

# Migration to VDL Mode - 2

Presentation to the  
C/AFT Datalink Sub-Group  
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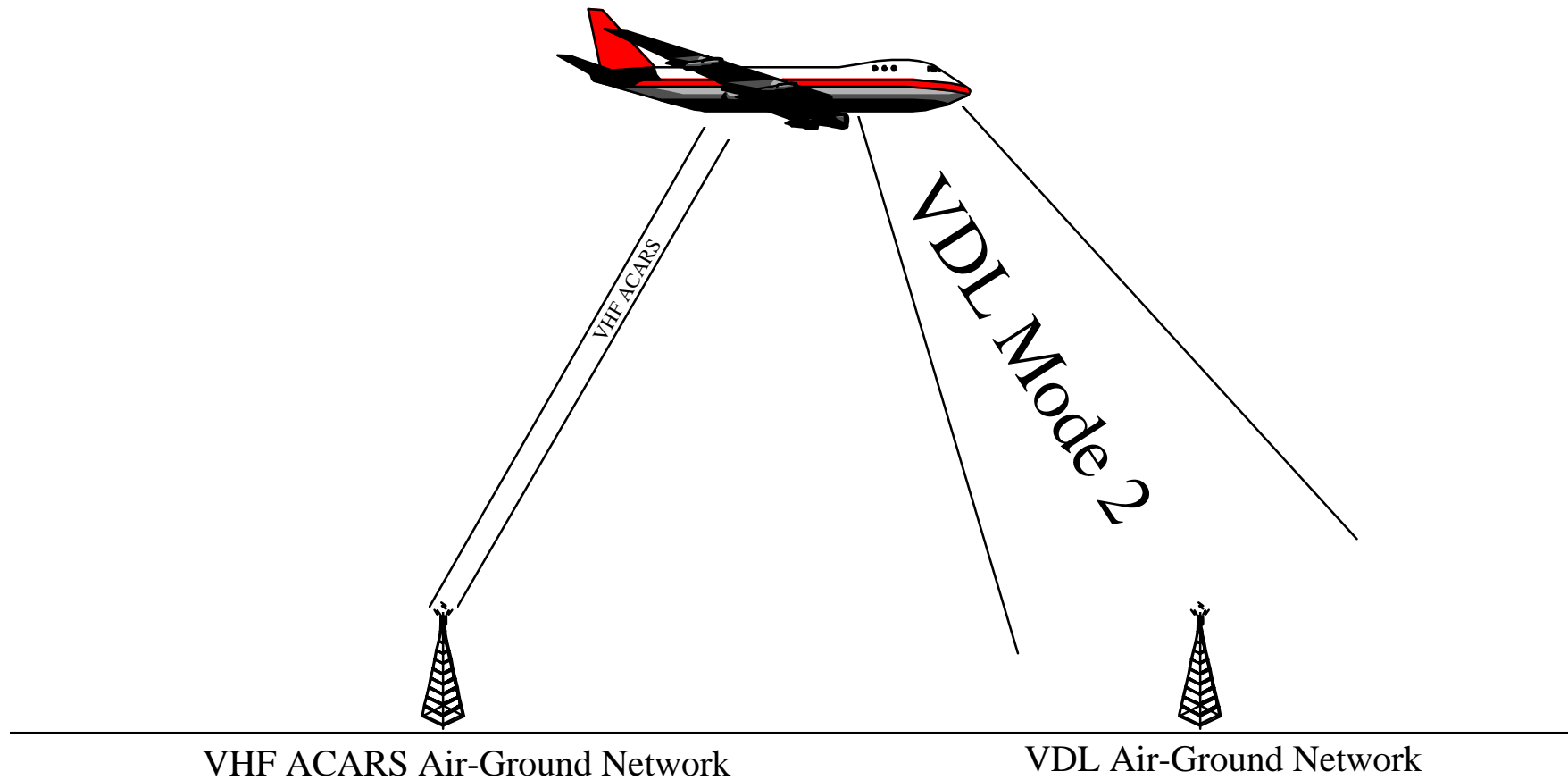
## Our Philosophy - Transition based on reliable benefits

- We are still using VHF ACARS because the justification for the proposed “future” systems are *benefits* which would be derived from new and untested applications.
- To justify the transition to a new VHF datalink system, it must as a priority improve the performance available to existing applications whose value is quantifiable.
  - ◆ *We must address the problem of short “payback”.*
- The improved datalink network performance may be an enabler for the introduction of “future” applications which would provide bonus benefits.

## Motivation for VHF Datalink transition

- The use of VHF datalink is rising steadily, and it is being used for ever more “critical” applications by airlines and ATS providers.
- As VHF ACARS traffic level rises, the one effective way to maintain an acceptable level of network performance is to use multiple VHF frequency channels.
- Where traffic is high, VHF channels are scarce. The long term solution is to use VHF Data Radios which make more efficient use of VHF channels.

◆ *VDR/VDL is here today!*



**VDL channel capacity is approximately 20 times higher than VHF ACARS**

## Twenty times more capacity...how?

- The basic channel data rate is 31.5 Kbps compared to 2.4 Kbps.
  - ♦ *a 10 to 1 improvement.*
- VDL Mode-2 uses a “window” size of eight compared to ACARS with a “window” size of one.
  - ♦ *fewer “traffic” lights to stop the data, typically a 2 to 1 improvement, which increases with message size!*
- There’s more to come!
  - ♦ *VDL supports bit-oriented applications, bit-encoding of AOC data also means a 10 to 1 improvement.*

## Constraint on datalink transition

- We Recognise that it would not be feasible to transition from the ACARS systems directly to a fully ICAO standard ATN system.
  - ◆ *The classic retrofit problem!*
- *VDL Mode-2 is here today* and provides an intermediate step supporting existing ACARS applications during the upgrade of aircraft fleet and airline ground systems.

## Key Transition Proposal Objectives

- To provide performance improvements *without* an immediate replacement or upgrade of the existing ACARS datalink applications, on the aircraft or at the airline host.
- To provide a migration path from ACARS protocol for air-ground datalink communications to protocols specified in the ICAO VDL Mode 2 and AMSS Data-3 standards.
- To provide ICAO-compliant datalink services which can support any future ATS internetworking protocols.

## VDL Mode 2 avionics implementation

- The use of VDR modem will require changes to the datalink avionics. Most probably the replacement of the ACARS MU by a CMU/ATSU.
- VDR modem can be used in ACARS mode to allow installation prior to deployment of new VHF datalink ground stations. (VDR Mode A).
  - ◆ *Mode A/Mode2 selection logic confined to the radio.*
- When the VDR is upgraded to support the VDL Mode 2, 31.5 kbps link, the ATSU/CMU should be upgraded to handle the ISO-8208 “X.25 Packet Layer Protocol” specified in ICAO VDL standard and AEEC Specification 631 (AVPAC).

## Why X.25 over VDL?

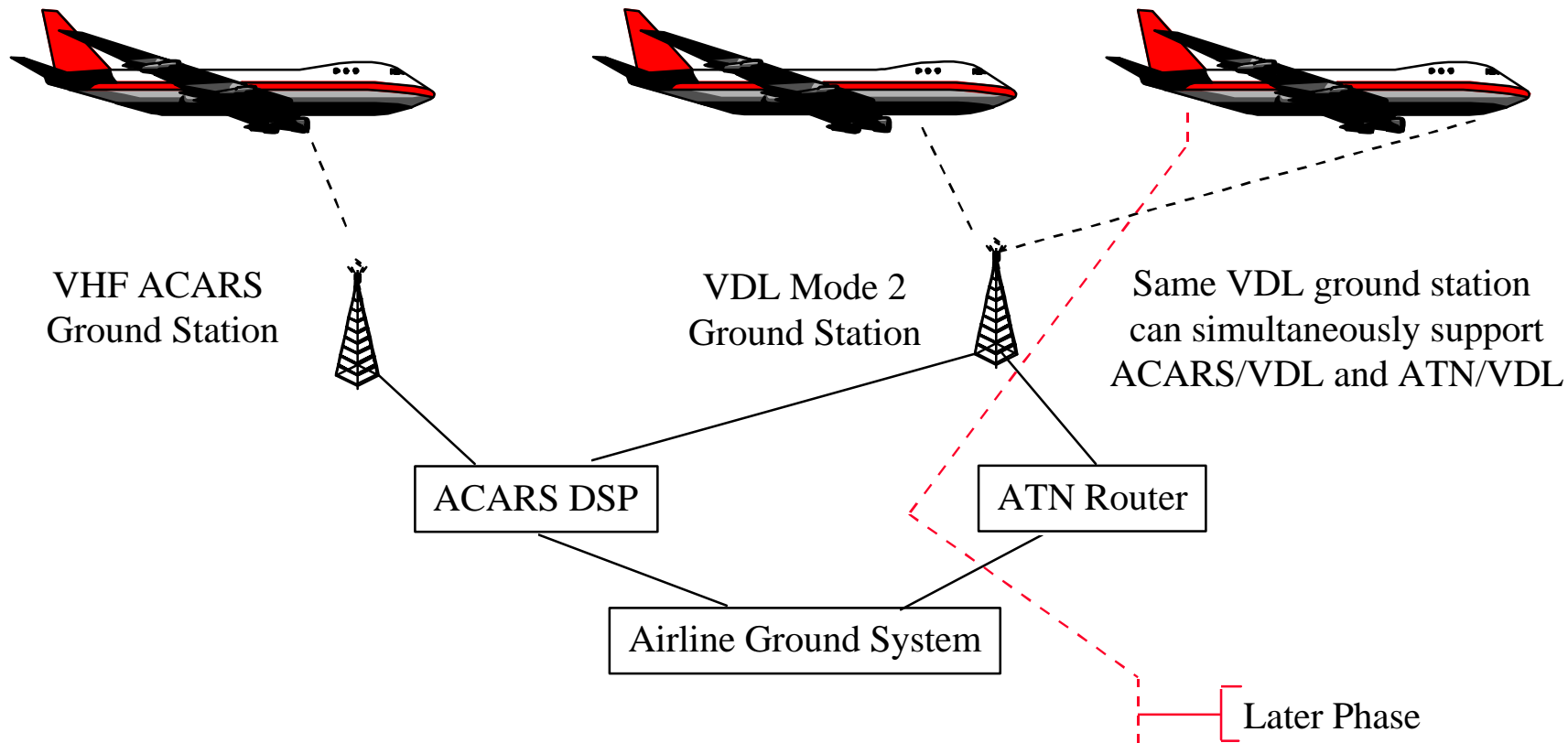
- ICAO VDL Standard was developed to provide an ATN compatible VHF datalink but the VDL ISO8208/X.25 protocol can transport data in any format.
  - ◆ *including today's ACARS based AOC data.*
- Allows same conversion between VDL or VHF ACARS air-ground connections and user ground system interface.
- Avionics can switch between VHF ACARS and VDL ground stations during the VDL deployment phase.
  - ◆ *applications can then be migrated as needed.*

## VHF Datalink Transition Phases

Phase 1: VHF ACARS

Phase 2: ACARS/VDL X.25

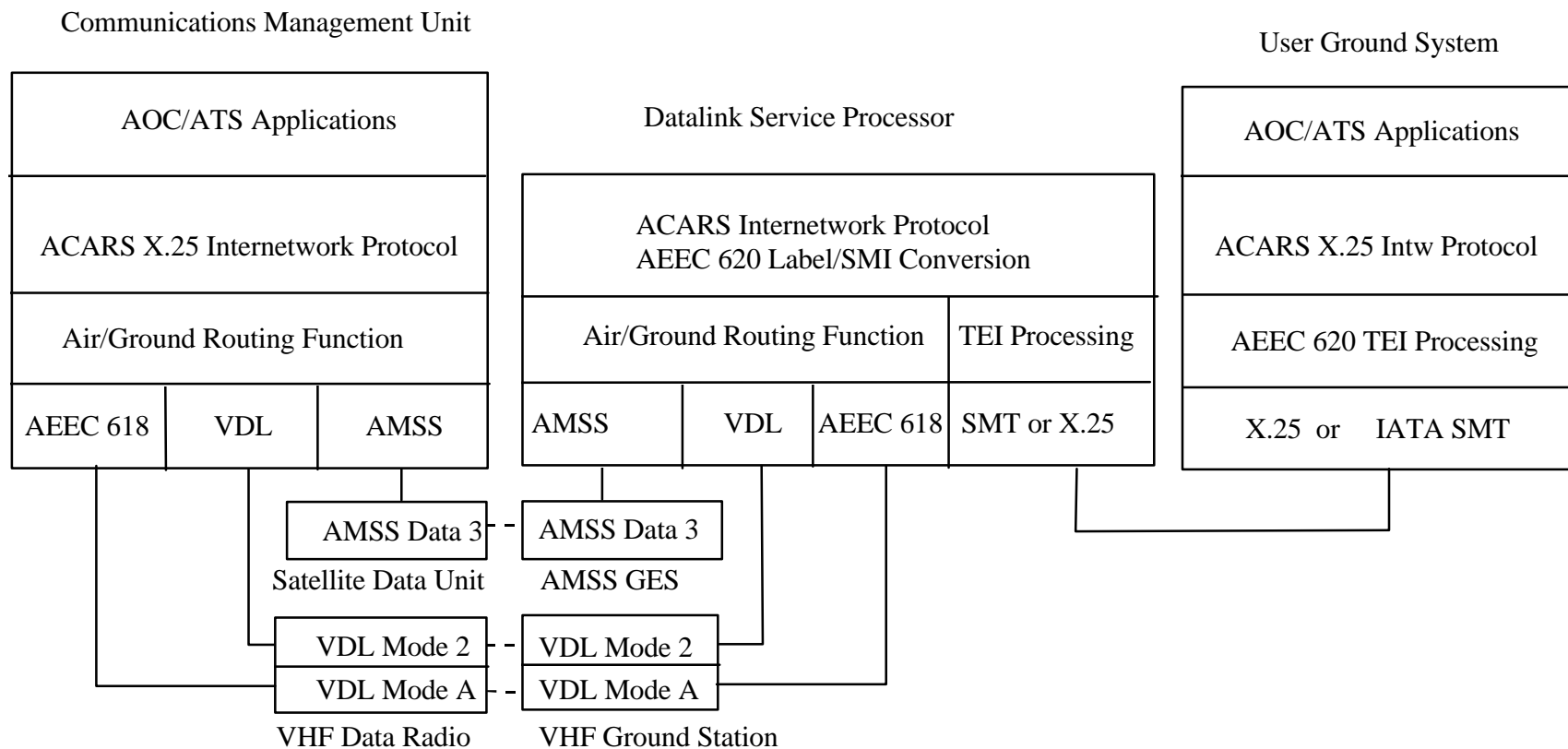
Phase 3: Airborne ATN router



## Another issue...AMSS Transition

- When the SDU was introduced, it provided a simplified AMSS Data 1/2 service to transport ACARS messages. This was to avoid implementing the Data 3 ISO-8208 based protocol in the ACARS MU.
- Current AMSS avionics can provide an AMSS Data 3 air-ground service equivalent to the VDL Mode 2 service but the ACARS avionics cannot use it.
- AMSS Data 3 uses the same ISO-8208 interface as VDL.
  - ♦ *a modified MU/CMU would use the same interface for both media.*

# AMSS/VDL X.25 Internetwork Architecture



## ACARS X.25 Internetwork Protocol

- Smooth transition for existing ACARS applications could be ensured by modifying AEEC 620 to allow ACARS messages to be sent using any of the following protocols:
  - AEEC 618 air-ground protocol
  - AEEC 631 AVPAC/VDL X.25 protocol
  - AEEC 741 AMSS X.25 protocol
- AEEC 620 could specify format for ACARS label and user data in AMSS/VDL X.25 user data packets.
  - ♦ *enabling DSP, Avionics and Ground Users to use common processing on messages sent over AMSS/VDL X.25 or AEEC 618 connections.*

## ACARS X.25 Internetwork Protocol - Benefits

- It is extremely simple. Not even necessary to send the AEEC 618 header in messages sent over AMSS/VDL X.25 connections.
- Much of the ACARS protocol handling will be eliminated as this will be handled by the standard X.25 processing.
  - ◆ *many of today's problems are due to poor ACARS protocol implementation or misinterpretations.*

*User's get all of the benefits with few of the risks!*

## Why not go further?

- ◆ **CLNP/TP4 add complexity and therefore risk with no performance benefit.**
  - ◆ *Airline/Service Provider coordination more complex.*
- ◆ **CLNP/TP4 should be validated (on the ground) before going “live” with operational traffic.**
- ◆ **CLNP/TP4 validation already a part of ATN validation.**
  - ◆ *Task better left to ATNSI and EURATN!*

*Lets build the ATN from the ground up, not from the aircraft down!*

## ACARS Subcommittee Action Plan

- AEEC 620 specifies an “ACARS Internetwork protocol” based on Labels and SMI’s but also states that the AEEC 618 protocol should be used on air-ground link.
- AEEC 631 AVPAC (VDL X.25) specifies a protocol for aircraft connections to a Datalink Service Processor, these are functionally equivalent to AEEC 618 connections.
- ACARS SC will be proposing at the next AEEC General Session to update AEEC 620 to allow use between the ACARS avionics and the DSP of either AEEC 618 connections or AEEC 631 AVPAC connections.