偏衝出跑道之風險管理

中華航空公司
企安室安全部副理
許榮祥

1995

交通工程與運輸管理

1996

机场塔台管制员

1998

华航培训机师--UND 飞行训练

2000

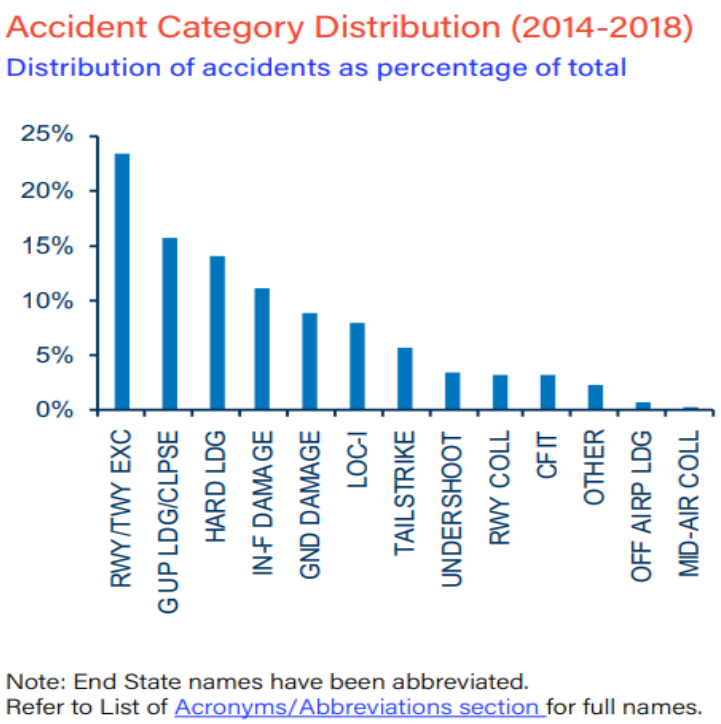
A300-600R/ B747-400/ B737-800

2018 IATA / TTSB飛安數據
RE 風險因子
RE風險管理
綜合建議

2018 IATA / TTSB
飛安數據

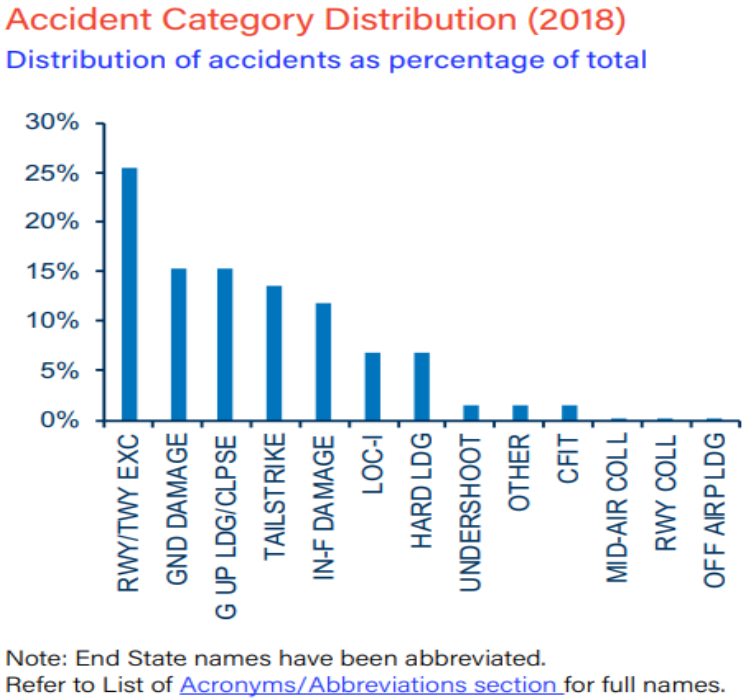
2018 IATA Safety Report

- 飛安事件率(2014-2018)



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations section for full names.

- 飛安事件率(2018)



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations section for full names.

衝偏出跑道、滑行道為近年來發生比例最高的事件類別

2018 TTSB Safety Report

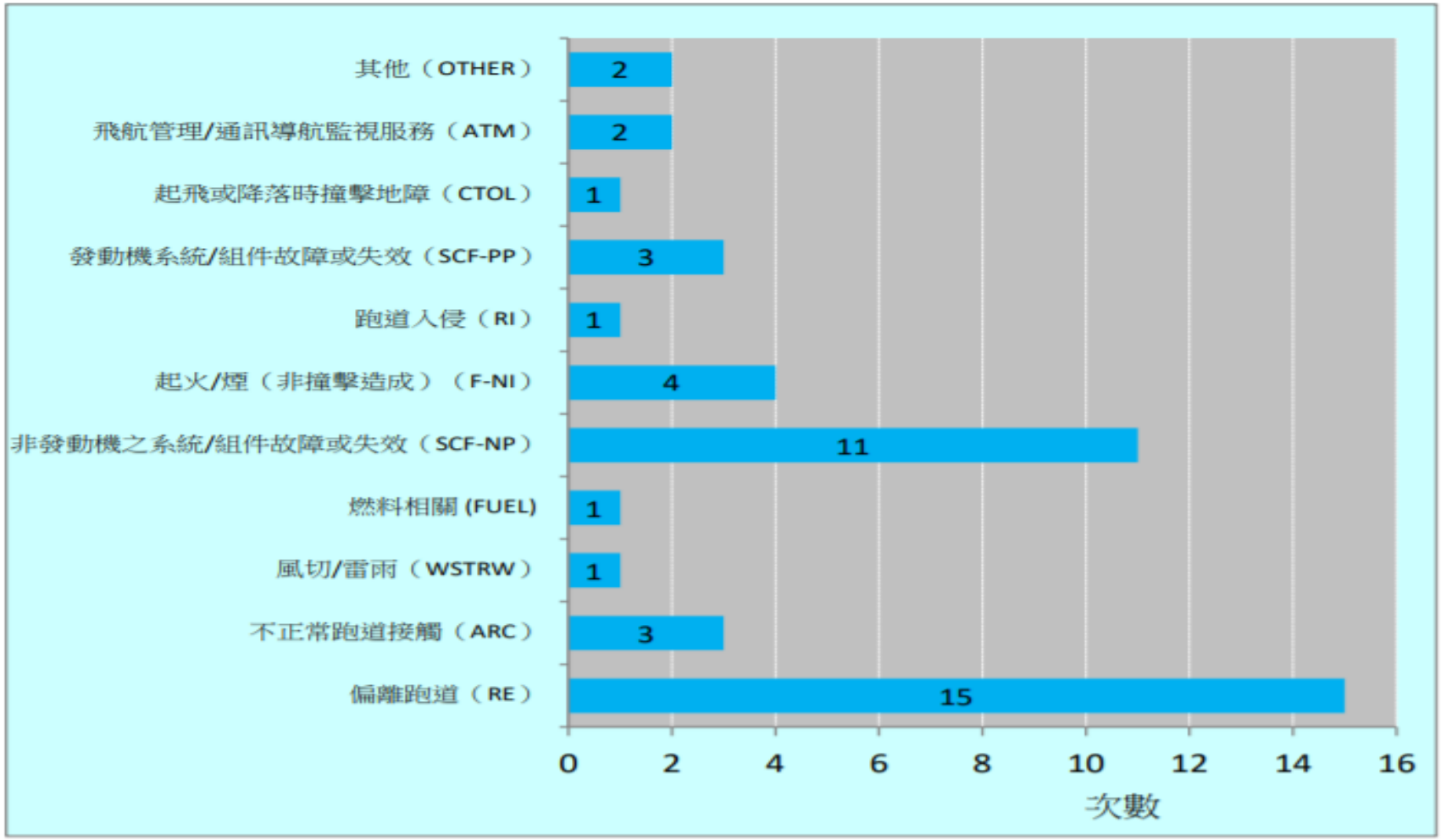
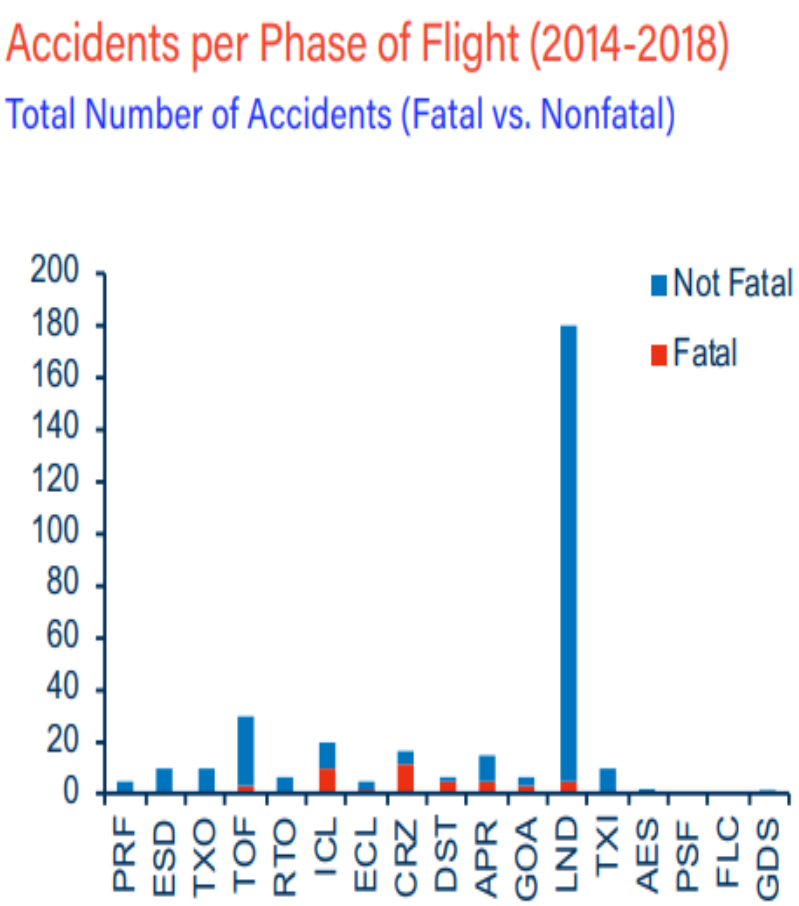


圖14： 2009-2018 年國籍民用航空運輸業飛航事故分類統計

2018 IATA/TTSB Safety Report



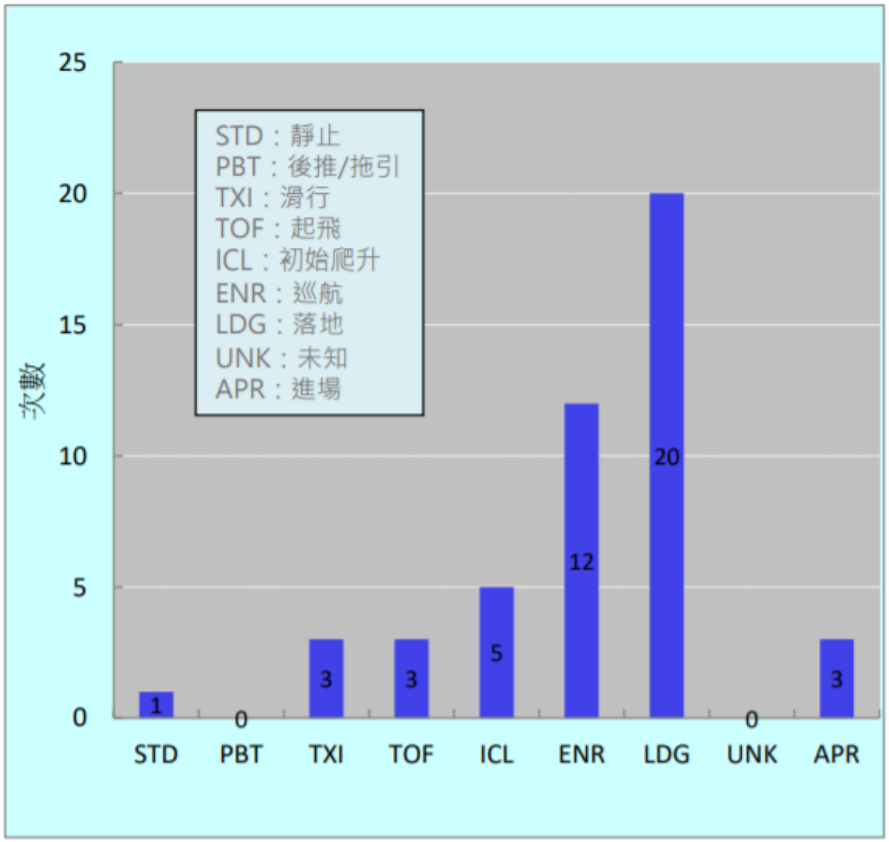
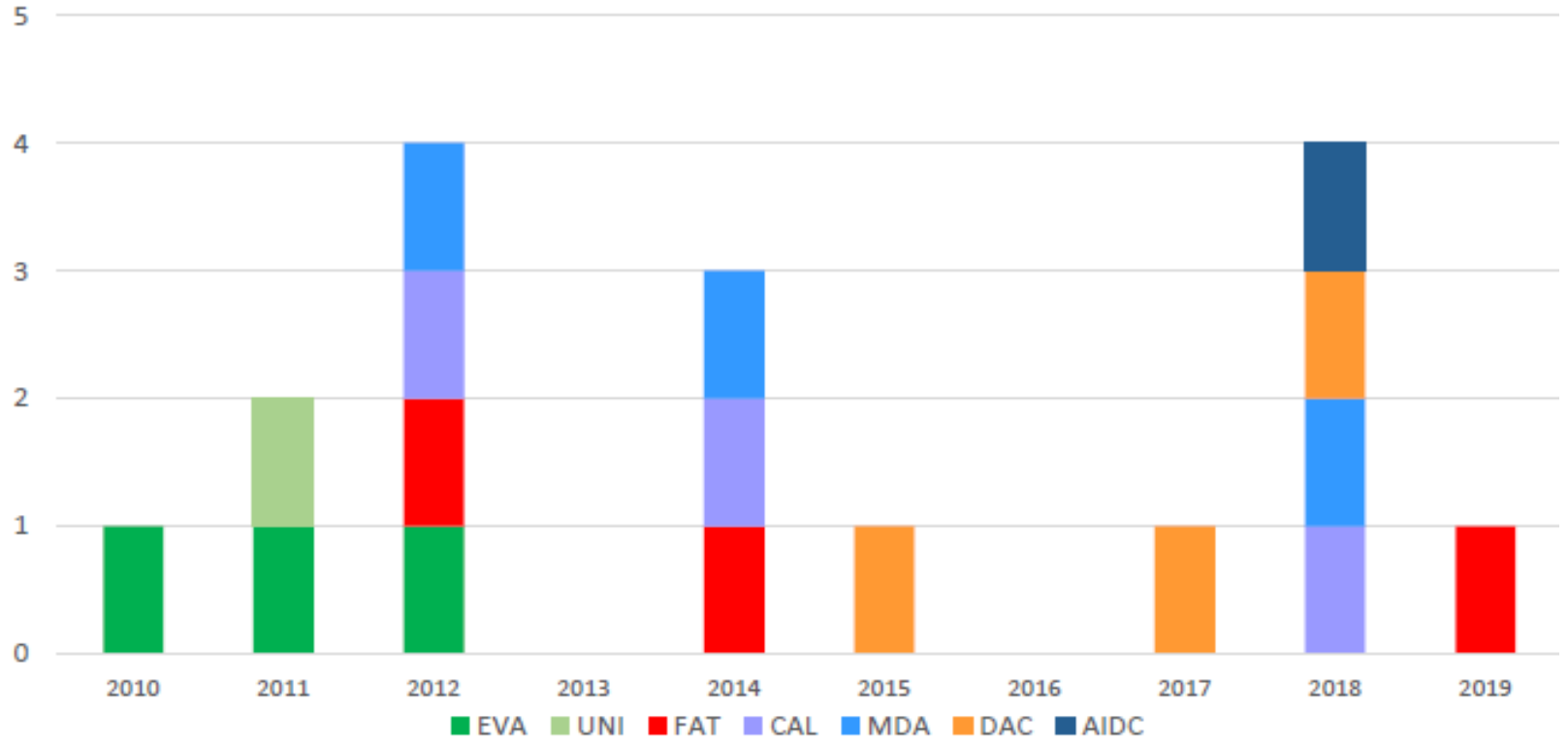


圖13： 2009-2018 年國籍民用航空運輸業飛航事故發生飛航階段次數

本國近10年跑道相關事件統計(1/2)

依ASC公佈之調查事件與報告，2010~2019年間於本國機場共17件跑道事件，計2起衝出跑道、14起偏出跑道及1起提早落地，其中7起發生於濕滑跑道。



本國近10年跑道相關事件統計(1/2)

機場 airport	跑道 runway	次數 times (RO/RV/USOS)
桃園機場	05R / 23L	0 / 4 / 0
	05L / 23R	0 / 1 / 1
台中機場	36	0 / 4 / 0
馬公機場	02 / 20	1 / 1 / 0
蘭嶼機場	13 / 31	0 / 2 / 0
金門機場	6	1 / 0 / 0
松山機場	10	0 / 1 / 0
高雄機場	9	0 / 1 / 0

Runway Excursion(RE)

- A veer off or overrun off the runway surface. (ICAO)

  定義：航機于起飛或降落時，偏出或衝出跑道範圍。

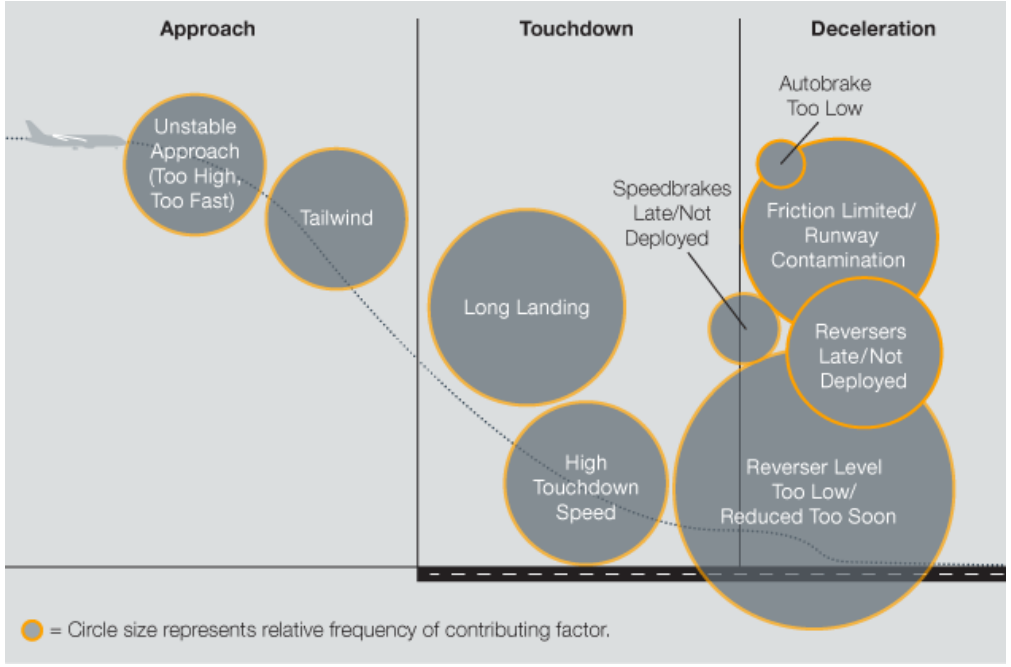
Veer off 

Overrun on Landing 

RE 風險因子

造成RE的可能原因

- 根據統計，大部分RE發生在落地階段，少數發生在起飛或者放棄起飛時。



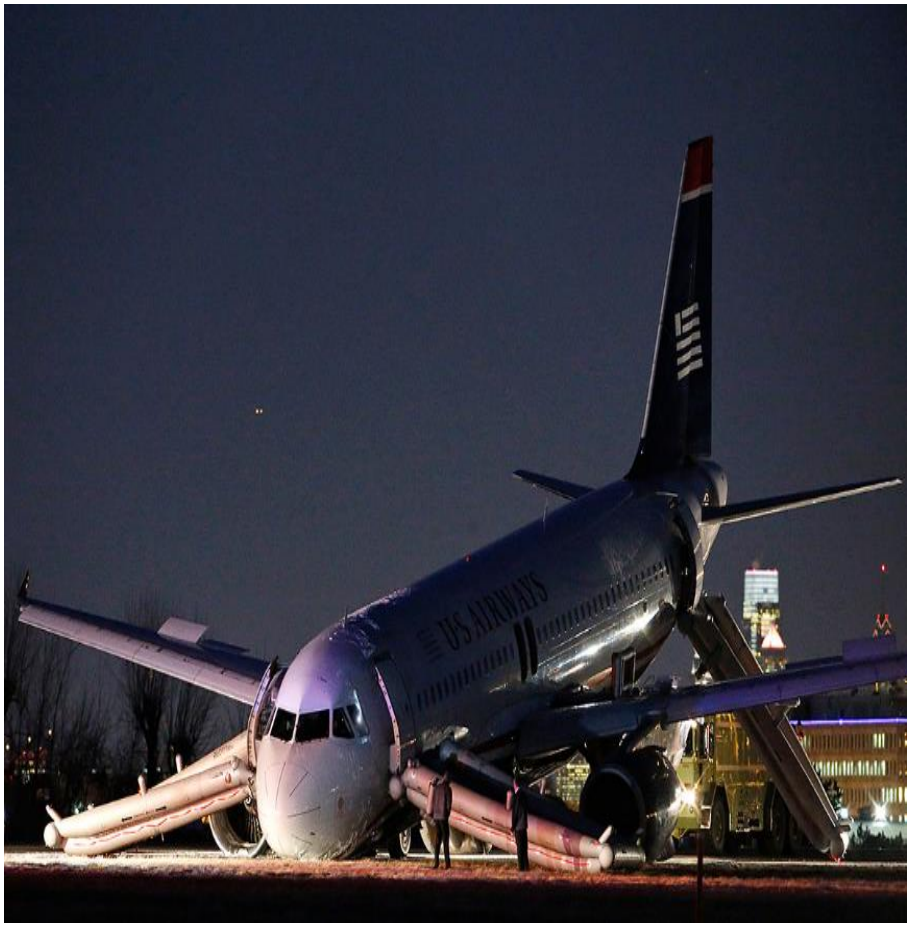
➢ 2003-2010年,Boeing

根據Boeing的統計資料，造成RE的肇因有：

- 跑道濕滑
- 不穩定進場(高度太高或速度太快等)
- 減速時反推力設定不足、使用時間太短
- 延遲落地
- …..

…

案例分享 1



飛航組員之行為表現與狀態

- 未能適切使用/遵守標準操作程序或最低裝備需求手冊 (MEL)。
- 狀況警覺降低 (如：疲勞或及分心)。
- 所需跑道長度計算失誤。

案例分享 2

天氣/機場因素

- 濕滑/受汙染跑道。
- 側風超限/順風超限。
- 側風/汙染跑道下反推力效應。
- 跑道狀況及煞車效果之資訊不足或不正確 。

案例分享 3

飛航組員技術與決策

- 觸地過晚。
- 未執行重飛。
- 偏離進場及落地軌跡。
- 夜間落地速度過快。
- 喪失跑道目視參考。
- 落地後側風修正不當。

案例分享 4

航機系統

- 疑似或確認遭遇水漂。煞車及減速效果不佳或失效。
- 落地滾行時推力不對稱。
- 重飛決策與執行。
- 落地前航機系統故障。

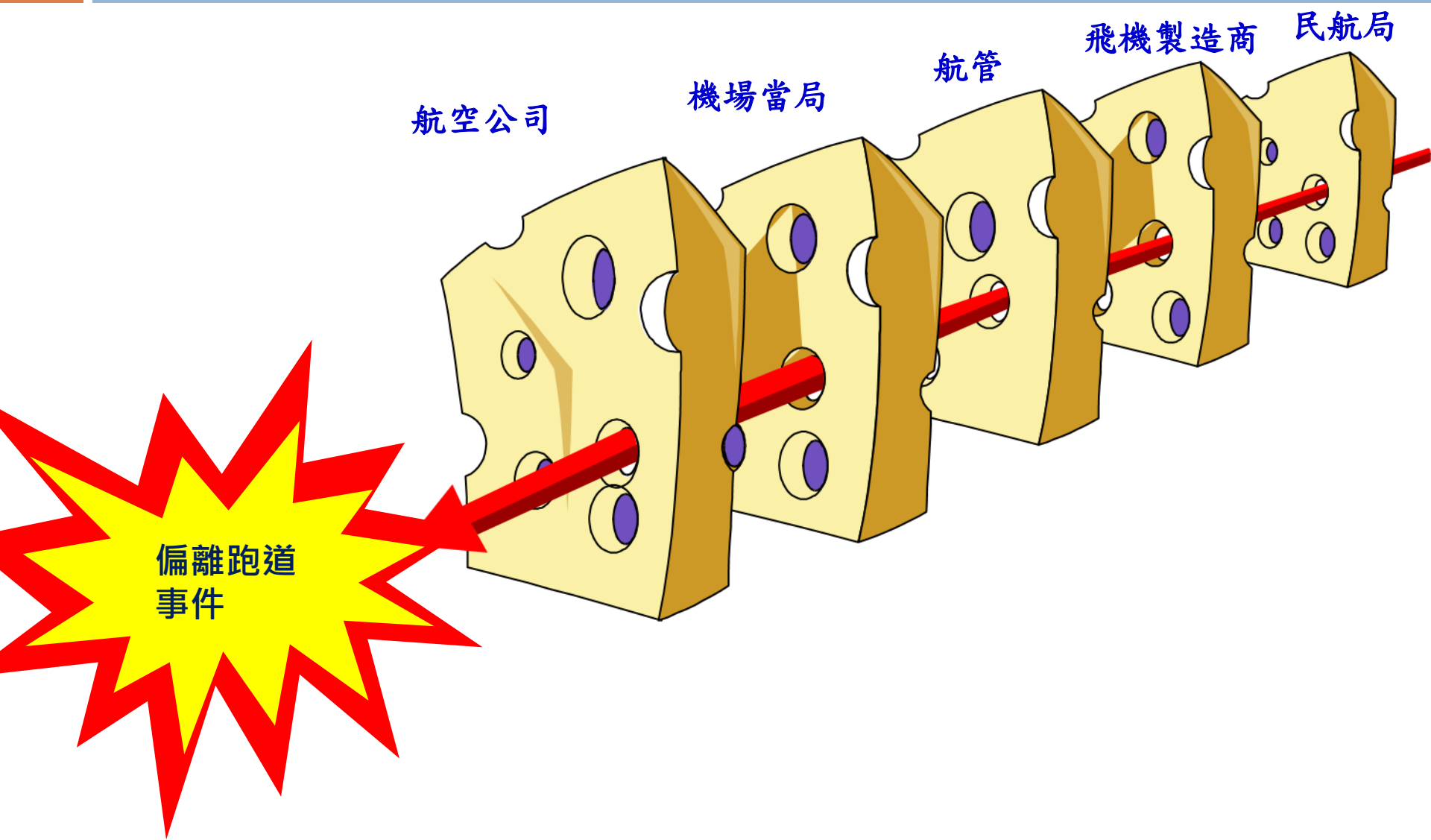
四大RE風險因子

- 飛航組員之行為表現與狀態
- 天氣/機場因素
- 飛航組員技術與決策
- 航機系統

RE風險管理

維護跑道安全之共同職責

維護跑道安全 – 風險管理



維護跑道安全之共同職責 – 主管機關

2018年10月ICAO空中航行會議于加拿大蒙特婁議程項目：

運行安全風險國際民航組織跑道安全方案(RSP)，及全球跑道安全行動計畫（GRSAP），促進在機場設立地方跑道安全小組，便利用來自國際民航組織和跑道安全方案的國際技術援助，包括培訓、差距分析和專家諮詢建議，增進跑道安全。

維護跑道安全之共同職責 -機場

- 監控、回報和改善跑道表面狀況。
- 具完善的跑道摩擦係數測量及污染物去除的執行計畫和裝備。
- 跑道設備應符合法律規定

  --ICAO Annex 14機場規範/民用機場設計暨運作規範。
- 建置提升跑道安全設備，以降低跑道事故風險

  --機場燈光系統升級與維護

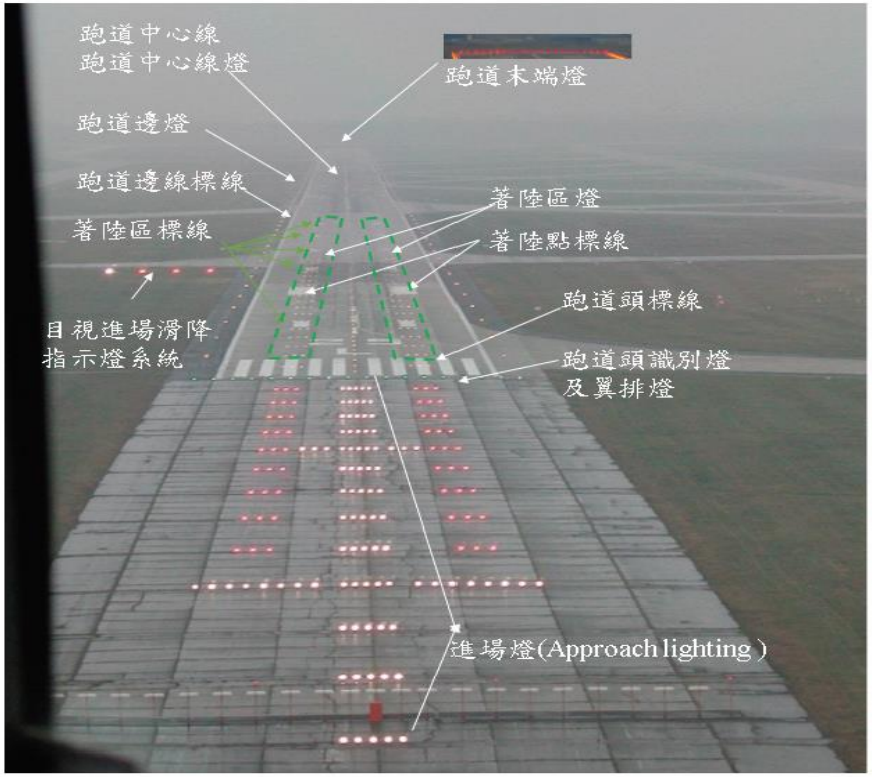
  --設置全鋪面之刮槽(Runway Grooving)

  --工程材料攔截系統 EMAS。

維護跑道安全之共同職責 -機場

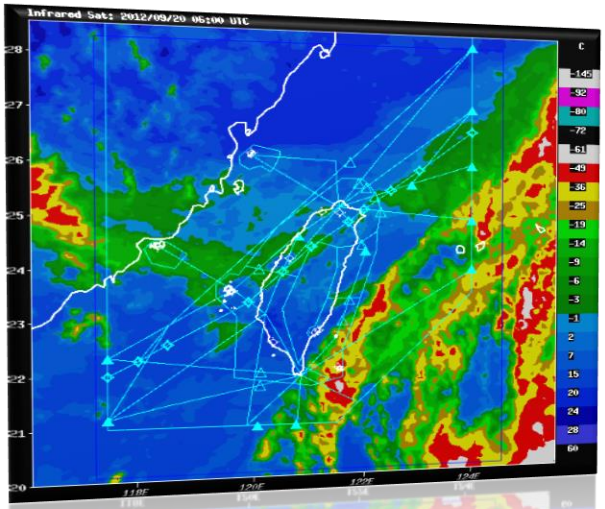
維護跑道安全之共同職責 -機場

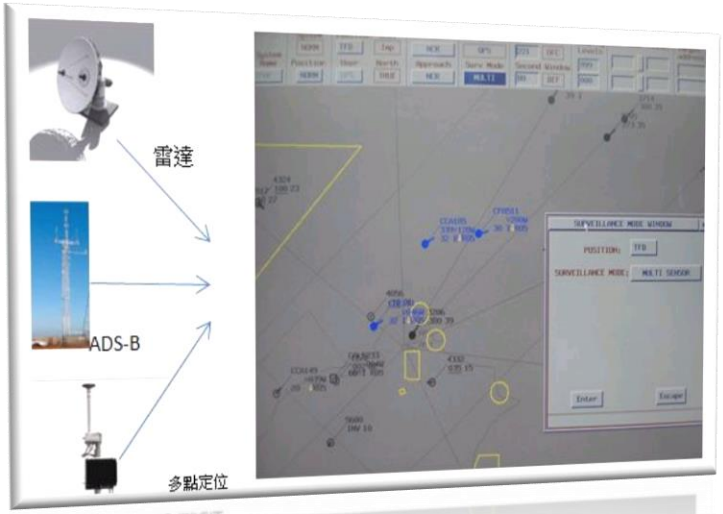
維護跑道安全之共同職責 -機場



維護跑道安全之共同職責 –航管

- 搜集氣象資訊並通知航機。
- 整合機場所提供之道面資訊並通知航機。
- 根據操作環境安排航機於適當的跑道起降。
- 對穩定進場之標準及重要性有完整的認知。





風險管理

風險管理又名危機管理，是一個管理過程，其中包括對風險的確定、量度、評估和發展應付風險的策略，目的是把可以避免的風險減至最小，成本及損失極小化。

利用適合的SPI(安全指標)監控可能造成RE的前期參數並提出有效的改善管理措施

RE相關安全績效指標

Tier 2

偏離跑道事件(RE)

2018事件率：0.023

Tier 3

SPI	SPT	2018 事件率
不穩定持續進場事件	≤0.045	0.011
地面操作失控	0	0
高速放棄起飛事件	0	0
起降過程剎車系統失效	≤0.003	0
飛航中起落架未能施放事件	≤0.003	0
重落地、經檢查航空器有損壞事件	0	0
主動提報組員派遣工時異常、休時不足事件	≤0.021	0
組員因疲勞導致違反民航法規或飛安事件	0	0
起飛性能計算失誤導致操作困難	0	0

Lagging Indicator

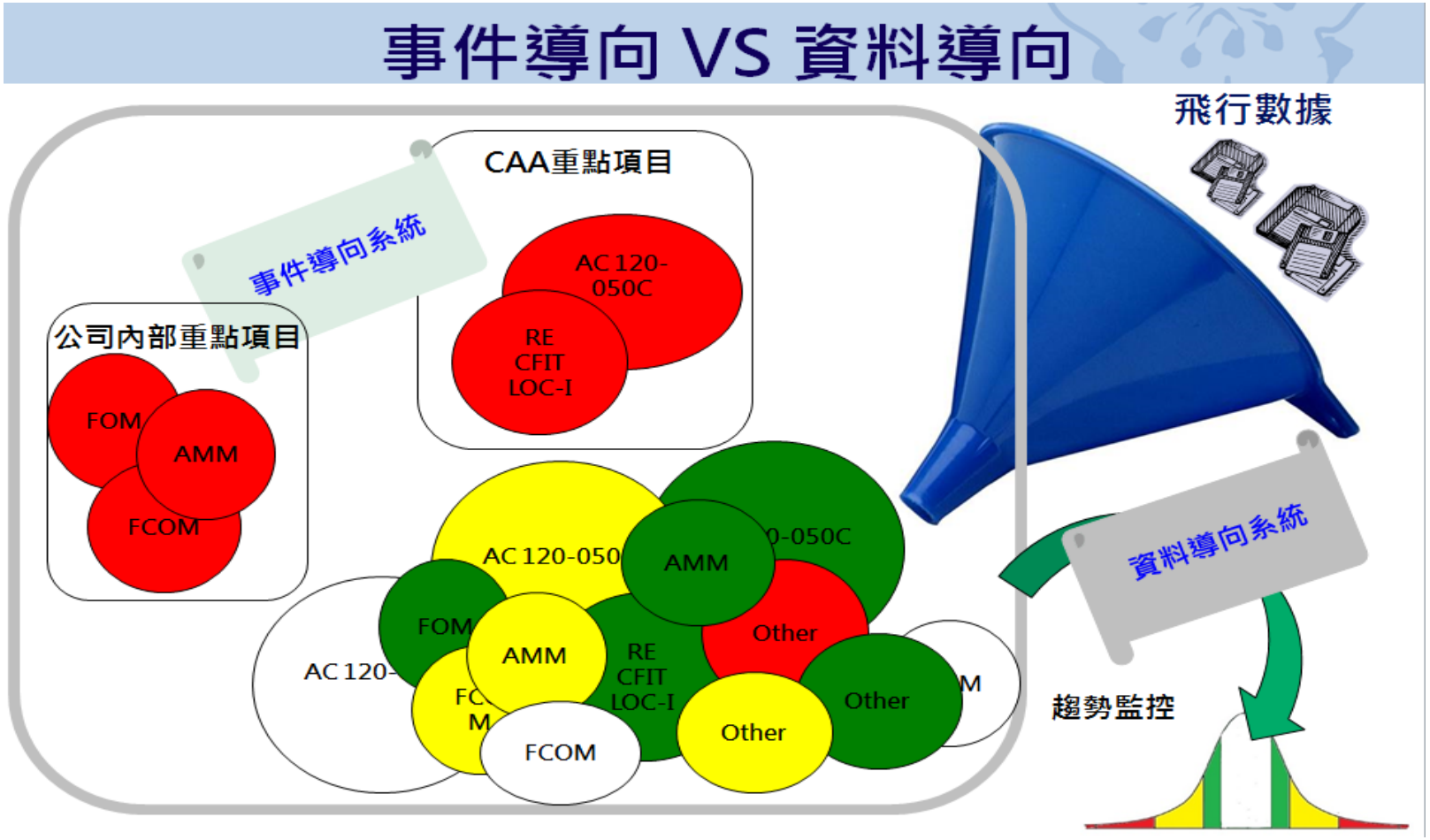
Precursor

CHINA AIRLINES

利用適合的SPI(安全指標)監控可能造成RE的前期參數並提出有效的改善管理措施

Tier 1-3				
安全指標項目		2018 Target	Jan-Dec	燈號
2.1	重大意外事件(Serious Incident - ICAO Annex13中所列之調查機構介入調查事件)	0	0.034	●
2.2	偏離跑道事件 (Runway Excursions , RE)	0	0.023	●
2.8	GDI (Severity High) 事件	≤0.01	0.011	●
3.1	飛機回航/轉降事件(空中關車、航管、天候及旅客因素除外)	≤0.054	0.057	●
3.2	空中關車事件 (In flight shutdown, IFSD)(每千飛時)	≤0.006	0.003	●
3.11	Pitch Angle High during Takeoff or Landing	≤0.105	0.08	●
3.13	載重不正確對航空器載重及平衡有明顯影響需報局事件	≤0.003	0.011	●
3.14	GDI (Severity Moderate) 事件	≤0.05	0.023	●
3.18	SAFA查核CAT 3缺點數	≤0.021	0.011	●
3.20	因人為疏失而導致航機不安全事件經評定之高/中度風險事件率	≤0.061	0.034	●
3.21	危險品錯誤裝載與未依規定申報事件	≤0.025	0.034	●
3.27	Level Bust	≤0.018	0.046	●

利用適合的SPI(安全指標)監控可能造成RE的前期參數並提出有效的改善管理措施



利用適合的SPI(安全指標)監控可能造成RE的前期參數並提出有效的改善管理措施

發展民航機飛航資料監控之
參數資料庫及應用方法
研究報告　（1/2）

「衝/偏出跑道事故類別」

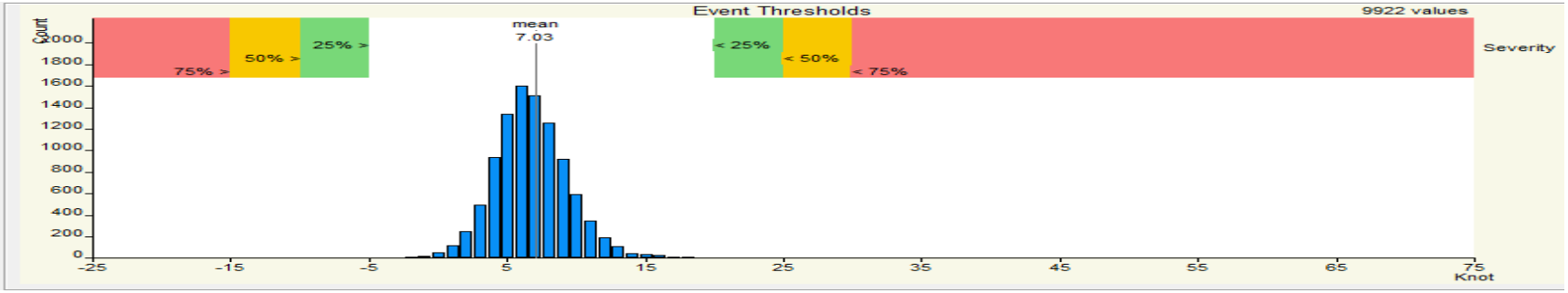
工作小組：官文霖、郭嘉偉、陳沛仲
執行期限：107年1月 - 108年12月
報告日期：107年12月

利用適合的SPI(安全指標)監控可能造成RE的前期參數並提出有效的改善管理措施

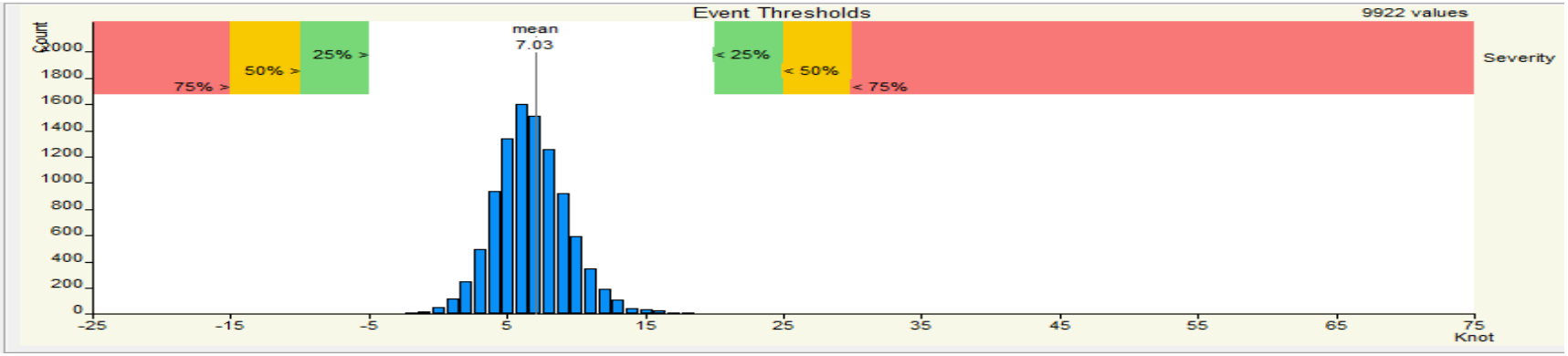
ASC&歐盟EOFDM工作小組 Precursor	華航 FOQA Event	放棄起飛 衝出跑道	未放棄起飛 衝出跑道	放棄起飛 偏出跑道	未放棄起飛 偏出跑道	落地後 衝出跑道	落地後 偏出跑道
Crosswind	High crosswind component (take-off)		X			X	X
Steering malfunction	Heading Dev during TO>100kts until lift-off		X				
Reverse thrust asymmetry	Asymmetric reverse power				X		X
Tailwind	High Tailwind Component (take-off)					X	
Excessive engine power(落地前)	High power on approach Approach Speed High (<50ft)					X	
Unstable approach	Deviation above glideslope Deviation below glideslope High rate of descent (<500ft) High rate of descent (500 to 1000ft) Late land flap Late Land gear					X	X
High energy over threshold	Approach Speed High (<50ft)					X	
Long flare	Long flare					X	
Deep landing	Deep Landing (distance from threshold)					X	
Abnormal runway contact	Excessive Bank on landing (at touchdown) Abnormal pitch landing low Abnormal pitch landing high Nosewheel landing Pitch attitude high at landing High normal acceleration (at landing)					X	X

利用適合的SPI(安全指標)監控可能造成RE的前期參數並提出有效的改善管理措施

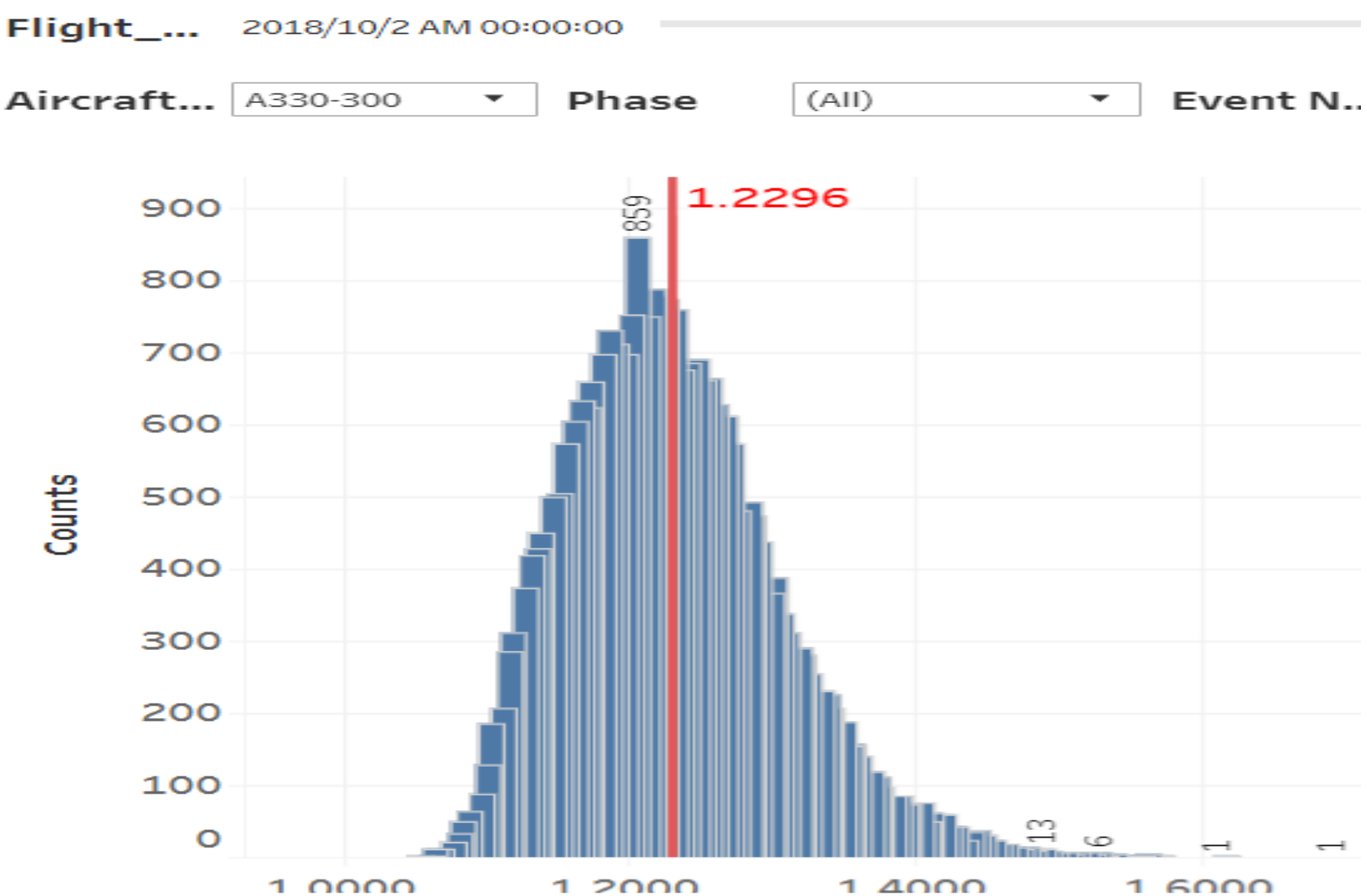
Approach Speed High(touchdown)，落地著陸時之空速。
以下為B738的分佈圖。



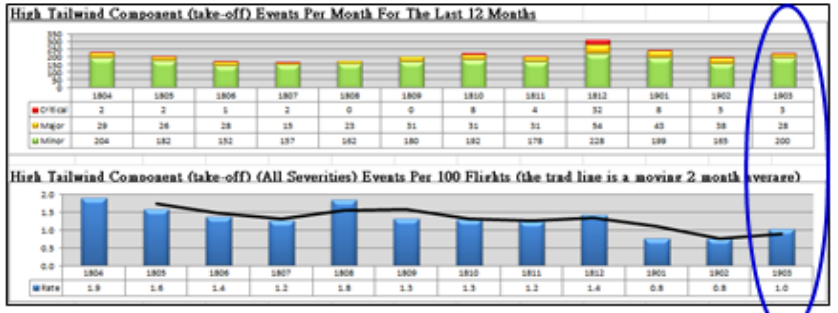
Rotation Speed High，起飛離地時之空速-Vr。
A350/B738/B744/B777皆可由此監控組員起飛帶桿情況，但A330飛行數據沒有記錄Vr(無法以此監控)，以下為A350的分佈圖。

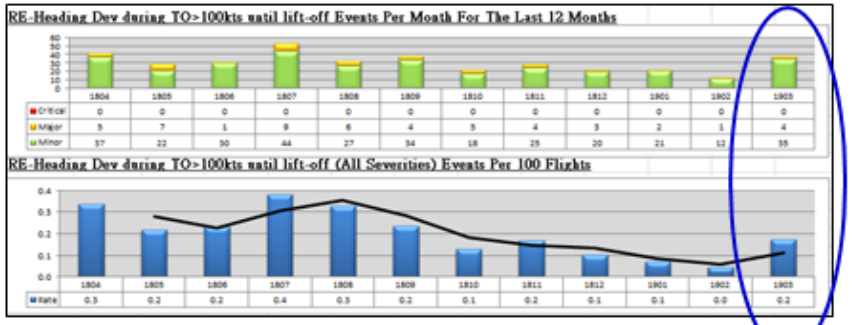


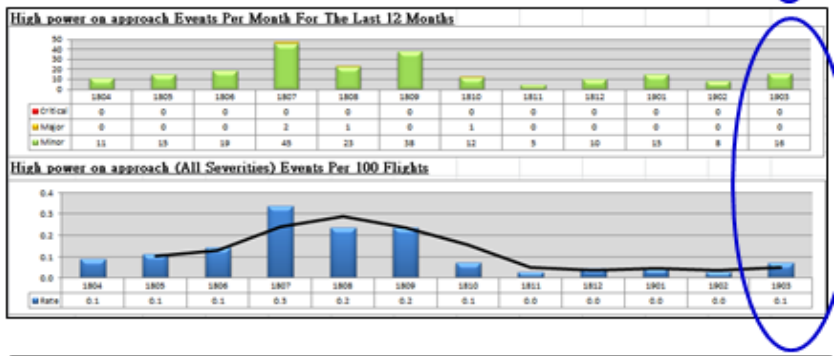
利用適合的SPI(安全指標)監控可能造成RE的前期參數並提出有效的改善管理措施

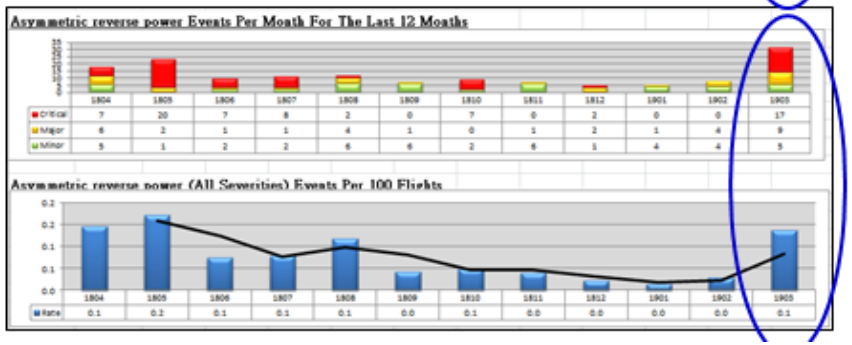


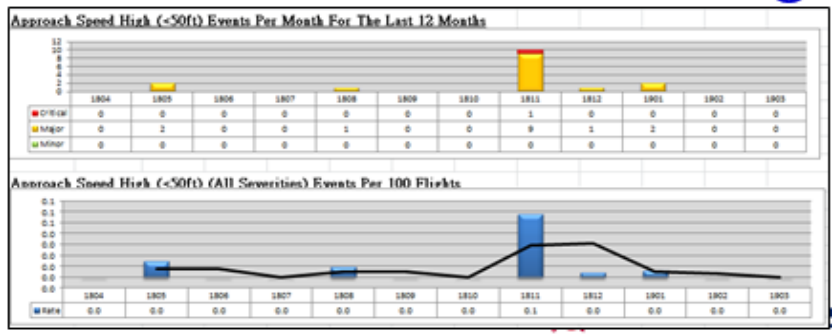
利用适合的SPI(安全指标)监控可能造成RE的前期参数并提出有效的改善管理措施









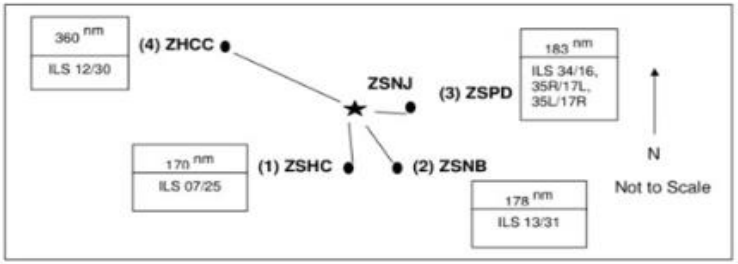


維護跑道安全之共同職責 – 航空公司

- 提供組員更新的天氣資訊與NOTAM，做好風險管控。
- 強化組員穩定進場(Stable Approach)之概念。
- 強化CRM精神，鼓勵並教育Pilot Monitor要落實執行監控作業，有偏移情形需立即call out。
- 必要時執行重飛以確保安全，公司應展現鼓勵及不處罰之管理文化。
- 發布安全研究相關資訊，透過期刊、課程及通告，提升飛航組員對跑道安全的認知。
- 利用適合的SPI(安全指標)監控可能造成RE的前期參數並提出有效的改善管理措施。

提供組員更新的天氣與機場資訊，做好風險管控

CHINA AIRLINES RIM Airport Page	ZSNJ-NKG-NANJING	NKG 5/6
		11-Mar-19



(1) HGH / ZSHC / HANGZHOU / CHINA N30 13.7 E120 25.9				
Ops. Hr.	H24	Equipment	GPU	✓
Fuel	JET		ACU	✓
Fire Fighting Cat.	9		Air Start Unit	✓
CAL Branch or Rep.	Yes		Tow Bar	744,340,330,738
A/C Type currently Operating		330,738		

(2) NGB / ZSNB / NINGBO / CHINA N29 49.4 E121 27.8				
Ops. Hr.	H24	Equipment	GPU	✓
Fuel	JET		ACU	✓
Fire Fighting Cat.	8		Air Start Unit	✓
CAL Branch or Rep.	Yes		Tow Bar	744,340,330,738
A/C Type currently Operating		330,738		

(3) PVG / ZSPD / SHANGHAI / CHINA N31 08.5 E121 47.4				
Ops. Hr.	H24	Equipment	GPU	✓
Fuel	JET A-1		ACU	✓
Fire Fighting Cat.	9		Air Start Unit	✓
CAL Branch or Rep.	YES		Tow Bar	744,340,330,738,777
A/C Type currently Operating		744,340,330,738,777		

Planning & Development Department

CHINA AIRLINES RIM Airport Page	ZSNJ-NKG-NANJING	NKG 2/6
		11-Mar-19

Mountain BRG:359° DIST(m):36700 Elevation(m):448

- Refer to JPSN chart for more information

3. WEATHER

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. High	7	13	16	21	29	29	32	32	27	22	16	10
Avg. Low	1	5	8	12	19	23	26	26	21	15	7	4

Temperature in Metric(°C).

- Heavy fogs in early morning from November to March. Typhoon season is from May till August. It scarcely snows.
- Prevailing wind comes from East. Perennial wind velocity is between1~5 to 17 m/sec.

4. TAXIING & PARKING

- Passenger flight: Normally parking gate assignment will be (Apron 3) No.210.
- Cargo flight: Normally parking gate assignment will be 67-69. Sometimes the gate numbers that cleared by Tower controller are different from the Follow me car, please make sure the ground marshal is in position and aircraft identification signals from the marshal is received before you can turn into the parking gates.
- The following wingspan limits do apply:
  - TWY A7 restricted to MAX wingspan of 171'/52m;
  - TWYs T4 and T5 restricted to MAX wingspan of 118'/36m;
  - TWY T13 restricted to MAX wingspan of 66'/20m;
  - TWYs T20 thru T22 are restricted to MAX wingspan of 157'/48m.
- B777-300ER shall offset centerline taxi at the corner to following TWYs:

K (North of A) and A;	A10 and A;	Q2 and Q;
A (from THR 24) to A;	A9 and T8;	Q2 and R;
A3 and A;	A10 and T8	Q3 and Q;
A7 and A;	B and Q;	Q3 and R.
A9 and A;	B and R;	

Note: Refer to FCTM 2.10 sharp turn to a narrow Taxiway.

- Upon landing the aircraft guides by Follow-me vehicle.
- Mandatory report holding points HP3/HP4/HP5/HP14, crews should make mandatory report while taxing through these points.
- When wingtip clearance is in doubt, suggest crewmembers to stop and request for tow truck.

Planning & Development Department

強化組員穩定進場(Stable Approach)之概念

6.9.8 Stable Approach Criteria

Instrument approaches should be planned to arrive over FAP/FAF, or 1,500 ft AAL, whichever occurs later, in the landing configuration, on proper glide path, and at proper speed. All instrument approaches must be stabilized no lower than 1,000 ft AAL.

Visual approach should be planned to be in the landing configuration, on proper glide path (VASI, PAPI), and at proper speed by 1,000ft AAL. All visual approaches must be stabilized no lower than 500 ft AAL. However, if maneuvering is required by the published procedures in order to be established on the center line of the landing runway (i.e.: HND VOR 16, JFK VOR 13, circling approach,...etc.), the aircraft must be stabilized no lower than 300 ft AAL.

A stable approach is defined as:

- Aircraft in landing configuration (as per respective FCOM); and
- Airspeed, not more than bug (target speed) +15 knots and not less than $V_{ref.}$ / V_{LS}; and
- Maximum sink rate of 1,200 fpm; and
- Engines "spooled up"; and
- For a precision instrument approach, less than 1 dot deflection on localizer and glide slope until visual glide path reference can be maintained (VASI, PAPI, etc.);
- For non-precision approach, less than 5 degrees deviation from inbound course;
- For a visual approach / segment, less than full high or full low indication on visual approach guidance (VASI, PAPI, etc.) unless the descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers and where such a descent rate will allow touchdown to occur within TDZ of the runway of intended landing.

If the aircraft is not stabilized by 1,000 ft/500 ft/300 ft AAL, as applicable, a missed approach is mandatory. A missed approach shall also be executed if, after passing 1,000 ft AAL on approach, it becomes obvious that a safe landing cannot be made within the TDZ (the first 3,000 ft or first 1/3 of the runway, whichever is less).

If, for any reason, approach conditions require any deviation from stable approach criteria, such deviations shall be briefed prior start of the approach.

強化CRM精神，鼓勵並教育Pilot Monitor要落實執行監控作業

FLIGHT SAFETY FOUNDATION

Reducing the Risk of
RUNWAY EXCURSIONS

Runway Excursion Risk Awareness Tool

Elements of this tool should be integrated, as appropriate, with the standard approach and departure briefings to improve awareness of factors that can increase the risk of a runway excursion. The number of warning symbols (⚠) that accompany each factor indicates a relative measure of risk. Generally, the higher the number of warning symbols that accompany a factor, the greater the risk presented by that factor. Flight crews should consider carefully the effects of multiple risk factors, exercise appropriate vigilance and be prepared to take appropriate action.

Failure to recognize the need for and to properly execute a Rejected Takeoff (RTO). Failure to recognize the need for a go-around and to conduct a go-around at any time during an approach, flare or touchdown is a primary factor in runway excursions.

Type of Operation	
Nonscheduled/air taxi/freight	⚠⚠
Training/observation	⚠
Flight Crew	
Reduced state of alertness — long duty period, fatigue	⚠⚠
Single-pilot operation	⚠⚠
Airport	
No current/accurate weather/runway condition information	⚠⚠
Unfamiliar airport or unfamiliar procedures	⚠⚠
Familiar airport — potential complacency	⚠⚠
Inadequate/obscured runway markings	⚠⚠
Excessive rubber/no porous friction coating or grooves on runway surface	⚠
Minimal or no approach/runway/taxiway lights	⚠
Air Traffic Services	
No airport traffic control service	⚠⚠⚠
Late runway change/unreasonable clearances	⚠⚠
Expected Approach	
No vertical approach guidance — e.g., ILS, RNP, VASI/PAPI	⚠⚠⚠
Nonprecision approach, especially with multiple step-downs	⚠⚠⚠
Visual approach in darkness	⚠⚠
LAHSO/partial runway closure	⚠
Planned long landing	⚠

Environment	
Visibility restrictions — e.g., darkness, fog, IMC, low light	⚠⚠⚠
Contaminated runway — e.g., standing water, snow, slush, ice	⚠⚠⚠
Tail wind greater than 5 kt	⚠⚠
High crosswinds/gusty winds	⚠⚠
Heavy rain/thunderstorm on field	⚠⚠
Aircraft Equipment	
No wind shear warning system	⚠⚠⚠
Inoperative braking system — e.g., wheel brakes, anti-skid, spoilers, thrust reversers	⚠⚠
Operating Procedures	
Cockpit distractions/non-sterile cockpit	⚠⚠⚠
Absence of no-fault go-around policy	⚠⚠⚠
Schedule pressures/delays	⚠⚠
Absent/inadequate descent/approach briefing(s)	⚠⚠
Absent/inadequate briefing/planning for braking management after touchdown	⚠⚠

Definitions:

ILS = instrument landing system
IMC = instrument meteorological conditions
LAHSO = land and hold short operations
PAPI = precision approach path indicator
RNP = required navigation performance
VASI = visual approach slope indicator

必要時執行重飛以確保安全，公司應展現鼓勵及不處罰之管理文化

TEM Guide for Arrival

HUMAN

- Fatigue/Experience level/Qualification of crew
- Communication barrier (e.g. crew/ATC, crew/ground..., etc)

ENVIRONMENT

- Terrain
- Visibility restricted (fog, haze, mist, smoke, snow..., etc.)
- Visual illusions (sloping runway, wet runway, snow)
- Wind conditions (crosswind, gusts, tailwind, shear)
- Runway conditions (ice, slush snow, wet)
- NOTAM, Jeppesen RWY/TWY constructions (e.g. 10-8, 20-8), & ATIS
- Non radar or non ATC control

EQUIPMENT

- Inoperative items that will affect the arrival

PROCEDURE

- Approach other than straight in ILS (e.g. cirling/visual approach at night, etc.)
- Possible last minute runway change
- Local rule complicated procedure for speed, landing gear, final flaps..., etc.
- Require use of supplementary procedure (e.g. Flight without on duty cabin crew checklist)

POSSIBLE COUNTERMEASURE TO OTHER THREAT OF CFIT/ALAR

- In order to strictly comply with published stable approach criteria in FOM, summarized

as following table (read item by item), crew should

	ILS Approach	Non-precision Approach	Visual Approach	Maneuvering Required(HND VOR 16, JFK VOR 13, Circling Approach)
Plan the approach to be	established in the landing config. on proper glide path/speed by:			
	Arriving over FAP/FAF, or 1,500 ft AAL (5NM), whichever occurs later		1,000 ft AAL	
Stabilized no lower than	1,000 ft AAL		500 ft AAL	300 ft AAL
Flight Path	< 1 dot G/S, LOC	< 5° deviation from inbound course	Less than full high/low indication on visual approach guidance	
Sink Rate	Maximum 1,200 fpm			

- Closely monitor "raw data" during approach
- Review locations of terrain, and highest terrain around the airport
- Use of Radio Altimeter for terrain awareness
- Promptly execute a missed approach when
  - An approach is unstable,
  - Required visual reference have not been sighted at minimums,
  - Loss of visual references after minimums but before landing rollout

Note: Once unstable, go-around is mandatory.

發布安全研究相關資訊，透過期刊、課程及通告，提升飛航組員對跑道安全的認知

維護跑道安全之共同職責 -飛機制造商

飛行時代的演進成就更高的安全係數

FOUR GENERATIONS OF JET

1 Early commercial jets

From 1952

Dials & guages in cockpit. Early auto-flight systems

Comet, Caravelle, BAC-111, Trident, VC-10, 707, 720, DC-8, Convair 880/890

2 More integrated auto-flight

From 1964

More elaborate auto-pilot and auto-throttle systems

Concorde, A300B2/B4, Mercure, F-28, BAe146, VFW 614 727, 737-100 & -200, 747-100/200/300/SP, L-1011, DC-9, DC-10

3 Glass cockpits & FMS

From 1980

Electronic cockpit displays, improved navigation performance and Terrain Avoidance Systems, to reduce CFIT accidents

A300-600, A310, Avro RJ, F-70, F-100, 328JET, 717, 737 Classic & NG, 757, 767, 747-400/-8, Bombardier CRJ, Embraer ERJ, MD-80, MD-90

4 Fly-by-wire

From 1988

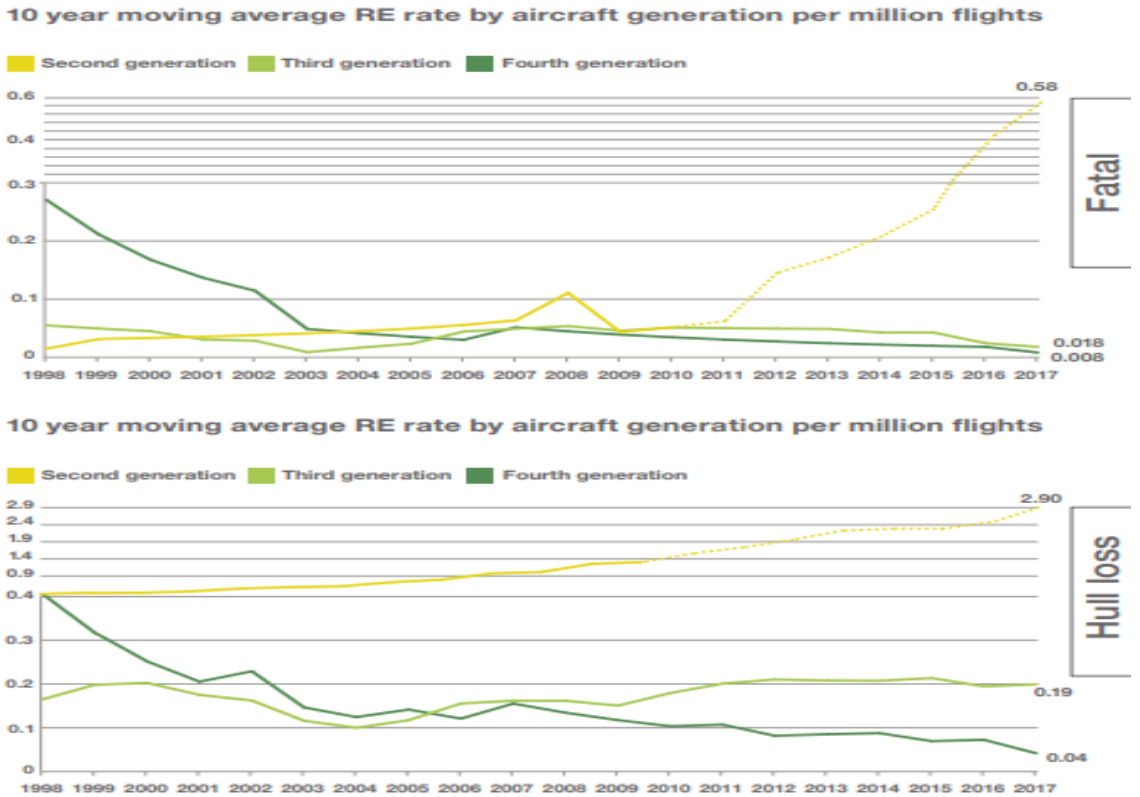
Fly-by-wire technology enabled flight envelope protection, to reduce LOC-I accidents

A318/A319/A320/A321, A330, A340, A350, A380, 777, 787, Embraer E-Jets, Bombardier C-Series

創新科技降低RE飛安事故

New technologies to reduce RE accidents have recently been introduced

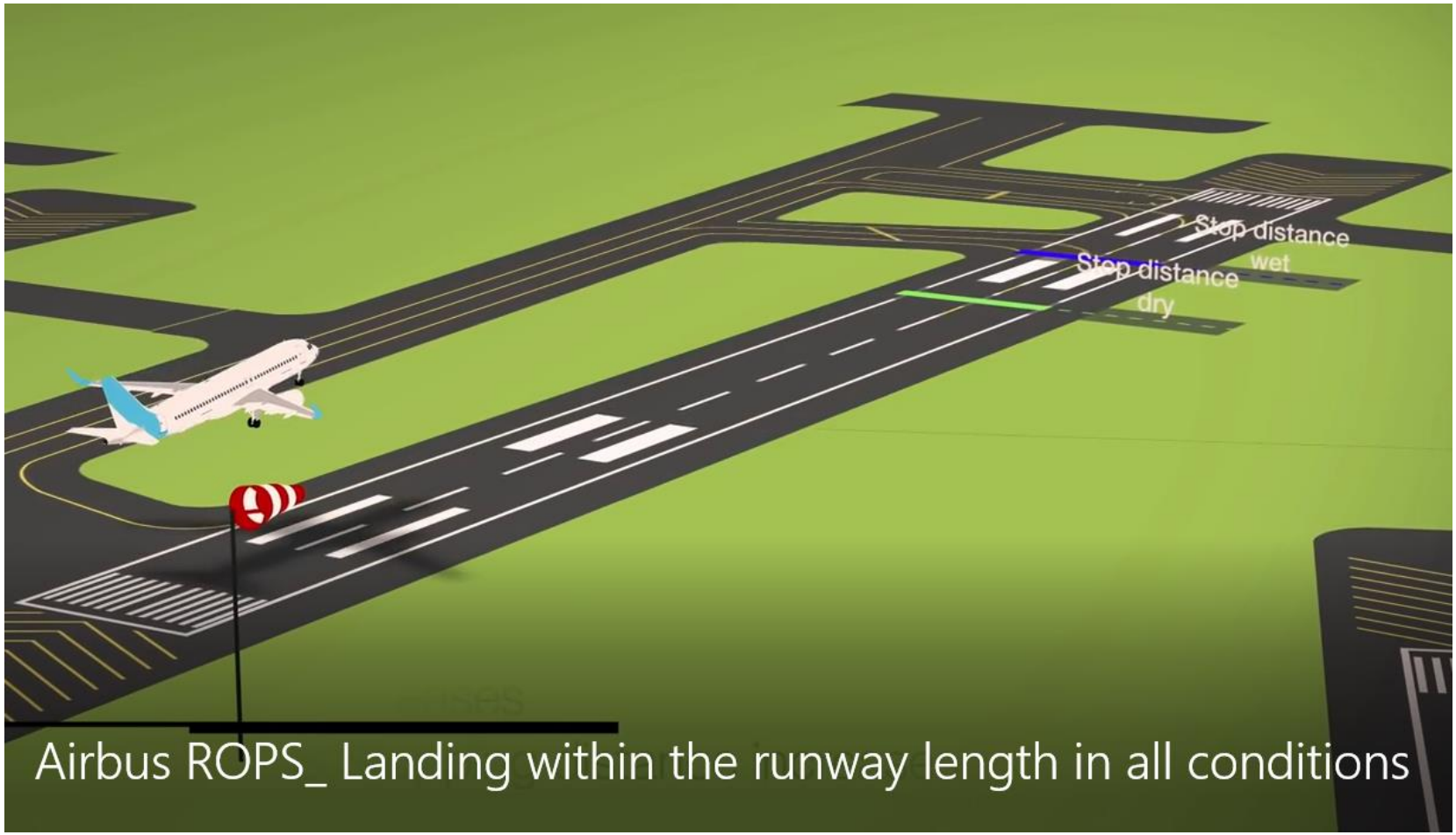
Most longitudinal Runway Excursions are related to aircraft energy management. Significant improvement of RE accident rates can be expected from the introduction of real time energy and landing performance based warning systems. Today, the proportion of aircraft equipped with such system is too low for the overall gain to be visible but this additional safety net is a promising step change to reduce longitudinal RE occurrences.



持續發展的新科技

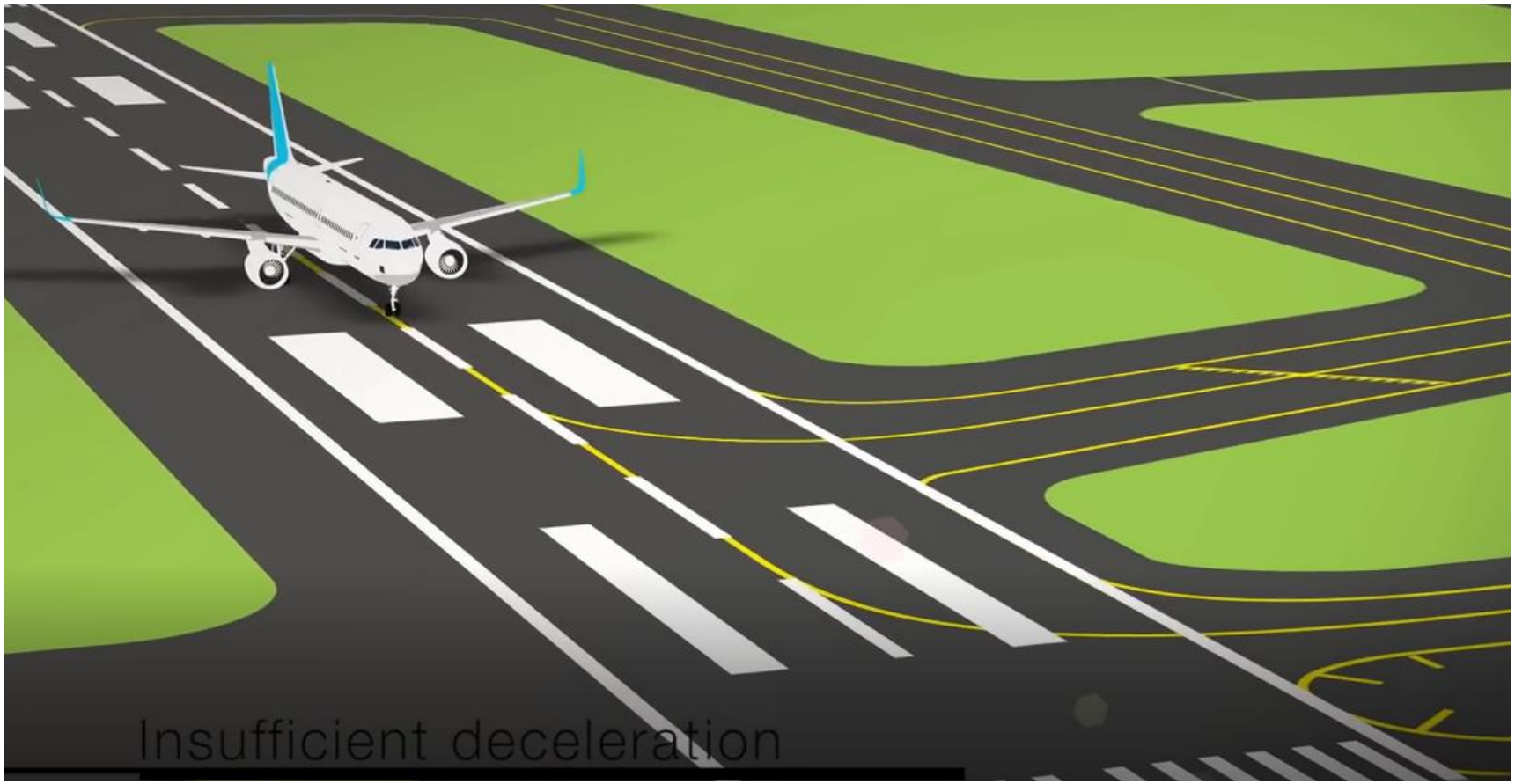
ROPS (Runway Overrun Prevention System) 提供了飛行員即時的落地煞車性能與煞停距離的監控資訊

ROPS (Runway Overrun Prevention System) 提供了飛行員即時的落地煞車性能與煞停距離的監控資訊



ROPS (Runway Overrun Prevention System) 提供了飛行員即時的落地煞車性能與煞停距離的監控資訊

ROPS (Runway Overrun Prevention System) 提供了飛行員即時的落地煞車性能與煞停距離的監控資訊



ROPS (Runway Overrun Prevention System) 提供了飛行員即時的落地煞車性能與煞停距離的監控資訊

ROPS (Runway Overrun Prevention System) 提供了飛行員即時的落地煞車性能與煞停距離的監控資訊

持續發展的新科技

- IATA 資料顯示 25% 的RE 事件發生在受汙跑道或濕滑道面。
- 在結冰或融冰的情況下，跑道煞車係數的資訊在報告發佈就已經過時了。
- 在強降雨或TSRA的情況下，道面煞車係數更是變化急遽。

濕滑道面的解決方案

Using Aircraft as a Sensor on Contaminated Runways

In any analysis of aviation accidents, Runway Excursions (RE) are usually identified as the top cause of aircraft hull losses. Many of these accidents occur on runways where braking performance is degraded by runway surface contaminants.

- 維護跑道安全綜合建議

維護跑道安全之共同職責 – 綜合建議

綜整歷年飛安統計資料以及本公司之操作經驗建議如下:

- 根據「飛航管理程式」ATC宜提供即時的天氣資訊 --風速、風向變化、能見度 及道面狀況等
- 當有積水或受污染跑道時，飛航組員與航管人員應主動積極掌握及時的情況，飛航組員並據以重新評估所需的落地距離，並將適時提供煞車狀況報告。
- 設置跑道中心線燈及落地區標示燈--強化組員目視參考的依據。
- 設置全鋪面之刮槽(Runway Grooving)--改善排水功能及增加摩擦效能。

維護跑道安全之共同職責 – 綜合建議

- 持續加強組員不良天候操作訓練
- 提升飛航組員於進場及著陸階段的狀況警覺、善用威脅與疏失管理技巧，加強風險識別及決策能力。
- 充實飛航組員的訓練科目及內容，遵守穩定進場與穩定落地之政策及標準操作程式，遭遇不穩定執行重飛或中止落地。

謝謝大家!

安全是我的責任，我按程式守法規，
我瞭解作業風險，我報告任何風險，
我持續提升安全。