Centralised Service on Data Communication Services (DCS) Concept of Operations (CONOPS)

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Abstract

Data Communication services (DCS) is a twofold centralised service:

- **Air/Ground Telecommunication Infrastructure** Centralised Service for transporting A/G ATS datalink information (e.g. CPDLC, ADS-C flight information services, Airport services (e.g. D-TAXI)) between mobile and ground users.

- **Added value centralised servers** (for CDPLC, ADS-C and CM (initial aircraft log-on)) reducing the number of servers in the European States and the associated operating costs

Keywords

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ANNEX 11 – Slides and Minutes of CS9 specific workshop of 10 July 2013

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ABBREVIATIONS

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Figure 1: – Overview of data communication services

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Figure 3: – Roadmap of data communication services

Figure 4: – CS9 components

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EXECUTIVE SUMMARY

Data Communication services (DCS) implemented under CS9 is a twofold centralised service. It includes:

1. The centralisation of **Air/Ground telecommunication infrastructure services**
   provision for transporting A/G ATS datalink information (e.g. CPDLC, ADS-C, flight information services, Airport services such as D-TAXI) between mobile and ground users.
   The service will be provided by a CS9 Service Provider (SP) in accordance with a Service Level Agreement performance-oriented contract established with EUROCONTROL. This will avoid that each ANSP establishes a separate contract with one of the Communication Service Providers (CSP) as currently done and will be providing a unique contractual interface for the access to all network resources (e.g. SATCOM datalinks). For the connection of mobile users, the service will rely on current wireless technologies (e.g. VDLM2) and in the future on SESAR validated and standardized new technologies (e.g. AeroMACS, new SATCOM). The fixed users (e.g. ATC centers) will be connected through CS8 (PENS). The centralised management of the services will provide a common contractual framework to facilitate the evolutions of the network resources (e.g. introducing new functionalities (such as multi frequency), and new technologies) and the resolution of observed deficiencies, as well as to negotiate optimal communication costs from a global perspective.

2. The **operation of added value centralised servers** allowing the reduction of the number of servers implemented in the European States and the associated operating costs.

**Three central servers** are foreseen to be part of CS9:

The **ADS-C** centralised server is receiving ADS-C data from the aircraft and is redistributing them to any ground Users which needs this information for ATM purposes. It allows this information to become available to a non-limited number of users without the need to transmit the aircraft data more than once on the capacity-limited Air/Ground communication subnetwork (e.g. VDLM2).

The **CPDLC** server will provide limited centralisation of CPDLC service provision (e.g. new ANSP deployments, centralisation per State) depending on local decisions.

The **Context Management (CM)** server is managing the initial logon of an aircraft establishing datalink session with an ATC center. Each ATC Center address is stored in the CM server avoiding the update of all the avionics databases each time a new ATC Center is implementing CPDLC services, or in the case an ATC center address needs to be modified (currently all aircraft databases are updated at the end of the avionics update cycle).
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INTRODUCTION

Introduction by the Director General of EUROCONTROL

Following a request of the European Commission in November 2012, EUROCONTROL developed the concept of Centralised Services (CS).

Version 2.0, dated March 2013 of the EUROCONTROL Proposal for a first set of nine Centralised Services to contribute to SES Performance Achievement is attached as Annex 3. A short description of the proposed CS is attached as Annex 4.

The Agency proposed the CS concept in order to significantly support:

- The Member States and their ANSPs to reach or at least to come closer to the EU performance targets,
- The implementation of SESAR results on a central pan-European level,
- The development of high tech solutions by European ATM manufacturers to be deployed on a central level providing the services to all ANSPs of the EUROCONTROL Member States,
- The creation of pan-European operational concepts for the Centralised Services proposed,
- The creation of a pan-European market for these ANS support services,
- The implementation of market mechanisms for some ANS support services through Tendering of the services with time limited performance based contracts,
- The creation of market opportunities for the ANSPs of EUROCONTROL Member States to provide services outside of their national boundaries, cooperating in newly founded consortia,
- The strengthening of the European Network, increasing capacity and safety,
- In the planning and execution phase much more user friendly 4 D trajectories throughout the European airspace.

EUROCONTROL works closely with the Member States, ANSPs, civil and military airspace users, airports, the aerospace industry, professional organisations, intergovernmental organisations and the European institutions.

On 29 April 2013 EUROCONTROL invited the Airspace Users to participate in a workshop where the concept of Centralised Services was briefed. The Minutes of this Workshop are attached as Annex 5.

EUROCONTROL also invited the EUROCONTROL Member States on 4 March 2013, the ANSPs on 24 April 2013 and the ATM Manufacturing Industry on 17 May 2013 to demonstrate the Centralised Services concept. The minutes of these workshops are respectively attached as Annex 6, 7 and 8.

Following the PC/39 on 16 May 2013 and PCC/31 on 2 July 2013 EUROCONTROL updated on the CS concept. The working papers and slides presented as well as an extract from the Minutes of both meetings are respectively attached as Annex 9 and 10.
EUROCONTROL advisory groups such as AAB, NMB, MAB, CMIC, as well as EU bodies such as the SSC, ICB and its subgroups were briefed. These briefings were followed by so-called CS specific workshops. This was a series of 9 workshops held in June and July 2013 - for each proposed CS one specific workshop was held; CS9 (DCS) workshop was held on July 10th, 2013. The slides presented as well as the minutes of this meeting are attached as Annex 11.

The questions asked and answered in an intensive dialogue since the beginning of the program are publicly available. We like to refer to the FAQ list that is constantly updated and available on the EUROCONTROL homepage.

The CBA figures presented in detail for all the 9 CS support the initial assessment done, that a 150 to 200 million € cost reduction for the airspace users is possible through the implementation of the 9 centralised services proposed by EUROCONTROL. Specific focus was put on the synergy effects foreseen between the different centralised services.

It was agreed with the stakeholders, that the Agency would invite the participants to the individual CS workshops, as well as the existing EUROCONTROL advisory groups to participate in specific meetings in September and October 2013 to develop a pan-European ops concept for each of the Centralised Services.

This draft ops concept has been prepared for the presentation and discussion with all interested stakeholders at the Ops Concept Workshop for CS9 (DCS) which will be held on 25th October 2013.

The Ops Concept will be used by EUROCONTROL to develop requirements to be part of a Call for Interest and a Call for Tender for CS9 (DCS). All proposed Centralised Services will be operated under performance based contracts by a Service Provider on behalf of EUROCONTROL.

Our partners are involved at every level of the corporate governance structure. The deployment and operation of CS will impact the remit of the Network Manager. Therefore, its governing body, i.e. the Network Management Board where the EC, EUROCONTROL, ANSPs, airspace user, airports and the military are represented could be extended in the future, the operation of the CS being regulated by EASA; the latter is already supporting the European Commission in the oversight of the Network Manager. Through its nomination as Network Manager, EUROCONTROL will be entrusted to manage the centralised services.

Frank Brenner
Director General of EUROCONTROL
October 2013
CHAPTER 1 – Context

1.1 Geographical applicability

The DCS is intended to be applied in all EUROCONTROL Member States. It should be extended to all States where the EC 29/2009 Regulation applies and potentially to the EUR/NAT region. It may be expanded to adjacent States if so required and in case it is identified as being beneficial for the overall ATM network.

1.2 Aim

The CS9 aims at:

- Providing a common performance-driven contractual framework to commonly and globally facilitate the resolution of observed deficiencies, and the introduction of network improvements,
- Optimising communication costs through the introduction of a common Performance-driven contract,
- Reducing the number of datalink interfaces needed by the Users,
- Testing and validating the centralisation of servers for air ground applications such as CPDLC, CM, ADS-C and potential future applications (e.g. ADS-B via satellite),
- Preparing the future data communication services in accordance with the European ATM Master Plan through the introduction of future technologies.

These context elements for CS9 are described in the following sections.

The CS9 Project will start with a feasibility study followed by a demonstrator, both part of Phase 1 of the CS Programme; this approach is chosen in order to study the feasibility of the communication centralised services, to confirm the Business Models, the feasibility (e.g. technical, operational), the business case and expected benefits, the performances, the impact on safety, security and regulation/certification. Depending on a GO/NOGO decision on the basis of the Phase 1 outcome, Phase 2 will be launched to start the operations.
1.2.1 **Current Data Communication Deployment**

Figure 1 below presents an overview of the provision of data communication services as it exists today.

![Diagram of data communication services](image)

**Figure 1: – Overview of data communication services**
1.2.1.1 **ATS datalink-services**

Currently, ATN-B1/VDLM2-based CPDLC services, regulated by Reg 29/2009, are being deployed in European En-route airspace (33 ACCs). The geographical scope of the data link provision and the applicable key dates is illustrated in Figure 2.

Each en-route ACC provides ATN-B1/CPDLC services to ATN-B1 aircraft over VDLM2. Each ACC has its own NSAP address for initial CM logon, requiring the need to have installed in each aircraft an avionics NSAP address database, containing the NSAP addresses of all 33 ATN-B1 ACCs in Europe (including Norway and Switzerland). Some ACCs are also providing CPDLC services to FANS 1/A aircraft over VDLM2 (AOA), VDLM0/A or SATCOM.

The next steps (cf. European ATM Master Plan) will require the implementation of ADS-C servers in each of the ACCs to meet the initial 4D trajectory management requirements as standardised by EUROCAE WG78/RTCA SC214.

The following map is showing the current CPDLC implementation status: the States highlighted green are already in operation with CPDLC; the States highlighted yellow are expected to operate in 2013 and the States highlighted red are expected to operate by 2015.

![Figure 2: Geographical scope of Regulation EC No 29/2009](image)

1.2.1.2 **AOC services**

Although the AOC services are out of the scope of the CS9, to provide a complete picture, it is worth noting that currently Airline Operational Communication. (AOC) are operated by two major Communication Service Providers operating their own ground network, in some cases in conjunction with the ANSPs.

AOC customers (mostly Aircraft operators and airports) are connected directly to their main ACSP(s).
1.2.1.3 **Telecom provision**

Core of Europe (‘2013’ States, cf. Figure-2) is covered by ground infrastructures (set of VDLM2 ground-stations and associated ground network; the same approach is expected to be followed by the periphery of Europe (‘2015’ States).

The CPDLC/ATN-B1 deployment assumes a dual coverage across States, with extensions to multi-channel VDLM2 (operating on multiple frequencies to increase bandwidth) in the short-term, required for maintaining VDLM2 capacity and Quality of Service (QoS).

Each ANSP has either a contract with a Communication Service Provider or operates and maintains the A/G segment itself (some ANSPs have established partnership with the Communication Service Providers (cf. figure-1)).

The ground-stations route CPDLC/FANS1/A data through the ACARS network to the users, and the VDLM2 ground-stations route the CPDLC/ATN-B1 data through the ATN A/G routers and G/G routers to the ANSPs ATN-B1 systems.

1.2.2 **Future Data Communication Deployment**

1.2.2.1 **CPDLC and ADS-C services**

Figure 3 illustrates a roadmap of today’s CPDLC services and future advanced data communications services. Step 1 of the European ATM Master Plan has defined the deployment of i4D trajectory management and airport data link services (DCL, D-TAXI), which are standardised as ATN-B2. 4D trajectories, supported by CS#2 (4DPP), will rely on ADS-C information.

The geographical scope of the data communication service provision will be considerably expanded (from 33 to 61 ACCs, many airports and TMAs).

![Figure 3: – Roadmap of data communication services](image)

The Pilot Common Project (PCP) proposal constitutes the first materialisation of the Step 1 of the European ATM Master Plan.
The exchange and sharing of the ADS-C-EPP is one of the 6 PCP proposals (ATM Functionality, AF#6). This is an enabler for the implementation of the i4D trajectory concept (i4D + CTA/CTo) of Step 1. The proposed schedule for the i4D trajectory is as follows:

Ground:
- 2016: Start of investments,
- 2018: Initial operational capability (IOC),
- 2022: Full operational capability for all ECAC States (61 en-route ACCs).

Airborne:
- 2018: Start of investments,
- 2019: Initial operational capability (IOC),
- 2023: 20% ATN-B2 equipped aircraft.

VDLM2 will continue to support CPDLC and i4D operations. SATCOM communications (Class B) will be used as back-up during Step 1 and as a complement to VDLM2.

AeroMACS will be used at some airports for the DCL (Departure CLeareance) and D-TAXI (Digital TAXI) services. Other new technologies currently developed by SESAR (e.g. New SATCOM, LDACS) will be rolled out later on.

It is expected that the subsequent Common Project(s) will deploy the exchange of CTA/CTO time constraints by CPDLC and the ATN-B2 services at TMAs and airports (DCL, D-TAXI).

1.2.3 Issues and proposed solutions

The current data communications deployment has revealed a number of deficiencies that will become problematic with wider deployment of CPDLC and ADS-C operations in Europe. A first analysis has revealed the following issues and identified solutions:

1.2.3.1 CPDLC functionality

Given current implementations and integration of the CPDLC functionality within the ANSP data processing systems, investments have been made and it is probably late to move to a full centralised use of CPDLC functionality as this might require new modifications in the involved ANSP centres. However, centralisation may be desirable for new ANSP deployments (e.g. deployment of one CPDLC-airport/TMA server per State or between a few adjacent States) or when it is felt cost efficient (e.g. in case the set of CPDLC messages is expanded).

1.2.3.2 ADS-C functionality

Installation of an ADS-C processing system at each ANSP (as for CPDLC today) is cost-inefficient (61 ACCs to equip). In addition when several ACCs that provide a service along the aircraft trajectory and the Network Manager are requesting the same 4D trajectory data from the aircraft, identical messages have to be sent between the air and the ground on a limited bandwidth channel (VDLM2), hence wasting a scarce resource. Moreover, the aircraft can only accept a limited number of ADS-C contracts at the same time. It would be more efficient to use a centralised ADS-C function. Exchange of data from the centralised ADS-C server to ACCs and to NM will be done through the ground-ground communication services (CS8).

Note: The notion of a centralised ADS-C system exists in Oceanic airspace

1.2.3.3 CM (NSAP) addresses functionality

The EUR NSAP address registry is maintained and published by ICAO. The aircraft and avionics manufacturers generate the CM database containing the NSAP addresses based on this registry. The period between a requested change and the availability of the update in the aircraft may take a year and a half.
Given the expected increase to 61 ACCs and many airports and TMAs, it is doubtful that each ANSP should implement its own ‘CM-SERVER’ considering that each aircraft would have to maintain such a large database, containing the NSAP addresses of all ACCs, TMAs and airports. The use of a single CM-server would avoid this problem.

1.2.3.4 Communication infra-structure

The extension of the geographical scope of datalink and the increasing fleet of aircraft concerned by EC 29/2009 Regulation will lead to more ANSPs to be connected to the VDLM2 ground-infrastructure through more ATN routing functions and to requirements for more wireless resources. This will make the communication infrastructure more complex with the need to introduce the necessary evolutions to increase its capacity (e.g. multi frequency, network optimisation) and to solve observed deficiencies which are currently limiting the network performances. New technologies (e.g. AeroMACS, new SATCOM) will also be introduced to support more demanding ATM services under development in the SESAR framework. ANSPs that are implementing current or future datalink will need to acquire the adequate expertise (e.g. ATN, VDLM2, new technologies). The introduction of different technologies (e.g. SATCOM) will require that each ACC establishes additional links (e.g. with the SATCOM service providers).

The current approach relies on a patchwork and “good-will” basis. This approach is reaching limits e.g. when deficiencies concern different sub components.

A common framework based on a common Performance-driven contract will facilitate the global introduction of network improvements, resolution of observed deficiencies, introduction of new technologies, as well as being a common framework to negotiate global communication charges.

1.2.4 Avoiding that it gets worse

There is a significant risk/concern that with a much wider deployment of CPDLC and ADS-C operations in Europe the above mentioned deficiencies may become a real issue, hence CS9 should pre-empt and avoid:

a) Unwanted limitations occurrence, when performing ADS-C operations,

b) That each ANSP installs its own CM and ADS-C server causing duplication and fragmentation,

c) That AOs need to install and maintain a large NSAP-address data base in each aircraft,

d) That each ANSP establishes its own separated contract with CSPs,

e) That evolutions and deficiency resolutions are managed on a patchwork approach.

1.2.5 The CS9 Demonstrator in a nutshell

The CS9 will start by defining and building a Demonstrator as part of the CS Programme Phase1 to:

- Evaluate the best business model to support the ATS/ATC services validated in the SESAR framework and the best contractual framework for an optimised and cost efficient A/G telecommunication infrastructure,

- Evaluate the feasibility of centralised CPDLC, CM, ADS-C servers.
1.3 **Intended Audience**

The intended audience are the CS9 CONOPS workshop participants and all the participants who are interested in the development of CS9 and related services, including all those who are currently involved in the services or that are already in operation with CPDLC. The document will also be used to define the operational and technical requirements of the Call-for-Tender for the Centralised Service on Data Communication Services (DCS).

1.4 **Intended Benefits**

Datalink implementation is currently on-going, hence CS9 shall not jeopardise current investment; however CS9 can support current CPDLC implementation and pave the way for the future A/G datalink improvements. CS9 will deliver benefits through the following paths:

- Optimise network performances and capacity facilitated by a common performance-driven contractual approach,
- Optimise communication cost based on one common performance-based contract,
- Simplify the connection to the users by implementing a common CM server allowing aircraft to establish a unique logon on the European network, hence avoiding onboard changes as the new equipped European centres are entering operation,
- Reducing the investment for all the stakeholders to implement the i4D trajectory management by offering a unique common centralised ADS-C service and centralised CPDLC services,
- Simplifying the access to the airborne data required to perform 4D trajectory calculation by providing a unique access point,
- Paving the way for the implementation of the new A/G systems and technologies developed by SESAR for all the airspace (e.g. AeroMACS for the airport, SATCOM covering the oceanic and polar areas and complementing VDLM2 in continental areas, future terrestrial systems for terminal and En-Route areas).

1.5 **Key Principles**

The proposed DCS relies on several key principles:

- Current avionics shall be preserved and modifications resulting from DCS implementation shall be avoided at the maximum extent,
- Investments made by current operators shall be considered,
- ATS D/L services systems, currently implemented (e.g. CPDLC, FANS1/A ATIS & DCL) are not forced to move to centralised servers until write-off,
- Assets ownership transfer is not a requirement. If it appends, it should result from a positive business case,
- DCS shall be opened to evolutions on the basis of SESAR validated and Standardised (ICAO, EUROCAE) solutions.
- DCS is based on SLA Performance-based contracts,
- Entering in Phase 2 (Operations) shall be confirmed by the outcome of Phase 1 for Air/Ground Telecommunication Infrastructure services and for each of the Central servers (CPDLC, CM, ADS-C) considering e.g. Business Models feasibility, technical feasibility, governance, business cases and expected benefits, impact on safety and security and the regulation/certification framework.
CHAPTER 2 – Operational Concept

2.1 Scope

The main objective of the DCS is to centralise Air/Ground Telecommunication Infrastructure services provision and to offer centralised A/G services to all stakeholders. As illustrated in Figure 4 below, CS9 comprises two main components, providing the following two main categories of services:

1. A/G Telecom Air/Ground Infrastructure Services for transport of data communications (CS9-1),
2. Data communication services (CPDLC, CM, ADS-C) i.e. the application servers (CS9-2).

These 2 categories of services might be provided under 2 separate contracts operated by 2 different CS9 (sub)Service Providers as these services are of different nature and are relying on different infrastructure.

Figure 4: – CS9 components
Figure 5 shows one possible high level view of different CS9 implementation topologies, regrouping the A/G Telecommunication infrastructure component, and the Data communication services components (the central CM, CPDLC, ADS-C servers), and their users.

All ACCs are connected to a central ADS-C server (amber dotted lines), which is connected through VDLM2 or SATCOM with all aircraft.

ACCs, already equipped with ATN-B1/CPDLC services (ACC1-2), are assumed to keep the existing architecture. New ACCs (ex. ACC3 on figure 5) should connect to a central CPDLC-server through CS8 (red dotted lines).

Airports (airport 1) are assumed to connect, through PENS, to a central CPDLC-server (DCL, D-TAXI, red dotted lines), using potentially AeroMACS for connecting to the mobile User.

All aircraft are connected to a central CM-server (blue dotted lines).
2.2 Components of the CS9 service

2.2.1 CS9-1: A/G Telecommunication Infrastructure Service

The “A/G Telecommunication Infrastructure Service” is in charge of transporting information between the end users, through Access Points, to fulfil the required Quality of Service in the most efficient way (e.g. cost charges, spectrum usage, transfer time).

2.2.1.1 Telecommunication infrastructure supporting DCS

The CS9 (Sub)Service Provider shall provide the “A/G Telecommunication Infrastructure Service” that will be defined through SLAs at the Access Points (see figure 4). The Access Points will be the interface for:

- Mobile users, allowing connection of aircraft and other mobiles for the exchange of D/L services information e.g. D-TAXI,
- Fix users (through CS8), allowing connection of ANSPs and Airports for the exchange of D/L services information,
- Data communication services, allowing connection of centralised servers (CPDLC, CM, ADS-C),
- Network management (e.g. supervision, configuration, billing services).

The supporting A/G Telecommunication Infrastructure shall include the following systems for the Air/Ground part:

- ICAO standardised ATN/VDLM2 system,
- interfaces with SATCOM services,
- ACARS systems (POA) and AOA (for ATS/ATC services),
- New ICAO standardised A/G sub-networks (e.g. AeroMACS, new SATCOM, future terrestrial systems) that will be introduced as necessary to support the QoS required by advanced data communication services, traffic evolution and/or network optimisation (e.g. more cost-efficient technologies).

Note:

Transport-type State aircraft routinely operating GAT are also covered in EC 20/2009 Regulation and when equipped with VDLM2 (or other suitable data link capability e.g. FANS 1/A) shall be accommodated like any other civil aircraft. The connection of military airspace users which are not equipped with the above civil Air/Ground standards/systems will need to consider solutions being developed in the framework of the SESAR programme.

For the Ground/Ground part, CS8 (PENS) shall be used to connect ANSPs and airports, the centralised CS9 servers as well as to connect military systems including ATM and air defence (through a gateway).
It will be the responsibility of the CS9 (Sub)Service Provider to optimise the infrastructure to fulfil the SLA requirements in the most efficient way. In particular, to achieve this goal, it is expected that:

1. For the VDLM2 A/G sub-network:
   A central harmonised plan for VDLM2 capacity maintenance across States be developed. The extensions for VDLM2 multi-channels operation will be planned, with backup, when and where required either at major airports or in major En-route sectors with important D/L traffic,

2. For SATCOM A/G sub-network:
   SATCOM services be provided through the CS9 (Sub)Service Provider to serve some oceanic/remote areas or to support in the continental area FANS1/A equipped aircraft (EC No 29/2009),
   It will be the responsibility of the CS9 (Sub)Service Provider to interface with current and/or future SATCOM providers for routing FANS-based CPDLC traffic for aircraft flying outside VDLM2 coverage or that are non-VDLM2 equipped. SATCOM will also complement VDLM2 (and future systems) for transporting en-route ATN-B2 CPDLC and i4D related information,

3. For the AeroMACS sub-network:
   AeroMACS services be provided through the CS9 (Sub)Service Provider for providing the required capacity in the airport which will implement the AeroMACS technology.

### 2.2.1.2 Data link services supported by DCS

The following A/G Data link services will be supported by the DCS A/G Telecommunication Infrastructure:

- **FANS1/A services (at DCS service start):**
  - AFN
  - CPDLC
  - ADS-C
  - D-ATIS
  - DCL

- **ATN-B1 Services**
  - CM (at DCS service start),
  - CPDLC (at DCS service start),
  - ADS-C services (IOC 2018)

- **ATN-B2 services (IOC to be defined).**

### 2.2.1.3 Other Data link services

Other services (such as Airline Operational Communication (AOC), Aeronautical Passenger Communication (APC) services) might be supported by the telecommunication infrastructure used by the CS9 (Sub)Service Provider (e.g. to optimise operating costs).

**These non ATS services (e.g. AOC, APC) are not part of DCS and are not covered by the associated CS9-1 SLA.**
In case a CS9 (sub)Service Provider would use the same infrastructure for DCS and non-DCS services:

- The DCS and non-DCS services shall be segregated (e.g. Quality of Service management, security management). Note: the level of segregation will be technology dependent as currently implemented systems do not necessarily provide the necessary mechanisms, however, it is foreseeable that future technologies will have this capability,
- Charging mechanisms shall be fully transparent and independent,
- Regulation shall be fully applied (e.g. spectrum and the datalink IR).

2.2.2 CS9-2: Data Communications Services

It is more efficient from cost and operational perspectives to implement centralised resources than fragmented resources (e.g. CM, ADS-C) implemented by each ANSP. These CS9-2 services are provided on the basis of central servers providing the required functions with the required performances. The servers are connected to the Access Points which establish Logical connections with the Users through physical connection via the A/G Telecommunication Infrastructure.

The “Data Communications Services” include:

2.2.2.1 Central CPDLC server

CPDLC server(s) shall provide CPDLC resources to ATC Centers and Airports that did not implement yet CPDLC services.

The choice to use a centralised CPDLC service for the users who have already invested locally in CPDLC servers (case of ACCs already providing ATN-B1/CPDLC services (see Figure 5; ACC1-2)) needs further analysis (immediate replacement or after amortisation).

2.2.2.2 Central ADS-C server

One ADS-C server (possibly redounded) shall provide centralised ADS-C services to the ATM network. 61 ACCs are expected to be connected to the central ADS-C server.

2.2.2.3 Central CM Server

One CM server (possibly with redounded) shall provide centralised Context Management (CM) services to the ATM network. It will interact with the aircraft.

2.2.2.4 Other potential DCS centralised Services

New applications, validated under SESAR framework, may result in enhanced A/G services (such as Satellite based ADS-B services). Hence additional types of central servers would be part of CS9 as these new applications materialise.

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1 The different services could be implemented in one or in separated equipments. An architecture analysis and a CBA have to identify the best approach.
### 2.3 Roles and responsibilities

ATM operational roles and responsibilities remain unchanged with today’s situation:

**ANSPs** will exchange Air/Ground related data through the CS9 services, as CS9 shall provide interfaces that are compliant with the relevant standards, no major changes are expected on the ANSPs systems because of CS9.

**Airspace users** will exchange data with the ANSPs through the CS9 services as it is done today. For on-board equipments which are compliant with the standards, the transition to the CS9 Services should be transparent.

The **CS9 (Sub)Service provider(s)** shall implement the DCS services as described in this CONOPS document, i.e.:

- A VDL and SATCOM adequate coverage that meets the performance requirements,
- Be ready to test/validate and then interface with and operate new communication technologies once validated (AeroMACS, new SATCOM or LDACS for instance),
- Implement, maintain and operate on the 24/7 basis,
- Provide helpdesk service to all the users,
- Report regularly to the NM and the stakeholders on system performances.

The CS9 (Sub)Service Provider(s) will be selected via an open Calls for Tenders resulting in contract with limited duration.
CHAPTER 3 – Regulatory requirements

3.1 Existing applicable regulations

- Commission Regulation (EU) 552/2010 and 1070/2009, laying down common rules on interoperability,
- European Commission - Regulation (EC) No 29/2009 laying down requirements on data link services for the single European sky,
- Regulation on spectrum.

3.2 Requirements for new/updated regulations to implement/operate the Centralised Service on Data Communication Services (DCS)

CS9 should not change the interfaces between the aircraft and the client systems; hence no new change to regulation has been identified on top of the current ones that may be needed for the deployment of i4D aircraft trajectories exchanges and of ATN-B2 services.

The initial phase (feasibility study / demonstrator) of the CS9 design and development project will identify potential needs for new specific regulations.
CHAPTER 4 – Links of the CS9 (Data Communication Services) to ICAO GANP, SESAR deployment, ESSIP – current procedures and future evolution

4.1 Baseline – Interim Deployment Programme (IDP)

Centralised Services (CS) are in line with the Interim Deployment Programme (IDP). The conformity analysis was initiated by EUROCONTROL and further completed at the Interim Deployment Steering Group (IDSG) Expert Team in the meeting of 27 June 2013.

The possible relationships between CS and IDP deployments have been analysed and clustered in four categories of potential interactions, which are:

1. **No relationships** between IDP activities and CS. This means that the functions and services deployed in a centralised manner by the CS do not directly interface any of the deployments of the IDP,

2. IDP deployment is improved by the independent CS capabilities. The functions and services deployed in a centralised manner by the CS will be used by one or several IDP deployments but in an independent way. This is the case when CS does not impact functionalities already deployed, i.e. **independent function improvements**, or when the CS implements some add-on function or services such as equipment performance monitoring, centralised management of shared parameters, i.e. **Development of supporting option**,

3. IDP is a **pre-requisite** for CS. This means that the functions and services deployed in a centralised manner by the CS reuse an IDP deployment,

4. IDP deployment is an **alternative** to the CS solution. The functions and services deployed in a centralised manner by the CS offer a different implementation of an IDP deployment.
The DCS centralised service is categorised as **development of supporting options** and related to IDP Work Package 4 “Air-Ground Data Link”. This means that Data Communication Services rationalised by this centralised service can improve the IDP deployments which was based on an initial analysis. Furthermore, the DCS centralised service analyses, defines and demonstrates the feasibility and benefits of a European Air Ground Data Communication Service which can be used in the future by functionalities deployed under the IDP.

The benefit dependency is that the DCS centralised service may facilitate and provide in the future cost efficiency to the use of “Air Ground Data Link” (IDP WP4) and therefore of Regulation (EC) 29/2009.

The figure below illustrates the IDP Breakdown structure for the DCS relevance.

**Figure 6: - IDP Breakdown structure for the DCS relevance**

### 4.2 Pilot Common Projects (PCP) and Common Projects (CP)

Centralised Services interact with the Pilot Common Project (PCP). Interdependencies between Centralised Services and the six ATM Functionalities (AFs) of the Pilot Common Projects (PCP) have been analysed.

The Centralised Services will influence the future Common Projects (CP), in particular AF#6 “Initial Trajectory Information Sharing (i4D)”. 
4.3 **European Single Sky ImPlementation (ESSIP)**

The possible relationships between CS and ESSIP, being the Level 3 of the European ATM Master Plan, have been analysed.

The DCS centralised service is categorised as development of supporting options and is related to the ESSIP Objective ITY-AGDL “Initial ATC air-ground data link services above FL-285” via VDL2.

Depending on the evolution of the DCS centralised service, in future, new ESSIP Objectives may have to be developed or existing ones may have to be amended.

4.4 **ICAO Global Air Navigation Plan (GANP)**

The possible relationships between CS and ICAO Global Air Navigation Plan (GANP) have been analysed.

The DCS centralised service and ICAO GANP in perspective contributes to more efficient CNS infrastructure, related to a number of enablers in GANP CNS roadmaps, i.e.

- Link media enablers, such as VDL Mode 0/A and Mode 2, current satellite systems, future satellite systems, and
- Services enablers, such as CPDLC and ADS-C over FANS or B1 and B2.

Furthermore, it enables many aviation system block upgrades and in particular:

- B0-TBO – Improved Safety and Efficiency through the initial application of DATA Link En Route,
- B1-TBO – Improved Traffic Synchronisation and Initial Trajectory-Based Operation, and
- B1-AMET – Enhanced Operational decision through integrated Meteo Info.
ANNEX 1 – Information flows

A1.1 Operational process

CS9 will be an enabler, hence no change to existing or planned operational processes are identified. This will need to be confirmed during the feasibility/demonstrator phase.

A1.2 Technical process (overall)

Figure 7: - Technical process (overall)

= CS9 development
ANNEX 2 – Data Set

For the services that are already in operation, interfaces are already defined and standardised (cf. respective sections for the operational services). The Airborne and standard and interfaces shall not be modified at the maximum extent. Ground systems and architecture potential changes will be evaluated during the feasibility/demonstration phase.
ANNEX 3 — EUROCONTROL Proposal for a first set of Centralised Services to contribute to SES Performance Achievement, March 2013

ANNEX 4 — Brief description of the Centralised Services

ANNEX 5 — Minutes of the 29 April 2013 Airspace Users CS workshop

ANNEX 6 — Minutes of the 4 March 2013 Member States CS workshop

ANNEX 7 — Minutes of the 24 April 2013 ANSPs CS workshop

ANNEX 8 — Minutes of the 17 May Manufacturing Industry CS workshop

ANNEX 9 — Working papers, slides and extract from the Minutes of PC/39, 16 May 2013

ANNEX 10 — Working papers, slides and extract from the Minutes of PCC/31, 02 July 2013

ANNEX 11 — Slides and Minutes of CS9 specific workshop of 10 July 2013

These annexes are provided in a separate file,
REFERENCES

1. European Commission - Regulation (EU) 552/2010 and 1070/2009, laying down common rules on interoperability:

2. European Commission - Regulation (EC) No 29/2009 laying down requirements on data link services for the single European sky


4. SJU - Proposal on the Content of a Pilot Common Project, Edition 1.0, 6 May 2013

5. ICAO/Paris - EUR NSAP Registry, version 1.0, 15/04/201
### ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>A/C</td>
<td>Aircraft</td>
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<td>A/G</td>
<td>Air/Ground</td>
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<tr>
<td>AAB</td>
<td>Agency Advisory Board (EUROCONTROL)</td>
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<td>ACARS</td>
<td>Aircraft Communication Addressing And Reporting System</td>
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<td>ACC</td>
<td>Area Control Center</td>
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<td>ACSP</td>
<td>Air/ground Communication Service Provider</td>
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<td>ADS-B</td>
<td>Automatic Dependent Surveillance-Broadcast</td>
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<td>ADS-C</td>
<td>Automatic Dependent Surveillance-Contract</td>
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<tr>
<td>AeroMACS</td>
<td>Aeronautical Mobile Airport Communications System</td>
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<td>AF</td>
<td>ATM Functionality</td>
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<td>AFN</td>
<td>ATS Facility Notification</td>
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<td>AIS</td>
<td>Aeronautical Information System</td>
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<td>ANS</td>
<td>Air Navigation Service</td>
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<td>ANSP</td>
<td>Air Navigation Service Provider</td>
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<td>AO</td>
<td>Airline Operator</td>
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<td>AOA</td>
<td>ACARS Over AVLC</td>
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<td>AOC</td>
<td>Airline Operational Communication.</td>
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<td>AOs</td>
<td>Airline Operators</td>
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<td>APC</td>
<td>Aeronautical Passenger Communication</td>
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<td>ATC</td>
<td>Air Traffic Control</td>
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<tr>
<td>ATIS</td>
<td>Automatic Terminal Information Service</td>
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<td>ATM</td>
<td>Air Traffic Management</td>
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<td>ATN</td>
<td>Aeronautical Telecommunication Network</td>
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<tr>
<td><strong>ATN-B1</strong></td>
<td>Current data link system on an aircraft, at an ACC and communication service provision, compliant with the RTCA DO280B/EUROCAE ED110B Interoperability Standard as adapted by the EUROCONTROL Specification. ATN-B1 consists of Context Management (CM) for Data Link Initiation Capability (DLIC) and initial CPDLC services.</td>
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<tr>
<td><strong>ATN-B2</strong></td>
<td>Future current data link system on an aircraft, at an ACC and communication service provision, currently under development by EUROCAE WG78/RTCA SC214. ATN-B2 will consist of Context Management (CM) for Data Link Initiation Capability (DLIC), advanced CPDLC-, and ADS-C services</td>
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<tr>
<td>ATN-ES</td>
<td>ATN End System</td>
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<td>AVLC</td>
<td>VDL Aviation VHF Link Control</td>
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<td>CBA</td>
<td>Cost Benefit Analysis</td>
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<td>CM</td>
<td>Context Management</td>
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<td>CMA</td>
<td>CM Application</td>
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<td>CMIC</td>
<td>Civil &amp; Military Interface Standing Committee (EUROCONTROL)</td>
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<td>CNS</td>
<td>Communication Navigation Surveillance</td>
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<td>CONOPS</td>
<td>Concept of Operations</td>
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<td>CP</td>
<td>Common Project</td>
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<td>CPDLC</td>
<td>Controller Pilot Data Link Communication</td>
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<td>CS</td>
<td>Centralised Service</td>
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<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>CSPs</td>
<td>Communication Service Providers</td>
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<td>CTA</td>
<td>Controlled Time of Arrival</td>
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<td>CTO</td>
<td>Controlled Time Over</td>
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<td>D-ATIS</td>
<td>Digital ATIS</td>
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<td>DCL</td>
<td>Departure Clearance</td>
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<td>DCS</td>
<td>Data Communications Services</td>
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<td>DL-FEP</td>
<td>Data Link Front End processor</td>
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<td>D-TAXI</td>
<td>Digital TAXI</td>
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<td>EASA</td>
<td>European Aviation Safety Agency</td>
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<td>EC</td>
<td>European Commission</td>
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<td>ECAC</td>
<td>European Civil Aviation Conference</td>
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<td>ESSIP</td>
<td>European Single Sky Implementation</td>
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<td>EU</td>
<td>European Union</td>
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<tr>
<td>EUR/NAT region</td>
<td>EURopean North Atlantic region (ICAO)</td>
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<tr>
<td>EUROCAE</td>
<td>European Organisation for Civil Aviation Equipment</td>
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<tr>
<td>FANS</td>
<td>Future Air Navigation System</td>
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<tr>
<td>FANS 1/A</td>
<td>Current data link system on an aircraft, at an ACC and communication service provision, compliant with the RTCA DO258A/EUROCAE ED100A Interoperability Standard. It is used in Oceanic and Remote airspace. FANS 1/A consists of ATS Facilities Notification (AFN) for Data Link Initiation Capability (DLIC), CPDLC-, and ADS-C services.</td>
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<tr>
<td>FAQ</td>
<td>Frequently Asked Question</td>
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<td>FCI</td>
<td>Future Communication Infrastructure</td>
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<td>Acronym</td>
<td>Description</td>
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<tr>
<td>G/G</td>
<td>Ground Ground</td>
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<td>GANP</td>
<td>Global Air Navigation Plan - ICAO</td>
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<td>i4D</td>
<td>Initial 4D trajectory</td>
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<tr>
<td>i4D Trajectory</td>
<td>The 4D trajectory is the path, consisting of route waypoints, predicted altitude and time (incl. vertical-, and time constraints at each of the waypoints), and predicted speed.</td>
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<tr>
<td>ICAO</td>
<td>International Civil Aviation Organisation</td>
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<td>ICB</td>
<td>Industry Consultation Body (EC)</td>
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<td>IDP</td>
<td>Interim Deployment Programme</td>
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<td>IDSG</td>
<td>Interim Deployment Steering Group</td>
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<td>IOC</td>
<td>Initial Operational Capability</td>
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<td>LDACS</td>
<td>L Band Digital Aeronautical Communication System</td>
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<td>NSAP</td>
<td>Network Service Access Point</td>
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<td>Plain Old ACARS</td>
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<td>Pan European Network Services</td>
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<td>Plain Old ACARS</td>
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<td>Description</td>
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<tr>
<td>QoS</td>
<td>Quality of Service</td>
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<td>RTCA</td>
<td>Radio Technical Commission for Aeronautics</td>
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<td>SATCOM</td>
<td>Satellite communication</td>
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<td>SESAR</td>
<td>Single European Sky – ATM Research programme</td>
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<td>Service Level Agreement</td>
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<td>SESAR Joint Undertaking</td>
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<td>Single Sky Committee</td>
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<td>VDL</td>
<td>VHF Digital Link</td>
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<td>VDLM0/A</td>
<td>VDL Mode 0 or Mode A (A standing for ACARS)</td>
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<td>VHF Digital Link Mode 2</td>
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<td>VGSs</td>
<td>VDL Mode 2 Ground Stations</td>
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<td>Very High Frequency</td>
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