

出國報告（出國類別：實習）

參加國際航空運輸協會 (IATA)  
「航網、機隊及班表規劃  
(Network, Fleet and Schedule  
Planning)」課程報告

服務機關：交通部民用航空局

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# 摘要

因一家航空公司的航線策略決定於航空公司未來的經營方向，在考量公司經營之商業模式(低成本航空或全服務航空)並決定策略後，後續就需要針對航網、機隊及班表等三個項目進行規劃作業，且規劃就像是一套日復一日、永無止息循環的動作，每個週期進行檢討規劃作業及修正後執行，使公司能永續經營。

航空公司之航網是航線組成，航網規劃主要是決定服務市場(航線的起、迄點城市)、航線的班次數及需要提供多少座位數(乘客需求)，另瞭解航網的形式有助於綜合考量各項限制條件下，創造最大的利益。

機隊規劃係提供適當之容量，滿足航網規劃時預測之旅客需求，航空公司之機隊規劃通常會分為 5 年、2 年及現況之規劃，甚至亦會有長達 10 年之規劃。而航空公司之商業模式(低成本航空或全服務航空)亦是決定規劃機隊時之重要條件。

班表規劃是一套決定將哪一架航空器分配飛航到什麼航線、什麼時候起飛，並訂定航班編號之過程。班表規劃需保持一定彈性，在綜合考量地停時間等因素下，使航機利用率最大化，計算出運能並設定服務航班班次。

最後我們透過講師設計之 Flamingo Airlines 問題，模擬進行航網、機隊及班表規劃之程序；另考量可在現況穩定發展後，規劃未來新增之航線，及提出可能遇到之風險及可緩解之措施，透過此項習題研究，讓我們可以快速地複習課程所學到的各種知識。

關鍵詞：航網(Network)、機隊(Fleet)、班表規劃(Schedule planning)

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# 授課講師與課程學員介紹

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學員：本次課程學員多來自航空公司派訓人員，包含中東的 Emirates Airways、Etihad Airways 及 Kuwait Airways 各一人、中亞的 Air Astana 兩人、歐洲的 LOT Polish Airlines 一人等，另有一名學員服務於飛機製造商 Airbus，以及本局派訓賴員一人，共 8 人。

## 目的

鑑於航空公司受國際經濟、油價、航空政策、地緣政治及 Covid-19 疫情等外部環境因素影響顯著，且未來仍有 2050 淨零排放之挑戰，經營環境日趨多變複雜；另近 3 年國內有星宇航空展開營運，使我國空運市場競爭更形激烈。民航局為管理機關，對航空公司營運能力及運能安排合理性等須有一定程度瞭解，爰派員參訓國際航空運輸協會訓練中心辦理「航網、機隊與班表規劃」之課程，希望能藉由課程瞭解空運市場需求與供給、航空公司考量之成本及營運能力、班表設計與規劃、客運航線與航網策略之規劃、機隊規劃及管理，除增加業務相關專業知能外，並期能有助於航空公司輔導管理及擬定航空產業發展策略，提升我國民用航空競爭力及促進發展。

# 過程：課程內容

## 一、 參考資料

### (一) 航權(Freedoms of the Sky)

1. 第一航權：不降落而直接飛越地主國領空至第三國之權利。



2. 第二航權：以非營運之目的（如：加油或維修等）而降落地主國的權利，又稱技術降落權。

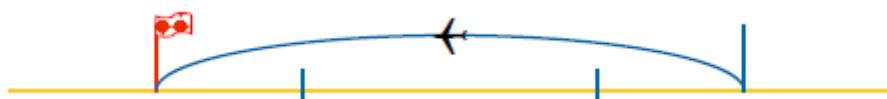


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3. 第三航權：本國航空公司於地主國卸載客、貨、郵之權利，又稱卸載權。



4. 第四航權：本國航空公司於地主國載運客、貨、郵，飛回本國之權利，又稱裝載權。





5. 第五航權：地主國授予本國航空公司可於地主國卸載來自第三國或裝載前往第三國客、貨、郵之權利，又稱第三國經營權，且該航線之啟程點及終點均在本國航空公司的權利。過往航空公司喜歡擁有第五航權，不過因為現今飛機性能提升且更為省油，航線幾乎以直飛為主；另地主國至第三國間之票價通常較該兩國業者票價為低，方有競爭性，故通常利潤不高，航空公司必須分析各航段需求，以及考量票價、旅客便利性等因素，審慎評估第五航權之效益。



6. 第六航權：航空公司以本國為基礎，於其他兩國間載運客、貨、郵之權利，換句話說就是結合第三航權及第四航權。近來新興的中東國家的航空公司像是阿聯酋、卡達航空，或是新加坡航空及荷蘭航空等都是利用第六航權的最佳代表。於本國無足夠點對點之旅運需求狀況下，藉由樞紐機場（Hub）的功能，結合各地之運輸轉運。



7. 第七航權：在本國以外之地主國建立營運中心調度機隊，載運地主國與其他國家間客、貨、郵之權利，又稱境外營運權。



(Base)

8. 第八航權：我國航空公司自我國飛往地主國，並於地主國國境內兩點間載運境內客、貨、郵之權利，又稱延伸的境內營運權。

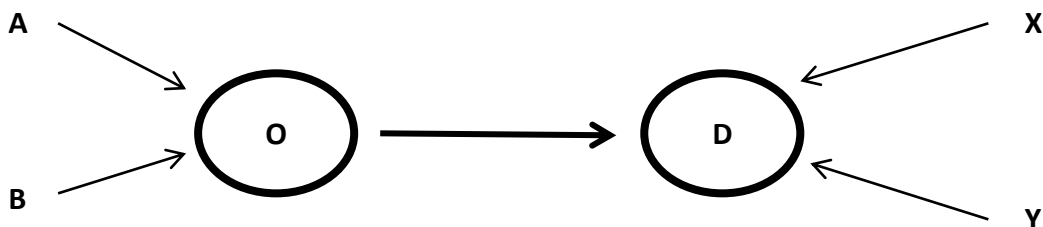


9. 第九航權：我國航空公司載運地主國領域內兩點間之客、貨、郵之權利，又稱獨立的境內營運權，換句話說就是地主國的國內航線。



## (二) 交通流 (Traffic Flows)

交通流是指一段時間內在一個區域內移動的車輛或行人流量及分佈狀況，在航空領域中，一段航線中的旅客會各自有不同的起訖點，因此要衡量整個交通流需求除了來自該航線起訖點之旅客需求外，與該航線有關之其他可能需求(如 A、B、X 及 Y 地的需求)亦須一併考量。



## (三) Block Time

1. 表示航空器自地面開始滑行後，經歷爬升、高空巡航、降落，最後滑行至空橋停靠所花費之時間。
2. Block Time 會受天候狀況、航管、空中交通、季節、風向、機場的宵禁及養護時間等因素影響，它對於班表規劃、轉機安排、旅客感受之服務品質、機場時間帶的掌握、航班準點率等皆有不小的影響，因此該時間成為航班之班表規劃需考量之重要因素。
3. 不同的航空公司因營運、機場地面服務、季節等原因，就算是飛航同一航線，Block Time 也會有所不同。

## 二、 航空公司的策略及規劃

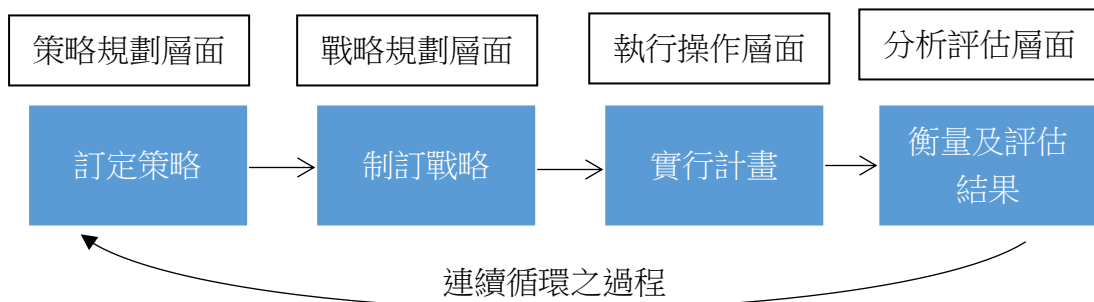
一家航空公司的航線策略會決定於這家航空公司未來的經營方向以及能否永續經營，因此往往公司在基於研究後或預設之商業模式下，會訂定出不同之策略。

航空公司策略主要分為三大部分：

- (一) 公司之商品策略：可細分為航網、班表、顧客之搭乘體驗。
- (二) 公司之資源策略：可再細分為機隊、機組員之安排及配置。
- (三) 公司之收益策略：主要可分為票價及行銷兩方面。

在航空公司決定策略後，接下來需著手進行的即是規劃。本次課程主要圍繞在航網、機隊及班表等三個項目，說明須考量之因素及如何進行規劃。

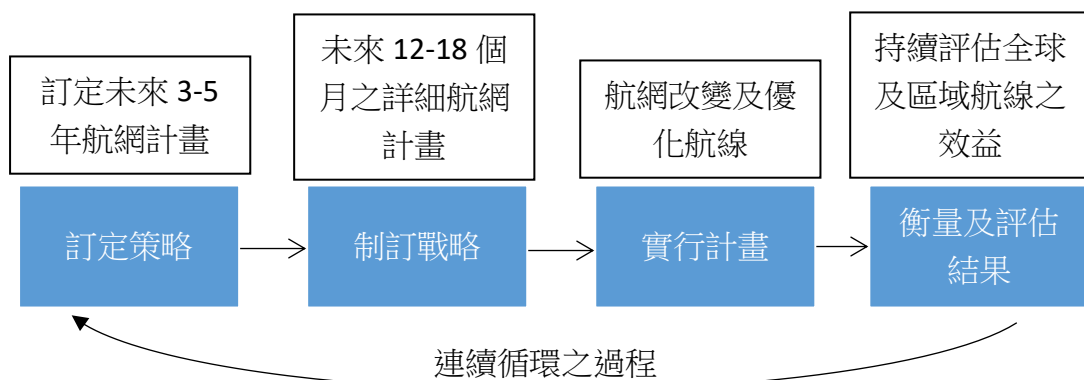
規劃就像是一個永無止息循環的圓圈，必須日復一日地進行檢討及執行，以配合世界局勢及環境的變化，進而讓公司能永續經營，商業規劃的循環如下所示：



### 三、 航網規劃

航空公司之航網是由許多營運的航線組成，因此航網規劃主要是決定航線的起、迄點城市、航線的班次數及需要提供多少的位置(乘客需求)，且因公司之資源有限，需綜合考量各項限制條件下，創造最大的利益。

套用商業規劃的循環圓圈，我們可將航網規劃各階段重點製作為下圖：



雖然航空公司在航網規劃時會持續訂定策略，但有幾個重要的時機點，當下計畫之策略可迎來重要的改變：

- (一) 航空公司剛成立時。
- (二) 新航線的開航。
- (三) 航班時間、班次數及提供之座位數改變。
- (四) 公司組成之機隊改變。

- (五) 與其他航空公司合作(共掛班號)及加入航空聯盟。
- (六) 其他競爭航空公司的出現。

在瞭解各階段規劃重點之後，我們就可來說明航網規劃的步驟，大致的程序如下：

- (一) 評估市場之需求：須考量交通流及市場之市佔率，並預測未來之成長性；另外根據既有之營運資料，我們可以知道每航班之載客率(load factor)、航班架次及提供座位數、每航班損益兩平及收益等資料，都可做為瞭解現況航網之優勢或弱點之根據。
- (二) 瞭解航線分析的關鍵組成因子：有航權、機場之時間帶限制、旅客需求、目前航班數及提供容量、當地之經濟條件、運量季節性之變化、班表及航網等相關因素，且須特別注意的是，在沒有取得機場之時間帶狀況下，就無法有任何航段飛行。
- (三) 預測市場之大小及成長性：由 IATA 或其他像是政府管道、銷售資料等來源取得各種客運量資料，並對於未來市場做出長達 3 年之預估。要注意的是，開拓新航線可能會帶來使整個航網取得更大之利益之機會。
- (四) 產出航網及航班時刻表並執行：在預測市場未來需求後，須以公司現有之機隊調度與維修狀態衡量各航空器可使用之最大效益，並綜合考量班表規劃需有彈性、執行班表須消耗之成本等因素下，產生航網之航線以及班表去執行，並一一檢討各航線之績效；另外，在像 COVID-19 等全球性影響世界各航空公司營運之重要因素下，對於航網及班表需更加的具有彈性，以適應全球迅速變遷的環境。

航空公司在瞭解及預測未來客運需求後，需依據需求規劃航網之航線，而在規劃航網方面，可將航網大致分成 3 種類型：

- (一) 線型：兩城市間直接連接之航線，有可能是線型、圓形或是三角形，且有先後順序，例如國際貨運航線。

- (二) 樞紐機場及輻射航網：是由一個主要之樞紐機場及連接其他機場之形式，主要之國際航線由樞紐機場負責，區域或是國內線則採轉運之方式連接至樞紐機場。採用樞紐機場營運之方式，可使營運航線最有效率。
- (三) 網狀：兩兩城市間皆有直接連接之航線，航網形式類似網子形狀。



至於為何樞紐形式之航網會是最有效率的呢？我們以下圖說明：



當有 5 個城市做為配對航線之起、迄點，若是以點對點之方式設計航網，則共需要 10 條航線及較小型之航空器來滿足各航線之需求；但若是以樞紐機場之方式設計航網，則僅需要 4 條航線且可以較大型之航空器營運來滿足旅客需求。對於一家航空公司來說，此種方式將會使每航班載客率高、成本亦較低，且可採行之航線策略較多(舉例來說，可將運能擴充連結至其他機場)，而在售票系統方面亦能以較簡略之方式讓顧客瞭解。

而做為一個良好的樞紐機場，必須要有以下特點：

- (一) 能滿足當地強烈之市場需求，且當地市場需求約要佔有 40-50%。
- (二) 當地及該國家之經濟狀況良好，且經濟行為旺盛。
- (三) 樞紐機場位於該區域地理位置中合適地點，且天氣穩定適合起降，並和許多其他高需求之樞紐機場連結。
- (四) 機場之跑道、候機室、航廈、安檢、服務時間、時間帶及地勤能量等條件足夠，且航廈內步行距離短，並提供像是貴賓室、免稅商店、餐廳等附屬設施，可使旅客體驗感到舒適。
- (五) 轉機時間及動線適當，並提供便利之轉機設施，標誌引導系統能清晰易讀，使旅客能輕易找到想要之設施及服務。
- (六) 電力、行李分類系統等皆須備有備援系統。
- (七) 軟體方面皆能訓練紮實，提供良好之服務素質。

另外 1 間航空公司航線不一定僅有 1 種航網形式，以泰國航空為例，它是一間以曼谷蘇凡納布國際機場為樞紐機場運作之航空公司，但因為普吉島的旅遊需求旺盛，亦有該地直飛其他城市及 BKK 之航線，因而形成網狀航線。航空公司之商業模式亦有適合之航網規劃，像是中華航空此類之全服務航空公司(full service carrier)，航網規劃係以樞紐形式之航網為主，機隊會有因應航線距離及需搭載乘客數而有不同類型之航空器；另外像是低成本航空公司(low cost carrier)則會以網狀形式為主，機隊部分亦是採單一機型之方式組成。

#### 四、 機隊規劃

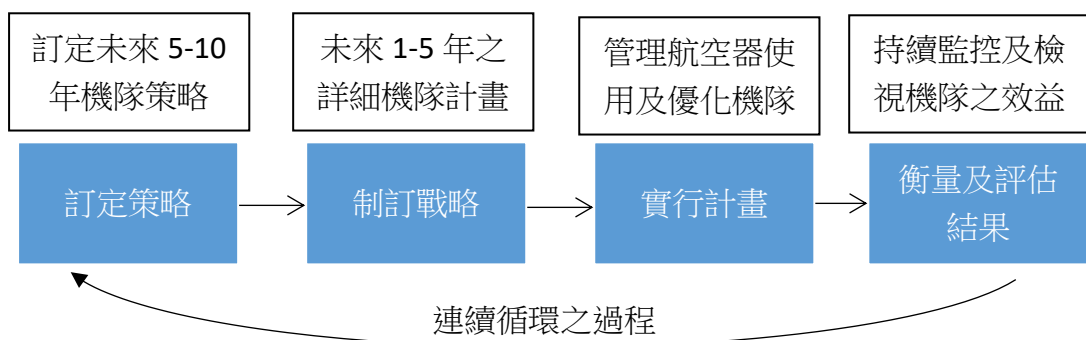
機隊規劃係為了提供適當之容量，以滿足航網規劃時預測之旅客需求，因此，要完成航網規劃後才會規劃機隊。而一般來說，航空公司之機隊規劃通常會分為 5 年、2 年及現況之規劃，但也可能因為航空器製造商研發新機型或訂單排程之關係而影響交機時間，航空公司亦會有長達 10 年之規劃。

根據航網規劃之策略，我們在機隊規劃該做什麼事呢？可以區分幾個項目來

思考：

- (一) 航空公司的商業模式：像是採全服務航空公司，或是低成本航空公司。
- (二) 航網規劃而產出的產品－航線：需衡量每一航線所配對城市之需求。
- (三) 每條航線及使用機隊類型可產生之收益。
- (四) 公司本身之成本結構。
- (五) 與其他競爭航空公司之優勢及弱勢所在。

我們可套用商業規劃的循環圓圈，可將機隊規劃各階段重點製作為下圖：



機隊規劃需考量未來市場發展、航空器之售價、租賃價格及殘餘價值，並綜合考量製造商訂單多寡及交機時間，因此上述因素皆會影響機隊策略之制定。機隊規劃需考慮一般之因素如下：

- (一) 航空器載重及所能乘載之座位數及貨運容量。
- (二) 實際營運之限制：像是機場跑道長短及容量、維修能量及人力評估、機組員配置等問題，且更有可能因為與航空器製造國間政治或商業之考量，而購買某國之航空器。
- (三) 經濟效益及財務操作：需評估以購機、租機或附條件買賣方式來取得航空器使用權，且製造國能否提供優惠利率或融資銀行的協助；另外為滿足單位成本及單位收益的目標，亦需納入考量是否以較高費用購買較省油之航空器。
- (四) 航空器及零組件取得之難易度：像是航空器製造商之交機時間、零組件是



否持續生產等因素。

- (五) 機隊之共通性：機隊中若大部分航空器為同一製造商製造，在電子設備、引擎方面之保養及維修將能更有效率，另外機組員之配置亦可以互相支援。根據以往營運資料及經驗，同機型之機隊數量越多，每架航空器每年之營運成本亦降隨之降低。

另外航空公司因為汰換機隊，亦是引進新航空器的原因，而汰換機隊需考量因素如下：

- (一) 機隊營運成本過高(此處不含所有權成本)，且仍需考量汰換後新增之所有權成本是否會超過減少的營運成本。
- (二) 航空器之噪音及碳排放量已不符法令限制。
- (三) 機齡老舊已超過公司政策。
- (四) 載客率的影響，例如 Covid-19 的關係，使得各航線需求及載客率大幅下降，各航空公司紛紛汰換空中巴士製造之 A380。
- (五) 機隊汰舊換新以降低整體維修成本。
- (六) 為滿足市場及旅客需求，更新機型來拓展市場及滿足另外之潛在需求。

另外因商業模式的不同，低成本航空與全服務航空公司對於機隊規劃也會有很不一樣的想法：

- (一) 低成本航空公司：主要航網為點對點或網狀航線，且不提供機上服務，於短程航線營運上有其優勢，且考量收入最大化及成本最小化，在增加載客數、減少維修、機組員派遣方便及降低訓練成本之考量下，使得機隊規劃特性如下：

1. 機隊為單一航空器類型。
2. 基本上為單走道航空器。
3. 為增加載客率，座位數密度高且為單一艙等之服務。
4. 航空器的使用率較高。

5. 考量飛機燃油效率問題，航空器之座椅會選用輕量材質，且會移除不影響安全之設施(如：插座)，來提高航機燃油效率。

(二) 全服務航空公司：基本係以樞紐機場之輻射型網絡提供服務，因此長程與短程航線皆需考量，機隊規劃特性如下：

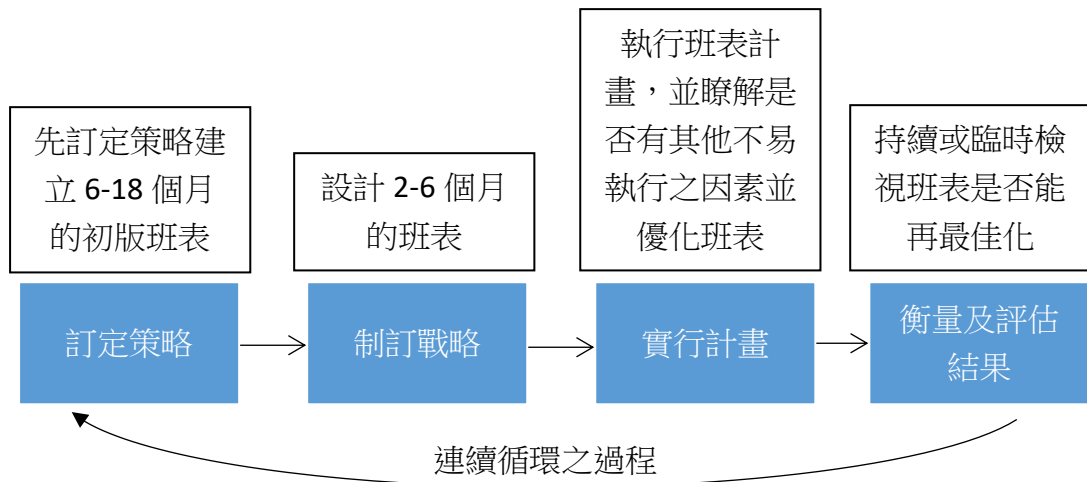
1. 因應不同市場需求，機隊之航空器機型較多。
2. 另為因應不同乘客及航線需求，單一走道及雙走道機型皆需考量。
3. 座位數密度及乘坐感覺均較低成本航空公司優異，並會配置多種艙等。

## 五、 班表規劃

班表規劃是將機隊中之每一型航空器分配到航線上，並安排它於幾時起飛、飛航航路為何、飛航時間需花費多久，且為每趟航班編制一個航班編號的一套程序。班表規劃需保持彈性，並在考量航機利用率最大化、兼顧足夠的地停時間、進行維修作業所需時間、以及營運成本等因素下進行規劃。班表規劃程序大致說明如下：

- (一) 必須先瞭解公司的商業模式是什麼，例如像是全服務航空或是低成本航空。
- (二) 根據公司航網需要，建立主要的城市配對及航線，而此部分就是做為一家航空公司主要銷售予旅客之商品。
- (三) 確認每條航線之收益及成本，並隨營運時間分析每一階段之成本及收益，已規劃較佳之班表時間。
- (四) 每次分析亦需跟其他競爭航線或公司比較，瞭解現況之優勢及弱勢為何，並可時時檢討改善。

我們可套用商業規劃的循環圓圈，可將機隊規劃各階段重點製作為下圖：



另外在既有航網改變，或是想再優化或改變班表，則可依上述班表規劃程序重新產出新班表並執行。而如何建立初版的班表，大致的程序如下：

- (一) 設定機隊中航空器之 Block Time 及推估最小地停時間( turnaround time)。
- (二) 推估各航班間所需之轉機時間。
- (三) 依照航網、機場限制、轉機時間及航空器等條件，分配適當之航班。
- (四) 依照每架航空器之維修期程及時間，在規劃班表時應粗略將該時間考慮進班表計畫中。
- (五) 每版本的班表計畫需考量是否對機組員之影響，並持續尋求班表優化的機會，以致產出最優之班表後開始銷售機票。

至於班表規劃會面對什麼樣的挑戰呢？我們可以分為幾樣項目說明如下：

- (一) 每日及各時段需求變化不盡相同，該如何設計一個好班表則是其中一個挑戰。
- (二) 機場允許起降之時間帶。
- (三) 為便利轉機客能用最短時間並順利銜接下一航班，轉機時間的考量也是一種挑戰。

(四) 機場的開放及關閉時間。

(五) 挑戰往往不是只有一種，而是複合上述各種挑戰的。

現在已有許多的自動化軟體可協助初步產製班表，但它無法以完全自動化之方式產製，必須仰賴班表規劃人員的知識、對市場上之經濟趨勢及經驗，完成最終的執行班表，為航空公司尋求最大利益及滿足各種旅客需求。

## 六、 習題探討(詳情可參考附錄 3)

本次 4 天課程中，最後測驗是用分組討論報告的方式進行，講師是以一家航空公司目前遭遇到的情況，請大家分別用課程學習到的地方替這家航空公司解決困境並規劃未來的航網、機隊及班表規劃。

講師是以某一國家擁有一家國籍航空(Flamingo Airlines)為例，其大約背景是政府擁有 25%之股份，而國內最大之 Stienner Industries 則擁有 45%股份；另為滿足 Stienner Industries 擴張之需要，以及該公司 CEO 往返於家、工廠及拜訪客戶之需求，且該國亦傾向於保留現有之航線狀況。

Flamingo Airlines 是以樞紐和輻射形式之航網營運各條航線，而 AAA 為樞紐機場，並串聯 1 條國內線、6 條區域國際線及 1 條長程國際線；另研議開發另一條國際線，並以該城市另外做為第 2 個樞紐機場之可行性。另外題目已將未來需求成長速度、航權、擁有 4 種機型之機隊、載客率、機場開放時間及轉機時間、現況班表，連帶亦將競爭之航空公司及航線一一述明，希望我們可以從航網、機隊以及班表部分解決目前遇到之問題

首先，我們先針對 Flamingo Airlines 遇到之問題進行解析，並根據需求、轉機航線、競爭航線、機隊使用狀況及機場開放時間之限制，針對航網中之三角形路線僅保留部分航線，並優化班表加強轉機客之需求；另外機隊方面建議 3 年內先保留現有機隊，並積累公司資金新購單走道客機，而依據我們優化之班表，飛航班次將增加，我們建議可採濕租之方式來擴增單走道機隊。在現況穩定發展

後，再開始規劃未來新增之國際航線，最後並提出因為航班增加可能遇到之風險及可緩解之措施。

## 心得與建議

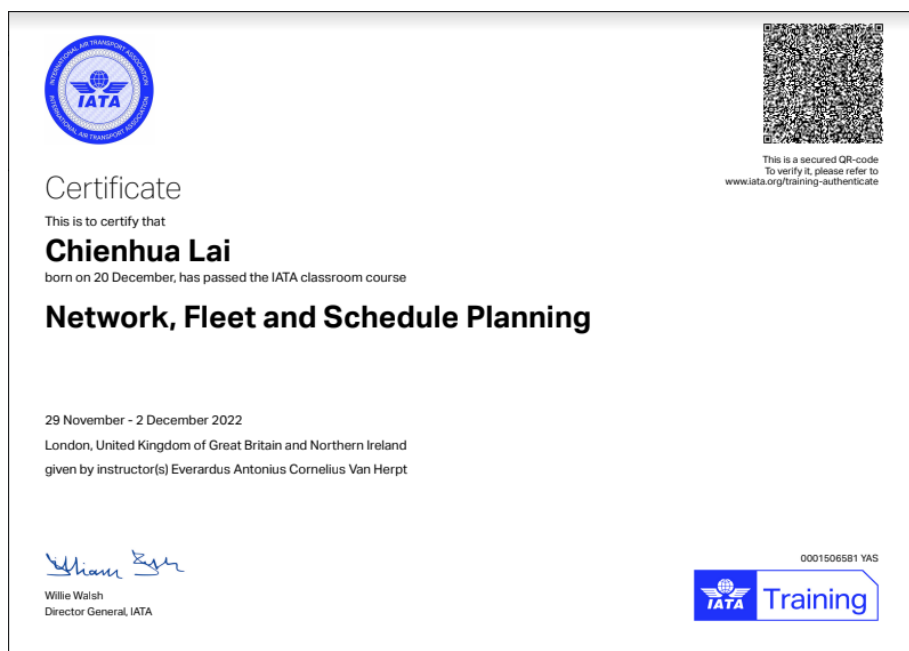
- (一) 本次受訓初步瞭解了航空公司營運時之航網、機隊及班表規劃的過程，以及規劃時須謹慎考慮之各種因素。航空公司最重要推出給客人的產品就是各航線航班之機票，這往往與旅客選擇之間是有互動及關連性的，而航空公司如果無法有吸引旅客及培養固定常旅客的條件，恐無法持續創造穩定之收入；另外需要考量的是必須控制成本，使航空公司能創下最大之收益。因此，在進行航網、機隊及班表規劃時，需將旅客偏好之需求，以及公司維護及機組員派遣等成本因素進行分析，以取得最佳策略。
- (二) 無論是中華或長榮航空，甚至近年成立之星宇航空，仍需持續地進行市場分析需求，評估擴增自己的航網及增加機隊。另外，因為 2020 年起受 Covid-19 疫情之影響，進行規劃勢必需要保留彈性，且須更頻繁的檢討種種規劃，以應付隨時變化之世界情勢。
- (三) 評估航線能否繼續經營，除考量航線的成本收益外，必須將和該航線有連結性的國際或國內航線，進行整合性之考量，另外我們在習題研討時，亦有針對此一問題進行討論，根據一同上課之阿提哈德航空班表規劃人員說明任一條航線都有其價值，不要輕易捨棄任一條航線，因此，當航線經營及收益不佳時，我們可先透過調整航班時間、航班班次及使用航空器機型等，便利乘客轉機連結其他航線，或更改航空器型式及調整航班等方式，提供晨、昏峰之不同旅客需求，綜上所述，停飛才會是最後須考量之手段。
- (四) 習題研討讓我們可以快速地複習課程所學到的各種知識，並可運用或想像在自己規劃時遇到的各種難題、考量之因素等。另外規劃時並無一勞永逸之結果，必須隨時檢視、更新及檢討自己的規劃結果，且必須試著去改變既有的航網、機隊及班表規劃，因為往往潛藏的利益都還並未被規劃人員所發現，講師也特別強調，要我們多方嘗試，如果沒有踏出那一步，你永遠不會知道未知領域的樣貌。

# 附錄

## 1. 課程合照



## 2. 證書



### 3. 習題探討

#### (1) 問題



#### Case study Flamingo Airlines

You have been invited to advise the new management of Flamingo Airlines on the restructuring of this ailing airline. You have been asked to propose changes to the business model, its network, fleet and schedule to help the airline turn to profitability.

#### Background of the airline and ownership

Flamingo Airlines was founded 30 years ago as the flag carrier of Birlandia. It was fully owned by the government of Birlandia with the objective to provide vital air links to surrounding countries. It has been loss-making since its inception and to change the airlines fortunes, the government has partly privatized the airline last year.

The current ownership is as follows:

Government of Birlandia	25%
Popular Bank	25%
Stiener Industries	45%
Management	5%

Popular Bank is the largest bank of Birlandia and has branches throughout the region. It wants the airline to expand and improve the connections to nearby countries to support its international operation and facilitate further expansion. It prefers direct flights and at least 3 frequencies daily to provide flexibility.

Stiener Industries is a major industrial conglomerate with its headquarters and several factories in Ardtown (airport code AAA), the capital of Birlandia. It also has several factories in and around Mayburg (airport code MMM) and have recently acquired a large industrial manufacturer with factories in Palaciaro (PPP) and Dartmundi (DDD). It aims to continue to expand rapidly in the region and needs the airlinks to support their business expansion.

Mark Stiener, the founder and CEO of Stiener Industries lives in Hillforest (HHH) and commutes frequently between HHH, AAA and MMM. Due to the recent acquisition, he also envisions having to fly regularly to PPP and DDD. He sees growth and expansion as a way to turn around underperforming companies.

The government is keen to keep all existing routes and would like to see Air Flamingo to expand further. It is willing to invest for up to 3 more years in the airline, after this, they will no longer financially support the airline. Within 5 to 10 years they would like to divest their remaining shareholding.

The CEO, CFO and CCO, COO together own 5% of the shares. Their main objective is to turn around the airline as fast as possible and sell their shares.

The supervisory board of Air Flamingo consists of 7 people, 4 of which have been appointed by Stiener Industries, 2 by Popular Bank and 1 by the Government of





Birlandia. Mark Stiener is the president and the board member appointed by the government has a special veto power for decisions regarding the network.

### **Current Network**

Flamingo Airlines operates as a hub & spoke carrier, using AAA as its hub.

It operates a single domestic route to HHH. It is a short flight, but due to difficult terrain will take around 6 hours to get there by car.

Flamingo Airlines also operates services to nearby regional destinations BBB, CCC, DDD, EEE and FFF. Since it operates to EEE and FFF as a triangle flight, it also offers EEE-FFF.

It operates one long haul route to MMM.

It has also studied flying to PPP, which has potential and can be served by either a single aisle or widebody aircraft.

### **Markets and traffic rights**

Ardtown (AAA) has developed itself into a regional financial center with all major banks, insurance companies and other financial institutions having their regional headquarters in Ardtown. In addition to the financial institutions, Ardtown is home to the regional headquarter of several regional non-governmental organizations.

Birlandia is well known for its splendid nature and is drawing tourist from around the world for bird watching, hiking, mountain biking and skiing.

Birlandia has a population of 5 million of which 1 million live in Ardtown (AAA). Hillforrest (HHH) is the second largest city with 150,000 inhabitants. Birlandia has a large population of immigrants from Palaciaro (PPP) who have come to work mainly in agriculture which is situated around Hillforrest (HHH).

Currently, around 35% of Flamingo Airlines passengers are traveling for business with 65% of passengers traveling for leisure. Currently, 15% of its passengers are connecting in AAA. On the route AAA-MMM, 50% of the business class passengers have a connection in AAA.

CCC, MMM and PPP are cities of more than 5 million inhabitants each and major hubs of other airlines.

Flamingo Airlines does not have any interline or codeshare agreements, nor is it member of an alliance.

The traffic growth in the region is forecasted to be around 3% per year for the next 5 years and previous studies have found that doubling the frequency to destinations would result in a 35% growth in demand for Air Flamingo.

Flamingo Airlines has 3<sup>rd</sup> and 4<sup>th</sup> freedom traffic rights for services from AAA to BBB, CCC, DDD, EEE, FFF, MMM and PPP and 6<sup>th</sup> freedom rights on all international connections via AAA. It also has 7<sup>th</sup> freedom rights between EEE and BBB, DDD, FFF, MMM and PPP.

### Competition

Penguin Air (PEA) is a network carrier based in CCC. It boasts a large hub & spoke network with domestic, regional and long haul destinations. It offers business class on all flights except domestic, has a frequent flyer program and is member of an alliance. New code share agreements outside the alliance are no longer permitted.

Air Tucan (ATC) is small regional carrier based in FFF. It offers a single class of service, connections on its own network and has interline and codeshare agreements with Penguin Air. It is open to cooperate with other airlines and currently operates the route FFF-CCC as a wet lease for Penguin Air.

Flying Fish Airways (FFA) is a low cost carrier based in DDD. Its business model is to offer single daily connections to destinations within 3 hours flying distance. It offers a single class of service, no connections (neither online nor offline) and a very simple frequent flyer program.

Royal Eagle Air (REA) is a premium network carrier based in DDD. All its long haul flights boast 4 classes of service (First, Business, Premium, Economy) and all its regional flights have 3 classes of service (Business, Premium, Economy). It has an extensive frequent flyer program and is member of an alliance. It has several cooperation agreements with airlines both inside and outside of the alliance.

The table below shows the competition on the different routes.

Route	Direct	PEA	ATC	FFA	REA
AAA – BBB		2 x daily *			
AAA – CCC		4 x daily			
AAA – DDD		2 x daily *		1 x daily	
AAA – EEE		2 x daily *	1 x daily *		
AAA – FFF		2 x daily *	1 x daily		
AAA – HHH					
AAA – MMM		1 x daily *			1 x daily
AAA – PPP		2 x daily *	3 x week *		1 x daily *
EEE – FFF			2 x daily		

Frequencies marked with an asterisk are offered as a connecting flight via the hub or focus city of the airline concerned.

### Current Fleet

The airline operates an older fleet of 2 x ERJ-135 (35 economy class seats), 3 x 737-300 (130 economy class seats) and 2 x 747-400 aircraft (30 business class, 330 economy class seats). The average age of the aircraft is 19 years.

The old aircraft are responsible for a poor on-time performance and poor completion rate. The variable operating costs of the current aircraft are some 20% higher than the aircraft now available on the market due to high fuel burn and high maintenance costs.

The route AAA-HHH is operated by an ATR42 turboprop which is wet-leased from a local charter airline. HHH has a short runway and can only be served by a turboprop aircraft. The turbo prop does not have sufficient range to operate any of the other routes flown by Flamingo Airlines.

There is a maintenance station in AAA for the 737-300, maintenance for the 747-400 is currently performed in MMM, with other providers based in CCC and PPP. The ERJ-135 is currently maintained in EEE and occasionally FFF, with another provider located in CCC.

Management has been in contact with several manufactures and has obtained the following options for replacement aircraft:

turboprop		regional			narrow body aircraft			wide body aircraft		
50	75	50	75	100	130	160	190	240	290	340
500 nm		900n m	1900 nm		3200 nm			5500 nm		

The table shows the maximum number of passengers and the maximum range. The maximum number of passengers is based on single class, all economy seats.

To add business class, deduct 1.5 economy class seat per business class seat for the regional and narrow body or 2 economy class seats per business class seat for the widebody aircraft. For first class, deduct 4 economy class seats for each first class seat on widebody aircraft. For premium economy, deduct 3 economy class seats per 2 premium economy class seats.

For example, the 240 seat wide body can have a configuration of 20 business class (=40 economy seats) and 200 economy class seats.

### Product

Air Flamingo offers a single class of service on its domestic and regional flights and has a 2-class configuration with angled lie-flat beds in business class and a standard economy class on its widebody aircraft.

Only the widebody aircraft offer inflight entertainment in both economy and business class. Inflight wifi is not available on any aircraft, however a streaming service of popular tv series is available on the turboprop.

Flamingo Airlines offers a free snack and drink on regional flights and full meal service on long-haul flights. Business class passengers on the long haul flight have access to priority check-in, fast-track security and are offered priority boarding. Lounge access is currently unavailable, but Flamingo Air has been in discussion with the airports in AAA and MMM to provide such a service.

Passengers get 1 free checked bag in economy class and 2 in business class.

Flamingo Airlines has a very simple frequent flyer program which is not very popular, only 5% of its passengers are members of the program.

There are currently no paid for ancillary services offered by Flamingo Airlines. Management would like to explore this option but feels it needs to improve its operational performance first.

#### **Current Performance**

Flamingo Airlines has been loss making since its inception. All flights just cover the variable cost, but none of the routes makes a profit.

The load factor on the 737 operated flights is on average 71%, on the ERJ operated flights 87%, the ATR operated flight 91% and the 747 operated flight 52%. Business class only has a 30% load factor on the 747 operated flights.

The management is aware of the bad reliability of the operation and is expecting that a new fleet will have a positive effect on demand for all flights with some 10% increase relative to the existing operation. It also believes that providing more and quicker connections could easily triple the number of passengers connecting in AAA.

#### **Airport limitations:**

The airport AAA is open from 5:30 in the morning till 22:00 in the evening.  
The airport HHH is open from 7:00 in the morning till 20:00 in the evening.  
The airport MMM is open from 05:30 in the morning till 23:00 in the evening.  
Airports BBB and CCC are closed at night from 0:00 till 5:00.

Airport AAA has 8 gate / parking positions for Flamingo Airlines.

All times are local times, all airports are in the same time zone

At AAA, the following Minimum Connecting Times apply

From	To	MCT (min)
domestic or regional	long haul	90
long haul	regional	90
long haul	domestic	90
domestic	regional	60
regional	domestic	75
regional	regional	75

There are currently no slot restrictions for AAA, HHH, DDD, EEE and FFF. Airport BBB is slightly congested, but no issues are expected to obtain the required slot. Airports CCC, MMM and PPP are slot coordinated. For those airports, a potential deviation of the desired slot of up to 45 minutes needs to be considered.

### Network Map

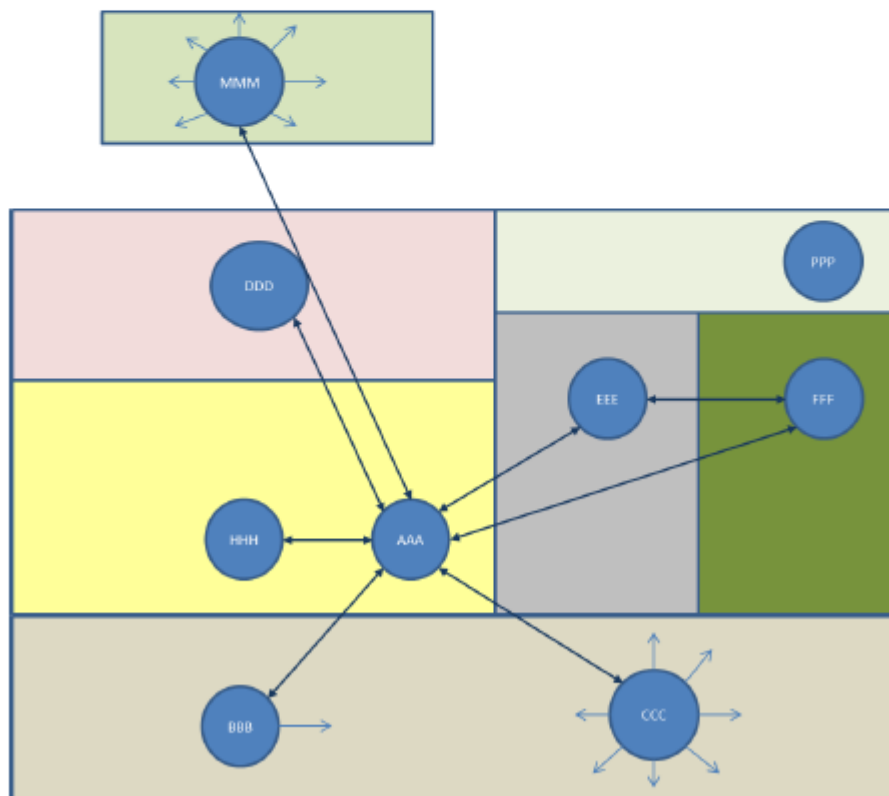


Fig. 1: Network map of Flamingo Airlines

### Current Schedule

from - to	days	dep	arr	a/c	Distance (nm)	BH (min)
AAA - BBB	1234567	08:00	10:00	733	690	120
BBB - AAA	1234567	11:00	13:00	733	690	120
AAA - BBB	1234567	14:30	16:30	733	690	120
BBB - AAA	1234567	17:30	19:30	733	690	120
AAA - CCC	1234567	08:00	10:00	733	630	120
CCC - AAA	1234567	11:00	13:00	733	630	120
AAA - CCC	1234567	14:30	16:30	733	630	120
CCC - AAA	1234567	17:30	19:30	733	630	120
AAA - DDD	1234567	09:00	11:40	733	850	160
DDD - AAA	1234567	13:00	15:40	733	850	160
AAA - HHH	1234567	11:00	11:45	AT4	160	45
HHH - AAA	1234567	12:30	13:15	AT4	160	45
AAA - MMM	1234567	20:30	06:30 +1	744	4500	600
MMM - AAA	1234567	21:30	07:30 +1	744	4500	600
AAA - EEE	1--5--	09:00	11:30	135	750	150
EEE - FFF	1--5--	12:15	13:00	135	220	45
FFF - AAA	1--5--	13:45	16:15	135	825	150
AAA - FFF	--3--7	09:00	11:30	135	825	150
FFF - EEE	--3--7	12:15	13:00	135	220	45
EEE - AAA	--3--7	13:45	16:15	135	750	150

Currently Flamingo Airlines does not fly to PPP, the distance is 2200 nm and would have a block time of 5 hours.

#### Questions:

##### Network:

- Which market segments can you identify?
- Which network type would be best suited to serve these market segments?
- Which product would be best suited to serve these market segments? (classes of service, frequency, direct vs connecting etc)
- Which routes would you operate and at which frequency?

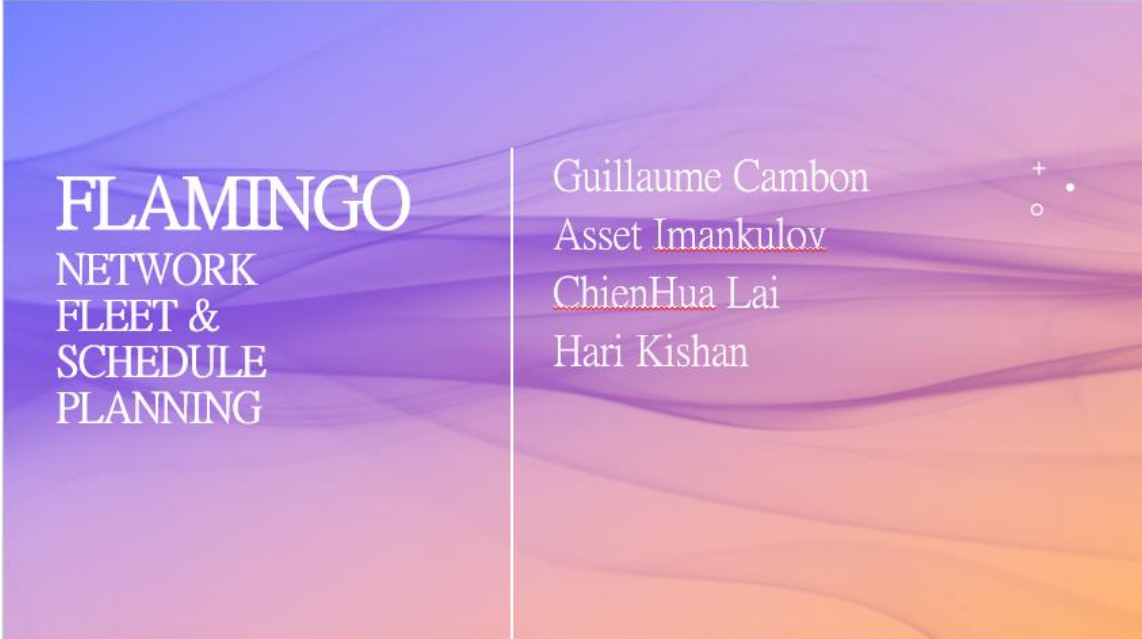
##### Fleet:

- What issues do you see with the fleet?
- How many aircraft types would you suggest for the airline?
- How many aircraft of each type would you suggest for the airline?
- Would you suggest replacing the current aircraft with new aircraft, if so what would the new fleet look like?

##### Schedule

- Does the schedule meet the requirements of the market segments?
- Does the schedule allow for maintenance to be performed?
- Does the schedule offer connectivity?
- What would you change in the schedule?

(2) 本組簡報



FLAMINGO  
NETWORK  
FLEET &  
SCHEDULE  
PLANNING

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## Thought map

- What is the current state?
- Where do we need to get to?

To get to where we need to get to:

- Where do we fly to?
- How frequently do we fly?
- When do we fly?
- What do we fly with?
- What do we offer our customers?

### Agenda:

- Thought Process
- Network Plan
- Schedule
- Fleet
- De-tours
- Future Plans
- Risk & Mitigations



## What key issues are we addressing

- Poor connectivity
- Low number of connecting pax
- Aircraft Utilisation
- Cost / Old fleet
- OTP
- Low load factors on major routes
- Inconsistent premium product

## Network Planning

### Key questions answered:

- Which City pairs
- At what frequency
- To deliver max profitability
- Offering reliable product
- To the premium and tourist segment

### Assumptions used:

- Demand calculation factors
  - X 2 frequency = 35% in demand
  - More connection = 3x number of pax connecting at AAA
  - +10% increase for new aircraft
  - PPP has been excluded from the current

## Network Planning – Current state & Future demand

ROUTES	Competition daily frequency	AS IS		
		Seater	Current daily frequency	Load factor
AAA-BBB	2	130	2	71%
AAA-CCC	4	130	2	71%
AAA-DDD	3	130	1	71%
AAA-EEE	3	35	0.6	87%
AAA-FFF	3	35	0.6	87%
AAA-HHH	0	42	1.0	91%
AAA-MMM	2	360	1.0	52%
EEE-FFF	2	2	0.3	87%

## Network changes consideration

- Where can we increase frequencies considering
  - Demand
  - Connectivity
  - Competition
  - Aircraft utilisation
  - Airport constraints

While there are several factors, as per the course, we have limited the analysis to these key factors from the case

# Network redesign

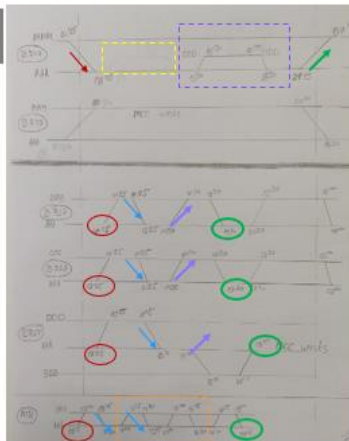
- Increase the volume of connecting pax via AAA: Improved connectivity
  - MMM departures to benefit from all other SH arrivals
  - MMM arrival to feed in to SH departures
- Provide arrival and departure connectivity to maximum destinations, use LH as baseline
- Leverage high LF on Triangle to design route
- Better utilisation of WB than leaving on ground thereby freeing up a 737 for additional deployment
- Frequency increases considering demand and competition [not all at one go]

*Note: This was the initial thought, ref: 'De-tour' and 'The Schedule' for the final consideration on triangle route*

# The schedule

## Morning and Evening bank connections

- WB, LH arrival
- Connects to all 6 destinations
- WB, LH departure
- All arrivals at A connecting to LH



## Afternoon bank connections

- Afternoon arrivals
- Connects between B,C,D

AIRCRAFT	Operating route	Weekly utilization (hrs)		
		Current situation	Scenario 1 (same fleet)	Delta (%)
737_1	B	56.0	56.0	0%
737_2	C	56.0	56.0	0%
737_3	D/B	37.3	86.3	75%
747_1	M	70.0	107.3	53%
747_2	M	70.0	70.0	0%
ATR42	H	10.5	21.0	100%
E135	E	11.5	70.0	509%
E135	F	11.5	70.0	509%
<b>TOTAL</b>		<b>322.8</b>	<b>515.7</b>	<b>60%</b>

## Schedule redesign approach [Routes, Aircraft and Maintenance]

1. Initial schedule developed considering BH, TAT, Airport constraints and connecting times for domestic/ domestic domestic/regional turns.
2. Flights allocated based on -
  - i. Fixing LH schedule, to ensure maximum feeder traffic to the LH route
  - ii. WB maintenance at MMM
  - iii. Schedule of SH routes adjusted to have maximum arrivals at AAA to connect to the LH departure
  - iv. SH to feed in to and feed from LH
  - v. WB considered to serve a SH destination from AAA to improve utilisation and better deployment of NB
3. Increase the frequencies for SH routes considering all limiting factors
4. Relook at flight allocation

## The schedule [Routes, Aircraft and Maintenance]

1. WB departs AAA and MMM at similar times, crossing over mid-air
2. The arrivals at AAA connect to BBB, CCC, DDD, EEE,FFF
3. Departure to MMM to connect from BBB, CCC, DDD, EEE,FFF
4. Redeploying additional capacity of 737
  - I. 737 taken off DDD and instead served by 747, which then continues back to MMM.
  - II. The extra availability of 737 deployed on BBB and CCC, to leverage low competition and high demand.

Note: this is one scenario. This can be later considered for re-deployment based on demand
5. HHH frequency increased to leverage the lower op cost. Gradual increase planned from 1 -4 daily
6. Triangle eliminated, and instead direct connection provided to EEE and FFF. Gradual increase in frequency planned, considering demand and MRO

# Network Planning – Current state & Future demand

**SCENARIO 1**

ROUTES	Competition daily frequency	AS IS			TO BE - FORECAST											
		Seater	Current daily frequency	Load factor	New frequencies	Demande increase			New aircraft	New seater	New load factors					
						Increased frequencies	Increased connectivity				n		n+1	n+2	n+3	n+4
AAA-BBB	2	130	2	71%	2	0%	30%	0%	130	92%	95%	98%	101%	104%	107%	---> High load factors
AAA-CCC	4	130	2	71%	2	0%	30%	0%	130	92%	95%	98%	101%	104%	107%	---> High load factors
AAA-DDD	3	130	1	71%	2	35%	30%	0%	130	62%	64%	66%	68%	70%	72%	
AAA-EEE	3	35	0.6	87%	2	88%	30%	0%	35	61%	62%	64%	66%	68%	70%	---> Low load factors
AAA-FFF	3	35	0.6	87%	2	88%	30%	0%	35	61%	62%	64%	66%	68%	70%	---> Low load factors
AAA-HHH	0	42	1.0	91%	2			0%	42							
AAA-MMM	2	360	1.0	52%	1	0%	35%	0%	360	80%	82%	85%	87%	90%	93%	---> Frequency can gradually increase
EEE-FFF	2	2	0.3	87%	0					70%	72%	74%	77%	79%	81%	

# Network Planning – Current state & Future demand

**SCENARIO 2**

ROUTES	Competition daily frequency	AS IS			TO BE - FORECAST											
		Seater	Current daily frequency	Load factor	New frequencies	Demande increase			New aircraft	New seater	New load factors					
						Increased frequencies	Increased connectivity				n		n+1	n+2	n+3	n+4
AAA-BBB	2	130	2	71%	2	0%	30%	10%	160	82%	85%	88%	90%	93%	96%	---> New 160 seater
AAA-CCC	4	130	2	71%	2	0%	30%	10%	160	82%	85%	88%	90%	93%	96%	---> New 160 seater
AAA-DDD	3	130	1	71%	2	35%	30%	0%	130	62%	64%	66%	68%	70%	72%	
AAA-EEE	3	35	0.6	87%	1	26%	30%	0%	35	82%	84%	87%	89%	92%	95%	---> Lower load factor
AAA-FFF	3	35	0.6	87%	1	26%	30%	0%	35	82%	84%	87%	89%	92%	95%	---> Lower load factor
AAA-HHH	0	42	1.0	91%	3			0%	42							
AAA-MMM	2	360	1.0	52%	1	0%	30%	0%	360	67%	69%	71%	73%	75%	78%	---> Increased frequency
EEE-FFF	2	2	0.3	87%	0					68%	70%	72%	74%	76%	78%	

## De-tours

1. Slot constraints at MMM
2. Fitting (or not) in a triangle route
3. Deploying additional 737
4. Afternoon bank connections
5. Maintenance for ERJ

## Fleet

1. Retain current fleet for the 0-3 years window
2. Leverage lower opex
3. Build up cash for fleet orders (2 x 160 seater)
4. New 160 seater on B & C, ref: Scenario 2
5. Consider the wetlease to be insourced based on frequency and operation

Note: We could not arrive at a cabin configuration based on our analysis. This has been excluded from the model. The recommendation is to monitor the business vs tourist demand to take a call accordingly.

## Future plan – gradual and measured upscaling

1. Constant measurement and feedback loop
2. Based on the scenario1, initially start with single daily on E & F – to use the in between time for maintenance. If the demand picks up, add additional frequencies and use night time for MRO in E &F
3. 747 deployment is currently on D. This can be moved to B and C based on the demand and/or based on the decision to enter new aircraft to service.
4. Demand by segment and class configuration to be analysed
5. Consider PPP based on fleet availability (AAA / MMM – PPP)

## Risk and mitigation

### **RISK**

- Frequencies not providing the forecasted increase in load.
- OTP – risk of old fleet
- New aircraft (un)availability

### **MITIGATION**

- Dynamic allocation of capacity
- Assume risk, develop scenario planning
- Better maintenance

# THANK YOU

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