Aviation Accident Prevention as part of Royal Air Maroc Safety Management System

July 2023

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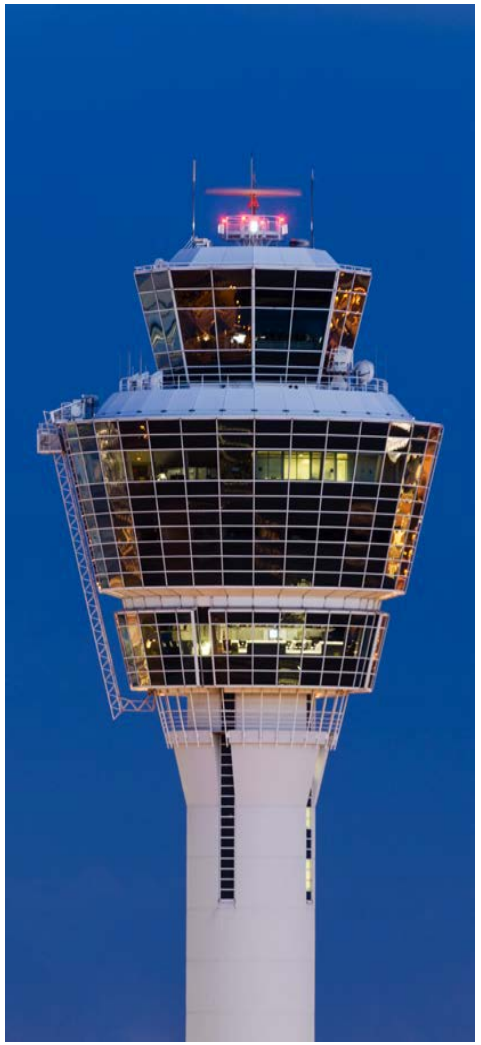
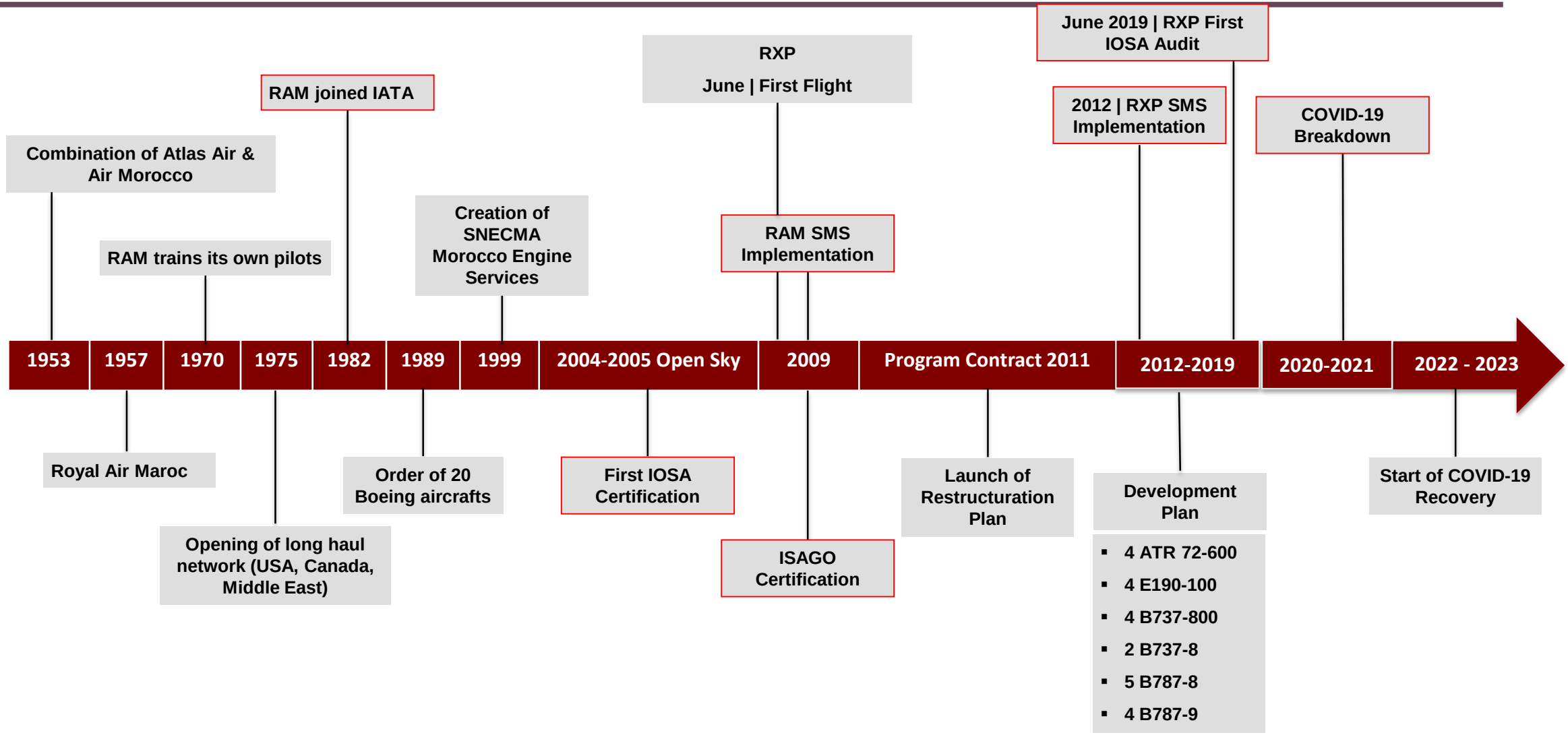


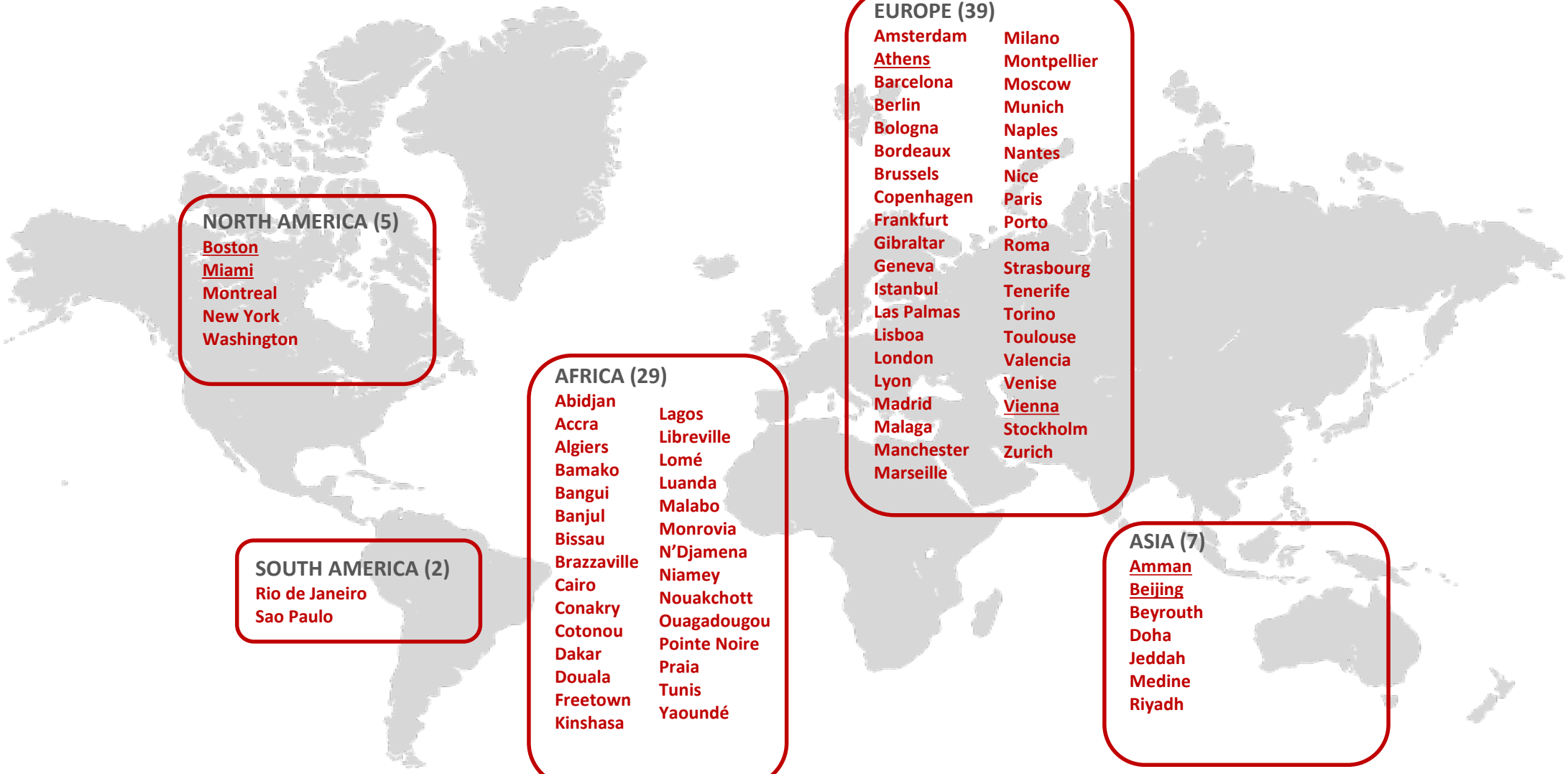
I. |Airline Overview |

History



I. |Airline Overview |

International Network



NORTH AMERICA (5)
- Boston
- Miami
- Montreal
- New York
- Washington

SOUTH AMERICA (2)
- Rio de Janeiro
- Sao Paulo

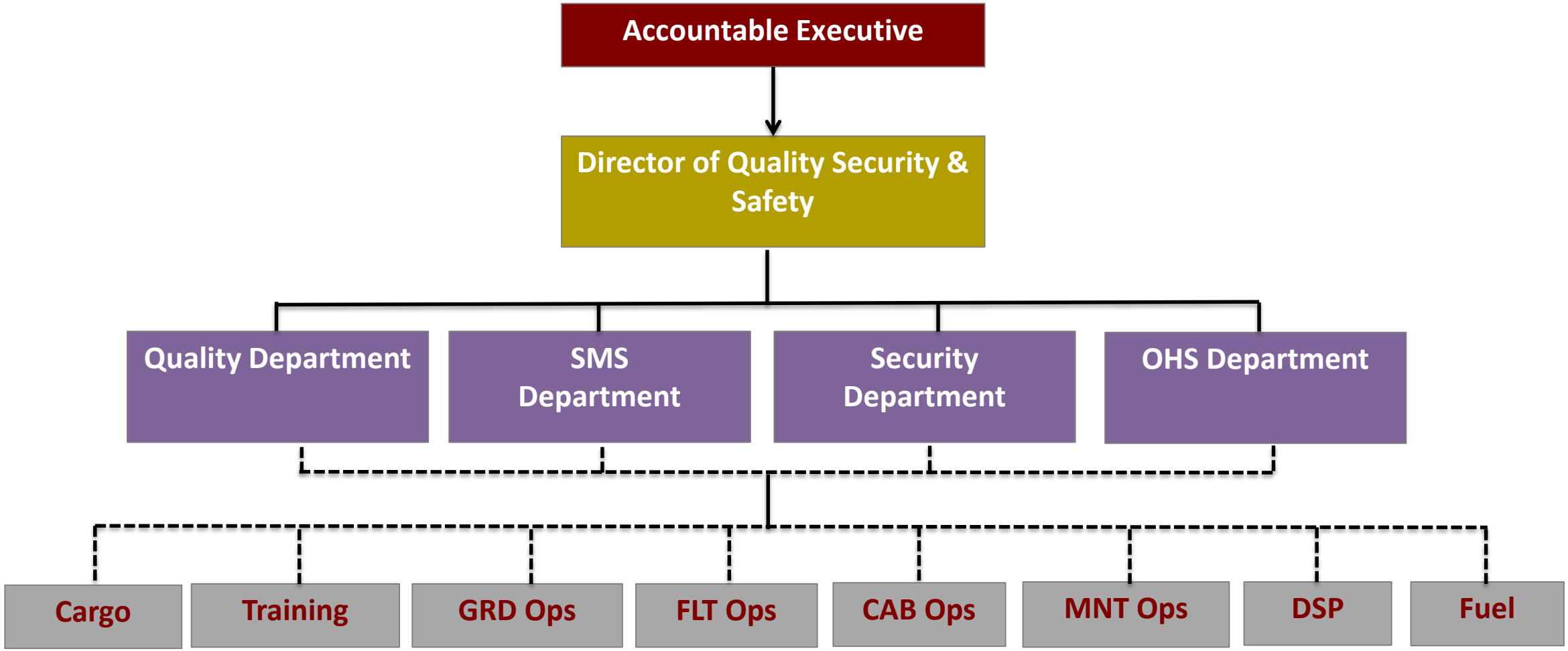
AFRICA (29)
- Abidjan
- Accra
- Algiers
- Bamako
- Bangui
- Banjul
- Bissau
- Brazzaville
- Cairo
- Conakry
- Cotonou
- Dakar
- Douala
- Freetown
- Kinshasa
- Lagos
- Libreville
- Lomé
- Luanda
- Malabo
- Monrovia
- N'Djamena
- Niamey
- Nouakchott
- Ouagadougou
- Pointe Noire
- Praia
- Tunis
- Yaoundé

EUROPE (39)
- Amsterdam
- Athens
- Barcelona
- Berlin
- Bologna
- Bordeaux
- Brussels
- Copenhagen
- Frankfurt
- Gibraltar
- Geneva
- Istanbul
- Las Palmas
- Lisboa
- London
- Lyon
- Madrid
- Malaga
- Manchester
- Marseille
- Milano
- Montpellier
- Moscow
- Munich
- Naples
- Nantes
- Nice
- Paris
- Porto
- Roma
- Strasbourg
- Tenerife
- Torino
- Toulouse
- Valencia
- Venise
- Vienna
- Stockholm
- Zurich

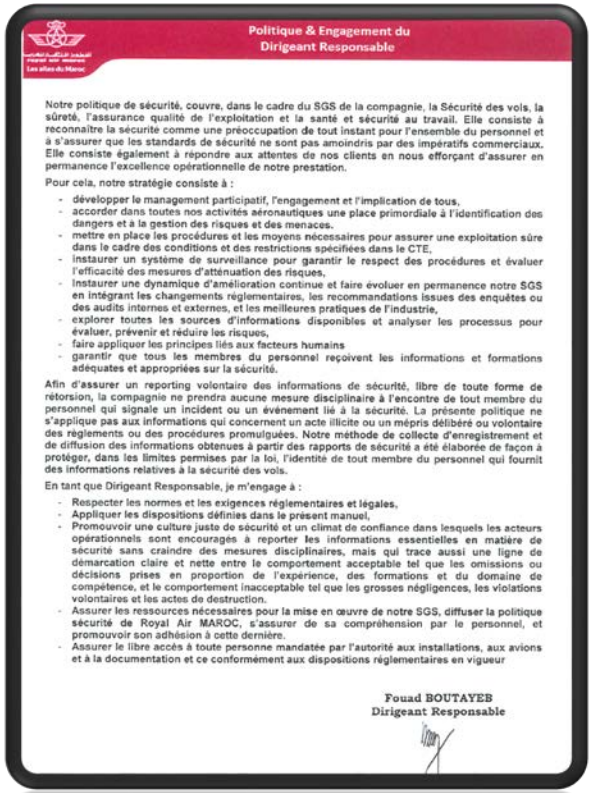
ASIA (7)
- Amman
- Beijing
- Beyrouth
- Doha
- Jeddah
- Medine
- Riyadh

II. |Royal Air Maroc Integrated Safety Management System

Organizational Chart



III. | SMS 1st Pilar : Policy & Safety Objectives |



Politique & Engagement du Dirigeant Responsable

Notre politique de sécurité, couvre, dans le cadre du SGS de la compagnie, la Sécurité des vols, la sûreté, l'assurance qualité de l'exploitation et la santé et sécurité au travail. Elle consiste à reconnaitre la sécurité comme une préoccupation de tout instant pour l'ensemble du personnel et à s'assurer que les standards de sécurité ne sont pas amoindris par des impératifs commerciaux. Elle consiste également à répondre aux attentes de nos clients en nous efforçant d'assurer en permanence l'excellence opérationnelle de notre prestation.

Pour cela, notre stratégie consiste à :

- développer le management participatif, l'engagement et l'implication de tous,
- accorder dans toutes nos activités aéronautiques une place primordiale à l'identification des dangers et à la gestion des risques et des menaces.
- mettre en place les procédures et les moyens nécessaires pour assurer une exploitation sûre dans le cadre des conditions et des restrictions spécifiées dans le CTE,
- instaurer un système de surveillance pour garantir le respect des procédures et évaluer l'efficacité des mesures d'atténuation des risques,
- Instaurer une dynamique d'amélioration continue et faire évoluer en permanence notre SGS en intégrant les changements réglementaires, les recommandations issues des enquêtes ou des audits internes et externes, et les meilleures pratiques de l'industrie,
- explorer toutes les sources d'informations disponibles et analyser les processus pour évaluer, prévenir et réduire les risques,
- faire appliquer les principes liés aux facteurs humains
- garantir que tous les membres du personnel reçoivent les informations et formations adéquates et appropriées sur la sécurité.

Afin d'assurer un reporting volontaire des informations de sécurité, libre de toute forme de rétorsion, la compagnie ne prendra aucune mesure disciplinaire à l'encontre de tout membre du personnel qui signale un incident ou un événement lié à la sécurité. La présente politique ne s'applique pas aux informations qui concernent un acte illicite ou un mépris délibéré ou volontaire des règlements ou des procédures promulguées. Notre méthode de collecte d'enregistrement et de diffusion des informations obtenues à partir des rapports de sécurité a été élaborée de façon à protéger, dans les limites permises par la loi, l'identité de tout membre du personnel qui fournit des informations relatives à la sécurité des vols.

En tant que Dirigeant Responsable, je m'engage à :

- Respecter les normes et les exigences réglementaires et légales,
- Appliquer les dispositions définies dans le présent manuel,
- Promouvoir une culture juste de sécurité et un climat de confiance dans lesquels les acteurs opérationnels sont encouragés à reporter les informations essentielles en matière de sécurité sans craindre des mesures disciplinaires, mais qui trace aussi une ligne de démarcation claire et nette entre le comportement acceptable tel que les omissions ou décisions prises en proportion de l'expérience, des formations et du domaine de compétence, et le comportement inacceptable tel que les grosses négligences, les violations volontaires et les actes de destruction.
- Assurer les ressources nécessaires pour la mise en œuvre de notre SGS, diffuser la politique sécurité de Royal Air MAROC, s'assurer de sa compréhension par le personnel, et promouvoir son adhésion à cette dernière.
- Assurer le libre accès à toute personne mandatée par l'autorité aux installations, aux avions et à la documentation et ce conformément aux dispositions réglementaires en vigueur

Fouad BOUTAYEB
Dirigeant Responsable

Safety Policy & Accountable Executive Commitment

FEUILLE DE ROUTE
DU RESPONSABLE DESIGNE
SYSTEME D'ENTRETIEN

En tant que Responsable Désigné Opérations Système d'Entretien, je m'engage à assurer continuellement la conformité, aux dispositions réglementaires nationales en vigueur, et à ce titre,

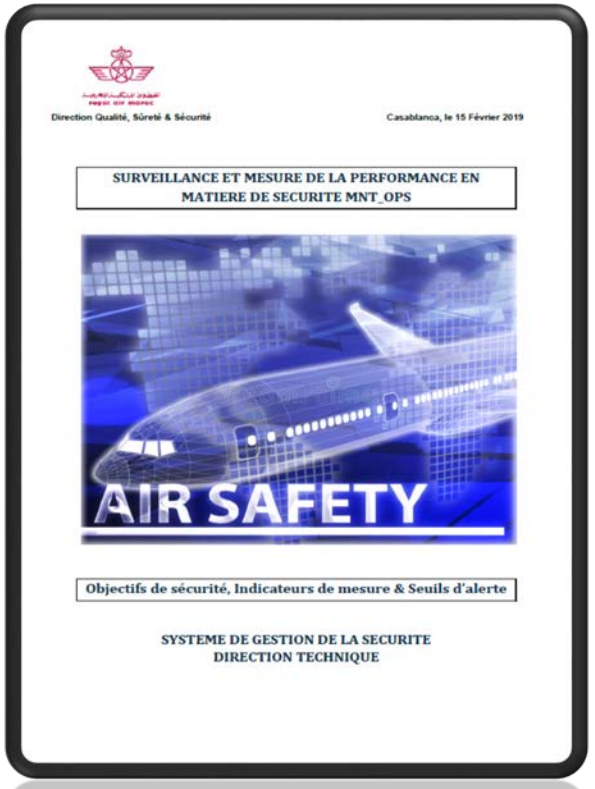
- Je veille à ce que la politique de la sécurité, sûreté et qualité de l'exploitation soit mise en œuvre dans ma Direction.
- Je m'assure que le personnel sous mon autorité a les ressources, la formation, l'expérience, etc., nécessaires pour accomplir en toute sécurité les tâches qui leur ont été confiées,
- Je m'assure que toute spécification de maintenance nouvelle provenant notamment d'exigences réglementaires nouvelles, de recommandations ou de consignes d'entretien émises par les Autorités et les constructeurs, ainsi que de toute consigne urgente décidée par la compagnie est bien transmise au personnel concerné.
- Je m'assure que les opérations de maintenance sont réalisées en conformité avec les spécifications et les restrictions spécifiées dans le CTE et avec les règlements et les standards de la compagnie applicables,
- Je m'assure de la diffusion à tous les niveaux de la Direction des informations liées à la sécurité, sûreté et qualité de l'exploitation, sûreté, santé et sécurité au travail,
- Je m'assure de la qualité et de la durée d'archivage des documents de maintenance.
- Je m'assure que les sous-traitants appliquent les dispositions relatives au Système de Gestion De la Sécurité concernant les activités sous-traitées et font remonter les informations pertinentes.

Dans ce cadre et pour l'amélioration continue du système de management de la sécurité mis en place, les objectifs suivants ont été arrêtés pour l'année 2019.

1. Réduire le taux de QRF Sol conséquence d'une panne technique
2. Réduire le taux de QRF VOL conséquence d'une panne technique
3. Réduire le taux d'écarts SAFA cause technique
4. Réduire le nombre des accidents de travail liés à l'activité technique
5. Augmenter le nombre de notifications d'événements MAR
6. Améliorer le taux de traitement des MAR
7. Diminuer le taux d'incidents par 1 000 HDV

Le Responsable Désigné Système d'Entretien
Adil JALALI

Designated Post Holder Commitment & Safety Objectives



Direction Qualité, Sûreté & Sécurité — Casablanca, le 15 Février 2019

SURVEILLANCE ET MESURE DE LA PERFORMANCE EN MATIERE DE SECURITE MNT_OPS

Objectifs de sécurité, Indicateurs de mesure & Seuils d'alerte

SYSTEME DE GESTION DE LA SECURITE
DIRECTION TECHNIQUE

Detailed Safety Objectives with Targets and Alert triggers

IV. | SMS 2nd Pilar : Safety Risk Management |

Relevant Committees

<table>
<tr><td rowspan="4">Multidisciplinary Committees</td><td colspan="3">SAFETY REVIEW BOARD
Meets twice a year with Accountable Executive</td></tr>
<tr><td colspan="3">OPERATIONS Committee
Meets weekly with Accountable Executive</td></tr>
<tr><td>Safety Action Group
(Ad hoc)
Meets as requested</td><td colspan="2">Quality, Safety & Security Committee
(CQSS)
Meets twice a year</td></tr>
<tr><td>Quality & Safety Technical Committee (CTQS)
Meets weekly</td><td>Security Committee (CTS)
Meets weekly</td><td>EOHS Technical Committee
(CTST)
Meets Quarterly</td></tr>
<tr><td>Local Committees</td><td>FOQA Committee
Meets Quarterly</td><td colspan="2">Mini-CTQS Committees
Meet twice a month</td></tr>
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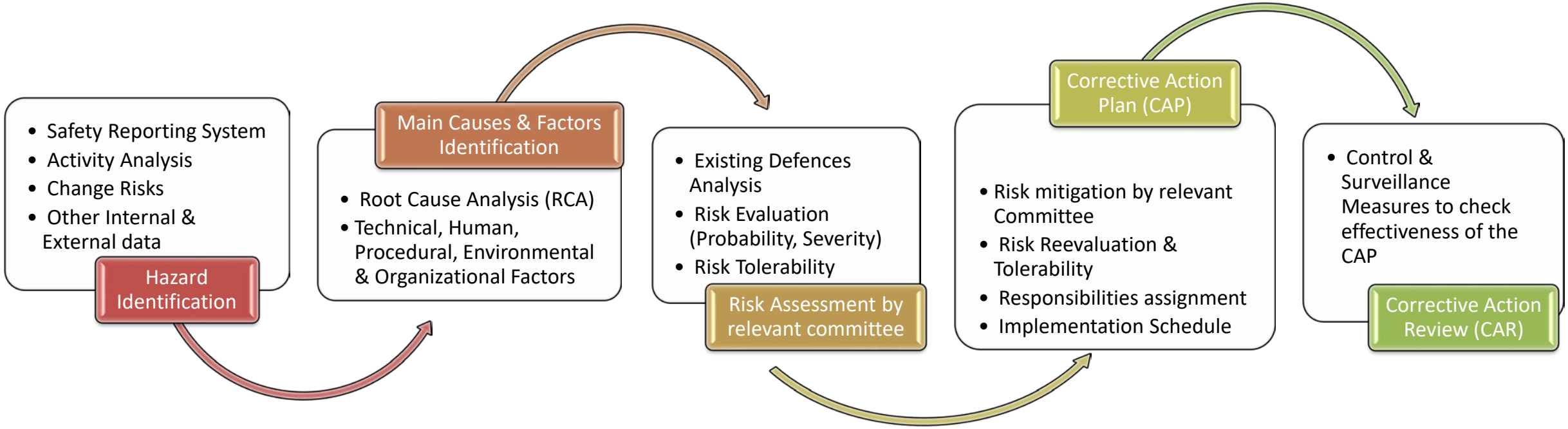
IV. | SMS 2nd Pilar : Safety Risk Management|

SRM Process



V. | SMS 3rd Pilar : Safety Insurance|

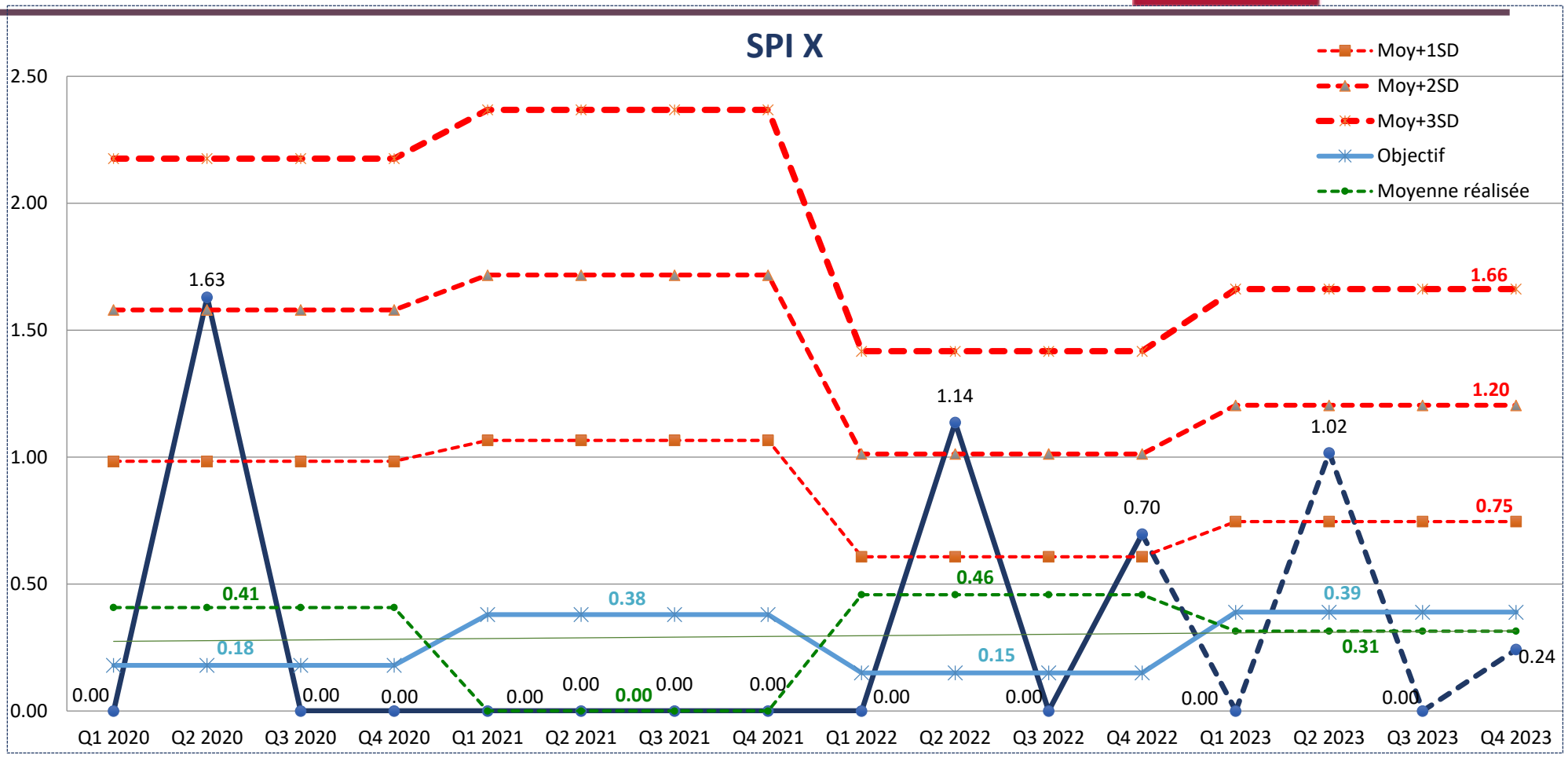
Safety Performance Management & Measurement

Safety Performance Management Process	Requirements	
Safety Objectives	Outcome-oriented	Process-oriented
Safety Performance Indicators (SPI)	Lagging Indicators	Leading Indicators
	High/Low impact	
Safety Performance Targets (SPT)	S.M.A.R.T	
Safety Triggers	Mitigation actions may need to be taken beyond Mean +1 SD, +2 SD or + 3 SD	
Acceptable Level of Safety Performance (ALoSP)	ALoSP to be achieved is established by the Safety Review Board (SRB), then measured & demonstrated by company's entities	

V. | SMS 3rd Pilar : Safety Insurance|

SPI's Monitoring – Predictive Analysis

An SPI must be
STABLE &
CAPABLE



SPI with High impact	Stability (2021) Alert Level not breached?	Capability (2021) Target Level achieved ?
SPI X	Yes / 4 pts	Yes / 3 pts

SPI with High impact	Stability (2022) Alert Level not breached?	Capability (2022) Target Level achieved ?
SPI X	Yes (II+I) / 4 pts	No / 0 pts

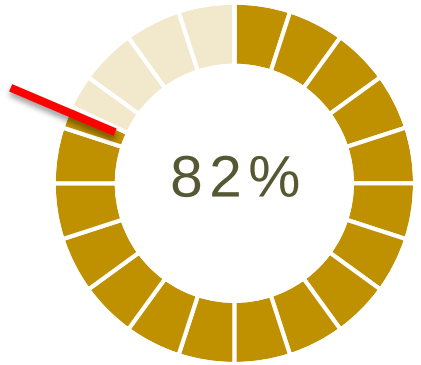
SPI with High impact	Stability Prediction (2023)	Capability Prediction (2023)
SPI X	Yes(1*I) / 4 pts	Yes / 3 pts

V. | SMS 3rd Pilar : Safety Insurance|

Safety Performance Management & Measurement

SPI Criticity Achievement 2022	SPI Criticity Prediction 2023
SPI 1	SPI 1
SPI 2	SPI 2
SPI 3	SPI 3
SPI 4	SPI 4
SPI 5	SPI 5
SPI 6	SPI 6
SPI 7	SPI 7
SPI 8	SPI 8
SPI 9	SPI 9
SPI 10	SPI 10

SPI Criticity 2012 / 2023		
Very Critical SPI	SPI 5 SPI 10	Stabilize below the alert levels and drive the target in 2023
Critical SPI	SPI 2	Monitor alert levels and drive the target in 2023
Tolerable SPI	SPI 7 SPI 9	Drive the target in 2023
Acceptable SPI	SPI 1 SPI 3 SPI 4 SPI 6 SPI 8	Monitor in 2023



Specific entity LoSP

	Achievement 2022	Prediction 2023
Level of Safety Performance (LoSP)	80%	82%

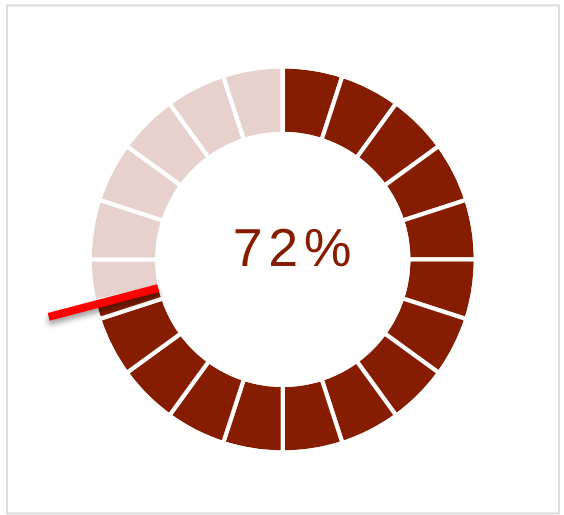
LoSP 2022 Accepted by SRB (Yes/No)	Yes

Minimum Acceptable Level of Safety Performance / ALoSP 2023	85%

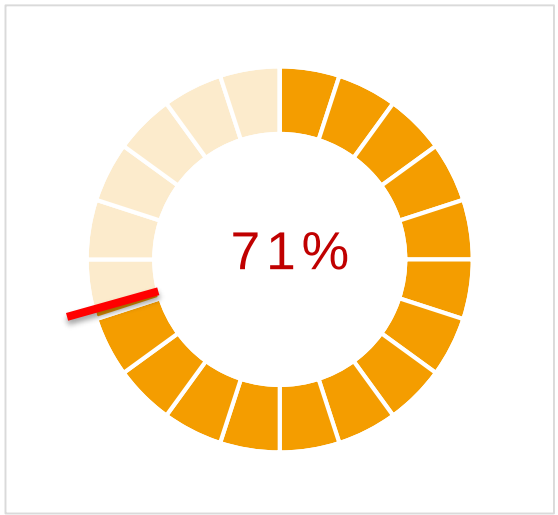
V. | SMS 3rd Pilar : Safety Insurance|

Company Level of Safety Performance LoSP

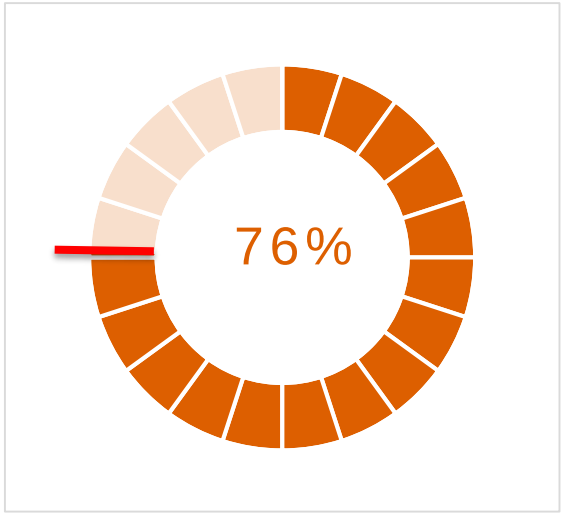
Royal Air Maroc **Level of Safety Performance** (LoSP) is monitored, measured and expressed in figures to give company's senior managers a quick and easy way to indicate the organization's safety performance, and an idea of the health status of the Safety Management System.



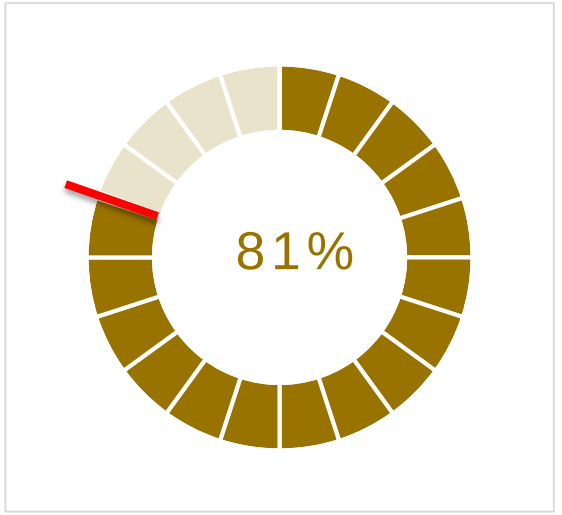
Company LoSP for 2020



Company LoSP for 2021



Company LoSP for 2022



Predicted
Company LoSP for 2023

VI. | SMS 4th Pilar : Safety Promotion|

Training & Education | E-learning SMS - Safety Communication

VII.| Accident Prevention Program|

Responsibilities & Aim of the Program


ENQUÊTE INTERNE

Perte de communication ATC avec la FIR de Bordeaux et Madrid

RAM761 du 14 Décembre 2020

The sole objective of this investigation is to identify the possible causes that contributed to this incident and to implement corrective actions to prevent future incidents or accidents; It is not the purpose of this activity to apportion blame or liability. (ICAO ANNEX 13TH)

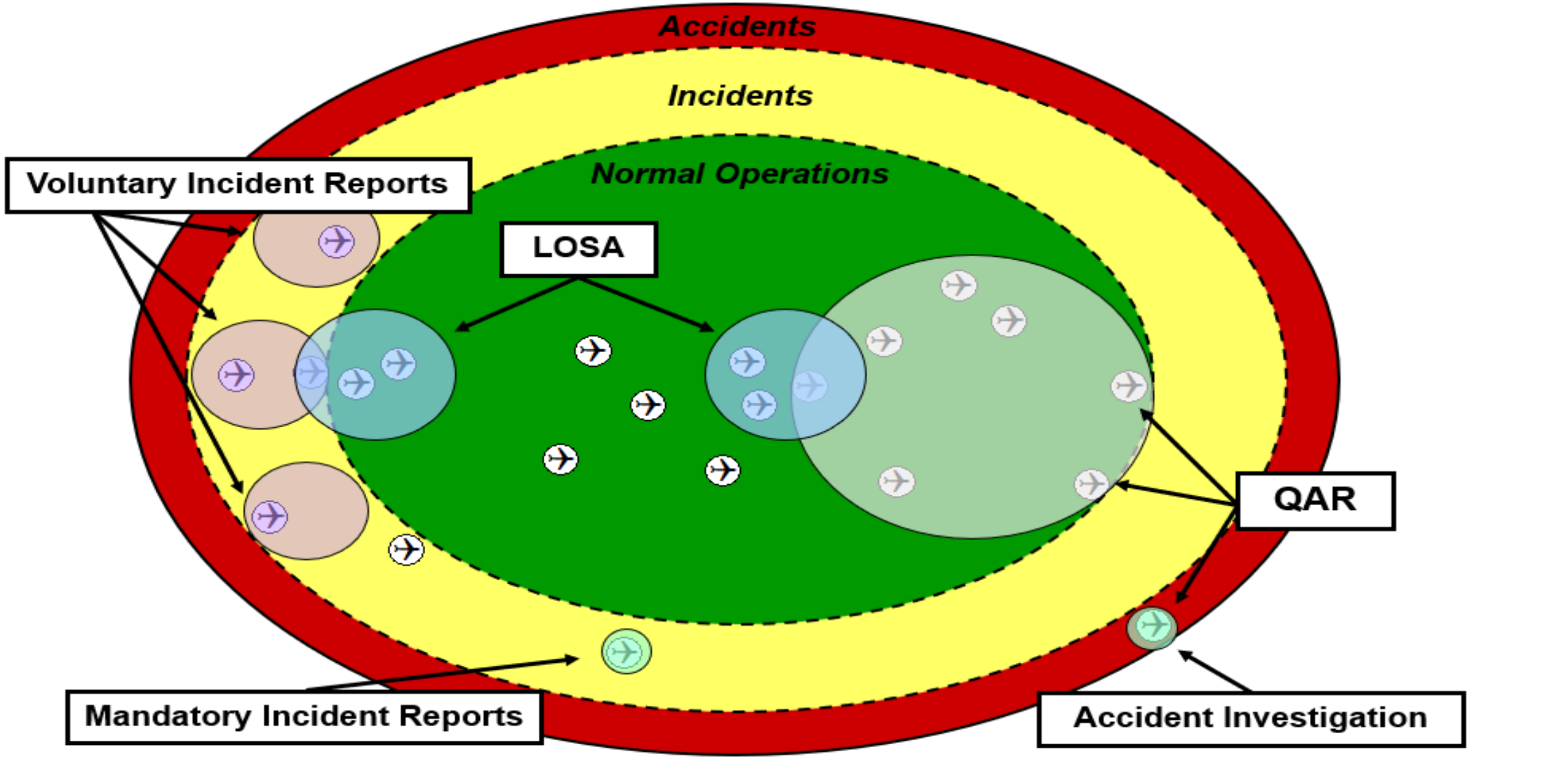
1 | 20

VP Quality Security & Safety is responsible for Royal Air Maroc's Accident Prevention Program, its performance and its integration into the Safety Management System.

- The aim of this program is to reduce the risk of accidents by identifying flight safety hazards, potential consequences, and developing and implementing countermeasures to reduce the risk.
- Safety investigations on accidents, serious incidents or operational incidents are essential component of Royal Air Maroc's Accident Prevention Program.

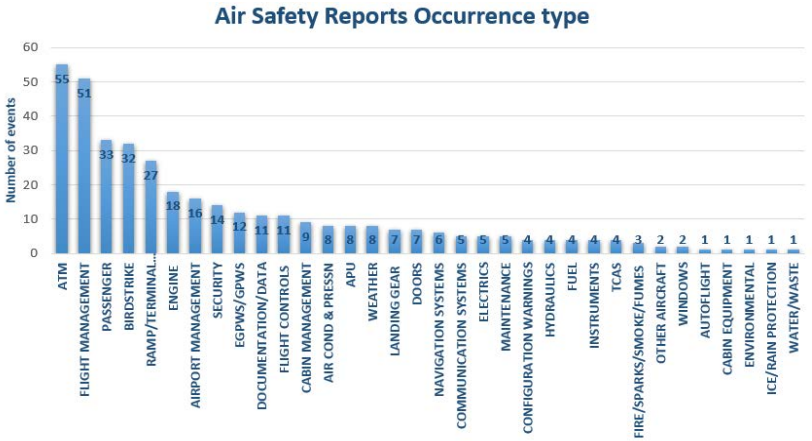
VII.| Accident Prevention Program|

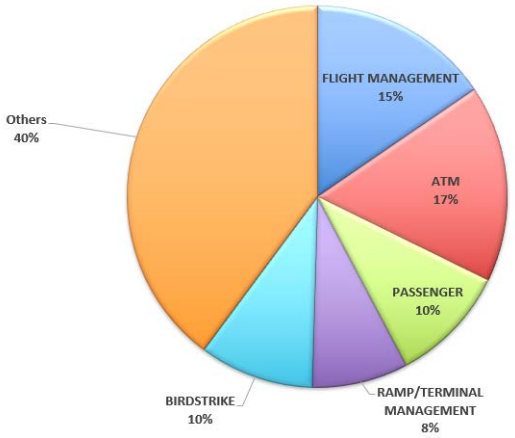
Safety Data Coverage

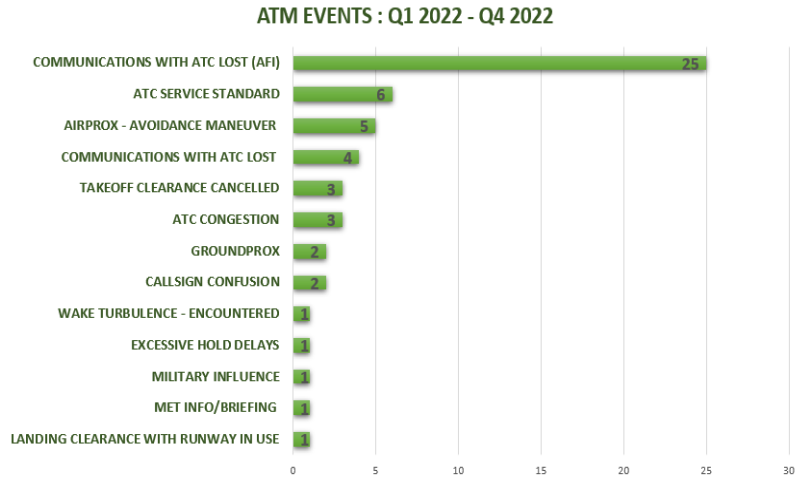


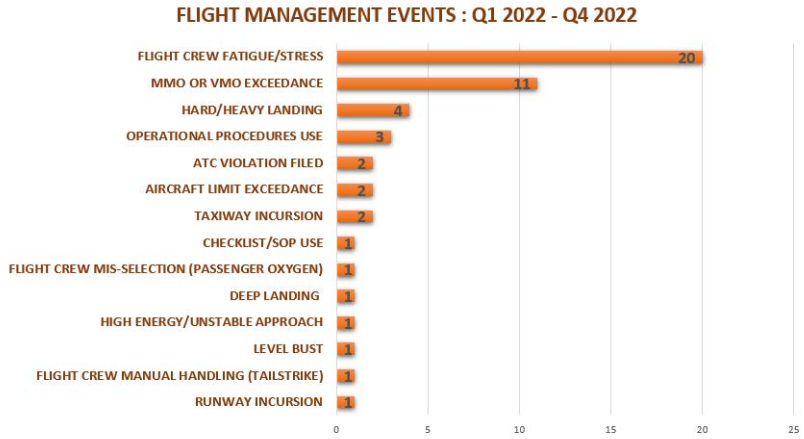
VII.| Accident Prevention Program|

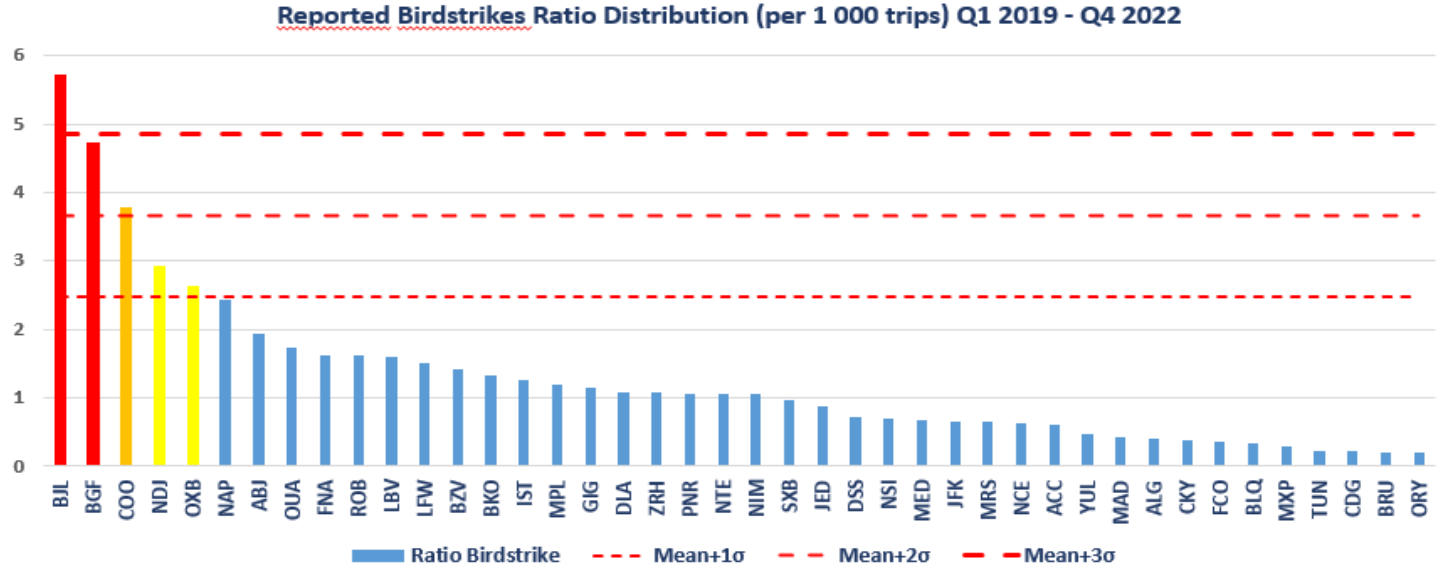
Safety Reporting











VII.| Accident Prevention Program|

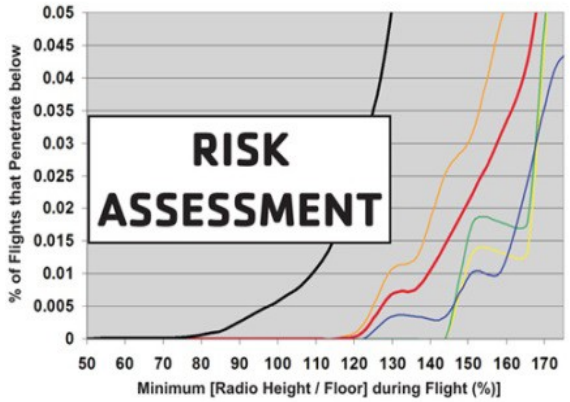
Flight Data Analysis Program

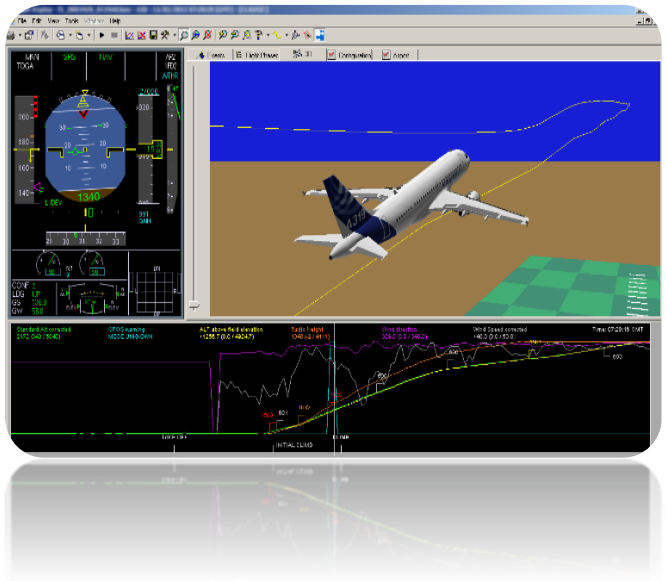
Capturing and analysing flight data to determine if the flight deviated from a safe operating envelope

Identifying trends

Promoting action to correct potential problems.

FDM for Flight Safety:





FOQA agreement signed with Royal Air Maroc pilots

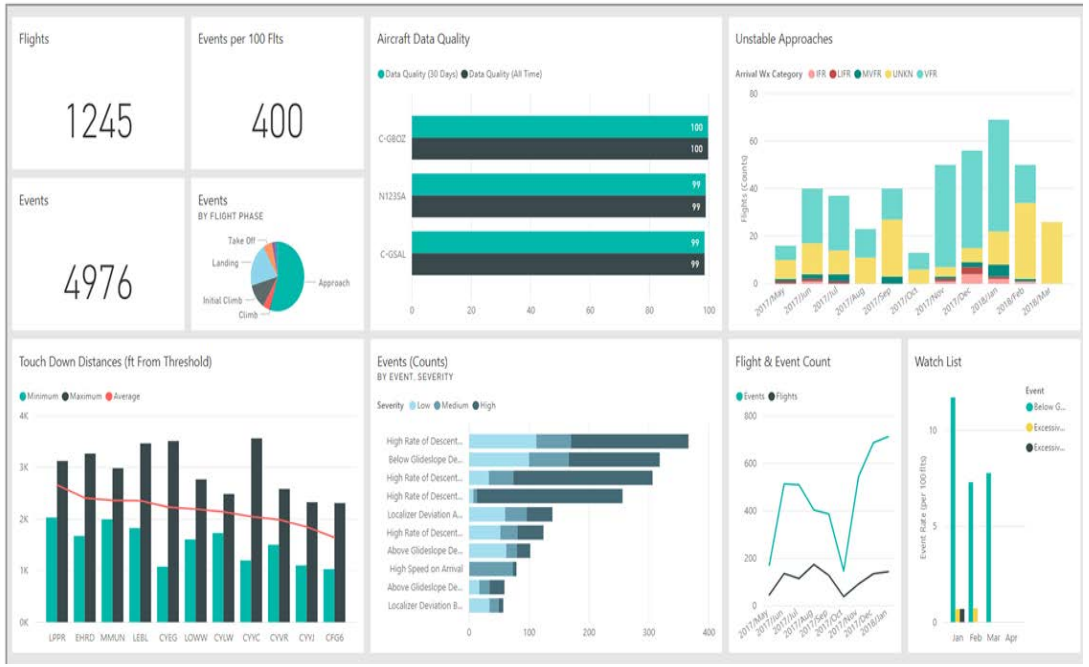
Develop objective and predictive information to enhance safety

VII.| Accident Prevention Program|

Flight Data Analysis Program

Monitored data:

- TAT PROBE Anomaly | LOC-I Precursor Excessive power during taxi-out / in | Ground Damage/Jet Blast Precursor
- Exceedance Limitation
- Long Landing | Runway Excursion
- Hard landing | ARC Precursor
- Go Around due Unstabilized Approach | Positive Safety Culture Precursor
- Unstabilzed Approach – UA | Runway Excursion Precursor
- Excessive Tailwind | Runway Excursion Precursor
- High pitch angle at Take-off | LOC-I Precursor
- High pitch rate at Take-off | LOC-I Precursor
- Slow Rotation | Runway Excursion Precursor
- EGPWS SINK RATE | CFIT Precursor
- EGPWS GLIDE SLOPE | CFIT Precursor
- EGPWS PULL UP | CFIT Precursor
- EGPWS TOO LOW TERRAIN | CFIT Precursor
- EGPWS TOO LOW FLAPS | CFIT Precursor
- EGPWS BANK ANGLE | LOC-I Precursor
- EGPWS (ALL)
- Late Config setting at LDG | Runway Excursion Precursor
- Gear down selection height (Interception height above 2500 ft AGL)
- High Lateral Acceleration Events | ARC Precursor



VII.| Accident Prevention Program|

Line Operations Safety Audit (LOSA)

LOSA uses trained observers to collect data about pilot behaviour and its situational context on “normal” flights from observers seats on the flight deck.

Such monitoring allows the capture of data which can characterise pilot strategies for managing "threats, errors and undesirable states".

The audits are conducted under strict no-jeopardy conditions; therefore, flight crews are not held accountable for their actions and errors that are observed. During flights that are being audited, observers record and code:

- Potential threats to safety;
- How the threats are addressed;
- The errors such threats generate;
- How flight crews manage these errors;
- Specific behaviours that have been known to be associated with accidents and incidents.

Royal Air Maroc next LOSA on Sept. 2023

LOSA COLLABORATIVE

VII.| Accident Prevention Program |

Other Safety levers

I. Regular IATA Operational Safety Audit (IOSA)

II. IATA Global Aviation Data Management Program integration (IDX : Incident Data Exchange, ADX : Accident Data Exchange, FDX : Flight Data Exchange) :

IATA's safety and security incident data management program that enables use and benchmark of global and regional trend data analytics to set and manage Safety and Security Performance Targets.

III. Safety Collaboration with the oneworld Best Practices Safety Group (oBPSG)

Regular meetings and information sharing between group members about safety metrics updates and Top safety issues.

IV. Training

In order to enhance personal skills and abilities, Royal Air Maroc invested and is seeking to invest on professional development in the following topics:

- Safety Management System Training
- Safety Risk Assessment Training
- Accident & Incident Investigators
- Human Factors & Crew Resource Management Training
- Fatigue Risk Management System Training
- Root Cause Analysis

VII.| Accident Prevention Program|

Internal Safety Investigation Sample

On August 15, 2021, a safety investigation was triggered by VP Quality, Safety & Security after tires blowout at landing of RAM 1400 while Anti-skid system was Inoperative

Synoptic:

During landing of flight AT1400, operated by CN-RNP , on runway 06 at OUJDA-ANGADS airport on August 15, 2021, the crew was notified after landing by a cabin crew emergency call of an engine fire on the left side of the aircraft.

The crew immediately confirmed the information with the control tower and informed the fire-fighting services. After full stop of the aircraft, the crew applied the "ENGINE FIRE ON THE GROUND" checklist, and when it comes to evacuate, they were advised by the fire service that there was no fire, just smoke from the burst tires on the left landing gear, and that the situation did not require an emergency evacuation.

The aircraft remained grounded on runway 06 due to the burst tires. The aircraft had been dispatched with DDM 32-02-02 concerning a failure of the anti-skid system.

VII.| Accident Prevention Program|

Internal Safety Investigation Sample

Take off time from GMMN : **2211 z**
Landing time at GMFO : **2259 z**
Crew : **6** (2 PNT + 4 PNC)
Total passengers on board: 141

Beginning of black traces 500 m from threshold 06

Beginning of destruction of the internal tire 600 m from the threshold
Start of destruction of the outer tire 700 m from the threshold
Beginning of traces of contact of the rim with the ground 800m from the threshold
Aircraft immobilized 1500 m from the threshold

VII.| Accident Prevention Program|

Internal Safety Investigation Sample

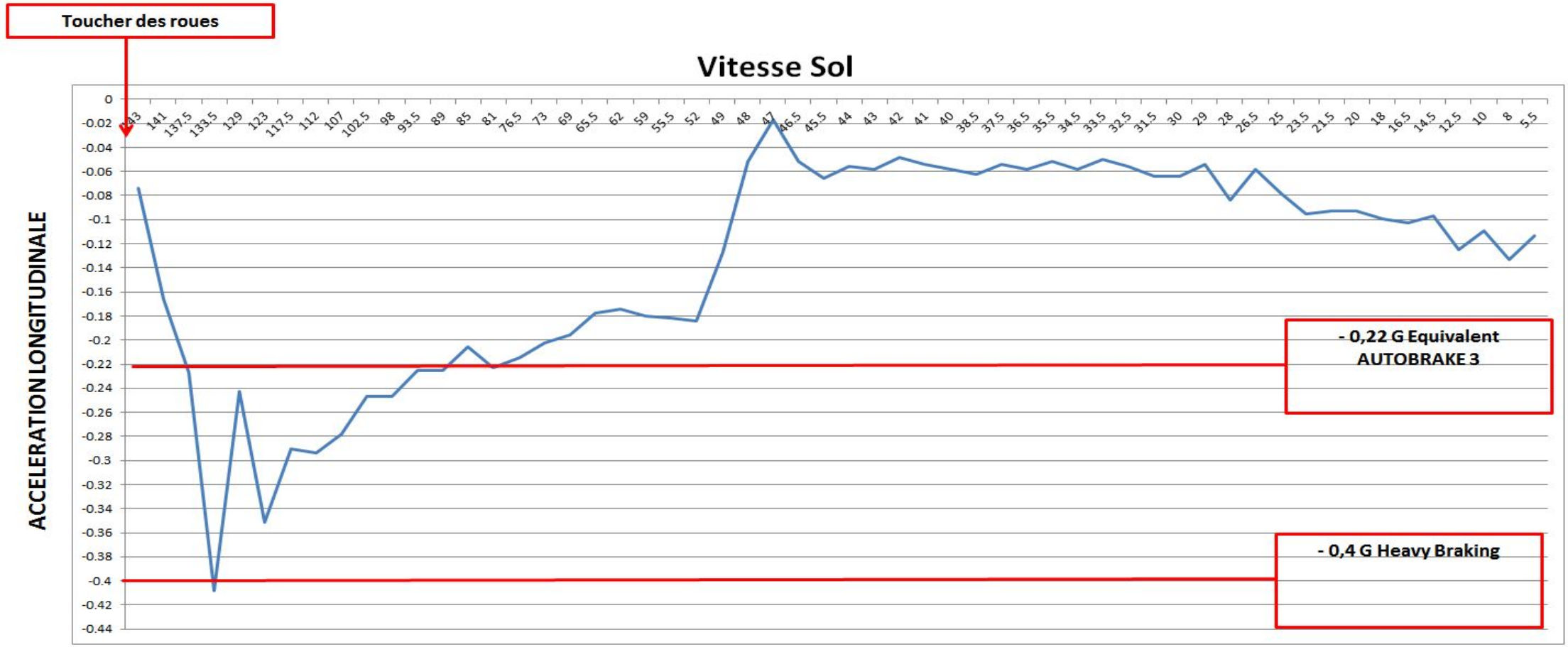
Captain Air Safety Report (ASR) :

AT1400 CNRNP dispatched with DDM 32-02-02 (HIL 1546-C) Allowed maximum take off weight 62.4T (landing limitation at OUD with application of the DDM via OPT 59.7T + trip). takeoff weight 60.5T. Landing weight 58.2T, Vref F40 132 kt, landing distance 2500m. After landing, while decelerating I received an emergency call from the cabin warning me of an engine fire on the left side, when the plane stopped we called the control tower and the fire. The aircraft remained on the axis until complete stop. We performed the CL engine fire on the ground, at the evacuation is needed item the firefighters were already on site around the plane and confirmed that there was no smoke or fire and that the area was secure, we then proceeded to a rapid disembarkation. Upon verification , we noticed that the two left tires had burst which led to the rims touching the ground and causing the sparks.

VII.| Accident Prevention Program|

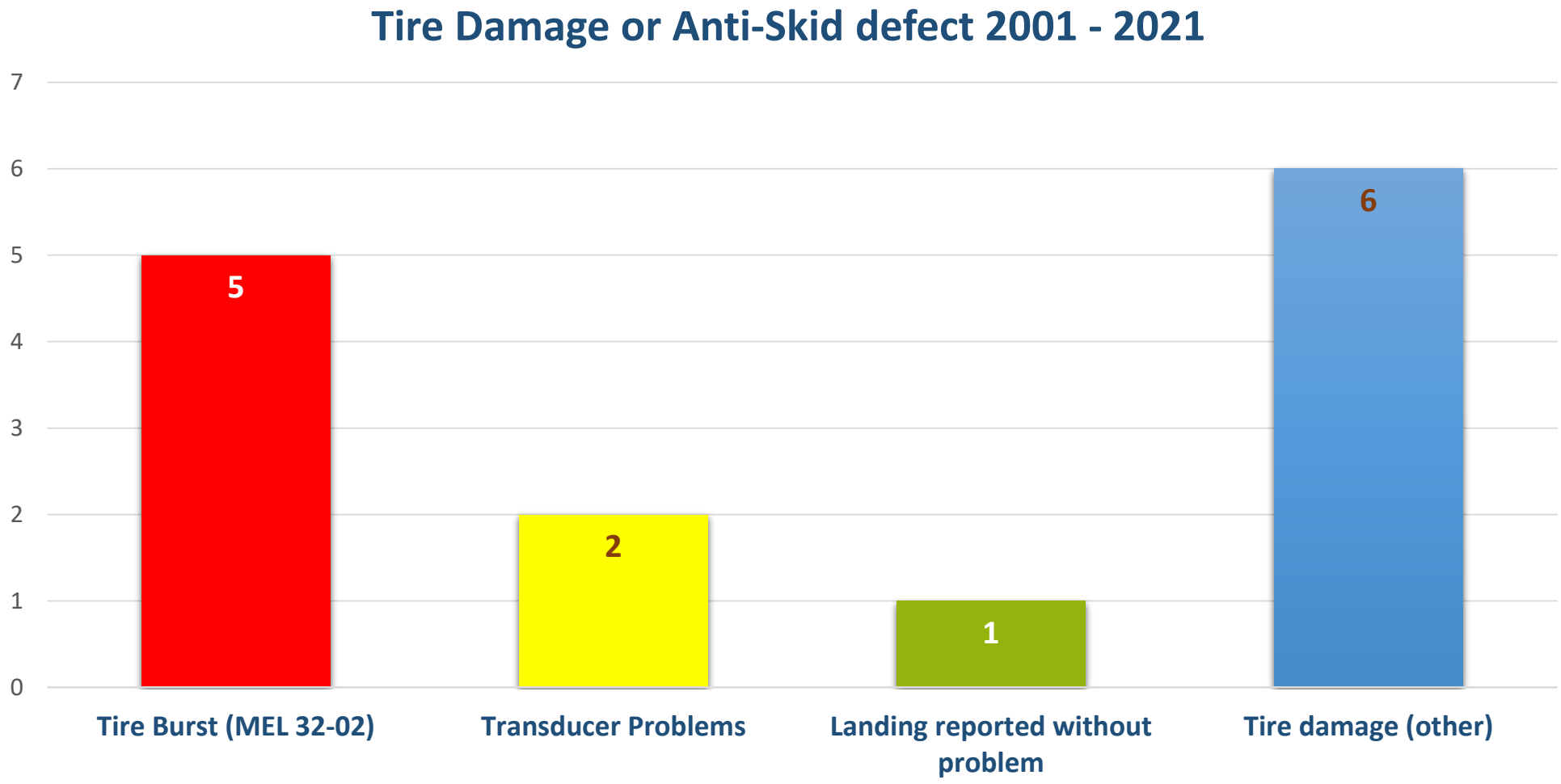
Internal Safety Investigation Sample

Flight Data Analysis



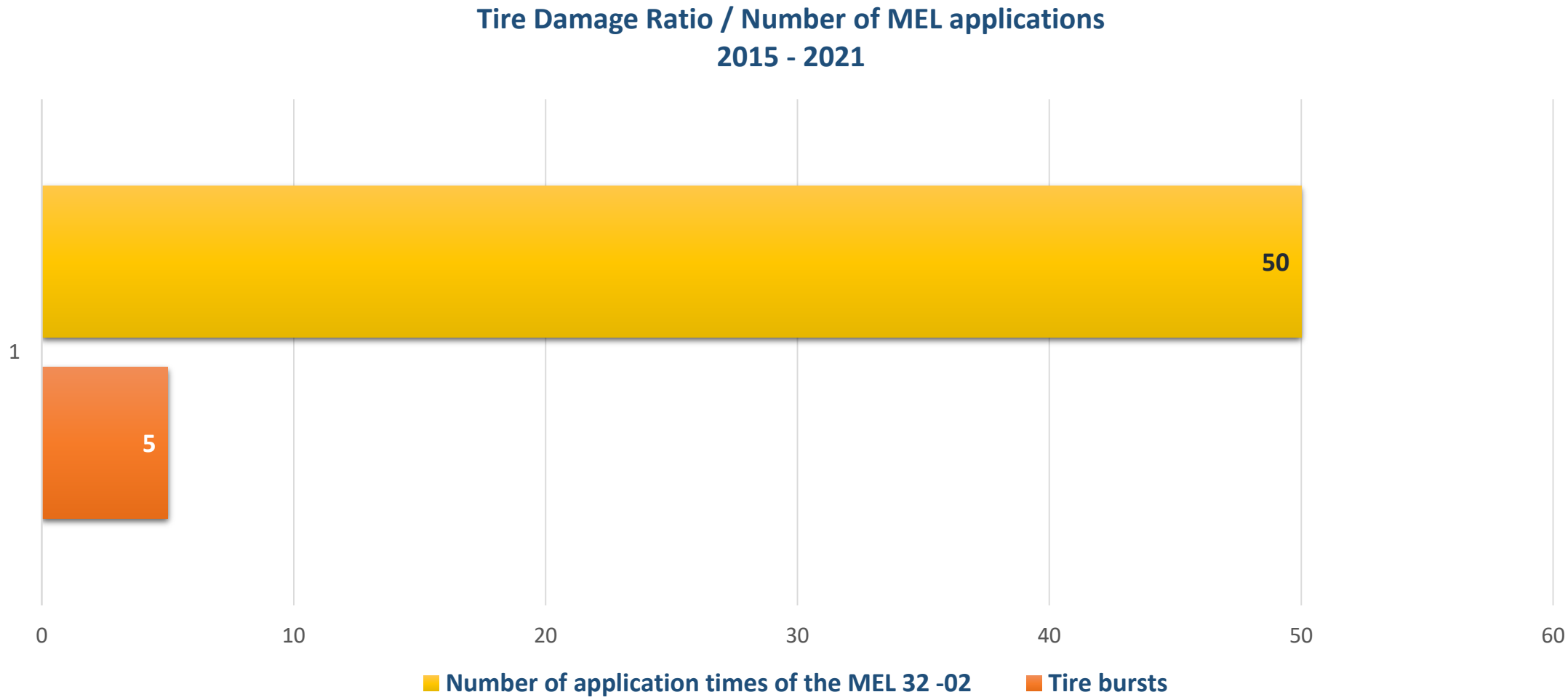
VII.| Accident Prevention Program|

Internal Safety Investigation Sample



VII.| Accident Prevention Program|

Internal Safety Investigation Sample



Root Cause Analysis:

After a debriefing session with the crew, the analysis carried out by the Safety Management System department shows that the probable root cause of this event is the over braking input, which was not compatible with the length and conditions of the runway,

Risk assessment:

Using the ICAO risk assessment matrix:

Probability : **LOW**
Severity : MAJOR
Risk Index: 3C
Acceptability : **ACCEPTABLE WITH MITIGATION**

Safety Recommandations:

1. A simulator session for the flight crew in conditions similar to those of the flight , to review with an instructor the braking with ANTI SKID INOP and the landing sequence as set by the manufacturer on Flight Crew Manuals.

2. Modify the MEL 32-02 so that it becomes a NOGO on departure from CMN home base .

3. Limit the number of sectors outside CMN to a maximum of 2, with MEL 32-02 is applied.

4. Rearrange wording of the new MEL taking into account these first two during **FLT/MNT OPS** coordination meetings.

5. Train the Antiskid Inoperative operational procedure during the recurrent simulator training (starting with session C).

6. Modify the B737 NG Antiskid Inoperative operating procedure to include the use of:
   - Flaps40.
   - Full available runway length.
   - Use maximum reverse thrust
   - Distribute an OSI “Safety bulletin” to all flight crews as feedback on the event

THANK YOU

FLY SAFE