Data-Link Services

From ELSA to Recovery Plan

Nicolas Warinsko
General Manager
SESAR Deployment Manager

World ATM Congress 2018

7th March 2018

SESAR DEPLOYMENT MANAGER

LET'S DELIVER TOGETHER

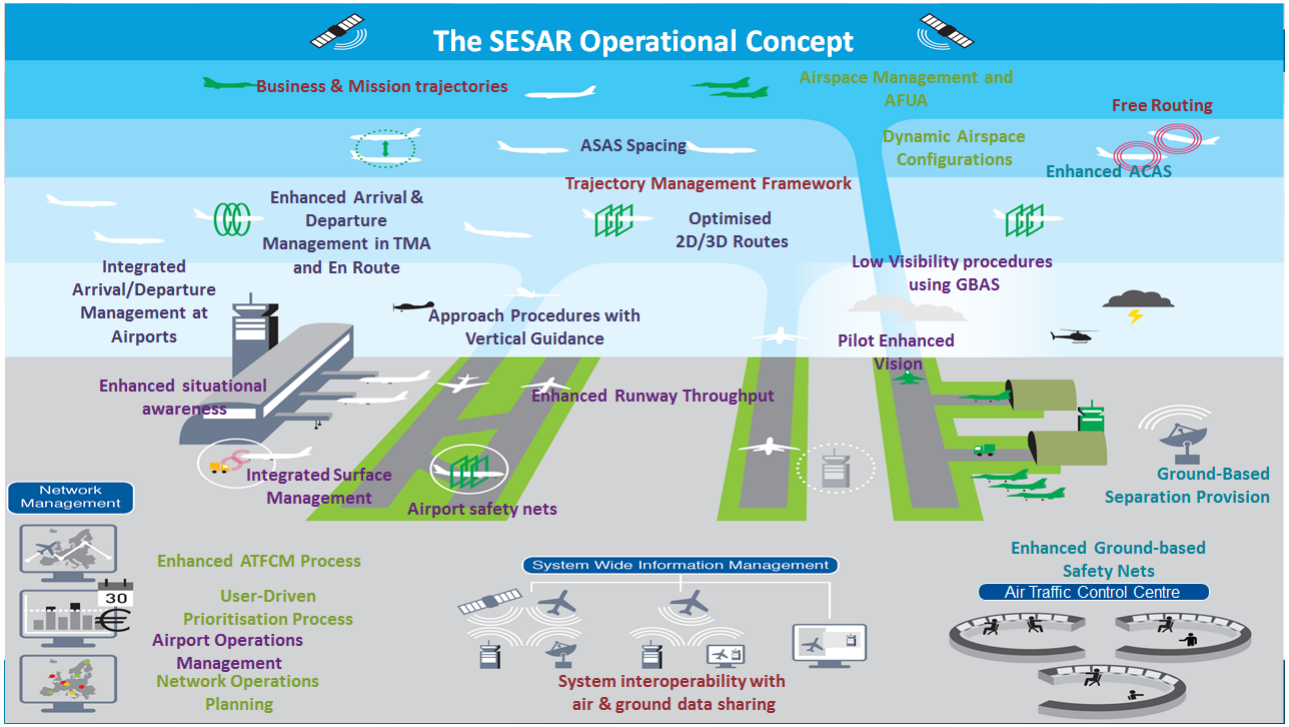
ELSA Study

Marouan Chida, SESAR Joint Undertaking

WAC 2018

Founding Members
EUROPEAN UNION EUROCONTROL

SESAR and datalink



The availability, in Europe, of **high quality data communications capabilities** for ATM with **appropriate Quality of Service** is essential to reach the Single European Sky (SES) objectives and subsequently the deployment of SESAR.

Sequence of Events

Mandate 29/2009:

SES Data Link Services Implementing Rule (DLS IR)(EC Reg. 29/2009) specified European implementation of datalink.

Performance Issues:

Performance issues of VDL/2 raised concern on the usability of the system. Some issues attributed to specific avionics installations but other problems remained to be solved.

The problem became highly visible and lead to a European Commission workshop in September 2013

EASA Report: April 2014

EASA conducted an investigation, under the mandate of the EC, into the performance issues of VDL/2 and published their report. The report identified a 10-point Action Plan which the SJU was asked to progress.

EC request to SESAR: June 2014

The EC wrote to the SJU requesting R&D actions on the points raised in the EASA report.

Call Published : August 2014

VDL Mode 2 Measurement, Analysis And Simulation Campaign

Call award and Execution : Feb 2015-Jun 2016

ELSA Consortium delivered the Final Report and all supporting technical material in June 2016. SJU published the documents in June 2016.

Oct 2016

SESAR Deployment Manager appointed as Data Link Services (DLS) Implementation Project Manager

Start of the datalink recovery plan

ELSA Objectives

- **Collection and analysis of data** from avionics and ground-systems to **identify the issues** affecting the end-to-end performance of the VDL2 Datalink;

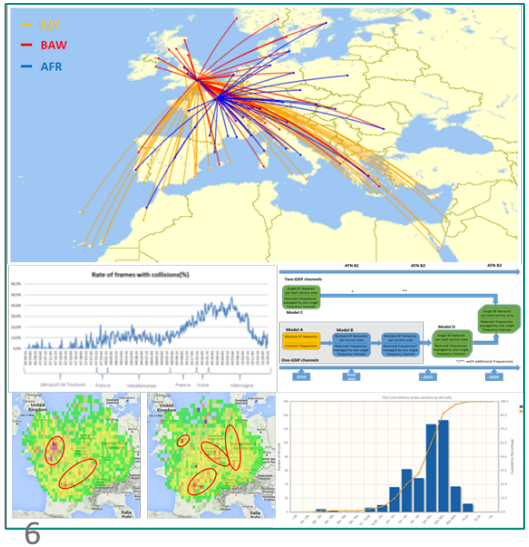
- Modelling and analysis of the **options for multi-frequency VDL2** deployment, in particular the options for channel use, frequency assignment, network topology and network management;

- **VDL2 protocol optimization** in support of both ATN and AOC communications (through RF Level Modelling and Testing)

A Unique Consortium & Partnership

A very committed team !

AIRBUS · BOEING · DASSAULT AVIATION · Honeywell · Spectralux avionics · THALES · SITA Create success. Together · ARINC · ALTYS TECHNOLOGIES · Rockwell Collins · HARRIS · ENAV · NATS · TELESPAZIO a LEONARDO and THALES company · AIRTEL ATN · LEONARDO · AIRFRANCE · BRITISH AIRWAYS · skyguide · Maastricht UAC · easyJet · TUI Thomson Airways · RYANAIR



More than 400 revenue and measurement flights

More than 1000 pages of technical reports

350,000 flight hours, and stress testing of common avionics

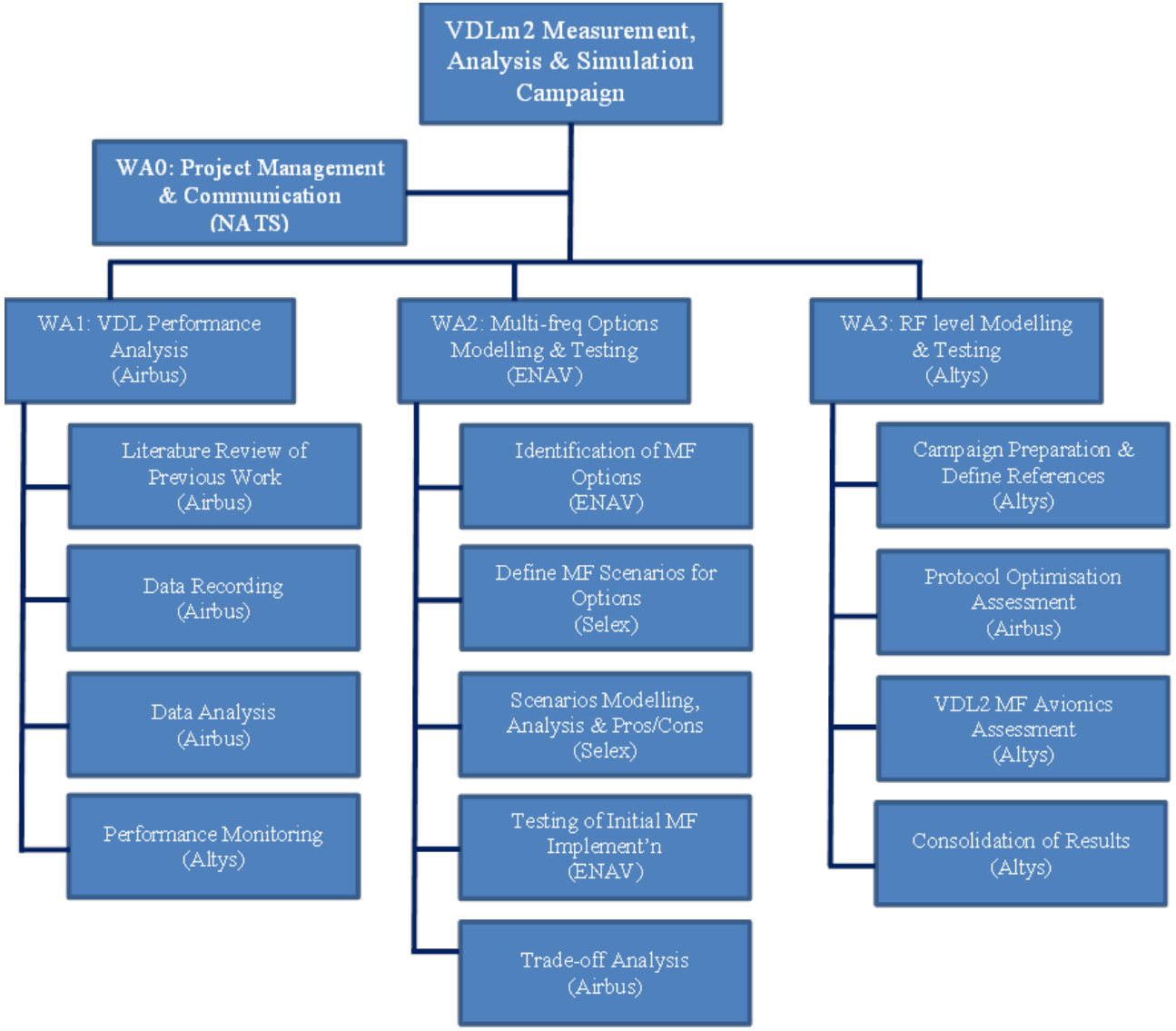
3 million air/ground exchanges, 700 hours of simulation

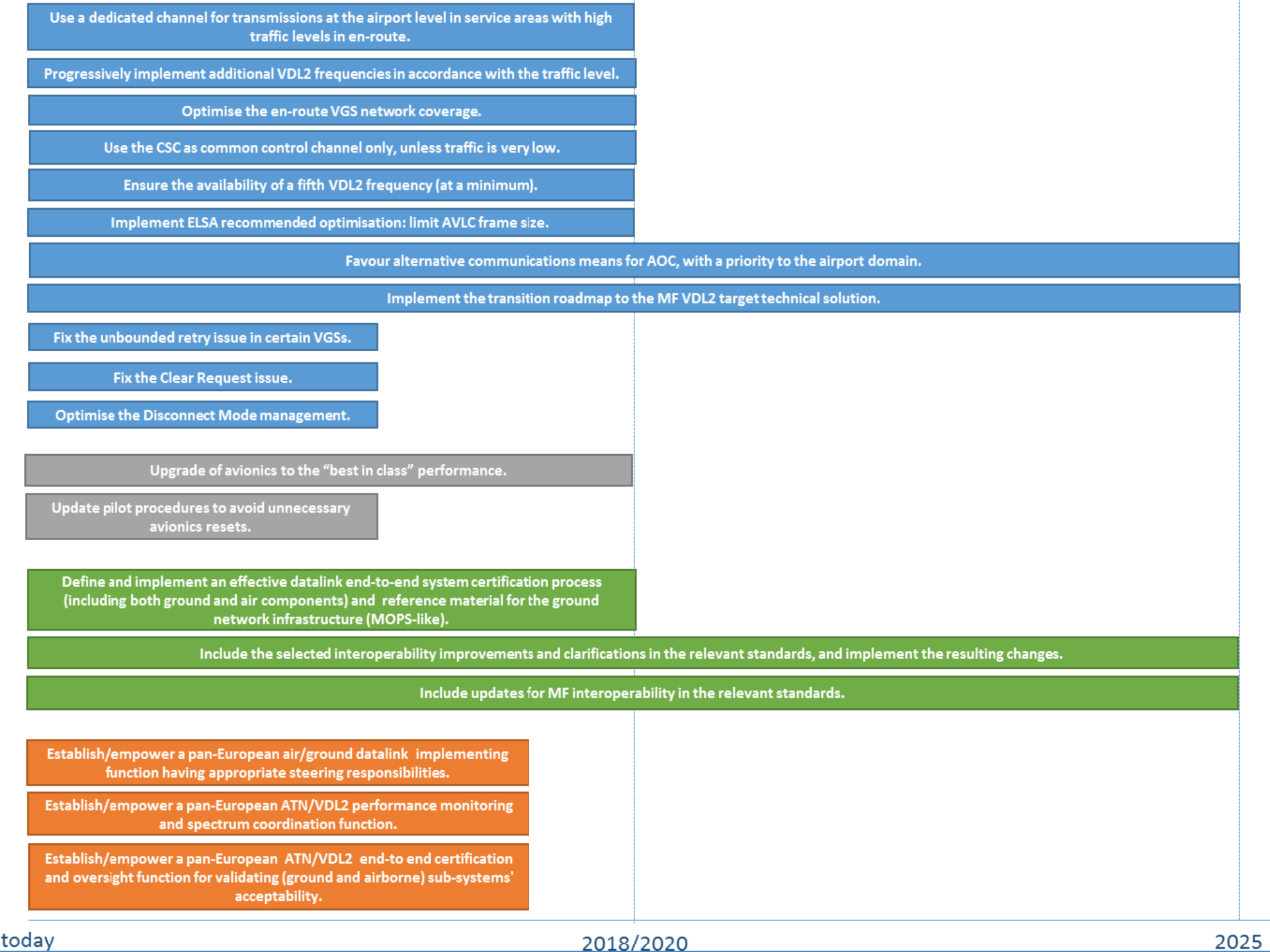
Network optimisation

100s of protocol optimisations options

More than 30 MF deployment options

ELSA WBS mapping project objectives

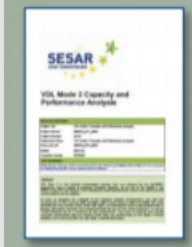



Use a dedicated channel for transmissions at the airport level in service areas with high traffic levels in en-route.
Progressively implement additional VDL2 frequencies in accordance with the traffic level.
Optimise the en-route VGS network coverage.
Use the CSC as common control channel only, unless traffic is very low.
Ensure the availability of a fifth VDL2 frequency (at a minimum).
Implement ELSA recommended optimisation: limit AVLC frame size.
Favour alternative communications means for AOC, with a priority to the airport domain.
Implement the transition roadmap to the MF VDL2 target technical solution.
Fix the unbounded retry issue in certain VGSs.
Fix the Clear Request issue.
Optimise the Disconnect Mode management.
Upgrade of avionics to the "best in class" performance.
Update pilot procedures to avoid unnecessary avionics resets.
Define and implement an effective datalink end-to-end system certification process (including both ground and air components) and reference material for the ground network infrastructure (MOPS-like).
Include the selected interoperability improvements and clarifications in the relevant standards, and implement the resulting changes.
Include updates for MF interoperability in the relevant standards.
Establish/empower a pan-European air/ground datalink implementing function having appropriate steering responsibilities.
Establish/empower a pan-European ATN/VDL2 performance monitoring and spectrum coordination function.
Establish/empower a pan-European ATN/VDL2 end-to end certification and oversight function for validating (ground and airborne) sub-systems' acceptability.
today
2018/2020
2025

From ELSA study to DLS Recovery Plan

The recommendations proposed for implementation will provide, if addressed in a coordinated way by all stakeholders, sufficient ATN/VDL2 capacity to support the deployment of ATS data link services.

ELSA study: "VDL Mode 2 Measurement, Analysis and Simulation Campaign"



- Recommends WHAT technical needs to be implemented in Europe
- Urges to establish a "pan-European air/ground datalink implementing function" to organize the activities

DLS Recovery Plan developed by SDM and approved by EC

- Defines the activities to be undertaken to achieve the full DLS implementation in Europe, avoiding inappropriate investments
- Based on the outcomes of ELSA study, it is a realistic recovery plan to bridge between current status and PCP/AF6

Thank you.

SESAR JOINT UNDERTAKING

Founding Members

EUROPEAN UNION EUROCONTROL

Data-link Services

Overview

Davide Corinaldesi
Data Link Implementation Program Manager

World ATM Congress 2018

7th March 2018

SESAR DEPLOYMENT MANAGER

LET'S DELIVER TOGETHER

DLS scenario and SDM role

- As part of the SESAR implementation, the Initial Trajectory Information Sharing (i4D) is one of the ATM functionalities requiring a synchronised deployment in Europe
- An essential prerequisite for this deployment is the data link capability implemented as described in the IR (EU) No 29/2009 on data link services (amended by IR (EU) No 310/2015) that is based on VDL M2 technology
- The implementation of the data link capability resulted in a system that did not provide the expected performance due to different reasons

DLS Background Scenario

- Fragmentation and diversity of baseline scenarios
- Lack of coordination for the definition of a Technical Solution
- Lack of a shared plan for DLS implementation
- No strong coordination among relevant EU Bodies

To coordinate the necessary steps to recover from the complex situation, the EC required to the SDM to develop a DLS Recovery Plan (based on ELSA outcomes) and then the SDM was mandated as DLS implementation Project Manager

DLS Recovery Plan - Path I overview

Path I Project focused on the deployment of the envisaged transitional solutions (Model B or Model C/MF for the ground segment, and "best in class avionics" for the airborne segment), paying special attention to the recommendations coming from ELSA study (i.e. MF implementation)

Ground Segment

Project Leaders	ENAIRE; ENAV
Project Contributors	ARINC; Austrocontrol; Croatia Control; DFS; DSNA; EANS; ENAV; HCAA; Hungaro Control; LFV; LGS; MATS; NAV Portugal; Oro Navigacija; PANSA; SITA INC BV Netherlands

Status

Completed

Airborne Domain

Three wide-ranging Implementation Projects, led by major European airlines* have been submitted in the framework of the 2016 CEF Transport Calls, with the specific purpose of upgrading their fleet with "best in class" avionics. **Such projects are expected to lead to the equipage 500 additional aircraft**, ensuring their compliance with Family 6.1.4 of the Deplyoment Programme. Two additional implementation initiatives – with a similar scope – have also been submitted by Military Authorities.

Status

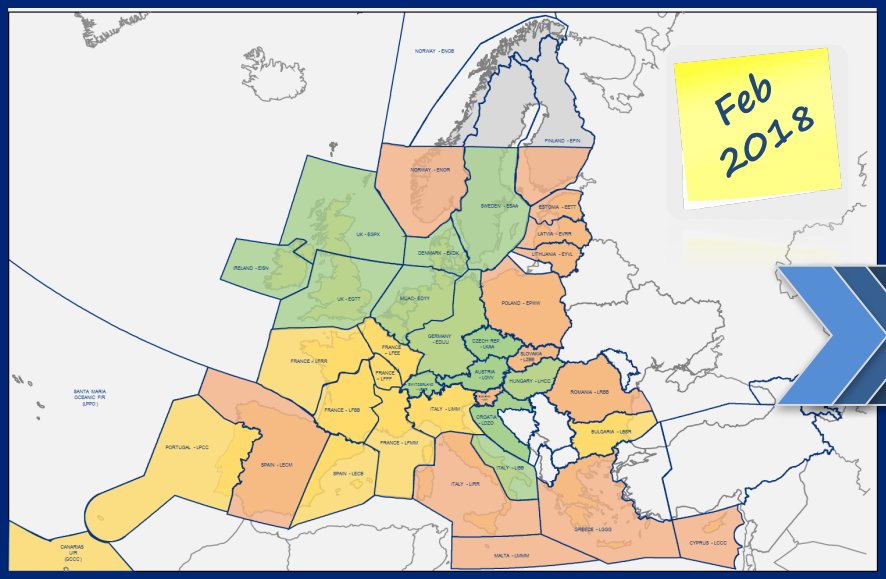
Work in Progress

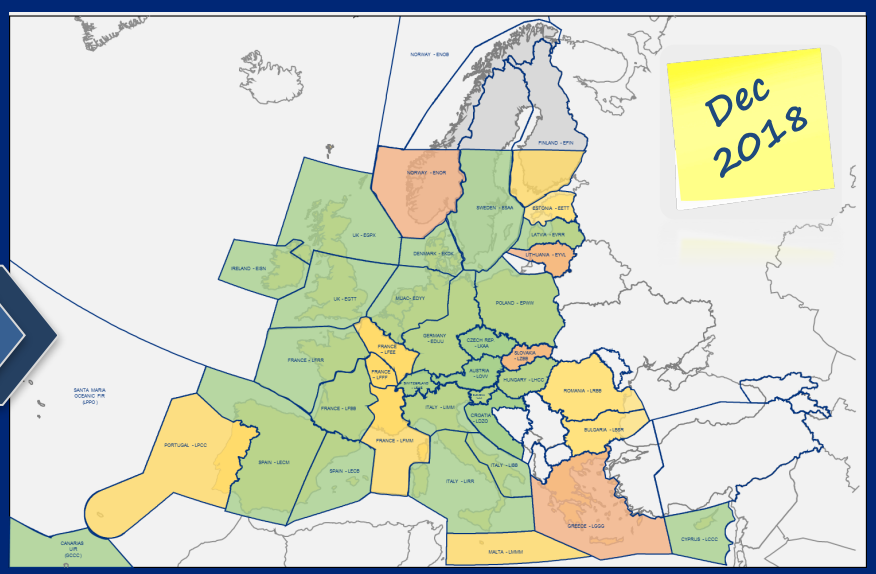
SESAR DEPLOYMENT MANAGER

** Ryanair, Lufthansa, TAP Portugal*

DLS Recovery Plan - Path I Ground implementation status

The charts presented below, stemming from SDM monitoring exercise, highlight that, although some Member States implemented DLS in compliance with IR (EU) No 310/2015 February deadline, many of them demonstrated a clear commitment into implementing DLS by December 2018.





DLS Provided in compliance with IR (EU) No 310/2015

DLS Provided but not in compliance with IR (EU) No 310/2015

DLS Not Provided

The results of the monitoring exercise have been delivered to EC in order to support decisional processes and shape the way forward

SESAR DEPLOYMENT MANAGER

DLS Recovery Plan - Path II overview

The progress of SDM tasks performed in close coordination with Path II Project (2016_159_AF6), and further consulted with involved stakeholders, is summarised below:

Completed

"2.1 – Requirements collection and Service Areas definition " and 2.2 – "European technical architecture definition" activities are completed. The Service Areas Proposal, together with the overall architecture have been included in the Report on Service Areas and DLS Overall Architecture deliverable submitted to EC on the 29/09/2017.

"2.3 - Elaboration of a Business Case for the target solution" activities are completed. Non-technical open points have been identified and needed to be further investigated. A dedicated IP submitted in the 2017 CEF Transport Calls is expected to address these open points.

Work In progress
Foreseen end date 2020

"2.4 - Transitional activities towards target solution": activities are in progress considering the Service Areas and the architecture outcomes.

"2.5 – Ensuring consistency of activities related to DLS Governance definition": activities are in progress considering the Service Areas and the architecture outcomes. The DLS Governance definition is under the responsibility of the Path II project stakeholders.

SESAR DEPLOYMENT MANAGER

SDM guidance: 2017 CEF Transport Calls

The SDM is continuing to guide the DLS Ground and Airborne implementation

In 2017 CEF Transport Calls framework the SDM has supported the submission of a multi-stakeholder IP to solve the open points emerged within **Path II Project** and to further **define the steps toward the target solution.** Also projects for the Airborne domain have been submitted.

2017_089_AF6 - IP1 - DLS European Target Solution assessment

Project Objectives

IP1 – "DLS European Target Solution assessment"

This Project will perform activities strictly related with the ones undertaken in Path II Project.
In particular, it aims at **resolving the technical (WP2) and non-technical (WP3) open points** arisen during the abovementioned Project.
Moreover, it will prepare the deployment of a Common European ATN Network, first step towards the target solution

Work Packages

Implementation Project activities have been grouped into the following work packages:

- **WP1 -** Design for a Common European ATN Ground Network;
- **WP2 -** Further analysis and definition of the technical open points identified in Path II project;
- **WP3 -** Further analysis and definition of the non-technical open points identified in WP3 of the Path II.

Project Leader:

ENAV, in Co-leadership with ENAIRE

20 Project Contributors:

Airtel, ALTYS Technologies, Arinc, Austrocontrol, BULATSA, Croatia Control, DFS, DSNA, ENAIRE, ENAV, ESSP, Eurocontrol / NM, Hungaro Control, Inmarsat, Leonardo - Finmeccanica, LFV, MATS, NAV Portugal, PANSA, SITA, Thales, University of Salzburg

Total Budget

€ 9.912.417

Shaping DLS Future - Complementary technologies - 1/2

The adoption of **complementary technologies** appears as necessary to **offload the VDL M2 network at a certain point in time** and improve safety and security

The adoption of complementary technologies will enhance the **flexibility of future DL systems** (different services with different performances could be provided on different links)

ELSA study (Ground-07 recommendation), suggests to favour **alternative communications means** for AOC with a priority to the airport domain

A **smooth transition** among the current DL system to a DL system based on multiple technologies has to be carefully considered

From R&D to large scale deployment plan

Where and When

Maturity Check for implementation

Clear view for the Multilink operational use

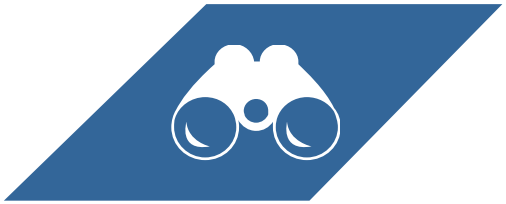
SESAR DEPLOYMENT MANAGER

Shaping DLS Future - Complementary technologies - 2/2

To extend the lifetime of the VDL Mode 2 technology, **the SDM has duly taken into account the complementary technologies (ground and/or space based) within the DLS Recovery Plan**

According to the **DLS Recovery plan** the use of **complementary technologies** is currently envisaged as from **2025**

Complementary technologies will play a crucial role in **taking over part** of the increased data traffic out of VDL Mode 2



Results gathered within IP 2017_089_AF6 "IP1 - DLS European Target Solution assessment" and Path II framework will support the SDM in continuing to develop the strategy for the future DLS (including DLS complementary technologies)

SESAR DEPLOYMENT MANAGER

European target solution as step towards DLS future

In this context, the European target solution represents in the SDM strategy an important innovating opportunity, being at the same time:

An **innovation model** to continue the operational use of the **VDL M2 network**

An **integration mean**, capable of supporting also **complementary technologies**

Therefore, due to this dual nature, the European target solution represents a crucial step towards future DLS, since it allows to take into account the future increased Air Traffic volumes

CONTACT US

w. www.sesardeploymentmanager.eu

t. +32 (0) 2 793 07 57

e. info@sesardeploymentmanager.eu

follow us on Twitter @SESAR_DM follow us on LinkedIn

SESAR DEPLOYMENT MANAGER LET'S DELIVER TOGETHER

Funded by the European Union

World ATM Conference

7 March 2018

Madrid

Data Link Recovery workshop
Eurocae activities

Luc Deneufchatel
EUROCAE

ELSA technical issues

- From ELSA study 26 VDL mode 2 issues were identified
  - 3 issues are generating changes to ED 92 (EUROCAE).
  - 2 issues could also lead to ED 92 changes but not yet confirmed (EUROCAE).
  - 5 issues are generating changes to A 631 (AEEC).
  - 6 issues are dealing with the ground network and infrastructure (EUROCAE & ETSI).
    - Will result in a EUROCAE companion document (RTCA not involved in this activity)
    - Activity is just starting and requires coordination with ETSI
    - Initial coordination between EUROCAE WG 92 and ETSI DLS team already took place
  - 10 issues are not relevant for the standardisation domain.

VDL mode 2 standards

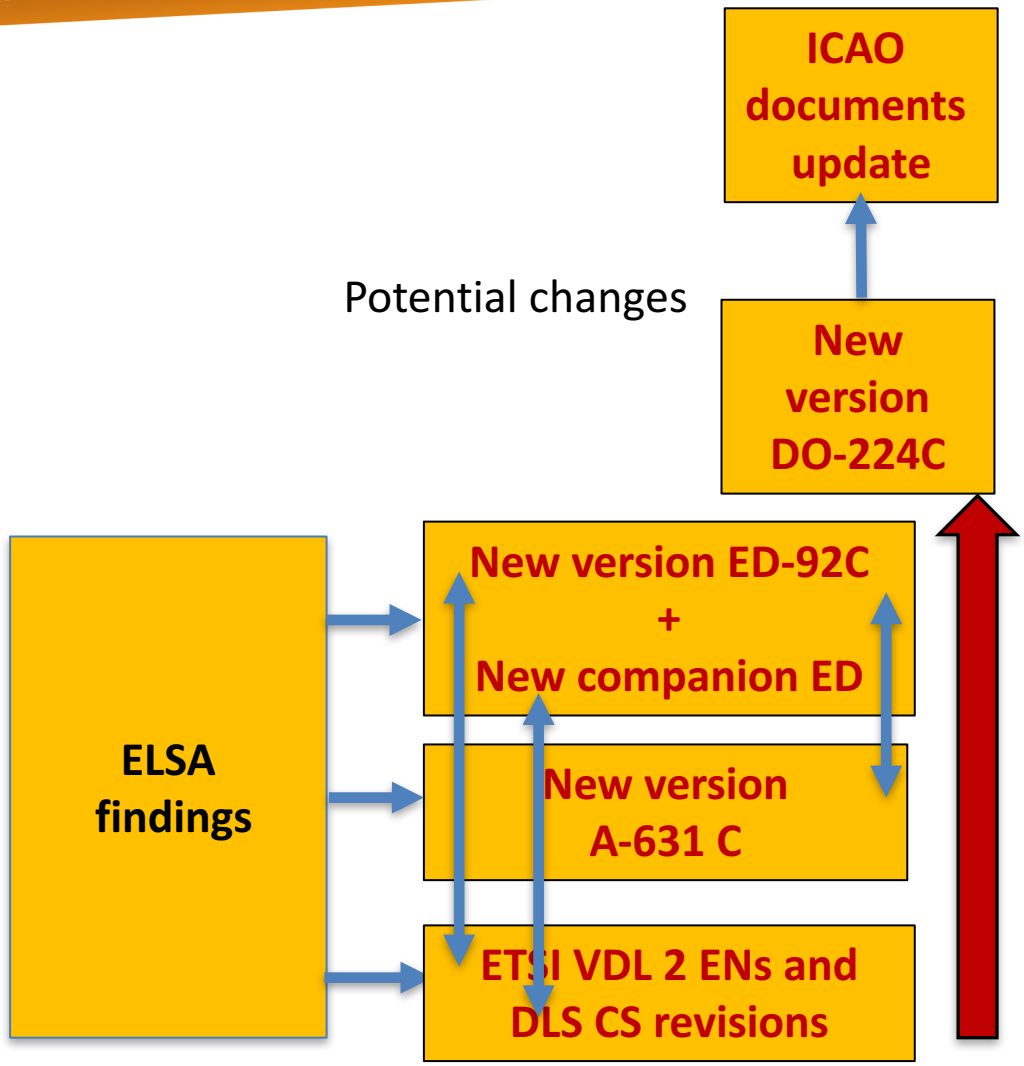
ICAO SARPS and Manual

DO-224 RTCA MASPS

ED-92B EUROCAE MOPS (joint with DO-281 RTCA MOPS)

ARINC A631 AEEC VDL mode 2 specification

ETSI VDL Mode 2 Ens
ETSI DLS CS



WG 92 past activities

- VDL mode 2 airborne MOPS activity started in the 90's with the first release of ED-92
- Three other releases of ED-92 have been published during the last decade
  - ED-92A providing some corrections resulting frfom
  - ED-92B including multifrequency requirements (2012)
  - ED-92B change 1 (2014)
- ED-92B is currently the technical basis for the VDL mode 2 ETSO

WG 92 current activities

- Revision of ED-92B is conducted by WG 92 jointly with RTCA SC 214 and coordinated with AEEC DLS SC
  - Changes to ED-92 & DO-281 require changes to the MASPS document (DO-224) for consistency and tracability
  - Could lead to ICAO material updates (SARPS & Manuals)
- New WG 92 activity to clarify ground network behaviours to ensure common understanding (i.e. ED Companion Document)
  - Potential rationalisation of VDL mode 2 link layer mechanisms (discard options and select common mechanism) – handover or hand of mechanisms are the main candidates

Documents publication objectives

- ED-92C
  - Completed: mid 2018 (open consultation to start in April)
  - official publication: end 2018
- New ED companion document (providing assumption on ground network behavior). This activity is coordinated with ETSI (initial coordination already took place)
  - Completed: end 2018
  - official publication: mid 2019
- RTCA MASPS DO-224
  - Completed : mid 2018

Nature of the changes within ED 92C

- All changes foreseen are not fundamental ones:
  - Mainly clarification and explanation
  - Traceability and consistency between MASPS and MOPS is another objective for changes
    - New tests introduced in the MOPS to map to MASPS requirements
  - Finally full traceability between ICAO material and MASPS should be also addressed
- Base upon these considerations no need to change the certification baseline appears (i.e. reference to ED-92B)
- ED-92 C could become the new technical baseline for new applications
- Upgrade of existing certified avionics (i.e. ED-92B compliant) with the last radio software release should be encouraged to fix some identified defect in the previous release

Other considerations 1/2

- ED-92 is a MOPS document:
  - AMC for the certification of the VDL Mode 2 avionic boxes (radio and ATSU/CMU)
  - Conformity demonstration to the basic requirements in a laboratory environment
  - MOPS test are not addressing the actual operational context of VDL mode 2 exchanges
    - New tests introduced in the MOPS to map to MASPS requirements
- End to end tests are considered as outside the perimeter of a MOPS
- VDL mode 2 operational issues are not coming only from the avionic domain:
  - Action on network and ground infrastructure are also required

Other considerations 2/2

- VDL mode 2 technology does not allow prioritization of exchanges sharing the same resource
  - Mixing AOC and ATS traffic on such low performance data-link system cannot ensure the stability of the quality of service when the traffic is growing (especially if the growth of AOC is quicker than the ATS one)
- Alternative technologies that are using resource and priority management mechanisms are more appropriate for handling these two different traffic (ATS and AOC)
  - Introduction of such technology should be accelerated
  - EUROCAE is currently developing standards for some of these technologies

EASA DLS actions

Maria Ruiz Algar

WAC, Madrid 6-8

March 2018

Your safety is our mission.

EASA DLS actions

EASA DLS Actions

1. Short term review - DLS exemptions

Support SDM DLS recovery plan, coordination with other organisations

On going

2. Launch the RMT. 0524 on DLS

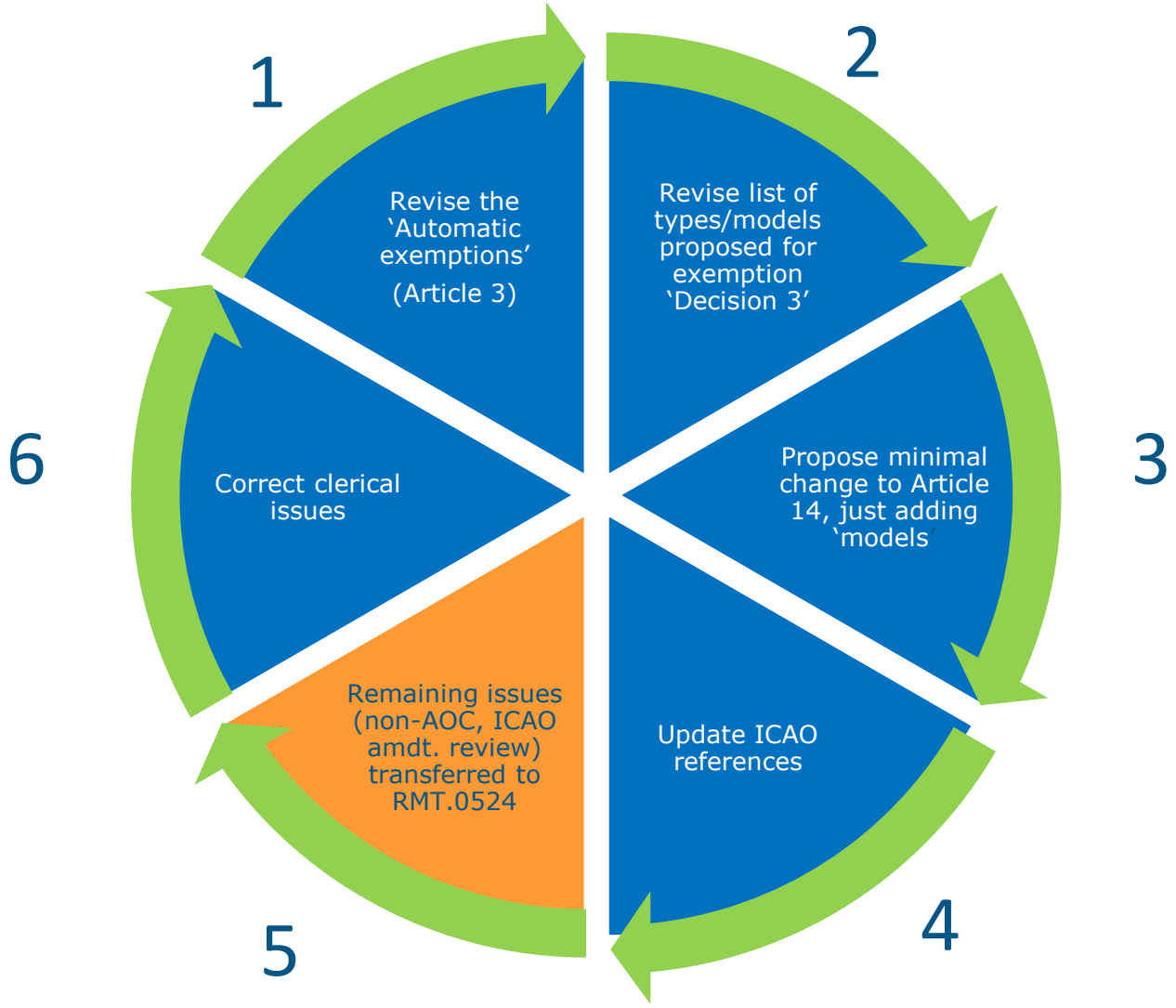
Started

Short term review – DLS exemptions report

Your safety is our mission.

EASA is an agency of the European Union

DLS exemptions report – Delivered!

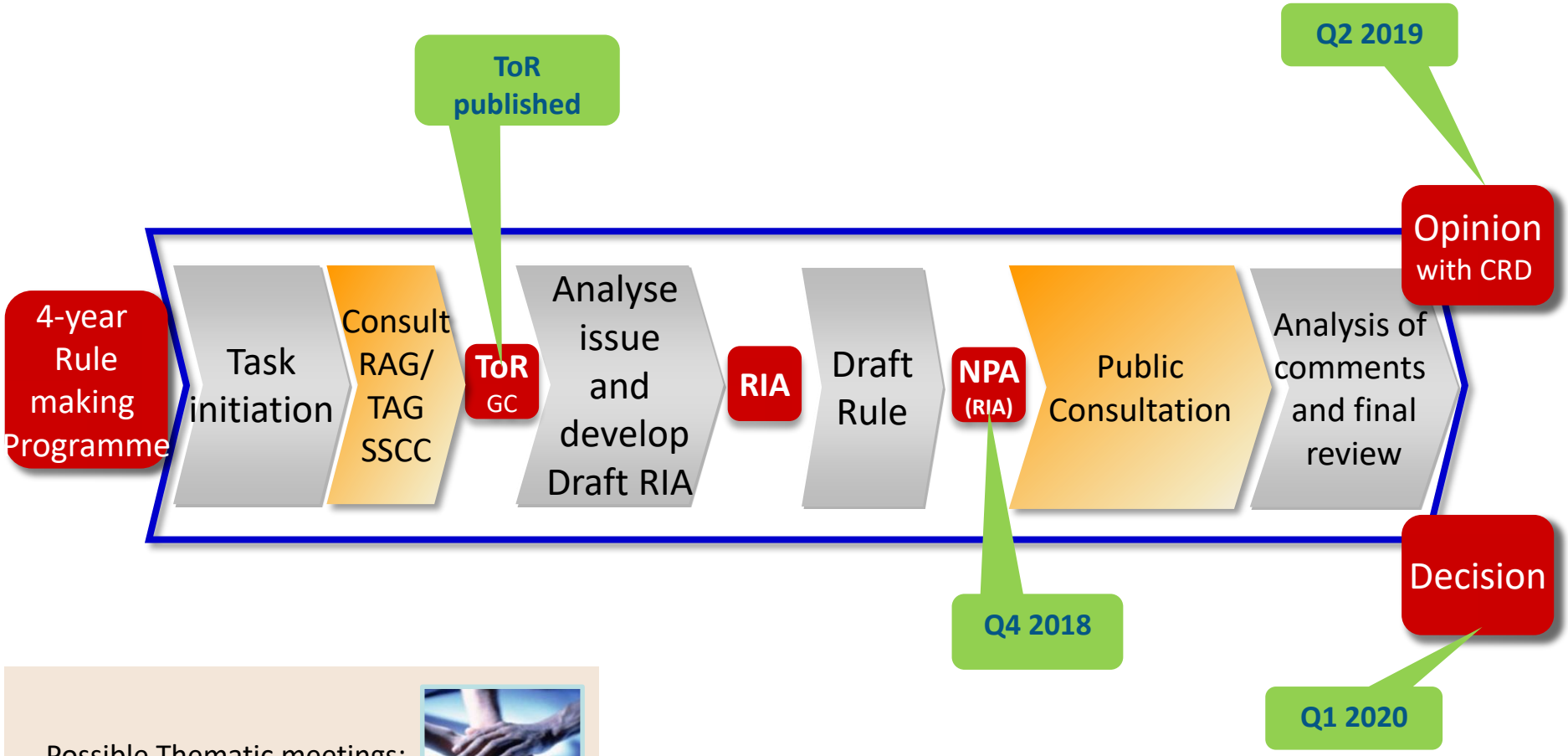


RMT.0524– Data link services

Your safety is our mission.

EASA is an agency of the European Union

RMT.0524 schedule



Possible Thematic meetings:

EASA
European Aviation Safety Agency

Any questions?

European Aviation Safety Agency

Thank you for your attention

Your safety is our mission.

EASA is an agency of the European Union

Network Manager
nominated by
the European Commission

Datalink performances

Outcome of the Datalink Performance Monitoring activities

Jacky Pouzet
Head of Communication and Frequency Coordination Unit
WAC Madrid, March 2018

EUROCONTROL

EC request to NM

Network Manager
nominated by
the European Commission

- ***continue supporting the DLS implementation and reinforcing the RFF function contribution, by notably pursuing the monitoring campaign***

- ***perform the pan-European ATN/VDL2 performance monitoring and spectrum coordination function infrastructure performances impact and monitoring function***

- ***centralised collection of 'best in class' avionics, possible contributions on architecture and governance issues, and contributions to the test and validation for both air and ground systems***

- ***duly report all findings***

EUROCONTROL

Changing role for EUROCONTROL / Network Manager

Network Manager nominated by the European Commission

- **The Central Reporting Office (CRO)**
  - Performance Monitoring
  - Knowledge Management
  - Problem Investigation

→ SESAR Deployment Manager (SDM)

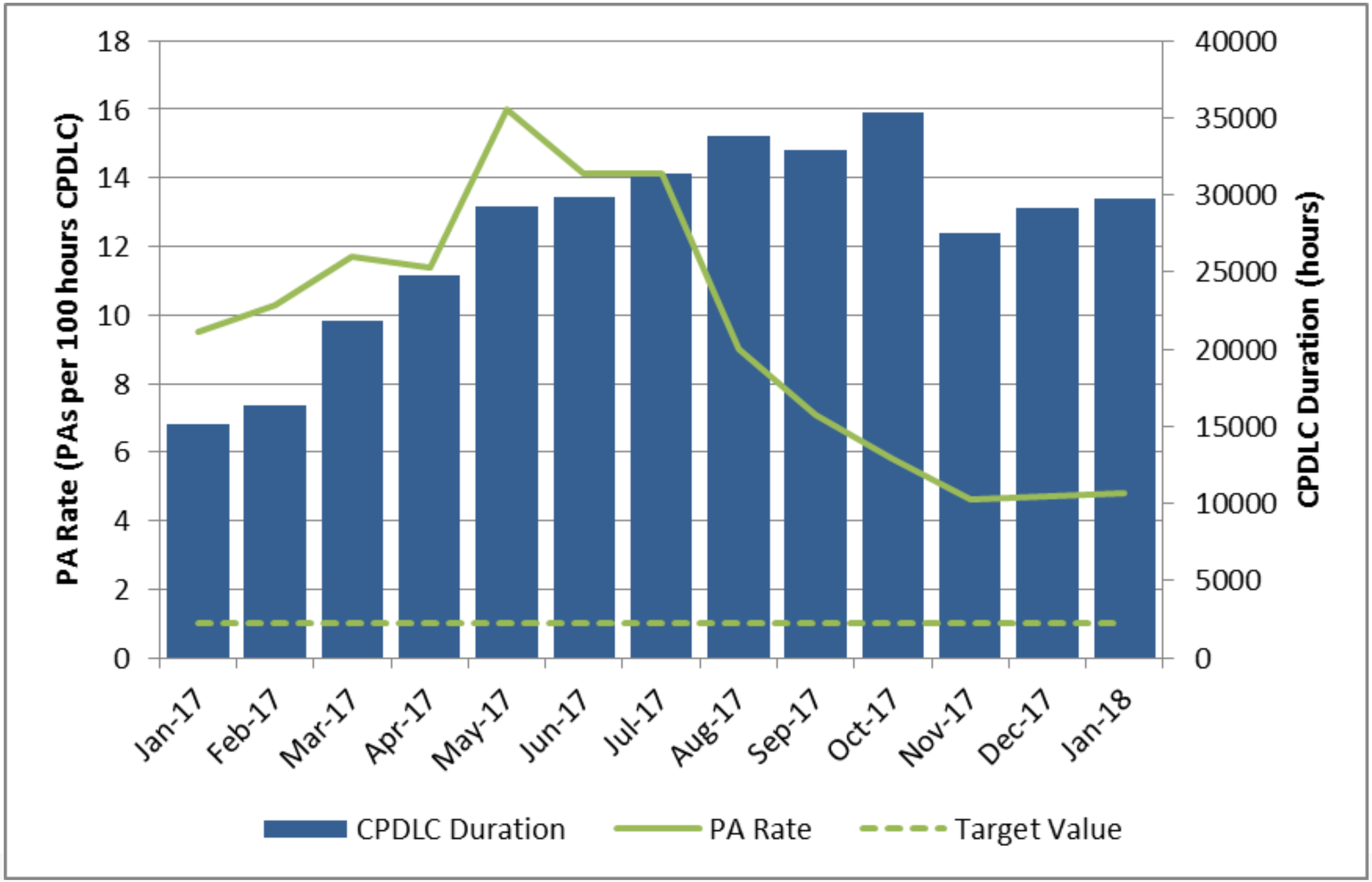
- **CRO is replaced by the Data link Performance Monitoring Function (DPMF)**
  - Focussed on performance monitoring activities

- **EUROCONTROL will continue to work on data link in other areas (Supporting EC, SDM, EASA, SESAR, ICAO, Inter-op testing etc.)**

What does the DPMF do?

Network Manager
nominated by
the European Commission

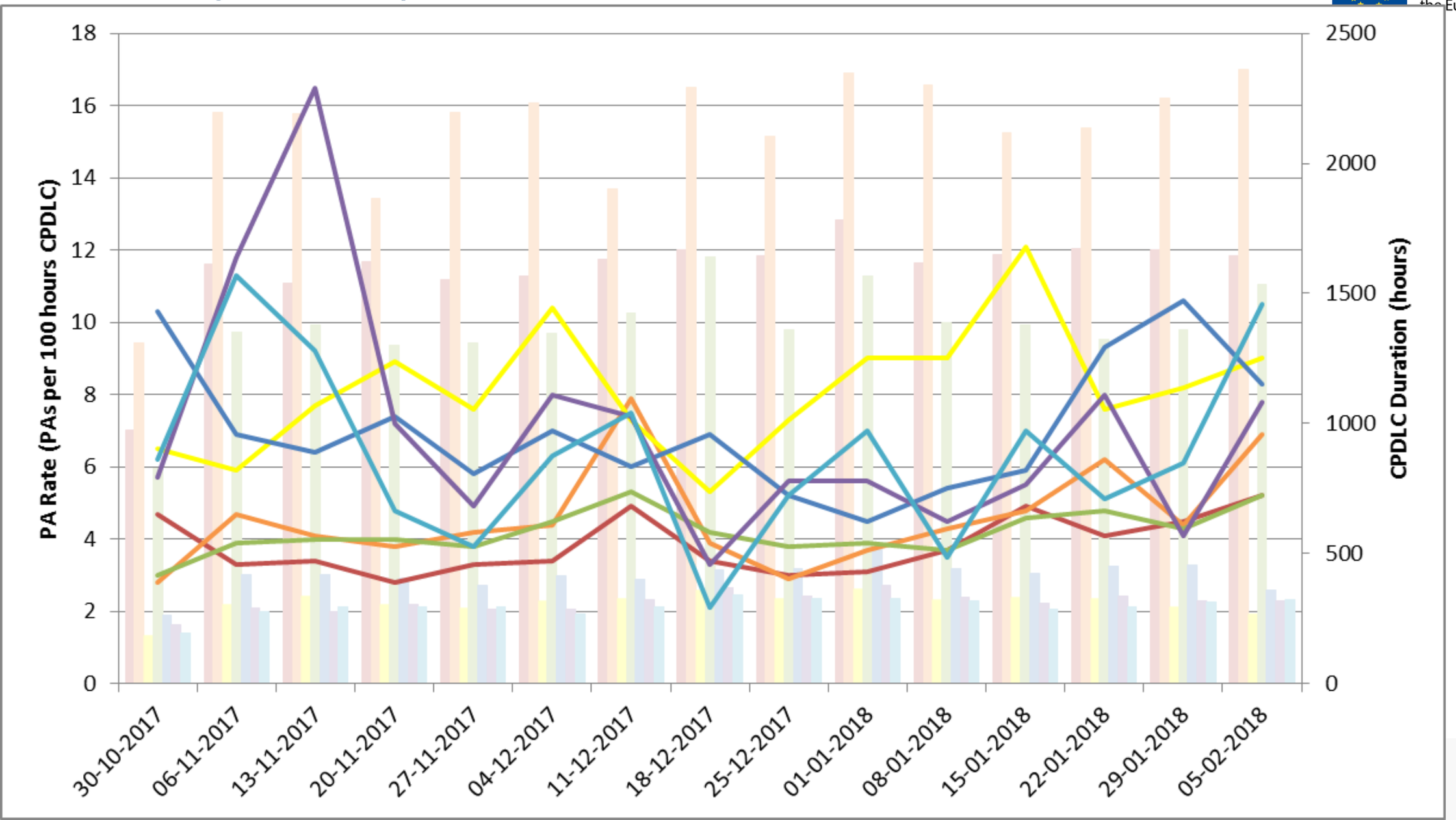
- DMPF role endorsed at NMB18 (April 2017)
- NM started the Monitoring of the Datalink Performances
  - Reinforced the **Radio Frequency Function**
  - Publish Monthly **Performance Reports**
  - Perform Ad-hoc performance analysis
  - **Forecasting** (VDL channel load)
  - Performance Investigations
  - Maintain an **avionics database (white list)**
  - Established the **working arrangements** reporting to the NMB/SSC.
    - First meeting of the Datalink Performance Monitoring hold on 6th September 2017.
    - Risk reported:
      - Non ATC channel load – Chanel forecast (NM is starting studies on forecasting)
      - Need to establish TECH and OPS discussion forum with stakeholders
- Supporting/coordinating with EC, SDM, EASA and EUROCAE



Network Manager
nominated by
the European Commission

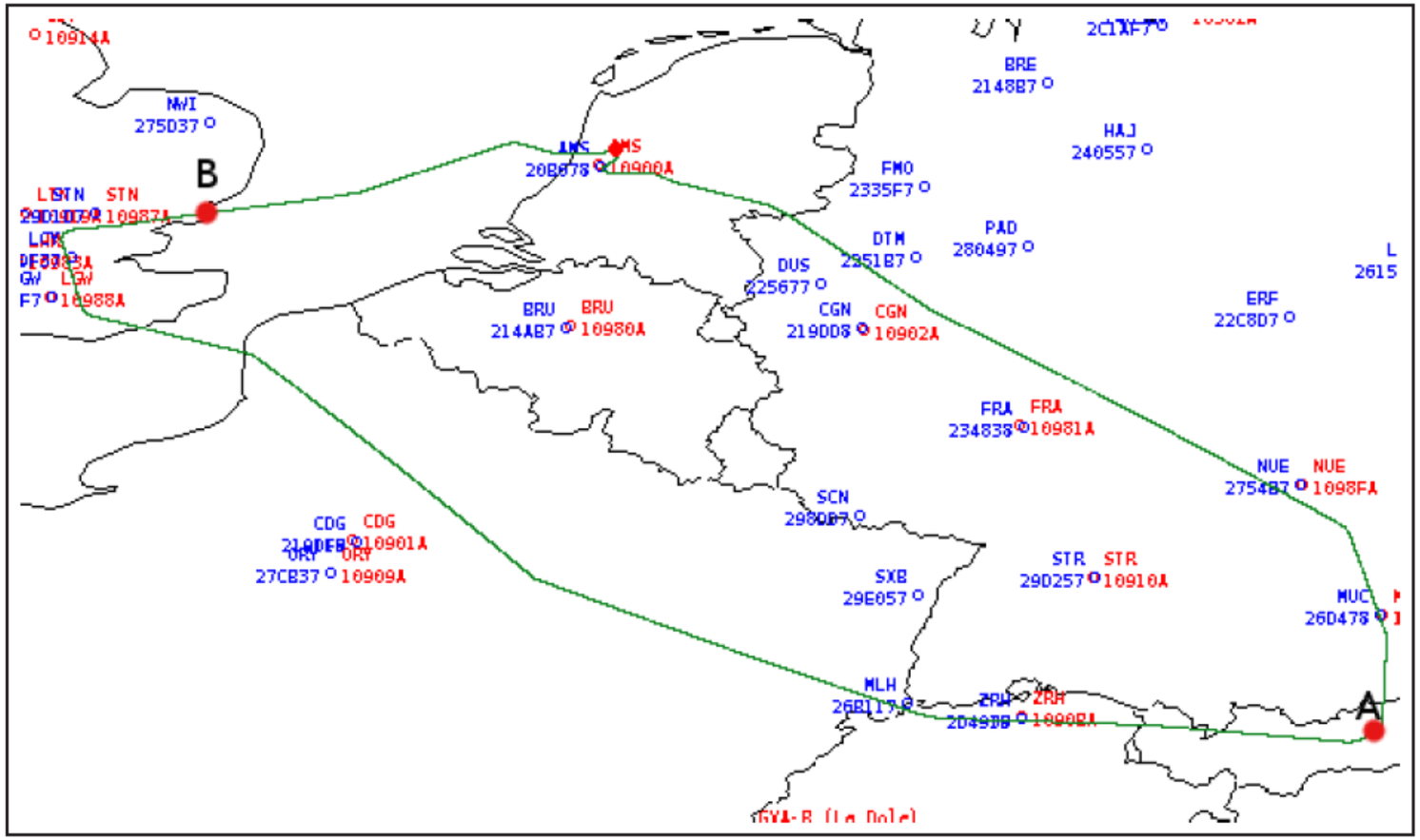
PA Rate
– past 12 months

Weekly PA rate per ACC – recent weeks



NM data link monitoring flight 2017

Network Manager
nominated by
the European Commission



Network Manager
nominated by
the European Commission

Channel Occupancy Peaks

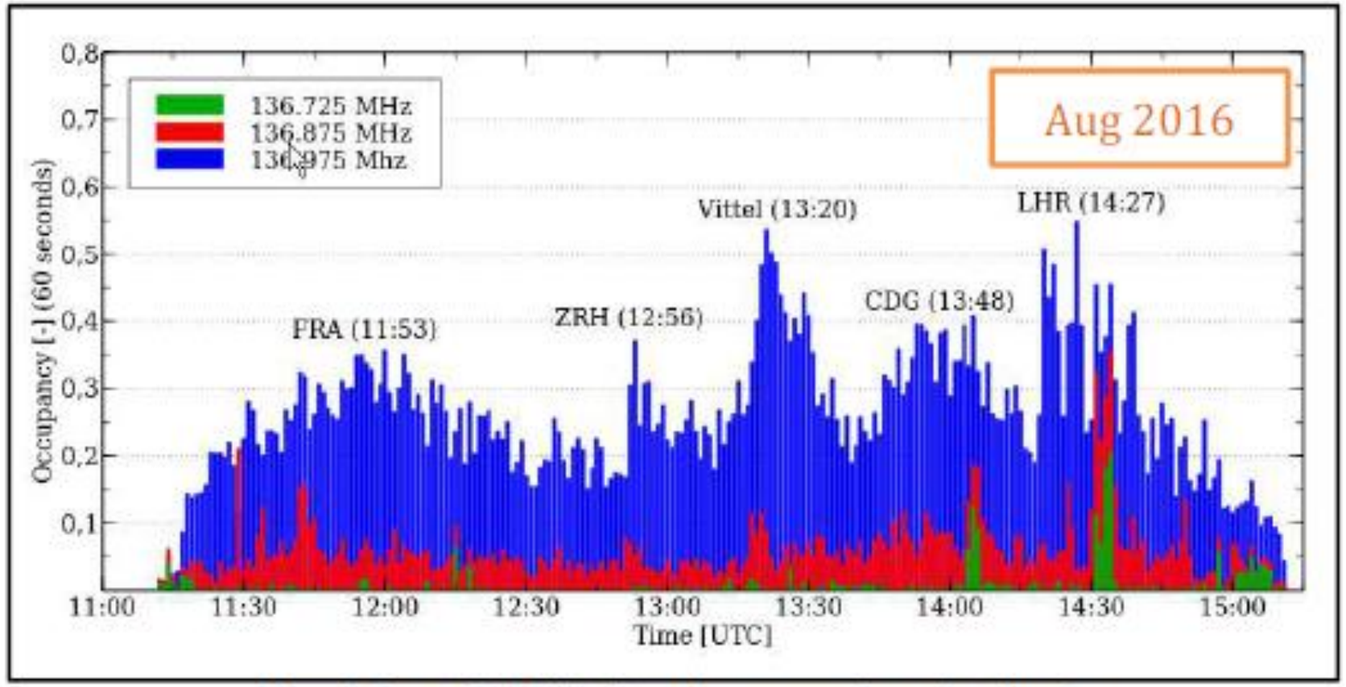


Figure 4: August 2016 Flight Channel occupancy observed at aircraft

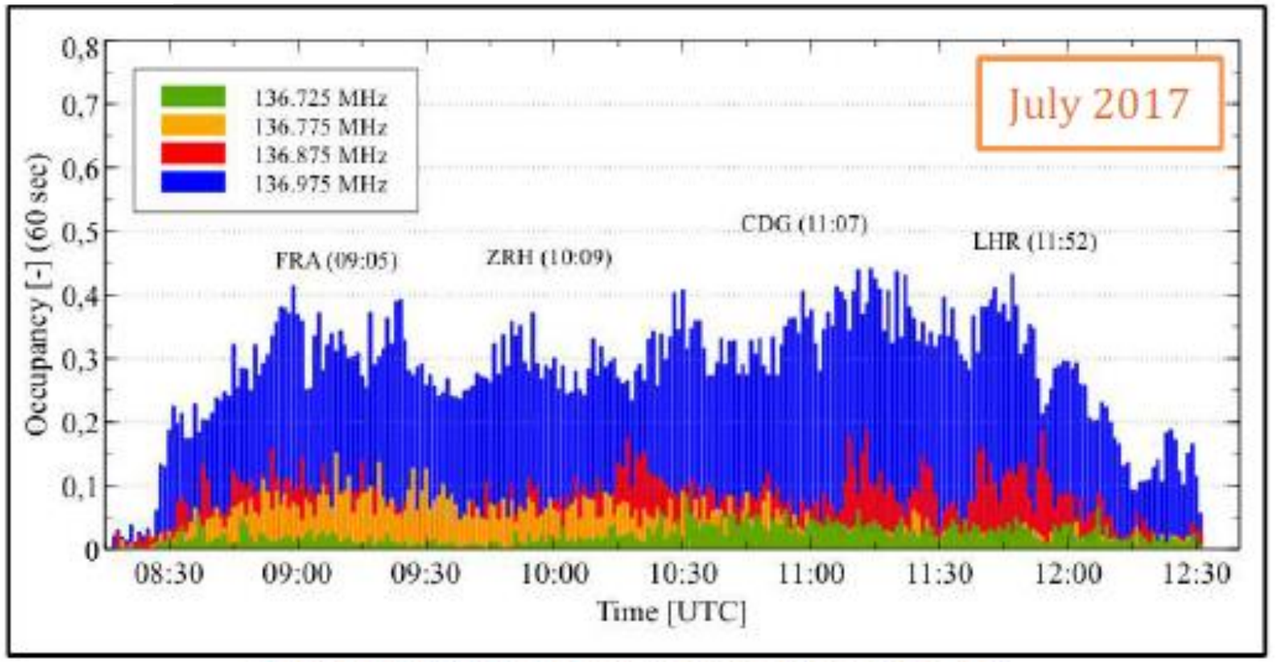


Figure 2: July 2017 Flight channel occupancy observed at aircraft

Airborne collision rate

Network Manager
nominated by
the European Commission

Frequency	Assignation	2015 August	2016 August	2017 April	2017 July
136.975 MHz	CSC	47.85%	42.57%	36.71%	50.28%
136.875 MHz	SITA terminal	-	16.31%	17.29%	16.26%
136.825 MHz	ARINC Terminal	-	-	-	-
136.775 MHz	SITA En-Route	-	-	TBD	7.52%
136.725 MHz	ARINC En-Route	-	0.00%	6.12%	9.92%

Table 7: Rate of burst collisions

Average Occupancy at -90dBm

Conclusions: GOOD NEWS

Network Manager
nominated by
the European Commission

- PA rate improved and stable -> Good news
  - Better network performances, thanks to the CSPs that implemented multi-frequencies
  - ANSPs are also implementing datalink services: paving the way and increasing sector capacity
  - Avionics are better (cf. Best in class)

- However: Risks are still present
  - Europe is not yet fully operational, hence extra load can be expected.
  - AOC traffic evolution is difficult to predict: new aircraft are requiring more bandwidth
  - ATN-B2 (requiring more bandwidth) is ready to be deployed

- The Network Manager views
  - Datalink is required to pave the future and bring capacity
  - VDL-2 network has improved but is still need severely congested -> Investment shall continue.
  - It is time to start the deployment of new technologies to reduce the VDL-2 load, mainly at Airport and for AOC
  - Performances shall continue to be closely monitored.