

Datalink Applications

Presented by

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ALTRAN on behalf of ENAC



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Civil Aviation University Of China

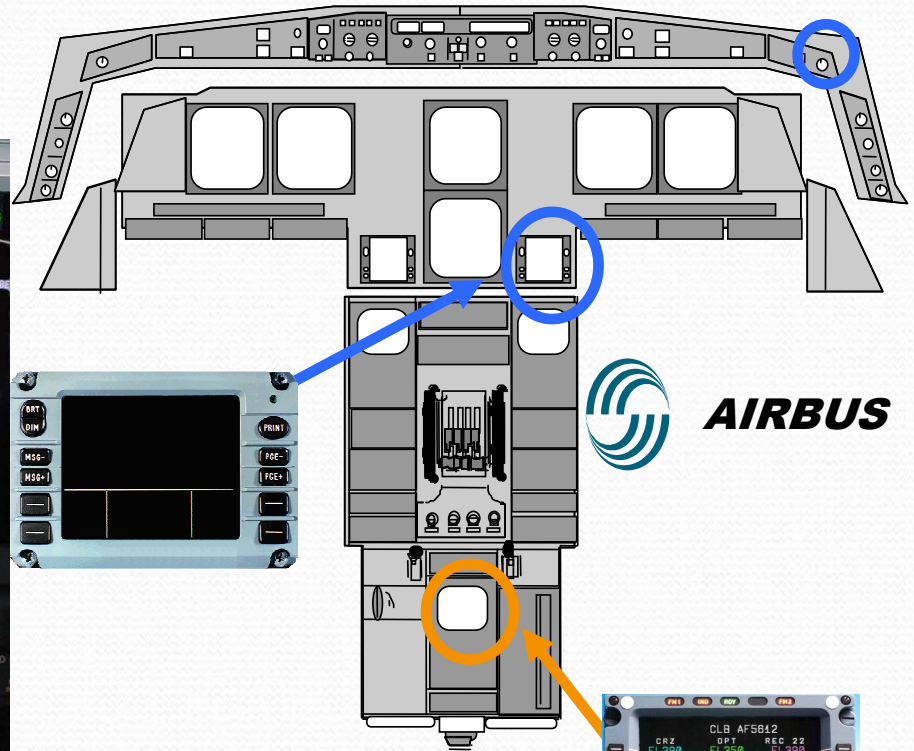
Outline

- Datalink Applications
 - ACARS A623 (DCL, OCL, D-ATIS)
 - DLIC service : CM or AFN
 - CPDLC
 - ADS
- Programme LINK 2000+
- FANS and ATN
- Conclusion

Data link onboard



Non dedicated HMI



Dedicated HMI for Request/response



ACARS applications

DCL

OCL

D-ATIS



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ACARS applications

- ARINC 623
 - DCL
 - Departure Clearance
 - OCL
 - Oceanic Clearance
 - D-ATIS
 - Digital - Automatic Terminal Information Service

(623) DCL phases

- Departure clearance request
 - The pilot fills in the required information
 - Type of aircraft and ATIS information letter
- Ground computing
 - Check flight plans
- Air traffic Controller response
- Response reception
- Ack or reject by the pilot

(623) DCL onboard



(623) DCL

- Request is transferred through ACARS
- Ground computing
 - Flight Plan correlation
 - Display on ATC Controller's screen
- ATC Controller send the response

(623) DCL ground side - Example

VOLS

STPV

ISA

0:08:22

15

Départs Eveillés

6

Départs Activés

•

AFR1205

1074 LPG

12:30

EGCC

ID

•

LIB3245

1011 MARGY

N04

14:45

LFBO

ID

•

AFR6112

1074 LPG

12:30

EGCC

ID

•

MXE04CC

BNE

13:55

EGFF

ID

•

AFR274

1086 RBT

B03

14:30

EGGG

ID

•

PRB400

1086 RBT

F12

14:35

EGGG

ID

•

AFR6123

1074 LPG

D03

13:20c

EGCC

ID

•

RAM546

1022 TERGA

M02

14:45

LFST

ID

•

AFR6712

LPG

12:30

EGCC

ID

•

AFR7711

1055 PERNO

A02

14:30

LFBR

ID

•

AFR8287

1073 BUDON

A01

14:15

NWWW

ID

•

BAW807

1073 BUDON

E02

14:30

EGGG

ID

•

FAL2510

1044 PERNO

A06

14:25

LFST

ID

•

IT632AB

1040 LPG

12:15

LIRF

ID

•

JAL333

1086 RBT

D14

14:35

EGGG

ID

•

AFR1287

1073 MARGY

B741

S16

14:15

NWWW

•

AFR2606

2606 MARGY

B737

D09

14:00

LYBE

•

JAL416

7667 CMB

B74B

A01

12:54

RJAA

RD

310

•

AFR6122

1074 LPG

FK28

12:30

EGCC

•

AFR6121

7556 BUDON

B73B

P82

14:00

LPPT

>>

•

AFR1024

7556 BUDON

B73B

P82

14:00

LPPT

Recherche
F2

Fiche
F3

Init. Fen.
F4

Liste Sup.
F5

Jour/Nuit
F6

LFPG E
LFP0 W
LFPB E

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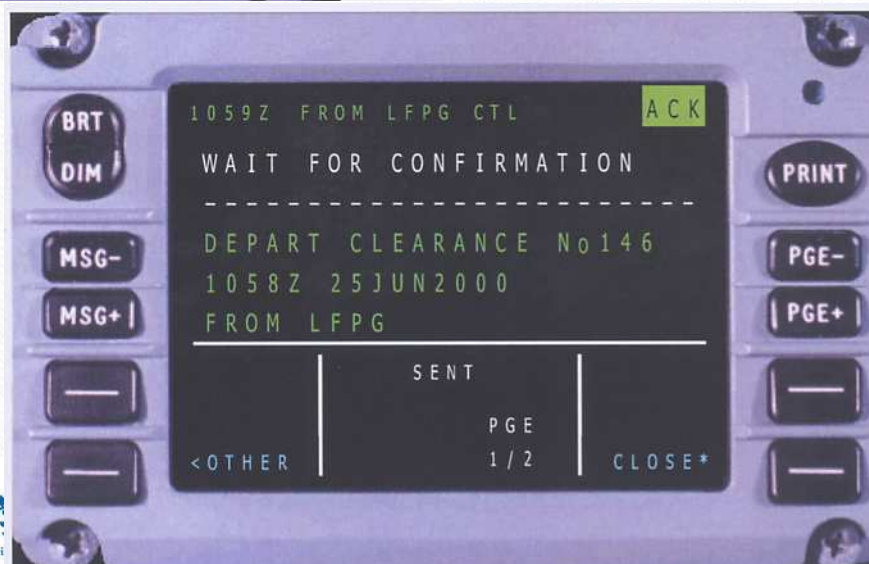
LFPG E
LFPO W
LFPB E



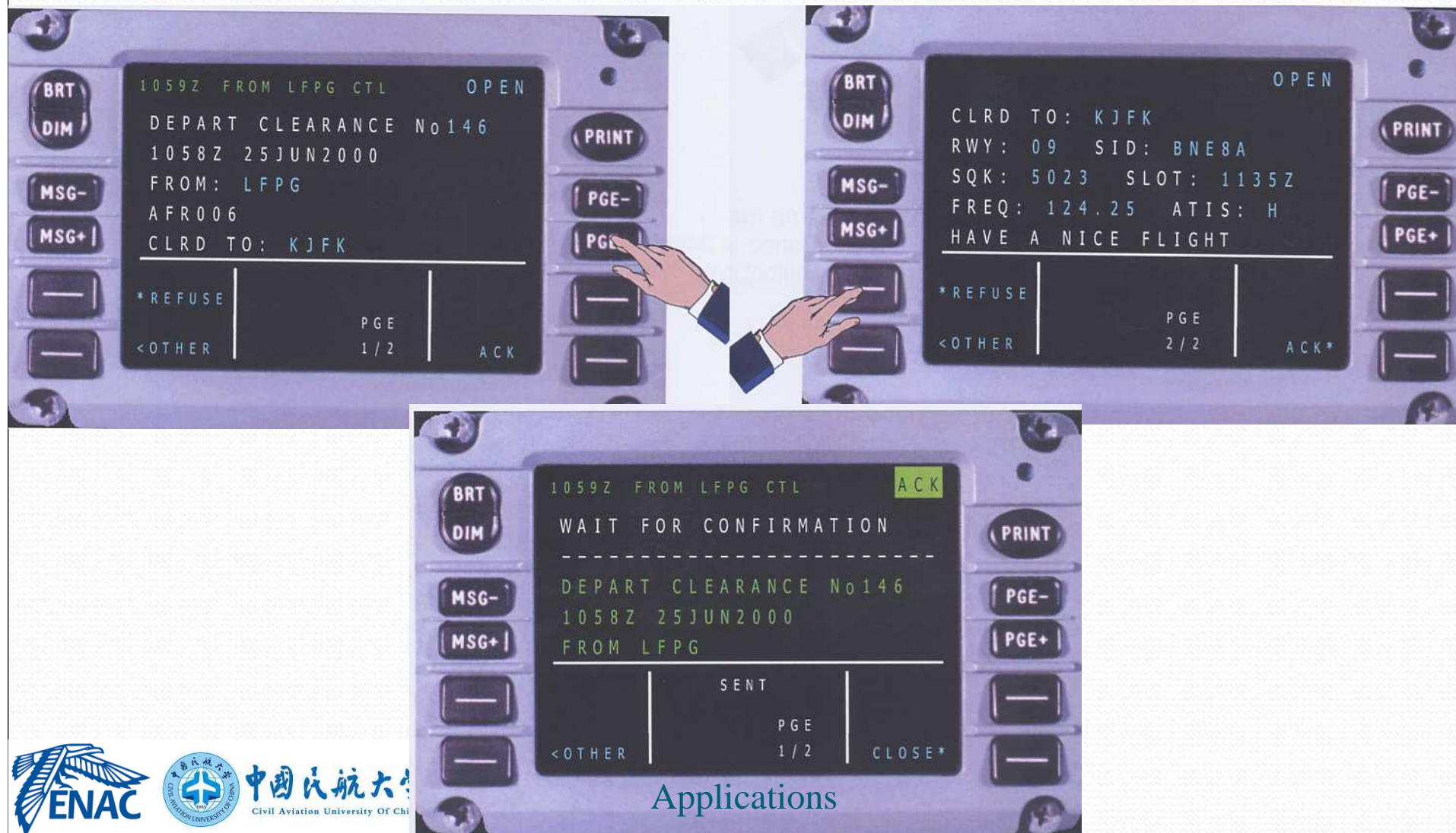
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Applications

(623) DCL onboard



(623) DCL onboard



(623) DCL

- Ack updates the Flight Plan
 - Copy of the clearance
- In case of reject revert to the voice

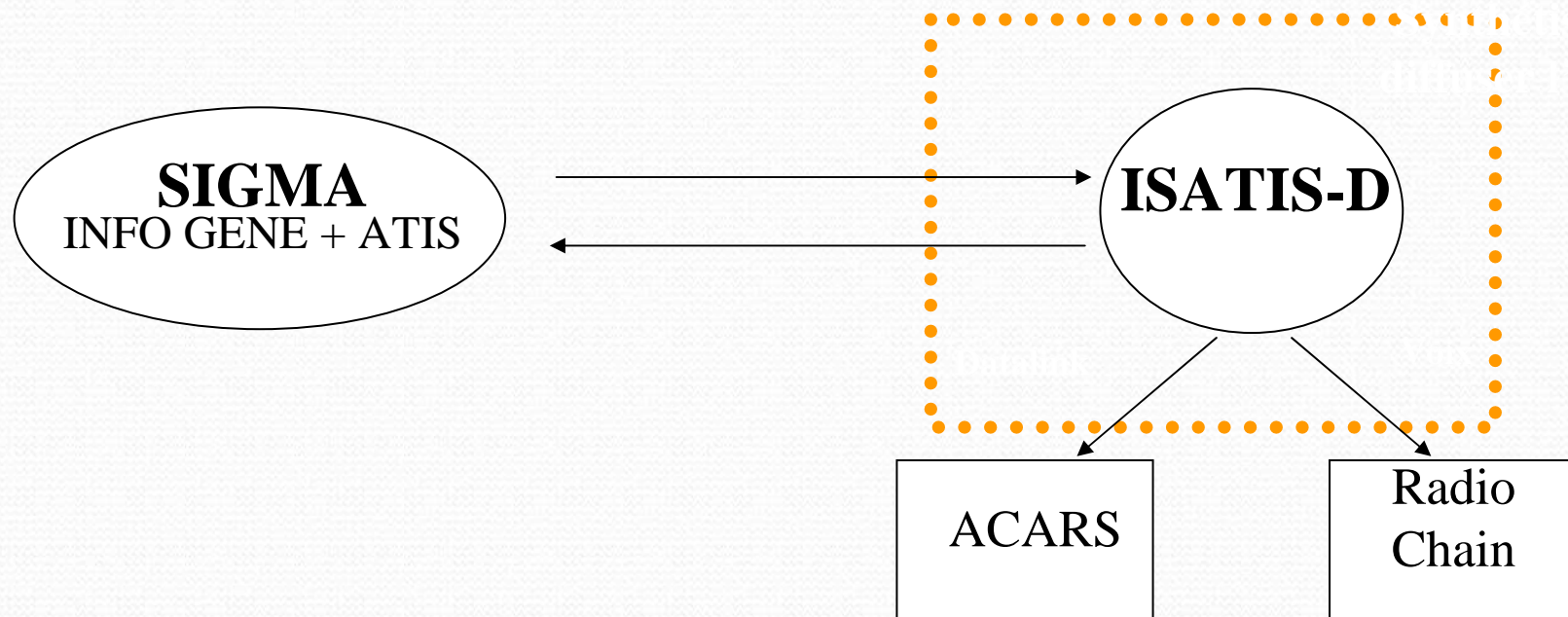
(623) OCL

- ATC clearance for oceanic
- Before entering oceanic controlled area
 - North atlantic
- Message sequence and phases similar to DCL
 - Content, of course, are different



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(623) D-ATIS example



Data preparation

ATIS Screen

SYNTH MAJ ATIS TEXTE SIGMA

130/80 10 150/80 20 160

└ 79 +14 └ 79 -14

NT 60

HBN <1100 ft

TA/TD +22/+23

0852 3500 mètres SOLEIL

Nuage 11 Nuage 22 Nuage 33

Phénomène 2

MOYENS AIRNAV HS > 6

VOR CGS VOR LUC VOR STP DME STP LIC NC ILS NA 05R R544

PISTE 05R COUVERTE D' POUR CAUSE DE RISQUE AVIAIRE - un deux trois
 sssssssssssssssssssssssssssss - VFR SPECIAL A LFMC - RADAR DU HAUT-MONTET
 RADAR PRIMAIRE HORS SERVICE - VFR SPECIAL A LFMD - VFR SPECIAL A LFMC - RAD

SYNTH MAJ ATIS TEXTE SIGMA

10:38 42

FOX TROT 10:38

Approche Type App : ILS

Piste Att : 05R

Piste déc : 05L

Etat des pistes

PISTE 05L FERME(ES)

Niveau de transition : 50

Informations opérationnelles

VOR LUC HS - VOR CNMHS - VOR STP HS - DME STP HS

GREVE SERVICES METEO

Vent : 250° 10 Kt 25 Kt

Visibilité : 3500 mètres

Temp : SOLEIL

Plafond : Nuage 11 Nuage 22 Nuage 33 Nuage 44

Température : +12° DP : +08°

QNH : 1013 QFE : 05L 1015 05R 1015

Phénomènes : Dom 1 : Phénomène 2

Acquitter Validation

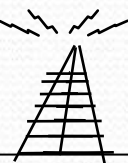
Préparer ATIS Moyens HS Zones Actives Texte Synthèse Page Texte Procédures

Voice

Data Link

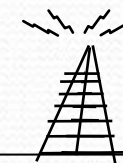


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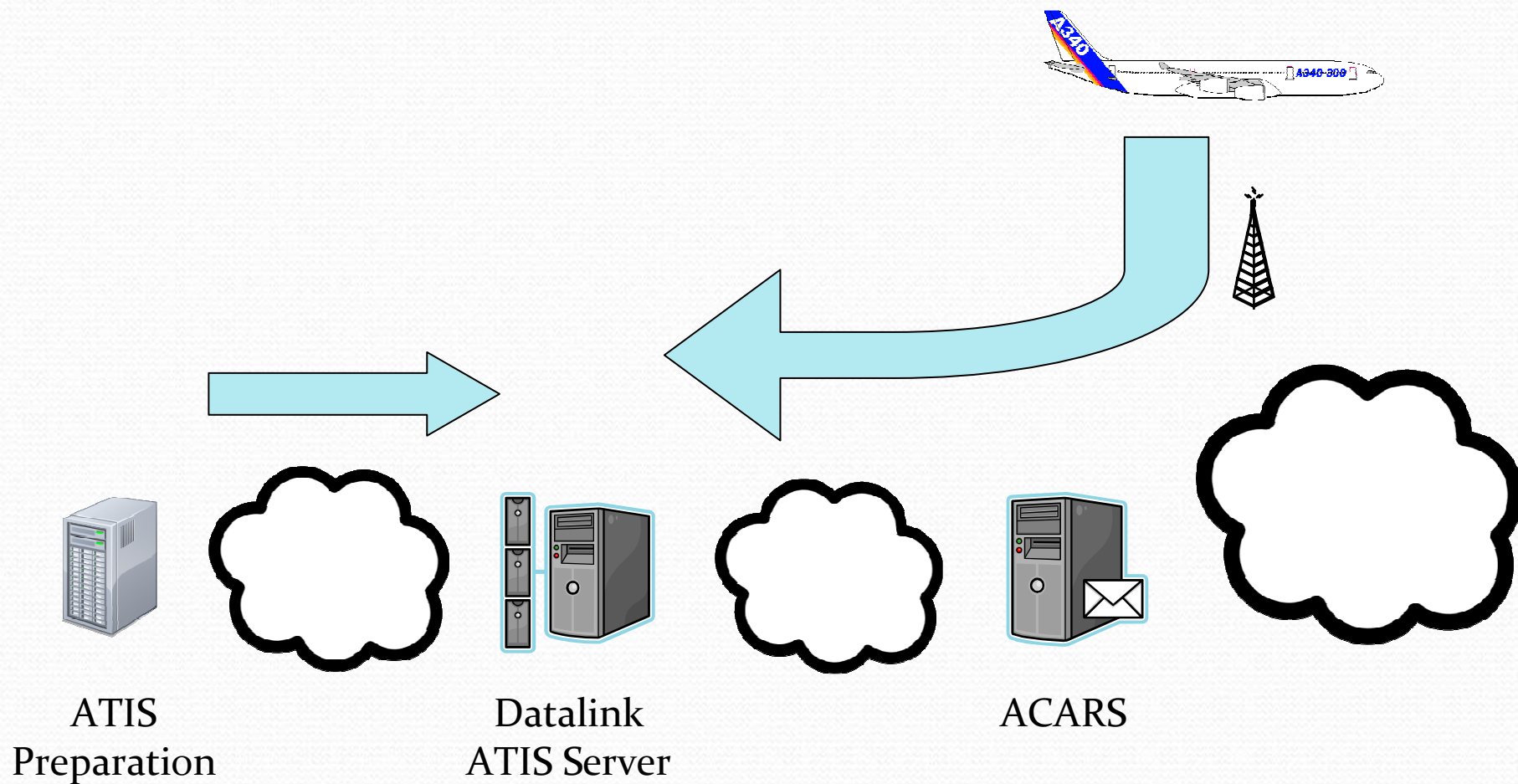
VOCODING

Applications



ACARS

(623) D-ATIS example



FANS and ATN applications

DLIC service

CPDLC

ADS



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DLIC service

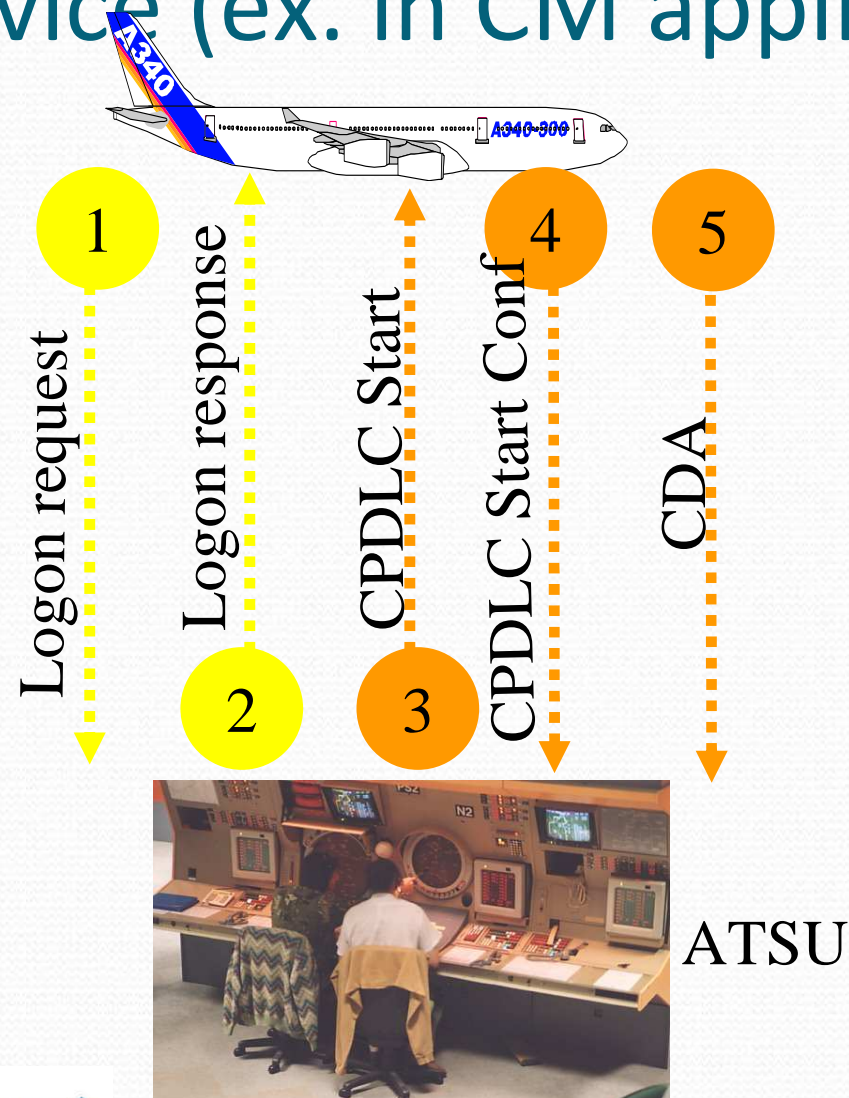
- Network side: aircraft known as an address
 - ATC systems: aircraft is linked with its Flight Plan
- ➔ Automatic correlation is needed
- Service : Data Link Initiation Capability (DLIC)
 - Logon
 - Addresses & Version of the applications
 - Application
 - FANS 1/A: ATS Facility Notification (AFN)
 - ATN: Context Management (CM)

DLIC service (ex. in CM application)

- Is executed prior to any other DL service
- Aircraft send to the CM server
 - Its ICAO 24 bits' address
 - Flight Id
 - From/to airports
 - Transport address of its applications + version
- FDPS looks for the aircraft to make a unique correlation
- Case of success : Data link is switch on
 - Connections for data link applications will follow
- Otherwise : revert to the voice



DLIC service (ex. in CM application)



CPDLC

- Controller Pilot Data Link Communication
- Exchange of short text messages between controllers and pilots
- Offers an additional com., complement of voice
- Services:
 - ACM : ATC Communication Management
 - AMC : ATC Microphone Check
 - ACL : ATC clearance
 - ...

ACM

- ACM = ATC Communication Management
- Transfer of ATC communications (voice and CPDLC)
 - Transfer of CPDLC will coincide with transfer of voice
- Initial establishment of CPDLC with an ATSU
- Transfer of CPDLC and voice for a flight
- Termination of CPDLC with an ATSU

AMC

- AMC = ATC Microphone Check
- Broadcasted to all aircraft on a sector

ACL

- ACL = ATC Clearances and information
- Issue of clearances and instructions to pilots
- Receipt of pilot requests and reports
- Available only after successful ACM

ACL (example)



IBE4189 turn left heading 160 and climb to FL 70.
270 and confirm heading, please?
IBE4189 turn left heading 160 degrees.
160 degrees turning 1730 xxxxx IBE4189. Thank you.
By.
IBE4189 just confirm maintaining FL70.
Oh! We have to maintain 70, sorry IBE4189,
we have the traffic in sight, sorry.
Expedite descent now.
Yes we'll do.

0846Z

FROM XXXCTL

OPEN

IBE4189 TURN LEFT HEADING 160 CLIMB TO 70

ADS

- Automatic Dependant Surveillance
- ADS-C: Contract (sometimes called ADS-Addressed)
 - Point to point (VHF / VDL / SATCOM / HF)
 - Currently only FANS 1/A
 - Oceanic and remote areas
 - No or poor radar coverage

ADS

- ADS-B: Broadcast
 - Use of 1090ES, UAT, VDL4...
 - Used by A/G et A/A
 - Sending ADS-B: ADS-B out
 - Onboard usage of ADS-B: ADS-B in
 - Surrounding traffic awareness
 - In trail procedure

Link 2000+



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Applications

Link 2000+

- Objective
 - To increase airspace capacity with a benefit in safety

Link 2000+

- Capacity increase
 - To reduce controller workload (Voice represents 1/3 of controller workload)
 - To reduce voice channel occupancy (Voice channels are saturated)
 - Frequency availability limits creation of sectors
 - Data-Link allows to speak less with more pilots
 - To increase the knowledge of the ground system
 - To improve trajectory prediction
 - To improve conflict detection
 - To offer more powerful tools to the controller
 - Data-Link allows integration of data into the system
 - Clearances issued via an HMI
 - Computer to computer link

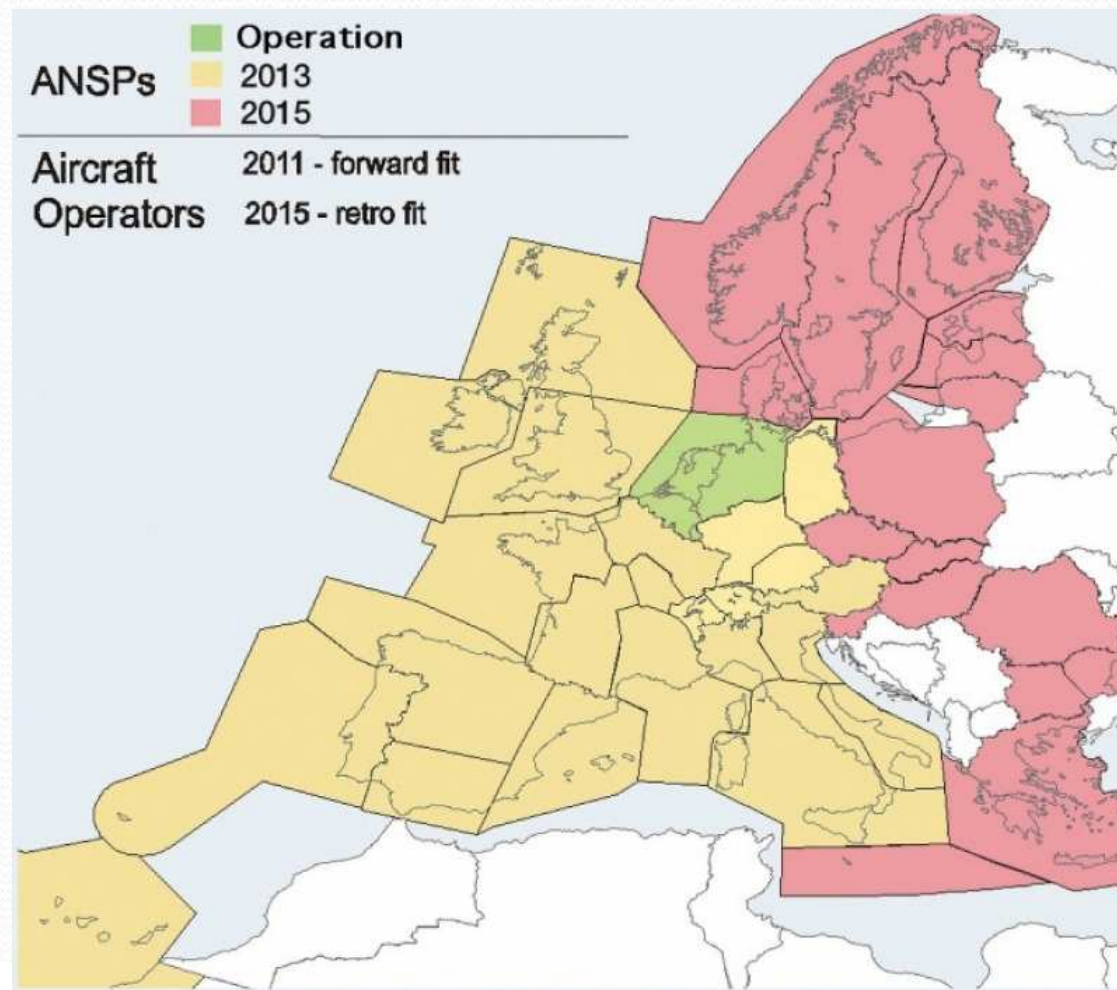
Link 2000+

- Benefits in safety
 - Data-Link helps to avoid misunderstanding
 - Results in a written clearance
 - Data-Link offers a 2nd communication channel
 - Allows to exchange in case no voice is available (jamming, missed selection of voice frequency)
 - Data-Link introduces flight plan consistency check
 - Ensures common air and ground data for a flight

Link 2000+

- Goal
 - Operational implementation of Data-Link
 - ICAO compliant
- Infrastructure
 - VDL mode 2 as ATN subnet
 - ACARS 623 for DCL and D-ATIS

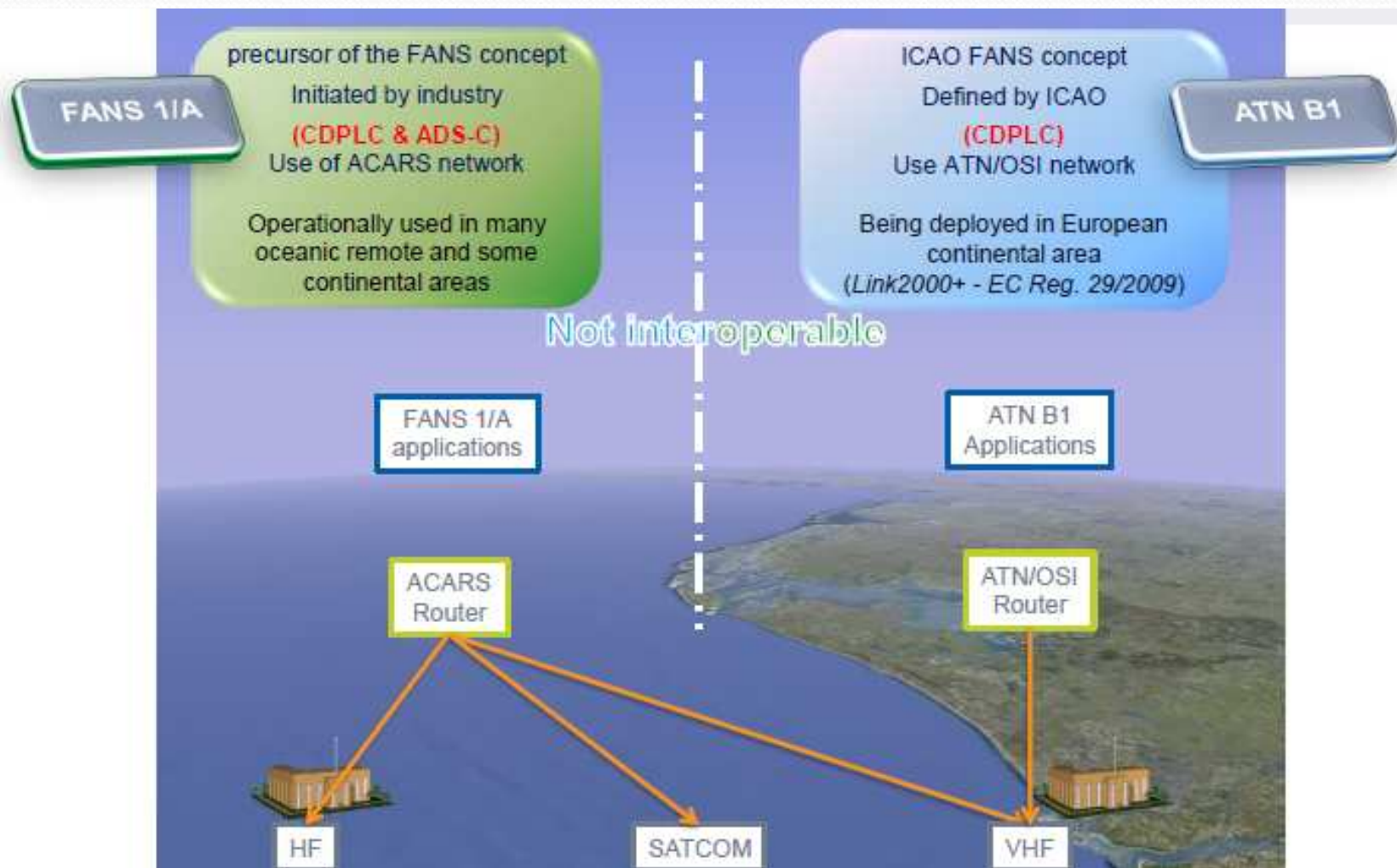
LINK 2000+



IR DLS

- Mandate
 - CPDLC (DLIC, ACM , ACL, AMC)
 - ATN through VDL2
 - European airspaces
 - Above FL 285
- Initial Implementing Rule 29/2009
- Amendment 2015/310
 - Deadline for ANSP : 2018
 - Deadline for Avionic : 2020

FANS 1/A vs. ATN B1



FANS 1/A vs. ATN

- Reminder FANS 1/A
 - A set of applications (A622)
 - AFN, CPDLC, ADS-C
 - Using a network
 - ACARS (A620 on the ground / A618 for aircraft)
 - Using A622 additional features
 - FMS integration
 - Interoperability standard: ED100/DO-258
 - Safety and Performance Req: ED122/DO-306

FANS 1/A vs. ATN

- Reminder ATN
 - Not the same “network” (vs. ACARS)
 - ADS-C not used yet (not in current ICAO Doc 9880)
 - Definition of a CPDLC “Logical Ack” message
 - “Real” end to end acknowledgement
 - Between pilot’s HMI and controller’s HMI
 - “Message sent” vs. “Message received”
 - ATN CPDLC not compatible with FANS 1/A CPDLC
 - Slight differences in messages
 - Accommodation is possible (double stack)
 - See ED-154/DO-305

FANS 1/A vs. FANS 2/B

- ATN implementation baseline 1
 - Standards
 - SPR: ED-120/DO-290
 - Interoperability: ED-110/DO-280
 - CPDLC subset (ACM, ACL, AMC)
 - Additional preformatted message
 - “CURRENT ATC UNIT”
 - When flight is assumed by a controller
 - FMS integration not achieved
- Airbus FANS B+
 - Compliant with European requirements (ATN B1)
 - ATC frequency loading capability

Other services

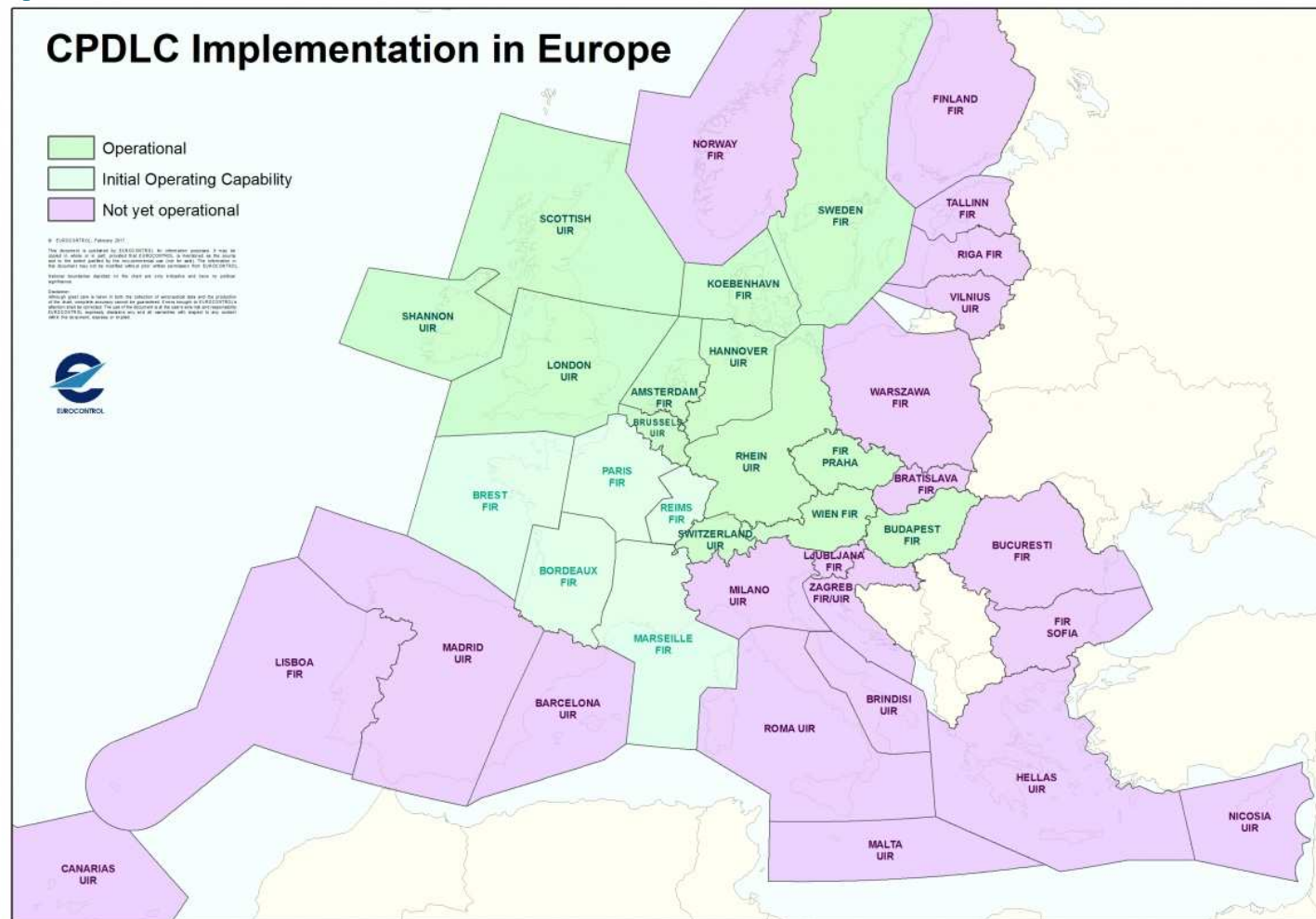
- DCL, ATIS, OCL
 - Use of ACARS until included in ATN (B2)
 - With additional features of A622
 - Applications described in A623
 - Standards
 - DCL: ED-85
 - ATIS: ED-89
 - OCL: ED-106

Status

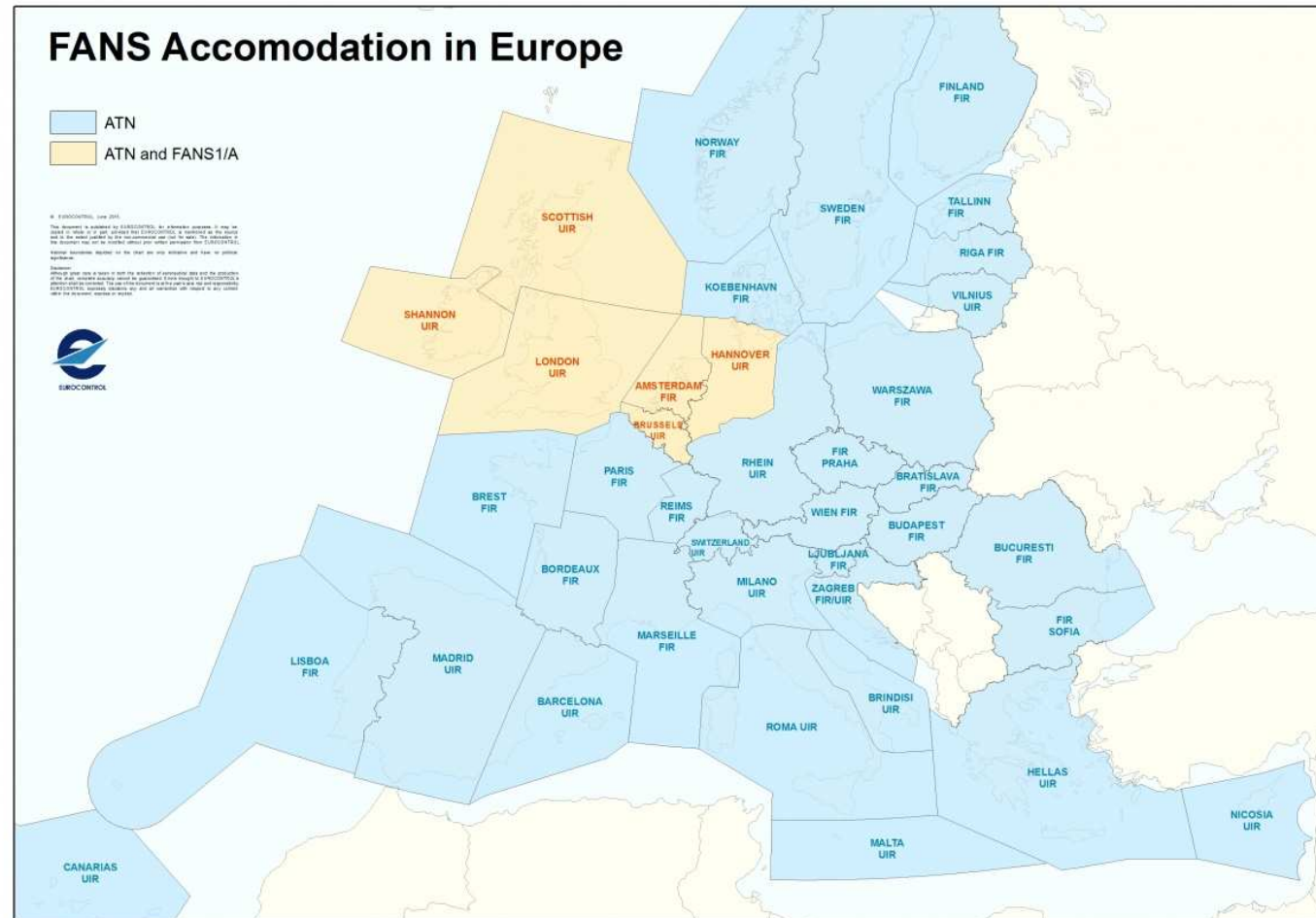


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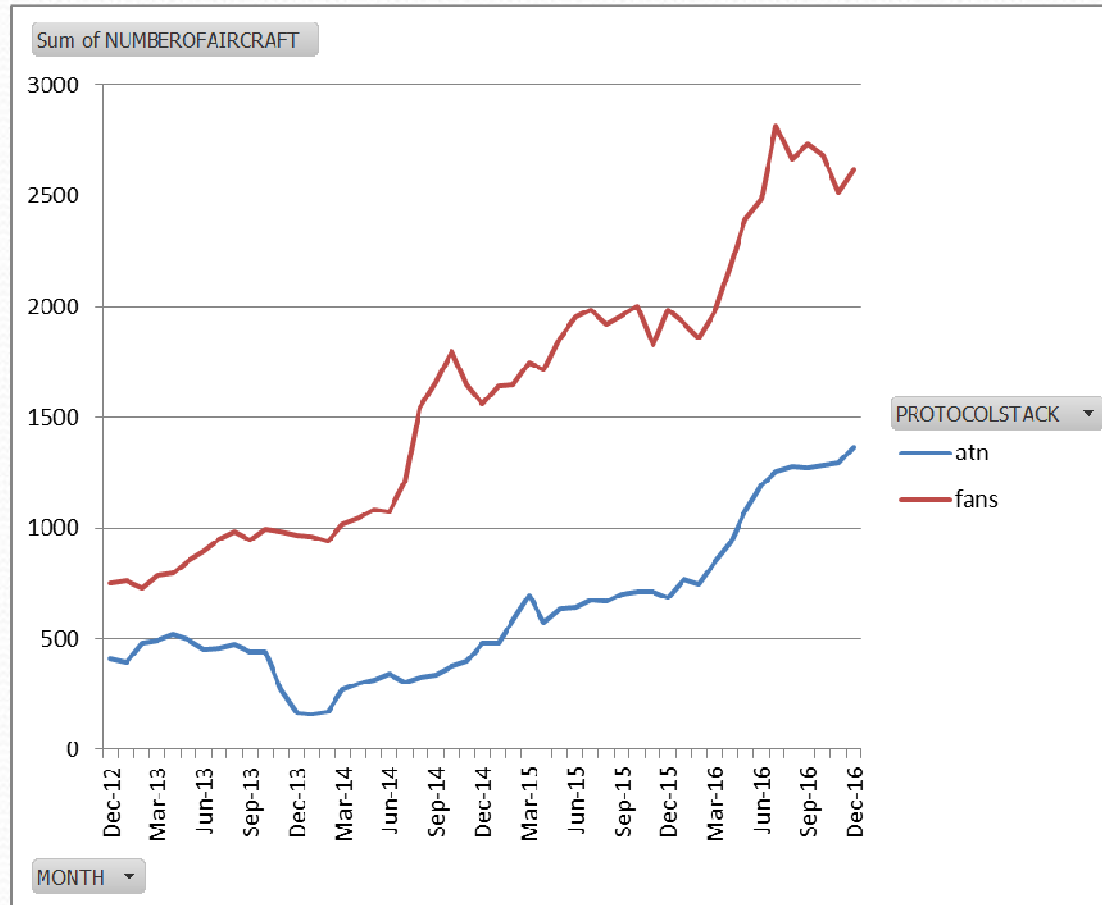
Europe



Europe



Europe

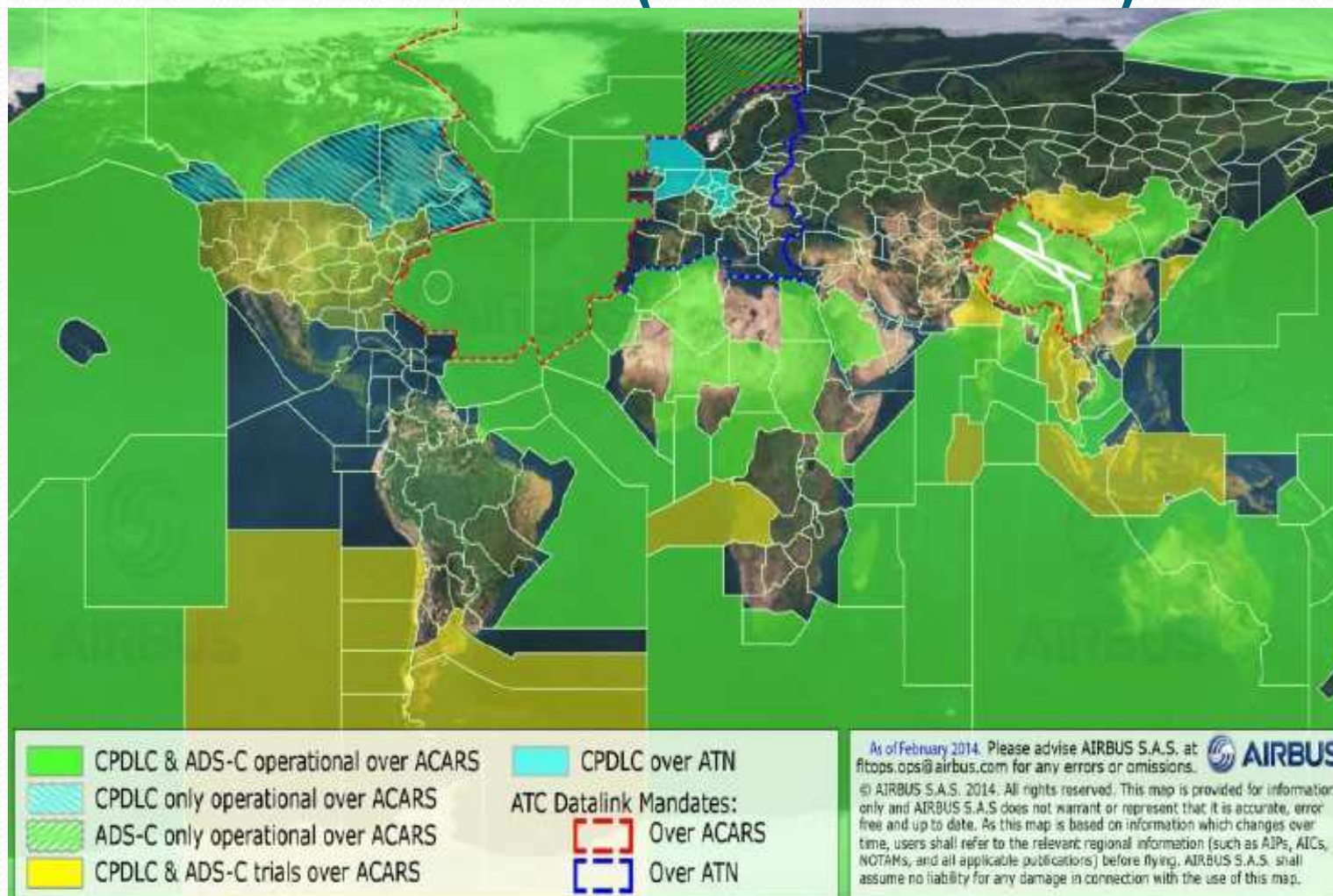


~25% of flights are capable
of performing CPDLC
over the ATN

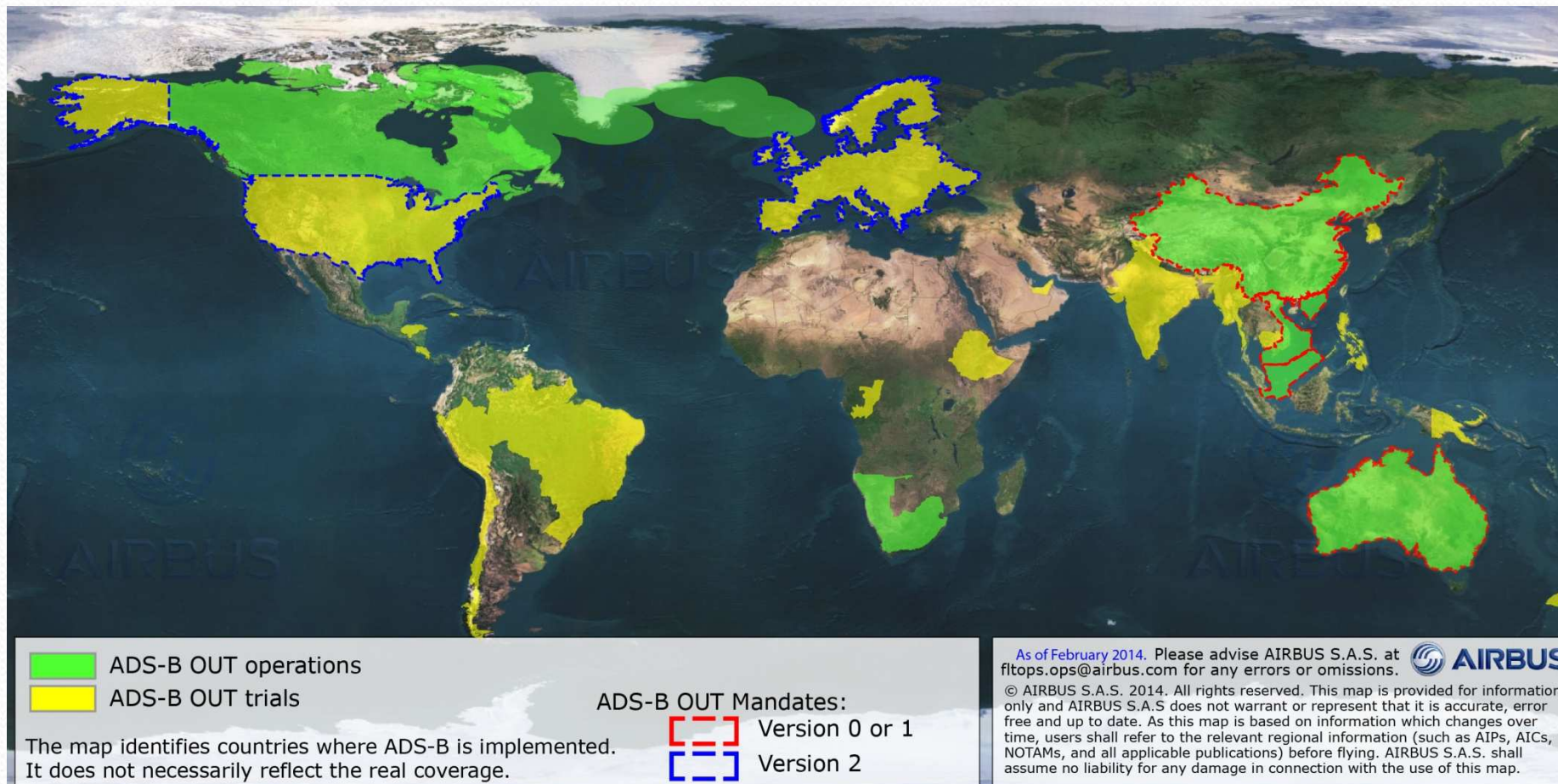
United States

- CPDLC Build 1
 - Miami
 - Operational use of CPDL in 2002
 - Data Link via VDL mode 2
 - Stopped
- NextGen
 - ADS-B out mandate in 2020 (1090ES and UAT)
 - Wait for ATN B2 (FMS integration)
 - FANS1/A meanwhile

FANS in the world (March 2016)



ADS-B in the world (February 2014)



Future

- And now?
 - New air ground subnetworks
 - LDACS (L-band Digital Aeronautical Com. System)
 - WiMax?
 - Satcom in Europe (only for availability purposes)
 - ATN using the IP suite
 - Handling mix of ATN OSI and ATN IPS?

BRT

DIM

MSG-

MSG+

—

—

0846Z

FROM KZAK CTL

OPEN

PRINT

PGE-

PGE+

—

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Thank you !

#UNABLE

STBY#

<OTHER

WILCO#