



**A330/A340**  
**A319/A320/A321**  
**AIM-FANS**  
**business**  
**process and**  
**NEXCOM**

*Airbus Interoperable Modular -  
Future Air Navigation System*

# **Contents**

- **AIMFANS - the overall picture and strategy**
- **The medium-term certification schedule**
- **Focus on the business process**
- **Now about NEXCOM**
- **Conclusion**

## — Why FANS ?

- The general objectives of FANS (ATM/CNS) are to :
  - ✓ Increase airspace *capacity*
  - ✓ Enhance operational *efficiency*
  - ✓ while allowing continued *safety* of air traffic
- These objectives are achievable by :
  - ✓ improving Air Traffic Control (ATC) procedures
  - ✓ using :
    - ➔ *better voice radios*
    - ➔ *data communications*
    - ➔ *satellite-based navigation*
- Airlines with equipped aircraft must get an *operational advantage*

***FANS (ATM/CNS) is to use airspace more efficiently***

## — **FANS Benefits**

- **FANS (ATM/CNS) implementation must benefit the various actors of aviation :**
  - ✓ **airspace users**
    - ➔ **Airlines**
    - ➔ **General aviation**
    - ➔ **Military**
  - ✓ **ATC service providers**
  - ✓ **others (equipment manufacturers, communication service providers, ...)**
- **It should be noted that, even if *airlines* are the main beneficiaries of FANS implementation, other actors' investments depend on their own benefits.**

***Benefit-driven development & implementation***

# — Main steps of evolution

- Several ATM/CNS environments are being defined

**FANS 1/A**  
*Oceanic/Remote airspace*

**C & S** : ACARS-based  
ATC datalink

**N** : GPS-based

**ATM** : Air Traffic Control  
(current procedure  
enhancements)

**from now on**  
Before ICAO standards.

**ICAO CNS/ATM-1**  
*High Density airspace*

**C & S** : New Comm.  
Network (ATN)-based  
ATC datalink

**N** : Extended Satellite.  
Nav.-based (GNSS)

**ATM** : Air Traffic Control  
(current procedure  
enhancements, initially;  
starts transition to Free  
Flight)

**from 2003+**  
ICAO standards

**"Free Flight"**  
*North America, Europe  
(tbc)*

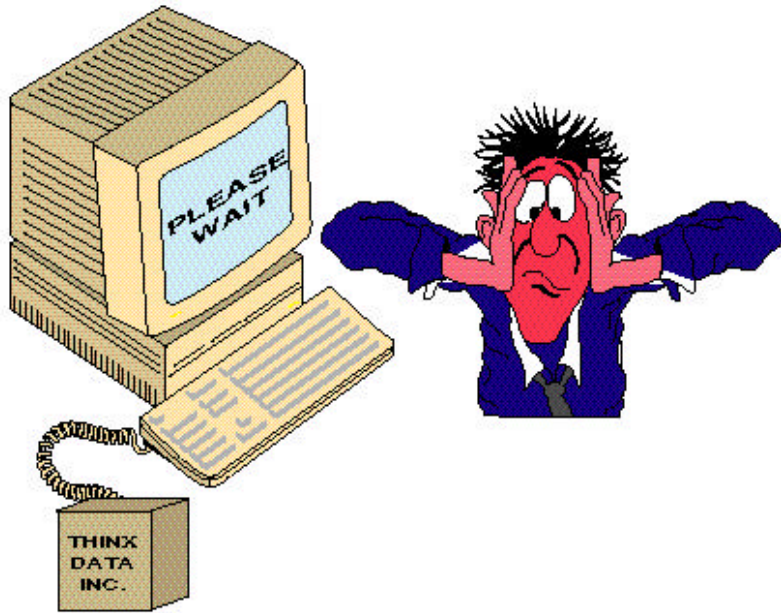
**C & S** : Based on  
Advanced Aircraft  
Reporting Sys. (ADS-  
Broadcast), and ATN-  
based ATC datalink

**N** : Extended Satellite.  
Nav.-based (GNSS)

**ATM** : "free flight"

**from 2008+**  
Beyond ICAO  
standards

# — ATM Headaches



Take ...



?

## — **Airbus Industrie FANS objectives**

- Adapt the aircraft to the *various ATM/CNS environments*
- Cope with a *moving environment*
  - ✓ Flexibility, responsiveness to different and changing functional requirements by region / routes
- **Minimize the burden** to airlines for the move to ATM/CNS
  - ✓ scheduling of avionics standards to minimize retrofit
  - ✓ compatibility with aircraft intermediate standards
  - ✓ Minimization of effects on peripheral equipment
- Introduce a user-friendly *Human Machine Interface* for ATC datalink
  - ✓ Optimized integration with existing functionality
- FANS (ATM/CNS) upgrades are designed to fit in the *Airbus family* concept

# **Airbus Industrie ATM/CNS strategy**

- **Identify the desired path**
  - ✓ using available standards
  - ✓ done
- **Install enabler equipment platforms**
  - ✓ ready to accept the new functions
  - ✓ done
- **Implement the new functions**
  - ✓ step by useful step
  - ✓ done and doing
- **Ensure widespread installation**
  - ✓ done and doing

# — Airborne functions - the path

**1999+**  
**FANS A/1** (interim)

- C** • ARINC 622 (analog radio)
- CPDLC (preliminary)
- N** • GPS
- RNP (initial)
- S** • TCAS
- ADS (preliminary)

**from 2003+**  
**CNS/ATM-1** (the “basics”)

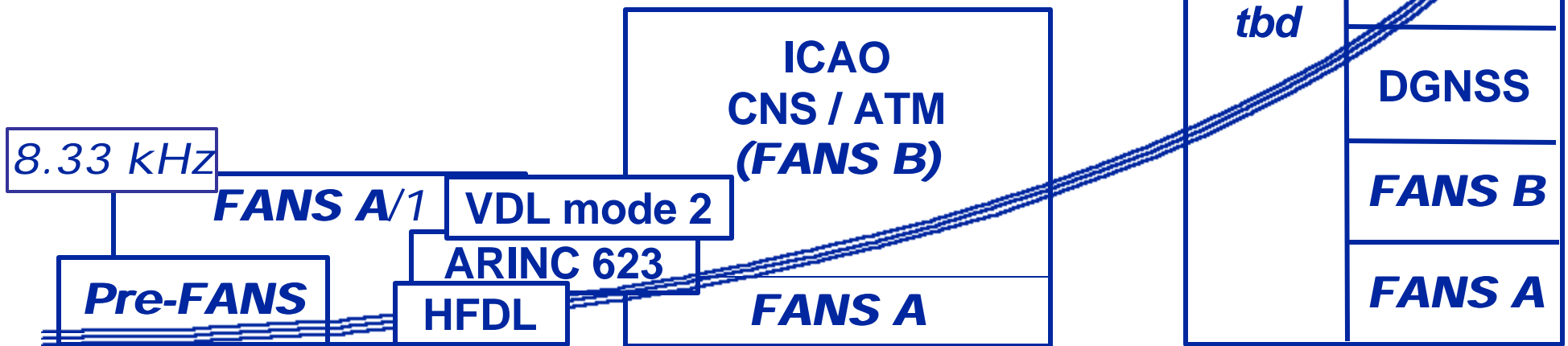
- C** • ATN (digital radio)
- CPDLC (ICAO)
- N** • GNSS
- S** • ADS (ICAO)
- ACAS

Global RSP (RCP / RNP / RMP) concept

**future, 2008+**  
**being defined**

**“Free Flight”**  
**concepts**

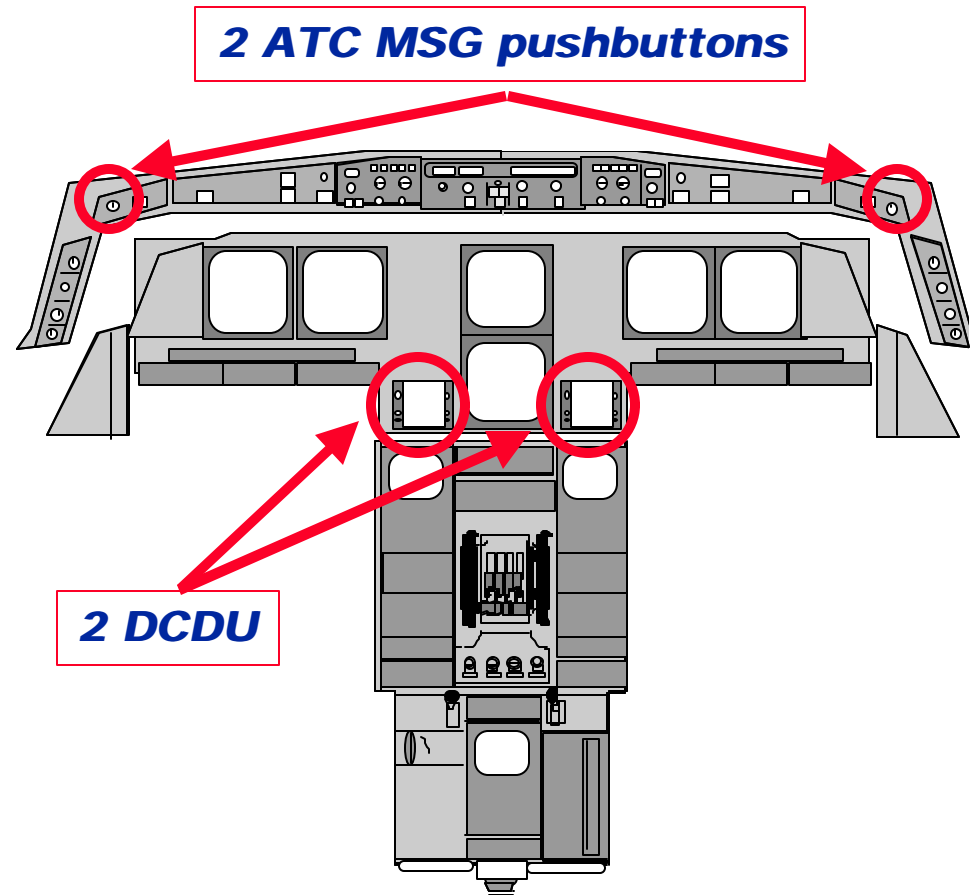
Note: some functions necessary for “Free flight” may be implemented prior to full concept availability.



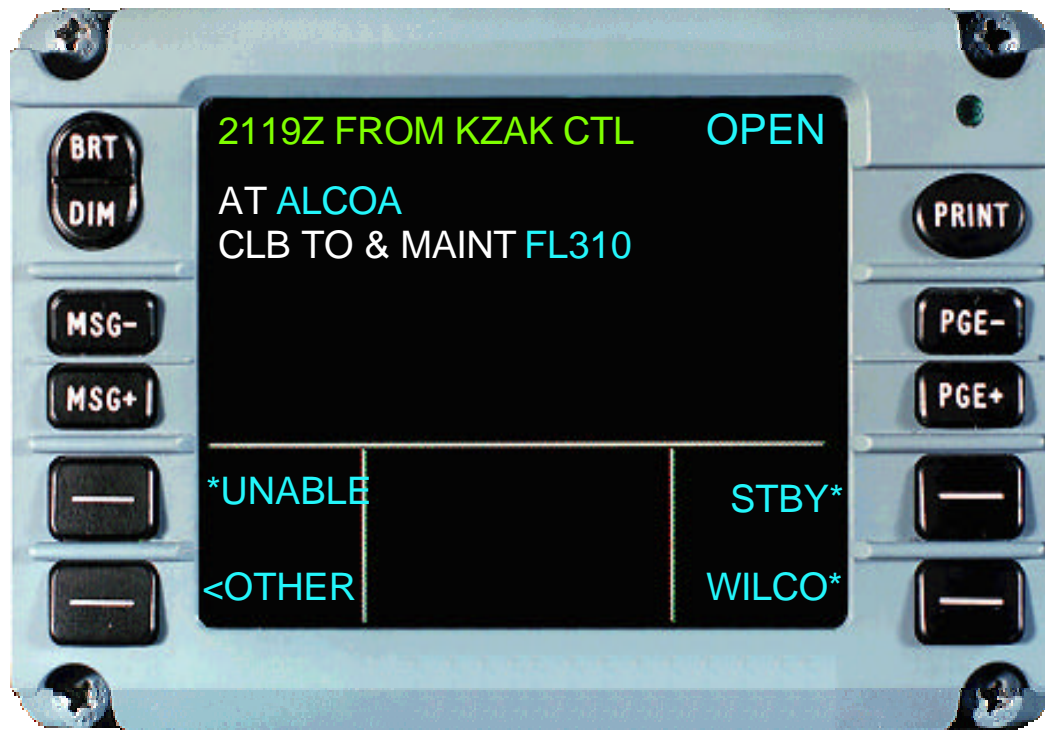
# — Human Machine Interface

- Two dedicated LCD screens with software programmable keys (**DCDU - Datalink Control & Display Unit**) were selected by a panel of pilots :

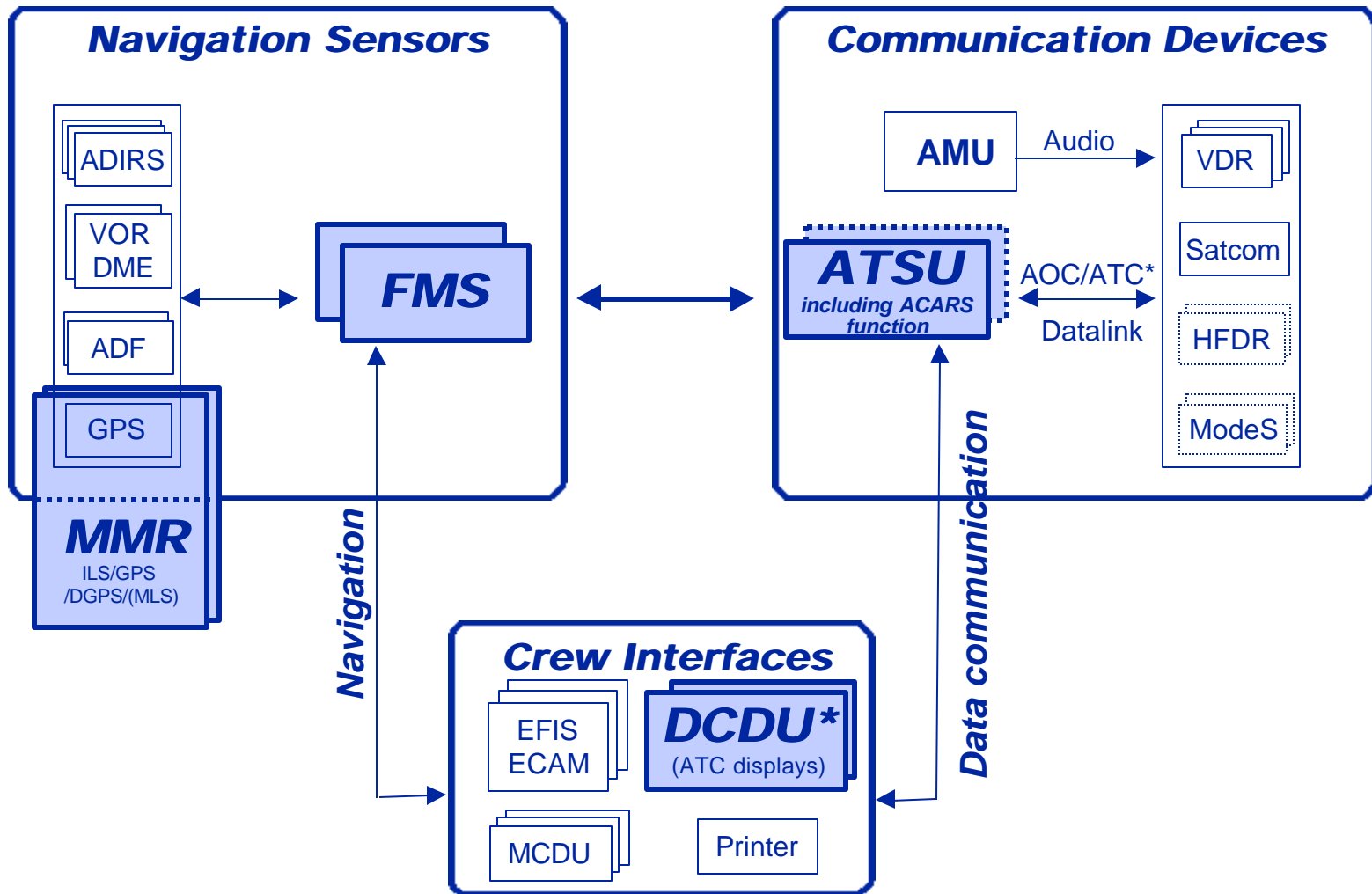
- ✓ Minimum perturbation of existing procedures leading to simple reversion to backup voice-based procedures
- ✓ Full time accessibility, readability for both crew
- ✓ limited head-down time



## — DCDU front face

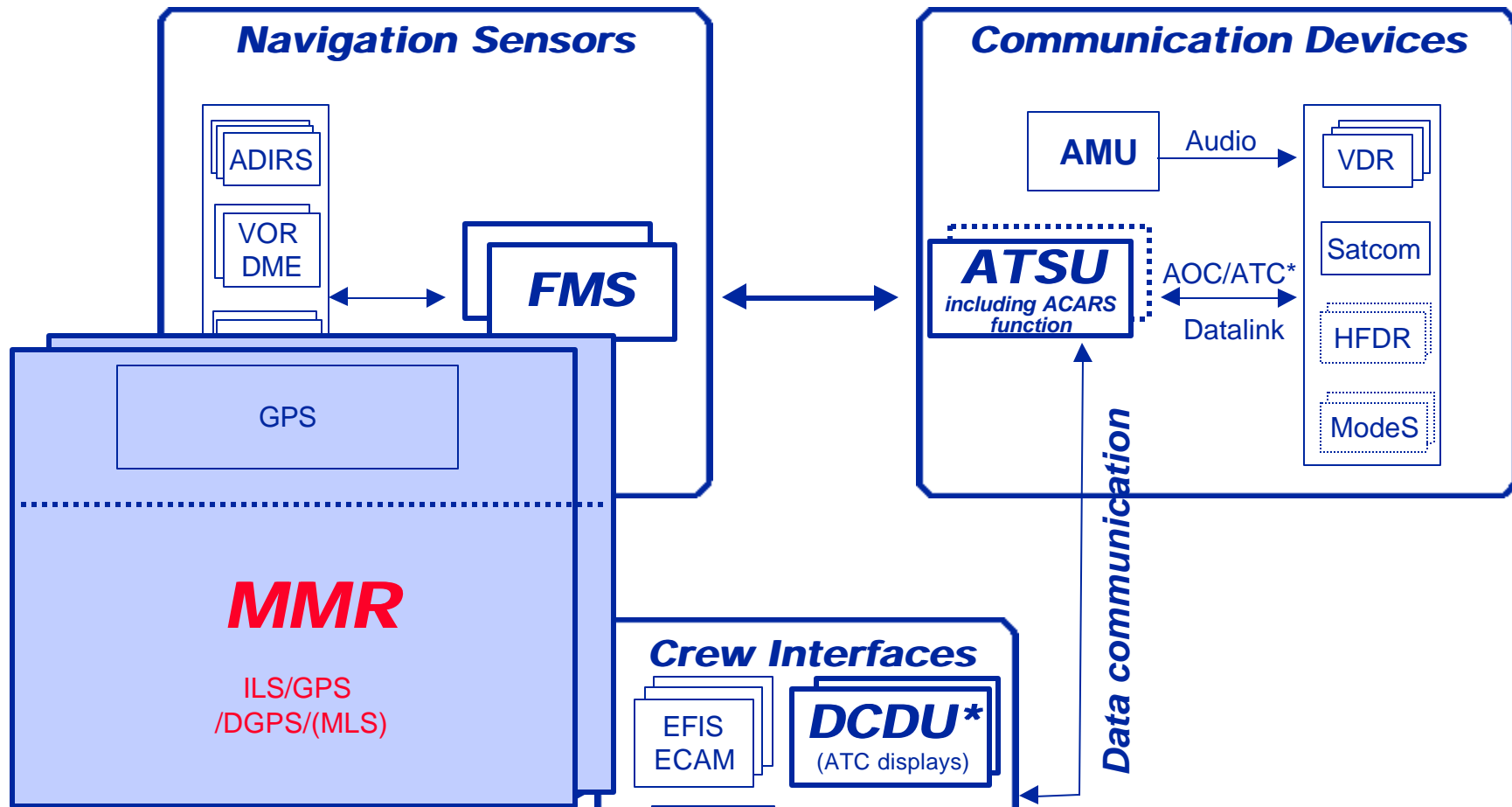


# — AIM-FANS architecture



\* introduced with FANS capability only

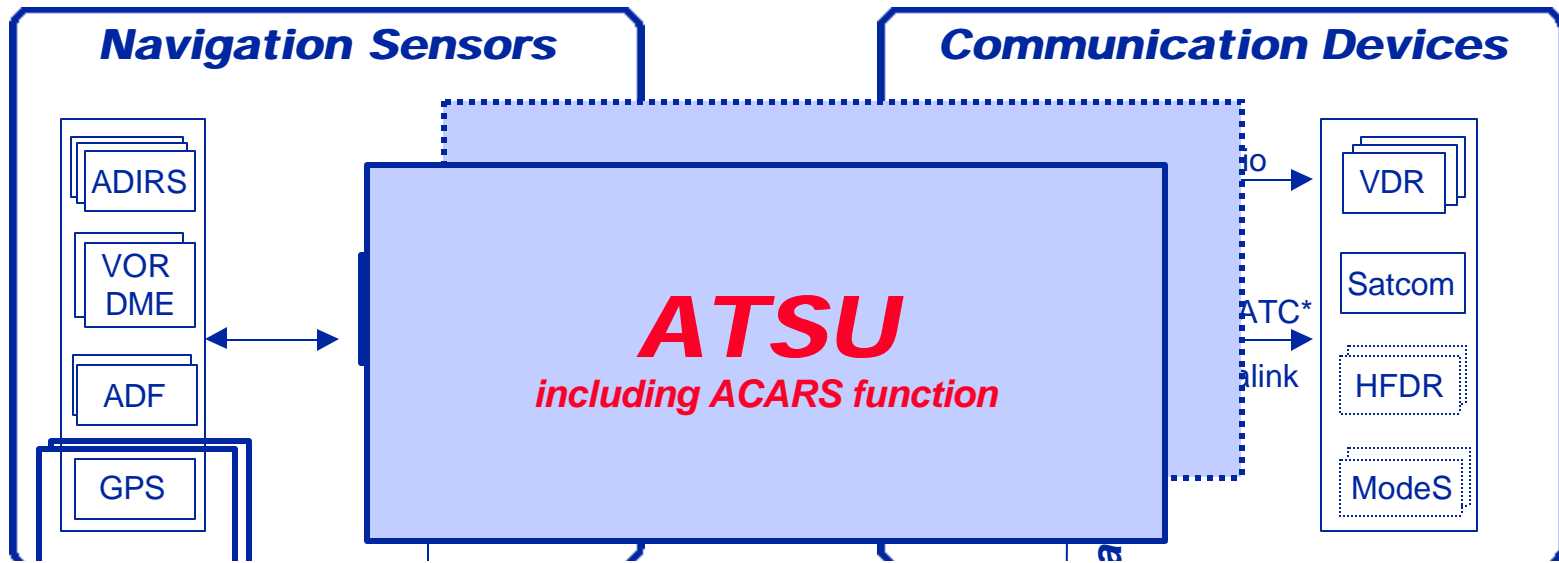
# — AIM-FANS architecture



A330/A340 certification (ILS + GPS) : Sep 98  
 A320 family certification (ILS + GPS) : Nov 98

4NS capability only

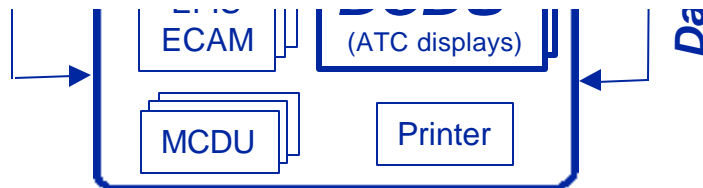
# — AIM-FANS architecture



A330/A340 certification (pre-FANS) : Dec. 98\*

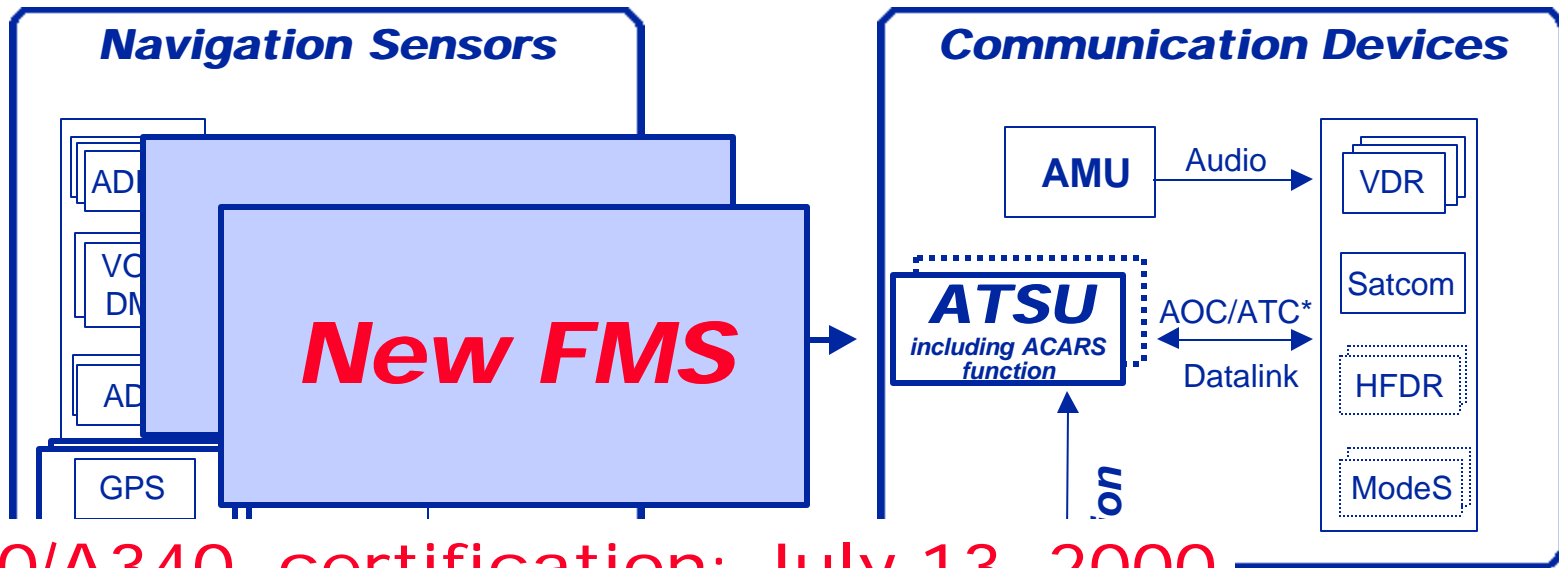
A320 family certification (pre-FANS) : June 99\*

\*includes airline-selectable Honeywell (Allied-Signal) & Rockwell-Collins AOC functions



\* introduced with FANS capability only

# — AIM-FANS architecture

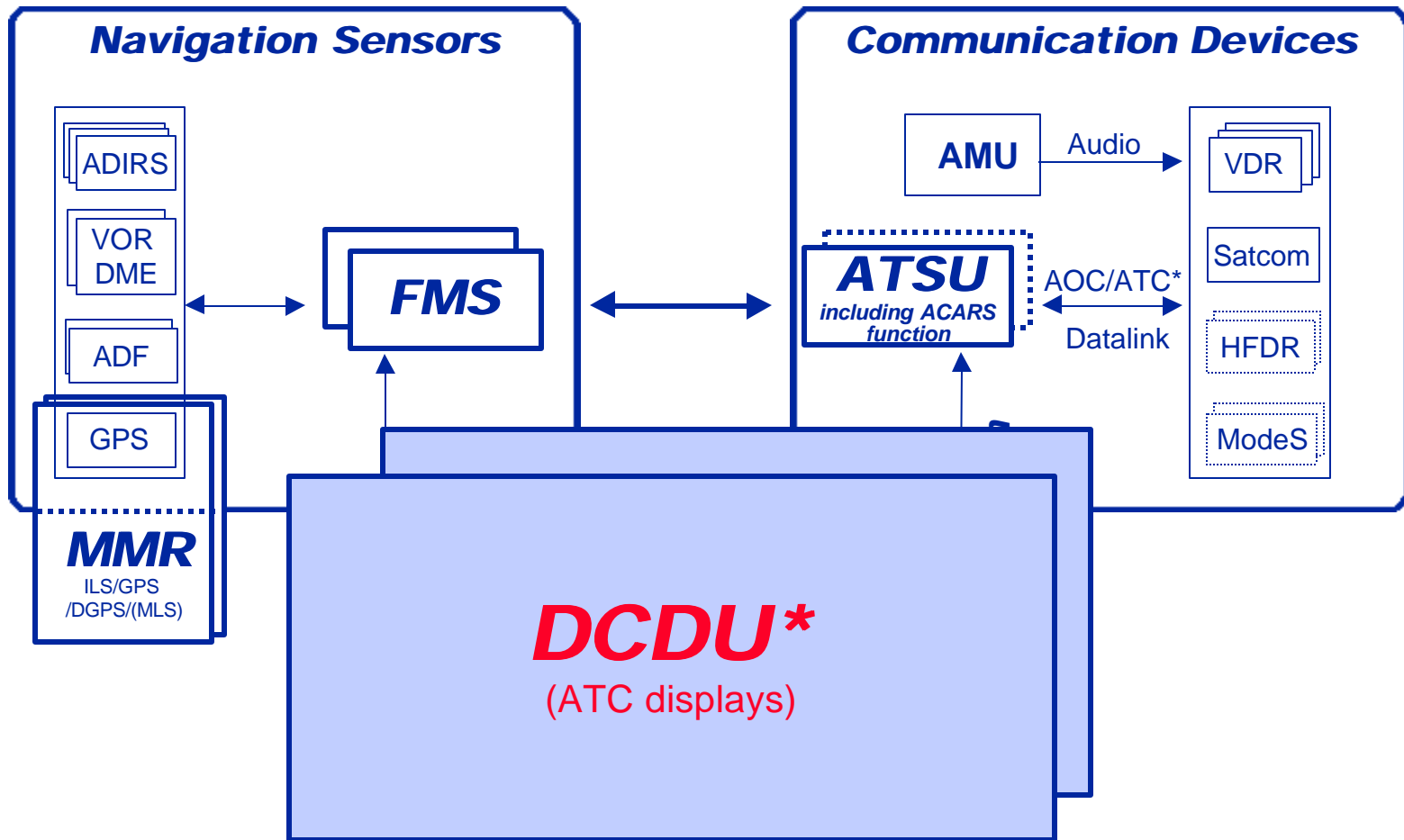


A330/A340 certification: July 13, 2000

A320 family certification: 2Q 2001

\* introduced with FANS capability only

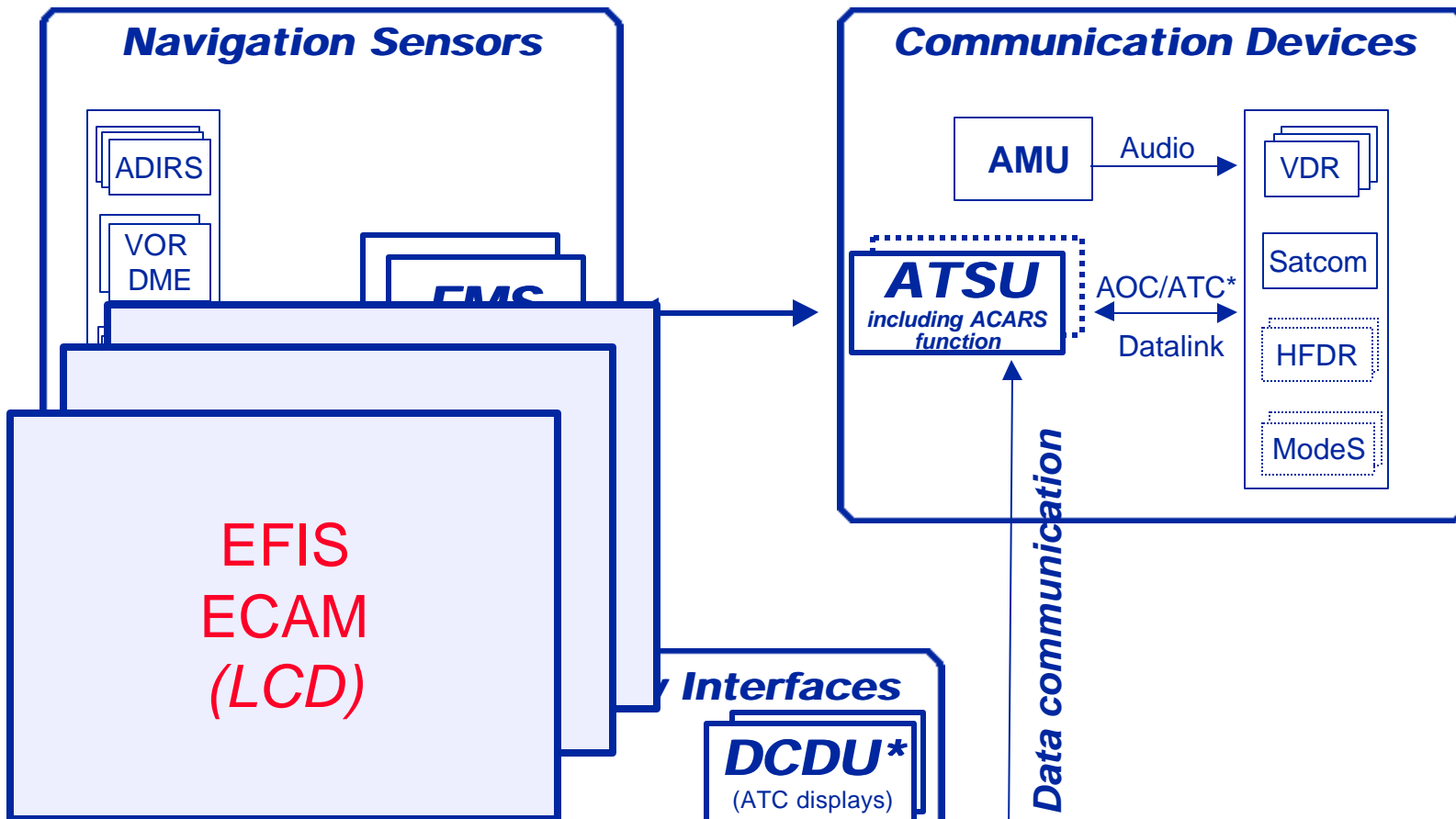
# — AIM-FANS architecture



A330/A340 certification (FANS A) :  
July 13, 2000

FANS capability only

# — AIM-FANS architecture



A330/A340 certification : 4Q 2001  
A320 family certification : 2H 2002

\* introduced with FANS capability only

## — AIM-FANS steps

- AIM-FANS is designed to allow the Airbus aircraft to be operated in the ultimate “FANS world” and during the transition towards it.
- It is based on *modular* and *flexible* avionics upgrades.
- Initial steps have been identified:

	<b>pre-FANS</b> <i>from 1998</i>	<b>FANS A</b> <i>from 2000 (A330/A340 only)</i>	<b>FANS B</b> <i>not before 2003</i>
<b>Navigation</b>	<i>FMS GPS (optional)</i>	<i>FMS GPS Based</i>	<i>FMS GNSS Based</i>
<b>Communication &amp; Surveillance</b>	<b>ACARS</b> networks <i>ATSU for <b>AOC</b> only</i>	<b>ACARS</b> networks <i>ATSU for <b>ATC + AOC</b> (ATC per RTCA definition.)</i>	<b>ATN</b> network <i>ATSU for <b>ATC + AOC</b> (ATC per ICAO definition)</i>

## — **Medium-term AIMFANS cert. schedule**

- **A330/A340**

- ✓ preFANS (ACARS)-----Dec. 11, 98

- ✓ FANS A + HFDL + added DSPs-----Jul. 13, 00

- ✓ ARINC 623/DCDU + ACARS upgrade-----3Q01

- ✓ VDL Mode 2/AOA + ARINC 615A interface-----3Q02\*\*

- ✓ ATN router + FANS B-----not before 1Q03⌘

- **A320 family**

- ✓ preFANS (ACARS)-----June 11, 99

- ✓ added DSPs-----Apr. 12, 00

- ✓ ACARS upgrade-----1Q01

- ✓ ARINC 623/DCDU + HFDL-----3Q01

- ✓ VDL Mode 2/AOA + ARINC 615A interface-----1Q02\*\*

- ✓ ATN router + FANS B-----not before 1Q03⌘

\*\* Depends on industry standards availability

⌘ Depends on Level C router, services and benefits availability

## ***Focus on the business process***

- **Enabler equipment platforms**
- **FANS A and HF Data Link**
- **VDL Mode 2/AOA and ARINC 623**
- **Navigation and Approach**
- **ATN and ICAO CNS/ATM 1**

## **— *Enabler equipment platforms***

- **MMRs, ATSU, FMSs, display systems**
  - ✓ **designed for ICAO CNS/ATM 1, plus margins for free flight**
- **Immediate operator benefits**
  - ✓ **lower cost of ownership**
- **Strategic benefits**
  - ✓ **enable new functionalities**
  - ✓ **enable orderly change**
  - ✓ **enable more efficient operations**
    - ➔ **with improved ATC procedures**
  - ✓ **enable higher traffic densities**
    - ➔ **with improved ATC procedures**
- **Installed on all new aircraft**
  - ✓ **over 1900 aircraft installations, starting 1999, delivered one-a-day**
  - ✓ **Also available for added 1100 in-service aircraft**
  - ✓ **These include over 1300 aircraft in North America**

## **FANS A and HF Data Link**

- **FANS A**

- ✓ improved airline long-haul operating costs, revenues

- ➔ ATC services available

- ➔ mainly in the Asia/Pacific region

- **HF Data Link**

- ✓ improved airline polar communications

- ✓ improved airline communications costs (Data is cheaper than HF voice, less need to buy Satcom installation)

- ➔ services available

## **— 8.33, VDL Mode 2/AOA and ARINC 623**

- **8.33 kHz VHF channel spacing**
  - ✓ spectrum relief
  - ✓ increased ATC capacity, fewer airline delays
    - ➔ATC services available
- **VDL Mode 2**
  - ✓ improved airline communications costs
  - ✓ faster airline messaging
  - ✓ spectrum relief
  - ✓ partial ATN sub-network
    - ➔communications services now being installed
- **ARINC 623 non-critical ATC services**
  - ✓ reduce airline departure delays
  - ✓ improve ATC traffic handling
    - ➔ATC services available

# — **Navigation and Approach**

- **In-service GPS/Inertial/FMS systems and SA abolition reduce benefits of SBASs (WAAS,EGNOS....) and GNSS 2**
- **Local-Area Differential GNSS (GPS)**
  - ✓ **expected to improve airline safety, service regularity**
    - ➔ **cost-effective**
    - ➔ **does not need large-scale infrastructures**
    - ➔ **wide acceptance expected**
  - ✓ **Cat 1 soon**
  - ✓ **then Cat 2; Cat 3 later**
- **Microwave Landing System**
  - ✓ **intended to improve service regularity**
    - ➔ **in Europe, at major hubs (AMS.....)**
    - ➔ **airline benefits more difficult than previously expected**

# — **ATN and ICAO CNS/ATM 1**

- **Can be hosted on enabler equipment platforms**
- **Airline benefits depend on services**
  
- **ATN**
  - ✓ **immediately improved airline communications costs?**
  - ✓ **Improved ATC messaging speed, sequencing**
    - ➔ **communications services becoming available**
  
- **CNS/ATM 1**
  - ✓ **immediately fewer airline arrival delays?**
  - ✓ **more airline slots?**
    - ➔ **ATC services becoming available**
  
- **Confidence in service availability - benefits, scale & schedules - is essential to the business process**

## **NEXCOM**

- **Need for spectrum relief is a given**
  - ✓ **Timeliness is essential**
  - ✓ **Any solution lasts a limited time**
  
- **Implemented solutions are**
  - ✓ **VDL Mode 2 - US & International - 5 to 10 years relief**
  - ✓ **8.33 kHz voice - International - low risk**
  - ✓ **dependable, requested by customers & widely available**
  
- **Nexcom**
  - ✓ **is additional to the above for manufacturers & many operators**
  - ✓ **is expected to be good for TBA more years (than VDL M2 & 8.33)**
  - ✓ **has perceived schedule & funding risks**
  - ✓ **is not yet requested by customers**
  - ✓ **also handles AOC/APC datalink?**

## **— NEXCOM and Airbus**

- **Assumed change sequence**
  - ✓ **Analogue voice: no avionics change - (or known 8.33 changes)**
  - ✓ **digital voice from 2005: radio & HMI changes for evaluation**
  - ✓ **VDL Mode 3 from 2008?: datalink avionics changes for evaluation**
- **Airbus will build whatever is needed to operate in the USA**
  - ✓ **Schedule will depend on customer interest**
  - ✓ **Existing AIMFANS installations are designed to extend to Nexcom**
    - ➔ **ARINC 750 radios, ATSU's already do 8.33 & VDL Mode A**
      - **-will do VDL Mode 2 by 2002**
    - ➔ **will require added software for digital voice, then for VDL - 3**
    - ➔ **already sold for over half the fleet, Service Bulletins exist for most of the remainder**
    - ➔ **Radio panels may need changing completely, depending on added digital voice functions**
    - ➔ **Aircraft wiring & other changes also likely to be needed**

## ***NEXCOM questions***

- **When is spectrum relief needed? Is digital voice soon enough?**
- **How many more years of spectrum relief will Nexcom bring ?**
  - ✓ **Compared with the existing US system**
  - ✓ **Compared with a “fast track” mix of 8.33 kHz voice & VDL Mode 2**
- **How will AOC and APC communications be handled on VDL-3 Data?**
- **Which added digital voice functions are to be implemented? When?**  
**Will HMI work take account of CPDLC Builds?**
- **Will transition & frequency planning take into account HMI issues?**
  - ✓ **25kHz: 760Ch. (+ 8.33kHz: 2280Ch.) + 3040 digital voice channels !**
- **When will standards be available? These are essential**
  - ✓ **Airworthiness & operational, digital voice & then VDL Mode 3:  
FAA-JAA/RTCA-Eurocae**
  - ✓ **Avionic: ARINC/AEEC (work has not started)**

## **Conclusion**

- The airlines and Airbus Industrie have
  - ✓ installed CNS enabler equipment platforms
  - ✓ installed many CNS functions
  - ✓ on a large proportion of the jet airliner fleet (1900 + 1100 aircraft, of which over 1300 in the US, adding an aircraft a day)
    - ➔when ATC benefits become visible, the rest will follow fast
- Now it is up to the ATC service providers to provide
  - ✓ immediately beneficial services for airlines
  - ✓ with confidence in benefits, scale and schedules
- With confidence in the ATC services, we can implement the remaining functions - specifically:
  - ✓ We need to build confidence in the need for digital voice and VDL - 3, in the schedule, and in the functions implemented
- Thank you for listening. Any questions?