行政院及所屬各機關出國報告
(出國類別：實習)


# 赴新加坡民航學院參加管制員／駕駛員

# 資料鏈路通信及自動回報監視應用課程

# 出國報告

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## 壹、 目的

由於國際民航運輸流量不斷持續成長，空域擁擠，而引導航機飛航之助導航設施受限於老舊科技、地面架設地點限制等因素影響，無法有效改善。國際民航組織（International Civil Aviation Organization，ICAO）為因應未來航行量仍將持續成長，下一世紀飛航安全及效率之需求，於 1983 年成立未來空中航行委員會（Future Air Navigation Committee，FANS）檢討各國現行助導航設施及飛航環境，探討未來飛航概念及利用衛星導航技術之可行性，並建議在世界各國共同協調有一致性作法及逐漸進化的概念之下發展未來 25 年之飛航環境。經過長達五年的討論、研究，ICAO FANS 委員會於 1988 年提出未來通信、導航、監視及飛航管理（CNS/ATM）概念之報告。1989 年 FANS II 委員會成立，繼續監督、協調 CNS/ATM 計畫之發展及轉移計畫。1991 年 ICAO 於第十次 FANS 委員會提出全球性 CNS/ATM 計畫，獲得各會員國共同背書。世界各國紛紛展開 CNS/ATM 相關計畫的研究、實驗及發展。

經過多年的研究、發展、測試，目前已有部分國家開始建置部分 CNS/ATM 功能。主要飛機製造廠商如 Boeing、Airbus 等公司亦已發展出 FANS 1/A 機載裝備套件。民航主管單位與航空公司攜手合作開始發展 RNP（Required Navigation Performance）規範，在部分越洋地區，規劃 FANS 航路（例如亞、歐間的孟加拉灣建置 UM501 FANS 航路），實際運用 CNS/ATM 地面系統及機載裝備，規劃較佳之飛航路徑，並透過資料鏈路（Data Link Communication）的應用，使地面航管單位在越洋地區亦能掌握航機動態，並保持聯繫。經由國家或區域間之合作，航機間之隔離得以縮短，空域使用效率增加，航機並得以飛航最佳路徑。CNS/ATM 將促使全球一致化、無

縫隙的飛航環境得以實現。

民用航空局自八十七年委託美國 MITRE 公司規劃本區 CSN/ATM 推動主計畫，隨後於八十八年三月成立「CNS/ATM 系統發展推動小組」，開始推動本區 CSN/ATM 規劃及建置。民航局飛航管制組為瞭解 CNS/ATM 對未來航管作業之影響，學習先進國家經驗，派遣管制員何麒麟赴新加坡民航學院參加「管制員／駕駛員資料鏈路通信（Controller/Pilot Data Link Communication，CPDLC）及自動監視回報（Automatic Dependent Surveillance，ADS）應用課程」。

貳、行　程

十一月十二日　　　　　自桃園中正國際機場搭乘中華航空公司 CI661 班機至新加坡。

十一月十三日至十七日　參加管制員／駕駛員資料鏈路通信及自動監視回報應用課程。

十一月十八日　　　　　自新加坡搭乘中華航空公司 CI662 班機返國。

參、過　程

授課教官

一、　Mr. Choong Keng Hin，新加坡民航學院教官，前新加坡航管中心主任，負責新加坡航管自動化系統建置以及 CPDLC/ADS 系統整合。

二、　Mr. Tan Soo Yong，新加坡民航學院教官，參與新加坡航管自動化系統建置以及 CPDLC/ADS 系統整合。

三、　Capt. Alan Chan，新加坡航空公司飛行員。

四、　Mr. Christopher Kok，SITA 公司顧客服務部門經理。

課程安排

一、 11/13（第一天）

    （一） 註冊（Registration）。

    （二） CNS/ATM 系統介紹（CNS/ATM Overview）。

    （三） 通信服務廠商（SITA）公司介紹（Communication Service Provider (SITA)）。

    （四） FANS 1/A 管制員／駕駛員資料鏈路通信介紹（FANS 1/A CPDLC Overview）。

二、 11/14（第二天）

    （一） 管制員／駕駛員資料鏈路通信資料（CPDLC Messages）

    （二） 管制員／駕駛員資料鏈路通信程序（CPDLC Procedure）

    （三） 管制員／駕駛員資料鏈路通信操作練習 （CPDLC Simulator Exercises）

三、 11/15（第三天）

    （一） 自動監視回報介紹（ADS Overview）

    （二） 自動監視回報廣播—航跡監視（ADS-B Conformance Monitoring）

    （三） 自動監視回報作業需求（1）（ADS Operational Requirement (1)）

    （四） 新加坡航空公司 ADS 作業簡報（SIA Airline Presentation）

    （五） 自動監視回報作業需求（2）（ADS Operational Requirement (2)）

四、 11/16（第四天）

    （一） 自動監視回報作業程序（ADS Procedures）

    （二） 航機自動回報位置與雷達偵測位置混合環境（Dynamic Tracks – The Mixed Environment）

    （三） 飛航管理系統自動化與人為因素（ATM Automation and Human Factors）

    （四） 模擬機自動監視回報與管制員／駕駛員資料鏈路通信展示

五、 11/17（第五天）

(一) 參訪新加坡航管中心

(二) 參訪新加坡樟宜機場管制塔台


肆、 心 得


一、 新加坡自十餘年前開始規劃目前之航管自動化系統，採用法國
THOMSON 公司著名之 EUROCAT 2000 系統，與目前相當先進之澳
洲 ATM 系統—ATAAATS 均為 EUROCAT 2000 系統。（我國東部航管
自動化系統，花蓮終端及台東終端系統亦為法國 THOMSON 公司子
公司 AIRSYS 公司承做，為 EUROCAT 1000 系統。）新加坡航管中
心並於數年前開始實驗資料鏈路通信（Data Link Communication），包
括 CPDLC、ADS、PDC 及 D-ATIS 等，由先前之獨立 CPDLC/ADS
管制工作站開始實驗、提供服務，目前已將 CPDLC/ADS 整合至航管
系統內。原來管轄越洋航路之非雷達席位已將 ADS 位置報告資料導
入航情顯示器（Situation Display），與航機間之通信也由原來品質較差
之 HF 通信轉移為資料鏈路通信。對於在同一管轄區內不具備
CPDLC/ADS 能力之航機，則以依據飛行計畫內之航機性能參數、航
路，並參考飛行高度、高空風影響等因素，計算航機位置，並將航機
資料及位置顯示在航情顯示器上。管制員目前在非雷達管制席位上亦
配備雷達顯示器，可以顯示 ADS 回報之位置，亦可顯示系統依據飛
航計畫計算之位置（含駕駛員報告位置之更新），大幅度提升管制員
對航機位置及動態之掌握。雖然管制員對雷達涵蓋外之越洋航路區域
仍採取非雷達隔離，但作業效率已有提升。在東南亞、中東、歐洲航
線經過之盂加拉灣，建立了 FANS 航路（UM501），FANS 1/A 航機使
用 FANS 航路，隔離由原 15 分鐘縮減為 12 分鐘。單一空層每小時可
飛航之航機也由原來的四架次增加為五架次，空域使用效率提升。本
項課程之 CPDLC、ADS 等 Data Link 應用均已整合、內建於 ATM 系
統內。本課程教官 Choong Keng Hin 曾為負責建立新加坡系統之專案

經理，亦曾擔任新加坡航管中心主任，除經驗豐富外，對於系統之應用，航管作業之整合以及整個南中國海飛航環境，有深刻之心得。

二、 未來 CNS／ATM 飛航環境主要之基礎為通信的數位化（Data Link）以及飛航的衛星化。由於全球兩大數據鏈路通信廠商 SITA、ARINC 已利用先進科技布建通信網路多年，所提供之 VHF 資料鏈路、HF 資料鏈路或衛星通信鏈路幾乎涵蓋全球，各國飛航服務單位採用 SITA 或 ARINC 數據鏈路網路服務，除可免除自行架設網路及後續維護所需耗費之龐大成本外，並可透過 SITA、ARINC 之服務將數據資料傳遞至全世界。航空公司早已於 1980 年代開始應用機載通信位置回報系統（ACARS）透過 SITA 或 ARINC 公司傳遞數據資料。本局於八十八年與美國麥特公司合作規劃本區 CNS/ATM 發展主計畫時即曾透過 SITA 公司之 VHF 數據鏈路實驗數位化終端資料自動廣播服務（D-ATIS），航機可透過 ACARS 接收數位化之 ATIS 資料。利用全球性之 SITA 或 ARINC 數據鏈路服務，在本局之測試中，航機甚至可以在中正機場地面上接收到洛杉磯機場之 ATIS（天氣及機場）資料。

三、 本項課程即為 ICAO 推動全球 CNS/ATM 計畫在資料鏈路方面之部分應用，包括管制員／駕駛員資料鏈路通信（CPDLC）及自動監視回報（ADS）。CPDLC 除作為輔助地面與空中之無線電通話外，並能解決在海洋或廣大陸地區域目前高頻（HF）無線電通話不良之狀況。另可利用衛星作為通信媒介，使地面與空中之溝通不會間斷。另外以數據化文字方式傳遞資料亦能有效改善因不同語言造成之誤解，增加通信的可靠性。

目前傳統的航機監視工具主要以雷達為主，但因雷達波直線視距的限制，涵蓋範圍有限，脫離雷達涵蓋，航機動態只能透過駕駛員位置報告獲得，隔離也因此採用非雷達隔離，空域使用效率不佳。自動監視回報（ADS）係航機將機載裝備計算之位置傳遞至地面管制中心，幫助地面航管掌握航機位置，並與其他航機做安全之隔離。ADS 目前除

位置外，另可傳遞相當多航機所能收集到之資料，包括高度、速度、航向及天氣等資料，且均為透過機載航電裝備自動傳遞，不增加駕駛員負擔。結合 CPDLC 及 ADS，管制員可不間斷的與駕駛員連絡，獲得航機位置，掌握動態，可以適用較低之隔離，增加空域效率及航行安全。

以下分別介紹 CPDLC 及 ADS。

四、 管制員／駕駛員資料鏈路通信（CPDLC）

(一) CPDLC 為管制員及駕駛員通信的一種方式。地面航管單位（Air Traffic Service Unit，ATSU）與天上航機，利用資料鏈路（Data link）交換包括許可（clearance）、資料（information）及要求（request）等訊息。

(二) CPDLC 資料鏈路之傳遞媒介，依目前科技所能使用之媒介，包括高頻（HF）、特高頻（VHF）無線電資料鏈路通信、S 模式次級雷達及衛星資料鏈路通信。

(三) CPDLC 可作為無線電通信之輔助，在無線電通信不良或涵蓋不足之地區，例如廣大海洋或偏僻沙漠地區等，亦可作為取代無線電通信之溝通方式。

(四) 管制員與駕駛員利用語音通信時通常使用定型化之術語，以避免發生溝通上之誤解。CPDLC 亦採取與航管術語相同之概念，依照日常航管及飛航作業，預先定義了涵蓋廣泛的訊息組（message set），供管制員駕駛員使用，並減輕輸入文字的負荷。部份 CPDLC 訊息更可直接進入機載航電裝備及地面系統，更新飛航資料庫，進一步簡化飛航及管制上之操作。在預設之訊息組中未涵蓋到的情況時，CPDLC 亦提供一般文字（Free Text）供管制員／駕駛員於特殊狀況時使用。ICAO 在 Doc 9694 Manual of Air Traffic Services Data Link Applications 及 Doc 4444 Air Traffic Services 中均有公佈事先定義之訊息組，為全球一致

採用之標準，可增加通訊之效率及安全。目前定義有 342 個訊息，上傳訊息 283 個，下傳訊息 114 個。詳細訊息內容如附件一。
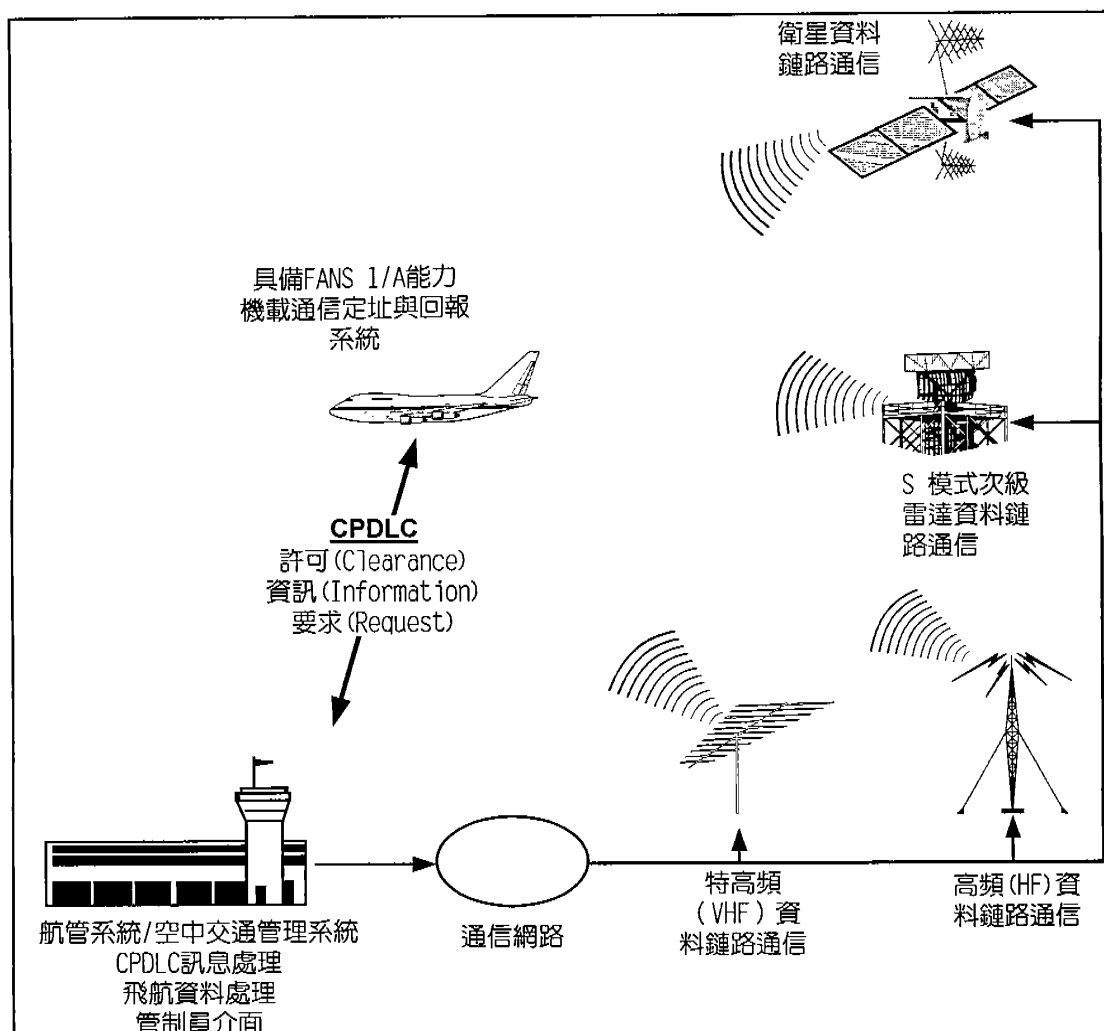


(五) CPDLC 訊息分為兩大類：

　　1· 上鏈訊息（uplink），由地面管制單位傳遞至航機。

　　2· 下鏈訊息（downlink），由航機傳遞至地面管制單位。

(六) CPDLC 訊息依功能，區分為下列訊息組：

| Uplink 訊息組 | 訊息數目 | Downlink 訊息組 | 訊息數目 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Response/acknowledgement | 10 | Responses | 6 |
| Vertical clearance | 46 | Vertical requests | 10 |
| Crossing constraints | 22 | | |
| Lateral offset | 9 | Lateral offset requests | 3 |
| Route modification | 31 | Route modification requests | 8 |
| Speed changes | 21 | Speed requests | 2 |
| Contact/monitor/surveillance request | 11 | Voice contact requests | 2 |
| Report/confirmation request | 33 | Reports | 35 |
| Negotiation request | 5 | Negotiation responses | 6 |
| | | Negotiation requests | 8 |
| Air traffic advisories | 15 | | |
| System management messages | 8 | System management messages | 7 |
| Additional messages | 27 | Additional messages | 18 |
| | | Emergency and urgent messages | 9 |

(七) CPDLC 訊息依緊急、警告、及回應需求，每個訊息均訂有各自 之屬性（Attribute）：

緊急（Urgency）屬性（上鏈及下鏈）　　警告（Alert）屬性（上鏈及下鏈）

| 屬性 | 說明 | 優先 | 屬性 | 說明 | 優先 |
|---|---|---|---|---|---|
| D | 遇難（Distress） | 1 | H | 高（High） | 1 |
| U | 緊急（Urgent） | 2 | M | 中（Medium） | 2 |
| N | 正常（Normal） | 3 | L | 低（Low） | 3 |
| L | 低（Low） | 4 | N | 無（No alerting required） | 4 |

回應（Response）屬性——上鏈

| 屬性 | 回應需求 | 有效之回應 | 優先 |
|---|---|---|---|

| W/U | Yes | WILCO, UNABLE, STANDBY permitted,<br><br>LOGICAL ACKNOWLEDGEMENT (only if required),<br><br>ERROR (if necessary) | 1 |
|---|---|---|---|
| A/N | Yes | AFFIRM, NEGATIVE, STANDBY permitted,<br><br>LOGICAL ACKNOWLEDGEMENT (only if required),<br><br>ERROR (if necessary) | 2 |
| R | Yes | ROGER, UNABLE, STANDBY permitted,<br><br>LOGICAL ACKNOWLEDGEMENT (only if required),<br><br>ERROR (if necessary) | 3 |
| Y | Yes | Any CPDLC downlink message,<br><br>LOGICAL ACKNOWLEDGEMENT (only if required) | 4 |
| N | No, unless logical acknowledgement required | LOGICAL ACKNOWLEDGEMENT (only if required),<br><br>ERROR (if necessary, only when logical acknowledgement is required) | 5 |

回應（Response）屬性——下鏈

| 屬性 | 回應需求 | 有效之回應 | 優先 |
|---|---|---|---|
| Y | Yes | Any CPDLC downlink message,<br><br>LOGICAL ACKNOWLEDGEMENT (only if required) | 1 |
| N | No, unless logical acknowledgement required | LOGICAL ACKNOWLEDGEMENT (only if required),<br><br>ERROR (if necessary, only when logical acknowledgement is required) | 2 |

（八）CPDLC 作業概念

1‧ 飛航服務單位發佈提供 CPDLC 服務公告，並提供相關航管單位之資料鏈路通信地址（AFN LOGON ADDRESS）。

2‧ 駕駛員於填寫飛航計畫時應於裝備欄（field 10）註明具備 CPDLC 能力（/J），並於飛航計畫備註欄（field 18）註明資料鏈路通信能力（DAT/S＝衛星資料鏈路通信、DAT/H＝

高頻無線電資料鏈路通信、DAT/V＝特高頻無線電資料鏈路通信、DAT/M＝S 模式次級雷達，及航空器註冊號碼。

3. 航空器登入航管系統（AFN Logon）

AFN(ATS Facility Notification)訊息之目的為告知地面航管單位機載資料鏈路通信裝備、版本號碼、相關地址資料（航機 ACARS 地址）、航空器呼號、航空器註冊號碼等。

AFN Logon 可由航空器發起，或由航管單位轉送（ATS unit on address forwarding）

4. 建立 CPDLC 通信

地面航管單位或航機均可發起建立 CPDLC 通信。

建立 CPDLC 通信之後，管制員可在航管系統上看到登入之航機呼號，駕駛員亦可知道已建立通信之航管單位。

5. 實施 CPDLC 訊息交換
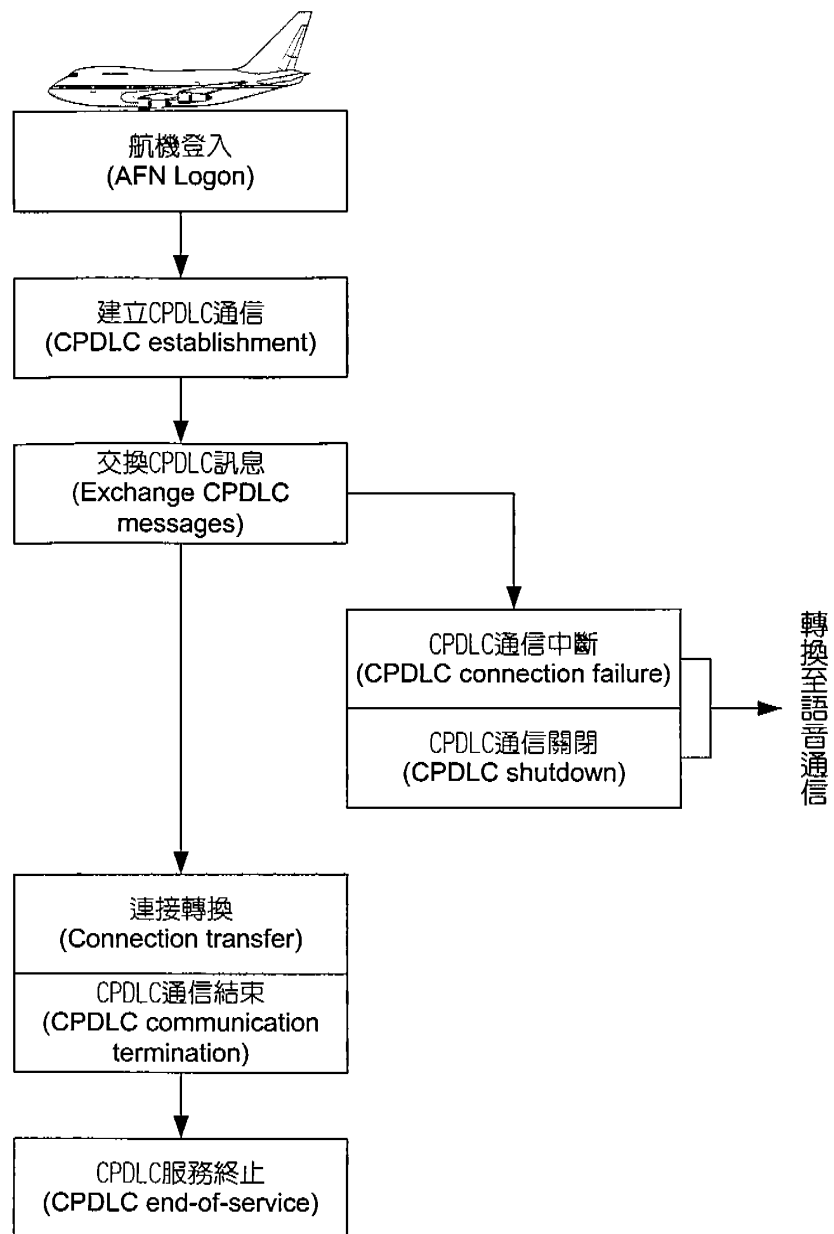
管制員與駕駛員於建立 CPDLC 通信後，即可開始交換訊息，例如航機要求新的航管許可、管制員發給航管指示等。部分 CPDLC 訊息，如航路修改，可於管制員或駕駛員確認之後，自動進入航管系統或機載系統，自動更新飛航計畫中之航路資料，免去管制員／駕駛員重複輸入之工作，並減少錯誤。

6. 於 CPDLC 通信中斷或關閉時，管制員與駕駛員間之通信轉換至無線電或衛星語音通信。

7. 於航空器即將脫離航管單位資料鏈路服務區域前，管制員通知駕駛員 CPDLC 通信終止，或將與航空器之 CPDLC 通信連絡轉移至下一有提供資料鏈路通信之航管單位。透過航管單位間自動化航機資料傳遞（另一項資料鏈路應用 ground-ground ATS interfacility data communication，AIDC），以及本項通信轉換，航機之動態及掌握，可以在不同航管單位間無縫隙的進行。

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┌─────────────────────┐
│      航機登入        │
│    (AFN Logon)      │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│    建立CPDLC通信     │
│(CPDLC establishment)│
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│    交換CPDLC訊息     │
│  (Exchange CPDLC    │─────────┐
│     messages)       │         │
└─────────────────────┘         ▼
           │            ┌─────────────────────────┐
           │            │      CPDLC通信中斷       │
           │            │(CPDLC connection failure)│──────┐
           │            ├─────────────────────────┤      │  轉換至語音通信
           │            │      CPDLC通信關閉       │──────┼──►
           │            │   (CPDLC shutdown)      │      │
           │            └─────────────────────────┘
           ▼
┌─────────────────────────┐
│       連接轉換          │
│  (Connection transfer)  │
├─────────────────────────┤
│     CPDLC通信結束       │
│ (CPDLC communication    │
│      termination)       │
└─────────────────────────┘
           │
           ▼
┌─────────────────────┐
│    CPDLC服務終止     │
│(CPDLC end-of-service)│
└─────────────────────┘
```

(九) CPDLC 應用數位科技，以資料鏈路通信方式輔助或取代傳統無線電語音通信，有許多優點，但因與傳統作業方式有大幅度改變，於計畫建置 CPDLC 時，亦應注意其可能帶來之影響。

| 預　　期　　之　　效　　益 | 可　　能　　之　　影　　響 |
|---|---|
| 減少因無線電頻率擁擠造成之通信延誤。 | 操作 CPDLC 所需之選取、輸入、傳遞及閱讀訊息較傳統無線電通信時間費時。 |
| 減少因無線電品質、語言及文化造成之 | 文字訊息缺少口語溝通時語氣強調之效 |

| | |
|---|---|
| 通信錯誤。 | 果。 |
| 提昇陸空通信效率。 | 增加管制員及駕駛員視線向下時間（head down time），減少管制員觀察雷達及駕駛員觀察外界狀況之時間。 |
| 部分 CPDLC 資料可直接進入航管系統及機載電腦處理，提昇飛航資料處理效率，並減少人為錯誤。 | 駕駛員無法瞭解附近航機與航管單位互動情形。 |

五、 自動監視回報（ADS）

(一) 自動監視回報（Automatic Dependent Surveillance，ADS）係航機將機載導航及位置計算裝備所計算出之航機位置及相關航機飛航資訊，透過資料鏈路，自動的將航機位置資訊傳送至地面航管單位。ADS 資料之傳送不需駕駛員操作。

(二) ADS 報告之航機位置及相關航機飛航資訊可使地面航管單位掌握航機之動態、飛行狀態改變、偵測航機間衝突及早採取解決行動，並有利於航機流量管理及提昇空域使用之效率。

(三) 傳統對航機位置及動態之掌握係透過陸基之雷達系統監視（雷達管制）或駕駛員報告通過某一位置點或具某位置點之方位距離之航機位置（非雷達管制）。雷達管制使用每分鐘 5 至 10 次之雷達偵測到之航機位置，可精確掌握航機動態，因此使用較低之隔離（本區使用 3-5 浬隔離），空域使用效率較佳。但雷達管制受限於雷達裝備視線距離（line-of-sight）之限制，目前一般長程雷達距離為 220 浬～250 浬，也就是說海岸 250 浬外之海洋區域或廣大沙漠區域，無法提供雷達管制。雷達涵蓋範圍之外，航管單位實施非雷達管制，隔離較大（10 分鐘至 15 分鐘），空域使用效率差。以台北洛杉磯航線而言，因通過越洋管制區域（Oceanic Control），實施前後 15 分鐘隔離，如遇航機速度不一致（有時候前一架慢後一架快），管制員多加 2 分鐘保護空間，同一高度一小時內僅能容納 3 架航機。
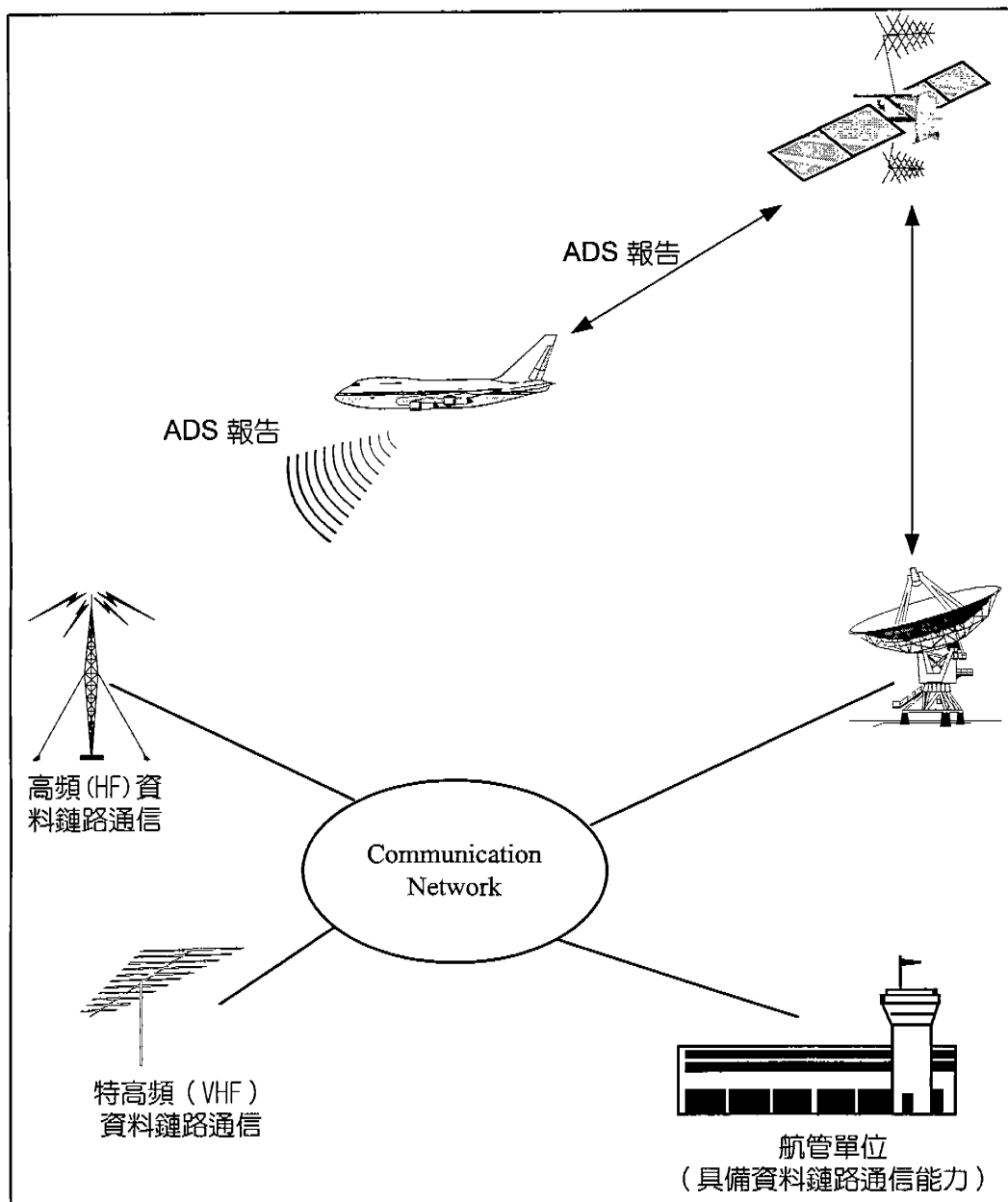
（四）ADS 係航機將自身計算之位置資訊透過資料鏈路傳遞至航管單
　　　位，因此 ADS 資料來源為航機實際執行航行之機載航行裝備。
　　　其所傳送之航機位置資料應不超過最近時間兩秒鐘以上。

（五）具備 FANS 1/A 能力之航機，可以同時與四至五個地面單位通
　　　信，傳送航機位置報告。航機之 ADS 位置報告除傳送至地面航
　　　管單位之外，亦可傳送至航空公司作業中心（AOC）。

(六) ADS 作業概念

1. 飛航服務單位發佈提供 ADS 服務公告，並提供相關航管單位之資料鏈路通信地址（AFN LOGON ADDRESS）。程序上，飛航服務單位應公告實施 ADS 之區域，航機於進入 ADS 區域或劃定之轉換區域（Transition area）前登入飛航服務單位。

2. 航機應於飛航計畫中註明具備 ADS 能力（field10 /D）及航空器註冊號碼（registration number，field 18），航空器註冊號碼供地面航管系與系統內飛航資料連結。

3. 地面航管系統收到航空器登入後，可自動依設定發出與航機之 ADS 約定（contract），要求航機依約定條件傳送 ADS 報告至地面航管單位。

4. 地面航管單位發出給航機之約定中可指示航機在下列四種時機發送 ADS 報告：

    (1) 依要求發送（on demand）

    (2) 於特定事件發生時發送（when triggered by an event）

    (3) 週期性發送（on a periodic basis）

    (4) 於緊急或危險情況時發送（in an emergency and/or urgency condition）

5. ADS 可報告之資訊包括：

    (1) 航空器呼號（aircraft identification）

    (2) 航空器三度空間位置(緯度、經度及高度)(3-D position of the aircraft (latitude, longitude and altitude))

    (3) 時間（time）

    (4) 位置資料準確性之指示數值（indication of the accuracy of the position data information，figure of merit）

    (5) 空中航跡向量（air vector）

        a. 航向（heading）

        b. 空速（馬赫值或指示空速）（Mach or IAS）

c. 爬升／下降率（rate of climb or descent）

(6) 地表航跡向量（ground vector）

    a. 航跡（track）

    b. 地速（ground speed）

    c. 爬升／下降率（rate of climb or descent）

(7) 預期航跡（projected profile）

    a. 下一航點（next way-point）

    b. 預計下一航點高度（estimated level at next way-point）

    c. 預計下一航點時間（estimated time at next way-point）

    d. 下一航點+1（(next+1) way-point）

    e. 預計下一航點+1 高度（estimated level at (next+1) way-point）

    f. 預計下一航點+1 時間（estimated time at (next+1) way-point）

(8) 天氣資料（meteorological information）

    a. 風向（wind direction）

    b. 風速（wind speed）

    c. 溫度（temperature）

    d. 亂流（turbulence）

(9) 短期意圖（short-term intent）

    a. 推算位置之緯度（latitude at projected position）

    b. 推算位置之經度（longitude at projected position）

    c. 推算位置之高度（altitude at projected position）

    d. 推算時間（projection time）

(10) 中期意圖（intermediate intent）如在航機現在位置與短期意圖間預期有高度、航跡或速度改變，短期意圖訊息將加入下列資訊，變成中期意圖，包括：

a. 現在位置至轉換點距離（distance from current point to change point）

b. 現在位置至轉換點航跡（track from current point to change point）

c. 轉換點之高度（level at change point）

d. 轉換點預計時間（projection time to change point）

(11) 預期航跡延伸（extended projected profile）

a. 下一航點（next way-point）

b. 預計下一航點高度（estimated level at next way-point）

c. 預計下一航點時間（estimated time at next way-point）

d. 下一航點+1（(next+1) way-point）

e. 預計下一航點+1 高度（estimated level at (next+1) way-point）

f. 預計下一航點+1 時間（estimated time at (next+1) way-point）

g. 下一航點+2（(next+2) way-point）

h. 預計下一航點+2 高度（estimated level at (next+2) way-point）

i. 預計下一航點+2 時間（estimated time at (next+2) way-point）

j. ......反覆至下一航點+128

六、 ICAO 公佈之第 9694/AN 955 號文件「飛航服務資料鏈路應用手冊（Manual of Air Traffic Services Data Link Applications）」有關飛航服務資料鏈路各項應用中，除管制員駕駛員資料鏈路通信及自動監視回報外，另包括數位化終端資料自動廣播（Digital Automated Terminal Information，DATIS），離場前許可（Pre Departure Clearance，PDC），

自動化之飛航資訊資料鏈路服務（automatic provision of data link flight information services (DFIS)），以及地面航管單位間之資料鏈路通信（ground-ground ATS interfacility data communication (AIDC)）。資料鏈路通信（data link）部分目前大部分國家採外包給通信服務廠商，如全球性之 SITA 及 ARINC 公司，但連結相關飛航服務單位（航管、諮詢、氣象、航站等）及航空公司作業中心之基礎建設 ATN 網路則均為各國 CNS/ATM 發展之重點項目。據聞香港與中國大陸正合作建設地面航管單位之資料鏈路通信（AIDC），加上中國大陸已建置之 CPDLC、ADS、FANS 航路，及自行發射之導航衛星，中國大陸之飛航環境將有跳躍式的躍進。

七、 全球許多國家已經展開 CPDLC 及 ADS 之試驗（trial），部分先進國家甚至已經進入實用階段。但因 CPDLC 及 ADS 資料鏈路之傳輸大部分國家均外包給通信服務廠商，數據資料經由通信服務廠商再轉經不同通信媒介（VHF、HF 或衛星）傳遞給航機，時間延滯較久，且需付費。此外 ADS 回報之航機位置，目前並不能如雷達偵測航機位置一般快速，航機間之隔離也無法縮減到如雷達管制般的三或五浬隔離。依據澳洲與新加坡實用經驗，CPDLC 及 ADS 目前應用在越洋管制上。也就是說在雷達及 VHF 涵蓋範圍內，可以使用較低隔離及快速通信之區域，並不使用 CPDLC 及 ADS。澳洲及新加坡以程序方式訂定使用 CPDLC 及 ADS 使用區域，要求具備 CPDLC 及 ADS 能力之航機，在指定之區域登入地面航管單位，並建立 CPDLC 及 ADS 通信，脫離指定區域後，則轉換至 VHF 無線電通信，航管單位並對相關航機實施雷達管制。台北飛航情報區範圍不大，且經多年努力，助導航及通信設施完備，幾乎全部飛航區域均有 VHF 及雷達涵蓋。目前本區各航路及終端管制區均採用雷達隔離，並與航機直接 VHF 聯繫。與相鄰飛航情報區，包括日本那霸、香港、馬尼拉等區均採用雷達交接，航機隔離小，空域使用效率高。短期內本區對 CPDLC 及 ADS 之需求似乎並不急迫。未來可考慮配合新一代航管系統或空中交通管理

系統（ATM）一併建置，以作為 VHF 及雷達之備份及與相鄰區域銜接，共同構成資料鏈路環境。

八、 CPDLC 及 ADS 在技術及應用上已證明為可行，部分國家也已開始實際應用，但並非已經達到完全成熟、普及之地步。具備 FANS 能力之航機有波音公司之部分機種，AIRBUS 公司之部分機種，其他許多機種，包括具備越洋飛行能力之航機並不都具備 FANS 能力。新加坡航管系統數年前完成 CPDLC 及 ADS 功能建置，隨後波音公司推出具備FANS 能力之 B777 航空器，新加坡航空公司亦購置 B777 新型客機，結果具備新型 FANS 能力之 B777 型飛機(與前一代 747 400 型之 FANS能力略有不同）無法與新加坡新建之資料鏈路系統通連。後來在花了大筆錢請法國原廠修改系統後才解決問題。新技術的全面應用是需要時間逐漸演進的，除飛航服務單位之系統外，使用空域之航空器、其他空域使用者之配合，均需普及至某一程度後，始具備全面實施之效益。

伍、 建議

一、 ICAO 在 CNS/ATM 計畫中勾勒出未來 25 年全球通信、導航、監視及空中交通管理之藍圖，並獲得世界各國之背書。自 1991 年起，全球主要飛機製造廠、航空產業界及民航主管機關均大力推動、研發、實驗各項 CSN/ATM 新技術及相關應用，ICAO 並已發佈相關指南及手冊。然 ICAO 亦請各國民航主管機關考量各國飛航環境、需求、能力，妥善規劃各國 CNS/ATM 計畫及時程，並與國際接軌，達到全球無縫隙之飛航環境。我國飛航情報區範圍不大，助導航及通信設施建設完備，空域及航機管理使用較目前發展之 CPDLC 及 ADS 更有效率。我國 CNS/ATM 計畫中有關 CPDLC 及 ADS 項目正進行通信連絡測試中，未來如不採國內自行研發方式建置資料鏈路通信，則應考量整體空域運用及航管系統更新期程需求之優先順序及相關技術、系統、航

空器配合裝備之成熟情形，適切的調整時程，以獲取最大利益。

二、 CPDLC 與 ADS 一為空中與地面通信連絡方式之重大變革，一為對航機位置監視與掌握之一大進步，均與飛航管制服務及系統有密切關係。先進國家除於實驗階段外，一旦進入實際應用，均將上述功能整合至飛航管制系統內，並輔以適當之航管程序及法規，提供管制員及航空器一個整體之飛航管制及資料鏈路環境。於航管系統之外，建立單獨 CPDLC 及 ADS 管制工作站，除將發生航管系統整合、資料交換等問題外，在不同系統間應用，對空域之劃分、運用、實際航機之管制，甚至管制員間之工作協調均將產生衝擊。本區於資料鏈路通信實驗完成後，應檢討建置 CPDLC/ADS 之時程及方式，儘可能避免於航管系統之外另建單獨工作站。

陸、 參考資料

一、 新加坡民航學院 CPDLC/ADS 應用課程上課資料

二、 ICAO 第 256 號通告「自動監視回報及航管服務資料鏈路應用（ICAO CIRCULAR 256-AN/152 Automatic Dependent Surveillance (ADS) and Air Traffic Services (ATS) Data Link Applications）」

三、 ICAO 第 4444 號文件「飛航及航管服務規則（Rules Of The Air And Air Traffic Services）」

四、 ICAO 第 9694AN955 號文件「飛航服務資料鏈路應用手冊（Manual of Air Traffic Services Data Link Applications）」

赴新加坡民航學院參加管制員／駕駛員

資料鏈路通信及自動回報監視應用課程

出國報告

附　　件

附件一　CPDLC 訊息組

1. 依 ICAO Doc 9694 Manual of Air Traffic Services Data Link Services 定義之 CPDLC message set，計有上傳訊息(Uplink messages) 238 個( 編號 0-237 )，下傳(Downlink messages) 114 個( 編號 0-113 )，合計訊息數目為 342 個。

2. CPDLC messages 除 Uplink 及 Downlink messages 外，另提供管制員及駕駛員「自由文字（Free text）」功能，以應付預先定義之訊息組未涵蓋之情況。

3. Uplink 及 Downlink messages 依功能區分為下列訊息組

| Uplink 訊息組 | 訊息數目 | Downlink 訊息組 | 訊息數目 |
|---|---|---|---|
| Response/acknowledgement | 10 | Responses | 6 |
| Vertical clearance | 46 | Vertical requests | 10 |
| Crossing constraints | 22 | | |
| Lateral offset | 9 | Lateral offset requests | 3 |
| Route modification | 31 | Route modification requests | 8 |
| Speed changes | 21 | Speed requests | 2 |
| Contact/monitor/surveillance request | 11 | Voice contact requests | 2 |
| Report/confirmation request | 33 | Reports | 35 |
| Negotiation request | 5 | Negotiation responses | 6 |
| | | Negotiation requests | 8 |
| Air traffic advisories | 15 | | |
| System management messages | 8 | System management messages | 7 |
| Additional messages | 27 | Additional messages | 18 |
| | | Emergency and urgent messages | 9 |

4. CPDLC訊息依緊急、警告、及回應需求，每個訊息均訂有各自之屬性（Attribute）：

■　緊急（Urgency）屬性（上鏈及下鏈）

| 屬性 | 說明 | 優先 |
|---|---|---|
| D | 遇難（Distress） | 1 |
| U | 緊急（Urgent） | 2 |
| N | 正常（Normal） | 3 |
| L | 低（Low） | 4 |

■　警告（Alert）屬性（上鏈及下鏈）

| 屬性 | 說明 | 優先 |
|---|---|---|
| H | 高(Hign) | 1 |
| M | 中(Medium) | 2 |
| L | 低（Low） | 3 |
| N | 無（No alerting required） | 4 |

■　回應（Response）屬性——上鏈

| 屬性 | 回應需求 | 有效之回應 | 優先 |
|---|---|---|---|
| W/U | Yes | WILCO, UNABLE, STANDBY permitted, LOGICAL ACKNOWLEDGEMENT (only if required), ERROR (if necessary) | 1 |
| A/N | Yes | AFFIRM, NEGATIVE, STANDBY permitted, LOGICAL ACKNOWLEDGEMENT (only if required), | 2 |

| | | ERROR (if necessary) | |
|---|---|---|---|
| R | Yes | ROGER, UNABLE, STANDBY permitted, LOGICAL ACKNOWLEDGEMENT (only if required), ERROR (if necessary) | 3 |
| Y | Yes | Any CPDLC downlink message, LOGICAL ACKNOWLEDGEMENT (only if required) | 4 |
| N | No, unless logical acknowledgement required | LOGICAL ACKNOWLEDGEMENT (only if required), ERROR (if necessary, only when logical acknowledgement is required) | 5 |

■　回應（Response）屬性——下鏈

| 屬性 | 回應需求 | 有效之回應 | 優先 |
|---|---|---|---|
| Y | Yes | Any CPDLC downlink message, LOGICAL ACKNOWLEDGEMENT (only if required) | 1 |
| N | No, unless logical acknowledgement required | LOGICAL ACKNOWLEDGEMENT (only if required), ERROR (if necessary, only when logical acknowledgement is required) | 2 |

## 5.　CPDLC訊息組

### 表 1.　Responses/acknowledgements (uplink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 0 | Indicates that ATC cannot comply with the request. | UNABLE | N | M | N |
| 1 | Indicates that ATC has received the message and will respond. | STANDBY | N | L | N |
| 2 | Indicates that ATC has received the request but it has been deferred until later. | REQUEST DEFERRED | N | L | N |
| 3 | Indicates that ATC has received and understood the message. | ROGER | N | L | N |
| 4 | Yes. | AFFIRM | N | L | N |
| 5 | No. | NEGATIVE | N | L | N |
| 235 | Notification of receipt of unlawful interference message. | ROGER 7500 | U | H | N |
| 211 | Indicates that ATC has received the request and has passed it to the next control authority. | REQUEST FORWARDED | N | L | N |
| 218 | Indicates to the pilot that the request has already been received on the ground. | REQUEST ALREADY RECEIVED | L | N | N |
| 237 | Indicates that the request cannot be responded to by the current unit, and that it should be requested from the next unit | REQUEST AGAIN WITH NEXT UNIT | N | L | N |

### 表 2.　Vertical clearances (uplink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 6 | Notification that a level change instruction should be expected. | EXPECT *(level)* | L | L | R |
| 7 | Notification that an instruction should be expected for the aircraft to commence climb at the specified time. | EXPECT CLIMB AT *(time)* | L | L | R |
| 8 | Notification that an instruction should be expected for the aircraft to commence climb at the specified position. | EXPECT CLIMB AT *(position)* | L | L | R |
| 9 | Notification that an instruction should be expected for the aircraft to commence descent at the specified time. | EXPECT DESCENT AT *(time)* | L | L | R |
| 10 | Notification that an instruction should be expected for the aircraft to commence descent at the specified position. | EXPECT DESCENT AT *(position)* | L | L | R |
| 11 | Notification that an instruction should be expected for the aircraft to commence cruise climb at the specified time. | EXPECT CRUISE CLIMB AT *(time)* | L | L | R |
| 12 | Notification that an instruction should be expected for the aircraft to commence cruise climb at the specified position. | EXPECT CRUISE CLIMB AT *(position)* | L | L | R |
| 13 | Notification that an instruction should be expected for the aircraft to commence climb at the specified time to the specified level. | AT *(time)* EXPECT CLIMB TO *(level)* | L | L | R |
| 14 | Notification that an instruction should be expected for the aircraft to commence climb at the specified position to the specified level. | AT *(position)* EXPECT CLIMB TO *(level)* | L | L | R |
| 15 | Notification that an instruction should be expected for the aircraft to commence descent at the specified time to the specified level. | AT *(time)* EXPECT DESCENT TO *(level)* | L | L | R |
| 16 | Notification that an instruction should be expected for the aircraft to commence descent at the specified position to the specified level. | AT *(position)* EXPECT DESCENT TO *(level)* | L | L | R |
| 17 | Notification that an instruction should be expected for the aircraft to commence cruise climb at the specified time to the specified level. | AT *(time)* EXPECT CRUISE CLIMB TO *(level)* | L | L | R |
| 18 | Notification that an instruction should be expected for the aircraft to commence cruise climb at the specified position to the specified level. | AT *(position)* EXPECT CRUISE CLIMB TO *(level)* | L | L | R |
| 19 | Instruction to maintain the specified level. | MAINTAIN *(level)* | N | M | W/U |
| 20 | Instruction that a climb to a specified level is to commence and once reached the specified level is to be | CLIMB TO *(level)* | N | M | W/U |

| | | | | | |
|---|---|---|---|---|---|
| | maintained. | | | | |
| 21 | Instruction that at the specified time a climb to the specified level is to commence and once reached the specified level is to be maintained. | AT *(time)* CLIMB TO *(level)* | N | M | W/U |
| 22 | Instruction that at the specified position a climb to the specified level is to commence and once reached the specified level is to be maintained. | AT *(position)* CLIMB TO *(level)* | N | M | W/U |
| 185 | Instruction that after passing the specified position a climb to the specified level is to commence and once reached the specified level is to be maintained. | AFTER PASSING *(position)* CLIMB TO *(level)* | N | M | W/U |
| 23 | Instruction that a descent to a specified level is to commence and once reached the specified level is to be maintained. | DESCEND TO *(level)* | N | M | W/U |
| 24 | Instruction that at a specified time a descent to a specified level is to commence and once reached the specified level is to be maintained. | AT *(time)* DESCEND TO *(level)* | N | M | W/U |
| 25 | Instruction that at the specified position a descent to the specified level is to commence and once reached the specified level is to be maintained. | AT *(position)* DESCEND TO *(level)* | N | M | W/U |
| 186 | Instruction that after passing the specified position a descent to the specified level is to commence and once reached the specified level is to be maintained. | AFTER PASSING *(position)* DESCEND TO *(level)* | N | M | W/U |
| 26 | Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified time. | CLIMB TO REACH *(level)* BY *(time)* | N | M | W/U |
| 27 | Instruction that a climb is to commence at a rate such that the specified level is reached at or before the specified position. | CLIMB TO REACH *(level)* BY *(position)* | N | M | W/U |
| 28 | Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified time. | DESCEND TO REACH *(level)* BY *(time)* | N | M | W/U |
| 29 | Instruction that a descent is to commence at a rate such that the specified level is reached at or before the specified position. | DESCEND TO REACH *(level)* BY *(position)* | N | M | W/U |
| 192 | Instruction that a change of level is to continue, but at a rate such that the specified level is reached at or before the specified time. | REACH *(level)* BY *(time)* | N | M | W/U |
| 209 | Instruction that a change of level is to continue, but at a rate such that the specified level is reached at or before the specified position. | REACH *(level)* BY *(position)* | N | M | W/U |

| 30 | Instruction that a level within the defined vertical range specified is to be maintained. | MAINTAIN BLOCK *(level)* TO *(level)* | N | M | W/U |
|---|---|---|---|---|---|
| 31 | Instruction that a climb to a level within the vertical range defined is to commence. | CLIMB TO AND MAINTAIN BLOCK (level) TO (level) | N | M | W/U |
| 32 | Instruction that a descent to a level within the vertical range defined is to commence. | DESCEND TO AND MAINTAIN BLOCK *(level)* TO *(level)* | N | M | W/U |
| 34 | Instruction that a cruise climb is to commence and continue until the specified level is reached. | CRUISE CLIMB TO *(level)* | N | M | W/U |
| 35 | Instruction that a cruise climb can commence once above the specified level. | CRUISE CLIMB ABOVE *(level)* | N | M | W/U |
| 219 | Instruction to stop the climb below the previously assigned level. | STOP CLIMB AT *(level)* | U | M | W/U |
| 220 | Instruction to stop the descent above the previously assigned level. | STOP DESCENT AT *(level)* | U | M | W/U |
| 36 | Instruction that the climb to the specified level should be made at the aircraft's best rate. | EXPEDITE CLIMB TO *(level)* | U | M | W/U |
| 37 | Instruction that the descent to the specified level should be made at the aircraft's best rate. | EXPEDITE DESCENT TO *(level)* | U | M | W/U |
| 38 | Urgent instruction to immediately climb to the specified level. | IMMEDIATELY CLIMB TO *(level)* | D | H | W/U |
| 39 | Urgent instruction to immediately descend to the specified level. | IMMEDIATELY DESCEND TO *(level)* | D | H | W/U |
| 40 | (reserved) | | L | L | Y |
| 41 | (reserved) | | L | L | Y |
| 171 | Instruction to climb at not less than the specified rate. | CLIMB AT *(vertical rate)* MINIMUM | N | M | W/U |
| 172 | Instruction to climb at not above the specified rate. | CLIMB AT *(vertical rate)* MAXIMUM | N | M | W/U |
| 173 | Instruction to descend at not less than the specified rate. | DESCEND AT *(vertical rate)* MINIMUM | N | M | W/U |
| 174 | Instruction to descend at not above the specified rate. | DESCEND AT *(vertical rate)* MAXIMUM | N | M | W/U |
| 33 | (reserved) | | L | L | Y |

*Note.— Wherever the variable "level" is specified, the message can specify either a single level or a vertical range, i.e. block level.*

### 表 3.　Crossing constraints (uplink)

| | *Message intent/use* | *Message element* | *URG* | *ALRT* | *RESP* |
|---|---|---|---|---|---|
| 42 | Notification that a level change instruction should be expected which will require the specified position to be crossed at the specified level. | EXPECT TO CROSS *(position)* AT *(level)* | L | L | R |

| 43 | Notification that a level change instruction should be expected which will require the specified position to be crossed at or above the specified level. | EXPECT TO CROSS *(position)* AT OR ABOVE *(level)* | L | L | R |
|----|---|---|---|---|---|
| 44 | Notification that a level change instruction should be expected which will require the specified position to be crossed at or below the specified level. | EXPECT TO CROSS *(position)* AT OR BELOW *(level)* | L | L | R |
| 45 | Notification that a level change instruction should be expected which will require the specified position to be crossed at the specified level which is to be maintained subsequently. | EXPECT TO CROSS *(position)* AT AND MAINTAIN *(level)* | L | L | R |
| 46 | Instruction that the specified position is to be crossed at the specified level. This may require the aircraft to modify its climb or descent profile. | CROSS *(position)* AT *(level)* | N | M | W/U |
| 47 | Instruction that the specified position is to be crossed at or above the specified level. | CROSS *(position)* AT OR ABOVE *(level)* | N | M | W/U |
| 48 | Instruction that the specified position is to be crossed at or below the specified level. | CROSS *(position)* AT OR BELOW *(level)* | N | M | W/U |
| 49 | Instruction that the specified position is to be crossed at the specified level and that level is to be maintained when reached. | CROSS *(position)* AT AND MAINTAIN *(level)* | N | M | W/U |
| 50 | Instruction that the specified position is to be crossed at a level between the specified levels. | CROSS *(position)* BETWEEN *(level)* AND *(level)* | N | M | W/U |
| 51 | Instruction that the specified position is to be crossed at the specified time. | CROSS *(position)* AT *(time)* | N | M | W/U |
| 52 | Instruction that the specified position is to be crossed at or before the specified time. | CROSS *(position)* AT OR BEFORE *(time)* | N | M | W/U |
| 53 | Instruction that the specified position is to be crossed at or after the specified time. | CROSS *(position)* AT OR AFTER *(time)* | N | M | W/U |
| 54 | Instruction that the specified position is to be crossed at a time between the specified times. | CROSS *(position)* BETWEEN *(time)* AND *(time)* | N | M | W/U |
| 55 | Instruction that the specified position is to be crossed at the specified speed and the specified speed is to be maintained until further advised. | CROSS *(position)* AT *(speed)* | N | M | W/U |
| 56 | Instruction that the specified position is to be crossed at a speed equal to or less than the specified speed and the specified speed or less is to be maintained until further | CROSS *(position)* AT OR LESS THAN *(speed)* | N | M | W/U |

| | | | URG | ALRT | RESP |
|---|---|---|---|---|---|
| | advised. | | | | |
| 57 | Instruction that the specified position is to be crossed at a speed equal to or greater than the specified speed and the specified speed or greater is to be maintained until further advised. | CROSS *(position)* AT OR GREATER THAN *(speed)* | N | M | W/U |
| 58 | Instruction that the specified position is to be crossed at the specified time and at the specified level. | CROSS *(position)* AT *(time)* AT *(level)* | N | M | W/U |
| 59 | Instruction that the specified position is to be crossed at or before the specified time and at the specified level. | CROSS *(position)* AT OR BEFORE *(time)* AT *(level)* | N | M | W/U |
| 60 | Instruction that the specified position is to be crossed at or after the specified time and at the specified level. | CROSS *(position)* AT OR AFTER *(time)* AT *(level)* | N | M | W/U |
| 61 | Instruction that the specified position is to be crossed at the specified level and speed, and the level and speed are to be maintained. | CROSS *(position)* AT AND MAINTAIN *(level)* AT *(speed)* | N | M | W/U |
| 62 | Instruction that at the specified time the specified position is to be crossed at the specified level and the level is to be maintained. | AT *(time)* CROSS *(position)* AT AND MAINTAIN *(level)* | N | M | W/U |
| 63 | Instruction that at the specified time the specified position is to be crossed at the specified level and speed, and the level and speed are to be maintained. | AT *(time)* CROSS *(position)* AT AND MAINTAIN *(level)* AT *(speed)* | N | M | W/U |

*Note.— Wherever the variable "level" is specified, the message can specify either a single level or a vertical range, i.e. block level.*

## 表 4. Lateral offsets (uplink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 64 | Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction. | OFFSET *(specified distance)* *(direction)* OF ROUTE | N | M | W/U |
| 65 | Instruction to fly a parallel track to the cleared route at a displacement of the specified distance in the specified direction and commencing at the specified position. | AT *(position)* OFFSET *(specified distance)* *(direction)* OF ROUTE | N | M | W/U |
| 66 | Instruction to fly a parallel track to the cleared route at a displacement | AT *(time)* OFFSET *(specified distance)* | N | M | W/U |

|  |  |  |  |  |  |
|---|---|---|---|---|---|
|  | of the specified distance in the specified direction and commencing at the specified time. | (direction) OF ROUTE |  |  |  |
| 67 | Instruction that the cleared flight route is to be rejoined. | PROCEED BACK ON ROUTE | N | M | W/U |
| 68 | Instruction that the cleared flight route is to be rejoined at or before the specified position. | REJOIN ROUTE BY (position) | N | M | W/U |
| 69 | Instruction that the cleared flight route is to be rejoined at or before the specified time. | REJOIN ROUTE BY (time) | N | M | W/U |
| 70 | Notification that a clearance may be issued to enable the aircraft to rejoin the cleared route at or before the specified position. | EXPECT BACK ON ROUTE BY (position) | L | L | R |
| 71 | Notification that a clearance may be issued to enable the aircraft to rejoin the cleared route at or before the specified time. | EXPECT BACK ON ROUTE BY (time) | L | L | R |
| 72 | Instruction to resume own navigation following a period of tracking or heading clearances. May be used in conjunction with an instruction on how or where to rejoin the cleared route. | RESUME OWN NAVIGATION | N | M | W/U |

## 表 5. Route modifications (uplink)

|  | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 73 | Notification to the aircraft of the instructions to be followed from departure until the specified clearance limit. | (departure clearance) | N | M | W/U |
| 74 | Instruction to proceed directly from its present position to the specified position. | PROCEED DIRECT TO (position) | N | M | W/U |
| 75 | Instruction to proceed, when able, directly to the specified position. | WHEN ABLE PROCEED DIRECT TO (position) | N | M | W/U |
| 76 | Instruction to proceed, at the specified time, directly to the specified position. | AT (time) PROCEED DIRECT TO (position) | N | M | W/U |
| 77 | Instruction to proceed, at the specified position, directly to the next specified position. | AT (position) PROCEED DIRECT TO (position) | N | M | W/U |
| 78 | Instruction to proceed, upon reaching the specified level, directly to the specified position. | AT (level) PROCEED DIRECT TO (position) | N | M | W/U |
| 79 | Instruction to proceed to the specified position via the specified route. | CLEARED TO (position) VIA (route clearance) | N | M | W/U |
| 80 | Instruction to proceed via the specified route. | CLEARED (route clearance) | N | M | W/U |

| 81 | Instruction to proceed in accordance with the specified procedure. | CLEARED *(procedure name)* | N | M | W/U |
|---|---|---|---|---|---|
| 236 | Instruction to leave controlled airspace. | LEAVE CONTROLLED AIRSPACE | N | M | W/U |
| 82 | Approval to deviate up to the specified distance from the cleared route in the specified direction. | CLEARED TO DEVIATE UP TO *(specified distance)* *(direction)* OF ROUTE | N | M | W/U |
| 83 | Instruction to proceed from the specified position via the specified route. | AT *(position)* CLEARED *(route clearance)* | N | M | W/U |
| 84 | Instruction to proceed from the specified position via the specified procedure. | AT *(position)* CLEARED *(procedure name)* | N | M | W/U |
| 85 | Notification that a clearance to fly on the specified route may be issued. | EXPECT *(route clearance)* | L | L | R |
| 86 | Notification that a clearance to fly on the specified route from the specified position may be issued. | AT *(position)* EXPECT *(route clearance)* | L | L | R |
| 87 | Notification that a clearance to fly directly to the specified position may be issued. | EXPECT DIRECT TO *(position)* | L | L | R |
| 88 | Notification that a clearance to fly directly from the first specified position to the next specified position may be issued. | AT *(position)* EXPECT DIRECT TO *(position)* | L | L | R |
| 89 | Notification that a clearance to fly directly to the specified position commencing at the specified time may be issued. | AT *(time)* EXPECT DIRECT TO *(position)* | L | L | R |
| 90 | Notification that a clearance to fly directly to the specified position commencing when the specified level is reached may be issued. | AT *(level)* EXPECT DIRECT TO *(position)* | L | L | R |
| 91 | Instruction to enter a holding pattern with the specified characteristics at the specified position and level. | HOLD AT *(position)* MAINTAIN *(level)* INBOUND TRACK *(degrees)* *(direction)* TURNS *(leg type)* | N | M | W/U |
| 92 | Instruction to enter a holding pattern with the published characteristics at the specified position and level. | HOLD AT *(position)* AS PUBLISHED MAINTAIN *(level)* | N | M | W/U |
| 93 | Notification that an onwards clearance may be issued at the specified time. | EXPECT FURTHER CLEARANCE AT *(time)* | L | L | R |
| 94 | Instruction to turn left or right as specified on to the specified heading. | TURN *(direction)* HEADING *(degrees)* | N | M | W/U |
| 95 | Instruction to turn left or right as specified on to the specified track. | TURN *(direction)* GROUND TRACK *(degrees)* | N | M | W/U |
| 215 | Instruction to turn a specified number of degrees left or right. | TURN *(direction)* *(degrees)* | N | M | W/U |
| 190 | Instruction to fly on the specified heading. | FLY HEADING *(degrees)* | N | M | W/U |
| 96 | Instruction to continue to fly on the | CONTINUE PRESENT | N | M | W/U |

| | | | | | |
|---|---|---|---|---|---|
| | current heading. | HEADING | | | |
| 97 | Instruction to fly on the specified heading from the specified position. | AT *(position)* FLY HEADING *(degrees)* | N | M | W/U |
| 221 | Instruction to stop turn at the specified heading prior to reaching the previously assigned heading. | STOP TURN HEADING *(degrees)* | U | M | W/U |
| 98 | Instruction to turn immediately left or right as specified on to the specified heading. | IMMEDIATELY TURN *(direction)* HEADING *(degrees)* | D | H | W/U |
| 99 | Notification that a clearance may be issued for the aircraft to fly the specified procedure. | EXPECT *(procedure name)* | L | L | R |

*Note.— Wherever the variable "level" is specified, the message can specify either a single level or a vertical range, i.e. block level.*

## 表 6.　Speed changes (uplink)

| | *Message intent/use* | *Message element* | *URG* | *ALRT* | *RESP* |
|---|---|---|---|---|---|
| 100 | Notification that a speed instruction may be issued to be effective at the specified time. | AT *(time)* EXPECT *(speed)* | L | L | R |
| 101 | Notification that a speed instruction may be issued to be effective at the specified position. | AT *(position)* EXPECT *(speed)* | L | L | R |
| 102 | Notification that a speed instruction may be issued to be effective at the specified level. | AT *(level)* EXPECT *(speed)* | L | L | R |
| 103 | Notification that a speed range instruction may be issued to be effective at the specified time. | AT *(time)* EXPECT *(speed)* TO *(speed)* | L | L | R |
| 104 | Notification that a speed range instruction may be issued to be effective at the specified position. | AT *(position)* EXPECT *(speed)* TO *(speed)* | L | L | R |
| 105 | Notification that a speed range instruction may be issued to be effective at the specified level. | AT *(level)* EXPECT *(speed)* TO *(speed)* | L | L | R |
| 106 | Instruction that the specified speed is to be maintained. | MAINTAIN *(speed)* | N | M | W/U |
| 188 | Instruction that after passing the specified position the specified speed is to be maintained. | AFTER PASSING *(position)* MAINTAIN *(speed)* | N | M | W/U |
| 107 | Instruction that the present speed is to be maintained. | MAINTAIN PRESENT SPEED | N | M | W/U |
| 108 | Instruction that the specified speed or a greater speed is to be maintained. | MAINTAIN *(speed)* OR GREATER | N | M | W/U |
| 109 | Instruction that the specified speed or a lesser speed is to be maintained. | MAINTAIN *(speed)* OR LESS | N | M | W/U |
| 110 | Instruction that a speed within the | MAINTAIN *(speed)* TO | N | M | W/U |

|  | specified range is to be maintained. | (speed) |  |  |  |
|---|---|---|---|---|---|
| 111 | Instruction that the present speed is to be increased to the specified speed and maintained until further advised. | INCREASE SPEED TO (speed) | N | M | W/U |
| 112 | Instruction that the present speed is to be increased to the specified speed or greater, and maintained at or above the specified speed until further advised. | INCREASE SPEED TO (speed) OR GREATER | N | M | W/U |
| 113 | Instruction that the present speed is to be reduced to the specified speed and maintained until further advised. | REDUCE SPEED TO (speed) | N | M | W/U |
| 114 | Instruction that the present speed is to be reduced to the specified speed or less and maintained at or below the specified speed until further advised. | REDUCE SPEED TO (speed) OR LESS | N | M | W/U |
| 115 | Instruction that the specified speed is not to be exceeded. | DO NOT EXCEED (speed) | N | M | W/U |
| 116 | Notification that the aircraft need no longer comply with the previously issued speed restriction. | RESUME NORMAL SPEED | N | M | W/U |
| 189 | Instruction that the present speed is to be changed to the specified speed. | ADJUST SPEED TO (speed) | N | M | W/U |
| 222 | Notification that the aircraft may keep its preferred speed without restriction. | NO SPEED RESTRICTION | L | L | R |
| 223 | Instruction to reduce present speed to the minimum safe approach speed | REDUCE TO MINIMUM APPROACH SPEED | N | M | W/U |

Note.— Wherever the variable "level" is specified, the message can specify either a single level or a vertical range, i.e. block level.

表 7.　Contact/monitor/surveillance requests (uplink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 117 | Instruction that the ATS unit with the specified ATS unit name is to be contacted on the specified frequency. | CONTACT (unit name) (frequency) | N | M | W/U |
| 118 | Instruction that at the specified position the ATS unit with the specified ATS unit name is to be contacted on the specified frequency. | AT (position) CONTACT (unit name) (frequency) | N | M | W/U |
| 119 | Instruction that at the specified time the ATS unit with the specified ATS | AT (time) CONTACT (unit name) (frequency) | N | M | W/U |

|  |  |  |  |  |  |
|---|---|---|---|---|---|
|  | unit name is to be contacted on the specified frequency. |  |  |  |  |
| 120 | Instruction that the ATS unit with the specified ATS unit name is to be monitored on the specified frequency. | MONITOR *(unit name) (frequency)* | N | M | W/U |
| 121 | Instruction that at the specified position the ATS unit with the specified ATS unit name is to be monitored on the specified frequency. | AT *(position)* MONITOR *(unit name) (frequency)* | N | M | W/U |
| 122 | Instruction that at the specified time the ATS unit with the specified ATS unit name is to be monitored on the specified frequency. | AT *(time)* MONITOR *(unit name) (frequency)* | N | M | W/U |
| 123 | Instruction that the specified code (SSR code) is to be selected. | SQUAWK *(code)* | N | M | W/U |
| 124 | Instruction that the SSR transponder responses are to be disabled. | STOP SQUAWK | N | M | W/U |
| 125 | Instruction that the SSR transponder responses should include level information. | SQUAWK MODE CHARLIE | N | M | W/U |
| 126 | Instruction that the SSR transponder responses should no longer include level information. | STOP SQUAWK MODE CHARLIE | N | M | W/U |
| 179 | Instruction that the 'ident' function on the SSR transponder is to be actuated. | SQUAWK IDENT | N | M | W/U |

## 表 8.　Report/confirmation requests (uplink)

|  | *Message intent/use* | *Message element* | *URG* | *ALRT* | *RESP* |
|---|---|---|---|---|---|
| 127 | Instruction to report when the aircraft is back on the cleared route. | REPORT BACK ON ROUTE | N | L | W/U |
| 128 | Instruction to report when the aircraft has left the specified level. | REPORT LEAVING *(level)* | N | L | W/U |
| 129 | Instruction to report when the aircraft is maintaining level flight at the specified level. | REPORT MAINTAINING *(level)* | N | L | W/U |
| 175 | Instruction to report when the aircraft has reached the specified level. | REPORT REACHING *(level)* | N | L | W/U |
| 200 | Instruction used in conjunction with a level clearance to report reaching the level assigned. | REPORT REACHING | N | L | W/U |
| 180 | Instruction to report when the aircraft is within the specified vertical range. | REPORT REACHING BLOCK *(level)* TO *(level)* | N | L | W/U |
| 130 | Instruction to report when the aircraft has passed the specified position. | REPORT PASSING *(position)* | N | L | W/U |
| 181 | Instruction to report the present | REPORT DISTANCE *(to/* | N | M | Y |

| | | | | | |
|---|---|---|---|---|---|
| | distance to or from the specified position. | *from) (position)* | | | |
| 184 | Instruction to report at the specified time the distance to or from the specified position. | AT *(time)* REPORT DISTANCE *(to/from) (position)* | N | L | Y |
| 228 | Instruction to report the estimated time of arrival at the specified position. | REPORT ETA *(position)* | L | L | Y |
| 131 | Instruction to report the amount of fuel remaining and the number of persons on board. | REPORT REMAINING FUEL AND PERSONS ON BOARD | U | M | Y |
| 132 | Instruction to report the present position. | REPORT POSITION | N | M | Y |
| 133 | Instruction to report the present level. | REPORT PRESENT LEVEL | N | M | Y |
| 134 | Instruction to report the requested speed. | REPORT *(speed type) (speed type) (speed type)* SPEED | N | M | Y |
| 135 | Instruction to confirm and acknowledge the currently assigned level. | CONFIRM ASSIGNED LEVEL | N | L | Y |
| 136 | Instruction to confirm and acknowledge the currently assigned speed. | CONFIRM ASSIGNED SPEED | N | L | Y |
| 137 | Instruction to confirm and acknowledge the currently assigned route. | CONFIRM ASSIGNED ROUTE | N | L | Y |
| 138 | Instruction to confirm the previously reported time over the last reported waypoint. | CONFIRM TIME OVER REPORTED WAYPOINT | N | L | Y |
| 139 | Instruction to confirm the identity of the previously reported waypoint. | CONFIRM REPORTED WAYPOINT | N | L | Y |
| 140 | Instruction to confirm the identity of the next waypoint. | CONFIRM NEXT WAYPOINT | N | L | Y |
| 141 | Instruction to confirm the previously reported estimated time at the next waypoint. | CONFIRM NEXT WAYPOINT ETA | N | L | Y |
| 142 | Instruction to confirm the identity of the next but one waypoint. | CONFIRM ENSUING WAYPOINT | N | L | Y |
| 143 | The request was not understood. It should be clarified and resubmitted. | CONFIRM REQUEST | N | L | Y |
| 144 | Instruction to report the selected (SSR) code. | CONFIRM SQUAWK | N | L | Y |
| 145 | Instruction to report the present heading. | REPORT HEADING | N | M | Y |
| 146 | Instruction to report the present ground track. | REPORT GROUND TRACK | N | M | Y |
| 182 | Instruction to report the identification code of the last ATIS received. | CONFIRM ATIS CODE | N | L | Y |
| 147 | Instruction to make a position report. | REQUEST POSITION REPORT | N | M | Y |
| 216 | Instruction to file a flight plan. | REQUEST FLIGHT PLAN | N | M | Y |
| 217 | Instruction to report that the aircraft has landed. | REPORT ARRIVAL | N | M | Y |

| 229 | Instruction to report the preferred alternate aerodrome for landing. | REPORT ALTERNATE AERODROME | L | L | Y |
|---|---|---|---|---|---|
| 231 | Instruction to indicate the pilot's preferred level. | STATE PREFERRED LEVEL | L | L | Y |
| 232 | Instruction to indicate the pilot's preferred time and/or position to commence descent to the aerodrome of intended arrival. | STATE TOP OF DESCENT | L | L | Y |

*Note.— Wherever the variable "level" is specified, the message can specify either a single level or a vertical range, i.e. block level.*

## 表 9. Negotiation requests (uplink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 148 | Request for the earliest time at which the specified level can be accepted. | WHEN CAN YOU ACCEPT *(level)* | N | L | Y |
| 149 | Instruction to report whether or not the specified level can be accepted at the specified position. | CAN YOU ACCEPT *(level)* AT *(position)* | N | L | A/N |
| 150 | Instruction to report whether or not the specified level can be accepted at the specified time. | CAN YOU ACCEPT *(level)* AT *(time)* | N | L | A/N |
| 151 | Instruction to report the earliest time when the specified speed can be accepted. | WHEN CAN YOU ACCEPT *(speed)* | N | L | Y |
| 152 | Instruction to report the earliest time when the specified offset track can be accepted. | WHEN CAN YOU ACCEPT *(specified distance) (direction)* OFFSET | N | L | Y |

*Note.— Wherever the variable "level" is specified, the message can specify either a single level or a vertical range, i.e. block level.*

## 表 10. Air traffic advisories (uplink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 153 | ATS advisory that the altimeter setting should be the specified setting. | ALTIMETER *(altimeter)* | N | L | R |
| 213 | ATS advisory that the specified altimeter setting relates to the specified facility. | *(facility designation)* ALTIMETER *(altimeter)* | N | L | R |
| 154 | ATS advisory that the radar service is terminated. | RADAR SERVICE TERMINATED | N | L | R |
| 191 | ATS advisory that the aircraft is entering airspace in which no air traffic services are provided and all existing air traffic services are | ALL ATS TERMINATED | N | M | R |

| | | | | | |
|---|---|---|---|---|---|
| | terminated. | | | | |
| 155 | ATS advisory that radar contact has been established at the specified position. | RADAR CONTACT (position) | N | M | R |
| 156 | ATS advisory that radar contact has been lost. | RADAR CONTACT LOST | N | M | R |
| 210 | ATS advisory that the aircraft has been identified on radar at the specified position. | IDENTIFIED (position) | N | M | R |
| 193 | Notification that radar identification has been lost. | IDENTIFICATION LOST | N | M | R |
| 157 | Notification that a continuous transmission is detected on the specified frequency. Check the microphone button. | CHECK STUCK MICROPHONE (frequency) | U | M | N |
| 158 | ATS advisory that the ATIS information identified by the specified code is the current ATIS information. | ATIS (atis code) | N | L | R |
| 212 | ATS advisory that the specified ATIS information at the specified airport is current. | (facility designation) ATIS (atis code) CURRENT | N | L | R |
| 214 | ATS advisory that indicates the RVR value for the specified runway. | RVR RUNWAY (runway) (rvr) | N | M | R |
| 224 | ATS advisory that no delay is expected. | NO DELAY EXPECTED | N | L | R |
| 225 | ATS advisory that the expected delay has not been determined. | DELAY NOT DETERMINED | N | L | R |
| 226 | ATS advisory that the aircraft may expect to be cleared to commence its approach procedure at the specified time. | EXPECTED APPROACH TIME (time) | N | L | R |

表 11.　System management messages (uplink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 159 | A system-generated message notifying that the ground system has detected an error. | ERROR (error information) | U | M | N |
| 160 | Notification to the avionics that the specified data authority is the next data authority. If no data authority is specified, this indicates that any previously specified next data authority is no longer valid. | NEXT DATA AUTHORITY (facility) | L | N | N |
| 161 | Notification to the avionics that the data link connection with the current data authority is being terminated. | END SERVICE | L | N | N |
| 162 | Notification that the ground system does not support this message. | SERVICE UNAVAILABLE | L | L | N |

| 234 | Notification that the ground system does not have a flight plan for that aircraft. | FLIGHT PLAN NOT HELD | L | L | N |
| --- | --- | --- | --- | --- | --- |
| 163 | Notification to the pilot of an ATSU identifier. | *(facility designation)* | L | N | N |
| 227 | Confirmation to the aircraft system that the ground system has received the message to which the logical acknowledgement refers and found it acceptable for display to the responsible person. | LOGICAL ACKNOWLEDGEMENT | N | M | N |
| 233 | Notification to the pilot that messages sent requiring a logical acknowledgement will not be accepted by this ground system. | USE OF LOGICAL ACKNOWLEDGEMENT PROHIBITED | N | M | N |

## 表 12.　Additional messages (uplink)

| | Message intent/use | Message element | URG | ALRT | RESP |
| --- | --- | --- | --- | --- | --- |
| 164 | The associated instruction may be complied with at any future time. | WHEN READY | L | N | N |
| 230 | The associated instruction is to be complied with immediately. | IMMEDIATELY | D | H | N |
| 165 | Used to link two messages, indicating the proper order of execution of clearances/instructions. | THEN | L | N | N |
| 166 | The associated instruction is issued due to traffic considerations. | DUE TO *(traffic type)* TRAFFIC | L | N | N |
| 167 | The associated instruction is issued due to airspace restrictions. | DUE TO AIRSPACE RESTRICTION | L | N | N |
| 168 | The indicated communication should be ignored. | DISREGARD | U | M | R |
| 176 | Notification that the pilot is responsible for maintaining separation from other traffic and is also responsible for maintaining visual meteorological conditions. | MAINTAIN OWN SEPARATION AND VMC | N | M | W/U |
| 177 | Used in conjunction with a clearance/instruction to indicate that the pilot may execute when prepared to do so. | AT PILOTS DISCRETION | L | L | N |
| 178 | (reserved) | | L | L | Y |
| 169 | | *(free text)* | N | L | R |
| 170 | | *(free text)* | D | H | R |
| 183 | | *(free text)* | N | M | N |
| 187 | | *(free text)* | L | N | N |
| 194 | | *(free text)* | N | L | Y |
| 195 | | *(free text)* | L | L | R |
| 196 | | *(free text)* | N | M | W/U |
| 197 | | *(free text)* | U | M | W/U |
| 198 | | *(free text)* | D | H | W/U |

| 199 | | *(free text)* | N | L | N |
|-----|--------|--------------|---|---|---|
| 201 | Not used | | L | L | N |
| 202 | Not used | | L | L | N |
| 203 | | *(free text)* | N | M | R |
| 204 | | *(free text)* | N | M | Y |
| 205 | | *(free text)* | N | M | A/N |
| 206 | | *(free text)* | L | N | Y |
| 207 | | *(free text)* | L | L | Y |
| 208 | | *(free text)* | L | L | N |

*Note.— Free text message elements have no associated message intent. The capability to send a free text message with any of the attribute combinations already used in the message set has been provided for in the technical requirements of the ATN (Annex 10, Volume III, Part I, Chapter 3).*

## 表 13.　Responses (downlink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 0 | The instruction is understood and will be complied with. | WILCO | N | M | N |
| 1 | The instruction cannot be complied with. | UNABLE | N | M | N |
| 2 | Wait for a reply. | STANDBY | N | M | N |
| 3 | Message received and understood. | ROGER | N | M | N |
| 4 | Yes. | AFFIRM | N | M | N |
| 5 | No. | NEGATIVE | N | M | N |

## 表 14.　Vertical requests (downlink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 6 | Request to fly at the specified level. | REQUEST *(level)* | N | L | Y |
| 7 | Request to fly at a level within the specified vertical range. | REQUEST BLOCK *(level)* TO *(level)* | N | L | Y |
| 8 | Request to cruise climb to the specified level. | REQUEST CRUISE CLIMB TO *(level)* | N | L | Y |
| 9 | Request to climb to the specified level. | REQUEST CLIMB TO *(level)* | N | L | Y |
| 10 | Request to descend to the specified level. | REQUEST DESCENT TO *(level)* | N | L | Y |
| 11 | Request that at the specified position a climb to the specified level be approved. | AT *(position)* REQUEST CLIMB TO *(level)* | N | L | Y |
| 12 | Request that at the specified position a descent to the specified level be approved. | AT *(position)* REQUEST DESCENT TO *(level)* | N | L | Y |
| 13 | Request that at the specified time a climb to the specified level be approved. | AT *(time)* REQUEST CLIMB TO *(level)* | N | L | Y |

| 14 | Request that at the specified time a descent to the specified level be approved. | AT *(time)* REQUEST DESCENT TO *(level)* | N | L | Y |
| 69 | Request that a descent be approved on a see-and-avoid basis. | REQUEST VMC DESCENT | N | L | Y |

Note.— Wherever the variable "level" is specified, the message can specify either a single level or a vertical range, i.e. block level.

表 15. Lateral offset requests (downlink)

| | Message intent/use | Message element | URG | ALRT | RESP |
| --- | --- | --- | --- | --- | --- |
| 15 | Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved. | REQUEST OFFSET *(specified distance)* *(direction)* OF ROUTE | N | L | Y |
| 16 | Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved from the specified position. | AT *(position)* REQUEST OFFSET *(specified distance)* *(direction)* OF ROUTE | N | L | Y |
| 17 | Request that a parallel track, offset from the cleared track by the specified distance in the specified direction, be approved from the specified time. | AT *(time)* REQUEST OFFSET *(specified distance)* *(direction)* OF ROUTE | N | L | Y |

表 16. Speed requests (downlink)

| | Message intent/use | Message element | URG | ALRT | RESP |
| --- | --- | --- | --- | --- | --- |
| 18 | Request to fly at the specified speed. | REQUEST *(speed)* | N | L | Y |
| 19 | Request to fly within the specified speed range. | REQUEST *(speed)* TO *(speed)* | N | L | Y |

表 17. Voice contact requests (downlink)

| | Message intent/use | Message element | URG | ALRT | RESP |
| --- | --- | --- | --- | --- | --- |
| 20 | Request for voice contact. | REQUEST VOICE CONTACT | N | L | Y |
| 21 | Request for voice contact on the specified frequency. | REQUEST VOICE CONTACT *(frequency)* | N | L | Y |

表 18. Route modification requests (downlink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 22 | Request to track from the present position direct to the specified position. | REQUEST DIRECT TO *(position)* | N | L | Y |
| 23 | Request for the specified procedure clearance. | REQUEST *(procedure name)* | N | L | Y |
| 24 | Request for a route clearance. | REQUEST CLEARANCE *(route clearance)* | N | L | Y |
| 25 | Request for a clearance. | REQUEST *(clearance type)* CLEARANCE | N | L | Y |
| 26 | Request for a weather deviation to the specified position via the specified route. | REQUEST WEATHER DEVIATION TO *(position)* VIA *(route clearance)* | N | M | Y |
| 27 | Request for a weather deviation up to the specified distance off track in the specified direction. | REQUEST WEATHER DEVIATION UP TO (specified distance) *(direction)* OF ROUTE | N | M | Y |
| 70 | Request a clearance to adopt the specified heading. | REQUEST HEADING *(degrees)* | N | L | Y |
| 71 | Request a clearance to adopt the specified ground track. | REQUEST GROUND TRACK *(degrees)* | N | L | Y |

表 19. Reports (downlink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 28 | Notification of leaving the specified level. | LEAVING *(level)* | N | L | N |
| 29 | Notification of climbing to the specified level. | CLIMBING TO *(level)* | N | L | N |
| 30 | Notification of descending to the specified level. | DESCENDING TO *(level)* | N | L | N |
| 31 | Notification of passing the specified position. | PASSING *(position)* | N | L | N |
| 78 | Notification that at the specified time the aircraft's position was as specified. | AT *(time) (distance) (to/from) (position)* | N | L | N |
| 32 | Notification of the present level. | PRESENT LEVEL *(level)* | N | L | N |
| 33 | Notification of the present position. | PRESENT POSITION *(position)* | N | L | N |
| 34 | Notification of the present speed. | PRESENT SPEED *(speed)* | N | L | N |
| 113 | Notification of the requested speed. | *(speed type) (speed type) (speed type)* SPEED *(speed)* | N | L | N |
| 35 | Notification of the present heading in degrees. | PRESENT HEADING *(degrees)* | N | L | N |
| 36 | Notification of the present ground | PRESENT GROUND | N | L | N |

| | | track in degrees. | TRACK *(degrees)* | | | |
|---|---|---|---|---|---|---|
| | 37 | Notification that the aircraft is maintaining the specified level. | MAINTAINING *(level)* | N | L | N |
| | 72 | Notification that the aircraft has reached the specified level. | REACHING *(level)* | N | L | N |
| | 76 | Notification that the aircraft has reached a level within the specified vertical range. | REACHING BLOCK *(level)* TO *(level)* | N | L | N |
| | 38 | Read-back of the assigned level. | ASSIGNED LEVEL *(level)* | N | M | N |
| | 77 | Read-back of the assigned vertical range. | ASSIGNED BLOCK *(level)* TO *(level)* | N | M | N |
| | 39 | Read-back of the assigned speed. | ASSIGNED SPEED *(speed)* | N | M | N |
| | 40 | Read-back of the assigned route. | ASSIGNED ROUTE *(route clearance)* | N | M | N |
| | 41 | The aircraft has regained the cleared route. | BACK ON ROUTE | N | M | N |
| | 42 | The next waypoint is the specified position. | NEXT WAYPOINT *(position)* | N | L | N |
| | 43 | The ETA at the next waypoint is as specified. | NEXT WAYPOINT ETA *(time)* | N | L | N |
| | 44 | The next but one waypoint is the specified position. | ENSUING WAYPOINT *(position)* | N | L | N |
| | 45 | Clarification of previously reported waypoint passage. | REPORTED WAYPOINT *(position)* | N | L | N |
| | 46 | Clarification of time over previously reported waypoint. | REPORTED WAYPOINT *(time)* | N | L | N |
| | 47 | The specified (SSR) code has been selected. | SQUAWKING *(code)* | N | L | N |
| | 48 | Position report. | POSITION REPORT *(position report)* | N | M | N |
| | 79 | The code of the latest ATIS received is as specified. | ATIS *(atis code)* | N | L | N |
| | 89 | The specified ATS unit is being monitored on the specified frequency. | MONITORING *(unit name)* *(frequency)* | U | M | N |
| | 102 | Used to report that an aircraft has landed. | LANDING REPORT | N | N | N |
| | 104 | Notification of estimated time of arrival at the specified position. | ETA *(position) (time)* | L | L | N |
| | 105 | Notification of the alternative aerodrome for landing. | ALTERNATE AERODROME *(airport)* | L | L | N |
| | 106 | Notification of the preferred level. | PREFERRED LEVEL *(level)* | L | L | N |
| | 109 | Notification of the preferred time to commence descent for approach. | TOP OF DESCENT *(time)* | L | L | N |
| | 110 | Notification of the preferred position to commence descent for approach. | TOP OF DESCENT *(position)* | L | L | N |
| | 111 | Notification of the preferred time and position to commence descent for approach. | TOP OF DESCENT *(time)* *(position)* | L | L | N |

*Note.— Wherever the variable "level" is specified, the message can specify either a single level or a vertical range, i.e. block level.*

表 20.　Negotiation requests (downlink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 49 | Request for the earliest time at which a clearance to the specified speed can be expected. | WHEN CAN WE EXPECT *(speed)* | L | L | Y |
| 50 | Request for the earliest time at which a clearance to a speed within the specified range can be expected. | WHEN CAN WE EXPECT *(speed)* TO *(speed)* | L | L | Y |
| 51 | Request for the earliest time at which a clearance to regain the planned route can be expected. | WHEN CAN WE EXPECT BACK ON ROUTE | L | L | Y |
| 52 | Request for the earliest time at which a clearance to descend can be expected. | WHEN CAN WE EXPECT LOWER LEVEL | L | L | Y |
| 53 | Request for the earliest time at which a clearance to climb can be expected. | WHEN CAN WE EXPECT HIGHER LEVEL | L | L | Y |
| 54 | Request for the earliest time at which a clearance to cruise climb to the specified level can be expected. | WHEN CAN WE EXPECT CRUISE CLIMB TO *(level)* | L | L | Y |
| 87 | Request for the earliest time at which a clearance to climb to the specified level can be expected. | WHEN CAN WE EXPECT CLIMB TO *(level)* | L | L | Y |
| 88 | Request for the earliest time at which a clearance to descend to the specified level can be expected. | WHEN CAN WE EXPECT DESCENT TO *(level)* | L | L | Y |

*Note.— Wherever the variable "level" is specified, the message can specify either a single level or a vertical range, i.e. block level.*

表 21.　Emergency and urgent messages (downlink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 55 | Urgency prefix. | PAN PAN PAN | U | H | Y |
| 56 | Distress prefix. | MAYDAY MAYDAY MAYDAY | D | H | Y |
| 112 | Indicates specifically that the aircraft is being subjected to unlawful interference. | SQUAWKING 7500 | U | H | N |
| 57 | Notification of fuel remaining and number of persons on board. | *(remaining fuel)* OF FUEL REMAINING AND *(persons on board)* PERSONS ON BOARD | U | H | Y |
| 58 | Notification that the pilot wishes to cancel the emergency condition. | CANCEL EMERGENCY | U | M | Y |
| 59 | Notification that the aircraft is | DIVERTING TO *(position)* | U | H | Y |

| | diverting to the specified position via the specified route due to an urgent need. | VIA (route clearance) | | | |
|---|---|---|---|---|---|
| 60 | Notification that the aircraft is deviating the specified distance in the specified direction off the cleared route and maintaining a parallel track due to an urgent need. | OFFSETTING (specified distance) (direction) OF ROUTE | U | H | Y |
| 61 | Notification that the aircraft is descending to the specified level due to an urgent need. | DESCENDING TO (level) | U | H | Y |
| 80 | Notification that the aircraft is deviating up to the specified distance from the cleared route in the specified direction due to an urgent need. | DEVIATING UP TO (specified distance) (direction) OF ROUTE | U | H | Y |

*Note.— Wherever the variable "level" is specified, the message can specify either a single level or a vertical range, i.e. block level.*

## 表 22.　System management messages (downlink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 62 | A system-generated message that the avionics has detected an error. | ERROR (error information) | U | L | N |
| 63 | A system-generated denial to any CPDLC message sent from a ground facility that is not the current data authority. | NOT CURRENT DATA AUTHORITY | L | L | N |
| 99 | A system-generated message to inform a ground facility that it is now the current data authority. | CURRENT DATA AUTHORITY | L | L | N |
| 64 | Notification to the ground system that the specified ATSU is the current data authority. | (facility designation) | L | L | N |
| 107 | A system-generated message sent to a ground system that tries to connect to an aircraft when a current data authority has not designated the ground system as the NDA. | NOT AUTHORIZED NEXT DATA AUTHORITY | L | L | N |
| 73 | A system-generated message indicating the software version number. | (version number) | L | L | N |
| 100 | Confirmation to the ground system that the aircraft system has received the message to which the logical acknowledgement refers and found it acceptable for display to the responsible person. | LOGICAL ACKNOWLEDGEMENT | N | M | N |

表 23. Additional messages (downlink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 65 | Used to explain reasons for pilot's message. | DUE TO WEATHER | L | L | N |
| 66 | Used to explain reasons for pilot's message. | DUE TO AIRCRAFT PERFORMANCE | L | L | N |
| 74 | States a desire by the pilot to provide his/her own separation and remain in VMC. | REQUEST TO MAINTAIN OWN SEPARATION AND VMC | L | L | Y |
| 75 | Used in conjunction with another message to indicate that the pilot wishes to execute request when the pilot is prepared to do so. | AT PILOTS DISCRETION | L | L | N |
| 101 | Allows the pilot to indicate a desire for termination of CPDLC service with the current data authority. | REQUEST END OF SERVICE | L | L | Y |
| 103 | Allows the pilot to indicate that he/she has cancelled IFR flight plan. | CANCELLING IFR | N | L | Y |
| 108 | Notification that de-icing action has been completed. | DE-ICING COMPLETE | L | L | N |
| 67 | | (free text) | N | L | N |
| 68 | | (free text) | D | H | Y |
| 90 | | (free text) | N | M | N |
| 91 | | (free text) | N | L | Y |
| 92 | | (free text) | L | L | Y |
| 93 | | (free text) | U | H | N |
| 94 | | (free text) | D | H | N |
| 95 | | (free text) | U | M | N |
| 96 | | (free text) | U | L | N |
| 97 | | (free text) | L | L | N |
| 98 | | (free text) | N | N | N |

Note.— *Free text message elements have no associated message intent. The capability to send a free text message with any of the attribute combinations already used in the message set has been provided for in the technical requirements of the ATN (Annex 10, Volume III, Part I, Chapter 3).*

表 24. Negotiation responses (downlink)

| | Message intent/use | Message element | URG | ALRT | RESP |
|---|---|---|---|---|---|
| 81 | We can accept the specified level at the specified time. | WE CAN ACCEPT (level) AT (time) | L | L | N |
| 82 | We cannot accept the specified level. | WE CANNOT ACCEPT (level) | L | L | N |
| 83 | We can accept the specified speed at the specified time. | WE CAN ACCEPT (speed) AT (time) | L | L | N |
| 84 | We cannot accept the specified | WE CANNOT ACCEPT | L | L | N |

| | | speed. | *(speed)* | | | |
|---|---|---|---|---|---|---|
| | 85 | We can accept a parallel track offset the specified distance in the specified direction at the specified time. | WE CAN ACCEPT *(specified distance) (direction)* AT *(time)* | L | L | N |
| | 86 | We cannot accept a parallel track offset the specified distance in the specified direction. | WE CANNOT ACCEPT *(specified distance) (direction)* | L | L | N |

*Note.— Wherever the variable "level" is specified, the message can specify either a single level or a vertical range, i.e. block level.*

附件二 ADS 訊息組

1    ADS功能摘要

| Message | Purpose | Triggering conditions | Source/ destination |
|---|---|---|---|
| Demand contract request | Obtain single ADS report on demand, specifying what data are to be reported | Controller/FDPS request | Ground-air |
| Periodic contract request | Request establishment of routine ADS reporting contract; specifying what data are to be reported and at what rate | Airspace proximity, changing airspace conditions | Ground-air |
| Event contract request | Request establishment of event ADS contract; specifying certain flight conditions under which relevant data will be reported | Airspace proximity, changing airspace conditions | Ground-air |
| Noncompliance notification | Indicates which data cannot be complied with for a given contract | Contract establishment | Air-ground |
| ADS report | Provide ADS data according to contract request | Contract conditions for initiating a report are met | Air-ground |
| Cancel contract request | Request cancellation of a specific contract | Air traffic conditions no longer require certain reporting | Ground-air |
| Cancel all contracts | Request cancellation of all contracts | Air traffic conditions no longer require any ADS reports from the avionics | Ground-air |
| Cancel emergency and/or urgency mode | Indicates cancellation of previously declared emergency state | Pilot cancelled emergency and/or urgency mode | Air-ground |
| Negative acknowledgement | Indicates that an error has been detected or that the avionics cannot comply with any part of the contract, indicating reason | Contract establishment, cancellation | Air-ground |
| Modify emergency and/or urgency mode | To change emergency and/or urgency mode reporting rate | Controller/FDPS request | Ground-air |
| Acknowledgement | Indicates that avionics can comply with contract, however the avionics is unable to send the initial report within 0.5 second | Contract establishment, cancellation, cancel emergency and/or urgency mode indication | Air-ground |
| Vertical rate change | a) positive vertical rate: aircraft's rate of climb is greater than the vertical rate threshold<br>b) negative vertical rate: aircraft's rate of descent is greater than the vertical rate threshold | Report once every minute whenever the aircraft's rate of climb/descent exceeds threshold | basic ADS information, ground vector |
| Waypoint change; | change in the next waypoint | Report once each time the event occurs | basic ADS information, projected profile |
| Lateral deviation change; | absolute value of the lateral distance between the aircraft's actual position and the aircraft's | Report once every minute while the aircraft's lateral deviation is greater than the value of the | basic ADS information ground vector |

| Message | Purpose | Triggering conditions | Source/ destination |
|---|---|---|---|
| | expected position on the active flight plan becomes greater than the lateral deviation threshold | lateral deviation threshold | |
| Level change | aircraft's level differs negatively or positively from its value in the previous ADS report, by an amount exceeding the level change threshold specified in the event contract request.<br><br>If there has been no previous report, a basic ADS report is sent. | Report once each time the event occurs. | basic ADS information ground vector |
| Level range deviation | a) aircraft's level is higher than the level ceiling<br>b) aircraft's level lower than the level floor | Report once every minute when the aircraft's level is greater than the value of the level ceiling or less than the value of the level floor. | basic ADS information ground vector |
| Airspeed change | aircraft's airspeed differs negatively or positively from its value at the time of the previous ADS report containing an air vector, by an amount exceeding the airspeed change threshold specified in the event contract request.<br><br>If there has been no previous report containing an air vector, a report is sent | Report once each time the event occurs | basic ADS information air vector |
| Ground speed change | ground speed differs negatively or positively from its value at the time of the previous ADS report containing a ground vector, by an amount exceeding the ground speed threshold specified in the event contract request.<br><br>If there has been no such previous report containing a ground vector, a report is sent. | Report once each time the event occurs | basic ADS information ground vector |
| Heading change | aircraft's heading differs negatively or positively from its value at the time of the previous ADS report containing an air vector, by an amount exceeding the heading change threshold specified in the event contract request.<br><br>If there has been no previous report containing an air vector, a report is sent. | Report once each time the event occurs. | basic ADS information air vector |

附件二 ADS 訊息組

| Message | Purpose | Triggering conditions | Source/ destination |
|---|---|---|---|
| Extended projected profile change | change to any of the set of future waypoints that define the active route of flight.<br><br>The number of waypoints covered in the contract is either defined by a specified time interval or a by selected number from the time of the request. | Report once each time the event occurs. | basic ADS information extended projected profile |
| FOM (Figure of Merit) field change | a) change in the navigational accuracy,<br>b) change navigational system redundancy<br>c) change in the Airborne Collision Avoidance System (ACAS) availability | Report once each time the event occurs. | basic ADS information |
| Track angle change. | aircraft's track angle differs negatively or positively from its value at the time of the previous ADS report containing a ground vector, by an amount exceeding the track angle change threshold specified in the event contract request.<br><br>If there has been no previous report containing a ground vector, a report is sent. | Report once each time the event occurs. | ADS information ground vector |

2    ADS MESSAGES 說明

2.1    *Basic ADS information*. Every ADS report contains the following information:

a)    the 3-D position of the aircraft (latitude, longitude, and altitude);

b)    the time; and

c)    an indication of the accuracy of the position data information figure of merit.

2.2    *Optional ADS information*. In addition to the basic information included in each ADS report, an ADS report may contain any (or all) of the following information:

a)    aircraft identification;

b)    ground vector;

c)    air vector;

d)    projected profile;

    e)    meteorological information;

    f)    short-term intent;

    g)    intermediate intent; and

    h)    extended projected profile.

2.3    The aircraft identification is contained in field 7 of the ICAO model flight plan.

2.4    The ADS ground vector is composed of the following information:

    a)    track;

    b)    ground speed; and

    c)    rate of climb or descent.

2.5    The ADS air vector is composed of the following information:

    a)    heading;

    b)    Mach or IAS; and

    c)    rate of climb or descent.

2.6    The ADS projected profile is composed of the following information:

    a)    next way-point;

    b)    estimated level at next way-point;

    c)    estimated time at next way-point;

    d)    (next + 1) way-point;

    e)    estimated level at (next + 1) way-point; and

    f)    estimated time at (next + 1) way-point.

2.7    The ADS meteorological information is composed of the following:

    a)    wind direction;

    b)    wind speed;

    c)    temperature; and

    d)    turbulence.

2.8    The ADS short-term intent is composed of the following information:

    a)    latitude at projected position;

b)    longitude at projected position;

c)    level at projected position; and

d)    projection time.

2.9    If a level, track or speed change is predicted to occur between the aircraft's current position and the projected position (indicated above), additional information to the short term intent data would be provided as intermediate intent (repeated as necessary) as follows:

a)    distance from current point to change point;

b)    track from current point to change point;

c)    level at change point; and

d)    d)    projection time to change point.

2.10   The ADS extended projected profile is composed of the following information:

a)    next way-point;

b)    estimated level at next way-point;

c)    estimated time at next way-point;

d)    (next + 1) way-point;

e)    estimated level at (next + 1) way-point;

f)    estimated time at (next + 1) way-point;

g)    (next + 2) way-point;

h)    estimated level at (next + 2) way-point;

i)    estimated time at (next + 2) way-point ...

j)    ... [repeated for up to (next + 128) way-points].

2.11   A *positive acknowledgement* indicates acceptance of a requested contract and contains no further information.

2.12   A *negative acknowledgement* indicates rejection of the requested contract and may contain information on the cause for rejection.

2.13   A *non-compliance notification* contains an indication on which part of a requested contract cannot be complied with.

2.14   A *demand contract message* indicates the contract type and which of the optional ADS information is to be included in the ADS report.

2.15   A *demand ADS response message* contains the basic ADS data and the optional ADS data required in the demand contract.

2.16 An *event contract message* indicates the contract type, contains an indication of the events to be reported on, together with thresholds (as required) for each event specified.

2.17 An *event contract response message* contains an identification of the event type and the required ADS data for the particular event.

2.18 A *periodic contract message* indicates the contract type, the required report interval, an indication of which of the optional ADS information is to be included in the periodic reports, and the modulus from the basic interval for each optional field to be included.

2.19 A *periodic ADS response message* contains the basic ADS data and the optional ADS data required in the periodic contract.

2.20 A *cancel contract message* contains an indication of the contract (i.e. periodic or event) to be cancelled. A cancel contract message without a contract type parameter indicates that all ADS contracts with the ground system are to be cancelled.

2.21 An *emergency and/or urgency mode message* indicates the position, time and FOM. In addition to the above, the aircraft identification and ground vector are sent with every fifth message.

2.22 A *modify emergency and/or urgency mode message* contains only a new reporting rate.

2.23 A *cancel emergency and/or urgency mode message* indicates that the pilot has cancelled the emergency and/or urgency mode.

2.24 ADS message data glossary is provided in Appendix A to this chapter. The range and resolution for variables used in ADS messages is presented in Appendix B to this chapter.


3    ADS訊息詞彙

3.1 The following data are used as the ADS message variables, or components of the variables, and are shown here in alphabetical order:

**ADS emergency report**. ADS information consisting of the following sequence:
— *position*;
— *time*;
— *FOM*;
— *aircraft identification* (optional); and
— *ground vector* (optional).

**ADS event report**. ADS **information** consisting of a sequence of *event type* and *ADS report*.

**ADS report**. ADS information consisting of the following sequence:

— *position*;
— *time*;
— *FOM*;
— *aircraft identification* (optional);
— *projected profile* (optional);
— *ground vector* (optional);
— *air vector* (optional);
— *meteorological information* (optional);

— *short-term intent* (optional); and

— *extended projected profile* (optional).

***Aircraft identification.*** A group of letters, figures or a combination thereof which is identical, to or the code equivalent of, the aircraft call sign to be used in air-ground communications, and which is used to identify the aircraft in ground-ground air traffic services communications.

***Air speed.*** Provides airspeed as a choice of the following: *Mach, IAS,* or *Mach* and *IAS.*

***Air speed change.*** Provides the threshold of change for either Mach speed or indicated air speed that requires that the avionics generates an ADS report when the current aircraft speed differs more than the specified threshold from the air speed in the last ADS report.

***Air vector.*** Provides the air vector as a sequence of *heading, air speed,* and *vertical rate.*

***Cancel contract.*** Allow the ground to cancel event and/or periodic contracts in effect.

***Contract type.*** Indicates which type of ADS contract is specified: demand, event, or periodic.

***Demand contract.*** Indicates that an avionics is to generate an ADS report containing the indicated data upon receipt of the contract. The data that can be indicated includes: *aircraft identification, projected profile, ground vector, air vector, meteorological information, short-term intent,* and *extended projected profile.*

***Distance.*** Distance in non-SI units.

***ETA.*** Estimated time of arrival at a way-point.

***Event contract.*** Indicates *event types* and the threshold for the specified event types.

***Event type.*** An indication of what type of ADS event is specified:

— *vertical rate change;*

— *way-point change;*

— *lateral deviation change;*

— *level change;*

— *level range deviation;*

— *airspeed change;*

— *ground speed change;*

— *heading change;*

— *extended projected profile change;*

— *FOM field change;* and

— *track angle change.*

***Extended projected profile.*** Provides a sequence (1-128) of way-point position data and ETA at the specified way-point.

***Extended projected profile change.*** Indicates that an ADS report is to be generated when there is a change in the extended projected profile.

***Extended projected profile modulus.*** Sequence of *modulus* and *extended projected profile request.*

*Extended projected profile request.* A choice indicating whether the extended projected profile information is to be provided on a time or way-point interval, and the interval of the specified choice.

*Facility designation.* Specifies the ICAO four-letter location indicator or the ICAO eight-letter combined location indicator, three-letter designator and an additional letter.

*Following way-point.* Indicates the way-point after the next way-point as a *Position.*

*FOM.* Indicates the figure of merit of the current ADS data. The information consists of the *position accuracy* and indications 1) whether or not multiple navigational units are operating, and 2) whether or not ACAS is available.

*FOM field change.* Indicates that an ADS report is to be generated when any FOM field changes.

*Ground speed.* Provides ground speed in non-SI units.

*Ground speed change.* Provides the threshold of change for ground speed that requires the avionics to generate an ADS report when the current aircraft ground speed has differed by more than the specified threshold from the last ADS report.

*Ground vector.* A sequence of *track, ground speed,* and *vertical rate.*

*Heading.* Provides aircraft heading in degrees.

*Heading change.* Provides the threshold of change for heading in degrees that requires the avionics to generate an ADS report when the current heading has differed by more than the specified threshold from the last ADS report.

*IAS.* Indicated air speed.

*Intermediate intent.* Set of points between current position and the time indicated in *the short term intent.* Consists of a sequence of the following: *distance, track, level* and *projection time.*

*Lateral deviation change:* Provides the threshold of change for lateral value that requires the avionics to generate an ADS report when the current lateral deviation exceeds the specified threshold.

*Latitude.* Latitude in degrees, minutes, and seconds.

*Level.* Specifies level in non-SI units.

*Level ceiling.* The level above which a level deviation event is triggered. Provided as a *level.*

*Level change.* Provides the threshold of change for level that requires the avionics to generate an ADS report when the current level differs by more than the specified threshold from the level in the last ADS report.

*Level floor.* The level below which a level deviation event is triggered. Provided as a *level.*

*Level range change.* Threshold of change permissible between levels in consecutive ADS reports.

*Longitude*. Longitude in degrees, minutes, and seconds.

*Mach*. Airspeed given as a Mach number.

*Mach and IAS*. Airspeed provided as both *Mach* and *indicated airspeed*.

*Meteorological information*. A sequence of *wind direction*, *wind speed*, *temperature* and *turbulence*.

*Modulus*. Provides a multiplier on the basic ADS report interval.

*Next time*. Time at next way-point.

*Next way-point*. Specifies the next way-point as a *position*.

*Non-compliance notification*. Used to indicate partial compliance to a contract.

*Periodic contract*. Provides the requirements for the generation of ADS reports. The periodic contract provides the reporting interval, and the modulus for when and what optional data to be included in an ADS periodic report.

*Position*. Provides aircraft position information using a sequence of *latitude, longitude,* and *level.*

*Position accuracy*. An indication of the navigational accuracy.

*Projected profile*. A sequence of *next way-point, next time,* and *following way-point.*

*Projection time*. Estimated elapsed time from current position to projected position in minutes.

*Reporting interval*. Provides the required ADS reporting interval.

*Report type*. Indicates which type of ADS report is provided: demand, event or periodic.

*Request type*. A choice indicating which type of ADS request is being uplinked. The choices are as indicated below:

— cancel event contract;
— cancel periodic contract;
— demand contract;
— event contract;
— modify emergency reporting rate;
— periodic contract; or
— cancel all contracts.

*Short-term intent*. A sequence of projected *position, projection time,* and *intermediate intent* (optional) data structures.

*Temperature*. Temperature in degrees Celsius.

*Time*. Time at position in HHMMSS format.

*Time stamp*. In every report in YYMMDD and HHMMSS format.

*Track*. Provides track angle in degrees.

*Track angle change*. Provides the threshold of change for track angle in degrees which triggers avionics to generate an ADS report when the current track angle differs by more than the specified threshold from the track angle in the last ADS report.

*Turbulence*. Indicates severity of turbulence.

*Vertical rate*. Rate of climb/descent (climb positive, descent negative).

*Vertical rate change*. The threshold of change for vertical rate that requires the avionics to generate an ADS report when the current vertical rate differs by more than the specified threshold from the vertical rate in the last ADS report.

*Way-point change*. Change in the next way-point information.

*Wind direction*. Wind direction in degrees.

*Wind speed*. Wind speed in knots.

## 4    ADS variables range and resolution

| Category | Variables/parameters | Unit | Range | Resolution |
|---|---|---|---|---|
| Aircraft identification | | IA5 | 2 to 7 characters | N/A |
| Airspeed | Mach | Mach number | 0.5 to 4.0 | 0.001 |
| | IAS (non-SI) | Knots | 0 to 400 | 1 |
| Date | Year | Year | 1996 to 2095 | 1 |
| | Month | Month of year | 1 to 12 | 1 |
| | Day | Day of month | 1 to 31 | 1 |
| Distance | Distance (non-SI) | Nautical miles | 1 to 8 000 | 1 |
| Extended projected profile | Time interval | Minutes | 15 minutes to 20 hours | 1 |
| | Number of way-points | Integer | 1 to 128 | 1 |
| Facility designator | | Character string | 4 to 8 | N/A |
| FOM (position accuracy) | | Integer | 0 to 7 | 1 |
| Ground speed | Ground speed (non-SI) | Knots | 50 to +2200 | 1 |
| Ground speed change | Ground speed (non-SI) | Knots | 0 to 300 | 1 |
| Heading | | Degrees | 0.1 to 359.9 | 0.1 |
| Heading change | | Degrees | 1 to 359 | 1 |
| IAS | | Knots | 0 to 1 100 | 1 |
| Lateral deviation change | Distance (non-SI) | Nautical miles | 0.5 to 150 | 0.5 |
| Latitude | Latitude degrees | Degrees | ±90 | 1 |
| | Latitude minutes | Minutes | 0 to 59 | 1 |
| | Latitude seconds | Seconds | 0 to 59.9 | 0.1 |
| Level | Pressure altitude (non-SI) | Feet | -600 to +100 000 | 10 |
| Level range change | Level (non-SI) | Feet | 10 to 5 000 | 10 |
| Longitude | Longitude degrees | Degrees | ±180 | 1 |
| | Longitude minutes | Minutes | 0 to 59 | 1 |
| | Longitude seconds | Seconds | 0 to 59.9 | 0.1 |

| Mach | | Mach speed | 0.5 to 4 | 0.001 |
|---|---|---|---|---|
| Modulus | | Integer | 1 to 255 | 1 |
| Projection time | | Minutes | 1 to 240 | 1 |
| Reporting interval | | Seconds | 1 to 59 | 1 |
| | | Minutes | 1 to 120 | 1 |
| Temperature | | Degrees Celsius | 100 to +100 | 1 |
| Time | Hours | Hours of day | 0 to 23 | 1 |
| | Minutes | Minutes of hour | 0 to 59 | 1 |
| | Seconds | Seconds of minute | 0 to 59 | 1 |
| Track | Angle | Degrees | 0.1 to 360 | 0.1 |
| Track angle change | | Degrees | 1 to 359 | 1 |
| Turbulence | Relative measure | Bit string | 0 to 15* | N/A |
| Vertical rate | Level (non-SI) | Feet/minute | ±30 000 | 10 |
| Vertical rate change | | Feet/minute | ±30 000 | 10 |
| Wind | Wind direction | Degrees True North | 1 to 360 | 1 |
| | Wind speed (non-SI) | Knots | 0 to 300 | 1 |
| * To be decided. | | | | |

附件三　世界各國 CNS/ATM 進度統計

資料來源：世界空運組織（International Air Transportation Association，IATA，http://www.iata.org）

| State | IATA Region | ICAO Region | Reference | Notes | Routes | ADS-B | ADS-C | CPDLC | GNSS Proc | HFDL | Mode-S | VDL Mode2 | VDL Mode3 | VDL Mode4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Afghanistan | SIN | CAI | | | | | | | | | | | | |
| Australia | SIN | BKK | | ADS in non-radar airspace across the continent as well as oceanic eg. aircraft Melbourne to Singapore report via ADS over the centre of the country. Available in Brisbane FIR (in addition to the existing CPDLC service) after the new ATC system (TAATS) goes operational in September 1999. The Melbourne FIR completed the transition to an operational FANS-1/A data link environment on March 2000. Data Link services are now available within the FIR from the western Indian Ocean boundaries with South Africa and Mauritius, the northern boundaries with Sri Lanka and Indonesia, across the southern half of the Australian continent to the eastern boundary with Brisbane, and south for the Qantas Antarctic flight program. While Automatic Dependent Surveillance (ADS) contracts are established automatically following a logon to the FIR, controllers are currently connecting CPDLC manually. This ability allows controllers using VHF voice to authorise the use of CPDLC on long-haul routes, such as Melbourne to Singapore, while ensuring that only voice is used on the high-density, radar routes along the east coast. | | | Operational | Operational | | | | | | |
| Austria | BRU | PAR | Airnavigation News 12 June 2000 | The first height monitoring unit (IIMU) became operation in May 2000 as part of the European Reduced Vertical Separation Minimum (RVSM) programme. The IIMU is located in Linz. Other IIMU's will become operational in September 2000 in Nattenheim, Germany and Geneva, Switzerland.. IIMU comprise a ground station arranged to receive Mode A,C and SSR replies. | | | | | | | | | | |
| Bahrain | AMM | CAI | IATA MIA Office | | | | Planned | Planned | | | | | | |
| Barbados | MIA | MEX | | | | | | | Operational | | | | | |
| Bolivia | MIA | LIM | Fltechonline | ARINC says it plans to deploy additional HFDL ground stations at Santa Cruz, Bolivia, and Guam in 2000 and at Gran Canaria, Canary Islands, and Bahrain in the first quarter of 2001 to further fill in its HFDL coverage and add capacity. | | | | | | Planned | | | | |
| Brazil | MIA | LIM | | | | | Trials | Trials | | Planned | | | | |
| Canada | LON | MEX | ICG/5 | Within the Canadian Northern Domestic Airspace: the introduction of the Reduced Vertical Separation Minimum | | | Planned 1/9/01 | Planned 1/9/01 | | | | | | |

| State | IATA Region | ICAO Region | Reference | Notes | Routes | ADS-B | ADS-C | CPDLC | GNSS Proc | HFDL | Mode-S | VDL Mode2 | VDL Mode3 | VDL Mode4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (RVSM) (targeted implementation as of 18 April 2002) and the use of Controller Pilot Data Link Communications (CPDLC) and Automated Dependant Surveillance (ADS). The target date for operational trials of CPDLC and ADS is the 4th quarter of 2001. ADS Waypoint position reporting in the Atlantic (Gander). Position reports are sent by satellite via ARINC and passed along to the Centres through the AFTN. | | | | | | | | | | |
| Cape Verde | NBO | DKR | INMARSAT info | ? Dakar/Cape Verde – ADS and CPDLC are planned for 2002/2003. Existing routes will become RNAV in 2001 with RNP10. RNAV random routing, west to east is also planned for 2001, initially FL350 to FL410. RVSM, initially at FL350 to FL410 is also an objective for 2001. | | | Planned | Planned | | | | | | |
| China | SIN | BKK | Janes Airport Review, Feb 2000 | Covering Kunming, Chengdu, Lanzhou and Urumqi FIR's. 4 other workstations will be located in remote regions. The Workstations will make use of satellite and VHF datalink coverage being delivered as part of ARINC's China data link Phase II Project. Trials with Qantas are underway. | L888 | | Operational 10/1/99 | Operational 10/1/99 | | | | | | |
| Egypt | AMM | CAI | INMARSAT info | New Eurocat 2000 with ADS/CPDLC installed in Cairo Centre | | | Trials | Trials | | | | | | |
| Fiji | SIN | BKK | | Partners with New Zealand, Australia and Boeing. ADS available in NADI FIR since September 99. | | | Operational 9/1/00 | Operational | | | | | | |
| Germany | BRU | PAR | INMARSAT info | Continuous A/C position reporting system via ADS and VHF. The first height monitoring unit (HMU) became operation in May 2000 as part of the European Reduced Vertical Separation Minimum (RVSM) programme. The HMU is located in Linz. Other HMU's will become operational in September 2000 in Nattenheim, Germany and Geneva, Switzerland.. HMU comprise a ground station arranged to receive Mode A,C and SSR replies. | | | Trials | | | | | | | |
| Hong Kong (SAR, China) | SIN | BKK | INMARSAT info | | | | Operational | Operational | | | | | | |
| Iceland | LON | PAR | INMARSAT info | Santa Maria FIR, ADS waypoint position reporting. | | | Trials | | | | | | | |
| India | SIN | BKK | INMARSAT info | FANS Action Team, Bay of Bengal (FAT BOB) trials planned for July 2000 in conjunction with India, Myanmar, Thailand and Malaysia. Calcutta and Madras ADS/CPDLC available | | | Operational 8/1/99 | | | | | | | |
| Indonesia | SIN | BKK | IATA SIN Office | | | | Trials | Trials | | | | | | |
| Iran, Islamic Republic of | AMM | CAI | IATA AMM_Office | ADS/CPDLC operational trials by end of 2000 as follows; FANS routes in Tehran FIR as follows: - KAMAR to RASHT then DASIS (ANKARA FIR) and/or DULAV (YEREVAN FIR). - SHARJAH to SHIRAZ then | | | Trials | Trials | | | | | | |

| State | IATA Region | ICAO Region | Reference | Notes | Routes | ADS-B | ADS-C | CPDLC | GNSS Proc | HFDL | Mode-S | VDL Mode2 | VDL Mode3 | VDL Mode4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UROMIEH or SHARJEH to SIRRI then UROMIEH. - SHARJAH to SHIRAZ then ULDUZ (BAKU FIR) Planned trials to establish more RNP/RNAV routes within Tehran FIR. Discussion with Military site to co-ordinate and implement RNP 5 in Tehran FIR Operational trials expected | | | | | | | | | | |
| Japan | SIN | BKK | INMARSAT information | In cooperation with the Japan Civil Aviation Bureau (JCAB), the FAA has agreed to jointly host and chair the Informal Pacific ATC Coordinating Group (IPACG)FANS Interoperability Team (FIT). The IPACG FIT requires support services to achieve its important goals of problem resolution, system performance assurance, and planning and testing of operations that will enable the realization of benefits for all FANS users and oceanic data link stakeholders operating in the North and Central Pacific regions. | | | Trials | Operational | | | | | | |
| Lao People's Democratic Republic | SIN | BKK | INMARSAT | ADS capability installed | | | Trials | | | | | | | |
| Maastricht UACC | BRU | PAR | INMARSAT info | ? PETAL-II CPDLC trials. During the PETAL-I series trials, the use of a 'live' ATC environment to link operational air traffic controllers, aircrew, industry, and EATCHIP air/ground datalink developes, has proven to be an extremely effective means of developing and validating European operational concepts, requirements, and procedures. Eurocontrol DED/2 has therefore launched a more comprehensive follow-on series of the trials, PETAL-II, to examine several open issues. Most notable among these open issues is the potential loss of aircrew and controller situational awareness when several aircraft in the same sector are using 'silent' datalink to conduct routine controller/aircrew communications. PETAL-II was established with an overall objective of conducting multi-aircraft air/gnd datalink operational trials during routine ATC operations | | | Trials | | | | | | | |
| Malaysia | SIN | BKK | | FANS Action Team, Bay of Bengal (FAT BOB) trials planned for July 2000 in conjunction with India, Myanmar, Thailand and Malaysia | | | Trials | | | | | | | |
| Mongolia | SIN | BKK | Raythcon & ATC Market Report dated June 8 2000 | Tested with Boeing aircraft. Currently one VHF ground station in Ulaanbaatar. New stations will be installed in Murun, Sainshand and Dalandzadgad. | | | Operational | Operational | | | | | | |
| Mozambique | NBO | NBO | IATA | The current activity is to assist the DGCA's in the SADC region to develop their own skills for the approval and certification process. Initial implementation is planned for Maputo International and Beirra International. | | | | | Planned | | | | | |

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| State | IATA Region | ICAO Region | Reference | Notes | Routes | ADS-B | ADS-C | CPDLC | GNSS Proc | HFDL | Mode-S | VDL Mode2 | VDL Mode3 | VDL Mode4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Myanmar | SIN | BKK | INMARSAT information | FANS Action Team, Bay of Bengal (FAT BOB) trials planned for July 2000 in conjunction with India, Myanmar, Thailand and Malaysia | | | Trials 3/1/99 | Trials 3/1/99 | | | | | | |
| Namibia | NBO | NBO | IATA | The current activity is to assist the DGCA's in the SADC region to develop their own skills for the approval and certification process. Initial implemenation is planned for Windhoek, Eros International and Walvis Bay. | | | | | Planned | | | | | |
| New Zealand | SIN | BKK | | in use since 1996 | | | Operational | Operational | | | | | | |
| Norway | BRU | PAR | INMARSAT info | Helicopter ADS operations | | | Operational | | | | | | | |
| Portugal | BRU | PAR | INMARSAT info | Santa Maria FIR, ADS waypoint position reporting. | | | Trials | | | | | | | |
| Puerto Rico | MIA | MEX | IATA MIA Office | Two GPS APP procedures in Aguadilla. GPS APP in Mayaguez. | | | | | Operational | | | | | |
| Russian Federation | BRU/SIN | PAR | INMARSAT info | ARINC has deployed two new high frequency data link (HFDL) ground stations at Krasnoyarsk, Russia, and Barrow, Alaska. These two sites, in conjunction with the company's existing HF ground station at Reykjavik, Iceland, complete ARINC's air/ground data link communication coverage over the north-polar remote land and oceanic regions. [Current geostationary satellite datalink service is unable to reliably reach regions above 80° North latitude.] ARINC says it plans to deploy additional HFDL ground stations at Santa Cruz, Bolivia, and Guam in 2000 and at Gran Canaria, Canary Islands, and Bahrain in the first quarter of 2001 to further fill in its HFDL coverage and add capacity. Trans Siberian route trails with British Airways planned for April 2000 using SATCOM data and voice on FANS 1 between Western Europe and Far East. ? Magadan CPDLC/ADS ground systems in place - no in-service date set but some trials and training still under way. Russia hopes to extend the North European ADS-B Network (NEAN) east by installing grund stations in Moscow, St. Petersburg and Riga as part of the NEAN Upgrade Programme (NUP) | | | Trials | Trials | | Trials | | | | Trials |
| Singapore | SIN | BKK | | Singapore airlines and Singapore CAA now active in the Boeing FIT | | | Operational | Operational | | | | | | |
| South Africa | NBO | NBO | INMARSAT info | | | | Trials | Trials | | | | | | |
| Spain | BRU | PAR | INMARSAT info | ADS Workstation is available in Canaries (VHF & HF ARINC says it plans to deploy additional HFDL ground stations at Santa Cruz, Bolivia, and Guam in 2000 and at Gran Canaria, Canary Islands, and Bahrain in the first quarter of 2001 to further fill in its HFDL coverage and | | | Planned | | | Planned | | | | |

| State | IATA Region | ICAO Region | Reference | Notes | Routes | ADS-B | ADS-C | CPDLC | GNSS Proc | HFDL | Mode-S | VDL Mode2 | VDL Mode3 | VDL Mode4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | add capacity. | | | | | | | | | | |
| Sri Lanka | SIN | BKK | Airsys ATM | FANS CNS/ATM Workstation available | | | Trials 9/1/00 | Trials 9/1/00 | | | | | | |
| Sweden | BRU | PAR | INMARSAT info | Continuous A/C position reporting system via ADS and VHF. Swedish research and development company GP&C Systems International working with the Government on VDL Mode 4 trials. AMCP recommended publishing SARPS for VDL Mode 4 in April 2000 by Nov. 2001 | | | Trials | | | | | | | Trials |
| Switzerland | BRU | PAR | Air Navigation News, 12 June 2000 | The first height monitoring unit (HMU) became operation in May 2000 as part of the European Reduced Vertical Separation Minimum (RVSM) programme. The HMU is located in Linz. Other HMU's will become operational in September 2000 in Nattenheim, Germany and Geneva, Switzerland.. HMU comprise a ground station arranged to receive Mode A,C and SSR replies. | | | | | | | | | | |
| Tahiti | SIN | BKK | FIT Report 15 Aug 2000 | ADS-C added to CPDLC in April 1999 | | | Operational | | | | | | | |
| Thailand | SIN | BKK | INMARSAT Info | FANS Action Team, Bay of Bengal (FAT BOB) trials planned for July 2000 in conjunction with India, Myanmar, Thailand and Malaysia. VHF network supporting trials. | | | Trials | | | | | | | |
| United Kingdom | BRU | PAR | Air Navigation News 29 May 2000 | ADS trials complete. ADS Waypoint position reporting in the Atlantic (Prestwick). Position reports are sent by satellite via ARINC and passed along to the Centres through the AFTN. | | | Trials | | | | | | | |
| United States | LON | MEX | Airnavigation News 15 May 2000 | Dynamic Airborne Reroute Procedures (DARP) workstation available in Oakland for southbound routes, LAX-AKL and LAX-SYD. Oakland Multi Sector Oceanic Datalink (MSODL). FANS 1 integrated with FDP and tested with Boeing A/C. New York Oceanic FIR, FANS 1 CPDLC undergoing pre-op testing and available through MSODL summer 2000. Local Area Augmentation Systems are being installed at O'Hare and Midway airports in Chicago, two airports are among the first to install its Honeywell SLS-3000 ground stations, which increase accuracy of aircraft Global Positioning Systems. Both systems will be operational in the near term and certified by FAA in early 2002. Raytheon successfully completed a 21 day test of the wide area augmentation system (WAAS). Analysis of the test results confirms resolution of key stability and performance issues. WAAS provided continuously augmented global positioning system navigation signals for the duration of the test. Measured accuracy was one meter horizontally and three meters vertically well within the 7 6 meter requirement | LAX-AKL, LAX-SYD | | Operational 4/1/99 | Operational 4/1/99 | | | | | | |

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| State | IATA Region | ICAO Region | Reference | Notes | Routes | ADS-B | ADS-C | CPDLC | GNSS Proc | HFDL | Mode-S | VDL Mode2 | VDL Mode3 | VDL Mode4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | In cooperation with the Japan Civil Aviation Bureau (JCAB), the FAA has agreed to jointly host and chair the Informal Pacific ATC Coordinating Group (IPACG)FANS Interoperability Team (FIT). The IPACG FIT requires support services to achieve its important goals of problem resolution, system performance assurance, and planning and testing of operations that will enable the realization of benefits for all FANS users and oceanic data link stakeholders operating in the North and Central Pacific regions. | | | | | | | | | | |
| Uzbekistan | SIN | PAR | | ADS position in Taskent. Validated with Boeing test platform via SITA network in June 2000 | | | Trials | | | | | | | |
| Vietnam | SIN | BKK | | Gm system inplace | | | Trials | Trials | | | | | | |

# 台北飛航情報區雷達涵蓋圖
## TAIPEI FIR RADAR COVERAGE

891020修正



長程雷達涵蓋(SSR)

長程雷達涵蓋

**圖例說明框:**
長程雷達(LRR)=三貂角、鵝鑾鼻
中程雷達(MRR)=馬公
短程雷達(ASR)=松山、中正、台中、高雄、花蓮

涵蓋距離:
LRR=220/250浬
MRR=180浬
ASR=60浬

本圖依據雷達最大涵蓋距離繪製,僅供參考。

中程雷達涵蓋

短程雷達涵蓋

**NORTH**
SECTOR
SFC/UNL
125.5(123.4)
255.4(270.4)

**WEST**
SECTOR
SFC/UNL
126.7(130.3)
302.2

**CHINMEN**
SECTOR
007/080
124.6(133.1)
307.7(299.6)

**MAKUNG**
SECTOR
015/110
128.1(129.6)
234.8

**SOUTH**
SECTOR
SFC/UNL
129.1(128.7)
308.4

**EAST**
SECTOR
SFC/UNL
133.6(127.7)
300.1(283.7)

MATSU
CHINMEN
MKG
TOROX
TNN
HCN
HLG
APU
GID
MOKAS
SANAS
TINHO
PILOX

SALMI
BULAN
MOLKA
BORDO
SEDKU
IGURU

ENVAR
ELATO
KAPLI
DADON
KALLO
RENOT
CYRUS
PARPA
ANDRE
POKIR
DOREX
BONEY
TULTO
LEKOS
PABSO
MORSU
ANLOT

短程雷達涵蓋

117°30'E