International Civil Aviation Organization

**ATN Seminar and Third ATN Transition Task Force Meeting**

Singapore, 26-30 March 2001

**Agenda Item 6: Planning and Implementation Considerations**

# ATN ACTIVITIES IN AUSTRALIA

(Presented by Mr. Craig Head, Australia)

# Australian ATN Activities

**Presented by**

**Craig Head**

# ATN In Australia

- **Airservices Australia has funded two ATN Programs since 1996.**
  - **Program 1 - ASIATN Project (1996 - 1998)**
    - Collaborative Research and Development Agreement was signed with TRAC (Airsys ATM Pty Ltd) in October 1996
    - Project was formally Completed in August 1998
  - **Program 2 - Investigation of Networked CNS/ATM Applications (INCA) (1998 - 2000)**
    - Started in July 1998
    - Completed end of July 2000

# Program 1 - ASIATN Project

- **Development of an ATN Validation Platform**
  - **End System Initial Platform**
    - Compatible with ADS-Europe Trials.
  - **End System Main Platform (Compliant to CNS/ATM-1)**
    - Ground End Systems
    - Airborne End System
    - ATN Routers
    - Aeronautical Mobile Satellite Service (AMSS) - Data 3 service
  - **Adapting existing products to the ATN**
    - EASY (Eurocat 200)
    - Air Ground Data Generator (AGDG)
  - **Develop modules to integrate various components to the ATN**
    - XTI (X/Open Transport Interface)
    - Satellite Data Unit (SDU) A429 Bridge
  - **Evaluate Initial Performance Criteria**

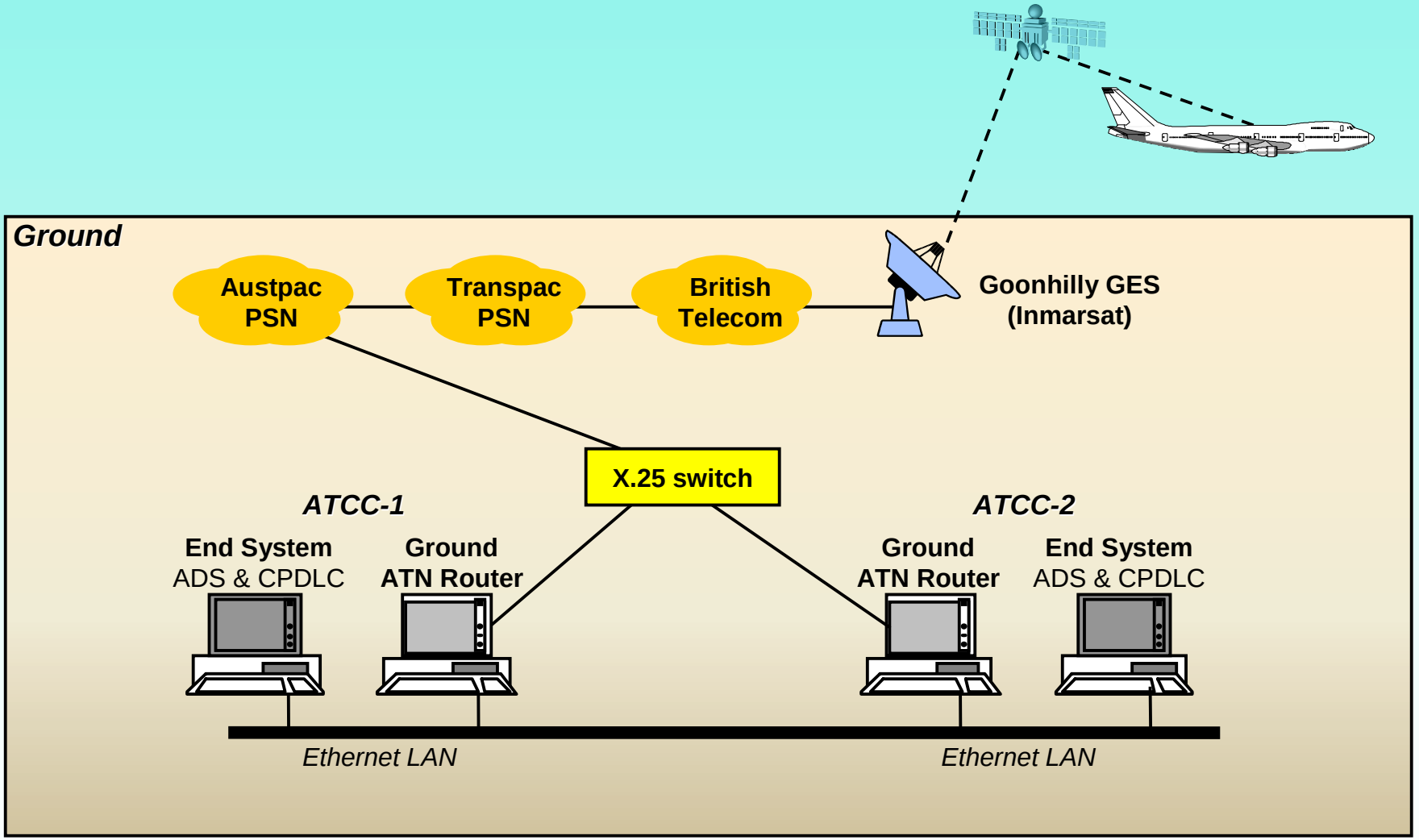
# ASIATN Achievements

- Development of a CNS/ATM-1 ATN Validation Platform
  - Provides both ground ATN equipment and pseudo aircraft ATN equipment
  - Implementation of the ADS and CPDLC applications and CM application
  - Tested using a SATCOM subnetwork and domestic and international packet networks
- Demonstrated ease of integration of CNS/ATM-1 into existing ATC system products
  - Thomson EASY (Eurocat 200)
  - Thomson AGDG
  - TES (Trial End System)
  - EurATN
  - ProATN

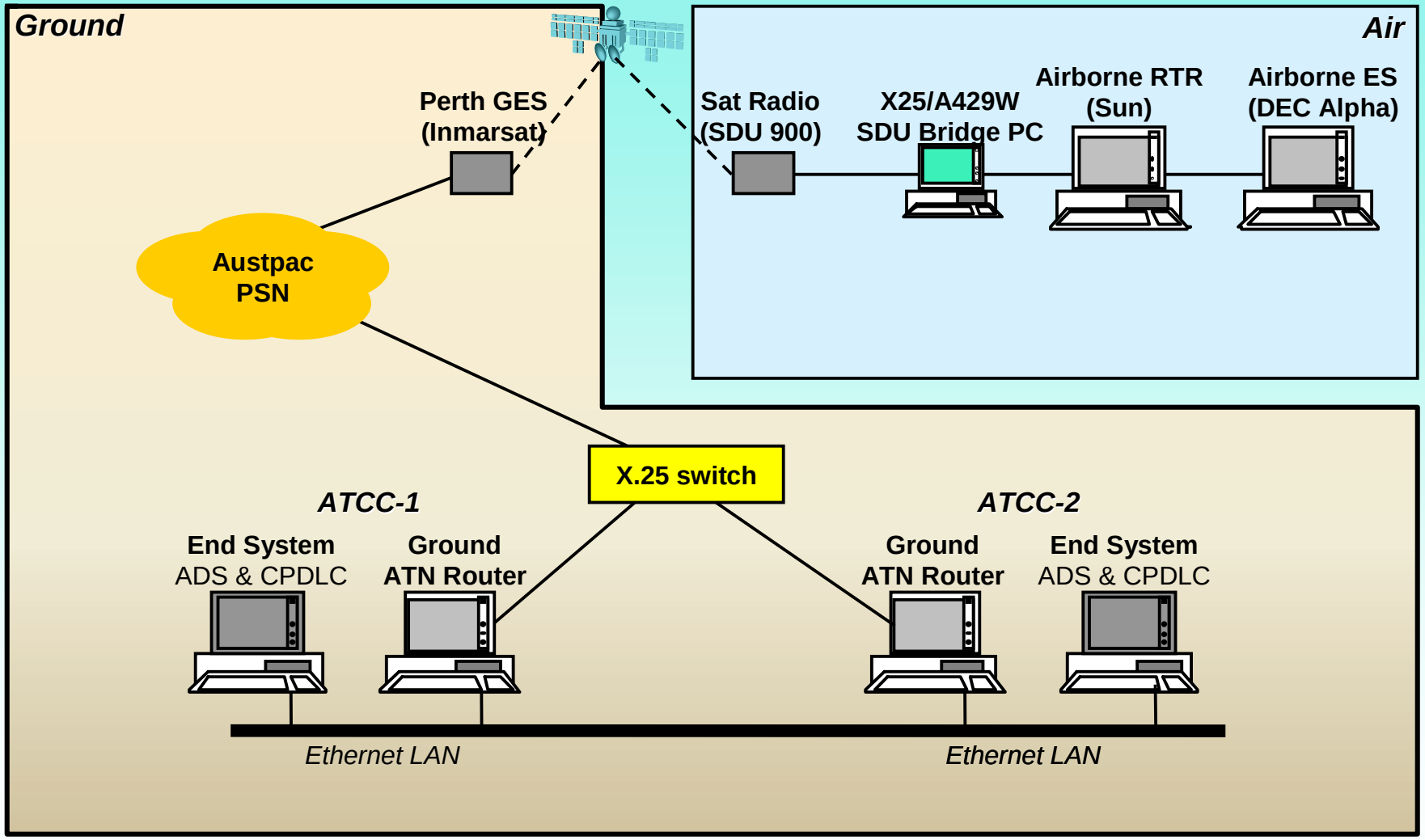
# ASIATN Achievements

- Successful test trials with live aircraft with ADS-Europe Program
- Developed experience in the ATN and related technologies
- Co-operation with other organisations around the world in the research and development of ATN

# Initial Platform - ADS-Europe Trials



# ATN Main Platform with AMSS



# Program 2 - INCA Project

- Continues the work performed by the ASIATN Project
  - ✓ Satellite Data Link Exploitation
- Expand ATN Validation Platform to include:
  - ✓ A VDL Mode 2 Subnetwork
  - ✓ An AMHS and AMHS/AFTN Gateway Functionality
- Conduct Exploitation Programs into these services
  - ✓ Participation in ATN trials with JCAB and Aerospatiale-Matra-Airbus
- Perform VDL Flight Trials

- Conduct an ATN Cost Benefit Analysis Study

# Summary of AMSS Results

- 80% Improvement in end-to-end transit delay performances over FANS-1
  - ✓ Transit Delay Performances over Satcom were better than anticipated. When using high speed channels, transit delays of less than 10 seconds on average were being recorded.
- Overall reliability of communications improved by the use of the ATN transport layer
  - ✓ Integrity Checking
  - ✓ Automatic Reordering and Retransmissions
  - ✓ End-to-End Acknowledgments
- Cost for ATN routing services and application data delivery was evaluated
  - ✓ Common Costs - routing information exchanges and logon.
  - ✓ ADS Costs - Periodic and Event Reporting.
  - ✓ CPDLC Costs - Dialogues and Transport Connection.

# VDL Activities

- **VDL Mode 2 Radio Equipment and Interface - July 1998 to July 1999**
  - ✓ **Adaptation of Airborne Radio (EVR 750) and Ground Radio (TRG 750) to comply with VDL Mode 2 Standards**
    - Radio built by Thomson CNI (Thomson-CSF Comsys)
  - ✓ **Development of a VHF Network Interface (VNI)**
    - VNI built by Thomson CNI (Thomson-CSF Comsys)
- **Installation and SAT - July 1999**
- **Development of a CMU/Bridge to Interface Airborne Radio to ATN Router - January 1999 to October 1999**
  - ✓ **Developed by INCA Project**

# VDL Activities

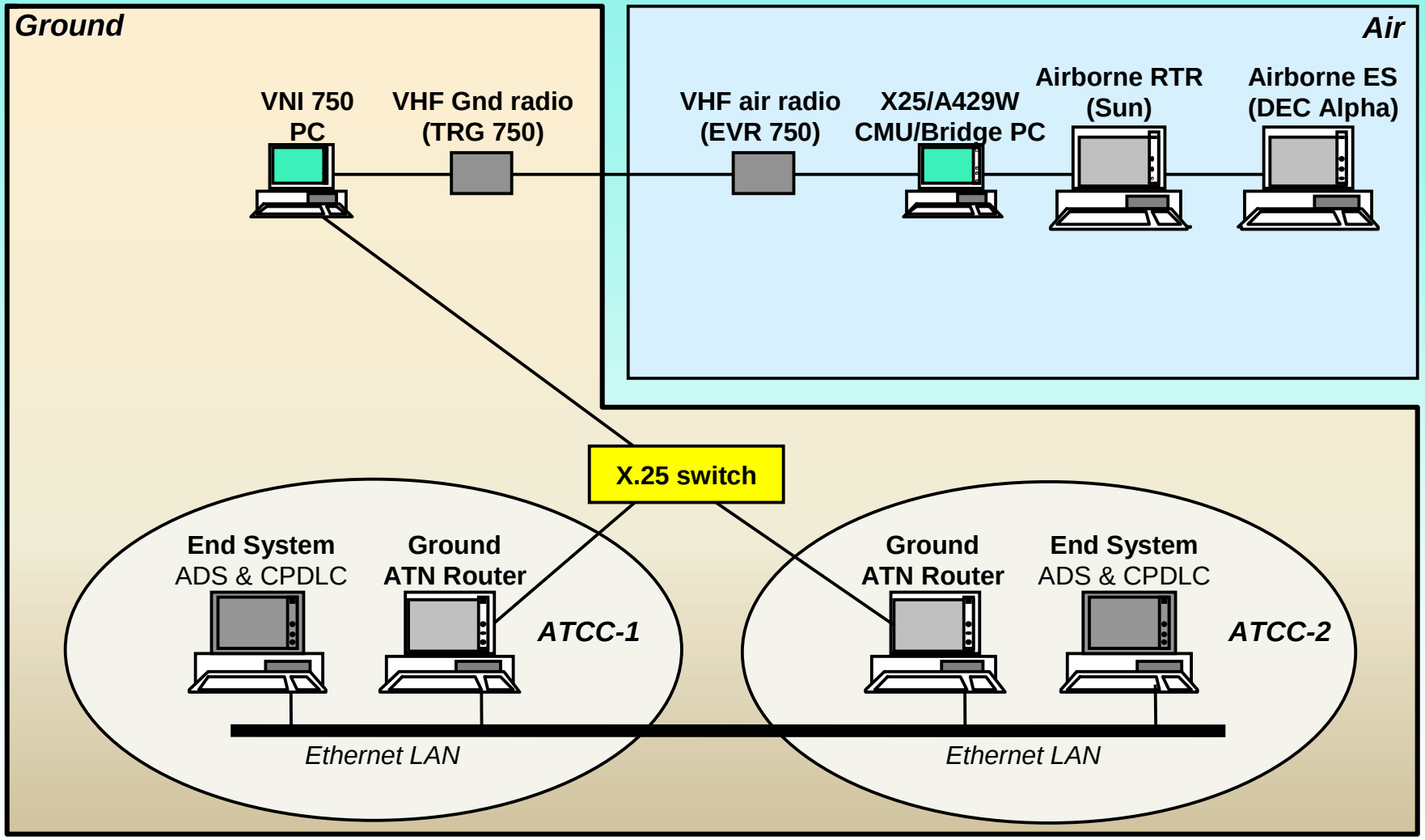
- Modification of EurATN to access both AMSS and VDL-2 - March 1999 to June 1999
  - ✓ Work Required for Airborne Component of Platform
  - ✓ Modifications made by INCA Project
- Modification of ProATN to access both AMSS and VDL-2
  - ✓ Work Required for Ground Component of Platform
  - ✓ Modifications made by Sofréavia
- Qualification Testing - October 1999 to January 2000
- Exploitation Testing - January 2000 to July 2000
- VDL Flight Trials - January 2000 to May 2000

# VDL Activities

- **JCAB ATN Trials - November 1999 to June 2000**
  - ✓ **Phase 1 Testing of ATN Router connectivity - Nov 1999**
  - ✓ **Phase 2 Testing of Upper Layers and CM and ADS Application - Dec 1999**
  - ✓ **Phase 3 Testing of CPDLC Application - Feb 2000**
  - ✓ **Phase 4 Testing of ADS and CPDLC Applications - Jun 2000**

- **Aerospatiale Matra Airbus Trials - June 2000**
  - ✓ **Interoperability trials of ADS and CPDLC using experimental ATN systems available in Europe including the Aerospatiale-Matra-Airbus "Iron Bird" Simulator**

# ATN Platform with VDL Mode 2



# Summary of VDL Mode 2 Results

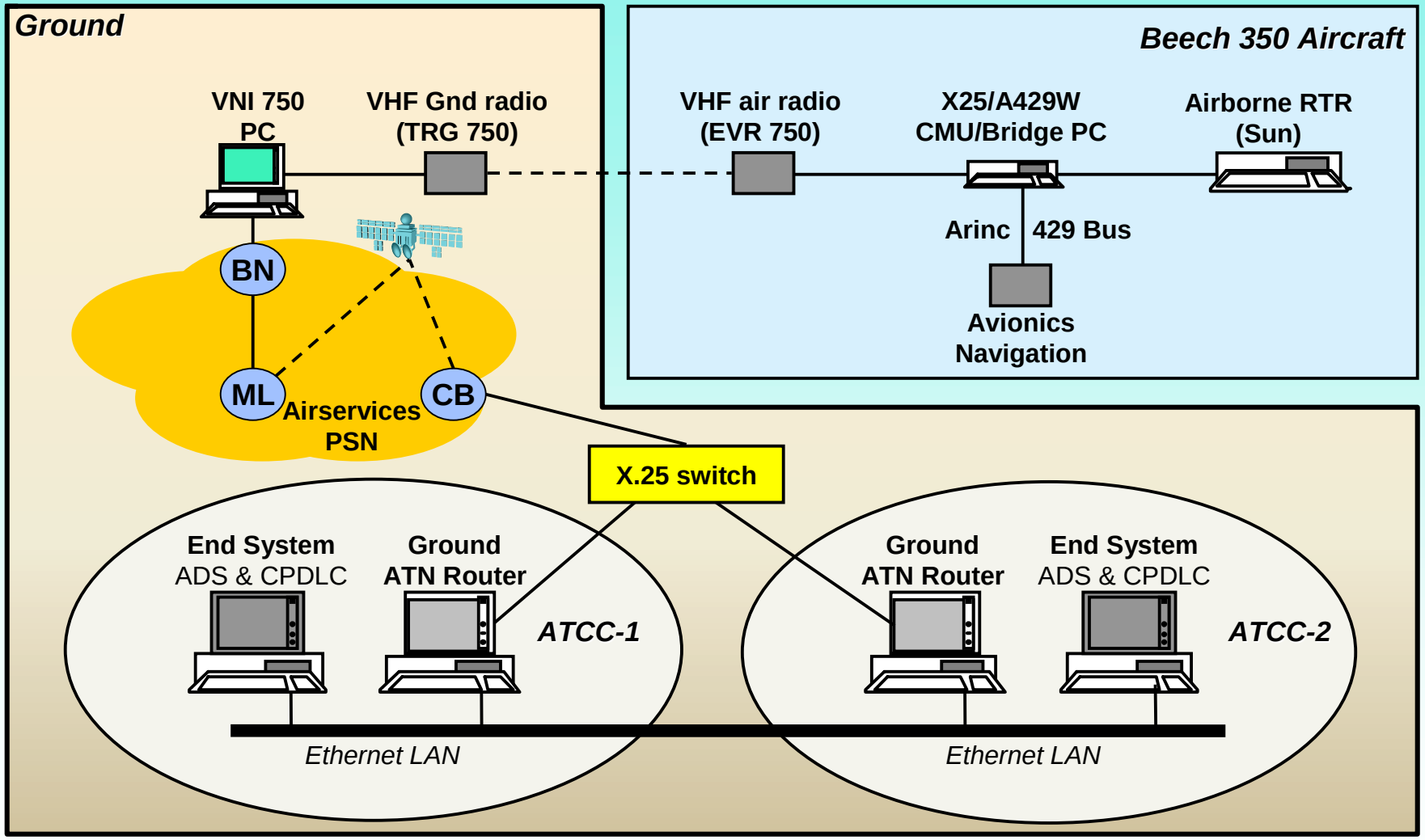
- **Round Trip Transit Delays in the range of 1 - 1.6 seconds**
  - ✓ **However there was a cluster of samples at around 20 - 25 seconds which is consistent with the re-transmission intervals of the Transport Protocol.**

- **Subnetwork Switching**
  - ✓ **Evaluate transit delays imposed on messages immediately following a subnetwork switch over between AMSS and VDL2**
    - While both subnetworks are connected
    - Establishment of alternate subnetwork

# VDL Flight Trials - (1)

- **Airservices Beech 350 Special Mission Aircraft used for flight trials.**
  - ✓ **Required rehosting of CMU/Bridge and Airborne Router computer platforms and EVR 750 radio set.**
  - ✓ **Trials conducted over two days (May 24 & 25) around Brisbane area with connection via PSN back to Canberra ATN Validation Platform**
- **Round trip times were measured on average to be around 2 - 3 seconds.**
  - ✓ **16% of the results also showed 30 - 40 second delays**
    - Results are still being analysed to ascertain what is causing the delays - Transport Layer Re-transmission timer is being triggered.
    - Re-transmission is expected to be caused by collisions on the A429 Williamsburg channel between the CMU/Bridge and Airborne Radio.
  - ✓ **PSN introducing a 1 second delay when compared to Lab results - Satellite Link and Digital Data Service**

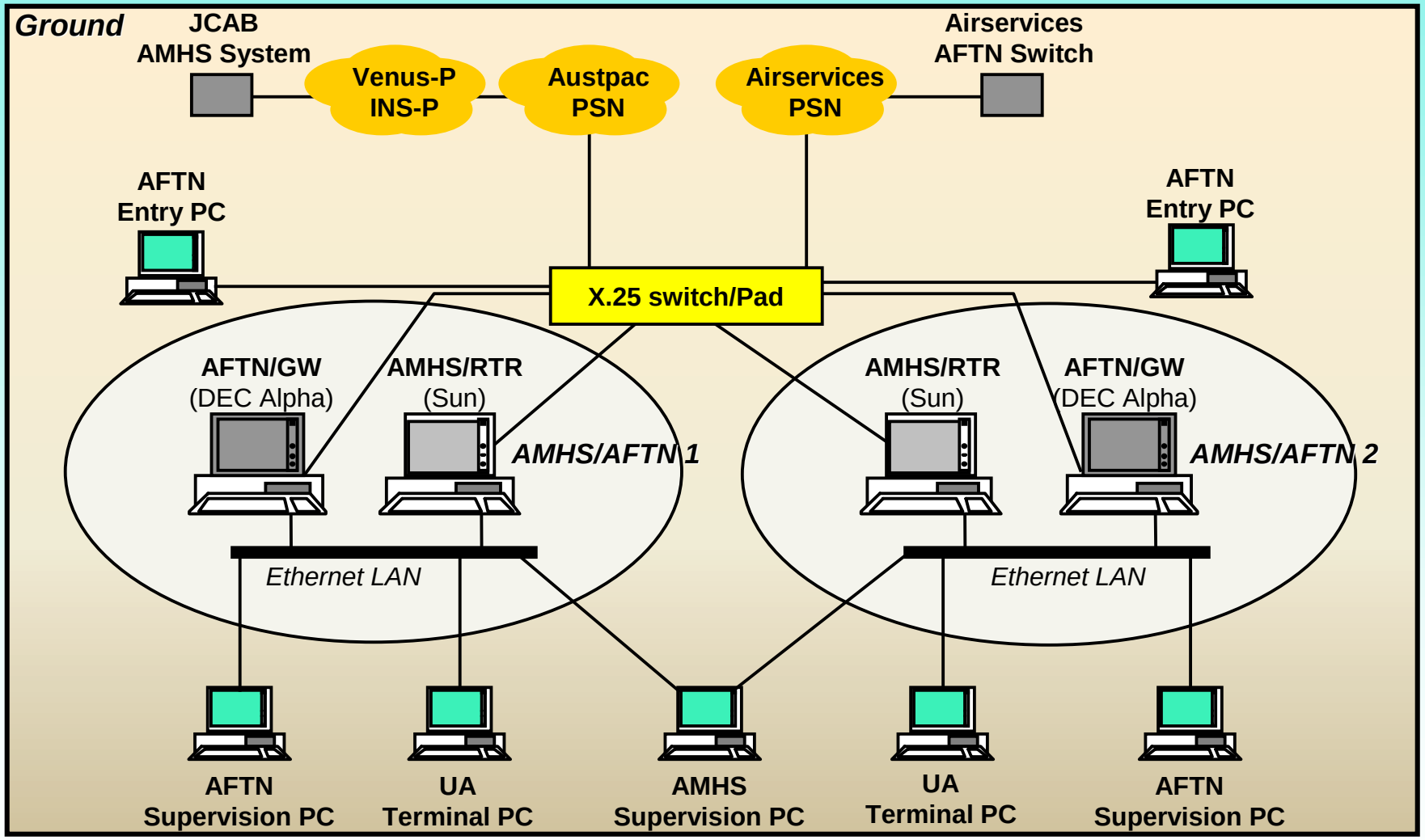
# ATN Platform with VDL Flight A/craft



# AMHS Activities

- **AMHS Development Work - July 1998 to May 1999**
  - **Work carried out by Syseca**
    - Integrating a ProATN stack to the ISOCOR X.400 server product (ISOPLEX)
    - AMHS/AFTN Gateway functionality incorporated into Aermac AFTN software
- **FAT - May 1999**
  - **Internal FAT conducted by Airsys ATM and Syseca**
- **Installation and SAT - June 1999**
  - **Carried out on the Platform**
- **Qualification Testing - July 1999 to January 2000**
- **Exploitation Testing - January 2000 to July 2000**
- **JCAB Trials - May 2000**

# ATN Platform with AMHS/AFTN



# Summary of AMHS Results

- **AMHS Trials with Japanese Civil Aviation Bureau**
  - ✓ **First trial of sending AMHS messages between two States in the Asia Pacific Region.**
  - ✓ **Difference in ATN SARPs interpretation**
    - Addressing of SS acknowledgment messages
- **Review Performance Issues**
  - ✓ **Message integrity - check for loss or corrupted messages**
  - ✓ **The envelope of a AMHS message is increased 10 fold when compared to the AFTN.**
    - However communication speeds has also increased over the years from 50 baud to 9.6kbps to 64kbps which should compensate for the additional information overhead.
    - Improved message delivery and automatic recovery due to the underlying OSI protocol layers.
    - ATN only applies to International Connections - Domestic circuits can use TCP/IP and P1, P3 and P7 protocols between end users & Message Servers

# Summary of AMHS Results

- **Impact of AMHS on current AFTN Procedures and Practices**
  - ✓ **AMHS could place responsibility back on to end users for confirming message delivery.**
  - ✓ **AMHS requires less supervision for message management**
  - ✓ **HMI and Operator interaction issues to be addressed**

- **Review of Addressing Schemes as proposed in the SARPs**
  - ✓ **Currently being addressed by the various ICAO Regions including Europe and Asia Pacific.**
  - ✓ **Platform has helped in trialing different types of address formats to handle gateway addressing and AMHS addressing**

# Cost Benefit Analysis

- Methodology Plan
- Generation of a Cost-Benefit Analysis Strategy Document
- Generation of Data Reports
  - ✓ Aviation Service Provider Infrastructure
  - ✓ Ground Based Sub Networks
  - ✓ Air Ground Sub Networks
  - ✓ Internetwork Routers
  - ✓ Ends Systems
  - ✓ Systems Management
  - ✓ Manufacturers
- Preliminary Report
  - ✓ Completed on 6 September 1999.

# Cost Benefit Analysis

- **Development of Operational Concepts**
  - ✓ **Services and Applications**
- **Development of Traffic and Routing Models**
- **Development of a CBA Model**
- **Running of Sensitivity Analysis**
- **Final Report**
  - ✓ **Completed end of July 2000.**