

出國報告(出國類別：進修)

# 停機坪安全管理 Ramp Safety Management

服務機關：交通部民用航空局臺北國際航空站

姓名職稱：航務員 / 李曉鈴

派赴國家：新加坡

出國期間：中華民國 104 年 11 月 30 日至 12 月 4 日

報告日期：中華民國 105 年 3 月 1 日



## 目次

|                       |    |
|-----------------------|----|
| 壹、目的.....             | 1  |
| 貳、過程.....             | 1  |
| 參、心得                  |    |
| 1 課程介紹.....           | 4  |
| 2 空側設施與機場運作.....      | 6  |
| 3 空側安全淨距與標示 .....     | 10 |
| 4 空側活動對安全之影響 .....    | 12 |
| 5 對地勤業者之安全管理與查核 ..... | 15 |
| 6 野生動物防制.....         | 18 |
| 7 FOD 管理.....         | 22 |
| 8 障礙物限制面管理.....       | 29 |
| 9 機場防火安全規範.....       | 35 |
| 10 人為因素與安全文化概要.....   | 42 |
| 肆、建議事項.....           | 46 |
| 附錄.....               | 50 |



## 壹、目的

本課程雖名停機坪安全管理，實則不僅提供新加坡樟宜機場有關停機坪安全管理相關作業方式之經驗分享，尤其特別著墨於進一步提供學員如何分析、辨別、提出解決對策並徹底執行，再透過安全系統管理等手法及後續持續的檢討改善，以提升機場各項安全相關事項。

## 貳、過程

首先感謝民航局提供機會參加此次由新加坡民航學院(SAA)所舉辦的停機坪安全管理課程(Ramp Safety Management)。本次訓練課程自民國 104 年 11 月 30 日至 12 月 4 日為期 5 天，與來自新加坡、印尼、香港、泰國、沙烏地阿拉伯、巴布亞紐幾內亞、薩摩亞、澳洲、以色列及塞席爾等國共計 19 位優秀學員一同學習。

受訓學員背景甚廣，除第一線執行機場空側作業管理之人員，有機場管理單位、交通安全管理與查核單位、學術研究單位及商務航空公司人員參加，一齊學習停機坪的安全管理、互相交流和經驗分享，以便在各自工作領域中應用或發揮。課程實施方式以講師授課為主，以影片及照片輔助加深學員對於課程之了解，並鼓勵學員發問和經驗分享，另有一次約 2 小時在新加坡樟宜機場實地參訪。本次課程主要的帶班導師為新加坡籍的 Ms. Mary Tan，在新加坡航空界已有超過 30 年的資歷，目前並擔任新加坡樟宜機場第四及第五航廈設計規劃之顧問。



本次受訓行程如下：

| 日期                         | 星期    | 地點      | 行程紀要                |
|----------------------------|-------|---------|---------------------|
| 11 月 29 日                  | 星期日   | 臺北→新加坡  | 啟程                  |
| 11 月 30 日<br>至<br>12 月 4 日 | 星期一至五 | 新加坡民航學院 | 參加<br>停機坪安全管理<br>課程 |
| 12 月 8 日                   | 星期二   | 新加坡→臺北  | 返程                  |

課程表：

**AIRPORT AIRSIDE/RAMP SAFETY COURSE**  
30 November to 4 December 2015

| DAY/DATE<br>TIME | MONDAY<br>30-Nov-15   | TUESDAY<br>01-Dec-15   | WEDNESDAY<br>02-Dec-15   | THURSDAY<br>03-Dec-15   | FRIDAY<br>04-Dec-15  |
|------------------|---|--|--|---|--|
| 0900 - 1015      | Registration and Orientation<br>(0900-0945)<br><br>BREAK (0945-1015)              | Overview of Safety<br>Management System<br><br><i>Michael Pang (SAA)</i>     | Hazard Identification & Risk<br>Assessment<br><br><i>Mary Tan</i>  | Airside Fire Safety<br>Requirements<br><br><i>Lim Kim Yeow (CAG AES)</i>          | Airside Safety Clearances and<br>Markings<br><br><i>Mary Tan</i>                           |
| 1015-1045        |   | BREAK  | BREAK  | BREAK   | BREAK  |
| 1045-1200        | Overview of<br>Airside/Ramp Safety Course<br>(1015-1200)<br><br><i>Mary Tan</i>   | On-Site Safety Inspection /<br>Audit and Tour of Airside                     | Case-study on Airside<br>Accidents<br><br><i>Mary Tan</i>  | Aviation Safety and Security<br>(Dangerous Goods)<br><br><i>Allan Tang (SAA)</i>  | Airside Activities - impact on<br>Safety<br><br><i>Mary Tan</i>                            |
| 1200 - 1315      | Airside Infrastructure and<br>System in Airport Operations<br><br><i>Mary Tan</i> |  | Roles of Ground Handling<br>Agents in Airside Safety<br><br><i>Yeo Chee Hong (SATS)</i>                      | Overview of Human Factors<br>and Safety Culture<br><br><i>Huang Li Ning (SAA)</i> | Lesson Learnt from<br>Airside/Ramp Safety Course<br><br><i>Mary Tan</i>                    |
| 1315- 1415       | LUNCH   | LUNCH  | LUNCH  | LUNCH   | LUNCH  |
| 1415 - 1530      | Safety Oversight of Ground<br>Service Providers<br><br><i>Robson Ng (CAG)</i>     | Aerodrome Operator<br>Organisation & SMS<br><br><i>Lee Kwong Hoe (CAG)</i>   | Class discussions:<br>Observations made on<br>Inspection / Audit and Airside<br>Visit<br><br><i>Mary Tan</i> | FOD Management<br><br><i>Saminathan Thanam (CAG)</i>                              | Sum-up of Ramp Safety<br>Course<br><br><i>Mary Tan</i>                                     |
| 1530- 1545       | BREAK   | BREAK  | BREAK  | BREAK   | BREAK  |
| 1545 - 1700      | Wildlife Control<br><br><i>Robson Ng (CAG)</i>                                    | Aerodrome Accident & Incident<br>Reporting<br><br><i>Lee Kwong Hoe (CAG)</i> | Class discussions:<br>Observations made on<br>Inspection / Audit and Airside<br>Visit<br><br><i>Mary Tan</i> | Obstacle Limitation Surface<br><br><i>Reuben Koh (CAG)</i>                        | Evaluation<br>and<br>Presentation of Certificate<br>(1545-1615)<br><br><i>SAA/Mary Tan</i> |

| 課 程 表             |                                  |                                      |                                    |                                  |                            |
|-------------------|----------------------------------|--------------------------------------|------------------------------------|----------------------------------|----------------------------|
| Day1<br>11 月 30 日 | Session 1<br>課程介紹                | Session 2<br>空側設施與<br>機場運作           | Session 3<br>地勤業者之<br>安全管理與<br>查核  | Session 4<br>野生動物防<br>制          |                            |
| Day2<br>12 月 1 日  | Session 1<br>安全管理系<br>統概論        | Session 2<br>樟宜機場參<br>訪與空側安<br>全查核練習 | Session 3<br>機場管理機<br>構與 SMS       | Session 4<br>機場意外與<br>事故報告       |                            |
| Day3<br>12 月 2 日  | Session 1<br>空側危害辨<br>識與風險評<br>估 | Session 2<br>空側事故案<br>例討論            | Session 3<br>地勤業者於<br>空側之安全<br>任務  | Session 4<br>樟宜機場參<br>訪後心得討<br>論 |                            |
| Day4<br>12 月 3 日  | Session 1<br>機場防火安<br>全規範        | Session 2<br>航空業安全<br>與保安(危<br>險物品)  | Session 3<br>人為因素與<br>安全文化概<br>論   | Session 4<br>FOD 管理              | Session 5<br>障礙物限制<br>面管理  |
| Day5<br>12 月 4 日  | Session 1<br>空側安全淨<br>距與標示       | Session 2<br>空側活動對<br>安全之影響          | Session 3<br>停機坪安全<br>課程學習心<br>得分享 | Session 4<br>停機坪安全<br>課程總結       | Session 5<br>課程討論及<br>頒發證書 |

## 參、心得

### 1 課程介紹

#### Overview of Airport Ramp Safety Course

根據 ICAO 安全管理手冊 Doc 9859 為安全所下的定義「安全是指對人員的傷害或財產的損壞，透過持續的危害辨識及風險管理，減少、維持或降低至可接受的程度。」本課程內容圍繞著安全這個主題介紹並提供解決對策參考，讓參與學員一起腦力激盪。

##### 1.1 打造空側安全環境之挑戰：

1. 管理政策的制定，安全是否凌駕於其他所有考量之上
2. 忙碌的停機坪作業過程
3. 停機坪的設計是否能符合地勤作業必須達到的程序與標準
4. 人為因素導致的錯誤或違反公司制定之政策及程序
5. 各利害關係人，特別是地勤業者、航空公司與飛航管制人員間之安全管理整合
6. 確保及時的安全指示、安全標準與安全資訊的傳達

##### 1.2 本課程提供下列與安全事項相關的研討：

1. 空側設施與機場運作
2. 空側安全淨距與標示
3. 空側活動對安全之影響
4. 對地勤業者之安全管理與查核
5. 地勤業者於空側安全之任務
6. 野生動物防制
7. FOD 管理
8. 障礙物限制面管理
9. 空側危害辨識與風險評估及 SMS 概論
10. 機場意外事件與事故報告



11. 空側防火安全規範
12. 危險物品之規範與分類
13. 人為因素與安全文化概論
14. 空側事故案例討論
15. 樟宜機場參訪

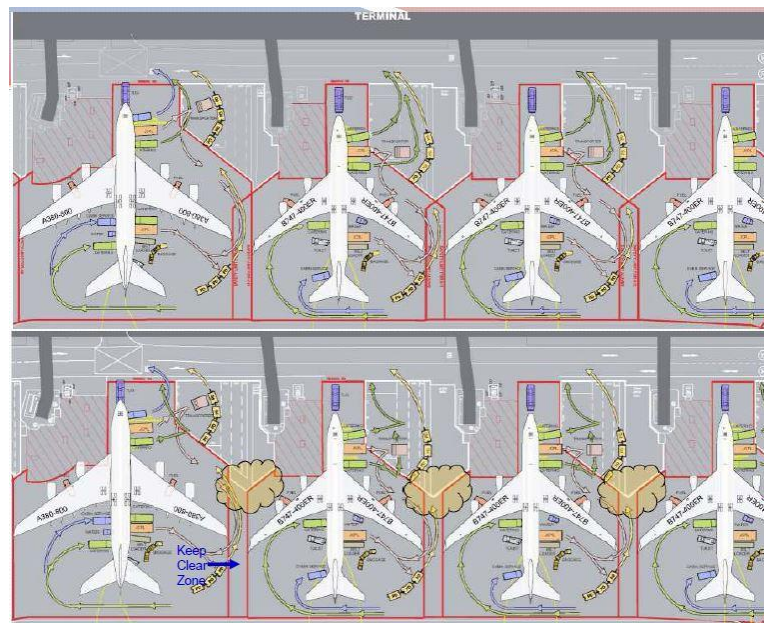
## 2 空側設施與機場運作

### Airside Infrastructure, Installations and Systems

空側設施之主要考量點包括：

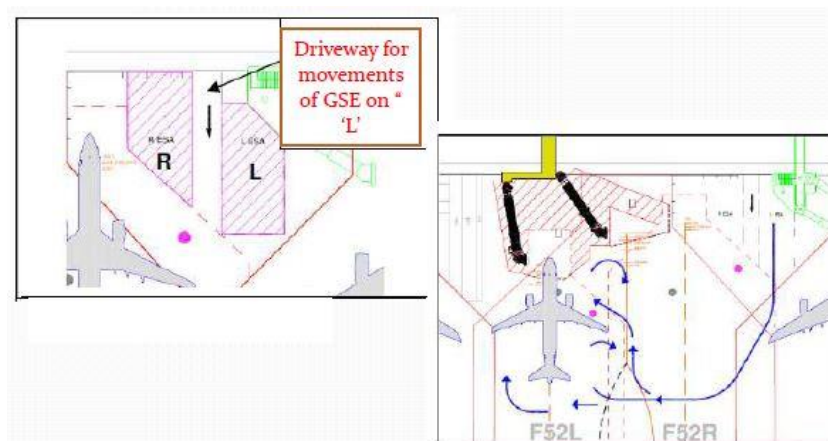
#### 2.1 容量與安全之競合：

一方面要能提高停機坪使用效率，如分別可提供給不同大小的航空器停放的共用機坪，另一方面還要顧慮到提供更多的周轉空間給地勤作業使用。



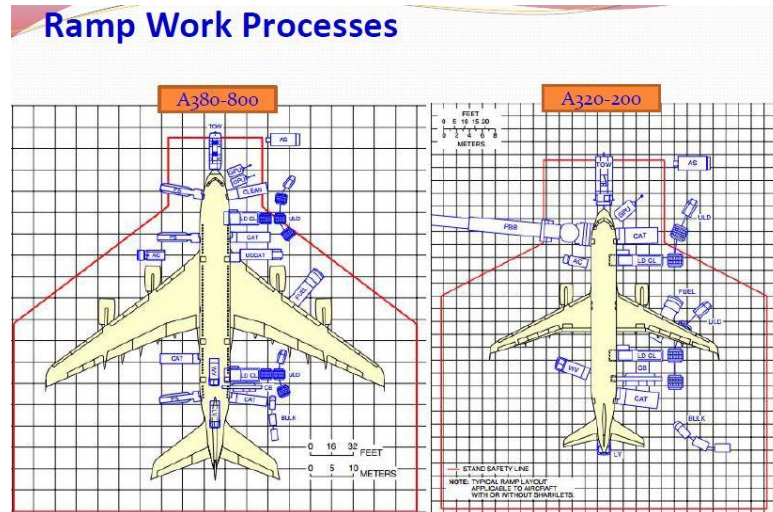
#### 2.2 安全與效率之競合

為了提升作業安全，限縮裝備停放區可使用的面積，如下圖示，但騰出的空間可做為為交通道便於作業車輛快速進出停機坪。



## 2.3 停機坪作業程序

每種飛機型式所需要的地勤服務與規模皆不相同，需平衡各機型所需使用之地勤服務，減少各項地勤作業之衝突。



## 2.4 工作環境之安全與人員健康

1. 透過如圖示之升降貨梯、螺旋梯、溜滑梯等，貨梯可將沉重的工具由地面運送至航機艙門，或是透過螺旋梯及溜滑梯可將航機上清運下待丟棄之垃圾快速的送抵地面，不僅降低工作人員體力之負荷，亦可減少工作人員長時間暴露於風吹、日曬、雨淋等嚴苛的工作環境中。

### Dumbwaiters





2. 有關雷擊防護，樟宜機場除了設置避雷小屋及雷擊告警系統，在航機接地部分，所有停機坪皆設置接地設備，採 3 點接地而非僅單點接地，以進一步確保雷擊防制之有效性。

## Lightning Protection System

Besides Lightning Rod on floodlighting masts, Other protection systems include:

- 3-point grounding



- Lightning device below PLB Cab



- Lightning Warning System



## 2.5 環境影響因素

建議在停機坪附近設置集中型的充電站，鼓勵地勤業者使用電動車，就近於停機坪附近充電，減少車輛移動，不僅降低空氣汙染，讓機坪工作人員減少暴露於汙染環境中，更可減少車輛間碰撞等交通意外事件。

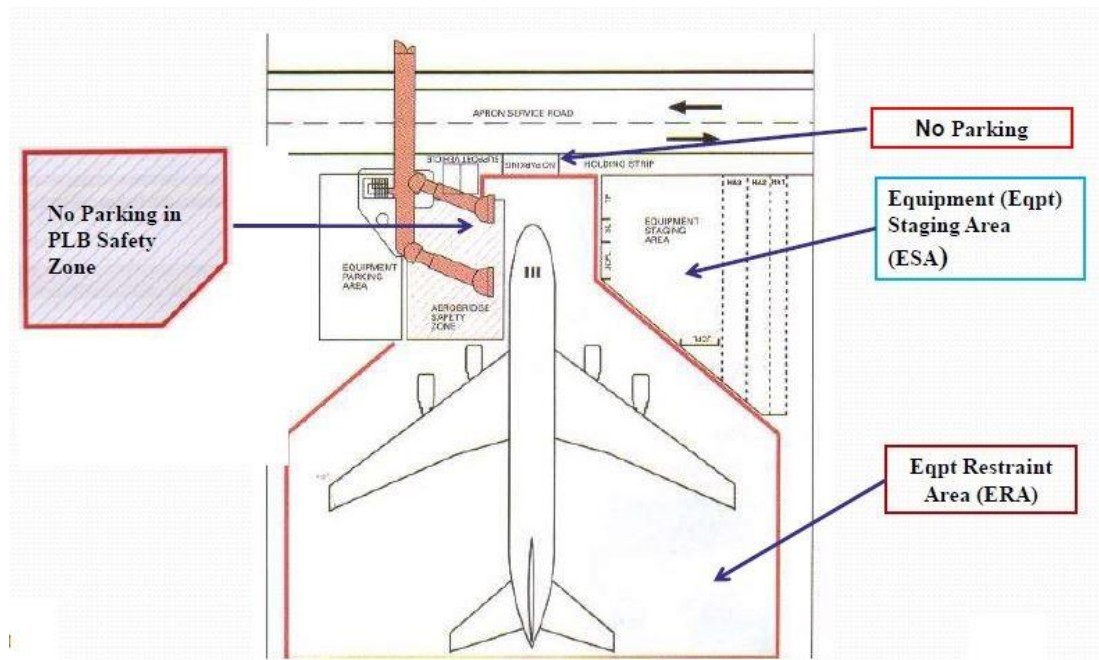


### 3 空側安全淨距與標示

除了大家所熟知的跑道、滑行道等各色各式標線、指示牌和燈光以外，其實最多人員活動的場域在停機坪，因此也常是意外發生的地點，如圖示為2013年發生於樟宜機場的地安事件，因地勤人員未遵守規定於航機停靠前將停機坪淨空，導致航機引擎吸入航空貨櫃；而去年印度也才發生地勤工作人員被吸入引擎而喪生。以上案例顯示，除了良好的停機坪規劃與設計，更重要的是要教育工作人員並且嚴格執行各項安全規範。







## 4. 空側活動對安全之影響

### 4.1 各類空側活動對安全之影響：

#### 1. 航機活動：

如未遵守航管後推或滑行指示。

#### 2. 地勤作業：

如各類地勤車輛互相碰撞或航機加油作業未遵守標準作業流程。

#### 3. 維護與施工作業：

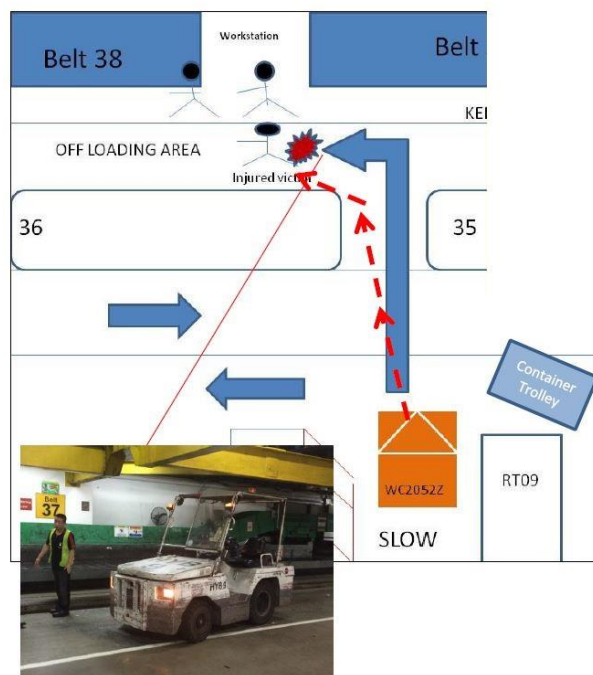
如未明確且充分標示施工區域與設立阻隔措施，或因施工限縮地勤作業操作空間致增加地勤作業風險。

#### 4. 裝備車輛移動：

如未禮讓航機或未遵守相關規範。

#### 5. 其他異常狀況：

如樟宜機場曾發生駕駛行李拖車人員於行李輸送帶區欲轉彎時未注意前方狀況，導致撞傷步行的工作人員，又或有些單位人員不常在空側開車或活動，也有可能因對空側環境不熟悉而發生事故。





## 4.2 降低風險之對策

1. 減少地面作業之車輛以避免與航機發生碰撞
  2. 控制在空側活動之車輛數量
  3. 檢視對車輛駕駛者與施工車輛之安全規範
  4. 加強執法力度
  5. 加強空側活動之監督
  6. 安全教育訓練計畫
  7. 現場控制車輛之移動
  8. 施工許可程序
  9. 定期的消防與救護演習
- 4.3 空側的活動非僅只航機與地勤工作人員，為了維持機場的安全運作，常有維護保養廠商於空側活動，對於這些不常在場面上活動之作業人員甚或是須於夜間或宵禁時段作業，應有相對應的安全措施及安全規範以降低作業之風險提升安全係數。

除基本的著裝要求(反光背心、安全帽、安全鞋等)，如圖示於場面作業之車輛或是吊車之吊桿頂端除了應配備有閃光燈以外，亦應豎立紅白相間之方格旗，以便能被清楚辨識。





為了提升空間之運用，樟宜機場將航機暫置於施工中的航廈前方，對於安全的維護更需相當嚴謹的規範與工作查核，以確保航機及地勤人員之安全，對於機場安全工作更是一大考驗。



## 5. 地勤業者之安全管理與查核

### Safety Oversight of Ground Services Providers

雖然 IATA 已有針對地勤業者做定期查核 (ISAGO, IATA Safety Audit for Ground Operations), 樟宜機場對地勤業者的安全查核仍非常的嚴謹, 平均每個月約 50 次, 分別針對不同航站、日間或夜間作業、窄體或廣體飛機或不同類型之停機坪(A380、MARS 共用機坪或遠端機坪)作業, 查核的主題例如各種形式的空橋操作、航空器運作與裝載安全、航機導引系統或人工導引之安全檢核。

查核目的主要為地勤作業之安全運作, 不以處罰為目的, 希望藉此來提升正確且安全的作業行為。

#### 範例 - 空橋操作安全檢查查核表

查核內容從航機抵達停機坪前、航機到達停機坪時及航機離開停機坪時等各階段的空橋操作, 查核項目總共多達 45 項; 查核完成後之報告會用 e-mail 發送給當事地勤業者, 地勤業者需提供報告所列缺失之改善方式、教育訓練紀錄或相關的標準作業流程, 以供機場管理單位追蹤改善措施及改善期程。

  
Airsides SOP – Volume 6 Airside Safety – SOP – 08 Rev 0.

| SOP #         | Latest update | Amendment History |  |
|---------------|---------------|-------------------|--|
|               |               | Last issue date   | Remarks  |
| AS – SOP – 08 | 30 APR 2014   |                   | New Release<br>Reassignment of AO Functions to<br>Airside Mgt Team |

#### OPERATION OF PASSENGER LOADING BRIDGE SAFETY INSPECTION CHECKLIST

Page 1 of 7

##### Instructions for Use:

- Go through the checklist and ensure that the actions are carried out according to the checklist.
- To indicate either YES / NO / NA (not applicable) on items which have been inspected.
- Indicate the action taken to resolve the matter under REMARKS.

##### ARRIVAL HANDLING

Date: \_\_\_\_\_ Time: \_\_\_\_\_  
Operator's name: \_\_\_\_\_ Handling Agent: \_\_\_\_\_  
ADP Number: \_\_\_\_\_ Operator arrival time: \_\_\_\_\_  
ADP Class: \_\_\_\_\_ ADP Expiry Date: \_\_\_\_\_  
Aircraft Type: \_\_\_\_\_ Aircraft Registration: \_\_\_\_\_  
Arrival Flight No: \_\_\_\_\_ STA / ATA: \_\_\_\_\_  
PLB Arm Audited (Pls circle): L1 / L2 / L3 Aircraft Stand: \_\_\_\_\_  
Inspected by: \_\_\_\_\_ Weather: Dry / Wet

Page 1/7



Airsides SOP – Volume 6 Airside Safety – SOP – 08 Rev 0.

Page 2 of 7

##### DEPARTURE HANDLING

Date: \_\_\_\_\_ Time: \_\_\_\_\_  
Operator's name: \_\_\_\_\_ Handling Agent: \_\_\_\_\_  
ADP Number: \_\_\_\_\_ Operator arrival time: \_\_\_\_\_  
ADP Class: \_\_\_\_\_ ADP Expiry Date: \_\_\_\_\_  
Aircraft Type: \_\_\_\_\_ Aircraft Registration: \_\_\_\_\_  
Departure Flight No: \_\_\_\_\_ STD / ATD: \_\_\_\_\_  
PLB Arm Audited (Pls circle): L1 / L2 / L3 Aircraft Stand: \_\_\_\_\_  
Inspected by: \_\_\_\_\_ Weather: Dry / Wet

| S/N            |   | Y | N | NA | REMARKS |
|----------------|---|---|---|----|---------|
| A. PRE-ARRIVAL |   |   |   |    |         |
| 1              | Use of Personal Protective Equipment (PPE) e.g. Proper hearing protection, proper safety footwear and etc.  |   |   |    |         |
| 2              | High visibility / reflective clothing worn by all staff.  |   |   |    |         |
| 3              | Timely arrival of PLB operator at bay at least 15 minutes prior to estimated time of arrival (ETA) of aircraft arrival.                               |   |   |    |         |
| 4              | Operator has a valid Class 'A' ADP and state licence of minimum Class 3<br>* Exceptions:<br>State Licence is not applicable for Class 3T ADP holders) |   |   |    |         |
| 5              | PLB operator check the surrounding area to ensure there is no Foreign Object Debris (FOD).  |   |   |    |         |
| 6              | PLB operator knows the aircraft type taxiing into the bay.  |   |   |    |         |

Page 2/7

| S/N                   |   | Y | N | NA | REMARKS |
|-----------------------|---|---|---|----|---------|
| <b>A. PRE-ARRIVAL</b> |   |   |   |    |         |
| 7                     | Passenger Loading Bridge (PLB) serviceability check.  |   |   |    |         |
| 8                     | Passenger Loading Bridge (PLB) wheels are correctly parked within their "park" boxes.<br>* Exceptions:<br>For A380 flights, L3 arm is in the "pre-position" box.<br>For MARS Right Bay, the PLB arm is in the "pre-position" box for Code C aircraft.<br>For MARS Left Bay, the PLB arm is in the "pre-position" box for Code E aircraft. |   |   |    |         |
| 9                     | If the assigned PLB is in the extended position with the wheel outside the white parking box, alert the Airside Control Centre immediately. DO not retract the PLB. Wait for a CAG officer to investigate the matter.   |   |   |    |         |
| 10                    | Safety chains are secured by the operator.  |   |   |    |         |
| 11                    | The Passageway of the PLB is free of litter.  |   |   |    |         |
| 12                    | A marshaller is deployed on Apron ground in case of PLB malfunction and manual docking of PLB to aircraft.  |   |   |    |         |
| 13                    | PLB operator adjusts the height of the PLB accordingly to the height of the incoming aircraft type.   |   |   |    |         |
| 14                    | PLB operator positions the PLB wheels in the wheels positioning box after checking serviceability of the PLB.   |   |   |    |         |

| S/N                             |   | Y | N | NA | REMARKS |
|---------------------------------|---|---|---|----|---------|
| <b>A. PRE-ARRIVAL</b>           |   |   |   |    |         |
| 15                              | PLB operator is aware of the steps to be taken in the event of PLB unavailability:<br>(a) Immediately inform the Airside Officer/Operations Supervisor of the flight to request for a passenger step to be dispatched to the stand;<br>(b) Inform CAG Airside Control Centre; and<br>(c) If maintenance staff is unable to rectify the PLB fault within 5 minutes upon reaching the site, the PLB operator would deploy the passenger step for passenger disembarkation when the decision by the Airline or CAG is reached. |   |   |    |         |
| <b>B. UPON AIRCRAFT ARRIVAL</b> |   |   |   |    |         |
| 1                               | PLB operator receives a thumbs-up signal from the headset man, before docking the L1 arm to the aircraft.   |   |   |    |         |
| 2                               | PLB operator moves the PLB with the roller shutter door open.   |   |   |    |         |
| 3                               | PLB operator stops the PLB 0.5m from the aircraft to make a final adjustment.   |   |   |    |         |
| 4                               | Besides the PLB operator, there are no other personnel in the cab during the docking process.   |   |   |    |         |
| 5                               | If the PLB operates abnormally during auto-dock mode, operator shall release the auto-dock button immediately to abort operation and to stop the PLB.   |   |   |    |         |
| 6                               | PLB operator activates the auto-leveller after docking to the aircraft. The auto-leveller was engaged prior to opening the aircraft door.   |   |   |    |         |

| S/N                               |   | Y | N | NA | REMARKS |
|-----------------------------------|---|---|---|----|---------|
| <b>B. UPON AIRCRAFT ARRIVAL</b>   |   |   |   |    |         |
| 7                                 | PLB operator adjusts and maintains the height between the PLB cab floor and the aircraft door sill at 20 cm for all aircraft types.                                       |   |   |    |         |
| 8                                 | PLB operator removes the key from the instrument console after the docking process.   |   |   |    |         |
| 9                                 | PLB operator extends the cabin closure towards the aircraft door.   |   |   |    |         |
| 10                                | * Applicable to A380 Aircraft Arrival<br>PLB operator uses the correct docking sequence. (ie: L1 / L3 / L2).<br>* To indicate NA for other aircraft types other than A380 |   |   |    |         |
| <b>C. UPON AIRCRAFT DEPARTURE</b> |   |   |   |    |         |
| 1                                 | A marshaller is deployed on Apron ground to assist.   |   |   |    |         |
| 2                                 | PLB operator secures all safety chains.   |   |   |    |         |
| 3                                 | PLB operator raises the cabin closure and confirms that the closure is fully retracted.   |   |   |    |         |
| 4                                 | PLB operator closes the aircraft door before disengaging the auto-leveller and retracting the canopy.   |   |   |    |         |
| 5                                 | PLB operator checks for clearances before retracting the bridge.  |   |   |    |         |
| 6                                 | * Applicable to PLB Auto Mode.<br>PLB operator retracts 0.5 m manually before setting to Auto Park function.  |   |   |    |         |
| 7                                 | * Applicable to PLB Manual Mode.<br>PLB operator withdraws the PLB according to the marshaller guidance.  |   |   |    |         |

| S/N                               |  | Y | N | NA | REMARKS |
|-----------------------------------|--|---|---|----|---------|
| <b>C. UPON AIRCRAFT DEPARTURE</b> |  |   |   |    |         |
| 8                                 | The operator retracts the PLB to the parking box position before start of pushback.<br>* Exceptions:<br>For A380 flights, the L3 arm retracts to the "pre-position" box.<br>For MARS Left Bay, the PLB arm retracts to the "pre-position" box for Code E aircraft. |   |   |    |         |
| 9                                 | Operator is to retract the PLB in the above listed exceptions ( refer to item C(8)) to "pre-position" box for aircraft to push out, following which the operator must park the PLB arm in the 'park box'.  |   |   |    |         |
| 10                                | If the PLB operates abnormally during auto-park mode, operator shall release the auto-park button immediately to abort operation and to stop the PLB.  |   |   |    |         |
| 11                                | PLB operator is aware of the steps to be taken in the event of PLB unable to retract from departing aircraft:  |   |   |    |         |
| a                                 | Inform the Airside Control Centre;   |   |   |    |         |
| b                                 | Seek the assistance of a tow tractor driver to tow the PLB;  |   |   |    |         |
| c                                 | Prior to towing the PLB, in the presence of the CAG PLB maintenance contractor; the PLB operator is to ascertain that:   |   |   |    |         |
| (i)                               | The aircraft cabin door is shut;   |   |   |    |         |
| (ii)                              | No passengers are in the PLB;  |   |   |    |         |
| (iii)                             | Weather closure has been retracted;  |   |   |    |         |
| (iv)                              | airline representative is informed;  |   |   |    |         |

| S/N   |   | Y | N | NA | REMARKS |
|---|---|---|---|----|---------|
| <b>C. UPON AIRCRAFT DEPARTURE</b>                   |   |   |   |    |         |
| (v)   | When retracting 3rd arm of the PLB, initial retract to "pre-position" box for aircraft to push out. After that, operator must park the 3rd arm in the 'park box'. |   |   |    |         |
| 11  | Roller shutter is lowered and closed after use and the wheels of the PLBs are parked within the parking boxes.  |   |   |    |         |
| 12  | PLB operator set the PLB to A300 height.  |   |   |    |         |
| 13  | PLB operator turns the key to 'OFF' position and remove the key.  |   |   |    |         |
| 14  | Emergency Stop button is depressed.   |   |   |    |         |
| 15  | PLB operator remains on the bridge until the aircraft has pushed back.  |   |   |    |         |
| <b>D. OTHER OBSERVATIONS/CONCERNS/COMMENDATIONS</b> |   |   |   |    |         |
| 1   |   |   |   |    |         |

#### Follow-up Actions

Write to the appropriate operations and safety manager to inform them of the outcome of the assessment and request follow-up actions on non-conformance.

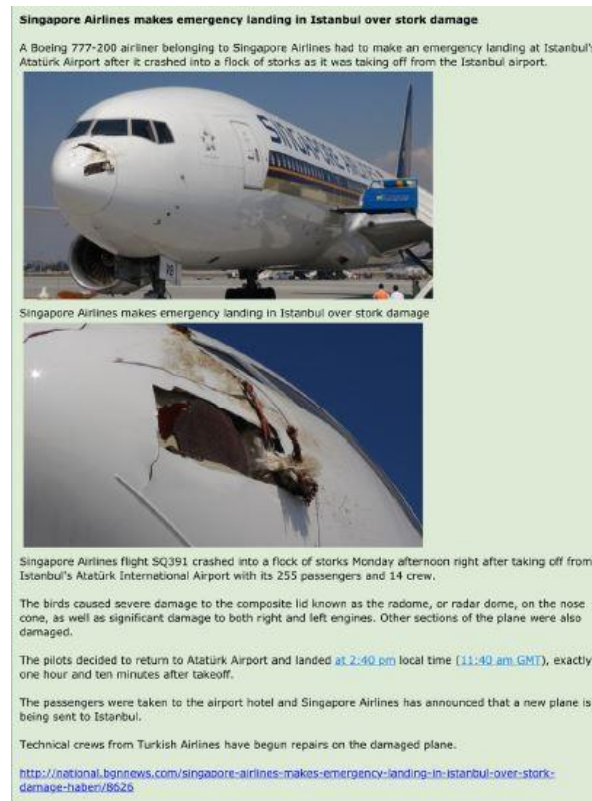
**TOTAL SCORE (%):**



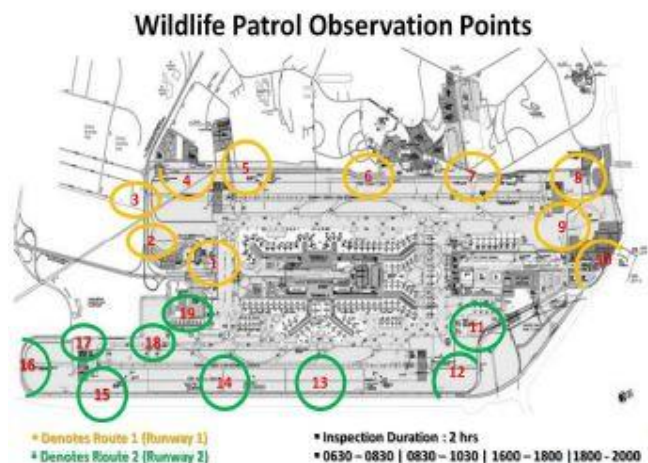
## 6. 野生動物防制

### Wildlife Control

野生動物對於飛航安全之影響重大，輕則造成航機受損，嚴重者甚至導致航機失事。



由於自然環境及野生動物棲地被破壞，機場或其周遭綠地及水域常成為野生動物覓食的場所，世界各國民航單位及研究機構莫不致力於找出減少野生動物於機場活動之對策，以降低其對飛航安全之影響。各機場亦因其環境條件不同而有不同的野生動物入侵，最常見的則是鳥類，鳥相的觀察可協助機場管理單位制定防制對策。



管理不善亦可能吸引野生動物入侵，禁止餵食野生動物、禁止於空側飲食或空側垃圾桶、垃圾車加蓋等都是必要的安全措施。



Workers consuming lunch at the opened area next to the truck with dogs in the background

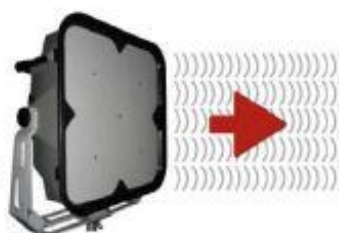


以下為比較新式之鳥擊防制工具介紹

### 6.1 長距離聲音干擾

#### LONG RANGE ACOUSTIC DEVICE

LRAD uses an array of proprietary drivers to produce focused sound, which reduces audio level behind the Device and surrounding areas.



### 6.2 雷射槍



### 6.3 音波聲網

針對不同鳥類，透過頻率設定，使產生的音波破壞鳥群之間的溝通，以達到驅趕鳥群的效果。

## ‘SONIC NET’ COULD REDUCE BIRD-PLANE COLLISIONS

November 5, 2015 | Conservation This Week | 0 Comments

People have tried all kinds of strategies to keep birds away from airports, a major site of bird-plane collisions. But loud noises and recordings of predators or alarm calls don't work very well because the birds ignore the fake threats after awhile.

Now scientists have come up with a promising new technique called a "sonic net". The idea is simple: Play sound that overlaps with the frequencies that birds use to call to each other. When the birds can't communicate, they tend to stay away — and out of the path of planes.

By some estimates, bird-plane collisions cause more than \$900 million in damage in the US per year. And because their habitat options are shrinking, birds often flock to the fields and wetlands around airports.

The study authors tested the sonic net strategy at three airfield sites in eastern Virginia. For about two months, the team recorded the number and types of birds at each site four times per week. Halfway through the study, the researchers turned on a speaker at one site that played constant pink noise in the 2-10 kHz range.

At the two sites where no sound was played, the number of birds didn't change much from the first to the second month. But at the site with noise, the number of birds dropped by 82 percent in the area close to the speaker and 65 percent in most of the remaining area. And the effect was just as strong after four weeks of sound exposure.

The birds might avoid the noise because they can't hear alarm calls from their fellow birds or the sound of predators, the authors saw. And it would be hard for the birds to adapt by changing the frequency of their

### 6.4 鳥不踏 (Anti-Perching Devices)



上圖為樟宜機場最新採用之塑製鳥不踏



## 6.5 樟宜機場鳥擊防制作為：

樟宜機場除了場內鳥擊防制作為，亦積極與民眾溝通介紹機場鳥擊防制工作，間接也教育民眾，讓民眾一起協助機場做好機場周邊鳥擊防制工作，維護飛航安全。

### The Straits Times, 20 May 2013



## Changi keeps fowl-ups to a minimum

Airport adopts measures to halve cases of birds hitting planes

By ROYSTON SIM

WHEN a bird comes up against an aeroplane, the result is not always pretty, sometimes even for the machine.

But various initiatives, from mimicking birds' distress calls to covering canals, has seen Changi Airport halve the number of such wildlife strikes from 13 to around seven a month in the last year.

The most serious incident to date happened last June, when a Brahminy Kite, a medium-sized bird of prey, flew into the engine of an Airbus A320 shortly after its wheels touched the ground.

The arriving plane's schedule was delayed by around two hours, as airport staff removed the carcass and inspected the aeroplane to ensure it was safe to fly.

Such incidents are rare at Changi, which has more than 27,000 flights per month. Most wildlife strikes are minor, with little or no damage to aircraft.

Yet they can pose significant problems, said Changi Airport Group (CAG) vice-president of air-side management See Seng Wan.

In 2009, in what has been labelled the "Miracle on the Hudson", a US Airways plane struck a flock of geese after take-off and lost power in both engines. Its pilot made an emergency landing in New York's Hudson River. All 155 occupants were safely evacuated.

The issue of wildlife strikes is more pertinent for Changi which, given its proximity to wooded areas and the coast, naturally attracts animals. Birds commonly spotted there include mynas,

crows and egrets.

The largest is the white-bellied sea eagle, which weighs up to 4kg. Other wildlife include bats, snakes and dogs.

To minimise the risk of wildlife strikes, CAG has ramped up a range of initiatives to keep birds and other animals out. Its wildlife management team, which comprises 12 officers, began conducting four to six two-hour patrols a day last year, compared to eight times a month previously.

Birds spotted near aircraft movement areas are dispersed by broadcasting bird distress calls from the patrol vehicle or through loudhailers. Officers can select up to 20 calls that mimic the sounds made by different species when in distress.

All bird sightings and subsequent actions taken are recorded in a system, so hot spots can be identified.

There are specific measures for different birds. Distress calls are

mainly for birds that flock, while anti-perching devices were installed on railings in three locations last year to discourage larger birds.

Added Mr See: "Birds and animals are always looking for two things, food and shelter. So we also try and eradicate their source of food."

The CAG horticulture team ensures no fruit-bearing trees or plants that attract animals are planted within the airport.

Its engineering team has a grass cutting and maintenance programme that keeps the 600ha of turf around the airport unattractive to birds. For instance, grass is not cut when it is wet, so that the soft topsoil along with its insects will not be churned out and attract birds, said Mr See.

All dustbins are covered so animals cannot forage for food. Staff are also forbidden from eating or drinking airside, where aircraft can access, and those caught face



Airport operations officer Afzal Laily (left) using a loudhailer with bird distress calls to disperse birds at Changi Airport. Anti-perching devices (above) have been installed to discourage larger birds. ST PHOTOS: MUGILAN RAJASEGERAN

a fine.

CAG works with various partners such as the National University of Singapore's Raffles Museum of Biodiversity Research, which conducts a quarterly census to determine the amount of bird activity within the airport.

Another partner is the Nature Society, which shares its knowledge of local bird species and helps identify unknown carcasses.

Its bird group chairperson Alan Owyong said the key solutions are to remove nesting sites and food sources. He has also advised CAG to cover bodies of water, which attract birds such as herons, and it has taken action.

The CAG has awarded a contract to cover these bodies of water, which include canals, with netting. Its staff also remove silt and floating plants from these areas.

All these measures have brought the number of reported bird strikes down by half, and

without the CAG having to cull birds in the past three years.

Still, it is currently assessing new methods to manage wildlife, such as long-range acoustic devices and grass sprays which help keep birds away.

Said CAG spokesman Robin Goh: "Animals are naturally able to adapt, so we constantly explore new measures to manage wildlife for the safety of our flights and passengers - which is always top priority."

royston@sp.com.sg

#### WATCH THE VIDEO:

[www.straitstimes.com](http://www.straitstimes.com)

The CAG team shows us the various methods employed to minimise wildlife strikes.

Download a QR code reader app on your smartphone and scan this code for more information.

## 7. FOD 管理

### FOD Management

FOD 所造成的最著名事故為西元 2000 年時協和號於戴高樂機場因為前機發動機掉落之鐵皮帶導致失事墜機事件，為維護飛航安全，樟宜機場投資鉅額設置 FOD 監測系統，對於 FOD 的管理鉅細靡遺。

#### 7.1 FOD 產生之原因





##### 1. 機場活動

行李車輪胎掉落相關零件散落，導致航機輪胎損傷，整組輪胎更換損失慘重。



## 2. 人員疏失

如圖，因溝通不良加上人為疏失導致 FOD(耳機員之有綫耳機)遺留在停機坪，為避免類似事件再次發生，樟宜機場改要求耳機員使用無線耳機。

| Date / Time / Location  | Event / Incident   | Actions taken/ Follow up  |
|---|--|---|
| 28 Sep / 1033 hrs<br><br>Runway 2 Between taxiways E7 & E8 (opposite former BT apron) | <p><b>Wireless headset &amp; handset found on Runway 2.</b></p> <p><b>What happened?</b><br/>CAG informed GHA to ID the items.</p> <p>GHA reported that they had lost the item during handling of a A320 ABT 1032 hrs.</p> <p>After arrival handling, headset man left the bag containing the wireless headset and handset on the tarmac next to the nose wheel of the A320.</p> <p>Then during departure handling, another technician then came along and used the headset (without asking for permission) to confirm the final fuel uplift with the Captain. He then left the headset on the nose gear strut door (rear of the nose gear). He then left the scene.</p> <p>The headset man began to look for the headset when the PLB was retracted from the aircraft. When he could not locate the headset he proceeded to do a hand signal to inform the Captain about situation. The Captain then hand signal him to pushback the aircraft.</p> <p><b>What went wrong?</b></p>  | <p><b>Actions taken?</b><br/>In house disciplinary action was taken on the technician. He was issued with a written warning.<br/>A safety notice was also issued all other technicians and they were also made to attend a toolbox briefing on the incident.</p>    |

## 3. 惡劣天候

如圖，颱風天或是平日突來的大風皆可能會將裝備吹離裝備停放區，造成飛航安全問題。





#### 4. 施工活動

如圖，可能因施工工地未確實做好 FOD 清理，以致航機拖行時航機輪胎壓到螺絲受損。



#### 5. 航機移動

如圖，航機尾流將道面上 FOD 吹往地勤車輛，致使地勤車輛玻璃破裂。



## 6. 機場設施老化

如下圖示，油漆老化剝落導致巨大的油漆塊出現在樟宜機場的快速出口滑行道上；樟宜的 FOD 小組將此塊 FOD 裝袋保存，如同犯罪證物般於袋上清楚標示相關訊息，並有專門的地點保存所拾獲或發現的 FOD。

|                   |  |   |
|-------------------|--|---|
| 18 Nov<br>1501hrs | <b>Location : RET E11</b><br><br> | <b>1530H – Rover 39 handed over FOD (paint flakes) collected from Rapid Exit Taxiway E11.</b><br><br>FOD by reported by pilot to Control Tower<br><br>Longest piece measuring 80cm x 35cm.<br><br>Paint flakes were from the runway designator marking<br><br>Weather – Sunny<br><br>Runway condition – Dry |
|-------------------|--|---|

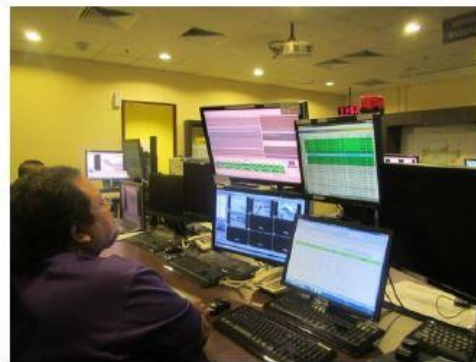
## 7.2 樟宜機場 DOD 管理：

### 1. FOD 偵測：

除了每周選定不同地點，由地勤單位和樟宜機場人員組成的團隊一字排開步行巡檢，更投入大筆經費設置 FOD 監測雷達，隨時有一組人員監看監測系統，當 FOD 警報響起，監視人員判定為疑似 FOD 時，再由另一組人員上場撿拾。



定期步行巡檢



FOD 監測系統

2. FOD 移除：

採清掃車動力清掃、運用磁性鐵條吸附金屬類 FOD 或人力清掃。

3. FOD 分析評估：

透過 FOD 資料的蒐集與分析，找出 FOD 熱點加強管理。

4. FOD 預防：

明確規範各個單位人員的責任、嚴格執行 FOD 查核、導入罰款制度，另外樟宜機場 2015 年在滑行道地帶試行設置 FOD 攔截網(高 0.9M)。

| Actions  | Responsibility - minimally |
|--|----------------------------|
| <b>1. Inspections</b>  |                            |
| Carry out frequent cleaning of the entire airside area<br>- ensure that aircraft stands and taxiway are free of objects and small pieces of debris | Airport operator           |
| Inspect the stands for FOD prior to aircraft arrival   | Ground handlers            |
| Provide FOD bin  | Airport operator           |
| Make sure that your vehicle/equipment do not have any loose parts that can come off  | Driver                     |
| Once you have finished work, check that you still have all the tools you started with  | Contractor                 |
| <b>Must pick up and dispose FOD at all times</b>   | <b>All personnel</b>       |



| Type of offence   | Fine     |
|---|----------|
| Failing to comply with verbal instructions (By-law No. 5 (1))       | \$150/-. |
| Leaving broken down vehicle unattended (By-law No.7)                | \$120/-. |
| Failing to ensure vehicle in good working condition (By-law No. 27) | \$120/-. |
| Failing to ensure load is secured – By-law No.53(2)                 | \$150/-. |

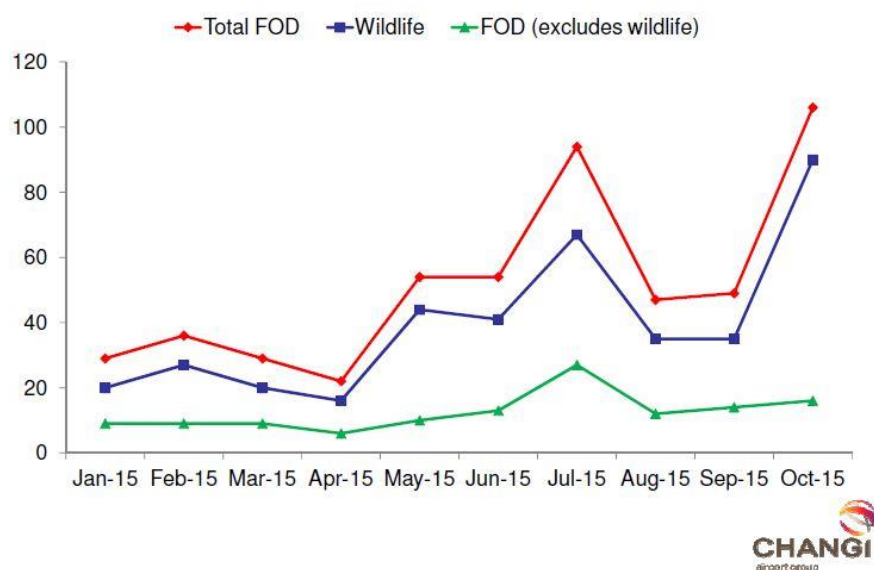


### 7.3 樟宜機場 FOD 偵測系統探討：

根據授課講師所述，樟宜機場 FOD 偵測系統使用狀況如下：

1. 僅能偵測靜物，若有鳥類暫棲於偵測範圍內會觸動 FOD 警示；若有野生動物快速從跑道通過，有可能不會觸動監視系統。
2. 系統警示後，須由監測人員透過監測螢幕判別是否可能為 FOD，從下列圖表可知，扣除野生動物，透過系統發現確實為 FOD 者，每個月通常不超過 20 件，實際上觸動系統的 FOD 多數為野生動物。
3. 系統監測人員判定為 FOD 時，由另一組人員上場撿拾，平均每次上場撿拾需關閉跑道或滑行道 6 分鐘，對繁忙的樟宜機場而言，為了維護飛航安全，每年關閉跑道及滑行道的時間累計起來相當驚人。

**Number of FOD detected on the runways, taxiways and reported on the apron areas**





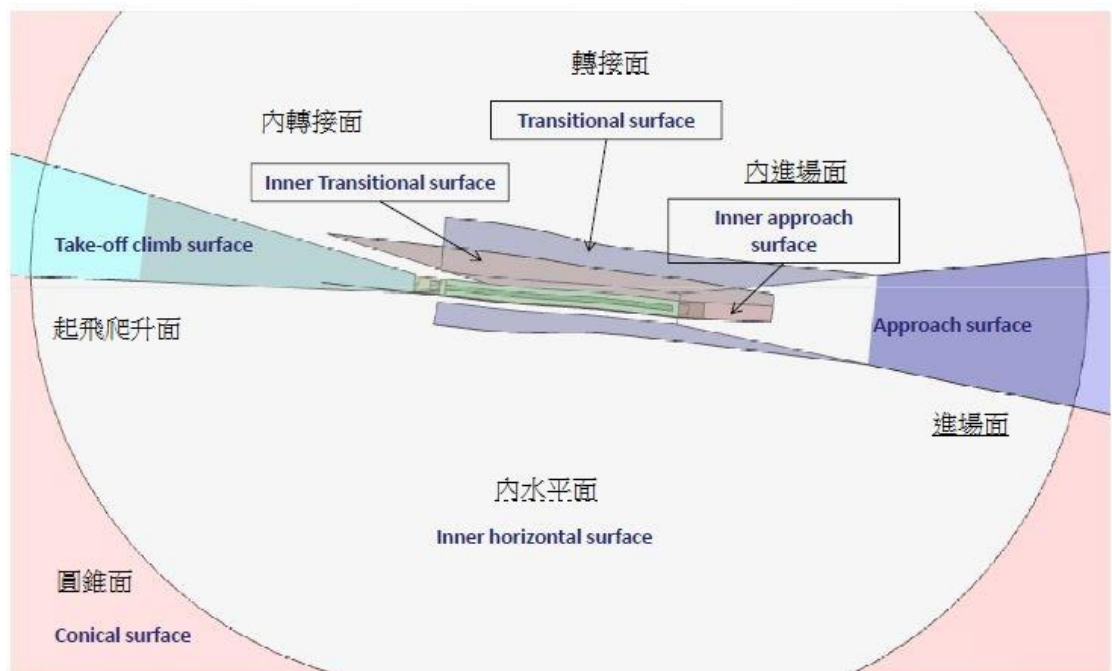
## 8. 障礙物限制面管理

### Obstacle Limitation Surface

障礙物限制面定義 ICAO 早已明定，所以做好日常的維護與管理才是維護飛航安全的保證，新加坡經驗如下提供參考。

#### 8.1 障礙物限制面包含：

1. 圓錐面
2. 內水平面
3. 進場面
4. 轉接面
5. 內轉接面
6. 內進場面
7. 起飛爬升面



## 8.2 施工申請：

新加坡經濟蓬勃發展，國內各地一直都有各式建設在開發，針對在機場附近或航道上會影響飛航安全的開發案，若是短期施工，則可直接上新加坡民航局官網申請，若為長期建案，則由市區重建局(Urban Redevelopment Authority)及建設局(Building and Construction Authority)向新加坡民航局申請。

The screenshot displays the CAAS website interface. At the top, there is a header with the CAAS logo, '30 years of enabling opportunities through aviation', and navigation links for CAREERS, MEDIA CENTRE, and AZ. The Singapore Government logo is also present. Below the header is a search bar and a main navigation menu with links to HOME, ABOUT US, AVIATION HUB, REGULATIONS, and E-SERVICES & FORMS. The breadcrumb trail indicates the current location: HOME » eServices & Forms » Application for Obstacle Clearance. On the left, a sidebar lists various eServices & Forms, with 'Application for Obstacle Clearance' highlighted. The main content area features a large image of an airport terminal and a control tower. The title 'Application for Obstacle Clearance' is prominently displayed. Below the title, a paragraph explains that development of buildings, use of tall construction machineries such as cranes and ship crossing can potentially affect safety of air navigation. It states that prior clearance needs to be sought from CAAS before interested parties carry out such activities. A bulleted list specifies the following Obstruction Control activities: TOP/CSC, Erection of Cranes and Tall Construction Machineries, and Ship Crossing. At the bottom, it provides an email address for enquiries: caas\_atc\_ansp@caas.gov.sg.

**CAAS** 30 years of enabling opportunities through aviation  
Civil Aviation Authority of Singapore

CAREERS | MEDIA CENTRE | AZ Singapore Government Integrity · Service · Excellence

CONTACT US | FEEDBACK | FAQs | SITEMAP

Google™ Custom Search

HOME ABOUT US AVIATION HUB REGULATIONS E-SERVICES & FORMS

HOME » eServices & Forms » Application for Obstacle Clearance »

**eServices & Forms**

- Aeronautical Information Management (AIM) System
- AIP Email Notification Service
- Air Operator's Certificate
- Aircraft Maintenance Licensing & Examination
- Aircraft Operations
- Air Traffic Controller Licensing
- Air Transport Licensing and Administration System (ATLAS)
- ALS Form and Report
- Overseas Quotation / Tender Opportunities
- Application for Aerial Activities
- Application for Obstacle Clearance
- Application Forms for Carriage of Dangerous Goods and Munitions of War by Air
- Application of Commercial Flights for Foreign Air Operators
- Aviation Development Fund
- CAAS Careers
- Design Approval

**Application for Obstacle Clearance**

Development of buildings, use of tall construction machineries such as cranes and ship crossing can potentially affect safety of air navigation either due to the close proximity between the structure and an overflying aircraft, or the structure may cause an obstruction along the flight path. As such, prior clearance needs to be sought from CAAS before interested parties carry out such activities. By accessing this page, applicants would be able to apply for the following Obstruction Control activities:

- TOP/CSC
- Erection of Cranes and Tall Construction Machineries
- Ship Crossing

For enquiries, applicants can email their requests to [caas\\_atc\\_ansp@caas.gov.sg](mailto:caas_atc_ansp@caas.gov.sg).

### 8.3 障礙物調查：

1. 樟宜機場將機場及其附近劃分為 7 個區域，分區執行障礙物調查。



2. 每個區域需分別各執行一次日間和一次夜間障礙物調查，總計作業時間 14 天。
3. 執行任務時須穿著安全服裝、攜帶障礙物調查檢核表、新加坡民航局核可之施工許可證、高度測量儀器、GPS 定位器、相機、地圖及望遠鏡等工具。



手持式障礙物高度測量儀器

4. 調查項目除了施工許可證檢查、許可操作的裝備數量、許可施工高度、障礙物標示及障礙燈，也包含巡視有無有礙飛航安全物體的施放，如空拍機、風箏、煙火、天燈、氣球、無人載具等

## Sample of Obstacle Checklist

| OBSTACLE SURVEY<br>ZONE: AIRSIDE (CHANGI)<br>DAY INSPECTION CHECKLIST |                      |  |  |   |  |   |   |   |             |              |
|---|----------------------|--|--|---|--|---|---|---|-------------|--------------|
| Surveyor  |                      |  |  |   | 1. Height Measuring Device - Model Leica DistoD510 / Serial No. 1013353129 | 2. Reference Height (m)                                 | 2.0   |   |             |              |
| Team  | Airside Safety Team  |  |  |   | 2. Verification Reference: A.5 SOP # 02                                    | 3. Height Reading (m)                                   |   |   |             |              |
| Survey Date   |                      |  |  |   | 3. Acceptance Criteria<br>+/- 0.3 m  | 3. Difference in Height (m)                             |   |   |             |              |
| Survey Time   | 0900 hrs - 1700 hrs  |  |  |   | 4. Frequency: Before Every Use   | 4. Remarks  |   |   |             |              |
| Checked By  |                      |  |  |   | 1. GPS Equipment - Model Garmin Nuvi 2565LM / Serial No. 2005548572        | 2. GPS Reference: PS4 FIX Location                      | N03° 22' 5.9"<br>E103° 59' 18.1"            |   |             |              |
| Signature   |                      |  |  |   | 2. Verification Reference: A.5 SOP # 02                                    | 2. GPS Reading  |   |   |             |              |
| Date  |                      |  |  |   | 3. Acceptance Criteria<br>+/- 8m (+/- 0.3")                                | 3. Difference   |   |   |             |              |
| Check within 3 days from date of survey                               |                      |  |  |   | 4. Frequency: Before Every Use   | 4. Remarks  |   |   |             |              |
| S/N   | Activity Period      | Company / Site Location  | Contact Person / Number  | No. & type of Equipments  | Marker Boards in Place To Delineate Unserviceable Areas                    | Number & Types of Equipments Tally With Approval Letter | Equipment Height Tally With Approval Letter | Good Condition Checkered Flags Installed On Highest Point | Observation | Action Taken |
| 1   | 18/12/14 to 30/06/15 | Koh Brothers Building & Civil Engineering Contractor Pte Ltd<br><br>Design and Build Contract for proposed retention pond, associated drainage and backfilling works on LOT 045941, PT MK 81 at Singapore Changi Airport - South End Reservoir | Phua Tin Shuh<br>Site Manager<br>97196041<br><br>Koh Lye Hock<br>Sr Project Manager<br>90956738<br><br>Lam Kang Ai<br>Site Eng<br>82883873 | 04 Crawler Crane (15m AGL)<br><br>Crawler Crane (20m AGL)<br><br>12 Long Arm Excavator (12m AGL)<br><br>10 Dump Truck (7.5m AGL)<br><br>29 Excavator (5m AGL)<br><br>12 Bulldozer (3.5m AGL)<br><br>14 Roller (3m AGL)<br><br>10 10-Wheel Lorry (3m AGL)<br><br>04 Lorry Crane (3m AGL)<br><br>04 Bobcat (2m AGL) |  |   |   |   |             |              |



5. 不符合施工許可證許可項目或未申請施工許可者，請施工廠商立即改善或補申請，且障礙物調查小組會於 3 個工作天內複檢確認。



Marking of Approved equipments to be used on site



CAAS Maximum Height Allowable Signage to be displayed at work area



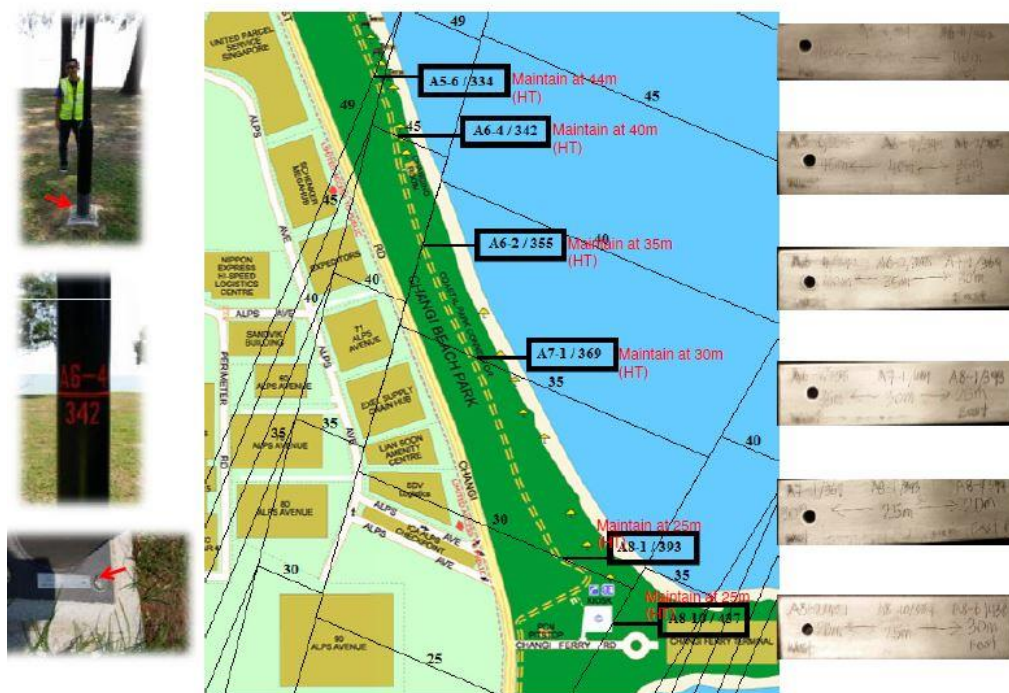
如上圖示，施工工地標示新加坡民航局的施工許可資訊，吊車上用特大加粗字體顯示許可操作的高度限制，不僅便於查核人員查核，若有違法施工者，於工地附近活動之民眾亦可協助有關當局維護飛航安全，另外，除了車頂或吊臂頂端有障礙燈供夜間辨識，於設備頂端繫上紅白方格旗做為日間識別及安全警示。



#### 8.4 樹木管理及調查：

建築物的高度一經建設完成幾乎是固定不再變動，而樹木卻是年年增高，需持續的監測與修剪才能符合障礙物限制高度。樟宜機場每兩年執行一次樹木高度測量，根據測量結果執行相對應的對策，如發現樹木超高時，發佈 NOTAM 通知相關單位，並聯絡地主或負責單位修剪樹木。

#### Tree Height Information Strips at Changi Beach Park



## 9. 機場防火安全規範

### Airside Fire Safety

#### 9.1 機場火災研討：

##### 1. 機場火災回顧：



1996 年德國杜賽爾多夫機場火災，導致 17 人死亡，機場航廈 A 與 B 嚴重燒毀，直到 1998 與 2001 年才分別改建或拆除重建完成，損失更是不可計數。



2006 年伊斯坦堡機場大火，2000 名工作人員從濃煙漫佈的機場貨運站逃出，造成機場跑道關閉，甚至出動救火飛機協助滅火。

##### 2. 機場火災原因：

上述火災原因為使用焊接工具產生火花或是電線短路而導致機場大火。因此機場明定禁止使用明火且特定地點禁止吸菸，對於在機場施工使用焊接工具時，亦有非常嚴謹的規範。

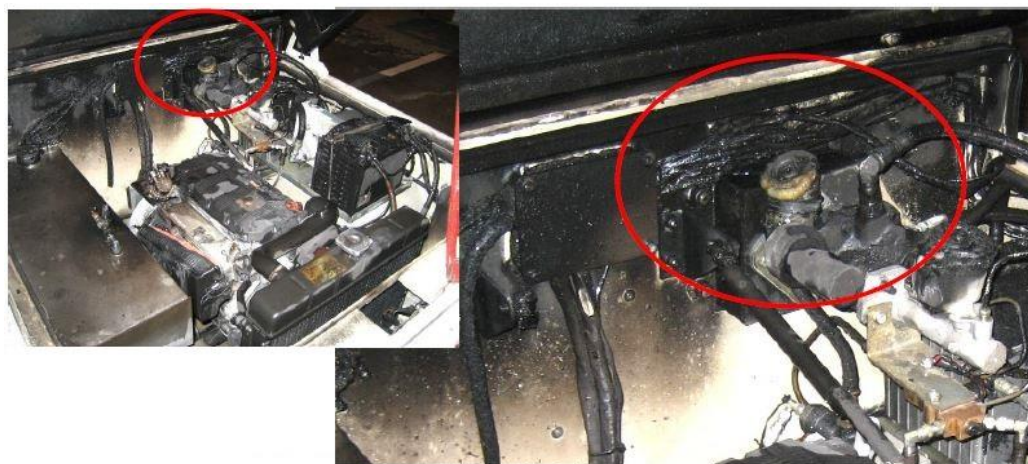
## 9.2 空側車輛安全檢查：

### 1. 案例研討：

機場內活動車輛數量眾多，多數為特種車輛，每日使用時間長，若維修管理不善，容易導致各類事故發生，尤其在炎熱氣候下，裝備車輛散熱不良，易導致引擎過熱。



2009 年 8 月樟宜機場車輛之空氣過濾器過熱導致車輛燒毀



絕緣電線熔化導致拖車引擎起火





2014 年 6 月樟宜機場電源車電源短路引起火災

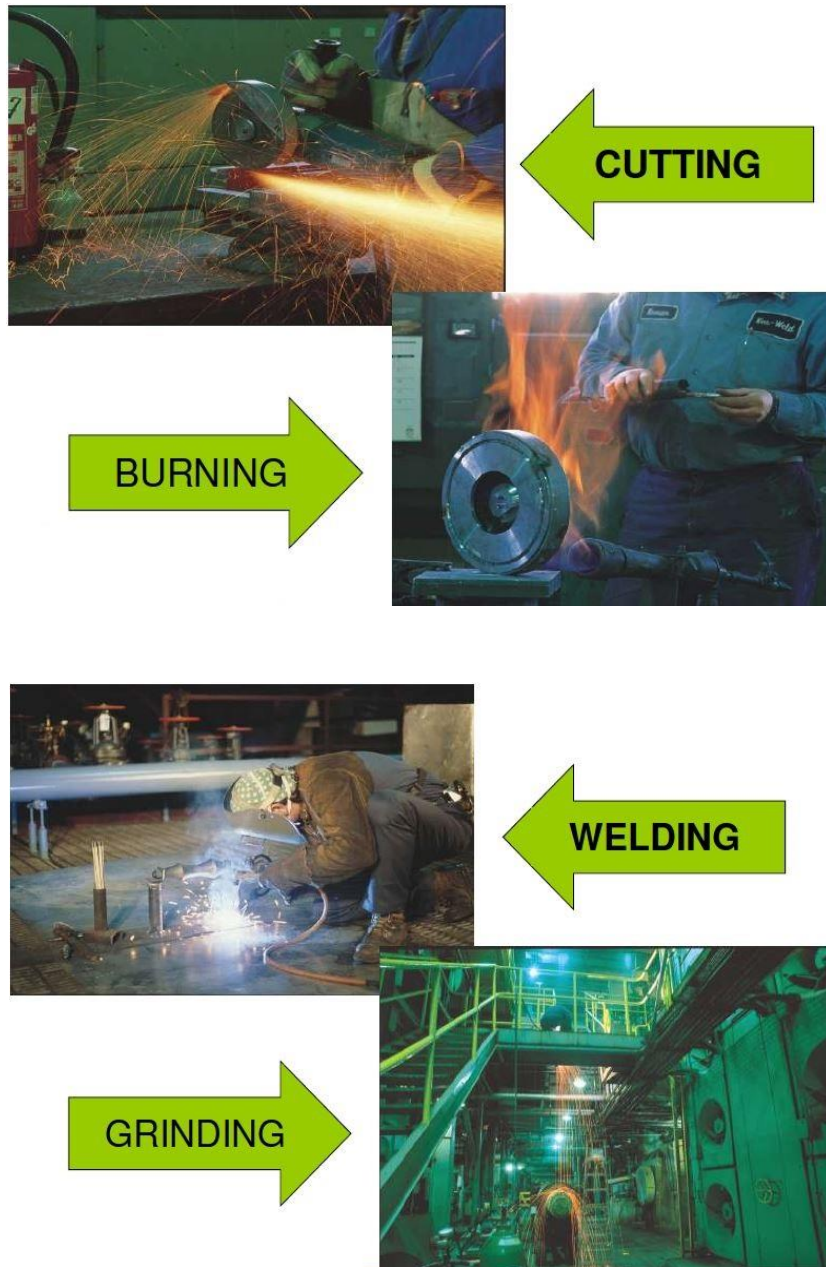
## 2. 改善對策：

除了車證申請及定期更新查核以外，樟宜機場的車輛檢查由消防隊與空側管理單位組成聯合查核小組做突擊檢查，且進一步將更專業的車輛安全檢查項目外包，以確保場內車輛安全性無虞。



### 9.3 高溫作業 (Hot Works) :

1. 不論切割、鍛造、焊接或鑽孔皆可能產生火花：





2. 高溫作業申請：  
如圖示，樟宜機場採電子化申請。

**CHANGI**  
airport group

**Airport Emergency Service**  
Hot Works Permit Online Applications

For non-electronic applications form, please download [here](#) and fax the completed form to 6545 7072 (Fire Safety Unit).

You will need to have Adobe Acrobat Reader to view the application form.

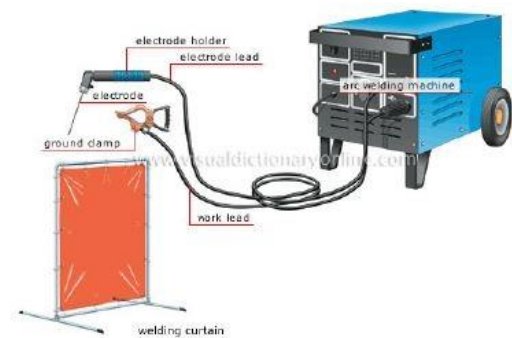
1. This form may takes you 5 minutes to fill in.
2. You will need the following information to fill in the form.
  - 1) CAG Fire Safety Manual.
  - 2) Singapore Standard S5510, Code of Practice for Safety in Welding and Cutting (and other operations involving the use of heat).
  - 3) Fire Patrolter's (SAA Trained) Name, NRIC/FIN No, Date of issue.
3. Please ensure that all fields marked with an asterisk (\*) are to be filled up.
4. Thank you.

**Part 1: To be filled by Applicant**  
(To be submitted at least 3 clear working days before the request date of Hot Work. Allowable Hot Work timings: Mon-Fri, 0830Hrs-1700Hrs. No Hot Work on weekends and Public Holidays.)

|               |                      |                     |                      |
|---------------|----------------------|---------------------|----------------------|
| *Name         | <input type="text"/> | *Office No.         | <input type="text"/> |
| *NRIC/FIN No. | <input type="text"/> | *Urgent Contact No. | <input type="text"/> |
| Designation   | <input type="text"/> | Fax No.             | <input type="text"/> |

changi airport | changi airport international | terms of use | contact us | useful links | site map  
© copyright 2011 the changi airport group. all rights reserved.

3. 高溫作業規範：  
施工地點必備滅火器，施工人員於作業時需著安全服裝(如護目鏡)，  
放置隔簾避免火花四濺





氧氣鋼瓶等必須與熱源保持一定距離，立式擺放，且用鐵鍊綁住避免傾倒，



氧氣鋼瓶等需裝設回火防止器



未裝置回火防止器導致氧氣鋼瓶燒毀

#### 9.4 消防演習

如圖，消防演習的實施地點涵蓋空側與陸側，參與演習的對象擴展至施工人員，有明顯的火災時集合點指示牌，讓未參加演習的工作人員或民眾在平時就可以明顯目視到，遭遇緊急情況時就可以有序的進行疏散作業，避免慌張失措造成二次傷害。



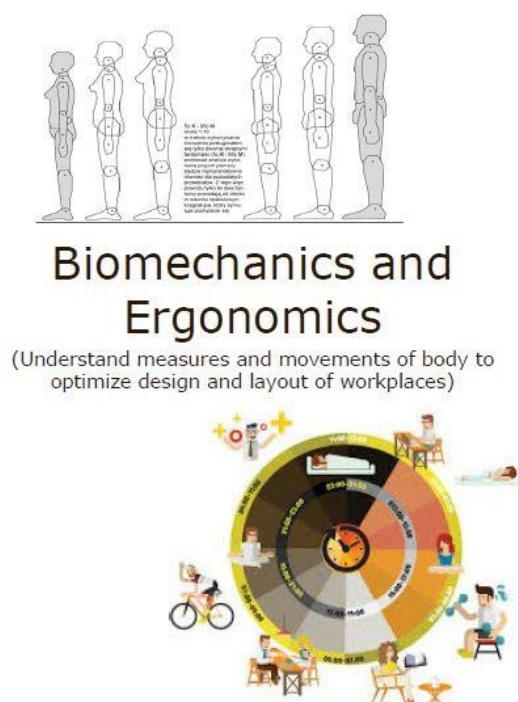


## 10. 人為因素與安全文化概要

### Human Factors and Safety Culture

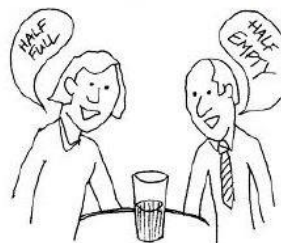
#### 10.1 人為因素研究

在航空業運作中為最具彈性、適應性及最有價值的元素是人，但人也最容易受到各種影響而降低工作表現，諸如身體狀況、藥物、態度、個性、決策過程、記憶、壓力、疲勞等等。



#### Psychology and Physiology

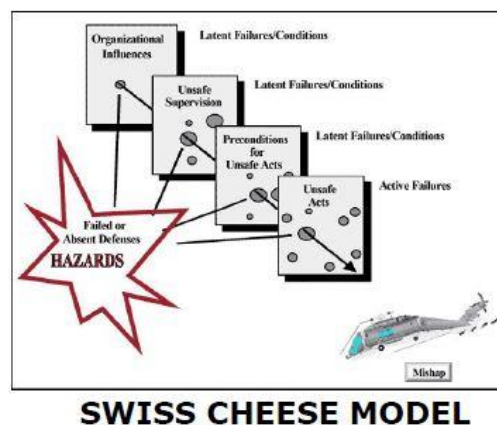
(Detect and transmit information)



#### Biology / chronobiology

(Understand nature of body rhythms and sleep and effects on shift work, etc.)

許多分析意外事件成因的研究模型都認為人為因素是導致意外事件、重要的防呆機制或是從危害狀況中復原的重要因素。



## 10.2 人為因素失效類型

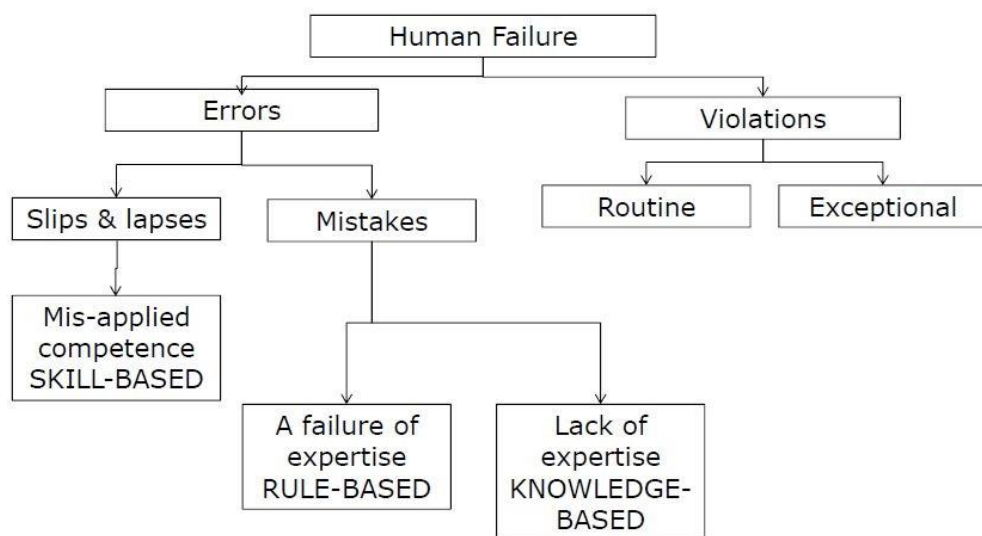
人為因素失效類型主要有下列兩類，了解人為因素失效類型有助於找到錯誤發生的原因，進而避免將來再犯。

### 1. 錯誤：

錯誤的成因為非蓄意為之的行動導致的，分別為技術面的誤失，如不佳的控制面板設計(人與硬體)、身體受生理時鐘影響(人與環境)或看起來眼花撩亂的技術文件(人與軟體)；以及專業能力不足導致的錯誤，如對規範的不熟悉。

### 2. 違反規定：

蓄意違反規定的原因可能是有犯罪意圖或故意搞破壞，或是明知不可為而為之，如超速；或即使相關規範、警示與提醒已充分提供，仍不遵守規範抄近路走捷徑以求準時完工，不考慮因此可能產生的後果。

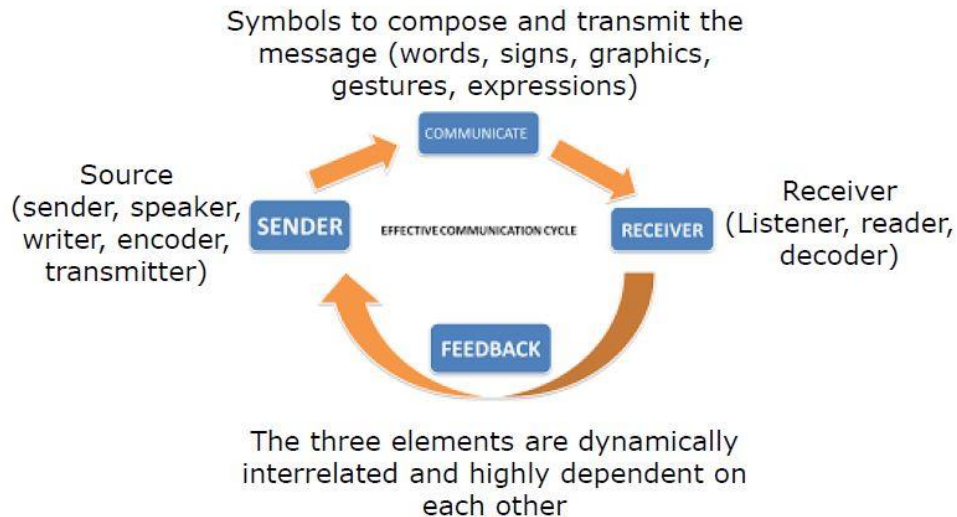


**Classification of Human Failure**  
*Adapted from James Reason 1990*



### 10.3 有效溝通降低人為因素影響

許多因素都會降低溝通的效率或正確性，例如由於共同經驗的缺乏、訊息傳遞過程中受到干擾或過度揣測而導致互相理解錯誤，藉由運用各種傾聽和問問題的技巧來確認彼此認知是否一致，以達到有效溝通減低人為因素所造成的影響。



### 10.4 控制人為錯誤的方式

1. 減少錯誤發生的可能性
  - 1.) 確保高水平的工作能力
  - 2.) 提供適當的檢核表、操作流程及手冊
  - 3.) 降低環境噪音、震動、極端溫度以及其他嚴苛的環境條件
  - 4.) 導入教育計畫以提高團隊合作和溝通效率
2. 降低錯誤發生的後果
  - 1.) 導入監控儀器提升人員工作表現
  - 2.) 將操作流程設計成當錯誤被發現時，其不良結果為可被逆轉的，例如事後的檢驗或交叉檢核。

### 10.5 應用人為因素提昇安全

1. 訊息簡單易讀
2. 指令單純化 (說白話，減少聽起來高深的專業術語)
3. 運用簡易的工具
4. 使用障礙物(如反光安全錐)

## 10.6 安全文化

### 1. 安全文化涵蓋：

#### 1.) 訊息文化：

藉由內部和外部查核及保密的安全事件通報，相關單位蒐集並分析資料以便隨時掌握該機關的安全體質。

#### 2.) 通報文化：

高階管理階層許諾保護提供安全事件或危害的通報人員個資且不會對通報人員做出紀律處份。

#### 3.) 公平文化：

員工了解他們必須對自己的行為負責，也會被公平的對待。

### 2. 安全的要素

#### 1.) 每個員工都要有安全的重要性之意識

#### 2.) 透過教育訓練、通告的發佈或自學以便具備足夠的安全能力與知識

#### 3.) 安全應該是高階管理階層及每位員工的共同目標

#### 4.) 透過目標管理或獎勵制度影響員工態度或激勵員工表現

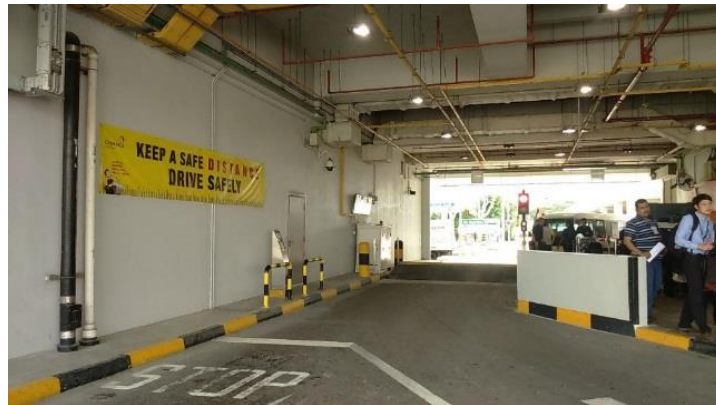
#### 5.) 管理的技巧包含查核、實地考察及提問的態度等

#### 6.) 藉由任務的正式派遣及清楚的職務責任描述以便明確規範每個人所應負的責任

## 肆、建議事項

此次參與新加坡民航學院舉辦的停機坪安全管理課程，雖然規範類的內容在民航局航訓所「新進航務人員專業資格訓練」或航務員複訓已有學習和接觸過，新加坡民航學院的授課講師們在工作範圍的專業程度，對工作抱持的熱誠及實事求是和精益求精的態度令人印象深刻。茲將參考新加坡經驗提出淺見如下：

1. 樟宜機場隨處可見各式安全相關海報或布條以隨時提醒空側工作人員注意相關安全規定，可作參考。
  - 1.) 保持距離安全駕駛(Keep A Safe Distance Drive Safely)：  
於管制哨口懸掛安全提示布條。



- 2.) 張貼相關緊急事件之聯絡電話，如火災和航機漏油事件聯絡機場應急部門(指消防隊)、意外及事故或設備故障聯絡樟宜機場空側管理中心，另宣導 SMS 危害通報可以使用網頁及電子郵件，事故通報打電話向機場空側管制中心、空側管理中心、機場應急部門、緊急醫療熱線或機場警察通報。



## SAFETY REPORTING

### Hazard Reporting

Open reporting is a habit we want to cultivate because it helps us identify potential dangers and mitigate them. It is non-punitive and report details are kept confidential. Tell us what you see and help make our airside a safer place to be.

**File a hazard report to:**  
[www.changiairportgroup.com](http://www.changiairportgroup.com)  
via e-services -> Hazard Reporting Application

**Email a hazard report to:**  
[changi.safety@changiairport.com](mailto:changi.safety@changiairport.com)

Your contributions are important! Help us identify hazards in the airport and stand a chance to receive Changi vouchers for reporting to us. Terms and conditions apply.

For hazards requiring immediate attention, call:  
**Fault Management Centre 6541 2424**

### Incident Reporting

The following numbers are useful in an emergency in the event an accident or incident has occurred:

|                                  |                                      |
|----------------------------------|--------------------------------------|
| <b>Airside Control Centre</b>    | <b>6541 2257</b><br><b>6541 2258</b> |
| <b>Airside Management Centre</b> | <b>6541 2273</b><br><b>6541 2275</b> |
| <b>Airport Emergency Service</b> | <b>6541 2525</b>                     |
| <b>Medical Emergency Hotline</b> | <b>6543 2223</b>                     |
| <b>Airport Police</b>            | <b>6546 0000</b>                     |

- 樟宜機場對於照顧並提供更安全的作業環境予地勤工作人員不遺餘力，如升降機之設置亦可作為參考。透過如圖示之升降貨梯、溜滑梯等，貨梯可將沉重的工具由地面運送至航機艙門，或由溜滑梯將航機上清運下待丟棄之垃圾快速送抵地面，不僅降低工作人員體力之負荷，亦可減少工作人員長時間暴露於風吹、日曬、雨淋等嚴苛的工作環境中。

## Dumbwaiters



3. 樟宜機場於交通道設置固定式測速機(如下圖示)，車輛駕駛人行經該區之車速會顯示在圖中 LED 指示板上(新加坡為右駕，當時該區無車輛經過因此指示牌無速度顯示)，旁邊並有指示牌提醒駕駛減速以及該區之車速上限，以便空側駕駛人員隨時注意車行速度，有效提升空側交通安全。



航空器於到場後及離場前，各式各樣活動在停機坪及其附近區域同時進行，停機坪的安全作業有賴每位地面作業人員遵守作業規範並隨時注意是否有異常狀況，然而單靠作業人員自覺及作業單位自主管理顯然是不足的，而且地面作業人員也非僅侷限於地勤單位人員，更應擴及執行維護及保養單位之作業人員及其外包人員，以上各單位需由其主管或監管組室於平日嚴格執法，並針對重要且影響安全作業之項目進行深入式查核。

本站空側已有針對地勤作業之查核，囿於人力編制及其他相關配套，查核內容及方式無法如樟宜機場全面，建議可以在目前查核基礎上建立查核制度及查核資料庫，以便進一步依照安全管理系統(SMS)之精神與原則，針對風險及危害導入解決對策，進而降低地勤或維護保養作業造成之風險及危害。



飛航安全及地面安全工作繁雜，需要團隊內成員通力合作，並與其他單位相互溝通協調，才能圓滿達成各項任務，再次感謝民航局提供這個寶貴的機會，讓我能到新加坡受訓，向世界最佳機場的樟宜機場學習，希望民航局在許可的狀況下能多提供名額，以便更多優秀人才能有機會出國學習，回國於服務單位貢獻所學。

## 附錄

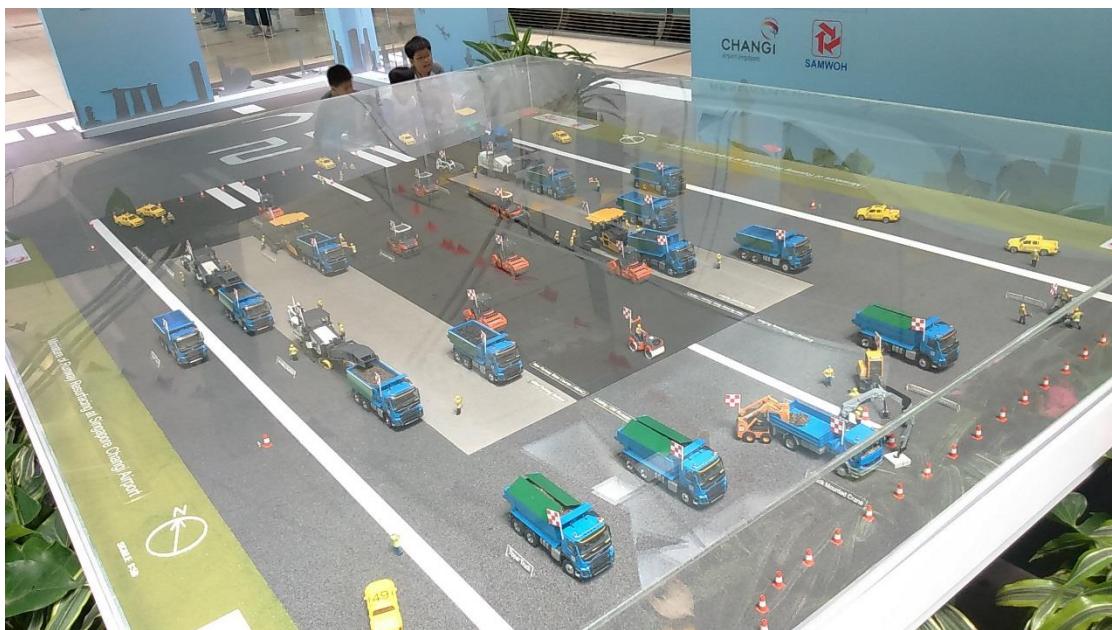
### ● 樟宜機場觀景台介紹



觀景台地景為模擬跑道意象

本頁上圖為跑道頭的鋼琴線，本頁下圖顯式跑道名稱及跑道中心線

- 跑道重建工程介紹 (Resurfacing Our Runways)



觀景區中島設置維妙維肖的模型，模擬跑道施工作業



## ● 機場跑道 vs 車行道 (Runways vs Roadways)



專區介紹各種鋪設跑道和車行道所使用的建材差異及其優缺點 (內文：跑道與車行道也許表面看起來沒有什麼不同，其實主要的差別在鋪疊的層次多寡不同、每層的厚度不同、使用材料亦不盡相同)



用實際材料輔以圖示及量尺，清楚顯示出跑道與車行道各層鋪設厚度及使用材料



- 空側作業介紹 (Airside Operations)

## AIRSIDE OPERATIONS

13

Grass around the aircraft movement areas has to be kept at an optimal height of 10cm, because this height has been proven to be the least desirable for most birds found in Singapore. Anything higher provides a nice 'cushion' for birds, whilst anything shorter has less obstructions, making it easier for birds to land.

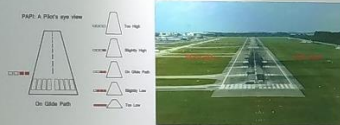
14

Foreign Object Debris (FOD) refers to any substance or debris found on the active areas of an airport (e.g. the runway) and can spell bad news for an aircraft. Typical FOD includes stones, dead animals, plastic wrapping or even liquids such as oils and lubricants.

15

Whether its fresh fish from Tsukiji Market or tulips from Holland, it comes through SATS Coolport@Changi and dnata Coolchain, our on-airport perishables handling centres. This allows us to enjoy the freshest delights from around the world.

18



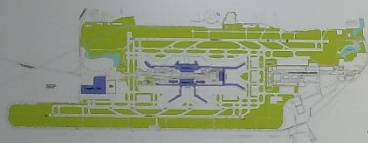
Precision Approach Path Indicator (PAPI) lights on the side of the runway help to guide pilots when landing. Each of the four lights is mounted at a different angle and shows a different colour. Two red and two white lights mean the pilot is on the right height and path to land the plane safely.

19



Pilots parking an aircraft are assisted by an Advanced Visual Docking Guidance System (A-VDGS), which provides information on its position based on aircraft type.

16



Do you know that the total size of Changi Airport is 1,300 hectares, or the equivalent of 1,800 football fields?

17



Don't worry, those spikes you see aren't weapons. They are anti-perching devices installed on all railings and lights to deter birds from coming into the aircraft movement areas.

● 樟宜機場空側實地參訪

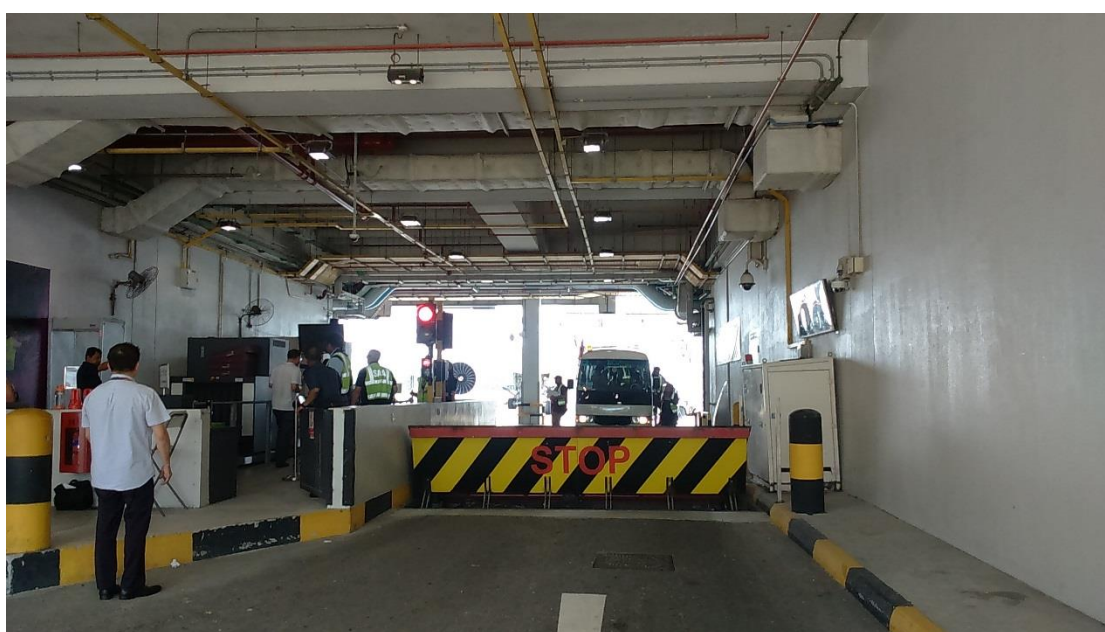
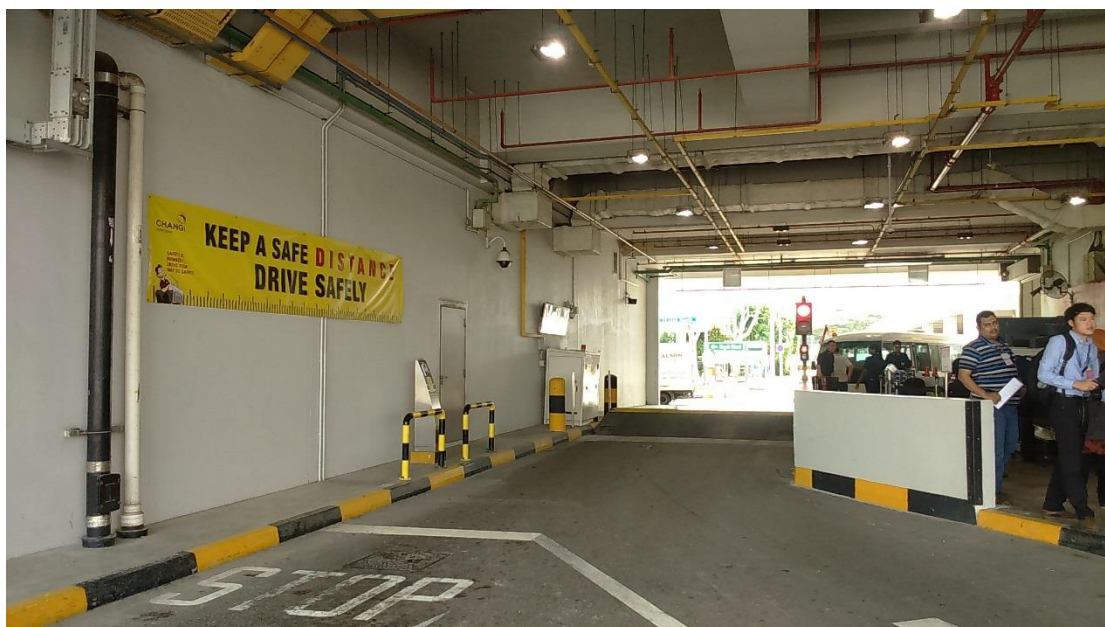


實地參訪 -1



實地參訪 -2





機場管制區出入口安檢

- 結業證書



S I N G A P O R E   A V I A T I O N   A C A D E M Y

This certificate is presented to

**Lee, Hsiao-Ling**

for having participated in the

Airport Ramp Safety Course

30 November 2015 to 4 December 2015

Director (Singapore Aviation Academy)  
Civil Aviation Authority of Singapore

Director-General  
Civil Aviation Authority of Singapore