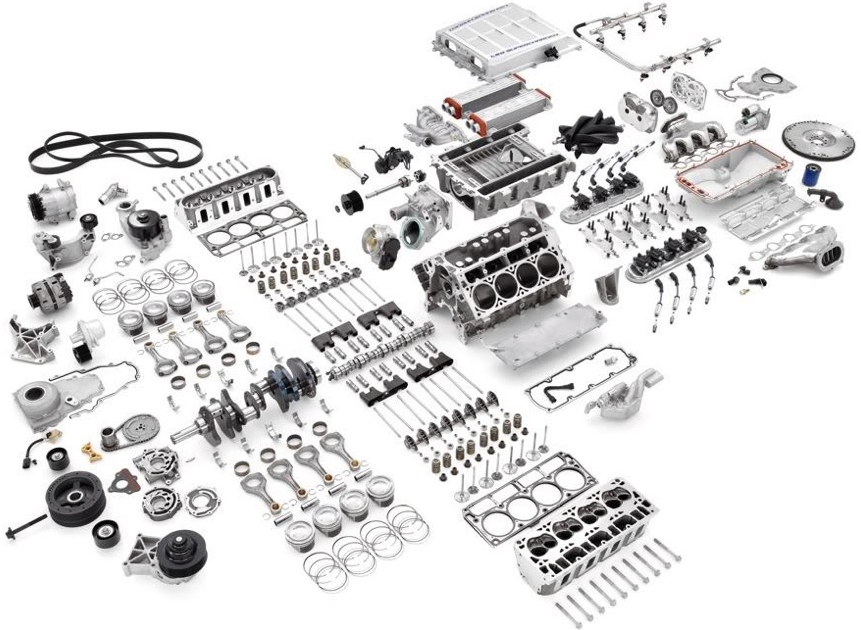

Software is Eating the World...
and A.I. is Eating Software

SOFTWARE TRIGGERED SHIFTS IN VALUE...



In the AI-powered disruption, everything will be up for grabs…

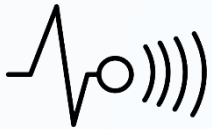
HOW SOFTWARE EATS THE WORLD...



Traditional Gas Engine Components

Electric Engine Components

Why is AI 3.0 working out?

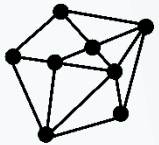


Data

- Sensor Proliferation
- Physical Actuation

Compute

- Cloud
- CPUs/ASICs
- Smarts at the Edge



Algorithms

- Deep Learning
- Auto Rule Generations, no need for extracting human expertise

The Transformation of Industry by AI has Begun

What does this mean for the industry?

Cognitive Maintenance – AI + AR
Truly long-view predictions, Explanations and exposing root-causes (Explainable AI)

Prescriptive Assistance for Humans:
Transforming millions of pages of text into context-based step by step guides

Safety through Autonomy:
Autonomous Aircraft, Self driving cars

Cognitive Security:
Cyber defenses for 100 Billion “things”

Optimization of Revenue & Events
Broader and deeper analytics

Artificial Intelligence Must Become a Critical Driver

AI will take enormous cost out of maintenance

Prediction

- Sensor / system data to provide early warning system
- Build Models automatically
- Secure end-points from cyber attacks

+

Diagnostic

- Identifying relevant correlations between sensor activity and system failures/warnings
- Explainable AI

+

Optimization

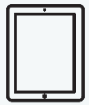
- Optimize performance, corrective actions and maintenance
- Determine next best actions for allocation of equipment, resources and location

+

Advisory

- Link probable repair to diagnostics procedures
- Technician assist through repair and diagnostics
- Connect maintenance technician with engineering assist

+



UI/UX

- Integrate insights into handsfree visual device
- Interact with machines and remote support technicians
- Collect data in the field using scanners

Security

Cognitive Prognostics

AI +AR

Prescriptive Assistance for Humans

GoDirect™ Connected Maintenance

RIGHT TIME TO REPAIR
Predict when a part will fail before it becomes an unscheduled event

RIGHT MAINTENANCE ACTION
Quickly know what corrective action has solved that problem most often in the past

RIGHT PART FOR THE JOB
Have the right part available when it is needed

RIGHT LABOR AVAILABLE
Have the right labor/skillset available for the repair

RIGHT PLACE FOR THE REPAIR
Have the right part available for the repair when needed

RIGHT INSTRUCTIONS
Have the instructions to repair/operate equipment readily available

An integrated vision that delivers top maintenance operational performance and gets smarter with time

Connected Honeywell Components
(APU, ECU, Wheels & Brakes, ECS, Mechanical)

Aircraft-wide maintenance log analanalytics, and diagnostic reasoning

Performance Based Contracts, and asset tracking

Ground Operations

Ground Operations

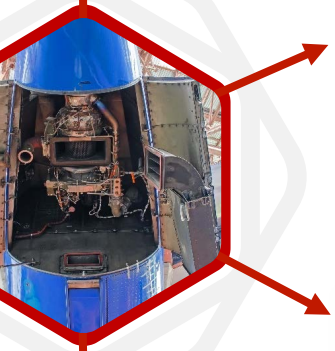
Maintenance Advisor

Honeywell

Connected APU Case Study

Explore Phase: **A330 Root Cause Analysis**
Identified all root causes for APU disruptions (operations and service) from MEL events.

- **60** A330 in fleet
- **16** Mo. of Ops
- **90K** Flight Sectors
- **327K** Mx Tech Log Entries
- **13k** APU Perf. Reports
- **570** APU Auto – Shutdown Reports
- **1.6M** Flight Data Records
- **44k** Fault Messages
- **3k** ATA 49 Events
- **151** HON shop removal records
- **88** Route geo-locations



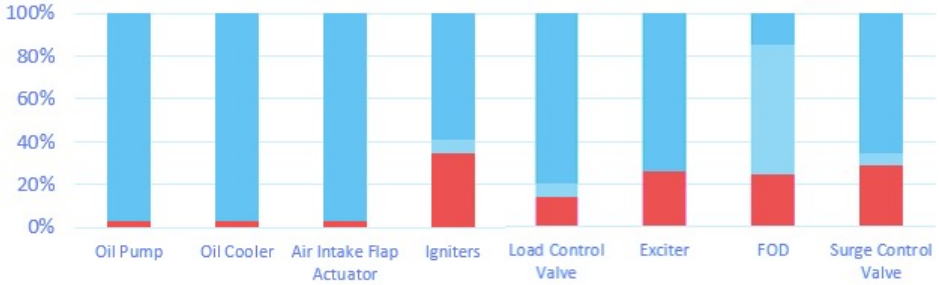
Investigate Phase: **Quantified MEL Reduction Analysis**
Deliver a report in 8 weeks forecasting performance improvement using GoDirect Connected Maintenance Service.

40%	51%	14	1%
REDUCTION MEL Sectors	**REDUCTION** IN DELAY MINUTES	**AVOIDED** COMPONENT REPLACEMENTS	**FALSE** REMOVAL RATE

Final Results: **Significant Reduction in APU MELs**

A330
APU MEL Flights

- Percentage of MELs eliminated
- Additional MEL reduction if action taken on all notifications
- New reduced MEL level



CONNECTED MAINTENANCE OPERATIONS

Connected APU

WHAT IT IS

Connected APU leverages existing aircraft data along with maintenance and shop records to provide a predictive and smart diagnostics solution.

KEY PROBLEM SOLVED

- Reduces APU related disruptions on MEL flights
- Reduces maintenance costs & delays

HOW IT WORKS

- Big data analytics approach
- Leverage AC data, operational Data, and shop data
- Generate reports to predict LRU failures

CUSTOMERS

Cathay Pacific A330
Hainan A330
Unannounced A320
Unannounced 777 (results 30-40% reduction in MELs)
Unannounced 737

FUTURE FEATURES & TIMING

- Available on A330, A320 & B777
- In development on B737NG launching Q1 2018

Honeywell

Improve aircraft availability through faster maintenance execution

Current State Maintenance Execution	GoDirect™ Connected Maintenance
Line mechanics spend 25%* of their repair time reading maintenance manuals	**SAVE TIME** SEARCHING MAINTENANCE MANUALS FOR THE RIGHT INSTRUCTIONS
High NFF rates result from shotgun maintenance at the line	**REDUCE NFF** BY EMPOWRING LINE TECHNICIANS WITH FASTER SEARCH TOOLS
Maintenance manuals provide static recommendations	**MINE DATA & IMPROVE** CORRECTIVE ACTIONS w/ MAINTENANCE LOG ANALYSIS
Analytics on the execution of maintenance actions are unavailable	**CAPTURE MORE DATA** TO CONTINUALLY IMPROVE MAINTENANCE OPERATIONS

CONNECTED MAINTENANCE

Maintenance Advisor

WHAT IT IS

- Connected mobile + cloud platform designed to transform maintenance operations using advanced computing techniques and artificial intelligence

KEY PROBLEM SOLVED

- Increases aircraft availability by reducing maintenance execution times and digitally transforming maintenance operations.

HOW IT WORKS

- Advises line mechanics on which troubleshooting steps to follow, steps them through the right instructions, and captures and shares that information for reporting and comunication with other stakeholders.
- Maintenance manuals are ingested into an advanced cognitive computer system, allowing simple natural language queries of any information in the entire set of maintenance manuals and delivery of step-by-step instructions from the manual via mobile or hands-free equipment.

CUSTOMERS

Platform is trial in progress, go live date is Q1 2018

FUTURE FEATURES & TIMING

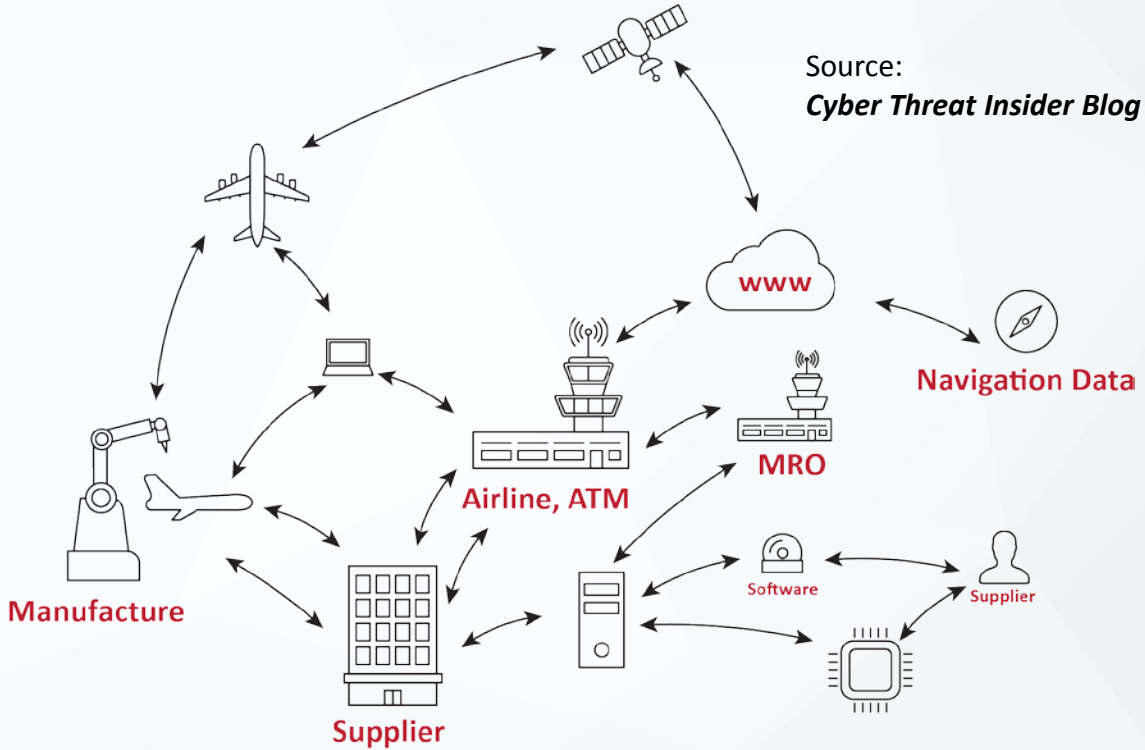
- Presently we have developed the technology to ingest the maintenance manuals and perform natural language searches. Integration of the platform is underway. Step-by-step mobile interfaces and integrated stakeholder dashboards are future items.

Honeywell

Cognitive Security

Threat Vector Space for Aviation

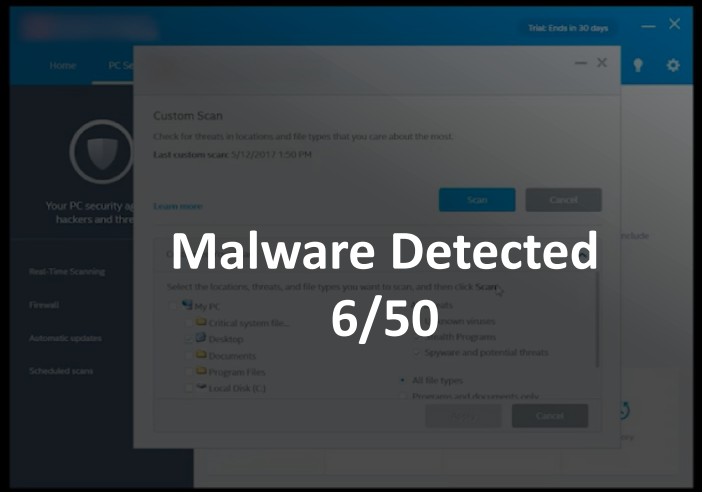
- Host Level Protection
- Network Firewall
- Network Intrusion Detection System
- Information Systems Continuous Monitoring
- Security Information Event Management
- Vulnerability Scanning
- Boundary Protections
- OS Standard
- Cyber Risk Assessment
- Tabletop Mission Cyber Risk Assessment
- Supply Chain Risk Management (Trusted Networks & Systems)



Source:
Cyber Threat Insider Blog

Threat Vectors

Viruses	Worms	Trojans	Ransomware	Password Trojans	Backdoors	Rootkits



Traditional Signature Based Security

Cognitive Anti Malware

Cognitive Security

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Wrap-up and Closing

Thank you to our Sponsor

Deloitte.